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Exploring the Pedestrians Realm

An overview of insights needed for developing a generative system approach to walkability

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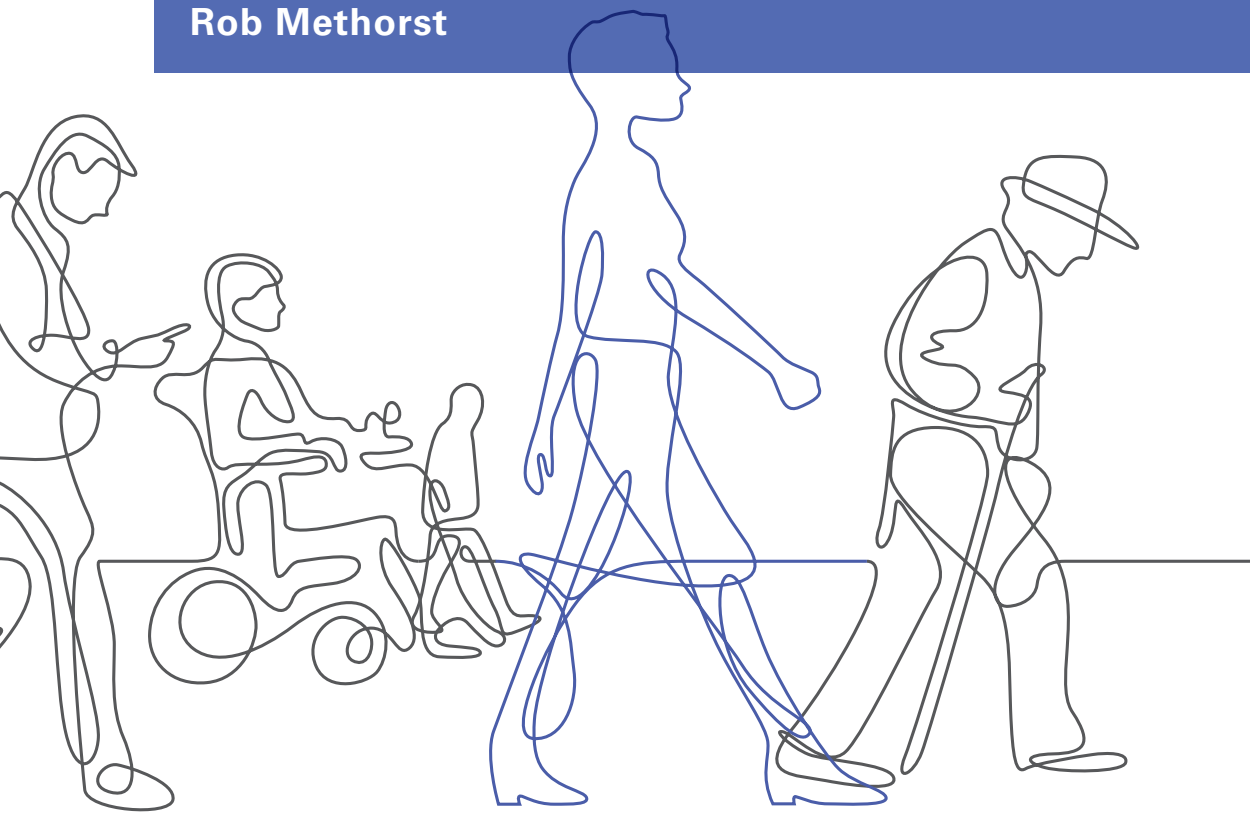
Rob Methorst



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An overview of insights needed for developing a generative system approach to walkability

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Table of contents

Table of contents v

List of Figures xiii

List of Tables xvii

SUMMARY xxi

SAMENVATTING xxix

PREFACE xxxvii

1. INTRODUCTION 1

1.1. Preamble 1

1.2. Thesis objectives and research questions 3

1.3. Key types of walking and sojourning 9

1.4. The benefits of walking and sojourning 10

1.5. The necessity of research on walking and sojourning policy 13

1.5.1. Basic facts about the significance of walking and sojourning 14

1.5.2. General pedestrian problems and their consequences 21

1.5.3. The perceived significance of walking and sojourning in public space 23

1.5.4. Future prospects regarding walking and sojourning 26

1.6. Demarcation, guiding principles, basic assumptions 32

1.6.1. Demarcation of scientific perspective 32

1.6.2. Geographical demarcation and demarcation of policy level 32

1.6.3. Demarcation of time horizon 34

1.6.4. Guiding principles for this thesis' research 34
1.6.5. Basic assumptions 35
1.7. The outline of the thesis 37
2. METHODOLOGICAL ACCOUNT 39
2.1. Introduction 39
2.1.1. Context of this thesis research 39
2.1.2. Explorative research to feed a holistic approach 40
2.1.3. Triangulation to improve validity of conclusions 40
2.1.4. This thesis' targeted research approach 42
2.1.5. Data sharing statement 44
2.2. Precursory research activities to this thesis 44
2.3. Orientation and building the conceptual framework 45
2.3.1. Introduction 45
2.3.2. Step 0. Orientation 45
2.3.3. Step 1. Conceptual framework 46
2.4. Identification of W+S system requirements 47
2.4.1. Introduction 47
2.4.2. Step 2a. Identification of W+S needs and abilities 48
2.4.3. Step 2b. Identification of exemplary W+S requirements 50
2.5. Assessment of the W+S system status quo in the Netherlands around 2018 52
2.5.1. Introduction 52
2.5.2. Step 3a. Assessment of the status quo of W+S conditions 53
2.5.3. Step 3b. Assessment of the status quo W+S behaviour and outcomes 54
2.6. Devising change 55
2.6.1. Introduction 55
2.6.2. Step 4a Explore the W+S policy playing field 57
2.6.3. Step 4b. Assessment of external influences on the W+S policy field 58
2.6.4. Step 4c. Assessment of the organisation of change 58
2.7. Conclusion 61
3. CONCEPTUAL FRAMEWORK FOR WALKING & SOJOURNING POLICY DEVELOPMENT 63
3.1. W+S policy development: attention in literature 64
3.2. System approach to walkability policy development 67
3.2.1. Introduction 67

3.2.2. Systems theory 68
3.2.3. System approach 76
3.2.4. Limitations of System Approach 80
3.2.5. How the System approach structures this thesis 80
3.3. The pedestrian travel and sojourning system 81
3.3.1. Introduction 81
3.3.2. The pedestrian travel and sojourning system as an entity 82
3.3.3. Conceptualisation of pedestrian behaviour 88
3.3.4. W+S Needs 95
3.3.5. Opportunities 105
3.3.6. Abilities 112
3.4. Conclusions and key messages 119
4. WALKABILITY SYSTEM REQUIREMENTS 125
4.1. Introduction 125
4.2. Methodology 127
4.2.1. Introduction 127
4.2.2. Pedestrian population 128
4.2.3. Exemplary walking and sojourning arrangements 136
4.3. The pedestrian population 138
4.3.1. Introduction 138
4.3.2. Environmental settings for W+S behaviour 139
4.3.3. W+S needs translated into system requirements 173
4.3.4. W+S abilities translated into system requirements 182
4.3.5. Conclusions - towards a 'Reference Standard Pedestrian' 228
4.4. Exemplary W+S arrangements 232
4.4.1. Introduction 232
4.4.2. Classification of W+S opportunities 234
4.4.3. General scoping review findings 242
4.4.4. The genesis of W+S opportunities 245
4.4.5. Towards advanced requirements for W+S opportunities 252
4.4.6. Requirements for basic W+S opportunities 254
4.4.7. Arrangements for W+S convenience opportunities 279
4.4.8. Arrangements for tempting W+S opportunities 290
4.4.9. Conclusions regarding exemplary W+S arrangements 299

4.5. Conclusions and discussion regarding W+S system requirements 303
5. STATUS QUO OF THE W+S SYSTEM 305
5.1. Introduction 305
5.2. Methodology - the general approach in this chapter 307
5.3. Dutch W+S arrangements 309
5.3.1. Introduction 309
5.3.2. Methodology 310
5.3.3. Results 311
5.3.4. Conclusions regarding Dutch W+S arrangements 323
5.4. Dutch W+S system performance 325
5.4.1. Introduction 325
5.4.2. Mobility and sojourning in public space 326
5.4.3. Safety and security 345
5.4.4. Convenience, comfort and attractiveness 398
5.4.5. Conclusions regarding W+S system performance 403
5.5. Discussion on the research into the status quo of the W+S system 406
6. DEVISING W+S IMPROVEMENTS 409
6.1. Introduction 409
6.2. Methodology 410
6.2.1. Introduction 410
6.2.2. Exploring the W+S playing field 411
6.2.3. Research into the Dutch W+S policy environment 412
6.2.4. Research into the status quo of the institutional framework 413
6.2.5. Identification of institutional controls and improvement potentials 416
6.3. The Dutch W+S playing field 417
6.3.1. Introduction 417
6.3.2. Theory 418
6.3.3. Results 420
6.3.4. Conclusions 422
6.4. The Dutch W+S policy environment 422
6.4.1. Introduction 422
6.4.2. Theory 423
6.4.3. Results 425
6.4.4. Conclusions 439

6.5. Organising change towards better support of W+S 440
6.5.1. Introduction 440
6.5.2. Theory 440
6.5.3. Results 456
6.5.4. Conclusions 473
6.6. Conclusion and discussion: institutional improvement potentials 479
6.6.1. Introduction 479
6.6.2. Conclusions concerning W+S policy activity controls 479
6.6.3. Methodology discussion 480
6.6.4. Discussion: indication of institutional controls and improvement potentials 480
6.6.5. Discussion on System & Result responsibility/accountability 498
6.7. Epilogue 499
7. CONCLUSIONS AND DISCUSSION 501
7.1. Introduction 501
7.2. Conclusions regarding this thesis' research approach 502
7.2.1. Introduction 502
7.2.2. Solidity of baseline research conditions and assumptions 502
7.2.3. Scoping review as the main method 503
7.2.4. Redefinition of the domain 504
7.2.5. Substantiation of complexity of the subject 504
7.2.6. Added value of this thesis - facilitation of paradigm shift 505
7.3. Conclusions regarding research results 505
7.3.1. Introduction 505
7.3.2. Conclusions regarding Modelling the W+S system 505
7.3.3. Conclusions regarding System requirements 507
7.3.4. Conclusions regarding the W+S System Status Quo 514
7.3.5. Conclusions regarding Devising change 516
7.4. Discussion 519
Visibility of pedestrians, walking & sojourning in public space 519
Filling gaps in knowledge 520
Literature references 521
Appendix 1 - Glossary of terms 557
Appendix 2 - W+S Policy literature scan 587
1. Methodology 588

1.1. Exploration of literature sources 588
1.2. Compilation of a dedicated literature database 592
1.3. Analysis of the literature database on potentials for W+S policy development 597
2. Literature scan results 599
2.1. Number of publications regarding W+S policy development 599
2.2. Subjects dealt with in the publications in the database 601
2.3. Distribution of publications over the thesis chapters 608
2.4. Identified overview publications 610
2.5. Relevance of publications for the Dutch case 611
3. Evaluation of literature scan results 614
3.1. How much research literature is available? 614
3.2. What subjects are covered? 615
3.3. What seems to be the State of Attention? 617
3.4. Value of the available body of literature for W+S policy development. 618
Appendix 3 - List of detailed research questions 621
Appendix 4 - Contributors 623
Chapter 1, 2 & 3 reviewers 623
Chapter 4 - workshop attendants and reviewers 623
Chapter 5 - reviewers 624
Chapter 6 - respondents and reviewers 624
Appendix 5. Exposure estimation calculations 625
Chapter 1 625
Average distance covered on foot to and from other modes 625
Chapter 4 625
Appendix 6 - Questions to policy actors 641
Appendix 7 - W+S policy actor analysis tables 645
Appendix 8 - Gaps in knowledge 653
1. Introduction 653
2. Input aspects (the institutional framework) 654
3. Output aspect (institutional products & activities) 655
4. Outcome (Performance, behaviour & perceptions) 655
5. Impact aspects (Bottom-line effects; benefits) 657
Appendix 9 - Background: thesis' sub-studies 659
1. Policy Life Cycle – critical factors model 659

2. Policy Pillars – points of interest for analysis 669
3. Impacts of Risk Awareness and Risk Acceptation on policy 721
4. Policy justifications 725
5. Diffusion of Innovation theory 734
6. The role of perception in walking and sojourning in public space policy 736
7. System- and Result-responsibilities 740
References 742
Appendix 10 - Curriculum Vitae Rob Methorst 751
Appendix 11 - 'Pedestrian falls' as addition to the current definition of traffic crashes 753
1. Introduction 753
2. Recent research on pedestrian falls 754
3. Consequences of excluding pedestrian falls 755
4. Discussion 756
Funding sources 756
References 756
Appendix 12 - How to define and measure pedestrian traffic deaths? 759
TRAIL Thesis Series 765

List of Figures

Chapter	Figure Nr	Title	page
1	1.1	Error-controlled regulation (adapted from McLoughlin, 1969)	5
1	1.2	Steps in a generative pedestrian quality policy process (after McLoughlin, 1969)	8
1	1.3	Travel time in hours per person per week (population 12 years and older) and travel modes in the Netherlands 1975 - 2005 (source: SCP (TBO) www.tijdsbesteding.nl 18-10-2006)	16
1	1.4	Travel time and number of trips per person per week (population 12 years and older), in the Netherlands 1975 - 2005 (source: SCP (TBO) www.tijdsbesteding.nl 18-10-2006)	17
1	1.5	Travel time on foot per person per day in the Netherlands (minutes)	17
1	1.6	Problems and consequences to a pedestrian in today's traffic (after Gunnarsson, 2001)	22
1	1.7	Future shares of age groups and people with mobility limitations in PQN countries	29
2	2.1	Triangulation strategy	41
3	3.1	Number of scientific and 'grey' publications in the thesis literature database	65
3	3.2	Number of publications in the literature database concerning the thesis' chapters and relevancy score	66
3	3.3	A system (i.e. pedestrian travel & sojourn system) with its environment (after Heylighten, 1992) as an open system	69
3	3.4	Sauter and Tight's assessment model for measuring walking (after Methorst et al., 2010:14, Part C)	69
3	3.5	A pedestrian travel & sojourn system containing a collection of interacting subsystems	84

3	3.6	The scopes regarding system output to a pedestrian's environment (after Richard e.a., 1996)	86
3	3.7	NOA Model for consumer environmental behaviour (adapted from Steg & Vlek, 2009)	91
3	3.8	Pizza model concerning factors inducing W+S behaviour (after Methorst, 2003)	109
3	3.9	Customer transportation needs (adapted from Van Hagen, 2006)	111
3	3.10	Fuller's model on task demand - capability - competence (adapted from Wegman e.a., 2006)	116
3	3.11	Conceptual Framework Pedestrian Behaviour	122
4	4.1	Conceptual model pedestrian W+S behaviour choices and outcomes (inspired by CROW, 2019)	242
5	5.1	Developments in shares of life cycle groups in the Netherlands 1998-2018	315
5	5.2	Estimated share of walking in passenger kilometres 1900-2009 in the Netherlands (percentages)	329
5	5.3	Percentage of trips per motive for walking and for all modes (OViN 2010-2017)	331
5	5.4	Percentage of total distance covered on foot and all modes per motive	332
5	5.5	Average distance per trip covered on foot, per motive	332
5	5.6	Number of trips per person per year - main mode and age (OViN 2010-2017)	333
5	5.7	Distance walked per person per year - age and gender (OViN 2010-2017)	334
5	5.8	Percentage of main mode and age group (OViN 2010-2017)	334
5	5.9	Percentages of walking and all modes over the months of the year	335
5	5.10	The average shares of walking in the modal split (trips) per month in the Netherlands in 2010-2017 (OViN 2010-2017)	336
5	5.11	Percentages of distance covered on foot per day of the week in the Netherlands 2010-2017 (OViN 2010-2017)	336
5	5.12	Average shares of walking in the modal split (trips) over the days of the week in the Netherlands 2010-2017 (OViN 2010-2017)	337
5	5.13	Percentages of walking trips made in the course of the day in the Netherlands 2010-2017 (OViN 2010-2017)	337
5	5.14	Average shares of walking in the modal split (trips) over the course of the day in the Netherlands 2010-2017 (OViN 2010-2017)	337
5	5.15	Schema avoided mobility and possible consequences	342
5	5.16	Share of persons older than 12 years of age having health problems and/or using walking aids to gender and age in the Netherlands 2019 (CBS Statline, 2019)	343
5	5.17	Adjusted 5 year averages of pedestrian fatalities for falls, traffic accidents and total (excluding fatalities from crimes)	352
5	5.18	5-year averages per year of fatalities in public space per mode	352
5	5.19	Context: total numbers of fall injuries in public space, private space and location unknown	353
5	5.20	Increase in numbers of all fall fatalities per kind of location relative to 1996	353

5	5.21	1998-2018 Developments in numbers of pedestrian casualties admitted to a hospital and severity classes (ignoring DHD data supplementation)	355
5	5.22	Developments in numbers of hospital admittances after pedestrian traffic and fall accidents in the period 1998-2018 (ignoring DHD data supplementation)	355
5	5.23	Casualties indexes - traffic (all modes), pedestrian traffic, and falls (LIS 1998 = 100)	358
5	5.24	Number of pedestrian traffic casualties admitted to a hospital per MAIS class in the Netherlands 1998-2014 (2012 excluded; source LMR/LBZ)	367
5	5.25	Percentages of medical costs of treatment in ED posts related to a pedestrian traffic casualty being hospitalised or not - 1998-2018 in the Netherlands	369
5	5.26	Development in gender numbers of pedestrian traffic casualties MAIS2+ 1998-2018 in the Netherlands, excluding 2012 (LMR/LBZ)	369
5	5.27	Distribution of total numbers of MAIS2+ pedestrian traffic casualties by age and gender in the Netherlands in the period 1996-2018 (LMR/LBZ)	370
5	5.28	Distribution of the total numbers of minor injury traffic casualties by age and gender in the Netherlands in the period 1998-2018 (LIS)	371
5	5.29	Distribution of risk per million NL inhabitants of MAIS2+ pedestrian traffic casualties per age and gender in the period 2016-2018 (LMR/LBZ)	371
5	5.30	Distribution of risks per million NL inhabitants of minor injury pedestrian traffic casualties per age year and gender in the period 1998-2018 (LIS)	372
5	5.31	Development in number of pedestrian traffic casualties MAIS2+ differentiated to gender and age groups - 5-year average numbers per year 1998-2018, excluding fatalities (LMR/LBZ)	372
5	5.32	Distribution of pedestrian traffic crashes over inside/outside built-up areas in the Netherlands 1998-2018 (excl. unknown location)	373
5	5.33	Distribution of pedestrian traffic crashes over the various speed limits of roads (excl. unknown location)	374
5	5.34	Percentages of pedestrian traffic casualties treated in an ED post per month - 5 year averages per year 1998-2018 (LIS)	375
5	5.35	Percentages of traffic casualties treated in an ED post (all modes, pedestrians) and LMR in the Netherlands - average per month in the period 1998-2018	375
5	5.36	Percentages of pedestrian minorly injured traffic casualties per day of the week - 5 year averages per year 1998-2018 (LIS)	376
5	5.37	Percentages of the days' MAIS2+ pedestrian traffic casualties in the Netherlands 2014-2018 (LBZ)	376
5	5.38	Number of pedestrian fall casualties admitted to a hospital per MAIS class in the Netherlands 1998-2014 (2012 excluded; source: LMR/DHZ)	383
5	5.39	Medical costs of treatment in ED posts related to a pedestrian fall casualty being hospitalised or not - 1998-2018 in the Netherlands	384

5	5.40	Development in gender numbers of pedestrian traffic casualties MAIS2+ 1998-2018 in the Netherlands (excluding 2012)	385
5	5.41	Number of MAIS2+ pedestrian fall casualties per age and gender in the Netherlands in 2016-2018 (LMR/LBZ)	386
5	5.42	Number of minor injury pedestrian fall casualties (non-hospitalised, MAIS019) per age and gender in the Netherlands in 1998-2018 (LIS dataset)	386
5	5.43	Risk per million Dutch inhabitants of MAIS2+ pedestrian fall injuries per age and gender year in the period 2016-2018 (LMR/LBZ)	387
5	5.44	Risk per million Dutch inhabitants of minor (non-hospitalised, MAIS019) pedestrian fall injuries per age in the Netherlands in 1998-2018 (LIS dataset)	388
5	5.45	Development in number of fall casualties MAIS2+ differentiated to gender and age groups - 5 year average numbers per year 1998-2018, excluding fatalities, (LMR/LBZ)	388
5	5.46	Winter peaks in numbers of pedestrian fall casualties in the Netherlands (LIS)	389
5	5.47	Year percentages per month of MAIS2+ pedestrian falls in the Netherlands - 5 year averages per year 1998-2002 and 2014-2018 (LMR/LBZ)	390
5	5.48	Year percentages per month of pedestrian minor injury falls - 5 year averages per year 1998-2002 and 2014-2018 compared to pattern of all modes and severities (LIS)	390
5	5.49	Percentages of number of pedestrian minorly injured fall casualties per day of the week - 5 year averages per year 1998-2018, compared to average all modes & severities (LIS)	391
5	5.50	Percentages of the days' MAIS2+ pedestrian fall casualties in the Netherlands 2014-2018 (LBZ)	391
6	6.1	Policy actors and their relations within the policy process (generic level)	419
6	6.2	The policy life-cycle (after Winsemius, 1986)	442
6	6.3	Policy life-cycle - critical factors (adapted from Methorst, 2010 and based on Winsemius, 1986)	443
6	6.4	Policy attitude towards W+S - scores of interviewed organisations	461
6	6.5	Main scopes of the interviewed organisations	465
6	6.6	Interviewed policy actors - W+S expertise Scores	466
6	6.7	Full-time equivalents per year employed for walking and sojourning policy activities (excl. Neighbourhood teams)	472

List of Tables

Chapter	Table Nr	Title	page
1	1.1	Number of hits in websites search	25
1	1.2	Number and share of children and the elderly in Japan, Germany, Italy, the Netherlands	28
1	1.3	Number (x 1000) of persons with limited mobility in the Netherlands	28
1	1.4	Trip distances per mode in the Netherlands in 2007	33
2	2.1	Overview of research steps, deliveries, applied measures and sources	43
3	3.1	Activity levels	89
3	3.2	Behaviour, awareness and errors	93
3	3.3	Classification of needs (Lapintie, 2008)	102
3	3.4	List of human needs in terms of Lapintie's classification.	106
4	4.1	Average shares in number of trips (2010-2017 in the Netherlands, per distance class	141
4	4.2	Volumes of everyday living environment pedestrian groups in various territorial conditions	143
4	4.3	SES based pedestrian groups (2015-2016)	147
4	4.4a	Lifecycle / age groups in the Netherlands in 2016 and 2025	150
4	4.4b	Households and inhabitants per age group (x 1000) in the Netherlands in 2016	150
4	4.5	Pedestrian groups based on transportation options (Netherlands, 2015/2017)	153
4	4.6	Volumes of key groups based on socio-psychological and cultural characteristics	159
4	4.7	Internet, access, use and facilities - percentage of population age 12+ in 2017	162

4	4.8	Current and future pedestrian group volumes in the Netherlands (x 1000) based on health characteristics	167
4	4.9	Number of mobility handicapped persons in the Netherlands (x 1000)	191
4	4.10a	Characteristics of cognitively impaired pedestrians	199
4	4.10b	Characteristics of mobility-impaired pedestrians	202
4	4.10c	Characteristics of sensory-impaired pedestrians	205
4	4.10d	Characteristics of wheeled pedestrians	207
4	4.10e	Characteristics of deviant posture pedestrians	208
4	4.10f	Characteristics of latently impaired pedestrians	209
4	4.11	Group volumes of disadvantaged (potential) pedestrians	210
4	4.12a	Reference Standard Pedestrian - task abilities summary - lifestyle, strategic and tactical levels	219
4	4.12b	Reference Standard Pedestrian - task abilities - operational activity level - Part 1	222
4	4.12c	Reference Standard Pedestrian - task abilities - operational activity level - Part 2	224
4	4.13a	Reference Standard Pedestrian related W+S system requirements per system component - Part 1	226
4	4.13b	Reference Standard Pedestrian related W+S system requirements per system component - Part 2	227
4	4.14	Coverage of subjects within the selected documents (N=89)	244
5	5.1	Development in number of inhabitants in the Netherlands 1998-2018 per urbanity class	312
5	5.2	Availability of public transport in the Netherlands from homes and from job locations	314
5	5.3	Development in volumes of life-cycle groups in the Netherlands 1998-2018	314
5	5.4	Estimation of main mode walking for transport per year in 2010-2017	330
5	5.5	Estimation of trips, covered distance and exposure times for circulation on foot	340
5	5.6	Estimated average sojourning exposures in hours per person per year in the Netherlands 2010-2017	341
5	5.7	Abbreviated Injury Scale (DfT, 2015)	349
5	5.8	Size of the dataset on ED admittances and primary total period casualties estimates for 1998-2018 in the Netherlands	357
5	5.9	Indicated numbers of casualties in LIS and LMR/LBZ - 2018 compared to 1998	358
5	5.10	Comparison of LIS data on primary injury diagnoses (all records) 1998 and 2018 on minor injury treatments which might be transferable from ED to general medical practitioners	359
5	5.11	Estimated real numbers of pedestrian casualties in the Netherlands 1998-2018 (5 year averages per year - rounded figures)	360
5	5.12	Calculated estimates of real magnitudes, severity and trends in number of travel casualties in the Netherlands 1998-2018 (rounded)	363
5	5.13	Calculated estimates of risk of getting injured or killed while moving in public space per million inhabitants in the Netherlands	363
5	5.14	Estimated yearly accident costs in 2014-2018 (x million Euros)	364

5	5.15	Pedestrian traffic casualties numbers and risks per million inhabitants per year in the Netherlands 1998-2018 (reported in LIS, LMR/LBZ and CBS Death causes statistics)	366
5	5.16	Number and period of hospital stays after pedestrian traffic crash 1998-2018 in the Netherlands	368
5	5.17	5 year averages per year of total medical costs at ED post (x million Euros)	368
5	5.18	Major mechanisms pedestrian traffic crashes in the Netherlands (BRON 2016-2018)	377
5	5.19	Counterparties in pedestrian traffic crashes in LIS and BRON datasets	378
5	5.20	Injured body part in pedestrian traffic casualties for ED treatment only and hospital treatment of pedestrian traffic crash injuries in the Netherlands 1998-2018 (resp. LIS and LMR/LBZ)	379
5	5.21	Type of injury in pedestrian traffic casualties for ED treatment only and hospital treatment of pedestrian traffic crashes injuries in the Netherlands 1998-2018 (LIS 1998-2018)	379
5	5.22	Pedestrian fall casualties - 5 year average numbers and risks per million inhabitants per year in the Netherlands 1998-2018	382
5	5.23	Number and period of hospital stays after pedestrian falls in public space 1998-2018 in the Netherlands	383
5	4.24	Distribution (percentages) of injury mechanisms in pedestrian falls in the Netherlands in 1998-2018 (LIS 1998-2018)	392
5	5.25	Injured body part in pedestrian fall casualties for ED treatment only and Hospital treatment of pedestrian fall injuries in the Netherlands 1998-2018 (resp. LIS and LMR/LBZ)	393
5	5.26	Type of injury in pedestrian fall casualties for ED treatment only and hospital treatment of pedestrian fall injuries in the Netherlands 1998-2018 (LIS 1998-2018)	393
5	5.27	5 year averages per year of number of murders and manslaughters in the Netherlands 1998-2018 (CBS Statline)	395
5	5.28	Pedestrian security victimhood - risk levels and estimation of number of victims per year in the Netherlands 2012-2019	397
5	5.29	Perception of security of walking and sojourning in public space in the Netherlands 2012-2019	397
5	5.30	Irritations (% of 'a lot of nuisance') in public space in the Netherlands	400
5	5.31	Summary of estimations of the 'production' of the four kinds of walking in the Netherlands 2010-2017	404
6	6.1	Overview of methodology applied for assessing the status quo of the W+S institutional framework	411
6	6.2	Respondents type of organisation and domain coverage	415
6	6.3	Conversion Winsemius' model into Policy Life-cycle circular model	444
6	6.4	Policy culture - attitudes towards W+S (adapted from Hudson, 2001)	460
6	6.5	Specific goals formulated by interviewed policy actors	462
6	6.6	Organisational controls which policy actors can adjust to make W+S change happen	481

SUMMARY

Introduction

The fate of common things is that they are taken for granted. This is true for pedestrians, walking and sojourning in public space. Consequently much relevant policy information is not (adequately) captured in literature. This thesis explores what pedestrians do, what their role is and what improvements therein are requisite. In this thesis a pedestrian is anyone on foot present in public space, both while moving about or standing stationary, including those who need walking aids, wheel chairs or other simple vehicles that are absolutely needed for their basic movement in public space. Four kinds of pedestrian activities are discerned: walking from A to B (main mode walking), walking to and from other modes (sub-mode walking), circulation (round trips), and sojourning in public space (standing stationary, waiting, playing, working etc.). In this thesis 'walking and sojourning in public space' is often abbreviated as W+S.

The aim of the thesis

The main aim of this thesis is to comprehensively cover, combine and advance what is known about pedestrians, walking and sojourning in public space and about effective and fair policies to sustain and improve conditions in this regard. The result is meant to become powerful information for policy making to improve pedestrian, walking and sojourning (W+S) conditions as a source of wealth and well-being.

Central research question

The central research question of this thesis is: *What insights are available and/or needed, how can they be acquired, and what controls can authorities adjust to effectively, efficiently and fairly improve conditions for walking and sojourning in public space as a source of wealth and well-being?*

Leading research questions

The central research question is split up into four leading research questions:

1. *What conceptual framework can be developed to structure and inspire research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, its interrelations and main determinants?*

2. *What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space supporting them to optimally contribute to the wealth and well-being of communities and the nation?*
3. *How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?*
4. *How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?*

Outline of the thesis

The thesis successively deals with the four leading research questions (themes). The research approach is captured in Chapter 2: Methodological account concerning the four leading research questions. Subsequently the research results with regard to the four themes presented: relevant conceptual models to picture the pedestrians system (Chapter 3), walkability system requirements (Chapter 4), the status quo of the W+S system (Chapter 5), and devising W+S improvements (Chapter 6). The thesis is wrapped up in a conclusions and discussion chapter (Chapter 7). Useful Background information is laid down in twelve appendices, of which the last two concern are articles published in scientific journals.

Research approach

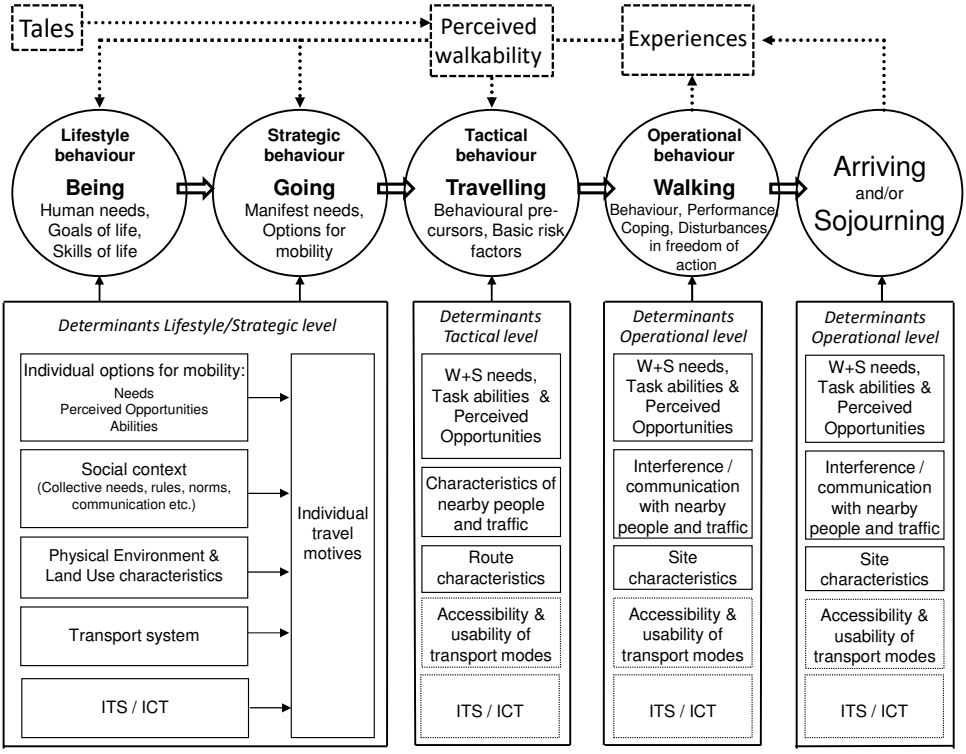
In order to comprehensively cover what is known about pedestrians, walking and sojourning in public space first of all key concepts regarding the W+S domain were (re-)defined to best suit the interests of the pedestrian. The next step was to conceptually explore the domain and broadly picture how the pedestrian, walking and sojourning system works. Using those general insights, available scientific and practitioners (grey) literature, and (statistical) databases were explored, applying elementary scoping review principles. Whenever possible best estimates are compiled to quantitatively and qualitatively describe relevant phenomena.

Modelling the system

The COST358 Pedestrians' Quality Needs project (Methorst et al., 2010) delivered a conceptual framework to support a system approach to walkability. This thesis advanced that framework, in fact a collection of conceptual models which together cover the process, content and context aspects of W+S policy development. A conceptual *process* model based on McLoughlin's (McLoughlin, 1969) error controlled regulation model is presented (Figure 1.2). On the highest abstraction level Heylighten's (1992) open system model covers both the *context* and *content* of the W+S system as 'black box' (Figure 3.3). The *content* of the W+S system (the system as a 'white box') is pictured in the Pedestrian travel & sojourning system model (Figure 3.5). The emergence of pedestrian behaviour is sketched in the Conceptual Framework Pedestrian Behaviour (see Figure below). The latter combines and advances Michon's and Hatakka et al.'s activity level models (Michon, 1979; Hatakka et al., 1999), and Methorst's Pizza model (2000) (Figure 3.11).

Steg & Vlek's Need-Opportunities-Abilities model (2009), Van Hagen's (2006) Customer transportation needs model, and the CROW theoretical model influences and choice moments of walking (CROW, 2019) inspired the set-up of the Conceptual model on pedestrian W+S behaviour choices and outcomes (Figure 4.1.). Finally, the *context* of the pedestrian system, particularly policy influences on the W+S system are extracted from the left-side column (Institutional Framework) of Sauter & Tights's (2010) assessment model for measuring walking. External influences on the pedestrian system and policy development are derived from the pedestrians travel and sojourn system models (Figure 3.5 and 3.11).

The process model directed this thesis' division in chapters; the content models directed the System requirements and W+S system Status Quo chapters (Chapters 4 and 5), whilst the context models directed the chapter on Devising W+S improvements (Chapter 6). The combined set of conceptual models is meant to inspire and facilitate a paradigm shift towards more effective and fair policies regarding pedestrians, walking and sojourning in public space.



System requirements

○ Research approach

The leading research question regarding system requirements is elaborated into four sub-questions on respectively the influence of environmental settings, general human walking needs, pedestrian abilities, and required arrangements for adequate and tempting W+S opportunities. The research into the first and third questions comprised scoping research into available literature and statistical data to position the various contextual phenomena, and the heterogeneous walking and sojourning needs and abilities. The research into pedestrian walking needs is based on findings from a dedicated workshop. The research into required arrangements (the fourth sub-question) was based on scoping available W+S guidance literature and exemplary W+S arrangements.

○ Context: environmental settings

The (international) explorations regarding environmental settings for walking and sojourning yielded indications regarding the need to travel on foot, and structural environmental constraints which potentially lead to suppressed mobility, social deprivation, and lack of safety and health. Vulnerable groups in these regards were identified, viz. various groups of cognitive

disadvantaged, and physically and/or temporary impaired; particular large groups are children and elderly. Seven kinds of relevant population attributes were discerned, identified and rated: 1) the everyday living environment, 2) social economic status, 3) lifestyle and demographics, 4) access to transportation, 5) social psychological characteristics (incl. attitudes), 6) access to information and information technology and 7) general health. The findings are clarifying, but far from conclusive as very few studies focus on general walking push and pull factors associated with the population attributes.

- **Translating human needs into W+S requirements**

Because of Lapintie's (2010) critical comments in this regard and because no literature was found to illuminate the translation of human needs into W+S system requirements, a dedicated workshop was organised to explore this subject. The workshop agreed that human needs cannot be translated directly into W+S requirements, without discerning the four kinds of walking and target group segmentation. Pedestrians as a group are extremely heterogeneous, which is true for human needs as well. Concrete W+S needs only apply after a potential pedestrian has decided to go to some outdoors destination and to do that entirely or partly on foot.

- **Translating abilities and skills into W+S requirements**

The explorations into what is needed for facilitating the very heterogeneous abilities of the population of (potential) pedestrians yielded many insight relevant for listing W+S arrangement requirements. It is important to stress that pedestrian abilities include much more than just covering serious disabilities as propagated by the United Nations Convention on the Rights of persons with disabilities. In fact about half of the (potential) pedestrian population have impairments that in some way can affect their ability to easily, comfortably and safely walk and sojourn in public space. This includes about 20% of the total population having long term cognitive impairments compared to what is needed in busy traffic conditions (including children), 38% having physical impairments and 3% having temporary cognitive impairments. The majority of them have light impairments [35% of the total population], causing inconveniences and increased risks. About 20% of the total population has moderate to severe impairments, causing them to subdue going outdoors and participate in social life. Following Asmussen (1996), for reference a so called hypothetical *Reference Standard Pedestrian* (covering all relevant impairments) is suggested.

- **Required offer W+S arrangements**

From the explorations this thesis learned that W+S arrangements require to at least provide for basic facilities for those who do not have a choice but to walk (cf. Reference Standard Pedestrian). Knowing that such basic requirements are not enough for (potential) pedestrians who do have a choice to walk or use other modes, and like or at least do not dislike walking. For them walking must feel as an attractive or even tempting option under the right conditions. However, an opportunity is only an opportunity if a person recognises them as such.

  - ***Basic W+S requirements***

Basic W+S requirements concern reachability, accessibility and safety of walking conditions. Reachability means that destinations that matter are found within walking distance (a strategic requirement, implying that such destinations should be within [much] less than 1 kilometres walking distance). Accessibility concerns do-ability, and needs to match posture, sensory, and psycho-motor characteristics of the vast majority of potential pedestrians on site, including the impaired and disadvantaged (like children, the elderly, users of wheeled pedestrian carriers, prams, carts, persons carrying goods or dragging suitcases etc.). Accessibility design guides (like CROW ASVV, 2012) offer detailed instructions for appropriate measures. Clear footway should be at least 1.8 meters wide. The route should be stable, smooth, clean and skid resistant and in no way difficult or dangerous to walk along. Safety concerns traffic safety, injuries from

falls and from assaults. Safety requires measures to prevent pedestrian getting injured or killed. A major problem is that common safety definitions are dis-functional for pedestrians: the most important causes of injuries (falls, and assaults) are generally not included in the definition and consequently neglected.

- ***Convenience requirements***

Assuming that basic requirements are met, convenience W+S requirements concern the absence of expectable irritations regarding indispensable or normally available qualities of W+S facilities. Examples of such irritations are dog excrements, unclean pavements, relatively long waiting times for street crossing and traffic nuisance. Convenience includes ease of movement and comfort aspects. If convenience requirements regarding ease of movement are met, this generally does not lead to (strong) feelings of satisfaction, ease of conviviality. It is just experienced as being 'in order' and does not stand out. Comfort arrangements, on the other hand can incite feelings of easiness, satisfaction and conviviality. Key reference group for convenience requirements are non-captive healthy and fit adults, who are likely to draw consequences from their irritations and experienced inconveniences and discomforts.

- ***Tempting W+S arrangements***

Tempting arrangements in principle concern new and as yet unfamiliar opportunities for walking and sojourning concerning experiences, discoveries or attractions that are created for the purpose of persuading (potential) pedestrians to walk and sojourn in public space and to visit an attraction. Such arrangements can be considered as a weapon in the competition and friction between cities, attractions, and policy objectives, where the number of attracted people matter. In this regard tempting people to walk more and more often is often important for achieving economic, social, health, safety and environmental goals.

System status quo (in 2018/2019)

- **Research approach**

The research regarding the W+S system status quo focussed on what is documented and entered up about prominent arrangements to offer W+S opportunities in the Netherlands, and on how pedestrians interact with their W+S environment.

- **What is documented about W+S arrangements**

General statistical data indicate that on average Dutch citizens have most destinations that matter within reach. There however is hardly any statistical information and documentation available about concrete reachability and accessibility conditions, and the quality and distribution of safety and security arrangements in the Netherlands. Regarding utilitarian walking asset management seems to be absent. The status quo is not monitored, but citizens can report abuses and faulty conditions, and this generally leads to repair actions. Asset management regarding recreational walking however appears to be better organised.

- **Effectivity of Dutch W+S arrangements**

This thesis researched the status quo of pedestrian activities (in about 2018/2019), current safety performances and experiences regarding convenience, comfort and attractiveness.

- ***Mobility and sojourning***

This thesis found and substantiated that pedestrian activities comprise more than what is commonly reported in mobility statistics. It comprises main-mode walking (A to B), sub-mode walking (to and from other modes), circulation (round trips), and sojourning in public space. This thesis argues that kilometres covered is not a fair measure for comparing travel mode performances: as main mode, pedestrian cover less kilometres per hour than other modes; pedestrians cover as many kilometres to and from other modes as they cover distance as main

mode; sojourning cannot be expressed in distance covered, but only in time spent this way. Walking is severely underreported in travel surveys (40% underreporting). Main mode and sub-mode walking together comprise 13% of total time spent travelling; 32% of walking exposure time concerns circulation. Sojourning in public space comprise about 40% of time spent as a pedestrian.

- ***Safety and security***

This thesis' research found and substantiated that pedestrian safety comprises 1) traffic safety, 2) falls, and 3) security/public safety. General statistics generally focus on traffic safety, which does not do justice to the many more injured and killed pedestrians in accidental falls and victims from harm inflicted by others. In the period 2014-2018 in the Netherlands on average 166 pedestrians per year died in public space (9.8 fatalities per million inhabitants). In the period of 1998- 2018 the number of traffic casualties amongst pedestrians decreased from 4,900 to 4,100, but the number of injured pedestrians because of falls increased from 52,700 to 76,800. No casualty data on security/public safety casualties are publicly available. Casualty risk increases with age and differs for gender. For males the increase is markedly at 70 and increases to 300% at the age of 80; for females the increase starts markedly at about age 50, and increases to 400% at age 80. The increase in risk correlates to osteoporosis and sarcopenia risks.

- ***Convenience, comfort and attractiveness***

Based on theoretical considerations (particularly Van Hagen's consumer transportation needs pyramid, 2006) convenience, comfort and sojourning were expected to matter for persuading non-captive walkers to walk more and more often. This is confirmed by Wandelnet 2014 monitoring data. No data are available about inconveniences, discomforts and lacks of attractiveness. Consequently, with regard to utilitarian and captive walkers no conclusions regarding convenience, comfort or attractiveness can be drawn regarding the influence of negative perceptions on (strategic) walking decisions.

Devising W+S improvements - the role of the institutional framework

- **Research approach**

Regarding research on devising change of W+S conditions five sub-questions were formulated: what kinds of factors and processes theoretically set the stage for W+S policy making, what the policy field looks like, what external influences there are on current W+S policy making, how policy W+S policy making is organised (or not), and what controls policy makers can adjust to enhance W+S policy making?

- **Theoretical considerations**

With regard the institutional organisation of change a background study was carried out to explore what important factors and processes in general can be expected to play a role in W+S policy making. Appendix 9 reports on this study. On the basis of the Topical Questions (What, Who, Why, Where, When and How; Spences-Thomas, 2012) the study substantiates the Winsemius (1986) based Policy Life-cycle critical factors model (Methorst, 2003/2010) and the Sauter &Tight (2010) measuring walking assessment model column on the institutional framework. This way a general picture of mechanisms regarding devising change could be drawn, inspiring the development of a tentative questionnaire for interviewing a selection of Dutch policy actors and systematically reporting results.

- **The Dutch playing field**

The background study on the workings of the institutional framework discerned four kinds of actors in the W+S (and probably others) playing field: strategists, W+S facilitators, clients, and catalysts. In the Netherlands the W+S policy field is found to comprise about 1,300 institutional policy actors, of which 950 can be expected to be key players because of their competences. It

appears that the field is dominated by governmental organisations. Client organisations however obtained a leading role regarding strategic information towards the governmental organisations, partly fed by data and meta knowledge from knowledge institutes. From 2019 the Platform Room for Walking is taking over the leading role.

- **The Dutch policy environment**

The research yielded that the W+S institutional framework and policy making can be affected by a variety of external conditions. Stimulating conditions (strengths) are that a number of foreign organisations can offer key information to support national policy making, supporting international agreements, favourable physical environment conditions in the Netherlands, the popularity of recreational walking, the relative wealth of the country, and the widely available neighbourhood teams for solving W+S problems 'on the go'. Weaknesses regarding external settings are the lack of insight in the W+S system, changes in land use policies, the strong focus on cycling (at the cost of walking) and transportation policy that is not linked up with the factual role of walking in mobility and sojourning in public space, the hidden nature of investments in walking, and budget cuts enlarging stress for persons with mobility limitations, and scarce expertise regarding utilitarian walking problems and solutions, and low priority assigned to walking and sojourning in public space.

- **Organising change towards better support of W+S**

Management of W+S conditions was explored on the basis of questions into the five policy pillars (Sauter & Tight, 2010), viz. leadership, knowledge and professions skills, strategies and policies, resources, and co-operation and partnerships. Leadership within the largest municipalities, NGO's and since 2019 the Platform Room for Walking can be considered a strengths. A weakness is that the collective partners are only beginning to be inspired. As yet in almost all organisations knowledge & professional skills is only in the beginning stage of development. Data, information and knowledge are not 'just-in-time' available where needed most, viz. most municipalities. Although in planning and design the pedestrian never was completely out of the picture, in plans for keeping neighbourhoods, roads and path conditions up to date, impacts on walking and sojourning have been neglected and/or forgotten in many ways.

The neighbourhood teams for keeping up public space quality are a true asset, but resource deployment for walking and/or sojourning is not a strength. Money is not a critical factor, but manpower deployment is marginal at best. Co-operation and partnerships are scratchy; very little manpower time is invested in the domain, as yet leaving no room for effective and efficient co-operation and partnerships.

Main conclusions and discussion

The main message from the thesis is that there is ample need and room for improvement of pedestrian, walking and sojourning conditions. On the one hand the offered W+S system (the physical, social-normative, transportation and communication environments and their interrelations) need attention. On the other hand the organisation of design, management and policy measures regarding the pedestrians' position in society and walking and sojourning in public space need to be enhanced.

With regard to policy development five issues are paramount:

1. Pedestrians are heterogeneous. Their needs for facilities vary and require customisation. 'One-size-fits-all' disadvantages vulnerable groups;
2. Current definitions regarding 'pedestrian', pedestrian activities', 'pedestrian safety', 'walking and sojourning requirements' stand in the way of improving pedestrian walking and sojourning conditions effectively and fairly;

3. Pedestrians need to be made more visible, both literally in public space as well as figuratively in statistics, research planning, institutional communications and policy making;
4. Although there is ample information on pedestrian needs, abilities and what is required to improve conditions, the information and knowledge is not where it is needed most: municipal policy makers and public space designers. Current leadership, knowledge and professional skills need to be enhanced to enable effective, efficient and fair policies.
5. Policy actors can adjust five kinds of organisational controls: fact-finding, competence building, direction and allotment, communication, and the organisation of policy implementation.

SAMENVATTING

Inleiding

Het lot van gewone dingen is dat ze als vanzelfsprekend worden beschouwd. Dit geldt ook voor voetgangers, wandelen en logeren in de openbare ruimte. Veel relevante beleidsinformatie wordt daardoor niet (adequaat) in de literatuur vastgelegd. Dit proefschrift onderzoekt wat voetgangers doen, wat hun rol is en welke verbeteringen daarin nodig zijn. In dit proefschrift is een voetganger iemand die te voet aanwezig is in de openbare ruimte, zowel bewegend als stilstaand, inclusief degenen die absoluut loophulpmiddelen, rolstoelen of andere eenvoudige voertuigen nodig hebben om te kunnen bewegen in de openbare ruimte. Er worden vier soorten voetgangersactiviteiten onderscheiden: lopen van A naar B (lopen in hoofdmodus), lopen van en naar andere modi (voor- en natransport), circulatie (rondreizen) en verblijven in de openbare ruimte (stilstaan, wachten, spelen, werken etc.). In dit proefschrift wordt 'wandelen en verblijven in de openbare ruimte' vaak afgekort als W+S.

Het doel van het proefschrift

Het belangrijkste doel van dit proefschrift is om te beschrijven, combineren en voort te bouwen op wat er bekend is over voetgangers, wandelen en verblijven in de openbare ruimte, en over effectief en eerlijk beleid om de omstandigheden in dit opzicht te bestendigen en te verbeteren. Het resultaat is bedoeld als krachtige informatie voor beleidsvorming ter verbetering van de voetgangers-, wandel- en verblijfsomstandigheden (W+S) als bron van rijkdom en welzijn.

Centrale onderzoeksvraag

De centrale onderzoeksvraag van dit proefschrift is: *welke inzichten zijn er beschikbaar en/of nodig, hoe kunnen deze worden verworven en aan welke knoppen kunnen authoriteiten draaien om de omstandigheden voor lopen en verblijven in de openbare ruimte, als bron van welvaart en welzijn, effectief, efficiënt en rechtvaardig te verbeteren?*

Leidende onderzoeksvragen

De centrale onderzoeksvraag is opgesplitst in vier leidende onderzoeksvragen:

1. Welk conceptueel raamwerk kan worden geformeerd om het onderzoek ter ondersteuning van W+S-beleidsontwikkeling te structureren en te inspireren, en om basiskennis over lopen

en verblijven in de openbare ruimte, de onderlinge relaties en belangrijkste determinanten ervan te bieden?
2. Welke systeemeisen moeten worden gesteld om (potentiële) voetgangers een adequaat en verleidelijk aanbod aan loop- en verblijfmogelijkheden in de openbare ruimte te bieden, zodat zij optimaal kunnen bijdragen aan welvaart en welzijn op lokaal en landelijk niveau?
3. Hoe goed worden voetgangers in staat gesteld om te lopen en te verblijven in de openbare ruimte, en in hoeverre komt de huidige situatie tegemoet aan de behoeften en loop- en verblijfsvaardigheden van voetgangers? Welke veranderingen zijn daarin te voorzien?
4. Hoe kunnen de omstandigheden voor voetgangers, lopen en verblijven in de openbare ruimte effectief, efficiënt en rechtvaardig worden beheerd en verbeterd?

Overzicht van het proefschrift

Het proefschrift behandelt achtereenvolgens de vier leidende onderzoeksvragen (thema's). De aanpak van het onderzoek met betrekking tot de vier onderzoeksvragen wordt beschreven in Hoofdstuk 2: Methodologie. Vervolgens worden de onderzoeksresultaten met betrekking tot de vier gepresenteerde thema's gepresenteerd: relevante conceptuele modellen om het voetgangerssysteem in beeld te brengen (Hoofdstuk 3), eisen aan voorzieningen en condities voor voetgangers (Hoofdstuk 4), de status quo van het W+S-systeem (Hoofdstuk 5), en hoe beleid voor verbeteringen in gang kunnen worden gezet (Hoofdstuk 6). Het proefschrift wordt afgesloten met een hoofdstuk over conclusies en discussie (Hoofdstuk 7). Belangrijke achtergrondinformatie is vastgelegd in twaalf bijlagen, waarvan de laatste twee bijlagen artikelen bevatten die in wetenschappelijke tijdschriften zijn gepubliceerd.

Onderzoeksaanpak

Om alles wat bekend is over voetgangers, lopen en verblijven in de openbare ruimte volledig te kunnen behandelen, werden allereerst kernbegrippen met betrekking tot het W+S-domein (her-)gedefinieerd om zo goed mogelijk aan te sluiten bij de belangen van de voetganger. De volgende stap was om het conceptueel te verkennen van het domein en in grote lijnen te schetsen hoe het voetgangers-, wandel- en verblijfsysteem werkt. Met behulp van die algemene inzichten werden beschikbare wetenschappelijke en (grijze) praktijk literatuur en (statistische) databases verkend, waarbij elementaire *scoping review* principes werden toegepast. Waar mogelijk worden de best mogelijke schattingen gemaakt om relevante verschijnselen kwantitatief en kwalitatief te beschrijven.

Het modelleren van het systeem

Het COST 358 Pedestrians 'Quality Needs-project (Methorst et al., 2010) leverde een conceptueel kader op ter ondersteuning van een systeembenadering van beloopbaarheid. Dit proefschrift bouwt daarop voort. In feite gaat het om een verzameling conceptuele modellen die samen de proces-, inhouds- en contextaspecten van W+S-beleidsontwikkeling bestrijken. Het proefschrift presenteert een conceptueel *proces*model (Figuur 1.2) dat is gebaseerd op het fouten-gestuurde reguleringsmodel van McLoughlin (McLoughlin, 1969). Op het hoogste abstractieniveau dekt het open systeemmodel van Heylighten (1992) zowel de context als de inhoud van het W+S-systeem als een 'black box' (Figuur 3.3). De *inhoud* van het W+S-systeem (het systeem als een 'witte doos') is weergegeven in het systeemmodel verplaatsen en verblijven door voetgangers (Figuur 3.5). Het ontstaan van voetgangersgedrag wordt geschetst in het Conceptueel Kader Voetgangersgedrag (Fig. 3.11). Dat model combineert en bouwt voort op de activiteitenniveau-modellen van Michon en Hatakka et al. (Michon, 1979; Hatakka et al., 1999) en Methorst's Pizza-model (2000) (Figuur 3.11). Het Need-Opportunities-Abilities-model (NOA) van Steg & Vlek (2009), Van Hagen's (2006) Klantenwenspiramide-model, en het CROW theoretische model over invloeden en keuzemomenten bij het lopen (CROW, 2019) inspireerden de opzet van het conceptuele model over voetgangers W + S gedragskeuzes en

resultaten (Figuur 4.1.). Ten slotte wordt de *context* van het voetgangerssysteem, met name beleidsinvloeden op het W + S-systeem, ontleend aan de linker kolom (institutioneel framewerk) van het onderzoeksmodel van Sauter & Tight (2010) met betrekking tot het meten van lopen en veranderingen daarin. Externe invloeden op het voetgangerssysteem en de beleidsontwikkeling zijn afgeleid van de systeemmodellen voor lopen en verblijven (Figuur 3.5 en 3.11).
Het procesmodel gaf richting aan de indeling van dit proefschrift in hoofdstukken; de inhoudsmodellen structureerden de hoofdstukken over Systeemvereisten en de W + S-systeem Status Quo (hoofdstukken 4 en 5), terwijl de contextmodellen het hoofdstuk over W + S-verbeteringen aanstuurden (Hoofdstuk 6). De totale verzameling van conceptuele modellen beoogt een paradigma-verschuiving naar een effectiever en eerlijker beleid met betrekking tot voetgangers, lopen en verblijf in de openbare ruimte te inspireren en te vergemakkelijken.

Systeem vereisten

o Onderzoeksaanpak

De leidende onderzoeksvraag met betrekking tot systeemeisen is uitgewerkt in vier deelvragen over respectievelijk de invloed van de handelingscontext, algemene menselijke loopbehoeften, voetgangersvaardigheden en vereiste arrangementen voor adequate en verleidelijke kansen on te lopen en verblijven in de openbare ruimte. Het onderzoek naar de eerste en derde vraag omvatte 'scoping research' naar beschikbare literatuur en statistische gegevens om de verschillende contexten en de heterogene behoeften, verlangens en vaardigheden met betrekking tot lopen en verblijven te positioneren. Het onderzoek naar de behoeften van voetgangers is gebaseerd op bevindingen van een speciale workshop. Het onderzoek naar benodigde arrangementen (de vierde deelvraag) is hoofdzakelijk gebaseerd op verkenning van beschikbare W+S richtlijnen- en aanbevelingenliteratuur en voorbeeldige arrangementen op dit terrein.

o Handelingscontext: randvoorwaarden

De (internationale) verkenningen met betrekking tot de handelingscontext (randvoorwaarden) voor lopen en verblijven leverden aanwijzingen op over de noodzaak om te voet te verplaatsen, en over structurele beperkingen die mogelijk leiden tot onderdrukte mobiliteit, sociale ontberingen, onveiligheid en ongezondheid. Hierbij werden kwetsbare groepen geïdentificeerd: verschillende groepen die cognitief benadeeld zijn, en mensen met lichamelijk en / of tijdelijke beperkingen; bijzonder grote groepen in dit verband zijn kinderen en ouderen. Er werden zeven soorten relevante kenmerken van de bevolking onderscheiden, geïdentificeerd en beoordeeld: 1) de dagelijkse leefomgeving, 2) sociaaleconomische status, 3) levensstijl en demografie, 4) toegang tot vervoer, 5) sociaal-psychologische kenmerken (incl. Attitudes), 6) toegang tot informatie en informatietechnologie, en 7) algemene gezondheid. De bevindingen zijn verhelderend. Ze zijn echter verre van uitsluitend, aangezien zeer weinig studies zich richten op algemene kenmerken van de (potentiële) voetgangerspopulatie die specifiek invloed hebben op beslissingen om meer of minder te gaan lopen.

o Vertalen van menselijke behoeften naar W+S-systeemeisen

Vanwege kritische opmerkingen van Lapintie (2010) in dit verband, en omdat er geen literatuur werd gevonden om de vertaling van menselijke behoeften naar W + S-systeemvereisten te duiden, werd er een speciale workshop georganiseerd om dit onderwerp van behoeften met betrekking tot lopen en verblijven in de openbare ruimte te verkennen. De workshop was het erover eens dat menselijke behoeften niet direct kunnen worden vertaald in W+S-systeemeisen, zonder onderscheid te maken naar de vier soorten lopen en naar doelgroepen. Als groep zijn voetgangers zeer heterogeen, en dat geldt ook voor menselijke behoeften. Concrete W+S

behoeftes tellen pas nadat een potentiële voetganger heeft besloten om naar buiten te gaan en dat geheel of gedeeltelijk te voet te doen.

o Het vertalen van capaciteiten en vaardigheden naar W S-systeemeisen

Het onderzoek naar wat er nodig is om de zeer heterogene vaardigheden van de populatie (potentiële) voetgangers, en beperkingen daarin, te faciliteren, heeft veel inzichten opgeleverd die relevant is voor de ontwikkeling van W+S-systeemeisen. Het is belangrijk om te benadrukken dat de vaardigheden van voetgangers niet alleen betrekking hebben op het al dan niet hebben van ernstige handicaps, zoals dat uitgedragen wordt middels het VN-Verdrag inzake de Rechten van Personen met een Handicap. Het onderzoek liet zien dat in de werkelijkheid ongeveer de helft van de (potentiële) voetgangersbevolking beperkingen heeft die op de een of andere manier hun mogelijkheden kunnen aantasten om gemakkelijk, comfortabel en veilig te lopen en te vertoeven in de openbare ruimte. Ongeveer 20% van de totale bevolking heeft langdurige cognitieve beperkingen (inclusief kinderen!) die het hen belet om goed om te gaan met drukke verkeersomstandigheden. Voorts heeft 38% fysieke beperkingen en 3% tijdelijke cognitieve beperkingen. De meesten van hen hebben een lichte beperking [35% van de totale bevolking] die ongemakken en verhoogde risico's veroorzaken. Ongeveer 20% van de totale bevolking lijdt aan matige tot ernstige beperkingen, waardoor ze zich moeizaam buitenshuis kunnen gaan en deelnemen aan het sociale leven. In navolging van Asmussen (1996) wordt, als toetssteen voor ontwerp en beheer van voetgangersvoorzieningen en arrangementen, een zogenoemde hypothetische Normvoetganger (die alle relevante beperkingen omvat) voorgesteld.

o Gewenste offerte W+S arrangementen

Uit de verkenningen van dit proefschrift kwam naar voren dat W+S-arrangementen minimaal moeten voorzien in basisvoorzieningen voor degenen die niet anders kunnen dan lopen (zie Referentie Standaard Voetganger). Dergelijke basiseisen zullen niet voldoende zijn om alle (potentiële) voetgangers over de streep te trekken om te gaan lopen. Personen, die keuze hebben om te lopen of andere modi te gebruiken, en die lopen leuk vinden dan wel of in ieder geval er geen hekel hebben, zijn minder gemakkelijk te overtuigen. Voor hen moet lopen aanvoelen als een aantrekkelijke of zelfs verleidelijke optie.

- ***Basis W + S-vereisten***

Basisvereisten voor W+S hebben betrekking op bereikbaarheid, toegankelijkheid en veiligheid van loopomstandigheden. Bereikbaarheid houdt in dat bestemmingen die er toe doen zich op loopafstand bevinden (een strategische vereiste, inhoudende dat zulke bestemmingen op [veel] minder dan 1 kilometer loopafstand moeten liggen). Toegankelijkheid heeft betrekking op het kunnen, en moet aansluiten op zowel de attitudes als sensorische en psychomotorische kenmerken van de overgrote meerderheid van [potentiële] voetgangers, inclusief gehandicapten en kansarmen (zoals kinderen, ouderen, gebruikers van voetgangersdragers op wielen, kinderwagens, karren, personen die spullen dragen of koffers slepen enz.). Ontwerpgidsen voor toegankelijkheid (zoals beschreven in CROW ASVV, 2012) bieden gedetailleerde instructies voor passende maatregelen. Een voetpad moet minimaal 1,8 meter obstakelvrije ruimte bieden. Verder moet de route stabiel, vlak, schoon en stroef zijn en mag deze op geen enkele manier moeilijk of gevaarlijk zijn om over te lopen. Veiligheid betreft verkeersveiligheid en verwondingen door vallen en (criminele) aanvallen. Veiligheid vereist voorzieningen en arrangementen om te voorkomen dat voetgangers gewond raken of overlijden. Een groot probleem is dat de gangbare definitie van voetgangersveiligheid disfunctioneel is: de belangrijkste verwondingsoorzaken (vallen en aanranding) worden doorgaans niet in de definitie opgenomen en bijgevolg veronachtzaamd.

- ***Gerieflijkheidseisen: gemak en comfort***

Als aan de basissysteemeisen wordt voldaan, kunnen bovendien W+S gerieflijkheidseisen worden gesteld, waarbij het er om gaat om te irritaties over gebrekkige kwaliteit van voorzieningen te voorkomen of de kans daarop sterk te verminderen. Gerieflijkheidseisen omvatten gemak van bewegen en aspecten van comfort. Uit divers onderzoek is bekend dat veel mensen zich onder meer irriteren aan hondenpoep, vervuilde trottoirs, relatief lange wachttijden voor oversteken en verkeersoverlast. Door te voldoen aan gemak-eisen (geen irritaties) kan over het algemeen niet worden bereikt dat mensen tevreden zijn en gezelligheid ervaren. Zo'n situatie wordt als 'gewoon in orde' ervaren en valt de meesten niet op. Comfort-arrangementen (zoals superkorte wachttijden, bankjes op strategische plekken, beschutting tegen regen, wind en zon) daarentegen kunnen wèl gevoelens van aantrekkelijkheid, tevredenheid en gezelligheid oproepen. De belangrijkste referentiegroep voor gerieflijkheidseisen zijn gezonde en fitte volwassenen, die verwachte irritaties en te ervaren ongemakken niet zonder meer accepteren, en een keuze hebben om al dan niet te gaan lopen.

- ***Verleidelijke W+S arrangementen***

Het hoogste niveau van kwaliteit wordt geboden met verleidelijke arrangementen. Die betreffen in principe nieuwe en nog onbekende wandel- en verblijfsmogelijkheden, zoals leuke ervaringen, ontdekkingen of attracties die speciaal worden gecreëerd om (potentiële) voetgangers over te halen om te gaan lopen en vertoeven in de openbare ruimte en/of een attractie te bezoeken. Dergelijke arrangementen kunnen worden beschouwd als een wapen in de concurrentiestrijd en wrijving tussen steden, attracties en beleidsdoelstellingen, waarbij het aantal aangetrokken mensen ertoe doet. In dit verband is het, om economische, sociale, gezondheids-, veiligheids- en milieubeleidsdoelstellingen te behalen, vaak belangrijk om mensen te verleiden om meer en vaker te gaan lopen.

Systeem status quo (in 2018/2019)

o Onderzoeksaanpak

Het onderzoek naar de status quo van het W+S-systeem richtte zich op wat er is gedocumenteerd en ingevoerd in databestanden over specifieke W+S arrangementen om gelegenheid te bieden voor lopen en verblijven in de openbare ruimte, en op hoe voetgangers omgaan met hun W+S-omgeving.

o Wat is er gedocumenteerd over W + S-arrangementen

Uit algemene statistische gegevens blijkt dat Nederlanders gemiddeld genomen de meeste bestemmingen die er toe doen, binnen loopafstand kunnen vinden. Er is echter nauwelijks statistische informatie en documentatie beschikbaar over plek-bereikbaarheid en toegankelijkheid en de kwaliteit en verspreiding van veiligheidsvoorzieningen in Nederland. De mate waarin voorzieningen voor utilitair (niet-recreatief) lopen getroffen zijn wordt zelden geregistreerd en gemonitord; er is zelden sprake van structureel asset-management. Op welk plekken voorzieningen als zebrapaden, obstakelvrije voetpadruimte van 1,8 meter, doorsteekjes, hellingbanen, verlaagde trottoirs, snelheid remmende maatregelen etc. getroffen zijn en wat daarvan de kwaliteit is, is in het algemeen onbekend en wordt niet structureel bewaakt. Burgers kunnen misbruik en gebrekkige omstandigheden melden, en dit leidt doorgaans tot herstelacties. Met betrekking tot recreatief wandelen lijkt asset-management echter beter georganiseerd te zijn.

o Nederlandse W + S arrangementen

Dit proefschrift onderzocht de status quo van activiteiten van voetgangers (rond 2018/2019), de mate van veiligheid en ervaringen met betrekking tot gemak, comfort en aantrekkelijkheid van de voetgangersomgeving.

- ***Mobiliteit en verblijf***

Dit proefschrift constateerde en onderbouwde dat voetgangersactiviteiten meer omvatten dan wat vaak wordt gerapporteerd in mobiliteitsstatistieken. Het omvat lopen als hoofdverplaatsing (A naar B), lopen als voor- en natransport (van en naar overstap op andere verplaatsingsmodaliteiten), circulatie (rondreizen, rondjes, ommetjes) en verblijf in de openbare ruimte. Dit proefschrift poneert dat afgelegde kilometers geen rechtvaardige maatstaf zijn voor het vergelijken van de prestaties van de vervoersmodaliteiten: voetgangers leggen per tijdseenheid (veel) minder kilometers af dan andere vervoerswijzen; in tegenstelling tot andere vervoerswijzen leggen voetgangers maar een beperkt deel van hun verplaatsingskilometers af voor hoofdverplaatsingen (van deur tot deur) en relatief veel als voor- en natransport (ongeveer evenveel afgelegde kilometers voor hoofdverplaatsingen en voor- en natransport); verblijven kan niet worden uitgedrukt in afgelegde afstand, maar alleen in tijd die op daaraan wordt besteed. In mobiliteitsonderzoek wordt lopen sterk ondergeregistreerd (er is ongeveer 40% onderrapportage). Lopen als hoofdverplaatsing en als voor- en natransport tezamen maken 13% uit van de totale reistijd (ongeacht verplaatsingswijze); 32% van de *looptijd* heeft betrekking op de 'circulatie'. Het verblijf in de openbare ruimte omvat ongeveer 40% van de tijd die Nederlanders als voetganger doorbrengt.

- ***Veiligheid en beveiliging***

Uit dit proefschrift blijkt en wordt onderbouwd dat voetgangersonveiligheid drie verschijningsvormen heeft 1) verkeersonveiligheid, 2) vallen, en 3) letsel, schade toegebracht door anderen dan wel angst daarvoor (betreft sociale en openbare veiligheid / criminaliteit). Algemene statistieken richten zich doorgaans alleen op verkeersveiligheid ed dat doet geen recht aan de grote aantallen gewonde en omgekomen voetgangers door vallen en slachtoffers van criminaliteit. In de periode 2014-2018 stierven in Nederland gemiddeld 166 voetgangers per jaar in de openbare ruimte (9,8 doden per miljoen inwoners), waarvan circa 55 verkeersdoden zijn. In de periode 1998-2018 is het aantal gewonde voetgangers door aanrijdingen (verkeersongevallen) gedaald van 4.900 naar 4.100; het aantal gewonde voetgangers door valpartijen is echter gestegen van 52.700 naar 76.800. Er waren geen gegevens beschikbaar over het aantal slachtoffers van criminaliteit in de openbare ruimte. Het risico op letsel bij ongevallen neemt toe met de leeftijd en verschilt per geslacht. Het totaal aantal slachtoffers onder mannen neemt duidelijk toe vanaf 70 jaar en stijgt dan met 300% op 80-jarige leeftijd ten opzichte van 70 jaar; bij vrouwen begint de toename veel jonger, namelijk rond de leeftijd van 50 jaar en neemt het aantal toe met 400% op de leeftijd van 80 ten opzichte van 50 jaar. De toename van het risico hangt samen met de risico's van osteoporose en sarcopenia.

- ***Gemak, comfort en aantrekkelijkheid***

Op basis van theoretische overwegingen (met name Van Hagen's klantenwenspiramide treinreizigers, 2006) werd verwacht dat gemak, comfort en verblijf van belang waren om mensen over te halen om recreatief te wandelen. Dat betreft (potentiële) voetgangers, die een keuze hebben om te gaan lopen dan wel op een andere manier te verplaatsen. Dit wordt bevestigd door de monitoringgegevens van Wandelnet 2014. Er zijn echter geen gegevens beschikbaar over irritaties (ongemakken, discomfort en gebrek aan aantrekkelijkheid van condities) van voetgangers. Daarom kunnen geen conclusies worden getrokken over de invloed daarvan op niet-recreatieve (utilitaire) verplaatsingskeuzen van voetgangers die geen andere keuze hebben dan te gaan lopen kunnen geen conclusies getrokken worden.

Beleidsontwikkeling van W+S-verbeteringen - rol institutioneel kader

o Onderzoeksaanpak

Voor het onderzoek naar beleidsontwikkeling ter verbetering van W+S condities zijn vijf deelvragen geformuleerd: welke factoren en processen vormen spelen in theorie een rol bij W+S beleidsvorming, hoe ziet het beleidsveld er uit, welke externe factoren zijn van invloed op de huidige W + S beleidsvorming, hoe is de beleidsvorming van W + S georganiseerd (of niet), en aan welke knoppen controles kunnen beleidsmakers draaien om W + S-beleid te verbeteren?

o Theoretische overwegingen

Met betrekking tot de institutionele organisatie van verandering is een achtergrondstudie uitgevoerd om te verkennen welke factoren en processen in het algemeen een belangrijke rol zullen spelen bij W+S beleidsvorming. Bijlage 9 rapporteert over dit onderzoek. De studie onderbouwt het model over kritische factoren in de beleidsleven-cyclus (Methorst, 2003/2010; Winsemius, 1986) en de model-kolom met betrekking tot het institutionele kader (Sauter & Tight, 2010) aan de hand van kernvragen (wat, wie, waarom, waar, wanneer en hoe? [Spencer-Thomas, 2012]). Op deze manier wordt een generiek beeld geschetst van mechanismen die een rol spelen bij veranderingsprocessen. Dat beeld is gebruikt om een voorlopige vragenlijst te ontwikkelen voor interviews van een selectie van Nederlandse beleidsactoren en om over de resultaten daarvan systematisch te rapporteren.

o Het Nederlandse speelveld

De achtergrondstudie naar de werking van het institutionele raamwerk onderscheidde vier soorten actoren in het W+S speelveld (en waarschijnlijk ook andere beleidsspeelvelden): strategen, W+S facilitatoren, klanten en katalysatoren. In Nederland blijkt het W+S-beleidsveld te bestaan uit ongeveer 1.300 institutionele beleidsactoren, waarvan er 950 vanwege hun competenties kunnen worden opgevat als hoofdrolspelers. Het speelveld wordt gedomineerd door overheidsorganisaties. Klantorganisaties verwierven echter, met behulp van data en meta-kennis van kennisinstellingen, een leidende rol op het gebied van strategische informatie naar overheidsorganisaties. Vanaf 2019 neemt de Platform Ruimte voor Lopen die leidende rol over.

o De Nederlandse beleidsomgeving

Het onderzoek leverde op dat het institutionele kader en de W+S beleidsvorming kunnen worden beïnvloed door verscheidene externe factoren. Stimulerende randvoorwaarden (sterke punten) zijn dat een aantal buitenlandse organisaties sleutelinformatie kunnen bieden ter ondersteuning van nationale beleidsvorming, ondersteuning van internationale afspraken, gunstige fysieke omgevingsomstandigheden in Nederland, de populariteit van recreatief wandelen, de relatieve welvaart van het land, en de brede beschikbaarheid van buurtteams voor het snel oplossen van W+S-problemen. Zwakke punten met betrekking tot externe condities zijn het vrij algemene gebrek aan inzicht in het W+S-systeem, structurele veranderingen in het ruimtelijke ordeningsbeleid, de sterke focus op fietsen (ten koste van lopen) en het transportbeleid dat niet inspeelt op de feitelijke rol van lopen bij mobiliteit en verblijf in de openbare ruimte, de verborgen aard van investeringen in lopen, bezuinigingen op de begroting die bij personen met mobiliteitsbeperkingen stress veroorzaken, de schaarse expertise met betrekking tot utilitair lopen-problemen en -oplossingen, en een lage prioriteit voor lopen en verblijven in de openbare ruimte.

o Verandering organiseren om W + S beter te ondersteunen

Het beheer van voetgangersvoorzieningen (in breedste zin des woords) werd verkend aan de hand van vragen over de vijf beleidspijlers (Sauter & Tight, 2010), nl. leiderschap, kennis en vakmanschap, vaardigheden, strategieën en beleid, middelen, en samenwerking en partnerschappen. Leiderschap binnen de grootste gemeenten, maatschappelijk organisaties en

sinds 2019 het Platform Ruimte voor Lopen mag worden aangemerkt als een sterk punt. Een zwak punt is dat de meeste partners pas korte tijd bezig zijn met de problematiek, waardoor in bijna alle organisaties kennis en vakmanschap nog in de kinderschoenen staan. Data, informatie en kennis zijn niet 'just-in-time' beschikbaar op de plek waar die het meest nodig zijn, namelijk bij de gemeenten. Hoewel bij de planning en het ontwerp de voetganger nooit helemaal buiten beeld is geweest, zijn in plannen om buurten, wegen en paden te optimaliseren voor voetgangers, lopen en verblijven vaak tussen wal en schip beland, verwaarloosd of vergeten.
De buurtteams, die de kwaliteit van de openbare ruimte op peil moeten houden zijn een echte troef; al met al worden er echter maar weinig middelen voor lopen en verblijven ingezet. Geld is meestal geen kritische factor, maar de inzet van mankracht is op zijn best marginaal. Samenwerking en partnerschappen zijn uiterst beperkt; er wordt zeer weinig menskracht geïnvesteerd in het domein, waardoor er nog weinig ruimte is voor effectieve en efficiënte samenwerking en partnerschappen.

Belangrijkste conclusies en discussie

De belangrijkste boodschap van het proefschrift is dat er duidelijk behoefte is aan, maar ook ruimte is voor verbetering van loop- en verblijfsomstandigheden. Daarbij gaat het enerzijds om verbetering van het ruimtelijke aanbod en ook sociaal-normatieve (positie van de voetganger), transport- en communicatieomgevingen, en het samenspel daarvan. Anderzijds zijn er stappen noodzakelijk om de organisatie van de aanpak te verbeteren: ontwerpprocessen, beheer en beleidsontwikkeling om de positie van voetgangers in de samenleving, en zijn handelingsomgeving te verbeteren.

Bij beleidsontwikkeling staan vijf zaken centraal:

1. Voetgangers zijn sterk verschillend. Hun behoeften aan faciliteiten variëren en vereisen maatwerk. 'One-size-fits-all' aanpak benadeelt kwetsbare groepen;
2. De huidige definities van 'voetganger', 'voetgangersactiviteiten', 'voetgangersveiligheid', en 'vereisten voor wandelen en verblijf' stremmeneffectieve en rechtvaardige verbeteringen van de positie van de voetganger, en passende condities voor lopen en verblijven in de openbare ruimte;
3. Voetgangers moeten zichtbaarder worden, zowel letterlijk in de openbare ruimte als figuurlijk in statistieken, onderzoeksprogrammering, institutionele communicatie en beleidsontwikkeling;
4. Hoewel er ruimschoots informatie is over de behoeften en vaardigheden van voetgangers en wat er nodig is om omstandigheden te verbeteren, is de informatie en kennis niet op de plek waar deze het meest nodig is, namelijk gemeentelijke beleidsmakers en ontwerpers van de openbare ruimte. Huidig leiderschap op bestuurlijk niveau, en kennis en vakmanschap van uitvoerenden moeten worden versterkt om effectief, efficiënt en eerlijk beleid mogelijk te maken;
5. Beleidsactoren kunnen aan vijf soorten organisatorische knoppen draaien:
   feitenonderzoek, vakmanschap, regie en verdeling van middelen en menskracht, communicatie, en de operationele uitvoeringsorganisatie.

PREFACE

This thesis is the product of 30 years of exploring the pedestrians realm and on how to improve pedestrian walking and sojourning in public space conditions. The book is made at the end of my career, to capture and consolidate what was learned over the years on the subject of what pedestrians do: walking and sojourning in public space. The format 'PhD thesis' is chosen to bring up the best possible content for substantiating policy development, and to make it a handbook that cannot easily be put aside as 'just another opinion'. So, the format is a means to an end, not a goal in itself, which is to endorse the domain.

The idea for a book came up in 1992, when I worked with my colleagues of the Dutch Pedestrians Association on a background documentation for a Symposium of the Dutch Pedestrians Association on the position of the pedestrian. We found that knowledge for tackling the pedestrians' problems was scarce and that there was a lot of 'reinventing the wheel'. It appeared that there was need for a proper handbook on pedestrians, walking and sojourning. At the Pedestrians Association it was not feasible to compile such a handbook. A decade later, when I transferred to the Rijkswaterstaat AVV traffic and transport research centre, a window of opportunity came up. The institute aspired to become a real knowledge centre, and actively supported doing PhD studies. In 2005 I took the bait and submitted a proposal on substantiating policy development for improving the pedestrians' position: a Pedestrians' Quality Needs project (PQN). As in the Netherlands the domain was no more than a niche, the idea was to assemble a small international group of researchers to profit from a larger nurse pond of front runners. So I sent out a call to colleagues in my international network, and particularly the International Co-operation on Theories and Concepts in Traffic Safety and the International Transport Forum at OECD (OECD/ITF). The call was extremely successful, and yielded more than 70 researchers that wanted to join. Rijkswaterstaat and the Ministry of Transport and Water Management took this up as 'a consequence of success' and agreed to adequately support the project. And they did! So, with the help of Rijkswaterstaat, the Ministry of Transport and Water Management and the European COST framework the project COST358 Pedestrians' Quality Needs (PQN) was set up, and I became chair of that large project and gained a lot of long term friends. A little bit later the International Transport Forum (OECD/ITF) itself started a sister-

project Pedestrian Safety, Urban Space and Health, which I could join as a working group member as well.

Leading the PQN project and participating in the OECD/ITF project was nearly a full-time job, preventing me to really work on the thesis. Only after closing up both projects at the WALK21 conference in The Hague (November 2010) it was possible to focus on working on the thesis again, part-time. Unfortunately three year later adversity struck as my wife became seriously ill, needing support and care. In March 2015 I decided to focus on supporting and caring for my wife and on the side work on the thesis, and retire from Rijkswaterstaat. In January 2020 she passed away; after three months I returned to completing the thesis.

At the start of the work on the thesis in 2005 there was only a faint image of the whole. Although at that time already many of the pieces of the thesis puzzle were found, it was expected that along the way many new pieces could be found, and that, in order to sketch a full picture of the pedestrians realm and ways to improve it, a number of missing pieces need to be acquired through hard work and creative appraisals. A lot of ground work was done by the PQN and OECD/ITF groups, which grouped and fitted the many found pieces together in their final reports. My own content contributions in the PQN and OECD/ITF projects focussed on constructing a theoretical framework (cf. this thesis' Chapter 3) and on the evaluation of the pedestrians' performance and satisfaction (cf. this thesis' Chapter 5). These preparations gave me a head start in further exploring and comprehensively covering the contexts, processes and content of the subject, and writing the thesis.

Apart from support from the many friends from Rijkswaterstaat and the PQN and OECD/ITF projects I profited very much from the wisdom, thinking along and advises, and regular reviews by Willem Vermeulen, Paul Schepers, Derk van der Laan, my promotor Bert van Wee and everlasting support by my dear wife Thea. It's a real pity she could not experience the completion of my life's work: a gift to pedestrian advocates, the academic world, and policy communities in the pedestrians realm.

Rob Methorst, Voorschoten / December 2020.

1. INTRODUCTION[1]

1.1. Preamble

This doctoral thesis concerns walking[2] [3] and sojourning[4] in public space and how a system approach to policy making can help to ensure that the pedestrians' needs and requirements are adequately facilitated, both in the short and longer term. For practical reasons the Dutch situation is taken. In this thesis a pedestrian is anyone who walks or stands stationary, including those who need walking aids, wheel chairs and other simple vehicles that are absolutely needed for their basic movement in public space. So, vehicles and technical means that are used for fun and sports, like skates, toy scooters and tricycles[5], although in legal terms these means are seen as 'pedestrian', are not dealt with in this study.

A pedestrian thus is a person travelling or sojourning on foot in public space, whether walking, running, playing, standing still. In modern times, the term mostly refers to someone walking on a road or footpath, but this was not the case in ancient times. With the advances of motorisation of society the pedestrian is banished to the side of the road or to dedicated infrastructure. In

1 This chapter is a further development of the author's own work as part of the COST358 Pedestrian 'Quality Needs project, viz. Part A: Introduction and Conceptual Framework (Methorst, 2010) of the Final Report of the COST358 Pedestrians' Quality Needs (Methorst et al., 2010), published at www.walkeurope.org, www.walkeurope.eu, and www.walk21.com/pqn-project.

2 Definitions of concepts used in this report are presented in Appendix 1 Glossary of terms.

3 Walkability describes overall walking conditions, in the widest sense. Walkability takes into account the pedestrians' abilities and competences, quality of pedestrian facilities and services, roadway conditions, land use patterns, community support, security, comfort of walking and connectivity to the transportation system. Scores on walkability indicate how well the pedestrians' needs regarding walking *and sojourning in public space* are taken into account.

4 Sojourning in public space concerns all pedestrian activities in public space that are not purposeful walking from an origin to a destination or a round trip. Together with purpose walking it defines the total of pedestrian behaviour.

5 This also concerns new trendy vehicles like the Segway; when they are used as walking aid for persons with limited stamina, of course, an exception is made.

principle one can walk anywhere, both in public and private space, provided the space is accessible and passable (http://en.wikipedia.org/wiki/Pedestrian).

As a species, humans *are* pedestrians, i.e. mammals, walking on two feet. It is true that other animals walk, too. What makes humans different from almost all other species is that they walk erect (Amato, 2004; Nicholson, 2008). In principle everyone is a pedestrian, but one can perform other roles, like car driver, bicyclist, passenger as well. Humans have a need to have an identity and to feel special. Being able to walk is such a common thing that very few people use it for defining their identity (Steenaert & Methorst, 1998). On the other hand, since other modes came up, there is more need to be aware of being a pedestrian, while walking and not driving through public space.

For operational functioning, people need to pay attention to special conditions only (Steffen, 1975). It is clear that the human brain would be overstressed if all common things would have to be given attention. This helps to explain why walking, although crucial, is generally not in the centre of attention[6]. The self- evident feasibility, relatively low conspicuousness and low costs of walking are additional arguments. Unfortunately the same mechanism makes pedestrian problems 'invisible' and deniable. What normal person wants to admit that he has problems coping with such a common activity? This general attitude makes it rather difficult for providers to find out what needs really are essential and what is needed to facilitate walking adequately. Many 'hidden' interests are represented and promoted by Non-Governmental Organisations (NGO's) that highlight concealed and dormant needs and demand political attention. In most countries however the interests of pedestrians are not supported by influential and powerful groups. From discussions amongst experts in the COST 358 Pedestrians' Quality Needs (PQN) project[7] and OECD Pedestrian Safety, Urban Space and Health research groups it appears that governmental attention for these needs is still rudimentary, both on the local and national level. As a result every now and then urgent walkability problems are remedied, but problems keep popping up. Walkability and sojourning quality are often questionable.

Pedestrian needs vary widely. There are many different needs, and needs vary from person to person and from situation to situation. Needs for walking differ from needs for sojourning in public space. Some of these needs are quite common and others so specific or unique that it is probably not reasonable to expect that society is prepared to satisfy all needs at any expense. In this context the Design for All (D4A) principle sets the stage for this study[8]. In D4A needs are seen in relation to abilities and competences; according to this principle the optimal policy regarding satisfaction of needs is to provide for the vast majority of public space users. This can best be done by concentrating efforts on providing for those that have difficulty in coping with the system. The premise is that, if the less able individuals are supported and facilitated adequately, more able persons are automatically seen to (EIDD [European Institute for Design and Ability], 2004)[9].

[6] Except for 1) children learning to walk, 2) people facing serious walking problems, and 3) walking as a challenge, for example long distance walking, climbing mountains, running a marathon.
[7] PQN: COST 358 Pedestrians' Quality Needs project (COST-office, 2006)
[8] In Sections 1.6 and 4.3.4 Design for All (D4A) will be discussed more extensively. It is an approach to the design of products, services and environments to be usable by as many people as possible regardless of age, ability or situation. It aims to be a broad-spectrum solution that helps everyone, not just people with disabilities. It also recognizes the importance of how things look and appeals to a wide range of potential users.
[9] The principle compares to the current common practise in process industry to base quality control on variance in quality of products, not on the degree of deviance from the average quality of a product.

The PQN project, the above mentioned OECD/ITF project and this thesis share having the same reasons to deal with walkability issues. The work for the thesis is closely linked to both international projects, makes use of the results and the vast experience available from the project groups, and scientifically underpins the PQN and OECD/ITF work on the issue.

1.2. Thesis objectives and research questions

With regard to the City of Geneva Pedestrian Masterplan, Wiedmer Dozio[10] aptly expresses what governmental tasks regarding the pedestrian comprise:

> '*Taking care of pedestrians is managing everyday life's commonplace events, is having an interest for and being sensitive to the unseen. No glory nor glamour. It is all about discretion, and is nevertheless our life's foundation.*'[11].

There is relatively little research on walkability policy[12]. Admittedly, there is an increasing body of literature on what is called 'Slow Modes', 'Vulnerable road users', 'Non-Motorised Traffic' or 'Human Powered Modes', but a closer look reveals that this research focuses on cycling and that the pedestrian is left aside most of the times. Furthermore, in policy and policy programmes walking seems to be nearly forgotten and cycling gets all the attention (Laursen, 2002). People, and researchers and policymakers are no exception, do not seem to believe in walking as an important mode (Lavadinho, 2010).

Thesis objectives

To the best of the author's knowledge there is no (scientific) overview of the pedestrian's needs and interests and translation of what they mean for designing walkability policy in a broad sense[13]. This thesis aims to close this gap in scientific knowledge by providing an impetus to an overview of building stones for a system approach to walkability policy development and implementation. It aims to comprehensively cover, combine and advance what is known about pedestrians, walking and sojourning in public space, and about effective and fair policies to sustain and improve conditions in this regard. It targets to result in a picture of what a generative approach[14] may look like and what workable controls autorities can adjust to improve walkability conditions. In a generative approach the focus is on structurally improving conditions, thereby automatically solving existing and potential problems. A generative approach goes beyond protecting the pedestrian from evils and aims at providing for walking

[10] Marie-José Wiedmer-Dozio is head of the Service de l'urbanisme de la ville de Genève (Director Urban Planning City of Geneva).
[11] Translated by Irène Vogel from a quote of Mrs. Wiedmer-Dozio in Rue de l'Avenir 2/2004
[12] In this thesis the concept 'policy' refers to *public* policy. Dunn (1981) defines public policy as 'long series of more or less related choices made by governmental bodies and officials'.
[13] The COST C6 Action 'A city for pedestrians: policy making and implementation' (Fleury, D., 2002) comes closest. This study's main objective was to promote better safety and urban quality for pedestrians and suggest planning and maintenance techniques aimed at improving urban quality. The project focussed on **the urban design** for pedestrian mobility and safety, not so much on overview of factors regarding the wider system that governments can influence to support and promote walking and sojourning in public space, although many of them were touched on. This thesis builds on the foundations laid by international projects like COST C6, WALCYNG and ADONIS.
[14] A generative approach reflects the highest level of policy maturity. See Section 2.2 of this thesis.

and sojourning the best way we can[15]. As walking is the most natural travel mode and the lubricating oil of the transportation system as well as a basic precondition for advantageous sojourning in public space, this is expected to deliver socio-economical and well-being benefits on a larger plane: wealth and well-being[16].

Central research question

The central research question for this thesis is:

What insights are available and/or needed and how can they be acquired, and what controls can authorities adjust to effectively, efficiently and fairly improve conditions for walking and sojourning in public space as a source of wealth and well-being?

Wiedmer-Dozio's statement at the start of this section makes clear that for adequate walkability policy making, one should have understanding of the largely unseen context and developments concerning walking and sojourning. This means that, in the choice of policy strategies, together with effectiveness and efficiency, the balance of power, interests and cultural interpretation needs to be considered[17].

Process design: a road map, leading research questions and methods

This thesis concerns policy making for the improvement of walking and sojourning in public space (W+S). The aim is not simply to solve existing walking and sojourning problems, but to find ways to improve conditions for walkers in such a way that they can function better. As a road map to answering the above central research question and support the improvement aims, therefore a quality driven and comprehensive policy process design is needed.

A policy development process is by definition a change process, which starts from awareness that the current situation is not good enough and needs to be changed for the better. Asby (1956) makes useful observations regarding guided change process:

> *" The system is actuated by a control device which is supplied with information about the actual state compared with the intended state. There are four common features of all control:*
>
> 1. *The system to be controlled*
> 2. *The intended state or states of the system*
> 3. *A device for measuring the actual state of the system and thus its deviation from the intended state*
> 4. *A means of supplying correcting influences to keep the system within the limits set."* (Ashby, cited in McLoughlin, 1969, p. 85)

[15] The author realises that this reeks of an overly optimistic view regarding the degree to which governmental policies can bring social change. However, the idea is not primary to *change* behaviour, but to *support* existing and future behavioural needs the best we can, yielding societal benefits.

[16] In my vision **wealth** includes physical, perceived and durable affluence: robust economic benefits and well-being. The benefits should be sustainable, meaning that they cannot lay burdens on future generations and should not go at the expense of the liveability of the planet. **Health** concerns physical and mental fitness and also includes well-being, enabling people to function properly and satisfactory.

[17] According to Bax (2011) this represents the so called observer approach, where attention is drawn to the plurality of values and meanings.

Van den Top argues that timeliness is essential for a stable regulation. If there is too large a time lag between information and action taken, it is possible that the action takes in on the moment that the state of the system has already changed (by other factors). The action can become contra-productive (Van den Top, 2012, p. 130 footnote 47). We therefore add a 5th common feature of control regarding the change process:

5. *Timeliness of information and consequential action* (Van den Top, 2012:130).

A change process ideally starts from a comprehensive image of how the system around the pedestrian functions and then follows identification of deviations from the intended state. The general principle involved is called 'error-controlled regulation' (Ashby, 1956). According to Ashby's ideas the system works like a thermostat, where a heat source is controlled by deviations from the prescribed temperature. In his book 'Urban and Regional Planning' McLoughlin (1969) discusses a system approach, where the system he wishes to control is the city, the desired states are expressed in the plan, the actual state at any time is measured by all forms of survey, and the actual conditions are compared with those intended by the plan. He concludes that the evolution of the city can be influenced by the flow of additions, removals and alterations to land uses and communications. He identifies two ways for achieving changes: directly by carrying out changes ('just doing things') and indirectly by regulating the flow of changes proposed by others through processes of development control (i.e. policy strategies). McLoughlin visualises the basic process in a simple model (see Figure 1.1.).

Although I realise that Ashby and McLoughlin's ideas are not without debate, I choose to take them as a starting point for developing a W+S policy process design, taking into account what critics claim, such as that reality is not so linear and straightforward, steps are not so clear, that in practise an iterative process is needed and that policy processes are cyclical.

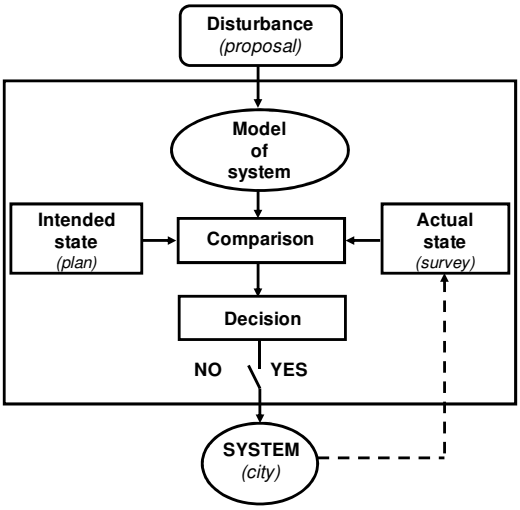


Figure 1.1. Error-controlled regulation (adapted from McLoughlin, 1969)

A typical policy process starts and ends in the context of the system, from the policy developer ('observer') perspective. In principle it should be cyclic, because after implementation the system changes trigger impact and this impact again can trigger new policy process cycles. In this thesis it is not an option to go through a full policy process cycle. The actual decisions on

strategies and implementation of plans are beyond the scope of a researcher and advisor. The process is, however, iterative, processing the consequences of captured new ideas and empirical evidence, and adapting positions taken, within reason[18].

This thesis' policy process model basically follows the McLoughlin model. I define a flow model featuring 8 steps to be taken (see Figure 1.2). This thesis follows the process steps. Apart from step 0, for each step a leading research question is formulated. In the text below I first introduce the process steps and leading research questions, and then clarify the scope, aims, research method(s) and position in the thesis.

The policy process starts off from a political decision about targets regarding walking and sojourning in public space (**step 0**). In this thesis the target is assumed to be the improvement of walking and sojourning in public space conditions, in such a way that the pedestrian activities can, compared to current conditions, contribute more to the wealth and well-being[19] of communities and the nation.

As in the McLoughlin model, the **first** step this thesis' process design starts with laying groundwork, building and substantiating in a model of the W+S system, or more accurate: a conceptual framework. The leading research question regarding this policy process step is:

1. *What conceptual framework can be developed to structure and inspire research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, its interrelations and main determinants?*

In this policy process step first a bird's eye view of current literature about walkability policy development is obtained. Based on a system approach, using general insights in walking and sojourning and walkability, a conceptual framework is sketched. The purpose of the conceptual framework is: 1) to structure research and policy development, 2) to inspire the quest by providing basic understanding of how the system works (what it is, how and why it functions, proper assessment of current state of affairs and current and future needs for change), and 3) devising improvements and evaluation (provide cues for meaningful improvements, criteria for assessing effectiveness, efficiency, fairness of interventions, and gaps in knowledge). The conceptual framework is built on insights found in literature, discussions in the PQN and OECD/ITF projects, and insights gained from 30 years working in the field. The conceptual framework is sketched in Chapter 3.

The **second** step is specification of what the conditions for pedestrians should be like: *the system requirements* for the pedestrian's optimal performance. The leading research question for this policy process step is:

[18] Depending on the stage of the work however the iteration stops. E.g. at the start of reporting on results from research into the detailed research questions, the argumentation behind formulation of the question finalises. The changes of position are not reported, but can be traced by looking at the successive drafts of the thesis.

[19] When speaking about communities and the nation 'health' has a different connotation than 'well-being'. Here I use 'well-being' for communities and the nation to indicate what 'health' is for an individual: physical and mental fitness, including the ability to function properly and satisfactory.

2. *What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation?*

Based on the structure and general insights from the conceptual framework, presented in Chapter 3, in this policy process step stock is taken of conditions that in general directly and indirectly affect pedestrians' behaviour in public space. The study not only covers features of the targeted policy object (i.e. the W+S system), but also preconditions for policy strategies to be effective, efficient and fair. Subsequently pedestrians' needs and abilities, and opportunities that need to be provided to fairly match the pedestrians' needs and abilities are discussed. Insights regarding pedestrian needs and abilities are gathered from scoping review research and expert group discussions. A requirements specification is built on theoretical insights and empirical evidence found in literature. Together this prompts a reference vision for the comparison of the actual state of the system with system requirements, crude ranking of requirements for demonstrating an item's relative importance for walking and sojourning in public space. To enable comparison, more detailed research questions concerning the status quo of W+S conditions, W+S performances and impacts are abduced from the considerations regarding the system requirements.
Situational institutional framework[20] requirements can be assumed to mainly depend on the dominant perception regarding urgency of specific improvements. Consequently the optimal state of the institutional framework cannot be specified beforehand. At this stage in the policy process only essential ingredients regarding the W+S institutional framework can be indicated. Because I presume that the W+S system needs to be adapted to pedestrian needs and abilities[21], and not the other way around, in principle the same is true for requisites of pedestrians' abilities[22]. In Chapter 4 the system requirements will be outlined.

The **third** step concerns describing the state of affairs (status quo) regarding the opportunities offered by the system (level of service), and how pedestrians actually perform. The leading research question regarding this policy process step is:

3. *How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?*

The research implies exploring 1) what conditions are offered to pedestrians, 2) what features typify W+S behaviour, and 3) concluding to what extent actual and expected W+S conditions match system requirements. The outlined system requirements (cf. Chapter 4) direct the exploration of conditions offered to (potential) pedestrians, i.e. facilities and services as proxy for W+S opportunities. While the identification of system requirements is built on international literature and experiences, the work regarding the status quo of the system in this thesis is restricted to a case study of conditions in the Netherlands. Features of current and expected W+S behaviour to be assessed are the W+S population characteristics and the population's W+S activities: its scale, volume and qualities (e.g. utility, safety and appreciation). The assessment

[20] The W+S institutional framework is the policy arrangement made up from institutions, i.e. policy actors, which by together affect walking and sojourning in public space.
[21] I presume that pedestrians' contemporary features cannot 'on the spot' be adapted to prevailing conditions. So, what is required depends on the (implicit) demands of pedestrians.
[22] New conditions may require new abilities (cf. new classes of computers require computer skills)

is based on scoping review of literature, including Dutch policy reports and notable signs and comments in professional journals, and statistical data. Research results are presented in Chapter 5.

The **fourth** step concerns *devising change*, i.e. an evaluation of the status quo and potentials of the institutional framework regarding walking, sojourning in public space and (potential) pedestrians. The leading research question regarding this policy process step is:

4. *How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?*

This policy process step covers surveying: 1) the composition of and division of tasks and powers within the W+S policy playing field in the Netherlands, 2) influences from the outside on the Dutch W+S institutional framework, and 3) how improvements of the pedestrians' position, and walking and sojourning in public space conditions are and can be brought about. Each of the assessments are directed by theoretical considerations described in this thesis' conceptual framework, and based on preparatory scoping review, a survey amongst Dutch policy actors, and complementary scientific evidence and documented expert judgements from scoping review. Results are presented in Chapter 6.

The next policy process **steps five, six and seven** are respectively Decision on interventions, Implementation (including management and control), and Evaluation and re-adjustment. These policy process steps are beyond the scope of this thesis and are therefore not considered and discussed in this thesis.

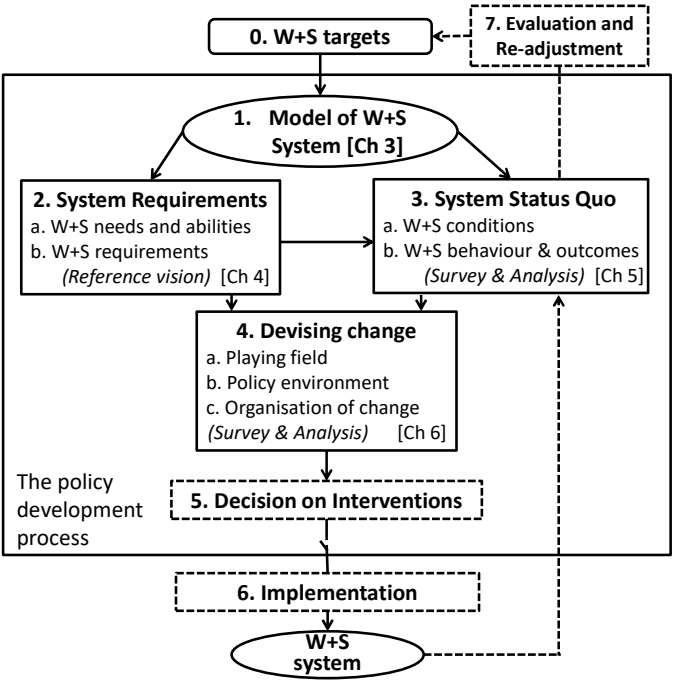


Figure 1.2. Steps in a generative pedestrian quality policy process (after McLoughlin, 1969)

The proposed policy process design is cyclic. Once a decision is made on W+S policy strategies and interventions are implemented, the situation for the pedestrian and stakeholders will change. It also may happen that autonomous changes take place. Furthermore, the policy context may change, for example because of elections, economical or societal changes. This will influence the perspectives on the W+S system requirements and possibly even the general goals. To cope with these changes plans need to be flexible and some kind of monitoring system is needed to reveal the direction of change.

In Figure 1.2 the chosen W+S policy process design is visualized. The numbers in the figure relate to the basic steps to be taken in a generative walking and sojourning quality policy process. The arrows indicate how the successive steps affect each other. Dotted lines show what boxes or relations are not (more than superficially) dealt with in this thesis.

In reality generative policy process steps are not so clearly defined. On the generative policy maturity level actions are taken continuously. They will not depend on a master plan or clearly defined policy processes. Often missing empirical evidence forces the policy developers to start on best guesses. During the process, because of advancing insight, their model of reality can and will be perfected. It often happens that later on questions pop up that lead to answers that make the policy developer discover that in an earlier stage relevant items were missed. Therefore an iterative process can be considered sensible practise.
Also, modelling and identification of general requirements do not have to be repeated in every new policy development process, so in some cases these steps can be jumped.

1.3. Key types of walking and sojourning

In the 'Advice on a strategy for walking in London' the London Planning Advisory Committee identified four kinds of walking (LPAC, 1997:2):

- *"**Access Mode** - where walking is used for all or most of the way between two places, for example home and the workplace, shop or school (i.e. walking as the main means of travel).*
- ***Access Sub-Mode** - walking to support a journey by another mode of transport, for example getting to and from bus stops, stations or car parks.*
- ***Circulation/Exchange** - carrying out a range of activities on foot in public spaces, including window shopping, meeting people in the street, and the interfaces between shops and café, and the street.*
- ***Recreation/Leisure** - including long distance walking and local activities such as children playing in the street."*

This thesis uses an advanced classification, which better matches functionality and available statistics on walking and sojourning. Regarding Access Mode and Access-sub-mode this thesis follows LPAC, renamed respectively *main mode walking* and *sub-mode walking*. Circulation and Exchange however are considered to be functionally different: while *circulation,* like main mode and sub mode walking, aims at covering distances, *exchange*, i.e. window shopping and meeting people, aims at doing something on the spot, and not so much at covering distances at significant walking speed. Any kind of walking for recreation or sports (including long distance walking), while being a way to spend time, aims at covering distance at a significant walking speed, demanding adequate facilities to be able to move about. In mobility statistics it is

somewhat awkward to differentiate between shorter and long distance recreational walks, while this is not done for other modes and other motives.

This thesis features *sojourning in public space* as a distinct type or class of pedestrian activities. Together purposeful (main-mode, sub-mode and circulation) walking and sojourning completes the total of pedestrian behaviour. Sojourning is defined by the aim to execute activities on the spot ('stationary' activities on foot), regardless of activity motive. It concerns all pedestrian activities in public space that are not purposeful walking from an origin to a destination or a round trip like walking the dog, posting a letter, recreational walking.

There are many kinds of sojourning: professional activities (vending, and utility, street and greenery maintenance etc), window shopping, recreational activities, playing games, children's play, waiting, hanging out, but public space is also the home of the homeless and sometimes the scene of crime and violence. Sojourning in public space is important because it is an indicator for quality of public space and it encourages all kinds of activities, which humans need for their well-being. The concept of sojourning is well-known in Danish, Dutch, German and French language public space literature (for example: 'verblijven' en 'verblijfsgebied' in Dutch, 'zone de rencontre' in Swiss literature). It was rather unknown in the Anglo Saxon countries; it was introduced through presentations and writings of the COST 358 Pedestrians' Quality Needs project.

Thus the four main types of walking are:

1. **Main mode walking** for transport (i.e. A to B [door-to-door] walking, excluding walking for recreation and professional walking);
2. **Sub-mode walking** (walking to and from other modes);
3. **Circulation** (round-trip walking [A to A], both for recreation and for professional walking);
4. **Sojourning** (activities on foot, not aimed at getting somewhere, nor recreational walking).

In this thesis walkability is seen as the quality indicator of the pedestrian's environment, seen from the pedestrian's perspective, providing opportunities for walking and sojourning. This includes the 'hardware' like the built, natural and mobile (transportation means) environment and people in the environment, as well as 'software' like norms, values, intentions and 'orgware' like policies, legislation, information and management.

1.4. The benefits of walking and sojourning

From literature it appears that walking and sojourning is a solution to many societal problems. Many authors and agencies point to the large number of benefits of walking and sojourning in public space. Below an anthology of such benefits is listed regarding transportation, spatial strongpoints, accessibility, safety, the economy, health, the environment, quality of life, social benefits and community goals, social benefits, and tourism and recreation.

Transportation benefits

- Walking is the most natural way of moving about as a human (Rauhala et al., 2003).
- Walking enables accessibility and crosslinking of all modes (BMVIT, 2015);
- Walking is essential for connectivity; it is the main supplier for public transport (BMVIT, 2015; Rauhala et al., 2003);

- Walking is a solution for increasing congestion (OECD/ITF, 2012; Turner et al., 2006);
- Walking is a solution for the burden of increasing infrastructure costs (OECD/ITF, 2012);
- Walking is fast on short distances (BMVIT, 2015);
- Walking is the glue and lubricating oil of the transport system (CROW, 2014; Methorst et al., 2010);
- Walking saves money for infrastructure investments and maintenance (Turner et al., 2006).

Spatial strong points

- Pedestrians are essential for an attractive living environment (CROW, 2014);
- Walking is the foundation for efficient land use (Speck, 2012/2018);
- A commodity public space is scarce; walking is best suited to compact and efficient land use (Speck, 2012/2018);
- Walking and pedestrians are a solution for the degradation of public open spaces; life choices are inevitably a function of the design of the built environment (OECD/ITF, 2012; Speck, 2012);
- Compact cities are increasingly the leading land-use design principle (Kuitert & Maas, 2017);
- Walking supports, maintains and improves the value of urban heritage and city wide cohesion (Rauhala et al., 2003);
- Public space benefits are increased by the presence of walkers. They make public space lively and safe (Speck, 2006; CROW, 2014; Kuitert & Maas, 2017).

Accessibility

- Walking offers very easy, cheap and flexible access to nearby destinations (BMVIT, 2015; OECD/ITF, 2012; Methorst et al., 2010);
- Walking makes other modes accessible (BMVIT, 2015; OECD/ITF, 2012);
- Walking improves accessibility and quality of public spaces (Rauhala et al., 2003).

Safety

- Pedestrians pose the least danger to other road users of all travel modes (Rauhala et al., 2003);
- Promotion of walking can be expected to have net benefit on safety of the population (Schwartz, 2012).

Health benefits

- Walking is healthy and occasions less health costs; can be considered a medicine for many ailments (OECD/ITF, 2012; Rauhala et al., 2003);
- Walking has both preventive and curative health effects (CROW, 2014);
- Walking is a solution for health and negative consequences of sedentary life (OECD/ITF, 2012);
- There are strong correlations between a walkable built environment and the amount of physical activity (Turner et al., 2006);

- Obesity and overweight kill people; obesity increases; walking helps to prevent overweight and obesity easily: even little walking (30 minutes per day) has tremendous effects (Turner et al., 2006).

Environmental benefits

- Walking is the mode with least detrimental environmental effects (BMVIT, 2015);
- Walking can substitute use of fossil fuels for motor vehicles (Turner et al., 2006; OECD/ITF, 2012);
- Walking abates harmful impacts of transport on the environment (Rauhala et al., 2003) and is a solution for air quality (OECD/ITF, 2012);
- Walking is a solution for energy saving needs (OECD/ITF, 2012);
- Walking is the most sustainable travel mode (Wandelnet, 2016)
- Walking causes hardly any pollution, CO2 and NOx emissions, and is lowest on energy consumption (Turner et al., 2006);

Quality of life benefits / liveability / community goals

- Pedestrians add ambiance and security of streets; it upgrades liveability in urban environments (Turner et al, 2006; Speck, 2016; Rauhala et al., 2003);
- It is necessary to have liveable communities; walking and sojourning make communities liveable (Turner et al., 2006; Speck, 2012);
- Walking creates and enables opportunities to socialise in public space (Fischer et al., 2004; BMVIT, 2015; Turner et al., 2006).
- Walking contributes to achieving universal community goals like connectivity, economic developments, environmental quality, good health, and safety (Schwartz, 2012);
- Children's education and growing up are a function of walking and sojourning (playing) in public space (Childstreet, 2006).

Social benefits

- Equity is served by walking: it is the same for different social groups, it improves social equity, and inter-generation solidarity regarding mobility and access (Rauhala et al., 2003);
- Walking creates opportunities to socialise (Turner et al., 2006; Kuitert & Maas, 2017);
- Walking has equity benefits: walking facilities serve everyone, regardless of age, gender, SES, abilities or impairments (Taylor & Damen, 2001; Schwartz, 2012) ;
- Walking promotes and supports social cohesion (Wandelnet, 2016; Appleyard, 1981);
- Recreational walking attracts volunteers (Wandelnet, 2014).

Tourism and recreation benefits

- Outdoor walking is the most popular recreational activity and brings money to local businesses (Turner et al., 2006; Wandelnet, 2014);
- Walking enhances the perception of nature (Wandelnet, 2014).

Economy

- Walking can help save on the car as highest expense in family budget (Turner et al., 2006);
- Walking can reduce health costs (Turner et al. 2006; CROW, 2014). 3.5% of the total expenses for medical interventions are directly due to lack of physical activity (RLi, 2018);
- Outdoor walking is the most popular recreational activity and brings money to supporting services (Turner et al., 2006);
- Pedestrians are vital for the local economy (CROW, 2014; Speck, 2012);
- Business investments in high quality locations draw skilled workers (Turner et al., 2006; Speck, 2016);
- Walking trails and routes affect value of properties positively (Turner et al., 2006);
- Walking can help reduce costs of road investments, accidents, building repair and pollution; it is a solution for the increasing burden of infrastructure expenses (OECD/ITF, 2012; Turner et al., 2006; Rauhala et al., 2003).

1.5. The necessity of research on walking and sojourning policy

How can a study on walkability in public space be justified? This question can be answered by pointing to the significance[23] of walking and sojourning in public space for society on the one hand, and on the other hand how the issue is treated in academic research and policy development. In this section the relevance of knowledge about walking and sojourning in public space will be roughly motivated. Later sections will present a more detailed picture.

Almost every human is a pedestrian at some time of the day. Still, little attention is paid to walking or sojourning in public space in policy plans (Fleury et al., 2002; Methorst et al., 2010; OECD/ITF, 2011). Recently attention in scientific research has grown substantially, but it still is far below the level of attention to bicycling.

As walking and sojourning in public space are generally taken for granted, their seemingly obvious significance, however, is not easily demonstrated, and it appears that the significance question cannot be conclusively answered. The answer depends on the perspective one takes and the evidence that is available. As this thesis studies pedestrian and walkability policy on the national level, it is logical to focus on the perspectives of national interest and of national policy developers and decision makers, and this on national level information and data. Basically there are three ways to express relative significance of walkability and sojourning in public space[24]: by drawing conclusions from meaningful facts and figures regarding walking and sojourning, by pointing to articulated perceptions of policy makers, and by highlighting its future prospects for supporting the population's quality of life:

[23] S*ignificance* refers to purpose and importance. In this section I intend to show that there is both societal and scientific significance: walking and sojourning in public space need to be supported better and it needs to be researched because there are (fundamental) gaps in knowledge.

[24] This notion is based on the concept of Spatial Quality, as defined by the RARO in 1990 (RARO, 1990) and advanced in the PQN project (Methorst et al., 2010). The general idea is that significance (or better: quality) gets defined by complementary quality layers. The basis is formed by objective (observable, measurable) characteristics of reality. The second layer concerns the perception of reality and the third layer concerns (objective and subjective) developments over time. In Section 2.2.2 the concept will be substantiated.

- **Facts and figures** matter because they form a solid basis for rational and effective decision making. The effectiveness of policy measures and strategies for the improvement of walkability and sojourning in public space depends on the degree to which the conditions in fact change.
- **The policy makers' perceptions** of reality are important because, in general, politicians base policy decisions on their perceptions, made up from the evidence they know about (i.e. imperfect insight in the facts)[25], conditioned by political beliefs and a sense of political urgency, spiced by their own experiences, 'public opinion' and their constituency's emotions.
- **Future prospects** are significant because these can help to determine whether an issue will probably continue to be important in the same way, will grow in importance or fade out by itself.

In order to understand this thesis' objectives and research questions, solid background information on the significance of walking and sojourning is needed. The next paragraphs broadly outline this background. Section 1.4.1 highlights some basic facts and key figures regarding walking and sojourning[26]. Section 1.4.2 captures dominant policy makers' perceptions on the issue[27] and in section 1.4.3 general insights in future prospects are presented[28].

1.5.1. Basic facts about the significance of walking and sojourning

In this thesis the first perspective regarding the significance of walking concerns facts and figures. The question to be answered in this section is whether there is empirical evidence to show that walking and sojourning in public space, and walkability are important matters for the functioning of society and whether there are firm arguments for policy attention.

In the following it will be argued that walking is a natural travel mode, which over the last century evolved from the dominant mode to one that now appears to stand in the shade of other modes. Can it be shown that this is an underrepresentation of the significance of walking? The thesis will assess to what extent walking still is an essential travel mode and whether sojourning in public space merits policy attention. In this context it is needed to show how important walking is for the population's mobility, for accessibility of premises and other transport modes, for cities, for participation in society, social contacts and recreation, and for sustaining health. Furthermore the matters of car dependency, sustainability, safety and security of walking and sojourning in public space, as quality aspects of mobility, accessibility and sojourning need consideration.

Walking as a natural travel mode

Walking is the oldest, most fundamental and natural travel mode (OECD/ITF, 2011). According to Amato, '*approximately six million years have elapsed since our ancestors took to bipedal locomotion'* (Amato, 2004:2). As a species, humans are pedestrians (Nicholson, 2008). Walking is one of the basic mobility skills which a toddler must master. Walking is the only form of

[25] In many cases professional lobbyist help politicians to enlarge insight in matters.
[26] In Chapter 5 more detail will be given.
[27] In Chapters 5 the policy makers' and decision makers' perceptions will be documented and analysed to help developing policy development recommendations.
[28] As context and input for policy development, various aspects of the future of walking and sojourning will be explored in Chapter 4, 5, 6 and 7.

mobility for which (able) persons do not need devices or vehicles, and which is therefore a mobility option open for (almost) everyone. Being able to walk is an essential precondition for independent mobility (OECD/ITF, 2011).
Walking seems to be in our genes, but the question is, how important walking is in modern times. Hasn't walking become obsolete with the introduction and spread of wheeled and winged vehicles?

Is walking essential for mobility of the population?

From national statistics, and most transportation research reports and policy plans, one might easily get the impression that walking is unimportant and a thing of the past. This is however wrongfully based on the idea that mobility is defined by the distances covered or by speed.

Although passenger kilometres, in literature and in policy documents, are generally seen as the most significant indicator for mobility, it remains to be seen whether this is true from a societal perspective. This thesis chooses to use the definition of mobility given in Oxford Dictionaries:

Mobility is the ability to move or be moved freely and easily[29].

Mobility defined in terms of passenger kilometres does not reflect that mobility is fundamental for the social and economic functioning of citizens, that accessibility on foot is a necessary precondition for all other forms of person transport, and that the freedom to choose to travel and sojourn in public space are particularly important. Secondly, by using passenger kilometres unproductive travelling because of needlessly long routes, and unfavourably located destinations or detours, contribute to 'increasing mobility'. From a societal perspective this is not beneficial, but harmful. In this thesis' view better indicators of mobility are the number of journeys or trips and travel time[30]. Available figures regarding the decrease in door-to-door walking (walking as a main mode) do not do justice to the importance of walking. This does not cover all types of walking and other activities on foot in public space, and more importantly, it is based on the questionable presumption that mobility is about covering as much distance as possible.

The share in number of door-to-door trips (walking as a main mode) is a fair indicator for the significance of walking. By far the largest amount of trips are short distance trips in urban conditions. Recent research confirms that 70% of all trips in the Netherlands are shorter than 7.5 kilometres and only 5% of the trips surpass 40 kilometres (Savelberg et al., 2011). Long distance trips may appeal to imagination, but are in fact a very small minority of trips.

It has to be mentioned however that the share of walking as a main mode does not include the vast and increasing numbers of sub-trips to and from other modes (walking as an access sub-

[29] Oxford Dictionaries, accessed 26-1-2014; Websters-online-dictionary, accessed 11-1-2012 define it as the ability and willingness to move, travel or to change house or work. In this thesis mobility is mainly used in the context of moving in public space. The key question regarding mobility is: can you reach the destination of your choice adequately?

[30] In this thesis a journey concerns door-to-door travelling; journeys can be split up in parts: trips using different modes; travel time is relevant as people can be assumed to have a travel time budget and travel time can also be seen as an indicator for the amount of energy persons need to put into walking. Mindell et al. (2012:1) finds that "*risk by distance travelled does not capture large differences in average speed* [between different modes] *which enable differential mobility for drivers, cyclists, and pedestrians*."

mode). Based on indicative figures[31], confirmed by statistical evidence from other countries[32], the author estimates that on average Dutch citizens walk about 400 meters per person per day to and from other modes (multi-modal walking; amounting to about 180 kilometres per year, representing 40 - 45% of all walking)[33].

With regard to time use trends, the Netherlands Institute for Social Research (SCP) offers some contextual insight. From the national Time Use Studies (Breedveld et al., 2006; Harms, 2008) it appears that from 1975 to 2005 time spent in a car (as a main mode) has increased from 3.0 hours per week per person to 4.7 hours per person per week, whilst time spent on walking, cycling and travelling by public transport has been more or less constant (see Figure 1.3). Furthermore, the average total number of trips per person has increased from about 15 per person per week to 17 per person per week, being mainly increased car use (see Figure 1.4; Harms, 2008)[34].

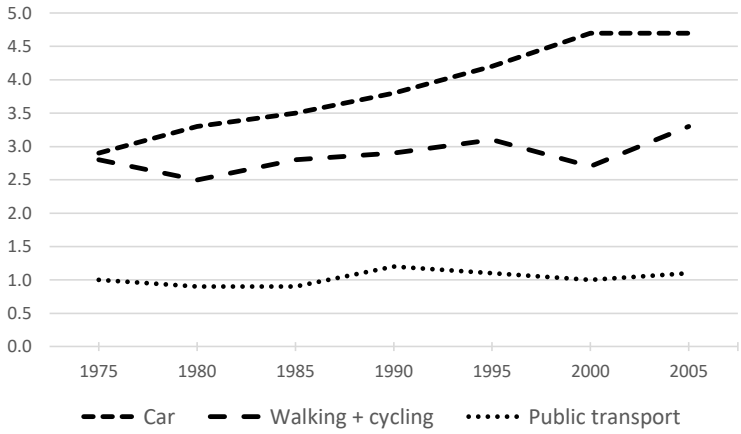


Figure 1.3. Travel time in hours per person per week (population 12 years and older) and travel modes in the Netherlands 1975 - 2005 (source: SCP (TBO) www.tijdsbesteding.nl 18-10-2006)

Statistical evidence pointed to a decrease in time spent on door-to-door walking from about 9 minutes per person per day to 7 minutes per person per day (Harms, 2008). This is however compensated by an increase in walking to and from other modes. It is likely that over the last 3 decades the total time spent as a pedestrian is more or less constant (see Figure 1.4: about 17 minutes per person per day, about 100 hours per person per year; SCP, 2006).

[31] In Knippenbergh (1993), (UITP (1997), Methorst (2005) indicative figures for before and after transport in the Netherlands are provided.
[32] Data from SWISS statistics in the Swiss PQN Country Report (Sauter et al., 2010) and Norwegian statistics (OECD/ITF, 2012).
[33] Calculations are based on figures of travel survey data from Statistics Netherlands and Rijkswaterstaat and indicative distances to and from main travel modes found by Methorst (2005). In the context of the PQN project the amount of multi-modal walking was calculated using the number of trips by car, public transport and bicycles and average distances to these modes derived from a 2005 rough pilot study by the author (the values were verified by Swiss and Norwegian studies). From average distances covered walking, travel time was calculated assuming average walking speeds of 4 km/h.
[34] Because of methodology related trend breaks in Dutch travel surveys more recent figures cannot be given.

Although modal shares change over time, the average number of trips per person per day and travel time are remarkably constant over time and country. The average number of trips per person per day, depending on travel survey criteria, varies between 2.8 and 3.6, and the average travel time budget is about 60 - 75 minutes (Zahavi, 1979; Hupkes, 1977).

More recent data will be presented in Chapter 5.

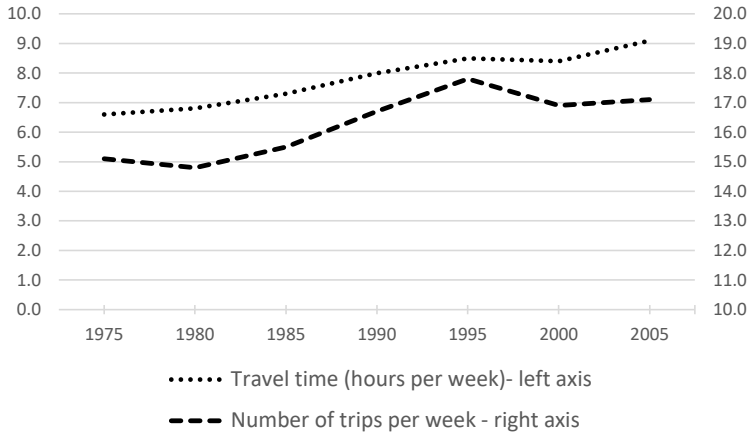


Figure 1.4. Travel time and number of trips per person per week (population 12 years and older), in the Netherlands 1975 - 2005 (source: SCP (TBO) www.tijdsbesteding.nl 18-10-2006)

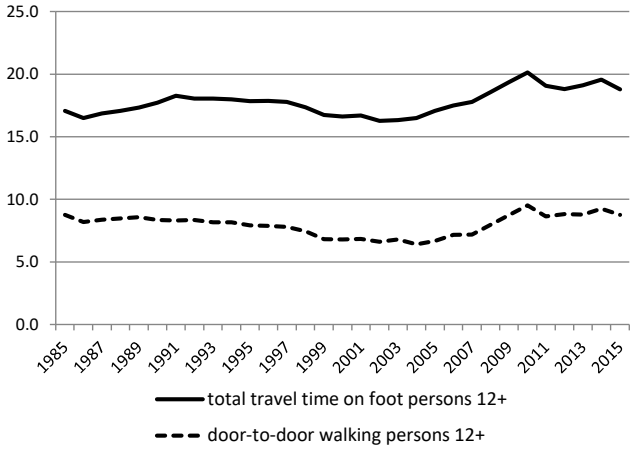


Figure 1.5. Travel time on foot per person per day in the Netherlands (minutes)(OVG/MON, 2008)

The importance of walking for accessibility

As stated above, all forms of mobility involve some walking. Apart from walking from door to door, a traveller has to walk to and from a vehicle, as in most cases the vehicle cannot be entered or exited inside premises of departure or at one's destination. He needs walking as an access

sub-mode, as in most cases other modes do not qualify in this respect. Thus walking is the glue of the transport system (Sauter, 2002).

Does sojourning in public space merit attention?

Sojourning in public space concerns all pedestrian activities in public space that are not purposeful walking from an origin to a destination or a round trip like walking the dog, or a city walk. There are many kinds of sojourning: professional activities, recreational activities, waiting, hanging out, but public space is also the home of the homeless and sometimes the scene of crime and violence. Sometimes walking and sojourning merge fluently, like in a city walk where one stops to view a building or while walking the dog, halting for a talk to an acquaintance. Sojourning in public space is important because the amount of it (i.e. number of people in public space or time spent in public space) can be an indicator for quality of public space and it encourages various kinds of activities, which humans need for their well-being.

Sojourning in public space serves many purposes, such as the local economy, communication, education and security. People in the street means clients for shops, means safety and security for sojourners, walkers and cyclists because of common supervision, and means that it is a place to be for inhabitants and tourists. By making public space attractive, it also supports property value and helps attracting people from the outside (Project for Public Spaces, 2010). Well-designed public open space (POS) that encourages physical activity is a community asset that could potentially contribute to the health of local residents (Giles-Corti et al, 2006). Sojourning in public space is essential for children to grow up and learn about life, people have to wait for public transport, street musicians and vendors earn their living there and democratic rights are demonstrated in the street and many more purposes (Gehl, 1978; LPAC, 1997).

Although almost everyone knows that many important things happen in public space, very little data are available about time spending in public space. Even in time spending surveys and statistics no clear indication was found on the amount of time that is spent in public space. Only in very specific cases, like festivals, protest parades, football matches some observations are made in this regard. As a consequence, the value of sojourning in public space tends to be underestimated or even denied, and lags behind in investments in public space quality and the promotion of sojourning in public space.

There are no precise statistics about time spent by grown-ups in public space. An approximation of time spent on sojourning in public space can be abduced from (older) time spending and leisure time studies. From time spending surveys in the Netherlands it is known that the amount of leisure time spent outdoors decreased from 14.8 hours per week in 1975 to 13.3 hours per week in 2000. Most leisure travel takes place on Sundays (21%) and Saturdays (18%). The rest of the weekdays are good for 12 – 13% of the trips. In 2001 and 2002 almost a billion daytrips (more than 2 hours from home, excluding trips of more than 500 km and walking trips) were made by the Dutch population, which equals about 60 daytrips per capita (Harms, 2006; Harms, 2008). Of these trips 430 million (27 per person per year) concerned some form of sojourning in public space[35]. It can be calculated that, even if only 25% of the time spent on these trips concerns sojourning in public space, this will amount to about 1 hour per person per week spent sojourning in public space for leisure purposes (about 50 hours per person per year). Sojourning

[35] The activities that include some form of sojourning in public space are: outdoor recreation (28,6 million trips), taking a walk (65.9 million trips), funshopping (112.8 million trips), public events (42.3 million trips), visiting heritage estates and areas (28.9 million trips) and 'various others' (156.0 million trips), totalling 434.5 million trips of total 981.6 million trips (source: Harms, 2006, table 6.2, page 85).

in public space for other reasons (waiting, lunch hour time, playing outdoors, hanging out, professional activities) will probably be just as much. Consequently, the total amount of time spent sojourning in public space will average approximately 2 hours per person per week (100 hours per person per year)[36]. This is about as much time as is spent on walking. So, like walking, sojourning in public space merits policy attention in its own right.

How important are walking and sojourning in public space for cities?

The vitality of a city is closely linked to people being out on foot. Cities are above all places to live, connect and socialise (OECD, 2011). People walking and sojourning in the city attract people. In shopping centres pedestrians are potential customers (Zhu et al., 2009). Contrary to what many shopkeepers believe, cars repel shoppers and tourists (Gehl & Gemsø, 2006). Tourists experience a city most intensely on foot.

The presence of pedestrians and bondage with the physical environment are important factors in keeping up spatial quality. Perceived security of public space is closely related to the presence of pedestrians. Urban mobility through the transport system has an important impact on a population's Quality of Life. Walking and sojourning is a prime indicator for Quality of Life in a city (OECD, 2011). In sum: the (economic) vitality of the city and Quality of Life at least partly depend on walking and sojourning.

Walking, sojourning and health

Health issues are becoming universal. For modern humans exercise is no longer a natural part of everyday life. Technical devices, like cars, elevators, electric bicycles made life easier, but pose new problems as well. Walking is a solution to many health problems (WHO, 2008). In the health community obesity is seen as a major problem, which needs to be tackled soon. Much awareness communication is directed at getting this message across to the general public.

There is ample scientific evidence that walking, as a physical activity, supports health. Physical exercise (like walking) of at least 30 minutes per day helps preventing many serious diseases and disorders, like obesity, cardio-vascular diseases, diabetes and even mental health problems (Sallis et al. 2006). It is a simple weapon against obesity and the cheapest medicine for many diseases, and a very cost-effective investment in public health (Racioppi et al., 2010). Promoting walking[37] is an effective strategy to keep the population healthy as well as a cost effective measure to counteract typically occidental diseases like cardiovascular and respiratory diseases, obesity, and also many forms of cancer, ageing deterioration included (cf. WHO Health Economic Assessment Tool HEAT for cycling and walking[38]). Even mental health related to environmental aspects and lifestyle, is positively influenced by regular walking while car use and hours spent in traffic jams represent an important stress factor, influencing both mental and physical well-being[39]. Consequently the WHO message is: 30 minutes of exercise can help prevent health risks; walking is a simple and feasible form of exercise that everyone can and should take up. In this context it is also a fortunate development that, in many European

[36] For comparison: on average a person spends about 450 hours per person per year travelling and about 100 hours per person per year on other forms of being in public space (sojourning): waiting for the bus, playing, window shopping, looking at a parade, sitting in the sun, taking a pause etc.
[37] Apart from communication activities, promoting walking may include all kinds of strategies providing adequate and attractive walking facilities, connective networks and safe environments etc.
[38] see http://www.euro.who.int/en/
[39] Source: http://www.who.int/topics/physical_activity/en/

countries, Nordic Walking has become a very popular form of exercise amongst middle-aged and older people, particularly women.

If people do not walk, they have to do other kinds of physical activity to stay healthy, which in most cases costs them and society more than walking does. Being able to walk and sojourn in public space helps to support children growing up, and sustains independence of the elderly and persons with limited mobility.

Health is both precondition (input) and 'product' of walking as a physical activity. Health can relate to the pedestrians' abilities and competences. A lack of health restricts walking options and thus mobility. On the other hand, by walking people can sustain or even improve their health, so that they can be more mobile. Walking is a solution to many health problems.

The positive effects of sojourning in public space on health and social well-being are pointed out in classic publications by Jacobs (1961) and Gehl (1971), and still found in modern publications and even movements like Project for Public Spaces ('placemaking') and Shared Space. Also, there are a number of studies referring to the beneficial effects of playing in public space on children's mental and physical health (Dol et al., 2009).

Walking and car dependency

The lack of access to car use nowadays can pose serious problems because many essential destinations cannot easily be reached without the use of a car (Jeekel, 2010). It is true that for many people in the Netherlands the bicycle offers an alternative, for some others modes like public transport or moped are an option.

It is important to mention that some groups in society, apart from their feet, do not have access to other means of transport by themselves and rely on others to be transported over distances that go beyond walking distances. This concerns particularly children and people who are not able to drive or cannot afford a car or use a two-wheeler. In 2014 28.5% of all 2 million households are car-less; 54.8% of the one-person households is car-less[40]. In 6% of the household no vehicle is available at all[41]. These are captive pedestrians, that do (most of the times) not have a choice but to walk. At a random moment, about half the population cannot choose to go somewhere by car[42]. The consequences of car dependency threaten the population's mobility and in some cases lead to social exclusion (Van Wee, 2011).

Walking and sojourning safety and security need careful consideration

In itself walking is a relatively safe travel mode. Pedestrians generally do not pose a threat to other categories of road users, but pedestrians are at risk. In this respect they are vulnerable road users. According to road accident statistics, which in the Netherlands are available from 1987, since that year approximately 10% of the road traffic fatalities[43] are pedestrians. This share does not vary significantly over the years (Methorst et al., 2010-3). The numbers vary from about 200 in 1988 to 62 in 2010 (police reported *traffic* fatalities in the BRON database;

[40] CBS Statline figures about car and motorcycle ownership, accessed 23-12-15.
[41] No vehicles in this case means that in these households there is not even a bicycle.
[42] According to Statistics Netherlands in 2011 there are 7.7 million cars in the Netherlands, 469 per 1000 inhabitants. CBS Statline, accessed on 28-8-2011:
http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=7374hvv&D1=0-5&D2=a&D3=l&VW=T
[43] Fatalities due to road traffic accidents, where at least one moving vehicle is involved.

including fatalities that are not reported by the police the 'true' number in 2010 is 72). From 1987 to 2009 the share of pedestrian traffic casualties admitted to hospital decreased from 11.1% to 7.1% of the police reported seriously injured road traffic casualties. The numbers decreased from 1708 in 1987 to 320 in 2009[44]. More recent data are presented in Chapter 5.

The numbers mentioned however do not represent the complete picture, as pedestrian accidents are seriously underreported and accidents without involvement of a moving vehicle are not taken into account. In fact currently the true numbers of such single accidents are about 4 times higher than the true numbers of vehicle - pedestrian crashes. More than half of these single accident victims are senior citizens (65+ years)(see Chapter 5).

Figures presented in the PQN Final Report and in Chapter 5 show that almost a fourth of all societal costs of travel accidents[45] are related to pedestrian accidents. The costs are this high because particularly the large numbers of treatments in Emergency Rescue departments of hospitals and hospital admittances add up to a huge amount of expenses. Thus government is confronted with high medical costs, costs of employment disabilities, transport costs in the context of the Social Support Act etc. (Methorst et al., 2010-3). So, walking and sojourning safety and security need careful consideration.

Conclusion

In conclusion, although this is by no means a complete account, walking contributes significantly to the nation's mobility, accessibility of premises and other travel modes, the vitality of cities, the population's health, sustainability and security. Car dependence may threaten mobility of the substantial group of people that do not have the option to choose to travel by car. Safety and the consequences of pedestrian accidents however are a serious issue, which, because of their impact, deserves full attention.

1.5.2. General pedestrian problems and their consequences

Some of the authors e.g. Gunnarsson (1995/2001), Risser (2002), Turner et al. (2006) and Schoon (2019) provide comprehensive overviews of pedestrian problems and consequences, meant to trigger awareness of the many kinds of problems that pedestrians can face and what that means for them and the concerned stakeholders. No information is available however about whether or how the guidance actually triggers the concerned stakeholder(s).

Gunnarsson (2001) classifies pedestrian problems into four main groups: *accessibility*, *capability and comfort*, *safety and security*, and *environment and aesthetics:*

- *Accessibility problems*: long walking distances to reach destinations that matter, lack of proximity and variety in city activities; lack of walkways; difficulties to reach destinations (various kinds of barriers, including stationary objects, poles, voluminous car traffic); lack of opportunities to approach buildings;

[44] The number corrected for underreporting is 648 pedestrians seriously injured MAIS2+ (Source: Dutch road safety statistics available through http://www.swov.nl/cognos/, accessed on 9-9-2011.) The figure for MAIS0+ is about 815 casualties admitted in a hospital. In 2009 the toll is 400 casualties MAIS0+ less than the average yearly number in 2003-2007.

[45] Travel accidents include road traffic accidents, involving a moving vehicle, as well as pedestrian single accidents, where no moving vehicles are involved. The latter are normally not included in road accident statistics, but did happen while moving about in public space (Methorst et al., 2010-3).

- *Capability and comfort problems*: narrow and crowded passages; high kerbs, steps, stairs and slopes; poor street lighting; poor information; lack of resting seats and meeting places; mud, splash, puddles; dog excrements, trash, litter;
- *Safety and security problems*: conflicts and risk of collisions with vehicles (traffic safety); risk of fall and stumbling; falling objects; threats and assaults;
- *Environment and aesthetics*: noise, vibrations; exhaust, soot and dust; exposure to adverse weather (sun, rain, wind, cold, snow); ugly, monotonous walking and city environment; lack of quiet and peaceful meeting places and places to play.

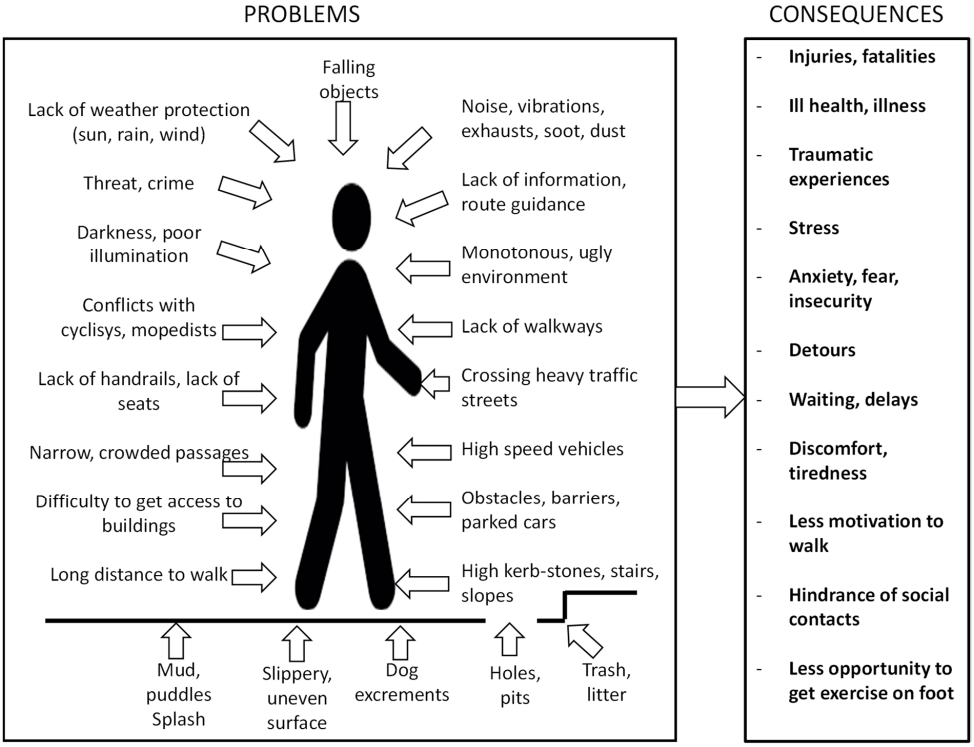


Figure 1.6. Problems and consequences to a pedestrian in today's traffic
(after Gunnarsson, 2001)

Gunnarsson also lists (general) consequences: injuries and fatalities; ill health and illness; traumatic experiences; stress; anxiety; annoyance; fear; insecurity; detours; waiting time and delays; disorientation; hindrance/limitation of social contacts; discomfort and tiredness. The result of these problems can be less motivation to walk, less opportunity to meet people and experience city life, and less opportunity to get exercise and keep fit (Gunnarsson, 2001; see also Figure 1.6).

Risser (2002) classifies pedestrian problems in a slightly different way. He discerns six categories, viz. safety problems, flow problems, convenience and comfort problems, lack of respect, aesthetics and pollution (noise, air, optical), and social climate (irritation, annoyance, stress from difficult interactions with traffic).

Schoon (2018) focusses on matching the design of pedestrian facilities to pedestrian characteristics (more on this subject in Chapter 4), and suggests to monitor mismatches regarding comfort and speed (travel time), safety, reliability and security. Critical, often problematic variables concern the great varieties regarding 1) the key pedestrian categories (commuters, shoppers/leisure walkers, disabled persons and children), 2) pedestrian dimensions, 3) pedestrian crossing behaviours under vehicular traffic conditions, 4) pedestrian crossing processes (observation, crossing, and gaining the opposite kerb), 5) pedestrian observation-reaction times, 6) pedestrian crossing speeds and times, and 7) safety margin times.

1.5.3. The perceived significance of walking and sojourning in public space

Additional to the significance of walking documented through facts and figures, for policy development the perception of policy makers and politicians is a relevant perspective. Policy decisions are largely based on the perception of policy makers of an issue. In a thesis about the options regarding walking and sojourning in public space policies, it is therefore relevant to investigate the public's, politician's and policy maker's perspectives and perceptions on the issue.

Sub-questions in this regard are:

- What is, in general, the role of perception in walking and sojourning in public space policy development and policy decisions?
- What do Dutch authorities officially express about walking and sojourning in public space in policy statements and policy plans?
- How do major sources[46] of policy makers and politicians treat the pedestrian, walking and sojourning in public space?
- How representative is the Dutch situation for the international situation?

In this section the short answers to these questions will be presented. More detail will be presented in Chapter 6.

The role of perception in walking and sojourning in public space policy

It is common knowledge in psychology that (policy) decisions are primarily based on the perceptions regarding an issue. The perceptions include knowledge, insights, experiences, awareness and emotions and are imbedded in culture (Fisher, 1997). If decision makers are not aware of an issue or if they see it as non-significant, non-urgent, uninteresting and unrewarding, they (as any normal person) will not decide to do something about it, and thus perception is a crucial success factor in policy development and implementation (O'Connell, 2002). To indicate the relative level of significance of walking and sojourning in public space, in this section the policy makers' and decision makers' perception of the issue will be captured. Indications for perceptions regarding the significance of walking and sojourning in public space can be found in policy statements and communications, budget plans and general developments regarding walkability and sojourning facilities in public space. In the next paragraph first a general overview will be given of policy attention to the issue on the national and local levels, as an expression of the politicians' perception. Next attention given to the issue by the media will be presented. For politicians, apart from official documents, the media are their main source of information, particularly regarding the opinions of their constituency, as well as thermometer

[46] See next page under 'Major sources influencing walking and sojourning development'.

of significance of topical matters (Graber, 2007). As in the Netherlands, apart from limited mobility and hiking advocacy groups, there is no longer a pedestrian lobbying agent to inform politicians, this type of influence can be neglected.

Walking and sojourning in policy documents and plans

There are indications that walking and sojourning are not high on the list of important issues of policy makers. In national policy notes and in parliamentary discussions, walking and sojourning in public space hardly ever appear. Gorissen (2011) found that in the Dutch National policy paper on mobility (Nota Mobiliteit) walking and the pedestrian is mentioned only with respect to 'chain mobility' and accident risk from car crashes. In the Strategic Plan Road Safety 2008-2020 however, the pedestrian safety is allotted priority, and 3 dedicated measures are specified: improvement of pedestrian crash protection of cars, safety improvement of pedestrian crossings and stimulation of pedestrian detection systems in cars (Gorissen, 2011). From the recent draft 'Structure Vision Infrastructure and the Physical Environment (Land Use)' of the Ministry of Infrastructure and the Environment (Ministerie I&M, 2011)[47] it can be concluded that walking and sojourning are now seen as predominantly provincial and local matters. Consequently it would be logical to find that local and regional authorities devote ample attention to the issue. In a sample of provincial and city-region plans Gorissen did not find any items on walking and pedestrians. In a sample of 20 local municipal traffic and transport plans, in 25% of the plans walking and the pedestrian and walking was amply dealt with, in 15% the issue was not mentioned at all, and in 60% of the plans the issue is mentioned, but not extensively worked out.

Major sources influencing walking and sojourning development

When an issue is not high on the policy agenda, it seems logical that politicians and policy developers do not specifically look for information, but simply rely on what is presented to them by their 'natural' sources: the public media, specialist newsletters and journals, and consultants, and their own experiences as a pedestrian. It can be expected that these sources, for susceptibility reasons, prefer to highlight matters that are obviously interesting to their target groups (Klapper, 1960[48]). Braman (2003) offers an additional explanation of the selectiveness by saying: 'We have been on our feet too long to study the art of walking'.
In an internet search (Google Scholar) no literature was found on the influence of communications on walkability policy development[49]. In order to get an indication of the importance of walking and the pedestrian in the media a tentative search on the websites of two nationwide newspapers (www.volkskrant.nl, www.telegraaf.nl) and two influential web-based traffic and transport newsletters (www.verkeerskunde.nl, www.verkeersnet.nl) was executed.

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[47] Over the years this ministry changed its name several times, from ministerie Verkeer en Waterstaat (Traffic and Water Works), in 2010 to ministerie Infrastructuur en Milieu (Infrastructure and the Environment), and in 2018 to ministerie Infrastructuur en Waterstaat (Infrastructure and Water Management).

[48] Klapper (1960) concluded: *'mass communication functions far more frequently as an agent of reinforcement than as an agent of change'* (cited in Lyengar & Kinder [News that Matters], 1987:?)

[49] Internet search http://scholar.google.nl/ on 11/12 January 2012 using phrases 'influence of communication on walking policy development', 'policy determinants walking communication', 'evaluation of policy development role of communication', 'walking policy strategies - media - communication - press', 'knowledge management policy walking', 'press, media as political resource walking' produced long lists. Of each list 10 pages were scanned for relevance. Many items dealt with the use of media for policy strategies; only a few dealt with the influence of media on politics or policy development, of which none with walkability and/or sojourning in public space policy development.

The websites search included the Dutch words for pedestrian and walker (respectively 'voetganger' and 'wandelaar') and for comparison the words 'bicycle', 'bicycling' and 'bicyclist' (respectively 'fiets', 'fietsen' en 'fietser') and 'non-motorised traffic' (in Dutch 'langzaam verkeer', which literally means 'slow traffic'). In the public newspapers bicycling scored more than 7 times as many hits as walking. In the specialists web-based newsletters walking scored even worse: only 1 in every 25 articles on non-motorised traffic concerned walking or the pedestrian, whilst in public newspapers this is about 1 in every 7 articles. These results confirm that walking and the pedestrian is not in the centre of attention in the media, and that the issue has low news value.

Table 1.1. Number of hits in websites search

Search word	Volkskrant	Telegraaf	Verkeerskunde	Verkeersnet
Voetganger (= pedestrian)	69	7,880	148	62
Wandelaar (= walker, hiker)	18	991	8	1
Fiets (= bicycle)	~ 600 (>100 in 2 months)	24,300	416	2,970
Fietsen (= bicycling)	38	30,700	294	1,330
Fietser (= bicyclist)	~ 9,000 (>100 in 4 days)	13,500	344	182
Langzaam verkeer (non-motorised traffic)	71	3,790	52	1,270
Verkeer / auto (= traffic/car)	20 / ~ 3,500 (>100 in 10 days)	155,000 / 290,000	352 / 469	2,000 / 2,300
Search on 18-12-2011				
Sites: www.volkskrant.nl, www.telegraaf.nl, www.verkeerskunde.nl, www.verkeernet.nl. In the Volkskrant website a maximum number of 100 hits is presented for most search words; the search was set at a period of 1 year (from 18-12-2010 to 18-12-2011).				

With regard to sojourning in public space the American movement Project for Public Spaces, concerning 'place making' can be seen as an influential source, focussing on high profile public spaces (city centres, squares, meeting places). In the Netherlands CROW developed a line of publications on the subject, as well as on designing public space for children. There are a number of NGO's active on this subject on the national level: Childstreet, VVN (Traffic Safety Netherlands), NUSO (national organisation for playgrounds and youth recreation), Jantje Beton, and the platform 'Ruimte voor de Jeugd'[50]. On the local level most municipalities have one or more playground associations. These NGO's inform and lobby for play spaces for children.

I do not have information on what consultants write and advise about walking and pedestrians. It is the authors experience that, whenever consultants advise on slow traffic matters, they focus on bicycling, and do not really include the pedestrian. Even in dedicated publications on recommendations[51] by CROW (the Dutch national knowledge platform on infrastructure, traffic, transport and public space) that in the title refer to walking, the interest of pedestrian are overlooked in most of the cases. In recent (national) conferences[52] on traffic and public space however the number of presentations on walking is significantly higher than in earlier years. In

[50] 'Ruimte voor de jeugd' is Dutch for 'Space for youngsters'
[51] I.e. 'Maatregelen op fietspaden en voetpaden' [= Measures on cycle paths and foot paths]
[52] I.e. Traffic Behaviour Day 2011 and the National Traffic Sciences Conference 2011.

2011 CROW started a special working group on pedestrian facilities, featuring delegates from a wide range of disciplines.

Perception of the significance of walking and sojourning internationally

The Dutch case on policy attention regarding walking and sojourning may not be representative for Europe. With respect to cycling the Netherlands is often seen as a model country (i.e. Zegeer, 1994; Rietveld et al., 2004); it is often assumed that this is also the case for walking. From the PQN Country Reports and experiences in the PQN and OECD/ITF projects it appears that in at least Switzerland, Spain and the United Kingdom the issue is higher on the political and research agenda, both on the national and local levels. The Swiss Country Report (Sauter et al., 2010) pictures a State-of-the Art in walking policy, communication and research, that documents the relative high priority walking is given in the country. Spain has put much effort in contributing to both the PQN and OECD/ITF projects by delegating more experts than any other country in the research groups[53]. The United Kingdom is the home of the leading NGO and conference organiser on walking (WALK21), and The Department for Transport in the United Kingdom has many publications on walking for empowering local authorities[54]. In the first decade of this century a dedicated policy programme was executed on pedestrian road safety (DETR, 2000a). As a local authority, London is exemplary. Its transport provider Transport for London has a special department for accessibility, which explicitly looks after walking routes in the city. Transport for London decided that in 2012 the city should have a consistent walking and cycling network for the Olympics (Transport for London, 2010). In Belgium the city of Brussels issued a strategic plan for pedestrian facilities (2012), which is also a good example.

Conclusion

There are indications that perception plays a delimiting role in walkability policy development. The rating of the significance of walking in the perception of policy makers and politicians does not always match its significance in functional terms (facts and figures). At the national level walkability is perceived as an issue to be dealt with by local authorities. At the local level the issue is generally 'integrated' in standard policies, but it is unclear to what degree consequences for pedestrians are considered. With regard to walking and sojourning in public space, policy makers and politicians do not seem to be agents of improvement, but rather agents of reinforcement of the status quo, that undervalue its functional significance. Although there are some signs of improvement, it appears that in some other countries progress in policy research activities regarding walkability and sojourning in public space, is stronger than in the Netherlands.

1.5.4. Future prospects regarding walking and sojourning

The third perspective regarding the significance of walking concerns future prospects. This perspective is relevant because it sheds light on the urgency of tackling matters: if a situation has a tendency to fade out, there is little need to take action; if evidence or perception indicate that the situation does not appear to go away by itself, there is reason to take action, and this is

[53] The participants list of the OECD/ITF working group featured four experts; the PQN participants list 9 contributers.

[54] The most recent three are: 'Proportion of urban trips under 5 miles taken by: (i) walking or cycling (ii) public transport' (2011), ' The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Full Report' (2010) and ' Active travel choices' (2010).

even more urgent, if the situation appears to be deteriorating. So, in order to identify posteriorities and urgencies, it is important to find out what future developments will most probably affect walking and sojourning in public space.

Prospects of the future, by definition uncertain, depend on the degree of insight available regarding future developments, trends and visions, and the probability of the developments and visions to actually materialise. In the PQN Final Report a section is included on the future of walking. It is concluded that (Methorst et al., 2010:33):

> *'... "the future of transport" reports rarely contain information about active modes, such as walking and cycling. This may come as no surprise given the fact that walking has been neglected by state institutions for decades.'*

Consequently there is not a lot of literature to fall back upon for documenting the importance of walking and sojourning in the future. The indication of its significance must be abduced from conclusions from a variety of policy sectors. In Chapter 5 more extensive accounts of future prospects will be given. As a prelude to the thesis research questions, major consequences of some dominant and interconnecting developments affecting walking and sojourning are presented in this section. On the demand side regarding walkability and sojourning in public space major trends concern demographic changes, increasing car dependency and social-economical changes. On the supply side major trends concern changing traffic conditions, decreasing governmental influence, raw materials shortages and technological responses, new alternatives for walking and sojourning, and climate change.

Demand - Demographic changes and inherent mobility limitations

With regard to the future of walking and sojourning in public space, two age groups are particularly important: children and the elderly. They tend to walk substantially more than other groups, while at the same time they have mobility limitations: children because they need to grow up and acquire travel and traffic abilities (Sandels, 1968), the elderly because with age their travel and traffic abilities gradually decline (Davidse, 2007). For the amount of sojourning in public space daytime schedule and employment developments, i.e. how days are spent, can be assumed to be the main factor.

In most Western countries the population is ageing. The number of children decreases and the number of elderly people increases substantially. Forerunners in this respect are Japan, Germany and Italy, where in 2010 the shares of the 65+ population groups are respectively 22.8%, 20.6% and 20.1%. In the Netherlands the share in 2010 is 'only' 15.5%. The US Bureau of Sensus for 2020 and 2030 predicted shares in the Netherlands of respectively 19.8% and 23.6% (see Table 1.2)[55].

Ceteris paribus there are multiple effects of ageing of the population on walking and sojourning in public space:

- A substantially larger part of the population will not spend time working and be economically productive. The elderly spend more time on non-work related travelling and sojourning in public space, which can often be done on off-peak hours. The number of pedestrians present in public space will probably increase;

[55] Source: US Bureau of Sensus: http://www.census.gov/population/international/data/idb/ (accessed on 25-12-2011). This source is used, because this way the figures for other countries are comparable.

Table 1.2. Number and share of children and the elderly in Japan, Germany, Italy, the Netherlands

	2010			2010	2020	2030
	Japan	Germany	Italy	the Netherlands		
Younger than 15 years	17,546,488	10,969,593	8,402,026	2,896,810	2,784,441	2,869,779
% younger than 15	13.8	13.4	13.8	17.5	16.1	16.1
65+	29,103,030	16,803,387	12,206,273	2,570,386	3,424,621	4,195,660
% 65+	22.8	20.6	20.1	15.5	19.8	23.6

- It can be expected that a larger part of the population will have mobility limitations (see Figure 1.7 and Table 1.3). There will be more need for facilities enabling them to use public space;
- The elderly are more prone to falling accidents than younger persons, both at home and in public space. The total number of casualties from falls in public space can be expected to increase. The consequences of the falls will be more serious as more subjects are fragile. On average they will probably need longer recovery periods during which they need support from others. The number of this type of casualties and general costs to society due to medical treatment, revalidation and support services will increase;
- Because physical and mental abilities decline, the elderly have more difficulties coping with complex traffic situations. In such situations they lack time to react properly and more often make mistakes when judging car speeds and dealing with oncoming traffic (Davidse, 2007). In general elderly are very cautious and they do not pose much of a risk for other road users: they are at risk, not risky (OECD, 2001). The elderly are not overrepresented in accidents, but because of their fragility, '*they are more often seriously injured or killed than younger persons' (Methorst et al, 2016:2305)*. The number of this type of casualties and general costs to society due to medical treatment, revalidation and support services will increase;
- Ageing of the population causes a decrease in number of inhabitants per home and per hectare. Sparsely populated or deserted residential areas discourage sojourning in public space, particularly by children, women and the elderly. In general there will be more demand for security and supervision (most probably to be provided as CCTV, not as supervision by staff).

Table 1.3. Number (x 1000) of persons with limited mobility in the Netherlands

Age groups	2000	2005	2010	2015	2020	2025	2030	2035	2040
Younger than 65	332	340	344	340	337	333	326	319	314
65 - 79	246	258	282	338	380	418	441	467	463
80+	356	405	454	505	565	655	832	949	1063
Total number of people with mobility limitations	934	1003	1079	1182	1282	1406	1600	1735	1840
% of population with mobility limitations	5,9	6,1	6,4	6,9	7,4	8,0	9,1	9,8	10,4
Estimation based on MON 2004 figures (Dutch Travel Survey)									

Demand - Increasing car dependency and walking

In the age groups of 18 - 64 years car use has become the norm. Among this group car ownership is no longer increasing rapidly; the market is more or less saturated. Future generations of elderly will probably use the car more than the current generation, as more of them have a

driving licence and own a car (OECD, 2001; Harms, 2006). The little increase in car use (car trips, passenger kilometres) will mainly come from this group.
There comes a moment in a person's life, however, that car use is not or no longer possible and facilities need to be accessed without a car (OECD, 2001). It can be expected that the number car-less households will grow. These persons will walk more. They will need better walking facilities, mostly because of limited physical ability.

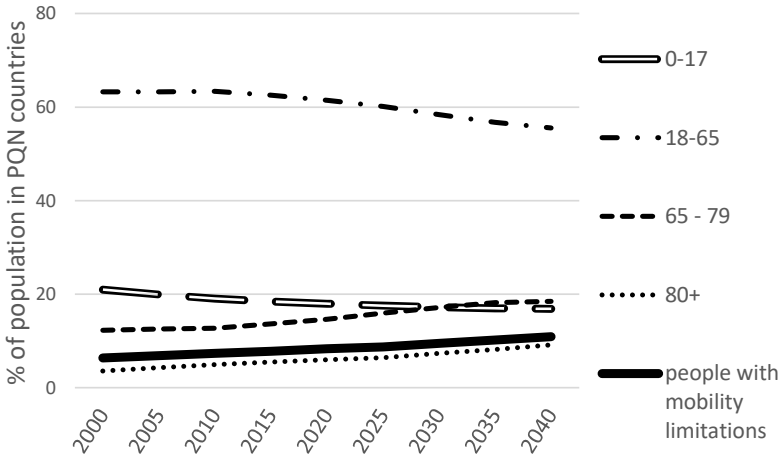

Figure 1.7. Future shares of age groups and people with mobility limitations in PQN countries.

The majority of trips concern short distances. It is unlikely that this will change significantly[56]. Therefore even in the future a substantial part of the trips made by car can be substituted by walking and cycling. In the WALCYNG study it was concluded that the majority of short distance trips (1000 meters or less) by car can be substituted by walking, solving both urban congestion, energy shortage and environmental problems (Hydén et al., 1998) and promoting health (Sallis, 2006).

Demand - Socio-economical changes

Ageing of the population will cause a larger demand for services; the demand for support, help with odd jobs at home and health care will grow substantially, probably to such an extent that the available work force is no longer able to comply (Eggink et al., 2010) and that alternative strategies need to be applied to take care that their needs are dealt with properly. An obvious solution would be to focus on independence of the elderly by ensuring that they do not need to ask for help for daily tasks, to counteract car-dependency by enabling them to walk to essential destinations. Proximity of services and availability of accessible and affordable alternatives for the car for trips beyond walking distance are key features. Internet shopping may seem to be a solution, but the side effect can be that there is more delivery traffic, generating (somewhat) larger traffic flows that are more difficult and dangerous to cross.

[56] This is not very likely because of the inflexibility of the available travel time budget, the financial implications, functional travel needs and the stability of spatial distribution of residences and services. This is confirmed by future prospects studies (Jansen et al., 2006).

An additional factor is that future elderly will have higher expectations regarding free time and recreation than the current elderly, because of their higher income and average education level. They will be more articulate and demanding (and politically powerful) towards the road and public space authorities.

Supply - Changing traffic conditions

In the coming decades traffic composition will change somewhat. Based on traffic forecasting models it is predicted that the number of vehicles in traffic will increase. The number of elderly pedestrians in traffic will also increase, producing a dangerous cocktail of more powerful and more vulnerable road users, trying to cross the roads (Methorst et al., 2003). For sojourning the increase in car ownership and thereby parked cars will result in less (attractive) space for sojourning activities.

The increased risk partly relates to the recent trend that e-shopping increasingly substituted traditional shopping. This development on the one hand causes an increase in number of home deliveries of goods by (small) delivery vans and on the other hand a lower number of shopping related trips. Still, on local collector and access (residential) roads pedestrians will be more often exposed to these vans. This means a higher accident and injury risk: more conflicts with more heavy vehicles under more difficult conditions, viz. less view from the vehicle to detect pedestrians.

Supply - Decreasing governmental power

It can be expected that government on all levels in general will lose clout to cope with citizens' demands. This is partly related to the ageing of the population and decreasing work force. Government will, on the one hand, have more trouble to obtain sufficient tax income and, on the other hand, need more expenditure on road and public space maintenance and health care. Investment budgets will evaporate, putting more pressure on the relations with the public. Policy interventions will rely more on 'market' initiatives.

Supply - Raw materials shortages and technological responses

Current consumption of raw materials and fossil fuels is not sustainable. Raw materials and fossil fuel shortages can be expected, although oil companies like Shell advertise that there is nothing to worry about for at least several decades. Technological adaptations are predicted by many, and it seems that most governments, including the Dutch government, trust that technological improvements will make radical measures superfluous. Despite price trends regarding fossil fuels and rare metals and the recent economic crisis, the Netherlands Bureau for Economic Policy Analysis found no reason to update the so called WLO policy scenarios (Hilbers, 2010).

In the Netherlands modern small and hybrid fuel and electric efficient cars were successfully promoted through tax measures. The market is changing, but the car and the consequential urban sprawl do not seem to be really challenged. Although car use (measured in passenger kilometres) has stabilised and in some cases even drops slightly (Canada and USA: Litman, 2011; the Netherlands: CBS-Statline[57]), society does not appear to be moving away from car dependency towards more walking, cycling and public transport.

[57] see https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80302ned/table?ts=1591360725470

Increasing raw material and fuel prices will affect the affordability of transport. This will affect low income groups, particularly unemployed and retired persons, most. For most of them human powered modes will be the most feasible mobility option. This will intensify inequality and probably segregation.

Supply - New alternatives for walking and sojourning in public space

Over the last century alternatives for walking have been presented, satisfying the human need to conserve one's energy. Walking uses up more human effort and energy than using vehicles and other 'tools'. It can be expected that additional alternatives for walking, but not for sojourning[58], will be forthcoming. Inventers and 'the market' will discover new 'wants', and produce them because people like the idea and want new opportunities, just like they welcomed the electric bicycle, the electric scooter, the rollator and the Segway. People will make use of these opportunities at the cost of regular walking as a main mode, providing them with additional mobility choices and extended action radius, but on the other hand foiling physical exercise and thus causing obesity and otherwise degrading one's health.

In 10 years time, in 2030 there will still be walking, because one simply can't take along devices all the time. It can be expected that a larger share of multi-modal walking, invisible for statistics and policy eyes, will more or less compensate the decline in door-to-door walking.

Supply - Climate change

Climate change will show itself through extreme weather types (storms, heat spells and extreme cold periods) happening more often. These extreme weather types will affect the elderly most (Gutman, 2011). It will suppress their mobility, sojourning in public space, and it will increase the risk of falls and risk in emergency situations, because they will not be able to escape the disasters.

Conclusion: walking as a solution

With regard to demography, mobility, car dependency, traffic conditions, the socio-economic situation, governmental power, raw materials and fuel availability and prices and the climate gradual changes that will affect walking and sojourning in public space, are expected. On the one hand these developments can negatively affect walking conditions, but they also hold a promise: a way out. Walking can be a solution. It is not only the most affordable travel mode for citizens, providing for walking comes much cheaper than providing for motorised traffic, coping with the consequences of accidents and health degradation. Being able to walk and sojourn in public space helps to support children growing up, and sustains independence of the elderly and persons with limited mobility. Furthermore, because of ageing of the population on the one hand, the number and share of the elderly will increase substantially, generating a huge additional demand for services (medical services, help with odd jobs in the house, escorting, food deliverance etcetera). Providing walkability can help keeping the elderly mobile and independent, thus preventing an astronomical burden of societal expenditure to support them[59]. Thus it can be expected that the importance of walking will increase again, at least for the growing number of captive walkers. The same can be expected for sojourning in public space as this is, particularly for the elderly, connected to walking.

[58] In futuristic thinking some presenters refer to 'virtual reality' as an alternative to physical presence in public space. This is contradicted by the increasing popularity of outdoor recreation and outdoor events: people want to meet people, and this happens mostly in public space.
[59] See Chapter 10 of this thesis.

1.6. Demarcation, guiding principles, basic assumptions

In this section the fundamental limitations of this thesis are submitted. Content of this thesis is demarcated regarding its scientific perspective, geographically and the policy levels included, the time horizon used, guiding principles, and lastly, its basic assumptions.

1.6.1. Demarcation of scientific perspective

This thesis does not aim to be an in-depths empirical study, but aims to be a comprehensive overview of important elements (and their origins) that are needed to design a generative and fair system approach to policy development on pedestrians, walking and sojourning in public space. Of course, whenever possible, empirical evidence is used to support conclusions, but many of the presented elements are based only on theories and models. As yet, most of the theories used need to be tested empirically. For most of the elements there is so little empirical evidence, that it would be an illusion to think that this one thesis could result in a recipe for a generic approach to policy development regarding walking and sojourning in public space. It can only be seen as a step towards such a goal.

The thesis aims to support policy practise. Thus it mainly concerns applied scientific knowledge, customising available scientific knowledge for a certain field: policy development on walking and sojourning in public space. Contrary to pure scientific literature, applied scientific literature is not always peer reviewed like articles in scientific journals and dissertations. Therefore it is necessary to fall back on 'grey' literature, such as *'reports, working papers, congress contributions and fact sheets from research organisations, research committees or research groups'* (Bax, 2011:22). In many cases validation[60] is assumed when it comes from research groups that are expected to have organised internal review mechanisms.

1.6.2. Geographical demarcation and demarcation of policy level

Demarcation A: European situation

The PQN and OECD Pedestrian Safety, Urban Space and Health working group's Country Reports (Methorst et al. 2010; OECD, 2011) confirmed that conditions for pedestrians and walking and sojourning policy vary widely from country to country, region to region and even city to city. There are differences in climate, in spatial conditions, quantity and composition of traffic, legal position, culture regarding walking and presence in public space etc. These differences can be expected to lead to different needs with respect to walkability and sojourning in public space facilities and make different demands on the pedestrian's competences and abilities. Tailored solutions for different continents, countries, regions and cities are needed. Within the scope of this thesis however only a limited amount of detail can be provided. Therefore the author decided to focus on walking and sojourning policy development on the continent he is most familiar with: Europe.

[60] With regard to 'grey' literature, validation of research content and conclusions can comprise peer review by external experts, discussions in open platforms or internal quality control, imbedded in the provider's organisation, such as obligatory fraternal review.

Demarcation B: The Netherlands - national policy level

The Netherlands, as a case, is chosen as a case because this is the country about which the author can access most information. Even within Europe there are vast differences between countries. With respect to modal split, the Netherlands is unique as an exceptionally large share of trips are made by bicycle. In comparison with other countries this goes at the expense of walking in the modal split. A substantial part of very short distance trips are made by bicycle. Whilst for trips up to 1 kilometres walking is dominant, in the range of 1.0 – 3.7 kilometres the majority of trips are made by bike (see Table 1.4). The modal share of walking therefore is lower than in most other countries (except Denmark), where the bicycle poses no significant competition for walking.

Table 1.4. Trip distances per mode in the Netherlands in 2007

	Distance classes (in percentages)						
Mode	0 - 0.5 km	0.5 - 1.0 km	1.0 - 2.5 km	2.5 - 3.7 km	3.7 - 5.0 km	5.0 - 7.5 km	> 7.5 km
Walking	76.2	53.1	24.0	12.5	6.3	3.0	0.0
Bicycle	14.3	31.3	44.0	37.5	31.3	24.2	6.9
Moped	.	.	.	.	.	.	.
Bus/tram/metro	.	.	.	3.1	6.3	6.1	4.6
Train	.	.	.	.	.	.	6.9
Car passenger	.	6.3	10.7	15.6	18.8	21.2	25.3
Car driver	4.8	9.4	21.3	31.3	37.5	45.5	55.2
Other modes	4.8	.	.	.	.	.	1.1
Total (per class)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
% of total no. of trips	7.1	10.8	25.3	10.8	5.4	11.1	29.4
Source: CBS Statline - accessed on 12-1-2012							

A practical consideration is access to data, information and the author's experiences. As the author worked at the Ministry of Infrastructure and the Environment in the Netherlands, the discussion will concentrate on information, principles and procedures that can help provide the needed level of detail for Dutch national level of policy development.

In most countries, and this certainly is the case in the Netherlands, national government does not have direct authority over walking and sojourning facilities, but it sets the stage for local authorities' policy making and implementation. Central governments implicitly and explicitly guide local and regional authorities and other stakeholders by codifying and enforcing norms, policy papers and statements, financial means, research programming, knowledge dissemination etc. To be able to do this properly, central government needs to have accurate, general insight and overview concerning the system's functioning. Detailed information about concrete measures, which stakeholders can implement, and their concrete design features on the local level, is not particularly needed, as this falls within the span of control of local authorities, practitioners and advisors. Accurate general insight and overview is not limited to obvious and highly visible matters. Hidden or partially hidden phenomena can cause serious problems (Rumar, 1999 & 2002).

Although Dutch conditions differ from conditions in other countries in Europe, it is assumed that the basic mechanisms within the walking and sojourning in public space, as well as the interests of pedestrians are similar. Therefore research questions, methods to be used to answer them and policy results can also be similar and the Dutch case can be seen as an research and policy development example for other European countries.

Demarcation C: Walking and sojourning in public space

The study is confined to walking and sojourning in public space. Public space is all space that one can enter without needing special permission and where a police public body has jurisdiction.

Conclusion

This thesis is confined to the European situation on the national level, taking the Netherlands as a reference case[61], and in principle limiting the scope to walking and sojourning in public space only. Recommendations will not necessarily cover the situation elsewhere; generic lessons learned elsewhere are taken into account, when relevant for the European and Dutch situation.

1.6.3. Demarcation of time horizon

The current pedestrian's environments are inherited from past developments. It appears that many developments and policies, particularly those on the national level, have long histories and long term consequences. Infrastructure measures for example, generally have a lifetime of thirty years or more. It generally takes a long time to issue legislation and even more time to abolish dysfunctional rules. This thesis is therefore not confined to the historical and current state of affairs, but extents to future prospects and durability aspects. For its conclusions and recommendations it basically refers to the period from the start of mass motorisation to 2030 as time horizon.

1.6.4. Guiding principles for this thesis' research

As this thesis is about public policy development on the national level, the approach to walkability and sojourning policy development should connect to the preconditioning role of national authorities regarding the effective and efficient promotion of the national performance, including collective wealth and well-being. In this context the following guiding principles are applied:

Start with the pedestrian

Usually orientation, exploration and policy development starts from the span of control of the domain that takes the initiative. The general idea is then to solve walking and sojourning problems while opportunity knocks, like updating legislation, street or intersection renovation, traffic management programmes etc. In practise this can lead to suboptimal solutions, as competing issues get priority[62]. Most of the times these issues are perceived more urgent, are better documented, backed up by more powerful stakeholders or politically attractive. Starting with the pedestrian’s needs and abilities can be expected to provide more helpful insights for

[61] The share of walking in mobility in the Netherlands differs from most other countries in Europe because of the prominent role of bicycling. In conclusions and recommendations this will be taken into account.

[62] For example: the problem of red light negation at signalised pedestrian crossings. The lights are said to be installed for the safety of the pedestrians; the pedestrians do not want to wait when no traffic is coming. Changing the lights cycle to suit the needs of pedestrians is not common practise.

the support of walking and sojourning in public space. In principle this means that system needs to be adapted to its users (pedestrians) as much as possible, and not vice versa[63].

Comprehensive analysis and rational policy development

For optimal effectiveness, policy development should consider all factors and their interrelations that affect the conditions for walking and sojourning in public space. It should also be rational and evidence based as much as possible.
As not all phenomena are substantiated by empirical evidence, information gaps need to be identified and filled in through insights by approximations from models of the pedestrian system. Analysis and policy development need to go beyond empirical data[64].
A logical consequence of the choice to focus on comprehensive coverage of the issue, however, is that the study focuses on overview and generic insights, and not on a detailed analysis of pedestrians needs, requirements, interventions and design aspects.

Coverage according to the 80 - 20 rule

Policy measures should be efficient. In this context the aim is not so much to have perfect information coverage, but to have at least adequate (80%) coverage of the issue. This can usually be achieved in 20% of the time that would be needed for perfect (100%) coverage. This position is justifiable as this thesis focuses on improvement options on the societal level and not on improvements of individual cases, locations, situations or even local policies. The idea is to present the full picture and accept that details need to be sorted out later at the appropriate policy level.

1.6.5. Basic assumptions

In order to denote relevance of this study for walkability policy development on the national level, some basic assumptions were made:

Scientific evidence prevails in policy development and decision making

Perceptions and emotions are biased and sometimes they are based on non-existing problems. It is no use to try to solve problems that only exist in the minds of the public or politicians, but in reality do not exist. Although it is clear that decisions are made on perceptions and it is important to know what the perceptions are, for validity and effectiveness reasons effort should be made to take care that perceptions come (very) close to 'objective' reality based on empirical facts.

Although reality sometimes refutes, in this thesis the assumption is that policy development and implementation is at least to some extent founded on evidence based science and logical reasoning. In this context it is assumed that, for walking and other modes' matters, walking is

[63] Thus the environment needs to be adapted to the human competences and limitations. In some popular design concepts, like Shared Space, it is assumed that humans will adapt to their environment, provided it is designed in a certain way. The devisers argue that, given the circumstances, pedestrians benefit. It may be however that some fundamental needs are compromised (Piaget, 1968; Methorst et al. 2007).

[64] In this respect Lyons notes *'...our understanding of the relationship between transport and society is limited and inadequate. Politicians will wish to argue that they create evidence based policy. However, the evidence that exists currently is incomplete and in some instances ambiguous or even misleading. Under the 'transport is here to serve' regime, evidence has implicitly taken to be 'that which can be counted' from which follows that 'if you can't count it, it does not count'. (Lyons, 2003:5).*

just as important as a travel mode as other modes are, and *numbers* count most [65]. On the other hand, this thesis does not adhere to 'if you can't count it, it does not count'. First of all, the glue function of walking in the transport system (Sauter, 2002) cannot always be totally captured in figures. Secondly, if no figures are available, many times they can be estimated using theoretical leads, based on empirical facts in analogue conditions.

National government takes up leadership
Because of the significance of walking and sojourning for achieving national social-economic, mobility, safety, health and sustainability goals, it is assumed that national government takes up leadership and sets the stage for improving walking and sojourning conditions. Local authorities and other stakeholders individually cover only parts of the territory and domains involved. On the national level, national government is the actor that connects all responsibilities. National government includes all ministries and national agencies[66]. It can be made plausible that by improving walking and sojourning conditions, important national targets regarding mobility, safety, security, economic affairs, social welfare, health and sustainability can be achieved. For this reason this thesis focuses on policy development that supports national government's leadership, although it is far from self-evident that national government actively takes up such a role.

Stakeholders can be motivated to help improving walking and sojourning conditions
With regard to stakeholders it is assumed that all of them are aware or can be made aware of their interest and responsibilities concerning conditions for walking and sojourning in public space. Furthermore it is assumed that they accept national government's leadership and coordinating role.

Local authorities own, manage and invest in public space. They are the responsible authority for its qualities. Other relevant stakeholders are public space users, parties that depend on pedestrians in public space (i.e. shopkeepers, café owners, vendors) and parties that influence the use of public space (i.e. the police, consultants, the media).
As there are many other interests to take care of, most of whom are more influential and rewarding than walkers interests, in practise it will be difficult to motivate most stakeholders to help improving walking and sojourning conditions significantly at the expense of other interests.

All stakeholders can accept and support Design for All as guiding principle
With regard to Design for All (D4A), persons who have most trouble coping are taken as the reference standard for designing and implementing interventions. Although this precept can conflict with individual stakeholder's interests and aims, it is assumed that they can accept the principle as guiding principle. In reality some stakeholders cannot be convinced to accept the Design for All principle and the principle that analysis and structuring of public space should start from the pedestrian's needs, abilities and interests. Besides, the D4A principle can be interpreted differently.

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[65] I.e.: a pedestrian casualty is just as serious as an injured car driver or cyclist; waiting time as a pedestrian gets the same weight as a car driver's waiting time; a child killed is just as serious a problem as an older person's death.
[66] This thesis takes the Dutch Ministry of Infrastructure and the Environment as the obvious coordinating ministry; with regard to walking and sojourning other ministries also hold key positions for desirable improvements.

1.7. The outline of the thesis

After Chapter 1 Introduction, where the reasons for the thesis, its objective, research questions and demarcation are laid down, Chapter 2 Methodological account, outlines how insights to answer the leading research questions were acquired. It considers the great variety of methods needed to feed a holistic policy approach to the improvement of the pedestrians' conditions, starting from accumulated expert knowledge and taking advantage of international professional networks, followed up by modelling and underpinning insights from readily available data, literature and practitioner's experiences, and completing the picture by filling gaps in essential knowledge through dedicated studies. In later chapters, where relevant, more detail is given about methodology used to answer the detailed research questions abduced from the leading research questions presented above.

Chapter 3 goes into providing a conceptual framework, serving as a frame of reference for the structure of the thesis and as guidance for the research into policy development regarding pedestrians, walking and sojourning in public space. The chapter starts with an overview of what attention is given in literature to walkability policy development, leading to the conclusion that lack of progress calls for new research and policy approaches. System approach promises to offer better prospects. This postulate is underpinned by presenting theoretical considerations regarding System approach, illuminating the main elements of such an approach to support walking and sojourning in public space. The chapter will be concluded by an account of gaps in knowledge and key messages from this part of the research.

Chapter 4 concerns drawing up system requirements. In this chapter preconditions for effective and efficient W+S development, pedestrian needs and abilities, and required conditions of the system around the pedestrian pass in review. In this context a scheme for assessing the status quo of the system is explicated.

Chapter 5 contains the assessment of the status quo of the walking and sojourning in public space and the system around the pedestrians.

Chapter 6 assesses the institutions framework that is in place to develop and implement policies for the improvement of the position of the pedestrian and walking and sojourning in public space conditions.
Chapter 7 concludes this thesis with a summary of research findings on strengths, weaknesses, opportunities and threats regarding the walking and sojourning in public space. It also includes a discussion section regarding the research approach, its results, and the practical value of the proposed system approach.

Each of the following chapters begins with a short introduction placing the chapter in the completion of the route towards the final goal. It summarises what can be learned from earlier steps in the process, what is to be learned in this chapter and what strategies, methods and techniques the author applied to find answers to the research questions dealt with in the chapter. Each of the following chapters ends with a conclusions on what was found and (if applicable) what significant gaps in knowledge were detected. Appendix 8 offers an overview of the detected gaps in knowledge.

The chapters have numbered sections (e.g. 1.1), subsections (e.g. 1.1.1) and often paragraphs (e.g. 1.1.1.1). For readability reasons sometimes in paragraphs further splitting is applied; in most cases these pieces are not numbered.

Appendix 1 provides a Glossary of terms, where the reader can find definitions and specifications of terms used in this thesis.
Appendix 2 - 9 contain background information.
Appendix 10 shows the author's concise Curriculum Vitae.
Appendix 11 - 12 include two recent scientific articles in scientific journals, of which the core messages are incorporated in this thesis.

2. METHODOLOGICAL ACCOUNT

2.1. Introduction

2.1.1. Context of this thesis research

This chapter reports on what methods were applied to answer the central research question and the derived leading research questions. The methodological approach of this thesis is stipulated by its context:

- The aim of the thesis is to reveal what range of opportunities and added value improving walking and sojourning in public space (W+S) conditions can offer. This implies *explorative research*, focussed on acquiring overview rather than studying a subject in depth; it is about finding pieces of the puzzle and fitting them together into a whole, and not so much about studying the pieces themselves;
- This thesis also aims to feed a *holistic approach* to W+S policy development, focussing on comprehensive coverage of interaction between its context, process and content. As mentioned in Section 1.5.2, accurate general insight and overview is not limited to obvious and highly visible matters. This implies scoping for hidden or partially hidden phenomena that (potentially) induce serious problems (cf. Rumar, 1999 & 2002);
- The making of this thesis, as an end of career job, offers an opportunity to sit back and *rethink theories* about the subject of walking and sojourning in public space, and the theoretical framework of how to improve conditions for pedestrians. Thus an advanced picture of the content, utility and potentials of walking and sojourning in public space can be drawn, improving its chances to become a policy priority subject and true improvement of pedestrian conditions.

Over the years more than 3,700 documents on the subject were (consistently) gathered, digitally stored and entered and coded[67] in an Excel database. The database not only contains scientific publications, but also grey literature and selective media clippings, particularly when no

[67] Status June 2020; codes and meaning are explained in Appendix 2 W+S Documents database.

dedicated scientific research was available; this applies especially for policy aspects. Documents were included if these concerned features, status quo or developments regarding pedestrians, walking, walkability or sojourning in public space, and influences thereon. In this context also relevant documents regarding data collection, research, experiences and tacit knowledge, theory, devising improvements, policy context and institutional activities and policy guidance were gathered. In the database the titles, authors, sources and codes for W+S policy and thesis relevance are entered[68].

All research activities for this thesis started from overall searches into the author's database on documents relevant for walking and sojourning policy making. Results from necessary additional (internet) literature searches were systematically included in the database and documents collection.

The collection of documents is the main source for this thesis' research. Although the number of documents in the collection and the database is large, a minority of 43% is scientific (= peer reviewed articles or dissertation), 48% is "grey" (= reports by trusted institutions) and 9% concern media clippings[69]. In the latter category many of the documents refer to (non-academic) research, of which the reports could be obtained and included in the collection.

2.1.2. Explorative research to feed a holistic approach

To uncover (partly) hidden facts on W+S related phenomena, problems, qualities, opportunities for and threats to improving W+S conditions, a targeted approach is needed for researching the central research question. In the precursory COST 358 Pedestrians' Quality Needs project (Methorst et al., 2010) it appeared that very few of the scientific publications cover and offer direct evidence regarding the (detailed) research questions of this thesis' research. This leaves many white spots in coverage of the domain. Consequently the research towards better coverage of the domain (cf. this thesis' main aim mentioned in Sections 1.2. and 1.6.1) needs to revert mainly to exploration and finding *best fits* through consulting and analysing the available documents, expert assessments and seeking analogies (i.e. not always fully accurate results from the 'abduction' form of reasoning)[70]. This concerns so called *scoping review*, aiming to rapidly map key concepts underpinning a new research area through analysis of available documents and experts' assessments (cf. Dijkers, 2015). Systematic review is not a practical option because this is too complicated (requires data that are often missing), time consuming and expensive. Scoping review research results can be expected to be a first step towards solid overview and best estimate insights in the volume, qualities and determinants of walking and sojourning in public space. In other words, in many cases scoping review will need to be complemented or followed up by validation through further research, based on solid and valid scientific data.

2.1.3. Triangulation to improve validity of conclusions

For validity reasons, following Bax (2011:48), this thesis' scoping review deliberately uses a variety of data sources and research methods next to each other to '*view the subject from various*

[68] The database and referred documents are available for further investigation and control purposes.
[69] Situation at 20-03-2019: total 3,533 documents, of which 1,513 (43%) are 'scientific', 1,681 (48%) are "grey" and 321 (9%) are media clippings.
[70] N.B.: following this reasoning, the author consistently used the term 'abduction' or 'abduces' instead of the in common parlance used 'deduction' or 'deduced' (cf. https://www.lexico.com/definition/abduce in philosofy; accessed 11-6-20)

angles' and uncover the many (sometimes partly hidden) aspects of their conditions. This approach is called triangulation, which is defined as 'combining various methods strategically to simultaneously highlight and relate more facets of reality' (Wester, 1995, cited in Bax, 2011). Bax finds that:

> *'Triangulation enables a check on research findings by repeating them with different techniques. [...] As such, triangulation acts as a kind of quality control, as it improves the internal validity of the study. Yin (1994) distinguishes several types of triangulation, such as triangulation of data sources, of investigations, of theories and of methods' (Bax, 2011: 48).*

This thesis' multi method and multi sources approach scours the policy process, and aims to comprehensively sketch the context and content of the W+S policy domain. This is carried through by always building on the research outcomes of previous process stages, and by using multiple sources and methods, dependent on the more detailed research questions that are abduced along the way.

In each of the process stages my triangulation strategy (see Figure 2.1) is to first prospect for information and data about at least Dutch national level conditions. Apart from some special cases, for practical reasons, the author did not carry out surveys himself to collect data on W+S conditions.

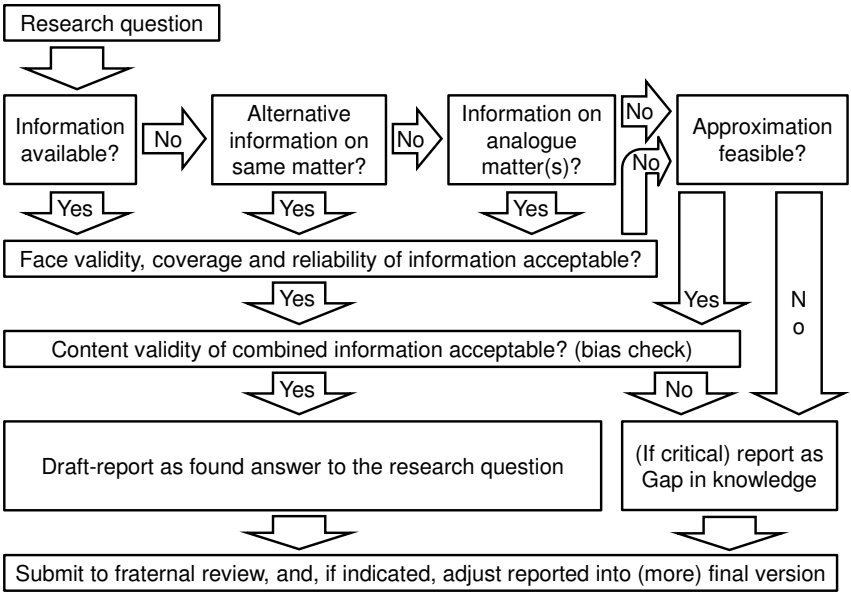

Figure 2.1. Triangulation strategy

This thesis prospects for answers to the questions by scoping literature, (inter)national statistical data, and where these quests were inconclusive, consultation of experts and expert focus group studies for references to possible answers to the questions. Next the author assessed the quality of the found data and information regarding validity, coverage, reliability and possible biases of the data and information. It was tested on these aspects by examining the data acquisition definitions and research methods. Assessments are based on knowledge about best practises in

this regard and related to expected values from theoretical considerations. The information was compared with published research results from other sources, both national and comparable international sources. If no national information on the researched W+S question is available, the author fell back on information from comparable countries; in the cases that no information regarding W+S is available, when applicable the author applied published next best information about analogous situations, which can reasonably be assumed to be valid for national W+S conditions. In some cases, for comprehensive and valid coverage, it was needed and possible to infer approximations, which were included in the research results, substantiated and clearly marked as approximation. If no documented, valid and reliable evidence to answer a research question could be found, such missing information was specified, listed and rated as 'gaps in knowledge'. Gaps in knowledge rated as 'critical' are included in W+S policy programme recommendations. The complete list is entered in Appendix 8 - Gaps in knowledge. Finally, draft reports were submitted to fraternal review, and if indicated, adjusted into a (more) final version.

2.1.4. This thesis' targeted research approach

The targeted research approach features the following steps (cf. Figure 1.2 on page 23):

0. An overall policy process approach, as pictured in Chapter 1, Figure 1.2, inducing a stepwise research approach
1. Redevelop and advance the already available PQN conceptual framework (see Chapter 3), defining what subjects in relation to the development of policy strategies for the improvement of W+S conditions need to be studied; sources and methods applied to re-develop the conceptual framework are outlined in section 2.2. and 2.3. This approach aims to answer the first leading research question concerning the development of a conceptual framework for structuring and inspiring research to support walkability policy development
2. Assessment of walking and sojourning in public space requirements (see Chapter 4), inducing more detailed research questions regarding the W+S status quo and its determinants; sources and methods applied are outlined in section 2.4. This approach aims to answer the second leading research question regarding what (pre)conditions are needed to support pedestrians to optimally contribute to the wealth and well-being of themselves, communities and the nation
3. Determination of the W+S status quo and major determinants (Chapter 5); sources and methods applied are outlined in section 2.5. This approach aims to answer the third leading research question about how pedestrians are treated in public space related policies, what W+S conditions they encounter, and what W+S behaviour occurs and how they currently perform regarding their needs and abilities and what changes in performance can be foreseen + impacts on individuals, community and nation
4. Identification of potential policy issues, by comparing the Status Quo with System requirements, identification of determinants and selection of matters open for improvement (Chapter 6); sources and methods applied are outlined in section 2.6. This approach aims to answer the fourth leading research question: how can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?
5. Evaluation and advancing of the body of knowledge acquired in this thesis (Chapter 7). The evaluation aims to assess this thesis contributes to scientific knowledge on policy development for improving W+S conditions and what important gaps in knowledge apparently do still exist.

Table 2.1. gives an overview of the research steps in this thesis, its deliveries, methods applied and sources used. In the following sections this thesis will start off with Section 2.2. broadly explaining precursory research activities to this thesis. Section 2.3. then describes how the conceptual framework regarding policy development for walking and sojourning in public space was built and what theoretical considerations were picked up. Section 2.4. communicates and substantiates what (pre)conditions are required to present pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space. Section 2.5. presents results of the assessment of the status quo of the system that is offered to pedestrians in the Netherlands. Section 2.6. presents results of the status quo of devising W+S policies and implementation. Each of these sections begins with a description of the leading research question, the 'product' that is aimed to be delivered at the end of the process (sub)step, and its role in the thesis[71]. Next sources and applied methods are outlined; details are included later on in the dedicated chapters. Section 2.7. finally, concerns evaluation, conclusions and discussion of this thesis' research. It shows how general conclusions regarding pedestrian policy have been drawn and limitations of the chosen methodological approach are assessed and discussed. Suggestions for further research are given.

Table 2.1. Overview of research steps, deliveries, applied methods and sources

Nr	(Sub-) Step	Deliveries	Methods	Sources
0. Orientation		Literature database & references General insights	Scoping review, discussions	Literature, prof. network
1. Conceptual Framework		Conceptual framework	Scoping review, discussions, Group work	Literature, prof. experiences
2. System requirements				
2a	W+S needs & abilities	Sketch of 'Reference Standard Pedestrian' and related requirements list	Scoping review, focus group	PQN & OECD/ITF, experts, literature, statistical data
2b	Exemplary system requirements	Indication of exemplary system requirements	Scoping review	literature, expert discussions
3. System Status Quo				
3a	W+S conditions	Description of dominant characteristics of current W+S arrangements	Scoping review, abduction, group work	Literature, statistical data, experts
3b	W+S behaviour and outcomes	Description of dominant W+S characteristics of W+S behaviour	Scoping review, triangulation of statistical data, fraternal review	Literature, statistical data, experts, media
4. Devising W+S improvements				
4a	Policy playing field	Advanced model on policy actors; list of institutional policy actors	Group work, scoping review, 5W+H	PQN, OECD/ITF, expert discussions, literature
4b	Policy environment	Description of dominant policy context characteristics; account of status quo	Scoping review, experts consultation	Literature, trainee surveys, experts
4c	Organisation of change	Theoretical framework; account of status quo and potentials	Scoping review, semi structured interviews of policy actors	Literature, PQN & OECD/ITF, newsletters
5. Conclusions and discussion				
5a	Conclusions	General conclusions for W+S policy development	SWOT analysis, abduction	Chapters 4, 5 and 6
5b	Discussion	General conclusions and suggestions for future research	SWOT analysis, abduction	Chapters 4, 5 and 6

[71] I use *aim* for what is targeted to be produced, and *role* for the function of the product in the thesis.

2.1.5. Data sharing statement

The 'aggregated age- and sex-specific data can be obtained from the data holders or, with the data holders' permission, from the authors' (Mindell et al., 2012: 2). Anonymised National Travel Survey, Mortality, and Hospital admittance data are available from Statistics Netherlands (CBS Statline or through authorised staff at SWOV Road Safety Research Institute and VeiligheidNL). The W+S documents database and available documents can be consulted through the author of this thesis.

2.2. Precursory research activities to this thesis

The work for this thesis is preceded by a variety of learning and research activities regarding walking and sojourning in public space and ways to improve conditions for pedestrians in public space. Much of the work in this thesis is based on experiences and insights acquired from 30 years working, first as a secretary of a Regional Traffic Safety Board, then as an expert and lobbyist at the former Dutch Pedestrians Association and next as a researcher/advisor at the Transport Research Centre of the Ministry of Transport and Water Management .
Based on these experiences the author initiated, led and participated in the COST 358 Pedestrians' Quality Needs (PQN) project, aiming at improving the understanding of how public space, the transport system and the social, legal and political context interrelate with pedestrians' quality needs, and advance effectiveness and efficiency of future policy and research (Methorst, 2010-1, p. 7). In that large[72] project the conceptual and knowledge foundation was laid for this thesis; working groups within the PQN project collected available information on walking and sojourning in public space, its determinants, its qualities and problems, as well as measures, strategies and policies to improve conditions for pedestrians.

Based on an earlier version of the conceptual framework model, presented in Figure 3.11 of this thesis, a comprehensive package of research questions was developed (see Methorst, 2010-1, pp. 101 - 116). The research questions were assigned to researchers in four working groups[73], formed by experienced researchers from universities and consultants from 19 countries. Thus a large part of the initial research questions were covered. In working groups the experts discussed the fruits of their data and literature collection, tested conceptualisations, shaped and sharpened insights, and finally reported and presented research findings in 2010 (see: https://www.walk21.com/pqn-project). The author's role in the group was research programmer, coordinating researcher and chair of the working group 4 Integration and Cohesion working group. Intermediary results were shared with the sister project of the OECD/ITF Pedestrian Safety, Public Space and Health, which published its Final Report in 2012.

Around 2010 the PQN and OECD/ITF communities agreed that, in most cases, in research and policy development the positioning and treatment of the pedestrian, walking and sojourning in public space is outdated. The then dominant mindset of public policy and most researchers traced back to the idolization of the car and technology, whilst it would be much more productive and fair to put people and society first (OECD/ITF 2012; Knoflacher, 1995/2013). To the author's mind this legitimises advancing System approach to W+S policy development,

[72] The COST Pedestrians' Quality Needs internationally joined forces of more than 70 researchers.
[73] The working groups respectively covered Facts and figures, Perception, Durability and future prospects, and Integration and Cohesion.

and through this work rearranging available bits and pieces of knowledge about the pedestrian, walking and sojourning in public space, and completing the puzzle by filling in the gaps through tentative, explorative research. This forms the basic principle for the set-up of this thesis.

2.3. Orientation and building the conceptual framework

2.3.1. Introduction

The first steps in the work for this thesis were orientation on available literature on walking and sojourning in public space (W+S) policy development and to conceptualize how, in general, walking and sojourning in public space comes about and what factors in general affect the pedestrian's behaviour, i.e. building a dedicated *conceptual framework* on the subject, as asked in the first leading research question for this thesis research. In the following I explain how I accomplished these two tasks. The research for this part of the thesis was conducted in the period of November 2005 to May 2015.

2.3.2. Step 0. Orientation

Research question, deliveries and their role in this thesis

The *research question* regarding orientation is: to what degree are the leading research questions, as introduced in Chapter 1, covered in (scientific and grey - practitioners) literature?

The orientation study aims to *deliver*:

- a database of publications for the support of research on the leading thesis' research questions, as presented in Chapter 1, including references to subjects of this thesis' leading research questions, and to advanced general insights in W+S policy development matters;
- a collection of publications for the support of research on the leading thesis' research questions, as presented in Chapter 1;
- general insights about coverage of the W+S domain in literature.

The orientation study's *role* is to provide general insights regarding the status quo and coverage of the W+S policy domain, references to publications relevant for starting off the quests regarding the thesis' research questions and providing access to (most of the) referenced publications.

Before the start of this thesis the general feeling amongst experts was that the quantity and quality of the available body of literature leaves a lot to be desired. If this perception can be proven wrong, potentials for developing policy strategies for the improvement of W+S conditions can increase substantially.

Sources and methodology

The research preparations established what sources are available for finding publications on walking and sojourning policy development. It was found that SCOPUS, Science Direct, Google Scholar, various library databases and specialised literature databases together contained references to a large number of publications on pedestrians and walking. Within these

databases a search was carried out on the keywords 'pedestrian' and 'walking' and within that selection on 'policy', 'strategy' or 'plan'. The search was limited to public policy, where walking and sojourning in public space were clearly the main topic, not just an example, and to conditions that arise in European countries, every day walking and generic approaches, thus excluding very technical and medical studies. The found publications were entered in an MS Excel database. Relevant publications and references acquired at earlier stages in the author's career (i.e. his own bookshelves) were also entered. The publications in this literature database were assessed and scored regarding subjects covered in the publication and their potential for W+S policy development, particularly for helping to find answers to the thesis' research questions as formulated in Chapter 1, section 1.3. (see also Appendix 2 - W+S Policy literature scan). The found publications were entered in a (digital and physical) library and coded to support research on the thesis' research questions.

2.3.3. Step 1. Conceptual framework

Research question, deliveries and their role in this thesis

In Section 1.2. the research question regarding a dedicated conceptual framework is stipulated:

What conceptual framework can be developed to structure and inspire research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, system relations and main determinants?

The research aims to deliver a concise set of theoretical (visualised) insights on the meta level to be used to structure and underpin the quest for answers to the central and leading research questions. Results are presented in Chapter 3.

The leading research question for this research step already hints to the *role* of a dedicated conceptual framework in the thesis. It is to help to structure research, to help ask the right questions, to help position the answers to the questions, and to help assess how well the research covers the subject.

Sources and methodology

The development of a conceptual framework to support W+S policy development implicates gathering relevant meta level theories and concepts, organising them in a framework and, where needed, complete the picture by identifying inter-connections between the meta theories and concepts, and adding and/or adapting theories and concepts to ensure comprehensive and consistent coverage of the W+S policy domain.

As mentioned before, the dedicated conceptual framework for this thesis did not need to be built from scratch. This thesis builds on an existing body of knowledge on walking and sojourning in public space. In the context of the PQN and OECD/ITF projects, already a prolusion of a conceptual framework was made from a variety of useful concepts and theories gathered, discussed and applied in earlier W+S related projects. While reporting and presenting the PQN and OECD/ITF project results, feedback from the audience, fellow researchers, policy makers and this thesis' promotor was asked. Their suggestions helped us to detect imperfections in the then available conceptual framework, concerning subject coverage and insufficiently substantiated conceptualisations and research outcomes. These deliberations also helped to find

out in what respects the conceptual framework and leading research questions for this thesis needed to be sharpened.

In the course of time many potential bits and pieces relevant for a W+S policy development conceptual framework were propounded. For this thesis the concerned concepts and theories were organised stepwise:

- Translation of the general system model advanced from the model proposed by Heylighten (1992) to the pedestrian travel & sojourning system with its environment as an open system;
- Definition and conceptual substantiation of respectively:
  - the system in its environment (system as a 'black box');
  - the system approach, i.e. how the system concept is used for developing W+S policy development;
  - the pedestrian travel and sojourning system itself (identification of system elements and main determinants of pedestrian behaviour, i.e. the system as a 'white box');
  - the main determinants of pedestrian behaviour;
- Summarising and visualising the conceptual framework on pedestrian behaviour.

These steps included supplementary scoping review to improve accuracy and substantiation. The works started with going back to the original publications on the concept or theory, and most of the times further orientation in Wikipedia and/or Google Scholar, followed up by a quest for additional scientific references. In many cases colleagues and experts in the author's network were consulted to find literature, or to lean on their professional judgements, and to validate and verify ideas on how the system works. Literature references are included in the thesis text (see Chapter 3); in the rare cases that no evidence based publications could be found, references to expert opinions are given.

2.4. Identification of W+S system requirements

2.4.1. Introduction

The second step in the work for the thesis concerns the identification of system requirements, to be dealt with in Chapter 4. This step aims to answer the second leading research question:

What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation?

To answer the leading research question two perspectives need to be covered:

a. *W+S needs and abilities*: what W+S activities and capabilities need to be facilitated to enable walking and sojourning in public space (the pedestrians' and equity perspective);
b. *W+S opportunities*: kinds, qualities and quantities of facilities that properly support walking and sojourning in public space (the suppliers' perspective and interests).

The approaches to the above subjects will be dealt with in the following subsections. In both cases the aim is:

- To establish what the relevant aspects to be studied in this thesis are;
- To abduce and underpin research questions for the assessment of the status quo of respectively the policy development context, pedestrian needs and abilities, and W+S conditions.

As this deals with a complex and multifaceted reality, in many cases triangulation is used to construct a fair picture of the subjects. The research for this part of the thesis was conducted in the period of November 2017 and June 2019.

2.4.2. Step 2a. Identification of W+S needs and abilities

Research question, deliveries and their role in this thesis

The leading research aim regarding the identification of W+S needs and abilities was to find out which W+S needs and abilities policy actors need to take into account to deliver W+S policies that bring most wealth and well-being to the concerned individuals, communities and the nation. This aim was effected into the following leading research questions:

- In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?
- How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?
- How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?

This research builds on earlier projects and literature about typologies of pedestrians and conceptual models of the pedestrian populations' needs, abilities and behavioural potentials, as well as sketches of desirable opportunities and spans of operational control.

The research aims to *deliver* a sketch of a 'Reference Standard Pedestrian'[74], indication of requirements regarding a standard pedestrian's task abilities, and indication of consequences if quality of W+S conditions does not meet such requirements for (at least) basic opportunities for walking and sojourning in public space. A more elaborated description of the research approach is given in section 4.2. of this thesis. Results are presented in Section 4.3. The pedestrian population.

The *role* of this particular research is to compile reference meta knowledge about human precursors (determinants) to walking and sojourning behaviours affecting the wealth and well-being of individuals, communities and the nation.

Sources and methodology

Intuitively the proper method to assess people's needs and abilities is to ask them. However, from psychology (i.e. Bradshaw, 1972/1994) and practical experiences it is known that asking people what their needs and/or abilities are, will not result in an accurate image of needs and abilities with regard to walking and sojourning in public space. Expressed needs can be far from

[74] cf. Asmussen, 1996.

felt or functional needs and abilities. Therefore, based on theoretical knowledge, a more suitable approach is devised.
The research regarding the three leading questions is inspired by an eclectic collection of theoretical concepts, viz. the NOA model (Steg & Vlek, 2009), the Activity Levels model (Michon, 1979; Hatakka et al., 1999), the 5W+H principle (Spencer-Thomas, 2012), Lifestyle Attributes Compilation (Methorst, 2018, see section 4.3.2), Task analysis (Van der Molen, 1981; O*NET, 2008, 2018), Design for All (EIDD, 2004; CEUD, 2007), the Reference Standard Pedestrian ('Nieuwe Normmens' by Asmussen, 1996), and the Pizza Model (Methorst, 2000/2010). The research with regard to the identification of W+S needs and abilities was designed and carried out in four steps with matching research sources and approaches. The sub-steps are:

1. A quest into environmental settings regarding pedestrian needs and abilities
2. Translating W+S needs into system requirements
3. Translating W+S abilities into system requirements
4. Conclusions regarding a 'Reference Standard Pedestrian'

1. Environmental settings
From processing available documents[75] regarding pedestrian population attributes the author abducted that the following (interacting) population or life style attributes in some way affect W+S needs and connected W+S system requirements: 1) everyday living environment, 2) socioeconomic status, 3) the life cycle and demographics, 4) access to transportation, 5) socio-psychological characteristics, 6) access to information and information technology, and 7) general health. In the following sub-subsections these attributes are explored. Especial attention was given to a) *definition, scope and relevance* of the attribute for W+S, b) which *groups* can be discerned, c) why the attribute affects W+S (*Interrelations*), d) *where and when* the attribute affects W+S, e) how the attribute impacts W+S needs and abilities (*Impact on walkers*) and f) what the *significance is for W+S policy making*.

2. Translating W+S needs into system requirements
To explore the relations between general human needs, reasons and motives for walking and sojourning in public space and corresponding W+S system requirements, in June 2013 an experts workshop was organised (Methorst, 2013; attendance list: see Appendix 4). To organise the workshop and analyse the workshop results the above sub-study research question (themes) was worked out into four more detailed research questions:

a. How do general and abstract human needs (as classified by Lapintie, 2010) relate to concrete motives and reasons for walking?
b. Which motives and reasons do (potential) pedestrians have for walking and sojourning in public space? How should they be sorted?
c. What trip types and groups can be distinguished regarding W+S needs, motives and reasons?
d. What kinds of conditions, facilities and/or services can (potential) pedestrians be expected to feel necessary or most suitable for achieving their general targets?

The workshop covered the most obvious walking activities, but was not able to completely cover the W+S system requirements. From comparing the workshop results with theoretical considerations (cf. Chapter 3 and section 4.3.1) it was clear that the workshop 1) did not cover all major pedestrians groups, 2) only broadly translated W+S needs into W+S system

[75] Excel database and document folder, containing in total 3,400 documents (status November 2018).

requirements, 3) did not cover W+S system requirements other than those concerning the physical environment, and 4) did not shed light on the relative importance of basic human needs-based W+S system requirements regarding the various pedestrian groups. A general observation that the workshop made was that insights in W+S needs help to get general insights in functional system requirements, that relatively little is needed to be able to walk, and the potentials are great; insights in pedestrian abilities seem to be most decisive for setting norms regarding system requirements.

Translating W+S abilities into system requirements
Theoretical considerations lead to that the research focussed on what system conditions should be offered to warrant participation in society for (almost) everybody, regardless their disabilities. By carrying out scoping review the following questions were successively answered: 1) what tasks (potential) pedestrians are to perform, 2) what kinds of abilities and skills this embraces, 3) how do W+S abilities and skills translate into W+S system requirements consistent with Design for All / Universal Design, i.e. enabling the vast majority of the (potential) W+S population to participate normally in society, regardless their disabilities. A great variety of literature and statistical sources were used; in section 4.3.4. the sources are specified.

Abduction of conclusions regarding a 'Reference Standard Pedestrian'
In order to abduce significance of W+S system requirements regarding a 'Reference Standard Pedestrian' the found indications for system requirements were arranged according to the walking and sojourning activity level, i.e. lifestyle/strategic and tactical, and operational level activities. The research results were scoped and listed for critical tasks, consequences of non-compliance, and connected system requirements. For each of the critical tasks the author and an external expert together (in discussion) assigned one to five star draft scores picturing impact (five stars = very strong impact) on members of specific disadvantages groups regarding 'mobility' and 'safety'. From these impact scores *benefit scores* were calculated and ranked into five classes. The draft scores were validated by 10 reviewers (see section 4.3.4. and Appendix 4).

2.4.3. Step 2b. Identification of exemplary W+S requirements

Research question, deliveries and their role in this thesis

This sub-step of this thesis' research aims to find out how the W+S system around the pedestrian can support functional demands, as specified in the previous sub-step regarding the demand side of pedestrian facilities. The *research question* in this regard is:

What kinds of W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians a suitable variety of W+S opportunities, now and in the next decade?

For the work of this thesis the central question is split up in three sub-questions:

- What kinds of conditions are (potential) pedestrians looking for?
- What factors frame the genesis of W+S opportunities?
- What kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

The research aims to *deliver* an identification of exemplary system requirements. This implies 1) developing a classification of W+S opportunities, 2) producing an overview of the main characteristics (indicators and norms regarding the quality of the W+S environments) found in (a sample of) documents on arrangements for the support of walking and sojourning in public space, 3) delivering insights in the genesis of W+S opportunities, 4) abducing broad insights in basic, convenience and tempting arrangements for walking and sojourning in public space. The results are presented in section 4.4. Exemplary W+S arrangements.

The *role* of this particular research in this thesis is to produce a reference meta knowledge for methodically assessing the status quo of the W+S system (cf. Chapter 5), and rating the conditions regarding their urgency to be improved (cf. Chapter 6). Furthermore, the criteria and norms enable us to select promising interventions for the improvement of W+S conditions (cf. Chapter 7).

Sources and methodology

In the course of time many W+S requirement specifications were captured in publications, such as W+S related legislation, guidelines, handbooks and policy recommendations from international and national projects. Many of them were entered and coded as relevant for requirement specifications in this thesis' documents database and library.

Most of the publications cover specific system aspects only, like infrastructure, traffic safety, health impacts or facilities needed for hiking. Some publications aim at more comprehensive coverage of the domain, but, as far as the author knows, none of them covers the whole W+S domain systematically, taking into account all major W+S quality needs as identified in the previous sub-step on the identification of W+S needs and abilities. Together, however, the selection of publications forms a rich snowballing *source* for the identification of W+S system requirements.

Not all 'official' requirement specifications are evidence based. In many cases such studies were not yet performed, available or known. While developing the specifications there appeared to be urgency to come up with 'best professional judgement' in this regard. With regard to 'official' requirement specifications therefore a critical approach is needed; the specifications therefore are assessed regarding the degree to which they promise to effectuate essential qualities[76] needed for the general support of W+S behaviour, as identified and normalized in the previous sub-step regarding the identification of W+S needs and abilities.

The answers to the three sub-question are based on scoping review of literature available in the dedicated documents database[77], particularly on W+S policy guidance and advise reports, charters, and (review) literature on determinants of W+S behaviour. With regard to opportunities based on spatial arrangements there are already a number of well-founded policy guides and websites. The aim of this research is to sketch a comprehensive picture of arrangements, covering the full range of opportunities, including also the social-normative, transportation, and information and communication technology arrangements to support and promote walking and sojourning in public space. With regard to each of the categories of

[76] E.g. being able to move around and sojourn in public space, safety and security, health (cf. Section 4.4.2. Classification of W+S opportunities).

[77] Up to September 2019 (the date of completing this part of the research) the database was continuously replenished with new findings, including those that were found during the stepwise execution of this sub-study (cf. Section 4.2.3).

arrangements attention will be given to three dimensions of opportunities: 1) functional utility (i.e. the experts perspective), 2) perceived value (i.e. the [potential] pedestrians' perspective, and 3) durability and future prospects (i.e. the dynamic perspective, limited to the experts' perspective). A more elaborated description of the research approach and sources is given in section 4.2.3.

2.5. Assessment of the W+S system status quo in the Netherlands around 2018

2.5.1. Introduction

The third step in the work for this thesis concerns assessment of the W+S system status quo in the Netherlands around 2018, to be dealt with in Chapter 5. This step aims to answer the third leading research question:

How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?

The role of the research in this thesis is to provide concrete input for the last stage of the research, i.e. conclusions on potential reform targets regarding arrangements to improve W+S conditions, dealt with in Chapter 7. In this regard the research for this policy development step aims to deliver an accurate and organised description of the state of affairs (status quo) of major W+S features such as volume, qualities, appreciation of W+S arrangements and outcomes of pedestrian behaviours.

To answer the leading research question two subjects need to be covered:

a. *W+S conditions*: what arrangements are offered to enabling and promote walking and sojourning in public space, i.e. how well the pedestrian's environment matches insights in W+S requirements. In systems theory terms this concerns *output*, i.e. the products of policy actions and strategies, how the system IS;
b. *W+S behaviour and outcomes*: current performance and developments therein. In systems theory terms this concerns *outcome*, i.e. the direct payoffs resulting from actions and strategies, such as mobility, safety, sojourning, anxiety, satisfaction, (absence of) waste products.

The research approaches to the above subjects will be dealt with in more detail in section 5.2. In both cases the aim is to comprehensively determine what the state of affairs is regarding walking and sojourning in public space. This description will, together with insights on devising change (presented in Chapter 6), serve as input conclusions on what matters qualify for improvement (chapter 7). The research for this thesis' part was conducted from November 2018 to May 2020.

2.5.2. Step 3a. Assessment of the status quo of W+S conditions

Research question, deliveries and their role in this thesis

The *general research question* regarding this sub-step 3a Assessment of the status quo of W+S conditions is what arrangements are in place to support walking and sojourning in public space? This thesis part's research targets on broadly capturing what is documented and entered up in statistics accounts about the status quo of arrangements to provide opportunities for walking and sojourning in public space. Within the context of this thesis (no time and/or budget to do fieldwork or extensive surveys) the question needed to be limited to:

What is documented and entered up about prominent arrangements established in the Netherlands to offer opportunities for walking and sojourning in public space, their distribution, and roughly how well these arrangements can be expected to serve the needs and abilities of the Dutch population of (potential) pedestrians?

The aim of this research is to *deliver* a description of dominant characteristics of current W+S arrangements compared to W+S system requirements as identified in Chapter 4.

The *role* of the research for this sub-step 3a Assessment of the status quo of W+S conditions, is to serve as input for the identification of W+S system conditions qualifying for policy attention (Chapter 7 Conclusions and discussion).

Sources and methodology

In the context of sub-step 2c Identification of W+S requirements a framework regarding the identification of exemplary W+S arrangements was developed. In the current research sub step 3a the framework is applied to the Dutch situation on the national level. This means that detailed situational conditions can only be dealt with globally. After all, conditions can vary much between and within communities. On the national level critical conditions and generalities are most relevant.

This thesis part's research targets concerns *scoping review*, i.e. internet searches, to capture what quantitative and qualitative information is publicly available on actual W+S opportunities in the Netherlands. The search started from requirements indicated in section 4.4. and focussed on national statistics, surveys on distribution, coverage and functionality of arrangements regarding the four main domains (public space, transport and traffic, social-normative environment, and Information and Communication Technology), reviews of experiences with implemented improvement policies and measures, and some anecdotic information about current conditions. In the text of section 5.3.3. data sources are specified (in footnotes mostly). Important data sources were[78]:

- CBS Statline (Statistics Netherlands - public data and datasets on regional key figures, nearness of facilities, population statistics, use of ICT, Security Monitor surveys; https://statline.cbs.nl/)
- Dutch National Government CLO website (Compendium for the living environment, 2016, https://www.clo.nl/);
- Dutch National Government legislation-website (https://wetten.overheid.nl/;

  College Rechten van de Mens (Human Rights College) (https://mensenrechten.nl/nl/vn-verdrag-handicap);

[78] websites accessed 15-6-2020

- Milieudefensie research on functions of public space (https://milieudefensie.nl/actueel/van-wie-is-de-stad-pdf);
- SWOV Road Safety Research Institute research on road safety arrangements (https://library.swov.nl/).

Research policy intentions are explicitly excluded, as these are not (yet) effectuated into opportunities for walking and sojourning in public space. The search results are captured in crude dossier folders and summarised in section 5.3.3.

Based on the bits and pieces of information from precursory projects, and available qualitative and quantitative information regarding current W+S arrangements a picture is constructed on the degree to which these arrangement suit the different classes of opportunities (see also Section 5.2. and 5.3.3.).

2.5.3. Step 3b. Assessment of the status quo W+S behaviour and outcomes

Research question, deliveries and their role in this thesis
The *research question* regarding the assessment of W+S behaviour is:

How do pedestrians interact with their W+S environment, and what are the consequences?

Important sub-questions in this regard are:
- What are the pedestrians' population features now and in the near future?
- What activities do they carry out and what freedom of movement do they appear to have?
- What is the scale of sojourning in public space?
- How safe is walking and sojourning in public space?
- How satisfied are citizens with W+S conditions?

This thesis' part explores the practical utility, i.e. what information is available about how pedestrians actually use the available system and perform their activities, how it affects them and what major impacts the outcomes have on the wealth and well-being of individuals, communities and the nation (W+S system impacts). It also explores what improvements can be expected to have even better impacts on the system and its stakeholders.

The aim of the sub-step research is to *deliver* a description of major W+S performances characteristics and outcomes (such as subgroup populations, mobility, safety and health characteristics and outcomes, satisfaction) applicable for the Netherlands.

The *role* of the research for this sub-step 3b Assessment of the status quo W+S behaviour is to serve as input for the identification of behavioural matters qualifying for policy attention (Chapter 7 Conclusions and Discussion).

Sources and methodology
In the context of sub-step 2b Identification of W+S needs and abilities, a taxonomy of W+S behaviours and related quality norms is developed and presented. This taxonomy serves as framework for the research on current and foreseeable W+S behaviours, consequences and satisfaction. The above sub-questions are researched by analysing various relevant national statistical data, and evidence from publications included in the dedicated W+S library on W+S behaviour in the Netherlands, professional newsletters concerning traffic, transport and public

space, and expert judgements, complemented by insights from other countries and adjacent domains, if no data or information from the Netherlands are available. In the text of section 5.4.2, 5.4.3. and 5.4.4. data sources are specified and discussed. Important data sources were:

- CBS Statline (Statistics Netherlands - public data and datasets on population statistics, mobility surveys (i.c. OVG, MON, OViN), Security Monitor surveys; https://statline.cbs.nl/);
- CELTH/CBS/NBTC/NRT, 2017 data on tourism (https://www.cbs.nl/nl-nl/publicatie/2017/47/trendrapport-toerisme-recreatie-en-vrije-tijd-2017);
- Wandelmonitor 2016 (https://www.wandelnet.nl/wandelmonitor-2016);
- CBS Death Causes dataset 1992-2017, selection pedestrian fatalities 'on streets or roads' (courtesy of VeiligheidNL);
- LMR Hospital admittances of pedestrians 1993-2015, selection 'on streets or roads' and summary of other locations (courtesy of SWOV Institute for Road Safety Research);
- LBZ Hospital admittances of pedestrians 2013-2018 - selected tables (courtesy of SWOV Institute for Road Safety Research);
- LIS dataset on Emergency Department treatments in hospital 1998-2018, selection on private accidents on 'street or road', and traffic accidents (courtesy VeiligheidNL);
- LIS follow-up surveys (https://www.veiligheid.nl/organisatie/publicaties);
- BRON police reported road traffic accidents (courtesy SWOV Institute for Road Safety Research).

Analysis of pedestrian activities is mainly based on CBS statistics; in order to cover gaps in coverage additional data are used to triangulate and that way sketch 'real' exposure of pedestrians in public space. Approaches are specified in section 5.4.2.
With regard to safety insights are based on analysis of datasets on death causes, hospital admittances, Emergency Department treatment, and police reported accidents. In order to complete coverage triangulation between these datasets and one or more tables from above sources an image of the status quo and foreseeable performance in the Netherlands is constructed. Approaches are specified in section 5.4.3.
Sketches with regard to security are based on tables from the Veiligheidsmonitors (Security monitor surveys 2012-2019) as published on the CBS Statline website.
Sketches regarding convenience, comfort and attractiveness for walking and sojourning in public space are based on Security monitor survey tables, Wandelmonitor 2016 (data and figures on hiking), and scoping research featuring data from municipalities, consultancy agencies and professional syndicates. Approaches are specified in section 5.4.4.

2.6. Devising change

2.6.1. Introduction

Chapter 3 Conceptual framework for walkability and sojourning policy development established that the role of the institutional framework is to deliver change impulses towards the W+S system in order to manage and improve its functioning.

Walking and sojourning in public space has the makings of a complex policy subject: W+S is a complex topic as there are (potentially) many actors, (potentially) many relations between

them, and (potentially) many aspects and approaches to be considered. Such complex matters cannot be appropriately covered in single interviews or discussions or focus group sessions. The latter is not (yet) a promising option, because in 2020 there still is little experience around with comprehensive, integral W+S policy development and implementation.

This part of the thesis' research concerns the exploring the potentials of the institutional framework regarding pedestrians, walking and sojourning in public space. It is the fourth research step in the work for this thesis: devising change. This research aims to give broad insight in the nature, extent and potentials of policy actors' activities regarding walking and sojourning in public space, how the institutional framework as a whole performs, and what need and room there is for institutional improving the support walking and sojourning in public space.

This research step aims to answer the fourth leading research question:

How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?

To answer the leading research question three sub-steps need to be covered:

4a. Explore the W+S policy playing field;

4b. Assessment of external influences on the W+S policy field;

4c. Assessment of the organisation of change.

In order to direct explorations and analysis, each of the sub-steps starts with conceptually modelling the matter. This leads to the following 5 research questions:

1. What kinds of factors and processes theoretically set the stage for bringing about improvement of W+S conditions?
2. What kinds of policy actors can be discerned regarding their function for sustaining and improving pedestrian, walking and sojourning conditions?
3. What kinds of settings outside the Dutch institutional framework can or do affect W+S policy activities in the Netherlands?
4. How is management of pedestrian and W+S conditions organised?
5. What controls can policy makers adjust to enhance W+S policy activities?

The approaches to the above subjects will be dealt with in the following subsections. Because of the different nature of the research and its late place in the thesis, theoretical considerations, methodology and results of the thesis' part of the research are not dealt with in detail here, but in Chapter 6. In this subsection highlights are given only.

The research for this part of the thesis was conducted in the period of May 2013 to May 2017, and (partially) updated in June and July 2020. The latter was indicated because W+S policy development gained momentum after completing the original research. Policy attention to walking in the Netherlands was particularly stimulated by the initiatives of Acquire Publishing which organised a National Pedestrian Conference in October 2018, by the municipality of Rotterdam who organised an international WALK21 conference in October 2019, and by the joint initiative of Wandelnet, CROW and the Ministry of Infrastructure and Water Management

to set up a platform Ruimte voor Lopen (= Room for Walking). The latter attracted more than 30 partners to join up and set up concrete W+S policy projects. Furthermore, the COVID-19 crisis happened; consequences for W+S policy development are however still unclear.

2.6.2. Step 4a Explore the W+S policy playing field

Research question, deliveries and their role in this thesis

The Final Report of the COST358 Pedestrian' Quality Needs project - Part A (2010:39 - Figure 7) presented a tentative model regarding stakeholders and their relations. The original classification discerned three kinds of policy actors: guiders, providers and users. Discussions with various experts suggested to advance and further substantiate the model. In this thesis an advanced model is used as a starting point for exploring the playing field and compiling a list of (potential) policy actors. The list inspires and directs assessing policy activities in the domain and its context.

The research question for this sub-step in the thesis is:

What kinds of policy actors can be discerned regarding their function for sustaining and improving pedestrian, walking and sojourning conditions?

The aim of the sub-step research is to *deliver* an advanced model on the playing field, policy actors and their relations within W+S policy processes on a generic level, and a list of (potential) institutional W+S policy actors, picturing the composition of and division of tasks and powers within the playing field.

The *role* of the research for sub-step 4a Explore the W+S policy playing field is to serve as building stone for research into devising improvement of pedestrian, walking and sojourning conditions in Dutch public space, and particularly to direct the organisation of interviews amongst (potential) W+S policy actors.

Sources and methodology

With help of discussions with various experts and supplementary scanning review and analysis of W+S policy development documents (conference accounts and proceedings, and policy process documents in the dedicated W+S library) the basic PQN policy actors model is advanced and substantiated regarding theoretical considerations, definitions and content. Based on an advanced model a more appropriate list of (potential) W+S policy actor institutions is compiled; the list is applied to recruit interviewees for sub-step 4c, particularly to assess the potentials of organisation of change regarding pedestrian, walking and sojourning conditions in the Netherlands. This work was carried out in May 2013 to March 2015. Because of increased attention to the domain, and particularly the activities of the platform Ruimte voor Lopen (Room for Walking) the list of (potential) players needed updating. Results of this research sub-step are presented in section 6.3.

2.6.3. Step 4b. Assessment of external influences on the W+S policy field

Research question, deliveries and their role in this thesis

W+S policy activities happen within a context of influences from the outside, such as international agreements, scientific research, the economy, transportation, demographics, social-normative trends and more. The research question for this thesis' sub-step is:

What kinds of settings outside the Dutch W+S institutional framework can or do affect W+S policy activities in the Netherlands?

The aim of the sub-step is to *deliver* context for positioning W+S policies and policy making, overview of opportunities and counterforces in outside policy worlds as well as explanations for current (2018) settings.

The *role* of the research is to provide context for policy making, enable assessment of room for change and potentials of W+S policy activities, and inspire development of new and advanced strategies.

Sources and methodology

Based on the Pedestrian travel and sojourning system model (see Figure 3.5) scoping review was conducted to develop a structuring checklist of 'dimensions' for exploring actual and potential external influences on Dutch W+S policy making. The checklist directed compilation of concise dossiers with regard to each of the environmental dimensions. The dossiers are compiled from results of the PQN, OECD and CROW W+S policy projects and policy actor interviews (see step 4c), as well as internet searches for underpinning by publicly available statistics, data, surveys and documented evaluations. In the text of section 6.4. sources and results are presented. The research was conducted in the period of September 2015 to December 2016.

2.6.4. Step 4c. Assessment of the organisation of change

Research question, deliveries and their role in this thesis

Having broadly described the playing field and the policy environment, the status quo of the W+S institutional framework can be studied. The *research question* for this sub-step 4c Assessment of the organisation of change, is:

How is management of pedestrian and W+S conditions organised, and what controls can policy makers adjust to enhance W+S policy activities?

Important sub-questions in this regard are:

a. What organisational preconditions must policy actors theoretically meet to be able to bring about improvement of W+S conditions[79]?
b. How does the W+S policy system actually work?

[79] Although this thesis is about W+S policy development on the (Dutch) national level, this thesis aims to deliver a sketch of the W+S policy preconditions regarding the W+S system as a whole, enabling accurate and adequate positioning of the W+S policy landscape on the Dutch national level.

c. What organisational controls can policy actors adjust to improve the pedestrian position, and walking and sojourning conditions?

The aim of this research is to *deliver*:

1. A theoretical framework regarding W+S policy development;
2. A structured questionnaire for the assessment of the status quo of the current W+S policy context, organisation and activities;
3. An account of the status quo of Dutch W+S policy development and implementation;
4. An indication of institutional controls that policy actors can adjust to improve pedestrian and W+S conditions.

The *role* of the deliveries is to lay an institutional foundation for the development of effective, efficient and fair policy interventions *on the Dutch national level,* built on identification of what policy preconditions and organisational aspects qualify to be improved. Important factors in this respect are anyway the clout of policy actors regarding improvement of W+S conditions and their sensitivity towards recommendations to develop and implement certain kinds of measures and policy strategies, and thereby feasibility of such measures. Ultimately these insights are input for Chapter 7 Conclusions and Discussion.

Sources and methodology

a. Theoretical framework regarding W+S policy development

In the PQN project 'Measuring Walking', a list of kinds of preconditions for W+S policy development was developed in co-operation with international experts in the domain. In this thesis a follow-up study was carried out to advance Measuring Walking results into a practical application.

This thesis' approach was to first acquire a general image of what factors influence an imaginable omnipotent W+S policy actor to undertake action to improve W+S, and what general factors determine the quality of such activities. This assessment was based on abduction from system models, outcome from expert group discussions (PQN, OECD/ITF and internal Rijkswaterstaat working groups) and reports, and substantiation through scoping research.

Next in the thesis' approach was to look the internal organisation of a (potential) W+S institutional framework. Sauter & Tight's model of the institutional framework was advanced and used as a conceptual framework for acquiring a qualitative overview of the preconditions to be met for effective and efficient W+S policy development and implementation. In the first stage of this research the focus was on what aspects, processes, conditions etc. need to be covered to acquire comprehensive insights regarding the discerned policy preconditions to be met (divergence). Based on these insights research questions about those items were formulated, tested and finally concentrated into a more concise set of research questions (convergence), for the (qualitative and where possible quantitative) assessment of the status quo regarding W+S policy on the national level.
In the divergence stage of the research scoping review was applied to find theories, empirical evidence and experiences regarding the precondition items. A variety of sources was tapped, such as management literature, social psychological literature, policy evaluation studies and safety management literature. From the acquired insights, together with the deliberations of an (internal) Rijkswaterstaat working group researching the State of Safety Management within the organisation, a wide range of questions regarding policy preconditions were collected, abduced and formulated. This research also delivered insights in how the W+S policy system

in principle works (or should work) and what the W+S policy landscape entails, particularly what roles and functions need to be attributed to the various policy actors on the national level.

To test the resulting sets of questions, within the Rijkswaterstaat organisation dedicated survey research was initiated[80]. SWOT[81] analysis of the validity and functionality of the answers to the questions was carried out.

Based on this evaluation the questionnaire was adjusted. It was found that the ancient Topical Questions (5W + H)[82] based on Aristotle's Nicomachean Ethics, which are commonly used in journalism to check completeness of information (Spencer-Thomas, 2012), formed a practical model for organising and completing the substantiation of the institutional framework components and reformulating questions regarding policy preconditions (convergence).
The outcome of this work is presented in section 6.5. Organising change towards better support of W+S, and Appendix 6. Questions to policy actors.

b. The status quo of W+S policy development and implementation
In the context of the above sub-step detailed research questions regarding policy preconditions were formulated. In the current sub-step the questions are applied to assess the status quo of W+S conditions. The aim is to uncover what attitudes of policy agents display towards the support of walking and sojourning in public space, particularly how motivated they are to improve W+S conditions, and what they actually do about it. These questions concern both information about countable facts and the policy actors' perception and attitudes about past, current and foreseeable future W+S policy conditions.

A variety of supplementary sources is consulted to find answers to these questions. Basic sources for the assessment of the W+S policy context were literature about governmental policies and experts in the W+S and surrounding domains. In the dedicated W+S documents database and library several specialist journal articles, policy notes, relevant research reports were included. Additional sources tapped are professional newsletters and parliamentary minutes. Furthermore advantage is taken of two student internships of for carrying out surveys about W+S policies on the municipal level. Additionally experiences regarding actual policy preconditions and current policy activities is drawn from members of my professional network, particularly W+S experts serving as members of a national CROW working group for the preparation of a W+S policy manual for municipalities.

Based on the bits and pieces of information regarding the detailed research questions a picture of actual and foreseen future W+S policy conditions is sketched in subsection 6.5.3. The author's professional network is used for validation and verification of the parts of the sketch that were based on ambiguous information. Finally the sketch of the status quo of the Dutch W+S policy precondition is advanced into list of institutional improvement potentials, i.e. W+S policy activity controls (see subsection 6.6.2.).

[80] Rijkswaterstaat trainee Mirjam van der Meer performed a study of current policy practises on road safety within Rijkswaterstaat.
[81] SWOT stands for: Strengths, Weaknesses, Opportunities and Threats.
[82] The Topical Questions are Who is it about, What happened, When did it take place, Where did it take place, Why did it happen, and How did it happen (Spencer-Thomas, 2012; 5 W's +H)

2.7. Conclusion

This thesis chapter describes the methodological approach. Four leading research questions are derived from thesis central research question. The leading research questions follow this thesis' policy process design, in which (almost) each step consists of a number of research sub-steps, for which sub-step research questions were formulated. To answer the research questions a mixed-methods approach is applied, mostly starting from scoping review, and available datasets. A mixed-method approach is applied because data and information on walking and sojourning are scarce, and the available data and information are often incomplete and biased. For a complete and accurate image it is necessary to check available information on validity, coverage and reliability, and find ways to correct biases and fill in blanks. To construct a complete and nuanced image of reality, multiple sources are used, and triangulation of the information is conducted to find the best proxy of a true image of reality.

The research is built on the outcome of recent international W+S research projects as well as professional expertise built up during 30 years. Based on this body of knowledge the author first advanced the W+S policy conceptual framework, inherited from the COST 358 Pedestrians' Quality Needs project, to inspire and structure the research. Apart from the heritage of the international W+S research projects, main sources for the research are literature and national statistical data and datasets. From before the beginning of the research a literature database and library were compiled, which was continuously updated along the way, also fed by searches in accessible literature databases like Science Direct and dedicated literature databases of research institutes. In some special cases results from special surveys could be used. The author's professional network was consulted to find guidance for research approaches, acquire additional references to relevant research, and particularly to verify research results. In cases where no documentation to support answers to my research questions was found, these gaps in knowledge were noted and listed.

3. CONCEPTUAL FRAMEWORK FOR WALKING & SOJOURNING POLICY DEVELOPMENT[83]

Chapter 1 pictured the relevance of this study on walkability and sojourning in public space policy development (from this point abbreviated to W+S policy development). Based on experiences in previous studies on walkability and sojourning in public space, it was remarked that, up till now, the issue has not been dealt with comprehensively in a scientific way and that there is ample societal and scientific reason for carrying out this thesis. The research objectives, central research question and four leading research questions were specified, the limits of the study are demarcated, and guiding principles and basic assumptions were presented.

Following up that introduction, this chapter dwells on providing conceptual insights regarding the subject of pedestrians, and walking and sojourning in public space and policy development on this, delivering a bird's eye view on a system approach to walkability policy development, i.e. theoretical overview of system approach, and a conceptual framework featuring the identification of system elements, interrelations between the elements, behavioural mechanisms and (policy) influences on walking and sojourning in public space.
Chapter 4, using concepts found in the current chapter, offers an overview of the System Requirements. That chapter also elaborates detailed research questions for Chapter 5 on the Status Quo of walking, sojourning and walkability.

Main aims of this chapter are:

1. To give general insight in the current state of affairs of literature on walkability policy development;
2. To deliver a conceptual framework:

[83] This chapter is a further development of the author's own work as part of the COST358 Pedestrian 'Quality Needs project, viz. Part A: Introduction and Conceptual Framework (Methorst, 2010) of the Final Report of the COST358 Pedestrians' Quality Needs (Methorst et al., 2010), published at www.walkeurope.org, www.walkeurope.eu, and www.walk21.com/pqn-project.

- to structure this thesis' research and policy development;
- to inspire the quest by providing basic understanding of how the system works;
- for devising change and evaluation[84].

Thus the function of this chapter is not to provide answers to this thesis' central question and leading research questions, but to underpin and substantiate those questions and place them in a wider context. The role of this chapter is to identify building stones and offer structure, instigating understanding of the role of walking and sojourning in public space, W+S behaviour and its main determinants.

The first aim in this chapter concerns capturing a bird's eye view of current scientific and practitioners' literature about walkability policy development. Experts in the COST358 PQN and OECD/ITF projects on walkability policy stated that the pedestrian is rather neglected in scientific literature and policy development. In this thesis therefore it is necessary to assess to what degree this is true and gather available literature for substantiation of walkability policy development. This will be done in section 3.1.

The second aim in this chapter concerns building a conceptual framework for this thesis' research and for pedestrian, walking and sojourning (W+S) policy development, defining what subjects need to be researched. It is built on a prolusion of such a conceptual framework delivered by the COST358 Pedestrians' Quality Needs project (Methorst, 2010-2). Its role is on the one hand to prevent to get lost in details, and on the other hand to check for completeness of coverage of pedestrians, walking and sojourning in public space as a subject and policy development in this regard. Furthermore the conceptual framework must also help to generate relevant questions and organise the quest: what data, information and knowledge needs to be gathered to answer the central and leading research questions. Besides it must help to identify clues for meaningful improvements, criteria for assessing effectiveness, efficiency, fairness of interventions, and gaps in knowledge.

The conceptual framework firstly concerns a definition of a system approach to W+S policy development. This is presented in section 3.2. In section 3.3. the pedestrian travel and sojourning system and its immediate environment is explained: what it is, how and why it functions. The chapter is rounded off with section 3.4. by conclusions and key messages.

3.1. W+S policy development: attention in literature

Walking is the oldest form of transport and there are ample societal reasons to foster walking, walkability and sojourning in public space (OECD, 2011:14-11). As such it would be reasonable to expect that over time walking, walkability and sojourning in public space received a fair amount of governmental attention and that there is a substantial body of research literature about it[85]. If available, such knowledge could be used as a starting point for policy development activities for sustaining and improving conditions for walking and sojourning in public space.

[84] See Methorst et al., 2010, Part A: Introduction and Conceptual Framework, p 34. The framework must be relevant, valid, reliable, predictive, flexible and self-consistent.
[85] As 'sojourning' is a relatively new concept, introduced by the PQN project, it is not logical to expect a vast body of literature about it.

International experts (in various WALK21 and ICTCT conferences) and dedicated scientific working groups (like COST C6, COST358 Pedestrians' Quality Needs and the OECD Working group Pedestrian Safety, Urban Space and Health), however, pointed out over and over again that walking and sojourning in public space are rather neglected in scientific research and governmental policy. They indicated that there is not much literature and what there is, is either fragmented and often of questionable quality. In a special study in 2011 (see Appendix 2) the author tried to verify this conclusion. He took a broad, multidisciplinary perspective, and did not restrict the search to one of the 'usual suspects' of traffic, traffic safety, transport, infrastructure, public space and land use planning and health promotion.

Firstly, the study established what resources are available for finding publications on walking and sojourning policy development. It found that SCOPUS, Science Direct, Google Scholar, various library databases and specialised literature databases together contained references to a large number of publications on pedestrians and walking. Within these databases a search was done on the keywords 'pedestrian' and 'walking' and within that selection on 'policy', 'strategy' or 'plan'. The search was limited to public policy, where walking and sojourning in public space were clearly the main topic, not just an example, and to conditions that arise in European countries, and generic approaches, thus excluding very technical studies. The found publications were entered in an MS Excel database. The publications in this literature database were assessed and scored regarding subjects covered in the publication and its potential for W+S policy development, particularly for helping to find answers to the thesis' research questions as formulated in Chapter 1, section 1.2.

The study ended up with a sample of 1,700 publications (potentially) relevant for W+S policy development. The number of publications on W+S policy development is increasing rapidly (see Figure 3.1; note the y-axis is in logarithmic scale), making it increasingly difficult to sift the wheat from the chaff. Another consequence can be that historical awareness degrades, because the older key publications get lost in the abundance.

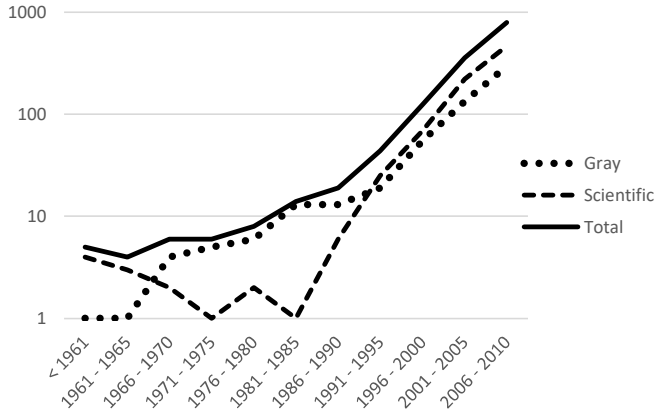

Figure 3.1. Number of scientific and 'grey' publications in the thesis literature database

It was found that the major themes covered by this thesis' were touched by substantial numbers of publications in the literature database. The numbers of relevant publications varied per theme. On the low end only 12 publications were found regarding *Added Value* and 107 (probably) relevant publications concerning *Theory*. On the high end 599 (probably) relevant

publications were found regarding *W+S policy measures* and 773 on *precursors and determinants of walking and sojourning in public space* (see Figure 3.2).

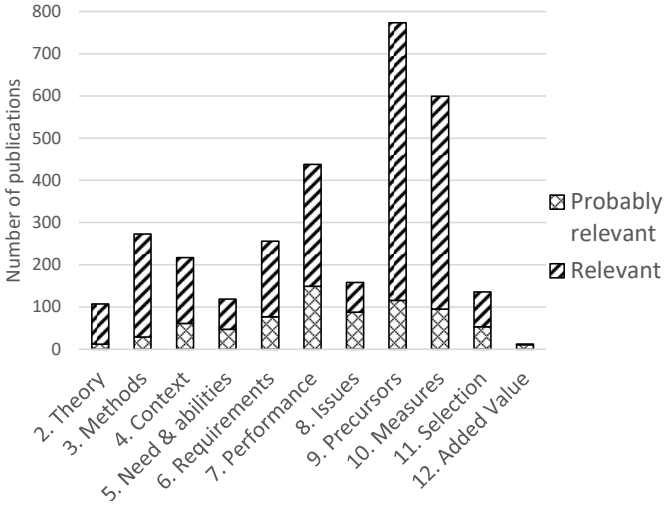

Figure 3.2. Number of publications in the literature database concerning the thesis' themes and relevancy score

As this thesis particularly aims to provide overview and global insight in what options there are for effective, efficient and integral W+S policy development, special attention is given to trace overview publications that cover the whole area comprehensively. Only 30, mostly older, publications that displayed a general W+S policy review were found, of which only two are scientific publications. Even in these 30 publications the authors dominantly focus on policy advise from a certain (external) perspective like safety, health, mobility, transportation policy, traffic calming and public space design, infrastructure, road design, public, accessibility of shops. Publications starting from pedestrian needs were quite rare; knowledge on walking, walkability, sojourning in public space is mostly a by-product from studies that have other goals. What appears from the analysis is that, in current W+S policy development, safety and health, and to a lesser extent city centre economics, are major drivers.

From the literature research the author concludes that the experts' statement that W+S is a rather neglected field in literature might have been true up until 2000, but that from that moment on the number of publications on pedestrians and walking has increased enormously. Scientific literature now offers ample information on problem causes, needs, abilities and requirements, but much less on promising and proven measures. It rather functions as 'icing on the cake', dealing with selected topics, 'nice to have', but also 'potentially serious trouble'; scientific literature does not evenly and comprehensively cover the W+S domain; for policy developers there is therefore ground to highlight 'grey literature'.

The literature scan produced a rich database of publications regarding the W+S policy development domain. Because of the variety of subjects, aims and situations and behavioural contexts, there seems to be great potential to identify what controls authorities can adjust to support and promote walking and sojourning as a source of wealth and well-being. The downside is that as yet overview is lacking.

3.2. System approach to walkability policy development

3.2.1. Introduction

The above mentioned lack in overview and cohesion between subjects covered poses a problem for developing coherent, integral and comprehensive W+S policy strategies and plans. It can be concluded that scientific knowledge is expanding significantly, be it mainly in depth, and largely missing the link with the policy world. Furthermore, as diagnosed in the preamble, there is the problem that humans generally tend to overlook common things and focus their attention on special conditions (Steffen, 1975; Atkinson et al., 1990; Swanson et al., 2008), which is also true for research and policy development. Special conditions get researched, common conditions tend to be neglected, deepening the gap between relevant issues, based on (hidden) facts, and perceived issues. The actual quantity and quality of walking and sojourning in public space (W+S) will depend more on unobtrusive general conditions than on the more conspicuous special conditions in specific situations, although, of course, the chain is as strong as the weakest link. In this context Rumar observed that there are three orders of explanations for system failures, namely (Rumar, 1999 & 2002):

- explanations which are obvious even at superficial examination (1st order problems/explanations), like reported accidents, victims and material damage; elementary risks like Black Spots;
- explanations which become evident after follow-up investigation (2nd order problems/explanations), i.e. primary causes and inducements, like speeding, driving under the influence of alcohol and crossing without looking;
- totally hidden explanations which only surface after thorough research into the precursors of undesirable conditions (3rd order explanations), i.e. lack of maintenance; socially acceptable risky behaviours, not complying to norms and guidelines, denial or a pathological attitude towards tackling pedestrian safety (like falls), omitted preventive measures.

Consequently an Ad-Hoc approach as a reaction to recognised 1st order problems, is like being the tip of an iceberg (Hydén, 1987), and cannot be expected to deliver overall improvements of a system. Rumar's observations are particularly relevant for walking and sojourning in public space, as significant system failure indicators, like the financial loss, pain, distress because large number of casualties from falls, suppressed mobility, inaccessible shops, children's retarded cognitive and physical development, are largely hidden from the public's, politician's and policy maker's detection.

From the literature scan it appeared that many bits and pieces, although not generally known, are covered by literature. From this it can be concluded that walking and sojourning in public space is not as simple as many people think it is and that 'there is much more to walking than walking' (Gemzoe, 2001:20). The question is how can the many ingredients be interconnected to 'bake a delicious pie'? Key questions in this respect are:

- how can we learn to understand W+S?
- how can we find ways to improve W+S conditions?

In order to find answers to these questions over time the author gathered ideas from other domains like spatial planning, sociology, traffic safety and safety sciences through literature scans, conferences, discussions with experts. Many researchers conclude that system approach

promises to offer a sound way out of the above mentioned deadlocks and can help to acquire understanding in complex matters, and offer an answer to the ever increasing societal complexity, nourished by fast growing scientific in-depth knowledge (e.g. McLoughlin, 1969; Koornstra et al., 1992; Ahmed & Ali, 2004; Wegman et al., 2005; Hagenzieker, 2012). With regard to road safety Hagenzieker (2012) concludes that authors increasingly assign the key word 'systems' to their article, which probably signals that they see System approach as a proper way to gather understanding and devise effective and efficient countermeasures to system deficits. System approaches do not focus on peculiarities, but rather on the interaction of 'common' conditions within the system.

In order to broadly answer the above questions and determine the limitations of a system approach the next subsections of this section look into the following matters: 2.2.2. Systems theory, 2.2.3. System approach, and 2.2.4. Limitations of system approach.

3.2.2. Systems theory[86]

Although walking and sojourning are quite common activities, they are also very difficult to explain. Walking and sojourning are complex phenomena, as people have many different reasons to walk or not to walk somewhere, and the consequences of the activity are manifold. Evidently, there are many factors influencing the amount of walking, the situations and conditions, the safety of it, the satisfaction it gives etcetera. To '*understand this complexity, scientists usually try to envisage the phenomena as simplified versions of reality known as a system or model. A system can be defined as a collection of interrelated parts or elements that work together by way of some driving process'* (cited from Pidwirny, 2006, http://www.physicalgeography.net/fundamentals/4a.html (accessed 3-10-2020). Systems theory is the trans-disciplinary study of the abstract organisation of phenomena, independent of their substance, type, or spatial or temporal scale of existence. It investigates both the principles common to all complex entities, and the (usually mathematical) models which can be used to describe them (Heylighten et al., 1992)[87]. Systems theory was originally proposed in the 1940's by the biologist Ludwig von Bertalanffly (General Systems Theory, 1969) and furthered by Ross Ashby (Introduction to Cybernetics, 1957).

Almost anything can be seen as a system: a stone, a tree, happiness. It is a way of analysing phenomena. A system[88] gets input (i.e. food, ideas, external sensory stimuli), it processes that input (=throughput) and produces output (i.e. observable behaviour, waste materials, new ideas) and delivers outcome (i.e. movement), which can have impact on the system's environment. Likewise a pedestrians' travel and sojourn system can be defined and pictured (see Figure 3.3.).

[86] This section is based on texts produced for the PQN Final Report - System approach - Part A: introduction and Conceptual Framework (Methorst, 2010-1). The information is based on snowballing from transportation and psychology handbooks, Wikipedia, additional literature scans and reflective PQN working group discussions.

[87] Citation of a webtext written by F. Heylighten and C. Joslyn, titled "What is system theory", http://pespmc1.vub.ac.be/SYSTHEOR.html

[88] With regard to human beings each specific discipline like biology or behavioural psychology has its own perspectives on man as a system. For example: in biology input is food, temperature, sun, air. Growth is seen as throughput and behavioural repertoire is output. In behaviourism external sensory stimuli are input, the brain is a black box and observable behaviour is output.

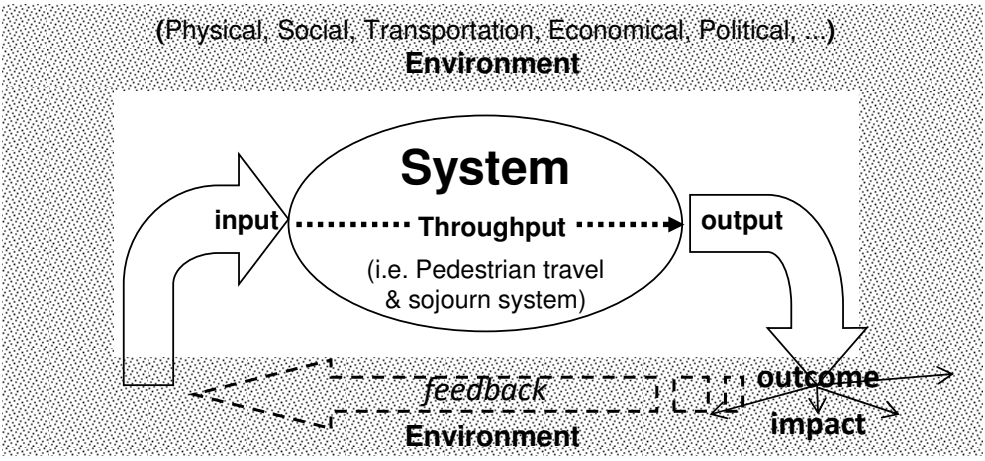

Figure 3.3. A system (i.e. pedestrian travel & sojourn system) with its environment (after Heylighten, 1992) as an open system

In the context of the COST 358 PQN project systems theory was discussed and worked out for W+S policy development. In the Measuring Walking workshops during the WALK21 conferences in 2006 - 2010, led by Daniel Sauter, and reported in the PQN Final Report (see Methorst et al., 2010, Executive Summary report, p. 11-16; and in Part B.4. Measuring walking, p. 7-30), the experts agreed on a set of system features that need to be measured to describe the

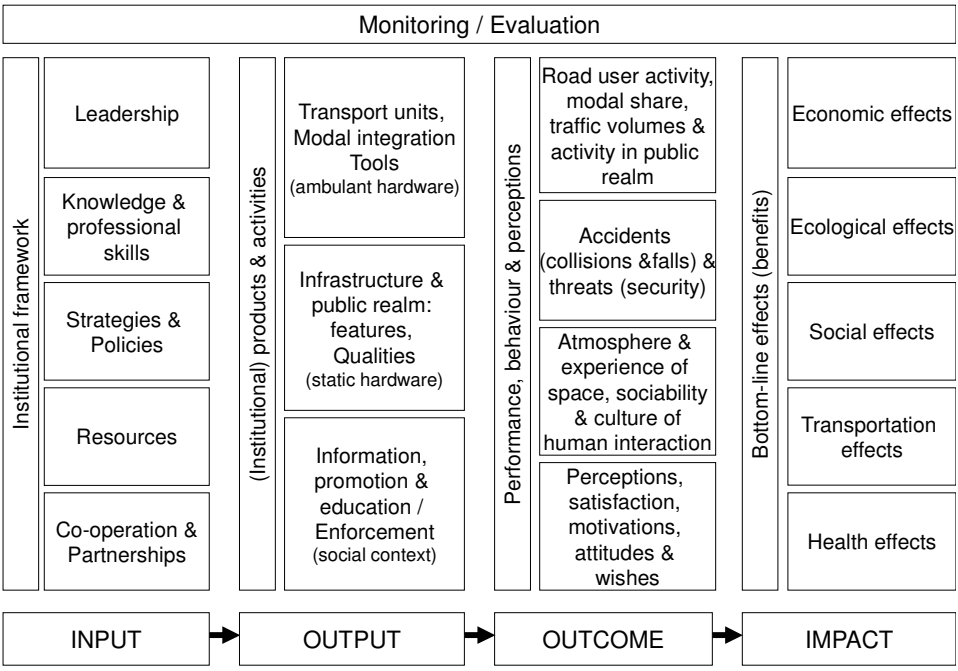

Figure 3.4. Sauter and Tight's assessment model for measuring walking (after Methorst et al., 2010, Part C, p 14)

state of affairs regarding walking and sojourning in public space. These features are 'input', 'output', 'outcome' and 'impact'. In Figure 3.4. the features are presented in an assessment model for measuring walking.

In the PQN Final Report Part A Introduction and Conceptual Framework, and Part B.5. Documentation - Policy process (Methorst et al., 2010), based on discussions in and reactions from the PQN working group 4 Cohesion and Integration, additionally the concepts of 'environment', 'system', 'throughput' have been touched.

Below the components of the model will be elucidated: environment, input, system, throughput and output. Furthermore I will go into the concepts of outcome and impact, describing the effects of the system on its environment.

Environment

'Environment' can be defined as the totality of surrounding conditions, influences or forces, by which living forms (systems) are influenced and modified in their growth and development[89]. In principle all systems function within an environment: our solar system functions within the galaxy; earth functions in our solar system; the Netherlands functions in Europe; walking and sojourning in Dutch public space functions within Dutch society. The latter is made up from several kinds of conditions and influences, forming a context[90].

The walking and sojourning system context can be decreed to consist of:

- external hardware
  Examples are non-public space, physical conditions outside the system territory, waterways, motorways;
- external social, political, technological and economic influences
  E.g. '*software*' influences from outside the system territory, like norms and values in neighbour countries, the citizen's everyday life, fringing technology, science and knowledge, external economic pressures, monetary values, supply and demand on an European or worldwide level, international transportation networks and systems;
- atmospheric, climatic and natural conditions
  This type of external factors includes: the weather and climate, geological and geomorphological structure, the natural environment beyond public space, natural ecosystems (i.e. endemic flora and fauna). These conditions set the stage for walking, but are largely beyond the span of control of the walkability and sojourning policy agents;
- the institutional framework
  The institutional framework organises change input towards the W+S system, and is in my definition not an integral part of the W+S system.

The environment is both the origin of the change agents that deliver input to the system and receiver of output and outcome of the system. In public policy development change agents are actors within some institutional framework[91]. The environment affects the actors: it enables,

[89] http://www.websters-online-dictionary.org/definitions/environment, accessed 29-6-2012.
[90] The context refers to a set of facts or circumstances, settings or background which determine, specify, or clarify the meaning of an event [after Websters' Dictionary, accessed 29-6-2012].
[91] This does not mean that the actors are governmental officials or politicians only. Other parties, like consultants, universities, NGO's, business stakeholders, trade unions etc. can be involved in the process as well.

allows, stimulates, supports, restricts or even forbids system input initiatives. In other words: the policy context determines policy scope and needs to be taken into account.
Changes in the pedestrian's travel & sojourn system can affect its surrounding environment, including the physical, social, transportation, economic and political environments, and form a cyclic process.

Input
Many things can act to arouse action or change within the pedestrian travel & sojourning system, and can be input. Examples of such input matters are, amongst others: energy (food), money, information, technology and building materials. In principle there are two different ways in which input is delivered: through interventions and through autonomous changes of the environment. The latter may initially affect the shared urgency for interventions, and ultimately also their effects. Therefore, in policy development autonomous changes of the environment need to be taken into account. Apart from the influence of environmental conditions and autonomous changes therein, the reach of actual interventions depends on pre-conditional factors within the institutional framework (e.g. leadership, sources, arrangements). With reference to Smits (2000) I will call this conglomerate of pre-conditional factors and intervention arrangements 'Orgware'. Following Sauter and Tight (2010), based on discussion in the Measuring Walking workshops and Sauter's research for the workshops, 'orgware' is described as follows:

> *' [Orgware] describes the institutional framework in which walking happens and informs about the financial, material, organisational and human resources made available by authorities as a basis for providing good walking conditions. It specifically comprises the leadership of politicians and (senior) officials, strategies and policies including laws, norms and procedures, the resources allocated (in terms of staff and funding), the research settings and the co-operation within and between administrations. It also includes citizen participation and partnerships with private stakeholders.'* (Methorst et al., 2010:13, Executive Summary report).

Characteristics of these orgware components affect the quantities and qualities of the products and activities delivered by the change agents. For example, weak leadership is prone to deliver non-ambitious, traditional, conservative, powerless policy plans, substandard design and ineffective compromises. This substantiates the relevance of the policy context as determinant of the quality and quantity of the system input.

System
As noted above, a system consists of interrelating elements guided by some driving force (Pidwirny, 2006). A system can be seen as a 'living' form. Systems can be seen as a black box or a white box, or something in between, depending of the degree to which detail can be observed, or one wants to observe[92]. When seen as a black box the internal structure of components and functioning are concealed or taken for granted. Alternatively, in a white box system the internal elements can be identified and studied. The pedestrian travel and sojourning system can be taken as a white box system. In this thesis the system is defined by its elements and interrelations, its role and function, or desired impact on the greater system, and the policy agent's (potential) authority. In Section 3.3. the system will be described in more detail.
Systems can be typified and specified in many ways, such as:

[92] One can choose to picture the system as a black box when one is not interested in the system details or when understanding the system seems to be difficult or even yet impossible. When relevant to know, it is obvious to choose to picture the system as white box.

- *Boundary of the system*:
  Boundaries can be erected regarding time (i.e. static, dynamic), space (i.e. territorial borders, physical form) and scope (i.e. discipline definitions, objectives, legislation, perception, span of control). System boundaries can be closed, fuzzy or open. Forrester (1968, 1990) indicates that in fuzzy and open systems there are feedback loops, of which the levels (integration, accumulations, states of the system) and rates (policy statements, activity variables, flows) matter. Such systems are learning systems. Key questions are: is there a feedback loop? If yes, what kind?
  With regard to W+S policy development the pedestrian travel and sojourning in public space system is delimited by the boundaries of the administrative system (i.e. country of the Netherlands and the government's tasks, competences and authorities), confined to public space, including land traffic, but not water and air traffic, confined to (mainly) utilitarian walking and sojourning, and elements and interrelations that can affect pedestrians, and not confined to certain disciplines. The boundaries are somewhat fluid, in the sense that the system can also be influenced directly by matters that lie outside the specified boundaries, like European traffic rules, foot-passenger ferries, joggers on city sidewalks, etc.;
- *System function*
  Systems can have a specific function or groups of functions (Wikipedia, 2012[93]). In this respect the transportation system's main function is to allow for mobility and goods transport. The W+S system's function is to enable door-to-door walking, walking to and from other modes, as well as circulations and sojourning in public space. Systems can be distinguished by their functions;
- *System structure*
  System structure is defined by its components (also called 'elements') and their interrelations. As said, in Section 2.5 the basic elements of the pedestrian travel and sojourning system will be described. I will confine to just mentioning their kinds: pedestrians, social-normative entities, fixed physical objects and mobile objects (transportation), their interrelations and relations with the outside world. A road traffic safety system can be defined in almost the same way, by just substituting 'pedestrians' by 'road users'. Another example: the industrial health & safety system will be defined by the workers, their physical environment, their social (normative) environment, tools, their interrelations and relations with the outside world;
- *System interconnectivity*
  The various components of a system have functional as well as structural relations to each other (Pidwirny, 2006), and the system is also connected to other systems. Thus the safety of a system is inextricably bound up with characteristics of the combined action of the components, and in turn is affected by influences from the outside, like policy guidance. The characteristics of the internal and external relations can be used to typify or define a system. Important characteristics in this regard are the degree of openness or isolation and the complexity of a system.
  Regarding openness or isolation: theoretically a system can be self-contained, i.e. a perpetual motion machine, functioning without input, external influence or output. In reality such systems do not exist. Isolated systems are rare, but they do exist, like the Galapagos Islands, where in isolation an aberrant ecosystem developed. All systems are affected by its environment to some extent. With each input the system form and function changes somewhat, which is why it can be seen as a 'living' thing: an evolutionary system; however, some systems evolve more and/or faster than others.

[93] Wikipedia: http://en.wikipedia.org/wiki/System, accessed on 21-9-2012.

Concerning the degree of complexity: a simple system has only one or two functions. A light bulb can be seen as a simple system; complex systems on the other hand consist of a multitude of elements, purposes, roles etc., which are affecting each other to such a degree that the output and outcome of the system becomes rather unpredictable and its boundaries are not so clearly defined or interpreted. Furthermore cause and effect are not always very closely related.
The W+S system can be seen as an open and complex system;

- *System size:*
  The size of a system can be defined in many ways: by its physical dimensions, number of people included, number of artefacts included etc. The pedestrian travel and sojourning system is large in many ways, as it includes almost the complete population of citizens, be it in just one role;
- *System behaviour*
  Systems do behave. A system receives input and its components react (or do not react) to the input. Together the components process the input. This may affect the system's primary function and risks involved. This reaction reveals itself through component and system behaviour, delivering output and outcome in terms of i.e. elevated number of conflicts, mobility, safety, health, satisfaction. The way a system reacts to external stimuli can typify the system, such as system dynamics, self-structuring and risk characteristics.
  A system is dynamic when internal processes or an intervention from its environment creates a series of changes in the system, which may in turn initiate new interventions when the system's output changes. The system is in a continuous process of change (Joutsiniemi, 2010, cited in Lapintie, 2010:25, B.5).
  Some systems are self-referential and able to create and recreate their structure and its constituent elements (so called autopoietic systems[94]); typically biological and social systems are of this type (Luhmann, 1986, cited in Lapintie, 2010:26, B5). An important feature in this regard is resilience, or the degree to which the system is able to react and 'automatically' remedy encountered problems.
  Every now and then a system malfunctions, causing damage to the greater system (society), including material and immaterial damage, casualties and fatalities. The urgency to do something about it depends to a large degree on dominant failure risk characteristics and risk acceptance by its stakeholders. From psychology it is known that there are mechanisms that steer risk perception and risk acceptance (Wildervanck, 1988; Hollander et al., 2003; Derriks, 2011). Derriks (2011) clusters the mechanisms to 'danger backgrounds', 'danger effects', 'individual factors', 'context' and 'other factors'. Risk acceptance can be presumed to set the stage for agenda setting for walking and sojourning in public space;
- *'Ownership':*
  A system can be owned by one person, a group, several groups or (almost) everybody. The pedestrian travel and sojourning system is not owned by a single person, small group of persons or some organisation. When trying to improve the system, the fuzzy ownership makes it very complex to develop, implement and manage adequate interventions. With

[94] Wikipedia: Autopoiesis literally means "auto (self)-creation" (from the Greek: αυτό – auto for "self"; and ποίησις – poiesis for "creation or production"), and expresses a fundamental dialectic between structure and function. An autopoietic system that refers to a living system is a 'machine' organized as a network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and (ii) constitute it (the machine) as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network.

regard to the W+S system there will probably be a variety of independent interventions simultaneously all the time.

With respect to the pedestrian travel and sojourning system Steenberghen (2010: 221-236) explains that:

> *" While there is a common agreement among system thinkers that a system is a dynamic and complex whole, interacting as a structured functional unit within an environment, the boundary between the system and the environment can be interpreted differently. These boundaries can be seen as permeable and variable in time and space. Evolutionary systems, similar to dynamic systems, are understood as open, complex systems, but with the capacity to evolve over time (Dyer, 2005). If I consider the pedestrian system as an open, complex evolutionary system, then the interaction between the system and its environment is not constant, and the systems outputs are indicative and flexible rather than comprehensive and fixed."*

> *" The structure of a complex system is not a simple feedback loop where one system state dominates the behaviour. Cause and effect are often not closely related in either time or space, and there is a multiplicity of interacting feedback loops and nonlinear relationships. The complex system is of high order, meaning that there are many system states (or levels). It contains positive-feedback loops describing growth processes as well as negative, goal-seeking loops. The cause of a difficulty may lie far back in time from the symptoms, or in a completely different and remote part of the system. In fact, causes are usually found, not in prior events, but in the structure and policies of the system. In the complex system, when we look for a cause near in time and space to a symptom, we usually find what appears to be a plausible cause. But it is usually not the cause. The complex system presents apparent causes that are in fact coincident symptoms. The high degree of time correlation between variables can lead us to make cause-and-effect associations between variables that are simply moving together as part of the total dynamic behaviour of the system (Forrester J. 1990)."*

Throughput

Throughput literally is 'what comes through' or 'what is processed'. It refers to the input that actually is used, applied and changed within the system before it incites output, changing hand from the change agents to the system participants and then again to the outsiders. With regard to computer systems, '*the system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network'* (Wikipedia, citing Rappaport, 2002[95]). In the W+S system throughput concerns how pedestrians deal with external change stimuli.

Output

Output of a system refers to the products delivered by the system. Output is the result of performance of a system. Examples of *outputs* are ‘products’ like, a pedestrian friendly urban environment, practical rules, norms and values, connected neighbourhoods, a healthy population, a sustainable environment etc. Sauter and Tight (2010:13) helpfully summarise 'output' as follows:

> *" Output focuses on products and activities by (institutional) actors, which are achieved through their efforts and activities. Outputs in the field of walking comprise land-use, the resulting accessibility and the (degree of) integration between different modes; infrastructure provision, features and qualities of public spaces; information, promotion*

[95] See https://en.wikipedia.org/wiki/Throughput

and the marketing of walking and the enforcement (e.g. regarding speeds and parking of motor vehicles)." (Methorst et al., 2010:13, Executive Summary report).

Clearly, Sauter and Tight refer to the output of the institutional framework as a system, not the W+S system itself. With 'qualities of public spaces' they show not only to take walking, but also sojourning into account.

Outcome

Outcome refers to the direct payoffs resulting from the actions or strategies. I use Sauter and Tight's definition and illustration:

" Outcome is the primary and immediately observable result of input and output. It is, for example, measured as levels of walking and sojourning, user activities and behaviour, also in terms of accidents (with vehicles or as a result of falls) and security (threats and attacks). Outcome can also be observed as atmosphere of a space which is created by the people using it. The final, yet crucial dimensions are perceptions and levels of satisfaction, attitudes and motivations as well as expectations and wishes of users or non-users and of politicians and the media." (Methorst et al., 2010:13, Executive Summary report).

The subject of performance of the system (refers to output and outcome together) regarding walking and sojourning in public space will be dealt with in Chapter 5.

Impact

Following Sauter and Tight (2010) 'impact' is defined as:

" .... a secondary outcome usually with longer lasting, often indirect effects. It is often hard to measure. We can distinguish between individual and collective effects with the latter usually being of most interest. They include the bottom-line economic, ecological and social benefits (effects) and can also be discussed in terms of specific effects regarding transportation or health." (Methorst et al., 2010:13, Executive Summary report).

Examples of impacts are availability of alternatives when other modes fail, high economic value of properties in a pedestrians-only precinct, Quality of Life delivered by a fine pedestrian and sojourning system, for the policy agent a positive imago. In some cases the ‘product’, such as a pedestrian friendly environment, can also again function as input to the system. As the output of the pedestrian system affects the environment, it also changes the preconditions for the system and thereby the input, thus producing impact. This illustrates Steenberghen's remark (cited above under System) that the pedestrian system is a *complex open system.*

Regarding the policy relevance of 'input', 'output', 'outcome' and 'impact' in the PQN project it was found that current analysis of walking and sojourning usually focuses on 'output' and 'outcome'. This mainly comprises the qualities of the environment and activities, while political discussions and decisions are often triggered and focussed on 'input' and 'impact' factors, such as impacts of (potential) disasters and substantial risks (i.e. penalties from higher authorities), investments and ecological and economic effects. Therefore it is important to look at all relevant factors right across the board (Sauter and Tight, 2010).

3.2.3. System approach

The previous section gave a first look at the system as a concept. The current section converts Systems Theory into a practical policy development approach, where the initiator and policy actor tries to deal with a system as a complex reality systematically, comprehensively and integrally. In this thesis' view the aim of System approach for W+S is to develop and substantiate the best possible system input (improvement interventions and keep up management), supporting planning and providing an optimal (and possibly flawless) system, facilitating the pedestrian to move as freely, comfortably and safely as possible. Thus the focus is *not* so much on fighting negative system outcomes like social exclusion, obesity and accidents, but on influencing precursory system failure (risk) factors within the process. This thesis' research and policy development work is aimed at supporting optimization of the walking and sojourning in public space system and reaching multiple targets such as safe, healthy, agreeable mobility for all, 'ageing in place', community development etc. Feedback information about the output, outcome and impacts of system input helps to evaluate effects of earlier inputs (interventions and autonomous developments) with respect to earlier policy targets, but does not always help to predict output, outcome and impact of new inputs. The effectiveness of planned system input can be predicted when the policy developer knows what makes the system tick and how the system will most probably react to the input.

In general System approach is based on Systems Theory. A true System approach takes into account that process, context and content should be balanced out (Pettigrew, 1992). This section focuses on how this can be applied in a system approach for supporting and promoting walking and sojourning in public space. The sequence in a system approach logically is first to develop a **systematic process**, then to carry out **comprehensive analysis** of the system, including its context, and next to develop and implement an **integral intervention (input) strategy**[96] and finally to monitor the actual system input, output, outcome and impact, to adjust the system for improved output, outcome and impact. Below these three System Approach features are elaborated.

Systematic process

A system approach starts from a clear aim and builds on adequate general insight in the context, the functioning of the target system and the processes which the stakeholders are involved in. Realising the decreed aims involves systematic planning, implementation, checking implementation results and acting on conclusions (cf. Rijkswaterstaat Plan-Do-Check-Act cycle, Van Vliet, 2007).

A science based systematic approach to pedestrian quality can be expected to make a big difference to the citizen's quality of life as a pedestrian. Aims with regard to the W+S system are[97]:

- to cover all options and prevent a one-sided approach and promote synergy between the policy content, process and context;
- to offer best value for money;
- to improve the image of the pedestrian issue by taking a 'professional' comprehensive rather than an intuitive approach that is often associated with 'minor' issues.

[96] 'Comprehensive' concerns coverage of analysis, information and knowledge about a subject, which should be as complete as possible; 'integral' concerns integration of all relevant and feasible activities in such a way that the best possible result is effectively and efficiently produced.

[97] The aims originate from an internal brainstorm session at DVS Centre for Transport and Navigation in October 2008.

A systematic, possibly cyclic and iterative, process design is followed. Such a process design should break up the necessary activities into manageable parts, have a logical sequence and suit the policy developer's context. In section 1.2. Thesis objectives and research questions, a process design for W+S policy development and implementation, which targets to take the above aims with the W+S System approach into account, was presented (see Figure 1.2). This process design is reflected in this thesis' chapter scheme.

Comprehensive analysis

Comprehensiveness of the analysis of the system's features and functioning is a key criterion for the effectiveness of the approach. It points to the consideration of all relevant elements and their interrelations, but another aspect is that all relevant perspectives are taken into account. David Harvey (1993) effectively illustrated the importance of this by using the example of a diorama with many peeping holes, in which a scene is displayed. Although the scene stays the same, the impression one gets out of the view from each other peeping hole, can be totally different. He argues that it is important to take as many perspectives as possible to cover an issue, because apparently the truth has many appearances. So, this feature of a system approach concerns knowledge, insight, explanation and predicting what can and will happen when no action is taken, and what when some kinds of interventions are taken.

The question now is what kinds of perspective should be taken into account to get a reasonably complete coverage of an issue. According to Ahmed & Ali (2004:473) system theory incites analyses of the system from three different viewpoints:

"1) analysis of systems relations to determine the nature of relationship between various components of the system

2) system effectiveness to judge how satisfactory are relationships among various components of a system for the whole system to survive or make optimum use of resources [RM: or system input, i.e. interventions]*; and*

3) system dynamics to investigate what forces a system to change and the direction in which the change occurs." (Ahmed & Ali, 2004:473).

Obviously, it is also wise to make sure that all Rumar's orders of problems/explanation are covered and to try to include all relevant disciplines in the study. Another clue is given by the Dutch Advisory Council on Land Use Planning (RARO[98]). According to this Council spatial quality can be seen as the sum of three kinds of valuations that together sketch a comprehensive picture of spatial quality (RARO, 1990). These valuations can also be applied to pedestrians' quality needs:

1. *Functional perspective*:

   Functionality or usage value, relates to what is being offered and to intrinsic quality supply. It concerns looking at the system from the 'head' and searching for 'facts' (concrete evidence), thus covering first order[99] needs and wants. This perspective particularly covers the experts' perspective and focuses on the supply side of facilitating pedestrian activity. This functional perspective concerns Ahmed & Ali's perspectives #1 determination of system relations and #2 assessment of the system's reaction to inputs;

[98] RARO is the acronym for Raad van Advies voor de Ruimtelijke Ordening, the Dutch Advisory Council on Land Use Planning.

[99] According to Rumar (1999) there are three kinds of problems that need to be dealt with: first order problems, that can be identified from available data, second order problems, that come forward through dedicated studies and third order problems that are almost totally hidden.

2. *Perception perspective*:
   The perception perspective relates to what is being requested and to subjective quality needs. It concerns looking at the system from the 'heart', including attitudes towards and of pedestrians, thus searching for 'opinions' and covering second order needs and wants. On the one hand this perspective covers the pedestrians' perspective and focuses on the demand side of facilitating pedestrian activity and on the other hand on public and political opinions that influence policy making and implementation of the issue. Ahmed & Ali did not include this perspective;
3. *Durability and Future Prospects*:
   Whilst the functional perspective and the perception perspective are mainly static[100] quality descriptions, the durability and future prospects perspective refers to a dynamic perspective and so called third order needs and wants. Durability[101] is, like user value and perception value, a relative value and depends on current qualities, future social values and future use of the physical environment and transport system. Historical developments, to a certain degree, can be described in 'objective' terms, but assessment of future prospects and durability are, because of the uncertainties involved, by nature at best expert guesses. Because interventions can have substantial impact on future developments, this kind of assessment is needed for balanced decisions that take into account, as well as I can, the interests of pedestrians in the future. It goes without saying that this perspective particularly covers the experts' perspective. This perspective concerns Ahmed & Ali's #3 perspective regarding system dynamics.

Comprehensive analysis at least covers the above perspectives, by looking at the actual systems' many features and performances, by determining its multitude of causal factors, determinants and sequential chains, correlations etc. The aim is to find out how (parts of) the system works and how its components work together. In order to get a complete and balanced picture, the three perspectives need to be collated into a fourth perspective: the integrative 'holistic' perspective, that seeks to find ways to balance out the different realities of the 3 'longitudinal' perspectives into coherent policy and research recommendations from the perspective of a prototypical pedestrian. In his thesis' conclusions with regard to the walking and sojourning in public space policy development, the four perspectives will be explicitly taken into account.

Integral intervention (input) strategy

Based on a comprehensive analysis of the pedestrian walking and sojourning in public space system, including its policy context, strategies can be developed to improve walking and sojourning conditions. In the analysis stage of policy development it is not practical to analyse all system features integrally, in a holistic way. In the implementation stage however taking the holistic view is essential. As every change action will change the 'natural' balance and 'organic' harmonies within the current system[102], to be most effective on the short and longer terms, improvement strategies should be focussed on putting maximal effort into covering all known

[100] Indication of the situation at a given moment

[101] Durability and robustness are strongly related concepts. In statistics robustness is defined as insensitivity against small deviations in the assumptions. Aspects are system performance and loss of function, collapse of powers with overall consequences that are scenario dependent, robustness and vulnerability, from component design to systems design (MoU of COST TUO601, 2006).

[102] Cf. Chaos theory and Barry *Commoner's Four Laws of Ecology* (Commoner, 1971, described in https://www.nas.org/academic-questions/23/1/the_roots_of_sustainability, accessed 4-1-2020); linked to Commoner's work, Chaos theory is commonly profiled as 'when a butterfly flutters its wings, this can change the world'. *Commoners Four laws of ecology are: 1. Everything is connected to everything; 2. Everything must go somewhere; 3. Nature knows best; 4. There is no such thing as a free lunch.*

relevant conditions, change factors and intervention angles consistently. Ideally such an integral improvement strategy covers:

- all relevant **components and interrelations** of the system: preconditions (orgware), hardware (physical space, stationary and mobile objects, the pedestrian's condition, other persons in the environment) and software (the social-normative environment, behavioural procedures and instructions, computer software);
- application of current **knowledge and expertise** from all relevant disciplines for developing improvement strategies and compiling balanced packages of interventions, together balancing out whatever strengths, weaknesses, opportunities and threats the considered interventions might have;
- improvement of both **current and future** ('objective') system functionality, also including provisions for adequate maintenance and system management and control opportunities across the life span of the interventions;
- **correction or compensation** for biased misperceptions, (known) undesirable side and counter effects which might degrade system's functionality;
- co-ordination of all relevant policy and implementation plans through some kind of **master plan**, covering:
  - all *planning levels* (strategic planning, tactical- structure planning and operational-implementation planning, management & control plans of the various policy agents);
    - all *planning cycle stages*, including monitoring & evaluation and provisions for necessary adjustments[103] (cf. Rijkswaterstaat's Plan-Do-Check-Act cycle);
    - *nested activity levels*[104] of both the walkers and other stakeholders, implementing the strategies in a logical, functional sequence, and taking care that short term plans should perfectly connect to mid- and long term plans;
    - the combined (and individual) latitudes (*spans of control*) of the planning and implementation agents[105].

Because of the multitude of factors, aspects and perspectives to be covered, a system approach can only be successfully applied as teamwork. The sheer complexity of including and balancing out the great variety of interventions, measures, trades, practises and methods, makes it impossible for a single person to do the job properly. In this context this thesis, being a one-person-project, cannot promise to deliver more than a general prolusion or demo (provisional prototype) of a system approach to W+S policy development.

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[103] Because of its complexity on the one side, and human limitations, a system approach cannot do without a feedback-loop from the systems output, outcome and impact to the system's input. Clearly, interventions are prompted by imperfect analyses causing imperfect intervention strategies. Furthermore unexpected effects can surface, apart from imperfect policies, due to unknown autonomous system influences. So, for good results, adjustments have to be made, based on feedback information gathers by monitoring the system's performance and evaluating the results of policy activities with respect to achieving the policy targets.
As the scope of this thesis is limited to the identification of insights needed for a system approach to walking and sojourning in public space, and does not include implementation of interventions, monitoring and evaluation of policy measures cannot be included.

[104] In Section 3.3.2 the concept of activity levels will be explained in detail.

[105] This implicates that sector plans are elaborations and a necessary part of integral plans.

3.2.4. Limitations of System Approach

From other fields[106] it is known that a system approach can help to get better insight in relevant factors and processes. A system approach integrates knowledge regarding aspects of walking and sojourning in public space as well as relevant interrelations, processes and contexts. It offers a holistic view on walking and sojourning and on conditions that determine walking and sojourning in public space. The focus is on the interaction and interrelation between the different types of factors both inside a defined system and with the environment around it. A system approach can therefore help to map determinants and influential factors comprehensively, making obvious that the total is more than the sum of parts.

However, like any approach, it can be shown that the described system approach has drawbacks and limitations. It can be concluded that the strategy is top-down based and as all models it is a simplification of reality. It implies loss of detail and items that are perceived 'not relevant' for the system functioning are excluded from the model representing the system. An example is the maps that are used in navigation instruments. They are based on aerial photographs, which show individual buildings. In the maps these buildings are simplified to 'built-up area'. Thus orientation by means of building characteristics, like 'single houses', 'detached housing' is not possible.
Other possible drawbacks can be that (implicitly) a priori assumptions are made with regard to the demarcation of the elements of the system and interrelations. With regard to pedestrians, for example, the common a priori assumption is that all pedestrians want to go somewhere. Mokhtarian & Salomon (1999) argue that this is not valid. Some pedestrians simply want to sojourn. Another example of a validity risk with regard to walking and sojourning in public space is that road safety practitioners commonly simplify the system to interaction between human, vehicle and road. As pedestrians differ fundamentally from other road users, this is an over-simplification that clouds the fact that pedestrians do not use a vehicle, and that not all relevant movements take place on roads. Furthermore it clouds the fact that for developing interventions it matters whether the human is the subject to be influenced as a road user or someone in the environment that may affect the subject's freedom of movement and safety. Later in chapter this will be elaborated.

From policy practise it is known that complementary bottom-up approaches, like taking advantage of grass roots initiatives, public debate, gathering narratives and stories, and participation and public-private partnership, can help to overcome these limitations by providing insight in characteristics of the elements and their interrelations and support for interventions, that cannot be delivered via the system approach alone. Such additional approaches however are beyond this thesis' scope and are not included in the deliberations.

3.2.5. How the System approach structures this thesis

System approach as conceptualised in the preceding sections, can be used to structure the research for this thesis and outline the report. It should deal with *context*, *process* and *content* in a balanced way. Policy development and interventions in the W+S system are taken as an initiative originating in the system's environment. Policy development should be systematic. It should be based on comprehensive analysis and measures should be integrated in an optimally balanced package deal. Furthermore, feedback from evaluation of the output, outcome and impact of the policy interventions should be used to improve the input at later stages.

[106] For example process industry, biology, medical sciences and road safety.

'Approach' refers to *how* a project is taken up and organised. The *process* design can be seen as the glue of the approach and therefore as a logical structuring devise for the outline of the thesis. That is why chapter subjects in this thesis are put in the order of appearance in the process, starting with orientation (Chapter 1 Introduction and Chapter 3 Conceptual Framework) and ending with Devising W+S improvements (Chapter 8).

Main features regarding the policy *context* have been presented in the above Subsection 3.2.1. Systems Theory, where the main features of input and orgware were sketched. In Chapter 4 on Walkability System Requirements the prerequisites regarding those features are elucidated, and in Chapter 5 the status quo regarding the W+S system is described. In Chapter 6 the status quo of the Institutional framework is assessed.

As for the *content* of the system: in the above Subsection 3.2.1 on Systems Theory main features of systems in general, as a black box, passed in review. In this thesis the W+S system can be seen as the main object of study, and therefore a description of Black Box features does not suffice. In the next Section 3.3 the W+S system is addressed as a white box, focussing on the definition of the system, its main features and driving forces. Subsequently, in Section 3.4 important guiding principles for W+S policy interventions are presented.

The insights on the W+S system as a white box, gathered in this chapter, serve as inspiration for the identification of general walkability and sojourning needs and abilities (demand side), and system requirements (supply side) in Chapter 4, as well as for the formulation of research questions regarding the assessment of the status quo in Chapter 5.

In the final section of this chapter (3.4) conclusions will be drawn with regard to (general) control mechanisms which authorities apply to improve walking and sojourning conditions and thus the Quality of Life of their citizens.

3.3. The pedestrian travel and sojourning system

3.3.1. Introduction

The previous section determined that the first step in the W+S policy process design is to develop and establish a conceptual framework regarding the W+S system. This section aims to:

- Provide basic insight in composition and internal workings of the pedestrian travel and sojourning system;
- Inspire and structure research regarding the leading research questions regarding the W+S system requirements, status quo and comparison;
- Identify what major factors and conditions affect walking and sojourning; how can (relevant parts of) it be conceptualised?

The insights presented here are based on a study of a selection of literature[107] on traffic and transport behaviour, traffic safety, city and land use planning, consumer behaviour, human needs and motives, and on professional experiences, debate with experts, notably within the

[107] The collection comprises literature and citations acquired through a W+S policy literature scan and literature privately collected over the years: see Appendix 2.

COST358 and OECD/ITF projects, and additional internet search. In this section the following subjects will be addressed:

- Definition of the system by its components and their interrelations (Subsection 3.3.2.). Items that will pass in review are system boundary, function, interconnectivity, structure, size, system behaviour, ownership, and output, outcome and impact;
- How pedestrian behaviour is brought about and how pedestrians interact with their immediate and distant environment. This subsection presents a selection of relevant behavioural theories (Subsection 3.3.3.);
- Pedestrian needs, wants and motives (Subsection 3.3.4.). This subsection covers the demand side regarding W+S policy development;
- Walking and sojourning in public space opportunities (Subsection 3.3.5.). This subsection concerns the supply side of W+S policy development, i.e. what is offered to pedestrians. General W+S system Strengths, Weaknesses, Opportunities and Threats are identified, and important guiding principles for offering adequate opportunities are presented;
- Pedestrian abilities (Subsection 3.3.6.). This subsection addresses how pedestrian abilities (in general) affect walkability needs and wants, and the selection of opportunities they can make use of.

Each of these subsections will first define the subject, subsequently their position and role in the thesis and in W+S policy processes is assessed on a theoretical level. Next major features of the subject are described. The subsection is rounded off with conclusions regarding consequences for this thesis and W+S policy making. A conceptual model on pedestrian behaviour, summarising both the system and behavioural models, delivering general clues for developing W+S system improvements is presented in Section 3.7.

3.3.2. The pedestrian travel and sojourning system as an entity[108]

As stated in 3.2.1: the pedestrian travel and sojourning system, in short the W+S system, is defined as a white box system by its elements and interrelations, its role and function, or desired impact on the greater system, and the policy agent's (potential) authority. It is delimited by the boundaries of the administrative system (in our case Dutch National Government), confined to public space, including land traffic, but not water and air traffic, confined to walking and sojourning, and the elements that can affect pedestrian behaviour. The boundaries are somewhat fluid. The system can also be influenced directly by matters that lie outside the specified boundaries, such as European traffic rules, foot-passenger ferries, joggers on city sidewalks.

The function of the system is to enable and support door-to-door walking, walking to and from other modes, circulation, and sojourning in public space. In this respect walking connects origins and destinations, enables the use of other travel modes, and enables the use of public space for social contacts, physical activity, recreation, ambulant work etc. Thus it contributes to wealth and well-being of communities and the nation, but is also supports sustainable development.

The pedestrian system is part of a greater whole. The pedestrian system itself consists of interacting elements or subsystems, and interrelations between them (see Figure 3.5.). Via interventions or autonomous changes the pedestrian system receives inputs from its environment, i.e. money for infrastructural changes, information on behavioural rules, a good

[108] This subsection is adapted from text in the COST358 PQN Final Report - Part A, pp. 35-39.

press for being environmental sustainable, punishment for not abiding the rules, technology and building materials.

When a pedestrian walks in public space, s/he functions within the transport system, which can be seen as part of a greater spatial system, and as part of a social, normative and cultural system. The pedestrian system also produces output, such as economic value, a pedestrian friendly urban environment, practical rules, norms and values, connected neighbourhoods, a healthy population, a sustainable environment etc. In some cases the 'product', such as a pedestrian friendly environment, can also function as input to the system.

When someone on foot encounters other walkers or moving vehicles, s/he is in traffic. Traffic is a typical phenomenon of the transport system. *People* travel from A to B. If they do not do this on foot, they use a *vehicle*[109] for it. With that vehicle, they mostly travel on roads. These roads in turn are part of the physical *environment*. The road network and the (immediate) environment are usually referred to with the concept *road infrastructure*. Traditionally the transport system is seen as a system in which the elements 'road user', 'road' and 'vehicle' interact with each other. From transport, traffic and road safety analysis it appears that it would be more appropriate not to speak of 'road' but of the 'physical environment' or 'spatial environment', as the surroundings of the road are a factor in road user behaviour as well.
From the pedestrians' perspective, not only movement (travelling) but also sojourning in public space should be regarded.

Furthermore, a person's behaviour is also affected by his or her social environment. People affect each other, both on the individual, group or societal levels. Also, when several pedestrians and vehicles make use of the road network, there are rules to ensure that this proceeds smoothly and safely. This means that traffic is *organised*. Within the transport and traffic safety communities this conceptualisation is now universally shared.

The system from a pedestrian's perspective is made up of four groups of interacting elements or subsystems. In Figure 3.5 the elements or subsystems are represented by small circles. Interactions are visualised as bi-directional arrows; external influences are represented as one-directional arrows (inputs or outputs). The system is demarcated by a large line circle; the 'environment' is positioned outside the system.

- **Pedestrians**
  In general pedestrians are expected to be able to use the roads open to them, and public space. Authorities (policy makers, decision takers and providers of facilities) assume that pedestrians have the physical and mental condition and knowledge needed for that role. This includes insight, skills, attitudes and being properly equipped (clothing, shoes, …) to cope with environmental circumstances. In some cases these demands however are or cannot be met, e.g. children expected to cope with encounters with fast riding cars, elderly obliged to cross a road at a speed of at least 1.2 meters/second.
  Pedestrians can be grouped on characteristics like personal and lifestyle features. Personal features are for example gender, age, job, education, position, income, physical and mental abilities etc. Lifestyle characteristics are choice of place of residence, type of household, personal values, attitudes, housing and recreational preferences, consumption patterns, travel habits etc.

[109] There may also be (some) unmanned vehicles, like 'people movers' or remote control vehicles.

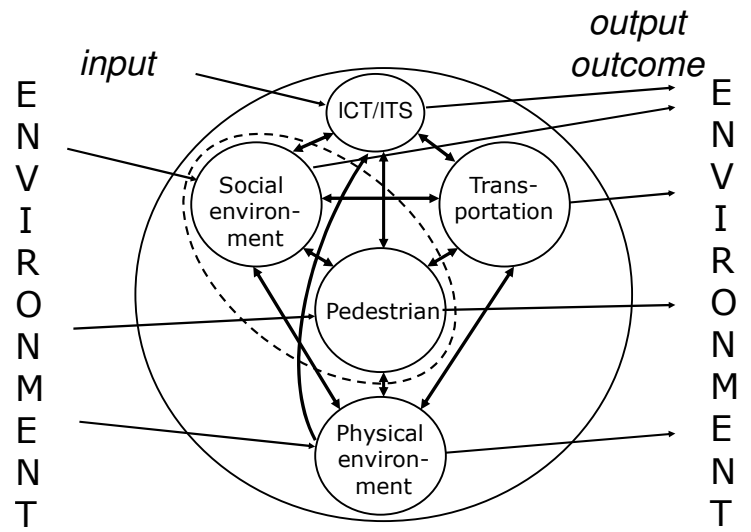

Figure 3.5. A pedestrian travel & sojourn system containing a collection of interacting subsystems

- **Social environment (≈ other humans in the pedestrian's environment)**
  The social environment has many different manifestations: as individual or groups of 'others' that interact physically or socially, as a more abstract normative environment that imposes rules, norms and cultural values, social positions that the pedestrian has to deal with.
  Other road and public space users affect the pedestrians' behavioural options, security and safety. Just like pedestrians they are assumed to have the physical and mental condition, knowledge, insight, skills, attitudes, outfits that such a role demands, which may or may not be justified.
  On a more general level the social environment has a normative dimension and a socio-demographic dimension. It imposes values and norms on pedestrians and affects their freedom of movement[110]. These norms and values exist because traffic and society needs to be organised on various levels (individual, local, regional, national, international). There is a difference between 1) the official rules, like the traffic rules and regulations and the monitoring of compliance with these (enforcement) and 2) norms understood as the implicit code about how one should behave in traffic and public space, or how it should be arranged and organised. In the latter case, this reflects the culture, norms and values that exist within society.
- **Transportation system (≈ a variety of vehicles)[111]**
  The (land) transportation system consists of moving vehicles and trains of vehicles that flow on roads, railways or waterways, of parked vehicles and of accessible units that pedestrians can use for transport towards other destinations. Traffic flow can be impersonal in that there is no interaction between the drivers and the pedestrians. Like parked vehicles they then are just objects that affect freedom of movement of pedestrians or even their safety.

[110] Burka rules can affect perceived security feelings and thus freedom of movement; air quality rules for cars on the other side do not affect most pedestrians' freedom of movement.
[111] The transportation system only includes the mobile part of the transport system, and does not include infrastructure, traffic lights, traffic rules etc. (see also Glossary).

Pedestrians can either choose to walk an entire trip or make use of transportation means. Accessible vehicles, like the cars and bicycle that one owns, public transport units, elevators, however provide opportunities to travel elsewhere, beyond walking range.
The vehicles on the road are assumed to be able to move and be steered or operated, that is to say, move in all horizontal directions and slow down and speed up. The passenger vehicles are also assumed to offer protection to the occupants. Vehicles, regardless of their function, must not hinder or endanger pedestrians. Problems arise when this is not the case.

- **Physical environment (≈ public space)**
  The physical environment includes the spatial structure, stationary elements in it and is affected by atmospheric conditions (weather). Some of it is natural, like woods, lakes, but within the urban area most of it is man-made. The spatial structure includes the geographical location of various activities, social institutions, work places etc. as well as transportation and walking and sojourning facilities.
  For the use by pedestrians the natural structure, roads and paths must be formed or built in such a way, and the road environment must be laid out in such a way, that pedestrians can reach their destination smoothly and safely[112] and that they can sojourn comfortably and pleasantly in public space when they need or want to.
  Atmospheric and climatic conditions, like temperature, sun, precipitation, moisture and wind influence the state and utility of the physical environment and 'behaviour' of the social environment and the transportation system.
- **ICT/ITS**
  ICT/ITS covers Information and Communication Technology (ICT) and Intelligent Transport Systems (ITS) to support smarter and safer travel behaviours. ICT concerns transmitting and processing of information by computers. ITS is defined as those transport systems which use ICT for the management of road traffic and the mobility of road users as well as how they connect with other modes (EU directive 2010/40/EU(2010)). The information concerns the pedestrian's environment to support, guide or manage the pedestrian's behaviour. ITS/ICT can be applied for positioning and navigation, traffic management (e.g. offering gaps in traffic for crossing a road, keeping traffic away from sojourning activities), crowd management, behavioural support (e.g. when and where to cross), surveillance (e.g. locating children, dementing elderly), protection (e.g. automatic braking of cars), warning against dangers (both pedestrians and other road users), emergency support and many other functions, and can have many forms. With regard to pedestrians, walking and sojourning ICT/ITS is a relatively new system component, which regarding walking and sojourning functionality is still in its infancy.

Other notes regarding the Pedestrian travel & sojourn system model (Figure 3.5), in short W+S system, are that the pedestrian is intentionally put in the centre, that the pedestrian and his direct social environment together form the Human Factor, and that a human can have different scopes and interests in the system. Furthermore, notes can be given regarding the size of the system, the system's behaviour, system ownership, and on the output, outcome and impact of the W+S system. The notes are:

- The pedestrian is put in the **centre** of the system model because this study aims at improving the situation and the position of the pedestrian. Existing inherent characteristics of pedestrians, like their physical and mental condition, knowledge, insight, skills and attitudes, are taken as a starting point; improving these pedestrian features are not primary targets; it is however clear that this may also improve the pedestrians quality of life;

[112] Of course this does not exclude dedicated facilities: cars are not allowed in pedestrian areas and streets, pedestrians are not allowed on motorways and both are not allowed on rail tracks.

- In the system model figure around the 'pedestrian' and the 'social environment' components of the system model of Figure 3.5 a dotted line ellipse is drawn. This ellipse stands for the **Human Factor**. It expresses that a pedestrian is involved in groups that influence his walking and sojourning and furthermore the same individual can be a pedestrian at one time and assume another role at other times and having different interests. Most experts (e.g. Hendriks et al., 1998, Fegan, 2008) agree that most people do not identify themselves as pedestrian when they are not actually walking. This is a critical fact when dealing with changing the system;
- Humans can have **different scopes and interests** in the system. Richard et al. (1996) concluded that scopes that people can have on their environment are nested. In Figure 3.6 such a nesting regarding the pedestrian issue is visualised.

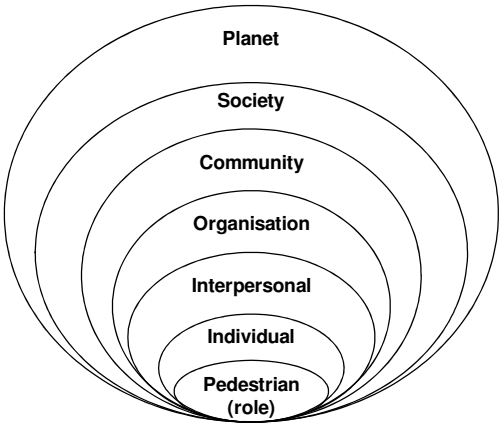

Figure 3.6. The scopes regarding system output to a pedestrian's environment (After Richard e.a., 1996)

With regard to walking and sojourning one can look at it from several cohesion levels:

- ***Personae* pedestrian**, where only one's own walking and sojourning interests count;
- **Individual person**, capable of assuming other roles and taking them into account, but not necessarily the interests of other persons;
- **Interpersonal,** taking into account the interests and perspectives of two or more individuals interacting in public space;
- **Organisation**, taking into account the interest and perspectives of one's own group, organisation, company or institute;
- **Community**, taking into account the interests and perspectives of the community one takes part in. Communities connect people and groups of people with a common interest. There are for example professional communities, territorial communities, internet users etc;
- **Society** or national level, where the binding factor is citizenship of a nation or group of nations;
- **Planet**, where the common interest is the survival of the species, all species or even the existence of the planet.

As stated in Section 1.5. Demarcation, the planet level scope will not be discussed in this study. The study will focus on the community and society scope levels. Knowledge

regarding the organisation, interpersonal and personae pedestrian scope levels will be taken as input for policy development.

- The W+S system **size** is large in many ways. It includes the complete population of citizens of the nation, be it in just one role, the pedestrian role. In a territorial sense it covers the total of public space, which in the Netherlands amounts to approximately 2.7%[113] of the national territory (includes about 80% of space for 'land traffic roads', plus 'public parks and gardens').
- The W+S **system behaviour** can be typified by the pedestrians' response to system changes and external impulses. It is a dynamic system, somewhat self-structuring (i.e. pedestrians sometimes solve their own problems) and relatively safe towards other human systems, such as the car or bicycle systems, or home construction. It is dynamic in a sense that input from the outside (interventions, autonomous changes) generally causes a series of effects in the system, delivering impacts on the greater system. For example better pedestrian facilities (like pedestrian areas in a city) will attract more walkers, make shops more attractive, more profitable and thereby making a city centre more attractive. It is somewhat self-structuring as for example the number of pedestrians in an area increases, it makes it more (socially) safe and results in more relaxed pedestrian behaviour. People attract people (Gehl, 1978; Jacobs, 1961).
- The W+S system is not **owned** by a single person; many stakeholders own pieces of it. The fuzzy ownership structure makes it very complex to develop, implement and manage adequate interventions.
- **Output, outcome and impact** of the W+S system depend on system input and changes occurring in the system. Output of W+S policy, like upgraded walkways, generates W+S system output in the form of improved pedestrian space, causing an outcome of more people in public space, impacting the economy and social well-being of a community. Clearly, if there is no system input from policy interventions, no policy related changes in W+S system outcome and impact in the greater system (the environment) can be expected; autonomous changes and internal W+S system dynamics however can produce 'unexpected' outcome and impact.

It can be concluded that the heart of the W+S system is the pedestrian and his/ her behaviour. The pedestrian's behaviour is influenced by his/her physical and social environment, transportation, ITS/ICT and, mostly through these elements, by external influences. Most of the times the influences are fuzzy: several elements affect the pedestrian at the same time; the influences change over time; causal chains can be very complex. Knowing this, in order to achieve positive impacts of the wealth and well-being of communities and the nation, it is crucial to acquire (at least) basic insight in what determines a pedestrian's behaviour. In the next subsections this subject is addressed.

[113] In 2008 the Netherlands covered 4,154,307 hectares, of which 106,115 were 'road traffic area' and 27,989 hectares 'park or public garden' (source: http://statline.cbs.nl/statweb/...., accessed 8-3-2013). I estimate that about 80% of 'road traffic area' is accessible for pedestrians; this means that about 110,000 hectares are public space = 2.7% surface.

3.3.3. Conceptualisation of pedestrian behaviour

Introduction

This thesis focusses on pedestrian behaviour that potentially affects wealth and well-being of communities and the nation. Every day people take decisions that may directly or indirectly influence the amount and qualities of walking and sojourning and their impact. Decisions are effectuated through activities, i.e. behaviour. Pedestrian behaviour can be visible or invisible, and can be habitual, impulsive or planned.

In this subsection I first explore how decisions and activities regarding walking and sojourning in public space are structured, next I reveal what general factors drive behaviour, and then I sketch why behavioural decisions in many occasions do not follow external impulses, like policy interventions, media campaigns or other attempts by policy agents to direct pedestrian behaviour.

The insights into these matters inspire and help to structure my research regarding W+S behaviour, walkability determinants and requirements, the status quo of walkability, and evaluation of the status quo regarding the needs for improvement. The subsection is rounded off with conclusions about the significance of presented models for this thesis and W+S policy development: W+S behaviour placed in a policy context.

Structure in W+S behaviour: four activity levels

According to Oxford Dictionaries behaviour concerns the way in which one acts, especially towards others[114]. From psychology it is known that much human behaviour is based on (conscious and subconscious) decisions (Atkinson et al., 1990). For developing policy interventions, a policy developer needs to know how W+S behaviour comes about, particularly whether and how the decision process is structured. No general studies or theories are found regarding W+S behaviour on this subject, but it can be assumed that general theories originating from psychological studies on road safety behaviour and driver education are also relevant for the W+S policy field.

With regard to needs, decisions and acts, John Michon (1979) introduced the idea that road users make a succession of decisions. He distinguished three levels: *strategic* (where to go), *tactical* (how to do it) and *operational* decisions (the actual walking and driving activities: 'automatic' reactions to traffic, steering, accelerating, braking). A more recent classification is the Goals for Driver Education (GDE) Matrix (Hatakka et al., 1999), which offers the same message, but on four levels: 'goals for life', 'Goals and context of driving', 'Mastering traffic situations' and 'Vehicle manoeuvring'. Inspired by Michon's and Hatakka's ideas, and specifically attuned to the national level scope of W+S policy development, in this thesis the following four levels of behaviour (activity levels) are distinguished:

- The **lifestyle** level, where some conditions just happen, e.g. where one is born, gender, age, and furthermore where fundamental decisions are taken on a limited number of occasions in a person's life, like where to live, where to work, what kind of job one takes, marriage, getting children, retire from work, taking driving lessons and buying a car, buying a public transport year card etc. These conditions and decisions relate to goals for life and skills for living. Such existential decisions relate to '**being**' and identity. As most people do not feel

[114] http://oxforddictionaries.com/definition/english/behaviour?q=behaviour, accessed 21-6-2013

themselves 'pedestrian', for most people such decisions are taken without explicit attention to consequences for walking and sojourning in public space.

- The **strategic** level, where decisions are taken before one gets into traffic, like travel choice (motive), where to (destination) and which mode will be used. Strategic decisions relate to '**going**'.
- The **tactical** level, where decisions are taken in traffic with regard to the route, crossing places, walking or driving speed and so on. Tactical decisions concern manoeuvring and relate to '**travelling**'.
- **Operational** behaviour: reactions to other road users, the traffic situation and other interacting persons and events. With regard to pedestrians, operational decisions concern operational control and relate to '**walking**' and '**sojourning**'.

Table 3.1. Activity levels

Levels of behaviour	Type of decisions	Behavioural goal
Lifestyle	Fundamental decision. Relates to goals for life and skills for living.	'Being' and identity
Strategic	Decisions relating to travel or purpose (motive), where to go (destination) and which mode will be used.	'Going'
Tactical	Decisions with regard to the route to be taken, places to cross, walking or driving speed and so on.	'Travelling'
Operational	Operational decision or reactions concerning other road users, the traffic situation and other interacting persons and obstacles.	'Walking' and 'Sojourning'

Michon and Hatakka et al. indicate that (in a single decision process) there is sequence in the types of decisions. Lifestyle decisions precondition strategic decisions, which in turn precondition tactical decisions etc. Operational decisions take place within a context of the conditions set by (implicit) tactical decisions; tactical decisions are taken within a context of the conditions set by (implicit) strategic decisions, and these in turn are taken within the context of conditions set by lifestyle decisions. It has to be remarked that in practise there can also be feedback loops and disturbances along the way, changing the outcome of 'lower order' decisions.

There is an important difference between lifestyle and strategic level decisions on the one hand, and tactical and operational decisions on the other hand.
The first groups of decisions are conditioned and taken before the actual walking and sojourning takes place in public space, can be seen as *precursors* to pedestrian activities, and particularly affect the quantity of walking, and in many cases can also result in not walking, partly walking, door-to door walking and/or to sojourning somewhere in public space. In these stages the role of pedestrian is not yet adopted. Lifestyle and strategic decisions set the stage for the acts of walking and sojourning, the amount of walking and sojourning, and thereby how much walking and sojourning can (maximally) contribute to the wealth and well-being of communities and the nation.

The second group, concerning tactical and operational behaviour, takes place while *en route* or while sojourning in public space, concern factual pedestrian activities and the qualitative aspects of walking and sojourning, like quickness, effort needed, safety, pleasure, impact on activities of other persons in the environment. Of course the latter may also, indirectly, influence the amount of walking, because good quality W+S facilities will be remembered and communicated, and will attract or allow for more walkers and sojourners in public space. The impact from W+S onto the wealth and well-being of communities will largely depend on the amount of walking generated, and particularly to what degree critical groups of pedestrians perform.

It can be expected that interventions with regard to the higher levels of behaviour have a larger effluence than interventions that only affect the tactical and operational levels of behaviour. In other words, interventions affecting a person's lifestyle, affect a larger range of operational behaviours and larger number of operational acts, than interventions only directed at affecting strategic or tactical level behaviours.

From the above it can be concluded that activity levels, as distinguished by Michon and Hatakka et al., structure pedestrian behaviour and relate to different types of clues for interventions. This thesis therefore takes this conceptualisation as the main structuring principle in this thesis' conceptual framework regarding pedestrian behaviour.

Major drives behind W+S behaviour

Knowing how the W+S decision process is structured, for effective policy development one also needs to know what pliant factors determine the (potential) pedestrian's decisions and behaviour, and thus what options there are to influence behaviour in such a way that wealth and well-being of communities and the nation is supported better: what general factors drive W+S behaviour. Like insight in the process structure of behavioural decisions, knowledge about *drives* can provide clues regarding options for improvement of W+S conditions. Although there are many studies about determinants of walking (and hardly any about sojourning), as far as the author knows none of them aimed to provide a well-organised overview of major drivers covering both the W+S demand and supply sides. Therefore such a model is lent from psychological inputs in environmental sciences.

In 'Principles of environmental sciences' (Boersema et al., 2009) Steg & Vlek provide a useful structuring model for internal and external determinants of consumer environmental behaviour: the NOA Model[115] (see Figure 3.7.). In their role of pedestrian, pedestrians 'consume' (walk or sojourn in public space) to fulfil their needs. Steg & Vlek explain that needs are not the sole quality determinants:

> *"… consumer environmental behaviour can be regarded as being governed by Needs (N), Opportunities (O) and Abilities (A) at hand for undertaking a particular resource-consuming activity. Needs and opportunities interact to shape people's Motivation to perform (MP) an activity: if there is a need as well as an opportunity, you want to consume. Opportunities and Abilities together determine Behavioural Control (BC): if there is an opportunity which you feel able to use, you could consume. And Needs and Abilities*

[115] Steg & Vlek wrote a chapter on Social Science and Environmental Behaviour, where they give an excellent overview of achievements of behavioural sciences with regard to environmental issues and research and policy making.

together underlie a subject's Opportunity Search (OS): if there is a need and you are capable of fulfilling it, you seek an opportunity to consume.

Hence, changing consumer behaviour would involve changing people's needs, their (physical, technical or social) opportunities and/or their ability or capacity (physically, mentally or financially) to engage in the relevant behaviour. This means that environmental policy making may be oriented towards the 'inside' worlds of needs and abilities, the outside world of opportunities and the mixed worlds of motivation arousal (e.g. through marketing), enhancement of behavioural control (e.g., through education) and opportunity seeking (e.g., through finding feasible ways to fulfil needs)."[116]

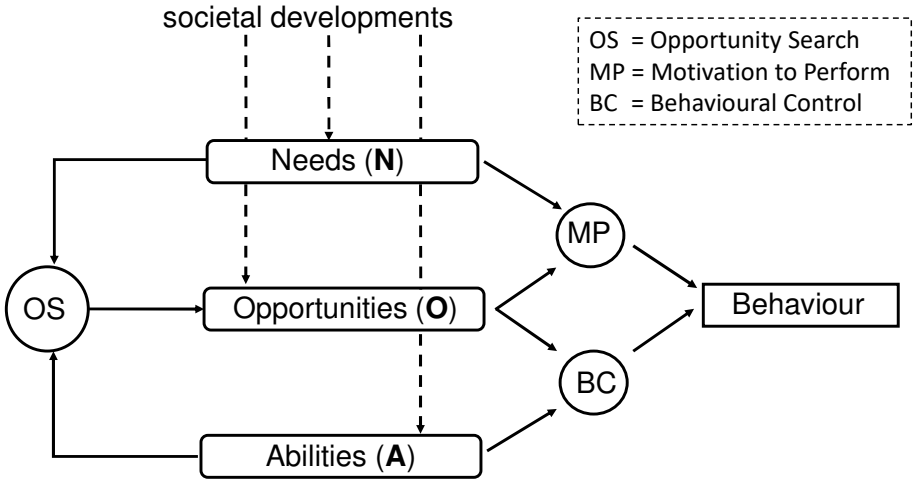

Figure 3.7. NOA Model for consumer environmental behaviour (adapted from Steg & Vlek, 2009)

The NOA model takes an analytical and rational perspective on the push and pull factors regarding consumer (read: pedestrian) behaviour. The subjects themselves as well as 'common' policymakers normally take a more intuitive perspective, focussing on concrete requirements and interventions. For example: citizens ask for zebra crossings, but essentially they want a comfortable and safe crossing, whatever form it may take. The analytical perspective takes a wider and more basic view and may include other options as well. If needs are expressed in functional terms, they will cover more options than a more specified requirement list will cover.

On each of the activity levels there are specific needs, opportunities and abilities to be taken into account. Thus for example on the lifestyle or strategic activity levels, an individual needs to have essential services like a grocery within one's action radius, the shop has to have practical opening hours and the individual has to know what the opening hours are. The route towards the shop needs to be easily convenient i.e. direct and findable, and predictably safe and without unforeseeable obstructions. On the operational level a pedestrian needs adequate crossing facilities, a sufficient gap in the traffic flow and the ability to cross before the gap closes. In other words: a (potential) pedestrian's *need* for e.g. acquiring food must be supported by the *opportunities* offered within the scope of his *abilities*. With regard to policy interventions, needs

[116] Quote from Steg & Vlek's text of Chapter 9, Section 9.7.2. Boersema et al., 2009

and abilities, i.e. the demand side of the equation, must be translated into 'requirements' (elaborated in Section 4.3.), to be met by opportunities that are (to be) offered, i.e. the supply side of the equation (elaborated in Section 4.4.).

On the lifestyle, strategic and tactical activity levels the behavioural decisions are based on personal experiences, knowledge and skills, without direct reference to actual conditions. This means that even if the opportunities are offered, the pedestrian still has to recognise them as such. The same is true for abilities and to a lesser extent, needs[117].
On the operational level, decisions are a *reaction* to perceived or experienced situational conditions, based on personal observation, processing and selecting activity options, which can be skill-based, rule-based, knowledge-based or just trial and error, if the person cannot find a reasoned way to deal with the situation within the available action time frame. In such reactions, needs are a given, that plays merely a contextual role. It can be expected that, on the operational level, abilities and opportunities are more dominant for determining the (mostly automatic) behaviour.

The NOA model indicates that societal developments, i.e. the performances of the other subsystems (social environment, physical environment and transportation), affect the consumer's (pedestrians') needs, abilities and opportunities. This in turn will influence his/her behavioural preferences, perceived options and ultimately his/her behavioural decisions.

In this thesis conceptual framework (see Figure 3.11.) on pedestrian behaviour the NOA model plays an important role regarding pliable human factors for pedestrian behaviour on the lifestyle and strategic activity levels, whilst at the tactical and operational activity levels they are 'translated'. At the tactical activity level needs are turned into travel motives and intent; on this level, although they might take a different form, abilities and perceived opportunities still are determinants. At the operational level however, needs are implicit (instinctive) and do not play a structuring but conditional role; task abilities and perceived opportunities in the context of task demand are taken as the main determinants (see also Figure 3.10 – Fuller's model).

Resistance to external change impulses

The NOA model is implicitly based on the assumption that behavioural decisions are reasoned and therefore more or less conscious decisions. Above is already argued that decision processes are not always reasoned, rational and straightforward. On the long term and for many lifestyle level decisions rationality can be a reasonable assumption. This assumption is supported by common knowledge about backgrounds of behavioural decisions: although initially based on reasoned and rational arguments, after a while the behaviour is no longer contemplated and becomes automatic, even when the initial arguments are no longer valid. Rasmussen (1983) and Reason (1990) learned us that, apart from fundamental lifestyle level activities, in practise most human behaviour concerns daily activities which is dominantly automatic, subconscious, skill-based, out of habit behaviour or behaviour based on impulses. This is true even for most strategic activity level decisions, like going to the usual grocery shop, taking the car.

Automatic and subconscious behaviour is no policy problem as long as such behaviour does not conflict with other people's behaviours or higher order policy aims. When however there is a conflict, it is extremely difficult to adjust such erroneous behaviour towards more desirable behaviour. This, incidentally, is also true for deliberate breaches of rules, another type of

[117] As we will see in the next subsection needs are by definition subjective, context sensitive and relative.

erroneous behaviour, as it is nearly impossible to directly influence such breaches of rules in cases where no law enforcement or social correction forces are present.

Table 3.2. Behaviour, awareness and errors

Level of task implementation	Awareness level	Type of error
Automatic (skill-based) behaviour	Subconscious unintended	Slips Lapses
Rule-based behaviour	Conscious, unintended	Rule-based mistakes
Knowledge-based behaviour	Conscious, unintended	Knowledge-based mistakes
Considered	Conscious	Deliberate breach of rules

Another well-known resistance to external change impulses is the so called cognitive dissonance mechanism. In this theory persons know and believe that they should comply to a certain strategy, while at the same time they find themselves doing things that they should not do, like taking the car instead of walking. Such a person then seeks to reduce discomfort by removing the inconsistency and bringing the cognitions into harmony, by discharging one or more of the dissonant cognitions[118] (Atkinson et al., 1990, p. 707) and sustain his or her now justified behaviour. Of course, people can also put up fences against external change impulses such as denial, looking away, group conforming etc. (Tabula Rasa, 2004).

Thus the pedestrian's behaviour seems to be determined by 'internal' factors like earlier decisions on the lifestyle and strategic activity levels, inertia regarding including changed conditions and argumentation and cognitive dissonance mechanisms. On the operational (and to some degree also the tactical) activity level, adaptive behaviour is particularly determined by 'external' environmental factors. In this regard Wijlhuizen (2009:130), referring to Dekker (2005) and Reason (2000), correctly remarks:

> *"...though human condition cannot adequately be changed, the conditions under which persons are functioning can. In order to change these conditions (building upstream defences[119]), knowledge is required about those processes that have consequences for safety [rm: and W+S]. Actually, building and maintaining these defences should prevent the classical pattern of 'drifting into failure.'*

Another, 'long term', option is to somehow make sure that the decision to show the undesirable behaviour is taken back to a conscious level. Lifestyle change moments, i.e. the moments when individuals need to consider behavioural options again, are most suited for such turnovers (Allport, 1954, cited in Yzetbyt et al., 1999:449; Tiemeijer et al., 2011:81).

In my conceptual model on pedestrian behaviour the above notions cannot be shown in detail, but they are included in my deliberations regarding policy issues and solutions in the chapters 5 and 6. In the conceptual model pictured in Figure 3.10. (Fuller model) the 'internal' and 'external' determinants are shown in the 'Determinants Operational Level' column. The upper box includes individual task abilities and perceived opportunities, but intentionally does not

[118] For example such a person can lower the importance of the discordant factors ('everyone goes by car'), add new arguments that soften or neutralise the breach of the strategy ('it rains and my coat leaks'), or change (lie about) one of the dissonant elements ('it's impossible to go there on foot').
[119] I.e. precursory conditions, which prevent mistakes or accidents from happening, like training to do the right things in emergencies by closing a route, police guidance, subtle priming behaviour.

mention needs or thereof derived motives and intent, as these concerns tactical behaviour aspects. In harmony with the system model pictured in Figure 3.5. behavioural determinants regarding humans in the environment, site characteristics and transportation aspects are entered.

W+S behaviour placed in a policy context

From the above considerations it can be concluded that a person's W+S behaviour in public space is preceded by decisions and activities on the lifestyle and strategic activity levels, and that such decisions are affected by a context made up by exogenous and endogenous factors, more specifically: how these are perceived.

Exogenous factors include environmental conditions and developments, such as physical space, societal developments and opportunities. Together the factors indicate walkability as a quality. The walkability indicators can affect a person's decisions and behaviour only if they are actually observed or noted, and processed. The influence can be conscious or subconscious. Most behavioural decisions are made subconsciously, without much thought or automatically, and are habitual or come as a reaction to what is offered.

Endogenous factors include a person's needs, his physical and mental condition, as well as his abilities to perform as a pedestrian. Generally these factors are quite difficult to change and, for the most part, need to be treated as a given, as 'mere' preconditions and independent determinants for W+S behaviour.

What ultimately matters is the impact W+S has on the wealth and well-being of communities and the nation, covering the interests of (the great majority of) individuals. Such impact can only be expected when operational behaviour factually happens: in the end only actual walking and sojourning activities count.

From a policy perspective, W+S behaviour can be either desirable, neutral or unwanted. W+S behaviour can be considered desirable when it delivers, or can be expected to deliver, wealth and well-being to communities and the nation. The more people walk (quantity) and find themselves well off (quality) without adverse distribution effects from interventions (efficiency and fairness), the more desirable the situation is. Such desirable behaviour can be seen as a strength or an opportunity. On the other hand, walking behaviour can be seen as undesirable and unwanted when it weakens or threats wealth and well-being. A logical consequence of these valuations would be to promote desirable behaviours and to suppress, neutralise or remedy undesirable and unwanted behaviours.

From the above it can be concluded that the quality of the W+S system and its potential to induce wealth and well-being of communities and the nation are determined by the pedestrian's factual, observable W+S behaviour. The observable operational W+S behaviour is preceded by decisions taken on the lifestyle, strategic and tactical activity levels. These decisions, based on perceptions which can differ from more objectively ascertained conditions, can be conscious or subconscious. The decisions are induced by a combination of needs, opportunities (perceived walkability) and abilities, which in turn are influenced by the societal context. For effectively improving walkability the policy maker needs to know what the decisive actual and perceived needs, abilities and opportunities are, and also to what degree the perception differs from 'objective' needs, abilities and opportunities.

In the next three subsections I address how, on a general theoretical level, decisive W+S needs, opportunities and abilities can be defined, and what this means for research in this thesis and policy making.

3.3.4. W+S Needs

From literature and discussions in the PQN project it is clear that *needs* can be defined in many ways, and that many types of needs can be distinguished. With regard to walkability and pedestrians needs, in most cases, however, a definition is not given. This subsection subsequently covers the definition of needs and related concepts, what kinds of needs there are and what their relevance is for W+S policy development. In this thesis the combined insights in W+S needs and pedestrian abilities (see next subsection) are used to formulate requirements for W+S conditions and to abduce research questions for assessing the walkability status quo. The latter will be done in Chapter 4 on W+S system requirements.

Definition of 'needs', 'quality needs', 'wants', 'motives', 'requirements'

The Oxford Dictionaries Online[120] define the noun 'need' as *1) circumstances in which something is necessary; necessity, 2) a thing that is wanted or required and 3) the state of requiring help, or of lacking basic necessities such as food*. In line with this I define a need as something that is necessary for humans to live a healthy life and feel well.

A *need* relates to a desirable state of the system. It does not matter how that desired state is achieved. A *need* exists irrespective of satisfaction of the need. Most of the times, however, needs refer to a higher level of aspiration than is currently realised. It is to be expected that particularly the elderly of the future will not be content with the current level of service (Methorst, 2005-2). A need may also concern difficulties that people experience to react adequately to a problem or to interrelated problems and the responses available. In many cases an expressed need can be seen as a claim for service (Bradshaw, 1994).

A *Quality need* refers to a desired quality of the pedestrian's environment, and is a synonym for person or group related *requirements*[121]. It can vary for individuals and groups, situations, countries. It also depends on culture, values and norms, the current level of service, the State-of-the-Art one is in and the safety level one is used to. Quality needs are by nature subjective, context sensitive and relative (Beukenkamp, 2001).

In the context of this thesis and W+S policy development[122], strictly speaking pedestrian needs as such cannot exist, as a pedestrian is just one of the many roles that a person can assume. On the lifestyle and strategic level, when a decision to walk or to sojourn in public space is not yet made, a person is by definition not yet a pedestrian or a walker. On the other hand, every human being is equipped as a pedestrian; it is inherent to our existence, and therefore these higher order needs are considered pedestrian needs, too. Lifestyle and strategic decisions can affect walking and sojourning options and performance, therefore there is good reason to take higher order needs into account.

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[120] http://oxforddictionaries.com/definition/english/need?q=need, accessed 19-3-2013

[121] When a quality need is not documented in an 'official' paper by experts or decision makers, it is not (yet) a *requirement*. People can have quality needs irrespective of documentation.

[122] From a biological and evolutionary perspective, however, humans are pedestrians, walking on two legs (Amato, 2004; Nicholson, 2008).

A *need* differs from a *want* in that a deficiency regarding a need would result in an evident negative outcome, like dysfunction, illness or death. A *want* on the other hand is simply something that a person would like to have, which would not necessarily lead to better performance as a human being. In economics, a *want* is something that is desired. It is said that people have unlimited wants, but limited resources. Each person has *wants*. You might want a laptop while your best friend may want a desktop computer. Thus, people cannot have everything they want and must look for the best alternatives that they can afford. Some economists have rejected this distinction and maintain that all of these are simply wants, with varying levels of importance. By this viewpoint, wants and needs can be understood as examples of the overall concept of demand (Risser & Chaloupka, 2010). In this thesis' view *wants* refer to qualities of the system, services or objects that are 'nice' to have and are felt to be less necessary than *needs*, which are 'need' to have.

The concepts of *motives* and *needs* are strongly related. Motives or motivation can be seen as consciously felt, expressible or articulated needs. In survey research respondents are asked for their motives for certain behaviours in order to discover what the needs behind them are. At the strategic activity level motives are (implicitly or explicitly) used to decide whether or not to go somewhere and how to do that. At the tactical and operational levels the needs are generally not so clearly voiced, because much of this behaviour is skill-based 'automatic' behaviour; skills are built on experiences with satisfying one's needs, irrespective of one's ability to voice such a need (cf. Rasmussen, 1983 and Reason, 1990). Thus needs are taken as the more basic desires behind motives. Risser & Chaloupka (2010) describe the difference as: a motive is a tendency towards fulfilling or satisfying certain needs or to prevent unwanted consequences as reflections of non-fulfilment or non-satisfaction of needs.

In practice most needs and wants are expressed in terms of familiar configurations or measures, and not in terms of function: walkers say they want a zebra or traffic lights; the underlying need is the need to be able to cross the street safely. For improving W+S conditions, the functional needs and wants must be 'translated' into *requirements,* which are documented characteristics of what a particular product or service should be or do[123].

Kinds of needs

Having defined and positioned the concept of needs, the question arises what kinds of needs there are regarding walking and sojourning in public space. A first action is to establish what expertise and literature is available about human needs with respect to walking and sojourning in public space. Next action is to establish how needs are identified and what approach is most suitable for this thesis. The third action is to assess to what degree literature helps to identify W+S related human needs. The last action is to cluster the variety of needs that potentially induce W+S behaviour into a list of needs. This list is to be used for guidance of the determination of actual W+S needs and system requirements in the Dutch context (to be dealt with in Chapter 4). Such insights will be deployed as reference for W+S policy development in this thesis. In the following text I present the results of the successive actions (marked I - IV) regarding the identification of kinds of needs regarding walking and sojourning in public space.

[123] Thus needs and wants are a feature of the pedestrian, whilst a requirement tells something about the object or service that is needed: e.g. a person needs food, food needs to be nourishing and non-toxic.

I. Expertise and literature about W+S needs

From contributions from experts in PQN and scanning literature in this thesis' dedicated W+S database (cf. sSction 2.1 and Appendix 2), it appears that there is a large body of literature on human needs, including many publications on mobility and safety needs, and even some on pedestrian needs. Many needs are identified and substantiated, but unfortunately it appears that there is no consensus about pedestrian needs. A problem also is that needs are typically formulated as requirements or quality needs, i.e. a set of properties of the pedestrian's environment, not as a human need, but as properties of the environment. In the following text of this subsection a selection of conceptualisations regarding W+S relevant *human* needs is presented. Before I do that, I first need to establish how to validly and reliably identify W+S relevant needs.

II. How are needs identified and what approach is most suitable for this thesis?

Because quality needs are subjective, it seems most sensible to ask (potential) pedestrians what they need and then classify the needs. This however has proved to be a very difficult and unrewarding task (Methorst, 2003; Lapintie, 2008; Risser & Chaloupka, 2010). A first difficulty is who to ask, since everyone is a pedestrian, but needs may vary substantially between persons, and not all needs will be equally important. Secondly, some basic needs are not recognised as a need, because they are assumed to be universally provided for anyway (the fate of common things…). Thirdly, some needs are recognised, but one is afraid, ashamed or too proud to admit them[124]. Fourthly, some needs may conflict with other needs[125]. Some needs are 'permanent' and universal, others are time or person related, and subconscious needs are not formulated. In many cases individuals react predominantly on personal needs, ignoring other people's needs (Risser & Chaloupka, 2010).

In this respect it is useful to assess how needs are identified. Bradshaw (1972) developed a much cited taxonomy of categories of needs (e.g. McKee, 1996, p61; Asadi-Lari, 2003; Monterde i Bort e.a., 2010, p. 114). Bradshaw identifies four main, partly overlapping, categories of needs, relating to the perspective that is taken:

- *Normative need* is a need which is identified according to a norm (or set standard); such norms are generally set by professionals. An example is a specified level of service, like time allowed to cross a street at traffic lights. The needed levels of service are fixed according to some criterion, determined by professionals;
- *Comparative need* concerns problems which emerge by comparison with others who are more or less needy. One of the most common uses of this approach has been the comparison of social problems in different areas in order to determine which areas are most deprived;
- *Felt need* is a need which people feel - that is, a need from the perspective of the people who have it (wants, wishes and desires);
- *Expressed need* is the need which people say they have. People can feel a need that they do not express and they can express needs they do not feel. As mentioned before: *motives* are expressed needs.

[124] For example many elderly will not admit that they need support to walk and postpone acquiring a walking stick or rollator or asking for help as long as they can (Methorst, 2003).

[125] For example the need to get somewhere in time may conflict with the need for safety or the want to enjoy the walk. The consequence can be that one takes more risks than one otherwise would do or that one gets stressed.

All these categories of needs comprise a selection criterion, reducing coverage of the totality of human needs. For the identification of individual or specific groups of needs this probably is no problem, but when the aim is to have comprehensive coverage of W+S related needs, none of the four categories of needs[126], as identified by Bradshaw, come up to the expectations of completeness. This thesis therefore proposes to add a new category of needs: *systemic needs* (needs identified from observations or educated prospects regarding a person's activities within the system) which, at least in theory, has the potential of delivering comprehensive covering of needs. Here the identification process starts from (systems) theory and is later on tested by empirical research. This thesis aims to deploy *systemic needs* as indicators for W+S needs to be attended to by W+S system improvements.

III. Literature on W+S related needs

Now that it is known how to prospect needs, it can be assessed to what degree literature offers useful cues for the identification of functional W+S needs.

In science one of the most common methods of assessing the state of affairs with regard to a subject, in this case 'needs', is to analyse what is being said about it in literature, and then classify the results. The dedicated W+S database is searched for overview publications on pedestrians' needs, focussing on the lifestyle and strategic decision levels. Only one such publications was found, viz. Hakamies-Blomqvist & Jutila (1997)[127]. Even this study is limited to door-to-door walking and concerns non-captive walkers (and cyclists), i.e. people who can choose alternative travel modes. Hakamies-Blomqvist & Jutila did their literature study in the context of the WALCYNG project, aiming at finding out how short trips by car can be substituted by walking and cycling trips. They studied what kinds of needs car users put forward as an argument to change habits to walking and cycling. As no distinction was made in how the original insights were gathered, I assume that it concerns all categories of needs identified by Bradshaw, but not systemic needs. Hakamies & Jutila (1997:4-9) discerned the following persuasive distinguishing qualities of walking and cycling[128]:

- Social climate:
  'By their choice of traffic mode, people send messages about their social standing.' 'The nature of the interaction between different road users is highly influenced by social attitudes'. Social attitudes experiences '*penetrate different levels of decision making related to modal choice from the importance attributed to parking facilities for cars versus bicycles to strategic urban planning*';
- Health:
  Walking and '*cycling is good for health, but cannot be done without a baseline health condition'*. The walkers' and cyclists' '*experienced health problems are minor compared to the experienced gains, and relate mostly to adverse health effects of polluted air or noise*';

[126] In theory normative needs can be based on a holistic perspective, but in practise norms are based on observations and experiences, without the aim of complete coverage of a domain.

[127] The search was done in 2006. There are other publications on pedestrians' needs, but these are confined to specific tactical or operational situations, like way finding, street crossing or pavement quality.

[128] The following text is an abstract of the WP3-WALCYNG report Section 2.1, applying the sequence of importance of the arguments as found by Hakamies & Jutila, using (parts of) sentences from the original report.

- Comfort:
  'Since walking is not only a means of transport, but also a way of socialising[129]*, spending time and relaxing, diverse facilities are seen as important for the comfort of pedestrians'.* Comfort is associated with the traffic environment, weather, social climate and culture and the working environment;
- Safety:
  Typically '*people are not very well informed about objective safety risks'* of walking and cycling. '*Their experienced safety, consequently, does not always correlate with evidence from accident statistics'. 'The experience of safety of the pedestrians is threatened both by cars and by cyclists, especially that of the elderly pedestrians'. 'Personal security can be threatened by other than directly traffic-related factors. In some cases, being too far away from traffic, can increase the fear of criminal assault, especially for women and older walkers and cyclists, during dark time and insufficient illumination'*;
- Mobility:
  'The main mobility problem of cyclists (and walkers) is the lack of a continuous and good quality dedicated path network'. 'Experiences of mobility problems do not always give a realistic reflection of the product competition'; on distances from 1- 6 kilometres, in general the private car is still considered to be the fastest traffic mode. Easy bicycle parking and the lack of need for it for walkers can make walking and cycling very fast compared to driving. Mobility is associated with social climate, vehicles and equipment, law & regulations, health, traffic environment and public transport[130];
- Aesthetics:
  Contrary to car drivers, pedestrians and cyclists have, '*because of their slower pace, time to look around and really get to know the environment'.* An aesthetically inspiring and attractive environment is especially valued by pedestrians and cyclists: beautiful buildings, trees and plants, freedom from crowds, good connections and a colourful atmosphere. Consequently, an unpleasant environment bothers walkers and cyclists more than it does car drivers. '*Noise from surrounding traffic and pollution are experienced as aesthetical problems as well as health problems. On the other hand, attractive routes for walkers and cycling may evoke more walking and cycling, even over longer distances'*;
- Financial advantage:
  'Financial matters concerning walking and cycling include both public and private economy.' Increased walking and cycling would lead to public savings. '*Local authorities* [however] [....], *do not receive the money that is saved by casualty reduction.*
  As to the private economy of road users, walking and cycling already is much cheaper than car driving.' Instead of 'punishing' (no tax deduction for walkers and cycling) people for the wrong kind of behaviour, they could be offered rewards.

Although this most probably is a correct reproduction of what can be found in literature, and evidently covering major needs, from a system approach perspective intuitively the list is incomplete and inconsistent. What for example strikes, is that the needs study focussed on the needs of non-captive pedestrians and cyclists; the large group of captive pedestrians (the ones with no other mode options) is neglected. Furthermore, noteworthy is the absence of reference to the influence of higher order needs on the lifestyle and strategic level, like having work, shops and other essential destinations within reach, modal choice options, having somewhere

[129] Risser & Chaloupka, 2010, p. 40: the possibility to be with, or at least amongst, other people
[130] Risser & Chaloupka, 2010, p.39: mobility at the micro level: affected by barriers when crossing the road to get to the bus-stop, by waiting times at traffic lights, by the length of walking routes, by lacks in security, etc.

to go etc. Consequently a more fundamental approach must be taken. After all, being a pedestrian is taking up a role to satisfy higher order needs. This means first finding out what *underlying human needs* can be identified (this paragraph), and then select what needs can be (partly) satisfied through walking and sojourning in public space, thus contributing to the wealth and well-being of communities and the nation (next paragraph).

A much cited and adopted theory regarding *underlying human needs* is the Maslow theory on the hierarchy of needs. It is known as the first theory of motivations to which people are exposed. Abraham Maslow identified five fundamental needs. He argued that there is a hierarchy in human needs (Maslow, 1943):

1. People will try to satisfy *physiological needs* (air, water, food, sleep) first;
2. When these very basic needs are more or less satisfied, *safety needs* become relevant (living in a safe area, medical insurance, job security and financial reserves);
3. After that, *social needs* like friendship, belonging to a group and giving and receiving love become relevant, and then follows:
4. *esteem needs,* and lastly:
5. the ultimate need is *self-actualisation*.

The theory is usually presented in the form of a Pyramid, with physiological needs forming the basis (see for example Figure 3.9. the Van Hagen pyramid of customer transportation needs).

Although the Maslow hierarchy lacks scientific support, it has plausibility[131] and, outside the psychology domain, is still frequently used to classify and prioritize needs and requirements, often without taking it as a hierarchy, though. However, the idea is that there is some prioritising in the sense that people pay most attention to needs they have not yet (fully) satisfied. For instance, someone who has already eaten will not feel rewarded when food is offered to him; if safety facilities are provided, a road user will not feel a need for safety at that moment and place.

Maslow's theory has been the subject of much debate amongst psychologists. One of the first much cited critics was Alderfer, who argued that, in reality, people don't necessarily work through the levels one by one, so there is good reason not to stick too rigidly to the principle of a hierarchy. In order to align Maslow's motivation theory more closely with empirical research, Alderfer created the ERG theory (Alderfer, 1969):

1. *Existence* refers to our concern with basic material existence motivators (containing Maslow's Physiological needs and Safety needs). *Health* is both a need and also, to a great part, the result of the measure to which these fundamental needs are fulfilled[132].
2. *Relatedness* refers to the motivation we have for maintaining interpersonal relationships (containing Maslow's Social needs and (internal) Esteem needs).
3. *Growth* refers to an intrinsic desire for personal development (containing Maslow's (external) Esteem Needs and Self-actualisation.

[131] However, experiments with a baby monkey that can get milk from an iron wire made surrogate mother and not from a soft cloth surrogate 'mother' show that the Maslow's hierarchy is not entirely correct. The baby monkey goes to the iron wire mother to drink, but stays more time with the soft cloth mother. Also, experiments with a baby who is given prime quality food, but no attention or physical touch show that both are badly needed. Also a number of needs are no static traits, but change over time and context (Mason, 1968).

[132] As such, health is not specified by Alderfer. In my context however, it is an important notion.

Contrary to Maslow's theory, the ERG theory does not state that lower order needs have to be satisfied before a higher order (underlying) need becomes relevant for inducing human behaviour. An individual can and will try to satisfy many needs at the same time. Moreover, if policy is directed at satisfaction of only one need at the time, this might frustrate the target persons (Alderfer, 1969).

Another critic, Seev Gasiet, has changed the scheme of Maslow somewhat and eliminated the hierarchical principle of Maslow's system. He divided needs and motives into four groups (Risser & Chaloupka, 2010):

a. Basic needs / psychological needs;
b. 'Warm' social needs (affiliation, social relationships, etc.);
c. 'Cold social needs' (dominance, 'being better' etc.);
d. Self-verification / Competence.

Instead of a hierarchy Gasiet sees a mixture of needs that are related to social principles. We need the others, but to satisfy 'cold social needs' may mean not to consider other citizens and their needs, leading to an interpersonal conflict of needs. 'Competence' contains parts of the meaning of the English word 'competition', with all its advantages but also disadvantages (Risser & Chaloupka, 2010).

Risser & Chaloupka (2010) also mention other critics like Graves, Hofstede, Early and McClelland. Graves (1970) found that people operate much less structured in the way they satisfy their needs. Hofstede (2001) and Early (1989) noted that different people with different cultural backgrounds and in different situations may have different priorities concerning needs. Other researchers claim that other needs are also significant or even more significant, like McClelland (1987), who identified needs for achievement, affiliation and power. Even Maslow (1968) himself added additional layers in his book 'Toward a Psychology of Being'.
The above conceptualisations of underlying needs which induce human behaviour, come dominantly from social sciences (psychology and sociology). Lapintie (2008) argued that the concept of needs should be defined and analysed interdisciplinary, integrating ideas from a systems-theoretic perspective. He looked at the classification of human needs from the perspectives of psychology, sociology, cultural theory, ethics, social and political philosophy, architecture and planning sciences. He argues that 'simple' homeostatic or existence needs and psychological needs are easily explained by psychology and sociology, but that there are many social and cultural needs that are not so self-evident. In his paper for Working Group 4 of the COST358 PQN project 'The Interdisciplinary Concept of Need' (Lapintie, 2008) he states:

> *'One such class of needs are the aesthetic needs. Human beings and societies have from early civilisations on invested in the aesthetic refinement of their environment, in addition to its mere functionality. Although aesthetic pleasure can be studied also in psychology, this is not all there is to it, since aesthetic experience can also be developed through aesthetic education and acquaintance with the arts. It is thus an inherent normative dimension studied in aesthetics as science (or philosophy).'*

Lapintie, too, finds it is not opportune to list needs, put them in a hierarchical order and then expect them to be satisfied one after the other. He believes that human perception and the satisfaction of needs is more complex than that.
According to Lapintie (2008) there are five levels of needs:

1. *Homeostatic or subistence* needs: focussed on the preservation of the human body
2. *Psychological* needs: having intra personal contacts and autonomy (independence, as: to be able to manage for oneself)
3. *Aesthetic* needs: experiencing one's immediate surroundings
4. *Social* needs: belonging to a group
5. *Political* needs: having political rights and benefitting from social justice.

In his note on the concept of needs Lapintie worked out his ideas. In table 3.3. the ideas are summarised. Being an architect, town planner and philosopher, regarding relevance and problems, for examples and substantiation he focussed on spatial aspects. Although he does not mention it, this thesis assumes that Homeostatic/subsistence needs also include the human need to conserve energy; compared to other modes, walking demands relatively much energy, which is known to prompt people to prefer the use of modes that are less physically demanding. Note that Lapintie's classification directly connects to Richards e.a.'s ideas on scopes regarding system output to the environment (circles of influence: individual - interpersonal - organisation - community/society; see Figure 3.6.).

Table 3.3. Classification of needs (Lapintie, 2008)

Type of need	Definition	Relevance and problems
Homeostatic / subsistence needs	Necessity of the human physical system to maintain a set level of temperature, nutrition, activity, etc.	Provision of shade, shelter, resting places, public wells, restaurants and cafeterias, safe crossings, etc.
Psychological needs	Necessity to reach e.g. relatedness, competence and autonomy in order to live a satisfying and meaningful life	Provision of accessible public and community spaces for meeting and communication, clear orientation and legibility, necessary control to ensure personal security.
Aesthetic needs	Preference for well-designed and/or meaningful cultural products and natural environments, can be refined through education and acquaintance with the arts	Provision of well-designed urban space, good materials and street furniture, scenic environments.
Social needs	Necessity of social groups to communicate and co-operate, as well as form social distinctions.	Provision of accessible public spaces for meeting and communication, clear orientation and legibility.
Public/political needs	Facilities and services that are considered citizens' rights that the political system is committed to. Disciplinary control/subjugation.	Provision of high-quality and accessible public spaces and public services, public transport, affordable and accessible housing, personal security, freedom to use public space within limits.

Lapintie's classification offers two classes that were not yet covered by Maslow and his subsequent critics: aesthetic needs and political needs. Hakamies did identify and substantiated the need for aesthetics. Lapintie's *Political needs* concern values on the societal level, relating to political rights, social justice, basic human rights and life-quality aspects, i.e. the dominant values referring to societal aspects and to inter-individual comparison processes. Risser & Chaloupka (2010) conclude that in Europe at least, there is consensus about what living conditions within a society people appreciate to have are health care, good education, to have

work and good working conditions, leisure time, social environment and relations, safety and security and to be able to participate in politics. According to Risser & Chaloupka these needs and their interaction have to be considered from the point of view of the citizens. If they are not taken care of properly, social costs will result. Evidently, this class of needs is particularly policy relevant, which reflects on governmental organisation: most governments have special ministries for dealing with those living conditions.

While Risser & Chaloupka refer to overall societal consequences, Nussbaum (2003), focuses on the need for fairness of the distribution of options for life quality. According to Oxford Dictionaries fairness concerns '*impartial and just treatment or behaviour without favouritism or discrimination*'[133]. Following the ideas of Sen (1980, 2001), she presented a list of central human capabilities, based on general human rights, that should be respected to achieve social justice, or in terms of this thesis' ultimate policy objective: internally well distributed well-being of communities and the nation.

Nussbaum's list of central human capabilities comprises (Nussbaum, 2003:41-42, cited freely):

1. *Life*: being able to live to the end of a human life of normal length
2. *Bodily health*: being able to have good health, being adequately nourished and have adequate shelter
3. *Bodily integrity*: being able to move freely from place to place; being secure against violent assault
4. *Senses, Imagination and Thought*: being able to use the senses, to imagine, think and reason, and do these things in a truly 'human' way, informed and cultivated by education; freedom of expression and religion
5. *Emotions*: being able to have attachments to things and people outside ourselves; to love who love and care for us; supporting forms of human association that can be shown to be crucial in their development
6. *Practical reason*: being able to form conception of the good and to engage in critical reflection about planning one's life; protection of the liberty of conscience and religious observance
7. *Affiliation*: being able to live with and towards others, to recognise and show concern; freedom of affiliation, assembly and political speech
8. *Other species*: being able to live with concern for and in relation to animals, plants, and the world of nature
9. *Play*: being able to laugh, to play, to enjoy recreational activities
10. *Control over one's environment*: being able to participate in political choices that governs one's life; being able to hold property (both land and movable goods); having the right to seek employment on equal basis with others; having freedom from unwarranted search and seizure.

Nussbaum's capabilities cover most of the classes of needs that Maslow, Lapintie and others identify, but also hint to the need for freedom of activities in public space that others did not mention like freedom to move from place to place, play, recreation, assembly. Existential needs, psychological needs, social needs are implicitly included; aesthetics, or experiencing the (built)

[133] As defined in Oxford Dictionaries https://www.lexico.com/definition/fair; fairness is defined as *impartial and just treatment or behaviour without favouritism or discrimination*; accessed 6-7-2020

environment and 'cold needs' on the other hand are apparently not seen as central human capabilities.

In the PLUME project (Planning an Urban mobility in Europe) Kaufmann & Risser (2005) defined human needs in terms of social aspects that have to be taken care of, i.e. needs defined in terms of requirements. They find that 'life quality' should cover health care, good education, to have work and good working conditions, leisure time, social environment and relations, safety and security, and politics (Kaufman & Risser, 2005, cited in Risser & Chaloupka, 2010).

IV. Clustering into a list of needs inducing W+S behaviour.
From the above the author concludes that expertise and literature deliver a great variety of needs that potentially induce W+S behaviour. The challenge now is to cluster these needs into a practical list of cues for W+S functional needs. In order to settle what *practical* means, this paragraph first explores the function of needs in W+S policy development. Next some critical issues are resumed regarding needs, culminating in a list of major human needs which potentially induce W+S behaviour.

With regard to the function of needs in W+S policy development, the key question is what do needs, if fully satisfied, contribute to achieving wealth and well-being of communities and the nation, and what happens if the needs are not satisfied?

Above already some critical issues regarding needs are identified: the difference between human needs and pedestrian needs, context sensitivity of needs, policy relevance of needs, positions taken in reference theories and studies, how needs are satisfied, and if not, what the consequences are. Below these critical issues again pass in review.

There is a *difference between human needs and pedestrian needs*. Pedestrian needs are human needs when walking and sojourning in public space. Not all human needs are relevant for walking and sojourning. Pedestrian needs have passed through two filters: the question whether *mobility or human movement* is necessary to satisfy the concerned need and the question whether this is done as a *pedestrian* walking through public space (either door-to-door or as access sub-mode to/from other modes) and/or sojourning in public space.

Both human needs and pedestrian needs are *context and person/group sensitive*. A ready-made, comprehensive, consistent and W+S policy relevant overview, tool, list or model of W+S related needs, is not found. From the above considerations it appeared that acquiring insight inductively from empirical research has not yet produced a comprehensive overview of W+S needs; a deductive, theory based approach potentially is more suitable for this. Conflicts may occur between needs and their satisfaction on the person, inter-person and community and national levels.

For some classes of human needs, particularly political needs, there is consensus about their *policy relevance*. This is already reflected in governmental organisation and legislation, e.g. the names of ministries, dedicated sections of ministries or other governmental bodies, the constitution or dedicated legislation and policies. Health care, good education, to have work and good working conditions, leisure time, social environment and relations, safety and security, to be able to participate in politics, and ecology are recognised political needs, but that does not automatically mean that a clear connection is made with walking and sojourning in public space.

Human needs theories take the *position* of individual persons (e.g. Maslow, Alderfer, Gasiet, Graves, Hofstede, Early, McLeland), a community or national level (e.g. Risser & Chaloupka, Nussbaum), or circles of influence (e.g. Lapintie). A clear relation to walking and sojourning is not drawn; the Hakamies & Jutila study comes closest, but covers in-traffic (tactical and operational) needs only, neglecting pre-conditional needs (Lifestyle and strategic activity level).

In order to *satisfy his/her needs*, a pedestrian must perform tasks like selecting a destination (or place to sojourn), deciding how to get there, choosing route, walk, react to traffic and cross streets, do his/her sojourning activity. One needs to be able to do so mentally, physically and financially (Steg & Vlek, 2009). With regard to W+S policy distinction should be made between W+S related needs on the lifestyle and strategic activity level (before the actual travel and sojourning decision is made, and the pedestrian role is not yet acted out) and needs of walkers and sojourning, when they are in public space. If needs cannot be satisfied, captive pedestrians have no option but to suffer the consequences; non-captive pedestrians can either accept the consequences or choose other travel modes.

In conclusion, a ready-made comprehensive list or model of *pedestrian* needs is not found. In order to construct such a list, based on the above considerations and Lapintie's classification, major human needs identified by the cited scholars are clustered (see Table 3.4.). In this thesis such a list is considered essential for defining and evaluating Walkability system requirements. It enables to develop a W+S requirement list by combining understandings related to the here presented human needs classification, insights in travel and sojourning motives induced by the classified needs, a classification of momentary contexts for walking and sojourning in public space (opportunities), and insights in pedestrian W+S abilities. In the context of Chapter 4 such insights are acquired and presented.

3.3.5. Opportunities

Needs can be satisfied if suitable opportunities are offered, i.e. if a person is hungry, his hunger can be remedied if food is available. Vlek and Steg (2009) show that needs coupled to abilities underlie a person's search for opportunities. What suitable opportunities are, depends on the person's actual needs and abilities. On the other hand, the offered opportunities can motivate him or her to perform.

Like the concept of walkability needs, in most cases literature does not offer a definition of the concept of opportunities for walking and sojourning. This subsection covers this thesis' definition, what kinds of W+S opportunities there are and what their relevance is for this thesis on W+S policy development. Together with walking and sojourning needs, walking and sojourning opportunities shape the motivation to walk and to sojourn in public space. In this thesis insights in W+S opportunities are used to outline requirements for W+S conditions and to abduce research questions for assessing the walkability status quo. The latter will be done in Chapter 4 on W+S system requirements.

Definition of 'opportunities'

Oxford Dictionaries define opportunities as "*a time or set of circumstances that makes it possible to do something*". Webster's dictionary define opportunity as: "1) *a favourable juncture of circumstances, and 2) a good chance for advancement or progress*".

Table 3.4. List of human needs in terms of Lapintie's classification.

Class of needs	Human Needs	Activity level *
Subsistence needs	Be able to live a normal life	S / O
	Bodily health (nourishment, maintain temperature)	S / O
	Conserve human energy	S / O
	Bodily activity (body 'maintenance' and training)	S / O
	Bodily integrity	S / O
	Objective safety	S / O
	Mobility at the micro level	O
	Comfort	O
Psychological needs	Senses, Imagination and Thought	S
	Emotions	S / O
	Lack of stress and anxiety (due to conflicts, lack of accessibility, orientation / legibility, security etc.)	S / O
	Practical reason	S
	Relatedness / interpersonal relationships / need to reach	S / O
	Autonomy	S / O
	Esteem needs	S / O
	Play	S / O
	Self-actuation/verification / competence	S / O
	Growth / growing up	S
	Security	S / O
Aesthetic needs	Aesthetic and environmental quality	S / O
	Cultural education	S
Social needs	Social Affiliation	S
	Social distinction	S / O
	'warm' social needs	S
	'cold' social needs'	S / O
	Social communication	S / O
Political needs	Human rights (equity and fairness: social goods, capabilities, 'life quality' e.g. • health care • good education • to have work and good working conditions • leisure time • social environment and relations • safety and security • politics (political affiliation)	S
	Mobility	S
	Accessibility and usability	S / O
	Safety and security	S
	Social inclusion	S / O
	Able to live with other species (fauna, flora)	S / O
* S = Lifestyle - Strategic activity level; O = Tactical - Operational activity level		

A related concept is *occasion*, which Webster's dictionary defines as "*that which falls in our way, or presents itself in the course of events*". Hence, occasions often make opportunities. The occasion of sickness may give opportunity for reflection (Webster's dictionary)[134]. So, opportunities are time and situation specific.

An opportunity may reflect to yet unidentified needs. To be relevant, the opportunity has to be recognised as such. Bacon once said that a wise man creates more opportunities than he finds[135]. What is an opportunity, is subjective; if a situation 'objectively' offers a favourable circumstance, communication and education can help to recognise or on the other hand ignore such opportunities.
A 'window of opportunity' to do something occurs when critical conditions together slid in place. When one or more of the critical conditions change, the window of opportunity closes. Opportunities are established by a favourable combination of circumstances, linking underlying needs, the flow of momentary activities (process) and conditions of the physical and social environment, transportation and atmospheric conditions. Societal developments can affect all system elements[136] and changed conditions may instigate changes in needs and opportunities. Walkability opportunities concern what is offered to the pedestrians and recognised as such. In other words: creating favourable conditions in an 'objective' sense is not enough; the facts need to come across to the targeted persons as well, which in many cases will not happen by itself.

Kinds of W+S opportunities

Like with needs, with regard to walking and sojourning in public space there are many kinds of opportunities. The pedestrian receives clues for walking opportunities from various environmental sectors at several abstraction levels, which together set the stage for walking and sojourning behaviour. With regard to W+S policy development three perspectives on opportunities are important: the user (pedestrian), policy agent and provider (policy development and implementation, management & control), and other stakeholder perspectives on the subject. The user perspective partly explains walking and sojourning behaviour. For the policy agent and provider, the user (pedestrian) can be client or customer. For other stakeholders, the user/pedestrian can be both client or competitor (e.g. regarding claims on space, rights of use, policy attention, governmental budgets). As this is a thesis on policy development, this thesis touches on the user and other stakeholder's perspectives on opportunities when they are relevant for policy development, implementation and management and control. The following first presents the various clues for W+S opportunities, and then the user perspective, the policy agent and provider's perspective and other stakeholder's perspectives. This subsection is rounded off by drawing conclusions about the relevance of W+S opportunities for this thesis.

Clues for W+S opportunities

In the context of the Vulnerable Road Users study (Methorst, 2003) the so called Pizza model was developed. This model aimed to form a source of inspiration for structuring transport and road safety interventions, and offers a comprehensive view on the factors that together provide opportunities for W+S behaviour. As such it can also inspire comprehensive stock-taking of system requirements.

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[134] Regarding 'opportunities' Oxford Dictionaries was accessed on 28-3-2013 and 4-1-2020 (https://www.lexico.com/definition/opportunity), and Websters Dictionary in June 2007.
[135] http://www.brainyquote.com/quotes/quotes/f/francisbac163128.html, accessed 29-3-2013
[136] Except general components like atmospheric conditions, climate, geo-morphological structures, which cannot be changed on the short term.

The Pizza model (see Figure 3.8.) directly connects to the Pedestrian travel & sojourning system model (see Figure 3.3.). At a general level the model shows that opportunities can be internal or external, i.e. within or outside the walkability domain, and either related to human factors or to 'things', i.e. technology or man-made entities. The model features four sectors, corresponding with the elements of the pedestrian travel & sojourning system. The model further discerns 3 levels of influence: a macro, meso and micro level, which correspond respectively with the Lifestyle/strategic, tactical and operational activity levels:

- *the pedestrian's personal conditions*
  On the macro level opportunities are defined by features of the pedestrian as a kind of road and public space user, such as (mostly) having two legs and therefore able to move without use of wheels; on the meso level opportunities are defined by features of the pedestrian as a member of a (small) group having the same interests and orientations; on the micro level by features of the individual person as a pedestrian. His or her physical and mental abilities and personal motives to walk, define opportunities.
- *the pedestrian's social-normative environment*
  On the macro level social values, like the feeling that walking and sojourning in public space is good for one's health, set the stage for opportunities[137]; on the meso level norms and standards concerning behaviour, like the compliance with traffic rules may induce the opportunity to walk without being called names, and on the micro level for instance the presence of nearby humans at night gives one the opportunity of a safe passage home.
- *the physical (spatial) environment*
  On the macro level favourable land use conditions, like nearby shops and services, provide the opportunity to do shopping on foot; on the meso level network conditions like connectivity for example can support activities on foot or to sojourn; on the micro level site characteristics e.g. may or may not provide easy opportunities for crossing a street or enjoying one's stay.
- *the transportation environment*
  For captive walkers, on the macro level, e.g. availability of nearby public transport functions, define mobility (transportation) options; on the meso level utility and attractiveness of vehicles as a kind (e.g. cars, buses) incite transportation opportunities when in need; on the micro level the presence of individual units like the family's car, a specific red city bus, at a particular moment, deliver opportunities to travel beyond walking distances.
- *the ICT/ITS environment*
  On the macro level the total of ICT/ITS policies and services provided sets the stage for walking and sojourning choices; on the meso level ICT/ITS dedicated systems support one or more kinds of walking and sojourning activities; on the micro level the individual ICT devices like smartphones, navigation devices and remote control units can e.g. support pedestrians to move about and sojourn with more ease, freedom, comfort and safety, and see and experience amenities, or call for help in emergencies.

[137] Social norms can be contradictory: there can be admiration for recreational long distance walkers for recreation, and contempt for poor, captive pedestrian, who have no choice but to walk.

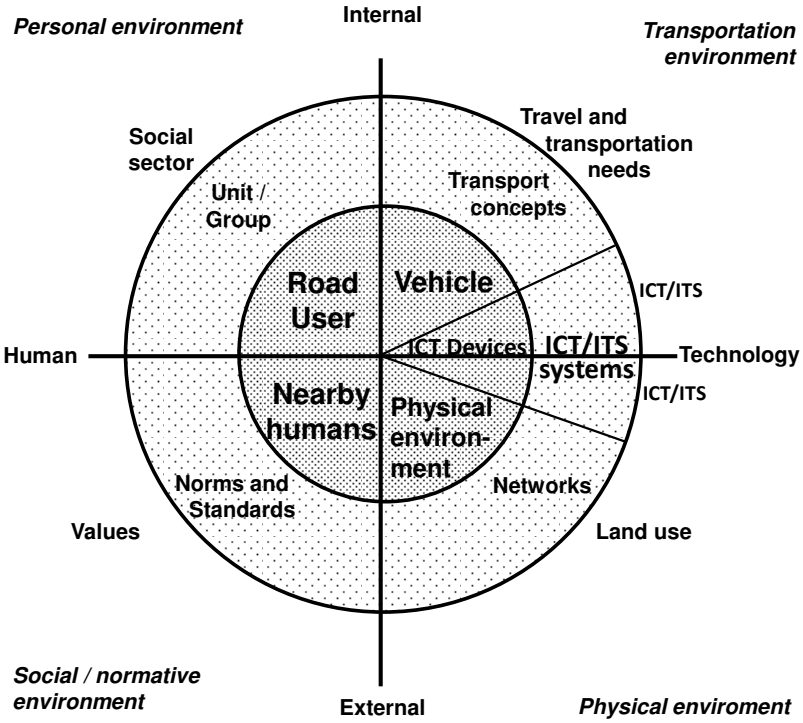

Figure 3.8. Pizza model concerning factors inducing W+S behaviour (after Methorst, 2003)

User perspective

In their user role, humans want to be offered (windows of) opportunities which facilitate the satisfaction of their needs and wants. In a theoretical sense important aspects are the content of the opportunity and the contextual conditions. The content of the opportunity spells what it is (e.g. a combination of conditions of the physical environment, a service, information, time table of the offer) and what it is good for (e.g. reaching a destination, comfort, convenience, conviviality). Contextual conditions concern current time and place in relation to the offer and what the consequences for the user are. This bears upon what and how much the user needs to do or be prepared to give or invest, and what abilities are required to make use of the opportunity. Furthermore it is important to discern to what activity level, i.e. lifestyle/strategic, tactical, operational, an opportunity belongs.

Available, perceived and advertised options may represent opportunities that generate new needs and wants. A common example: the *need* or *want* to hear music while walking. Before the introduction of the Walkman and later MP3 players only a few people did feel the need to listen to music while walking. The introduction of the portable music players created the opportunity and new needs. Other examples of such emerging needs are mobile phones, led-warning lights for joggers, wheeled suitcases, sidewalk extensions at pedestrian crossings, and heart beat and step counters. The introduction of affordable navigation software on mobile phones creates new opportunities and its own needs. They present new opportunities for those who were afraid to travel to unfamiliar places for fear of getting lost.

Likewise, decreasing options to some extent also influence needs, although this relation is less clear. People get used to having certain options and expect to have them 'indefinitely'. Additional options create satisfiers (nice to have), while losing an option creates dis-satisfiers (need to have).

Policy agent and provider perspective

In their role of policy agent and/or provider of facilities and services, governmental authorities have a different perspective on walking and sojourning in public space opportunities. This thesis assumes that the ultimate aim of the policy agents is to support and promote wealth and well-being of communities and the nation, in which walking and sojourning can be considered a means to this end. In this respect the pedestrian can be seen as client or customer. The policy agent and provider's task is then to entice the pedestrian to contribute to the wealth and well-being of communities and the nation by walking and sojourning in public space.

As it is sheer impossible to provide unlimited opportunities for walking and sojourning, the question is what facilities and services (opportunities) need to be provided. A practical answer is given by Van Hagen (2006, 2011). Based on Maslow's theory of needs, he developed a model concerning the kinds of opportunities public transport (train) services can offer to their (potential) customers. It was developed as a policy tool for the Dutch National Railways (NS) about customer needs and wants as a basic requirements list. Like Alderfer's theory, Van Hagen's version of the needs (opportunities) pyramid is evidence based (public transport customer preferences research). Van Hagen couples (potential) travel needs, suitable opportunities and behaviour on the strategic activity level in a practical model. As pedestrian needs on the lifestyle and strategic level are similar for all travel modes, such a model can be translated from public transport (for what it was made) to walking and sojourning in public space. From a provider's perspective there are three kinds of opportunities (Van Hagen, 2006; see Figure 3.9.):

1. *Basic opportunities*, which need to be provided because they directly influence volume of use (in our case W+S). First of all, transportation and/or sojourning in public space needs to be doable[138]. Basic opportunities then are safety and reliability, together accounting for 50% of the public transport customer needs and wants[139]. If transportation is unaffordable and notoriously unsafe, people do not use it. Uncertainty about what might happen underway is a first step towards feeling unsafe, which can be intensified when the environment is dirty or no-one is around. Reliability is that you, as a traveller (walker, sojourner), get what you expect to get. Regarding travel modes reliability concerns certainty about being able to arrive at the intended destination, at the intended moment, under the foreseen conditions (i.e. costs, effort, comfort, safety, lack of stress). Compared to non-captive travellers, pedestrians and sojourners, reliability has different meanings for captives, as their alternatives are either not to travel/walk/sojourn in public space or to suffer the hardships.
2. *Dis-satisfiers*, which irritate people and prompt them to choose other options if they can. These factors are generic and apply for everyone, although possibly not to the same degree. Speed (time, or effort needed to get where you want) tips the balance for choosing a certain mode. For sojourning speed also matters, but mostly in the sense of lack of speed; interaction on the other hand can be particularly satisfying. Convenience comes second.

[138] Van Hagen positions his market model in the context of market conditions and focuses on non-captive travellers, particularly car owners, who have a choice regarding travel mode. He implicitly assumes that the (intended) trip is doable within a person's range of abilities and financial possibilities.
[139] The percentage given are indicated by Van Hagen, 2006, based on customer research.

People do not want a 'shooting match' with tickets, tariffs, tolls, barriers, long waiting times, congestion etc. Dis-satisfiers are so called push factors.

3. *Satisfiers*, which sweeten usage of a chosen mode or activity. Comfort is a plus. This concerns all facilities that give the body rest or easiness, like a heated waiting room, comfortable seats, drinks offered. Travelling may also be nice: nicely designed surroundings, sounds, smell, friendliness, privacy, status etc. Satisfiers are specific. They depend on personal characteristics and preferences. They are so called pull-factors.

The percentages indicated in Figure 3.9 are based on customer preference research for train services by Van Hagen. For walkability needs the distribution of shares is probably not exactly equal, but the sequence can be expected to be similar.

The Van Hagen model shows that a practical solution for founding system requirements on insights in customer preferences is thinkable: there are basic opportunities, dis-satisfiers and satisfiers. Offering basic opportunities is essential for the support of at least captive walkers and sojourners and directly relates to system functionality. The second kind serves to make life easier for captive walkers and sojourners, and may help to tip the balance for non-captive walkers and sojourners for choosing to walk and sojourn, and thus have a W+S volume effect and a well-being effect. The third kind of opportunities is directed at promoting well-being.

Van Hagen's ideas connect to the Van Wee's passenger transport model, in which travel needs and abilities to travel, the distribution of potential destinations and the travel resistance together determine the volume, composition and distribution over time and space of transport and traffic (Van Wee, 2009). The distribution of destinations and travel resistance together shape opportunities on the lifestyle/strategic level. Resistance reflects how difficult it will be to satisfy travel needs and wants. If basic facilities are not available, this directly influences the volume of trips, as people are not satisfactorily enabled to travel (and/or sojourn in public space); dis-satisfiers intensify the travel resistances and thus subdue potential satisfaction of needs; satisfiers lower the travel resistances and thus expand 'normal' potentials.

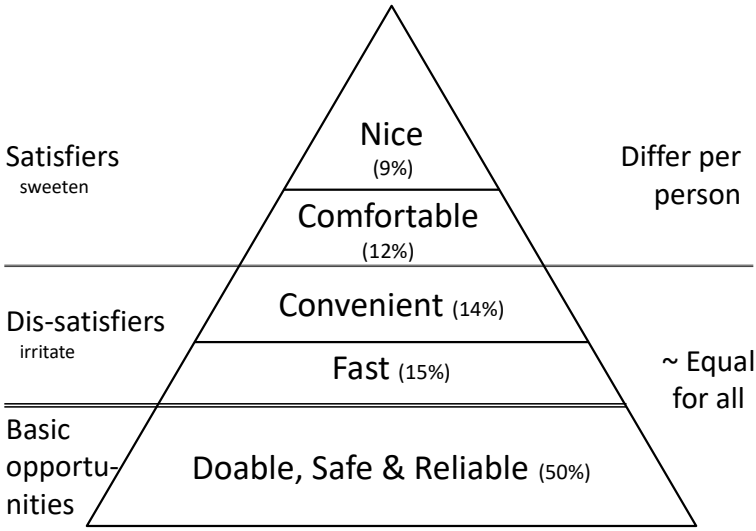

Figure 3.9. Customer transportation needs (adapted from Van Hagen, 2006)

Other stakeholder's perspectives
Other stakeholder's roles regarding the provision of W+S opportunities can be either as a (co-)provider of facilities and services or as competitor. As provider their role is similar to the governmental role. As competitor their interests diverge from the pedestrian's interests, e.g. by providing complementary mobility options or alternative ways for achieving higher order goals (like health, safety, security), claims on governmental attention and budgets, rights of access to and use of public space. Competitors in many cases may have better papers in negotiations than pedestrians, e.g. by offering less straining mobility, better and more explicit deals for governmental parties, better support by public media and the powerful etc. As a supporter of W+S opportunities they must be cherished, as a competitor they have to be taken very seriously.

Relevance of W+S opportunities for this thesis
Regarding the policy relevance of W+S opportunities it can be concluded:

- Opportunities set the stage for the satisfaction of needs. Using opportunities goes hand in hand with making (mostly small) sacrifices. Within the limits of the (potential) pedestrian's abilities resistances have to be conquered;
- Opportunities represent a favourable combination of conditions for walking and sojourning in public space, which provides chances of success for achieving advancement, progress or profit regarding higher order goals;
- Opportunities are subjective and need to be recognised by the subject; there is no certainty that an 'objective' W+S opportunity will indeed be grasped when it presents itself within its 'window of opportunity';
- Only opportunities that matter for wealth and well-being of communities and the nation are policy relevant;
- A policy agent can (help to) offer facilities and services; stakeholders can both be providers and competitors. In the latter role they must be taken into account;
- Not all opportunities are important to the same degree. Basic opportunities should be provided as they are essential for the functioning of communities and the nation; dis-satisfiers are important to deal with as they incite non-captive walkers to choose other modes and activities, whilst dealing with satisfiers may help to attract additional walkers and sojourners.

In Chapter 4 (documented) experiences regarding W+S opportunities are prospected, analysed and used as input for developing requirement specifications for walking conditions, strategies and policies: what do opportunities consist of and what do they, in relation to needs and abilities, mean for walkability practise in current Dutch conditions.

3.3.6. Abilities

Even if they want to, humans are not always able to make use of recognised opportunities. Together with walking and sojourning needs, walking and sojourning abilities underlie a person's opportunity search (Steg & Vlek, 2009). This subsection covers the definition, what kinds of abilities there are and what their relevance is for W+S policy development. In this thesis insights in W+S needs and abilities are used to formulate requirements for W+S conditions and to abduce research questions for assessing the walkability status quo. The latter will be done in Chapter 4 on W+S system requirements.

Definition of 'abilities'

Oxford dictionaries give two definitions[140]: 1) *possession of the means or skill to do something*, and 2) *talent, skill, or proficiency in a particular area*. Wegman et al. (2006), based on Fuller (2005) present a schematic representation of road user abilities and their limitations: task demands (D) can only be met if task ability (T) is great enough. Task ability is the result of competences (C), minus the situation dependent state. In Figure 3.10. an adapted version of Fuller's model is pictured[141].

Kinds of abilities

A person's abilities with regard to walking depend on several factors. Fuller (cited in Wegman et al., 2006) provided a useful categorisation that takes into account that general competences differ from person to person and that these general competences cannot be utilized in full in concrete situations.

On the general level (equals the *Lifestyle activity* level) an individual is endowed with competences that in principle enable a person to perform certain tasks. Fuller argues that an individual's competences are related to one's knowledge, skill, insight and attitudes, which depend on one's personal characteristics, training and experience. With regard to pedestrians important personal characteristics are age, gender, vehicle ownership and mobility handicaps. Age for example influences physical and mental capacities. Young children are small and cannot see over parked vehicles; their brain is not fully developed; they do not have adequate traffic and traffic communication experience etc. Older people on the other hand are confronted by diminishing sensory and motor capacities and are more fragile than younger people. In practise gender, driver licence and vehicle ownership matter for exposure and choice options. For sojourning activities social competences are an important factor.

In 1980 the World health Organisation issued the international Classification of Impairments, Disabilities, and Handicaps, where ***Impairment*** [is defined as] *any loss or abnormality of psychological, physiological or anatomical structure or function,* ***Disability*** *as any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being, and* ***Handicap*** *as a disadvantage for a given individual that limits or prevents the fulfilment of a role that is normal. In this way* ***impairment*** *refers to a problem with a structure or organ of the body; disability is a functional limitation with regard to a particular activity; and* ***handicap*** *refers to a disadvantage in filling a role in life relative to a peer group* (selectively cited from WHO, 1980:11-19). The sequence of underlying illness-related phenomena is presented as:

Disease ⟶ Impairment ⟶ Disability ⟶ Handicap

Although strictly speaking not a disability, it needs to be remarked that some common diseases like osteoporosis and sarcopenia have serious indirect effects. Osteoporosis causes brittle bones and makes a person frail in case of incidents; sarcopenia concerns declining muscle power, affecting one's ability to keep balance and making someone more susceptible to falls.

[140] https://www.lexico.com/definition/ability, accessed 19-6-2020

[141] My version of the model presented in Wegman e.a. (2006) is mirrored: the strategic level is pictured at the top, the operational level at the bottom, instead of the other way around. This is done to comply with placing the strategic level as the highest level.

Besides, actual task abilities can be limited by temporary personal physical and psychological conditions, which are affected by stress, distraction, illness, fatigue and psychoactive substances like alcohol, medical and other drugs.

In turn, concrete task demands can further limit or hinder one's task performance: other road users, road conditions, the vehicle or walking aids that are used (if any), time and the weather conditions can make it more difficult to perform adequately or can make it less attractive to be in public space.

Individuals try to calibrate their behaviour to momentary capabilities and recognised concrete conditions. For example: many elderly know that they cannot walk very fast, so they take extra time and care when crossing.

At the *lifestyle/strategic* level abilities concern *competences*, including the latitude that a person perceives to have, to choose to go somewhere and choose a travel mode. Important determinants for these choices are age, gender, driver licence and vehicle ownership, freedom of choice or legal competence, place of residence and living conditions, but also personal history, moods, attitudes, knowledge, insights, experiences (including tales from others), physical and mental capabilities, i.e. general preconditions for behaviour (Wegman et al., 2006).
Many women, but also men, choose using the car because of perceived dangers while walking or sojourning in public space. There may be a clear need to travel on foot, and a good opportunity, but execution is averted by fears (Nussbaum, 2003). At this stage also social and organisational capacities play a role: children, the elderly and handicapped persons are often dependent on others for going outdoors. Also, a person's social-economic position of being less wealthy, may lead to choosing cheaper forms of transport. For them walking can be the only option. Cultural or religious background can influence latitude, too. In some orthodox religious background situations females are not allowed to go outdoors by themselves. In some other cultures pedestrians keep shorter following distances than usual in Europe, etc. In the Netherlands some immigrant groups do not like the bicycle as travel mode, and they like walking more (Harms, 2006). In winter, because of slipperiness, there are many casualties, and fear of falling keeps some people, particularly frail elderly, at home.

At the *tactical* activity level task ability counts. At this level decisions regarding route, direction, orientation, attention, i.e. preconditions for operational behaviour, are made. Stamina[142] in relation to the distance to be covered, and reduced muscle power can reduce walkability. Readability of the environment can be below one's threshold to pick up the needed information to find one's way. The question is also whether public space offers enough contact options with other people, plus options to evade trouble, by creating sufficient differentiation in space (quiet and lively) and offering alternative routes.

Finally on the *operational* level of actual walking and sojourning in public space, capabilities are about being able to react to one's environment: actual task demands. This concerns abilities to walk, difficulties in the walking environment, the amount of traffic present, how good one is to cope with traffic and traffic conditions etc. Human energy is limited, and, apart from deliberate physical activities (games and sports on foot), people try to use it as efficient as possible. Not every human can walk easily under all conditions, like longer distances, slopes or steep stairs. Other abilities that matter are vision, hearing, touch, understanding traffic, quickness of reaction, stamina. The consequences of an accident, handicaps or temporary

[142] Stamina concerns how well a person can endure physical activity

injuries can limit a person's abilities. Depending on one's physical and mental condition a person can walk short or longer distances. Walking aids can help mitigate problems. Children cannot very well handle traffic conditions. Emotions and moods can restrict reaction to incidents.

Abilities are a major determinant for walking and sojourning performance. In the PQN project Vukmirović (2010) researched walking abilities. Following the US National Center for O*NET development for Department of Labor (USDOL) she discerned four main groups of abilities: physical, psychomotor, sensory and cognitive abilities. She defined these abilities as follows:

> *"**Physical abilities** are those individual skills that include strength, endurance, flexibility, balance and coordination.*
>
> ***Psychomotor abilities** are skills that affect the ability to manipulate and control objects.*
>
> ***Sensory abilities** are abilities that affect the visual, sound and speech perception.*
>
> ***Cognitive abilities** are the abilities that affect the acquisition and use of knowledge during solving certain problems."* (Vukmirovic, 2010, p 193).

Pedestrians form an extremely heterogeneous group. With regard to walking performance, in general young and healthy male adults have the least limitations. They can walk the greatest distance, have fair safety records and the least problems with accessibility of buildings and other destinations. Their excellent competences and task abilities make them very tolerant for less favourable walking environments, whilst for people with impairments and mobility limitations such environments can be prohibitive. In practise the transport system and specifically the road network is designed with some kind of reference standard car or vehicle in mind, defining a design envelope regarding the need for space, optimal curves, maximum slopes, travel speeds, service and safety provisions etc. This prompted Asmussen (1996) to suggest to construct a New Reference Standard Human[143] as a pedestrian and formulate minimum requirements for pedestrian facilities in the transport system. Nowadays this is referred to as the Design for All principle, enabling persons with serious disabilities to be agreeably reach their planned destinations and enjoy being in public space. Asmussen showed that this concerned a remarkably large proportion of citizens (almost 40%)[144] who otherwise suffer great difficulties while walking and sojourning in public space. In Chapter 4 Asmussen's ideas are advanced.

As mentioned above, competencies can also be temporarily impaired by being under the influence of alcohol or medical drugs, the use of a mobile phone or MP3 player, having fogged glasses, heavy bags, or simply distracted by companions or interesting objects in shop windows (Fuller, 2005, cited in Wegman & Aarts, 2006; see also Figure 3.10).

Walking is the only travel mode that, in normal conditions, is available for everyone. In this respect it is important to note that there are persons who have the option to choose to travel by other modes and people that do not have such options. In general, the most able persons also have most options. For most handicapped persons, children and persons who are financially less well off, if they want to travel independently, their only option is to walk. It needs to be mentioned that having a disorder or a disease does not necessarily mean that such a person perceives himself to be limited in his mobility. About half of the persons who, on medical

[143] The New Reference Standard Human is a literal translation of the Dutch concept “Nieuwe Normmens”.

[144] For more concrete information see Chapter 4, Section 4.4.5., where the sizes of the various pedestrian groups are shown.

grounds can be considered to have mobility restrictions, do not find themselves to have restricted mobility (Social Data, 2005).

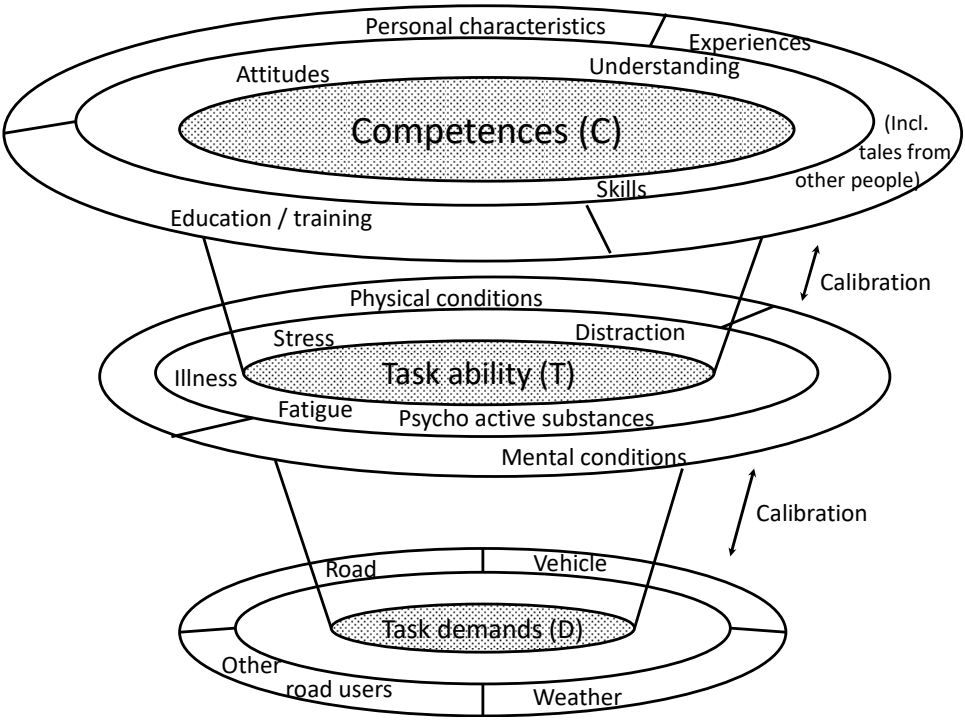

Figure 3.10. Fuller's model on task demand - capability - competence (adapted from Wegman e.a., 2006)

Over life W+S abilities are not constant. As novice walkers, children have to learn to walk, to deal with social conflicts, and conflicts in traffic. After serious impairments persons need to relearn to walk and/or deal with their impairments. Elderly persons gradually lose physical and mental capacities to walk. Abilities need to be kept up (cf. Langford et al., 2006, regarding driver's low mileage bias). Whenever critical limits are reached, accidents become more prevalent. With age frailty increases, meaning that resistance to external forces decreases. In case of an accident, risk of being seriously injured or killed increases. Although in general the elderly are not more often involved in accidents, they are more often seriously injured. From health research it is known that there is a so called frailty spiral, and that walking speed is an indicator for falls (Wijlhuizen, 2009).

Another important notion in this regard is that humans, when not engaged in physical exercise, strive to conserve energy and therefore often tend to choose the mobility or walking option that requires the least effort. Generally they take a short term perspective. By not training the body, motor and psychomotor functions slowly degrade[145]. On the longer term this affects walking abilities and stamina, with extensive functional consequences, like obesity, social exclusion.

[145] 'Use it or lose it'

The latitude (Span of Control) or room for manoeuvre is connected to one's abilities, competences and skills. This room to play is not easily determined; the latitude that a person actually makes use of depends on that person's perception of his own room for manoeuvre and his initiatives to stretch this latitude.

This thesis uses the term Span of Control to indicate the degree of freedom a person or organisation has to bring about changes in (part of) the system: to decide on changes, act upon those decisions and be in control of the outputs, outcomes and perhaps even impacts of the changes. Span of Control is similar to *latitude* regarding decisions and manoeuvre space. The term *span of control* was originally used in the context of Human Resources management and refers to the number of subordinates of a supervisor[146]. This freedom can be limited or stretched by[147] external influences (other people, organisations, norms, rules), characteristics of the persons or organisations in question (e.g. how powerful they are, how capable and healthy they are, how modest or altruistic they are etc.), self-regulation, and finally, aggressive action.

Span of control (SoC) is a relative concept, depending on the perspective taken. Following the Bradshaw (1972) taxonomy of partly overlapping needs, the hereunder mentioned perspectives can be taken:

- *Normative span of control:*
  This SoC is based on formal and informal rules, e.g. European Directives, national or local legislation and directives, guidelines and agreements or implicit culture. Examples are the distribution of authority, and responsibilities between national, regional and local authorities and the police;
- *Subjective span of control:*
  Subjective SoC is based on the perception of the person or organisation in question. The subjective SoC can deviate substantially from normative, legal or technical (systemic) latitude;
- *Comparative span of control:*
  Comparative SoC is the SoC that a person or organisation perceives (not) to have, compared to the (perceived) latitude that comparable other persons or organisations have, permit themselves and is permitted by others. Examples are public support for some authorities, awareness of a problem and what can be done about it, 'positive political context' and 'we know each other' or 'we are aware of what's going on';
- *Expressed span of control:*
  Expressed SoC reflects what is being stated, written, or explicitly allowed or forbidden. This can deviate from the actually allowed SoC;
- *Systemic*[148] :
  This type of SoC is determined by system boundaries, for example the 'market', the organisation's mission, or the current phase of the process (i.e. the organisation is not free to change budgets right after agreement on the budget year plan). Limitations are for instance: 'lack of financial means', 'lack of legal instruments', 'lack of public/political support', 'lack of shared visions and interests'.

[146] cited from http://en.wikipedia.org/wiki/Span_of_control
[147] based on discussions within the Ministry of I&M for updating the Dutch National Strategy for Road Safety, October 2011.
[148] the 'systemic' perspective is not mentioned by Bradshaw, but an addition by the author.

Other behavioural preconditions (and consequences) that can be connected to abilities are *'responsibility'* and *'commitment'*.
In Oxford Dictionaries *responsibility* is defined as *1) the state or fact of having a duty to deal with something or of having control over someone, 2) the state or fact of being accountable or to blame for something, and 3) the opportunity or ability to act independently and take decisions without authorization*[149]. The public feeling is that citizens are responsible and liable for their own actions, whilst on the other hand also independence is seen as a basic human quality or need. The question is whether self-responsibility can be maintained, as abilities can restrict a person's potentials to live up to these expectations (commitment: being dedicated to a cause; engaged to restrict one's own freedom of action), and also how this relates to civil rights in terms of Nussbaum's capabilities. For example, can children or elderly be considered to be totally responsible and liable for their misjudgements in traffic or being too slow in crossing a street within the time given by traffic lights? Like with *needs* and *span of control* the Bradshaw perspectives can be taken. Non-matching perceptions, norms and/or commitment of the subjects and providers of facilities and/or services can be assumed to lead to serious risks.

Conclusions re. relevance of abilities for W+S policy development
With regard to W+S abilities it can be concluded:

- It is necessary to distinguish between competences, task abilities and task demands. Capabilities on the competences level set the stage for, but also surpass, abilities in concrete operational conditions. So, being 'proven' competent is no guarantee for successfully completing tasks. Task demands should not go beyond task abilities, as this will inevitably lead to 'mistakes' and increased risks.
- Basically there are four kinds of (cap)abilities: physical (cap)abilities, psycho-motor (cap)abilities, sensory (cap)abilities and cognitive capabilities.
- Diseases can limit a person’s competences, but also his or her resilience in difficult situations.
- On the lifestyle and strategic activity level cognitive abilities matter most. Perceived abilities, the social environment, social economic position and organisational capabilities set the stage for mobility decisions.
- On the tactical and operational activity levels physical abilities, psycho-motor abilities and sensory abilities set the stage for walking; cognitive abilities determine the quality of reactions to presented encounters and conflicts within the range of sensory and physical abilities; particularly in complex situations cognitive abilities are a critical factor.
- Abilities are not constant. Competences evolve gradually, but operational abilities can vary from day to day or even situation to situation, and are difficult to predict.
- Task demands relate to concrete physical environmental conditions, traffic, and people in the environment.
- A person's span of control, or room to play, and responsibilities can be considered from a number of perspectives: normative, subjective, comparative, expressed or systemic. Mismatches between perceptions and norms of, on the one hand, pedestrians and the other hand, providers of facilities and services can lead to potentially risky decisions.

[149] http://oxforddictionaries.com/definition/english/responsibility?q=responsibility, accessed 19-6-2020

3.4. Conclusions and key messages

This chapter aimed to provide general insight in the current state of affairs of literature on walkability policy development and to deliver a conceptual framework to structure this thesis' research and policy development, to inspire the quest towards insight in how the system works and to guide devising improvements and evaluation.

From a literature scan it was concluded that, contrary to what experts said in the past, recently a lot has been published on walking and sojourning in public space. However, most of the publications have a rather narrow scope. Scientific literature does not evenly and comprehensively cover the W+S domain. Voids are only partly filled by grey literature, but there surely is no adequate coverage of the domain.

From the great variety in subjects covered in literature it can be concluded that walking and sojourning in public space is not as simple as many people think it is. There is more to walking than walking (Gemzø, 2001:20); many serious problems, like casualties from falls in public space, suppressed mobility of deprived groups, are almost totally hidden. Such hidden problems can impede the potentials of walking to contribute to the wealth and well-being of communities and the nation. Insight in the true conditions for walking and sojourning in public space and the complexity of precursor and consequences, is a prerequisite for achieving real revenues.

A system approach, featuring a systematic policy process, comprehensive analysis of the domain and integral interventions, promises better results than reacting to manifest problems. It is expected to help acquire insights in relevant hidden, but true conditions and processes affecting the volume and qualities of walking and sojourning. From fleshing out the pedestrian travel & sojourning system, it was found that the system is affected by both autonomous external influences and policy activities.

The effectiveness, efficiency and fairness of policy activities depend on the quantity and quality of the input to the system (the 'orgware' produced by the policy context). In this respect it is important to assure that interventions to improve the W+S system are properly prepared, managed and truly carried through. The presence of weak leadership, inadequate knowledge and professional skills, lame policies and strategies, insufficient resources, and lack of co-operation and partnerships, do not justify high hopes for successful W+S strategies and policies. Although autonomous developments sometimes solve problems, when there is no true input no improvements are to be expected. In other words, the process towards improvement of W+S conditions cannot do without real and substantial investments in orgware and implementation of measures.

Apart from the initiatives from leadership, knowledge about the reasons behind W+S problems is needed to find clues for improvement measures. From the presented pedestrian travel & sojourn system model it can be abduced that walking and sojourning are a result of the pedestrian's behaviour in interaction with his environment, consisting of the stationary physical environment, social and social-normative environment (influence of other humans) and the mobile physical environment (the transport system).

Walking and sojourning behaviour takes place on several activity levels. On the lifestyle activity level the stage is set for mobility decisions. Personal conditions and *lifestyle* decisions, like where and how to live, and environmental conditions (including both physical and societal aspects), precondition walking and sojourning activities. *Strategic* decisions concern activity

planning, induced by a variety of reasons, comprising direct mobility choices, such as where to travel to, whether or not to walk from door to door, to walk to and from other modes, or sojourning in public space. When the decision (consciously or subconsciously) is taken to walk, *tactical* decisions (like route choice, adapting a mindset like walking quick or slow, enjoying the environment or just passing through etc.) are induced. Based on these precursory decisions *operational* walking and sojourning takes place. This behaviour level can be typified as reactive, automatic, and/or instinctive. However, for impacts on society (wealth and well-being of communities and the nation), ultimately only this operational walking and sojourning counts. Operational W+S behaviour, however, only comes about if the precursory activity levels allow for it.

An important question in this regard is how W+S behaviour comes about. From theoretical considerations in this chapter it follows that W+S needs, abilities and opportunities together induce W+S behaviour (Steg & Vlek, 2009). These needs, opportunities and abilities are affected by societal influences.

Regarding *needs* it was concluded that there is need for a comprehensive general list or model of what *pedestrian* needs on the various W+S activity levels are. Based on Lapintie's classification precursory major *human* needs identified by influential scholars are clustered and listed (see Table 3.4.). This thesis now hypothesizes that a W+S requirement list can be constructed by combining understandings related to the presented human needs classification, insights in travel and sojourning motives induced by the classified needs, a classification of momentary contexts for walking and sojourning in public space (opportunities), and insights in pedestrian W+S abilities. In the context of Chapter 4 such insights are acquired to determine requirement specifications for the W+S system.

Regarding *opportunities* it was concluded that W+S opportunities concern what is offered to the pedestrians *and* recognised as such. There is no certainty that an 'objective' W+S opportunity will indeed be grasped when it presents itself within its 'window of opportunity'. Opportunities set the stage for the satisfaction of needs. Using opportunities goes hand in hand with making (mostly small) sacrifices. Within the limits of the (potential) pedestrian's abilities resistances have to be conquered.

With regard to W+S policy development three perspectives on opportunities are important: user (pedestrian), policy agent and provider (policy development and implementation, management & control), and other stakeholder perspectives on the subject. Opportunities that matter for wealth and well-being of communities and the nation are particularly policy relevant. Not all opportunities are important to the same degree. Basic opportunities should be provided as they are essential for the functioning of communities and the nation; dis-satisfiers are important to deal with as they incite non-captive walkers to choose competitive modes and activities, whilst dealing with satisfiers may help to attract additional walkers and sojourners.

Abilities are context sensitive. Abilities, or more general: capabilities, depend on a person's competences and task abilities, and relate to task demand from actual walking and sojourning conditions (walkability). Capabilities on the competences level set the stage for, but also surpass, abilities in concrete operational conditions. Being 'proven' competent is no guarantee for successfully completing tasks. Task demands should not go beyond task abilities, as this will inevitably lead to 'mistakes' and increased risks. Basically there are four kinds of (cap)abilities: cognitive, sensory, physical, and psycho-motor (cap)abilities.

There is great variety in (cap)abilities between persons, (cap)abilities take different forms at the discerned activity levels, and abilities are not constant. Competences evolve gradually, but operational abilities can vary from day to day or even situation to situation, and are difficult to predict. Task demands relate to concrete physical environmental conditions, traffic, and people in the environment. A person's span of control, or room to play, and responsibilities can be considered from a number of perspectives: normative, subjective, comparative, expressed or systemic. Mismatches between perceptions and norms of, on the one hand, pedestrians and the other hand, providers of facilities and services can lead to potentially risky decisions.

This thesis recapitulates the above components and determinants of pedestrian behaviour in a conceptual framework model (see Figure 3.11.). The model is constructed for inspiring and structuring research and policy development recommendations in the following chapters of this thesis.

In the model the main line of the (potential) pedestrian's successive activities is pictured by balloons and blue arrows: *Being, Going, Travelling, Walking,* and *Arriving and/or Sojourning* as the final stage. Walking and sojourning experiences and tales from others about their walking and sojourning experiences induce *Perceived Walkability*, which feeds back to the perception of the qualities of determinants and W+S behaviour at the lifestyle, strategic and tactical levels. Walkability, as a quality notion and 'product' of the system, is subjective and depends on the options for choices, the ease of the realisation process and possibly the comfort and pleasure derived from the activities on the one hand and social, economic, political and environmental factors and the perception of these conditions on the other hand.

Below the balloons generalised precursory factors and their relations to W+S activities are shown in boxes, with straight line arrows towards the activity they are feeding. Each of the boxes contains the factor categories of pedestrian's personal conditions, pedestrian social-normative environment factors, physical space factors and transportation environment factors. The specificity of the factors relates to the activity level in question.

The main determinants for going to walk (*strategic* level activity planning) are:

- The *individual's options for mobility* (his interacting momentary manifest needs, perceived task abilities and perceived opportunities combined)
- The *social context* (including perceived[150] collective needs, norms, values and rules, including international regulation and economic conditions)
- The *physical environment & land use characteristics* (distribution of destinations, environmental qualities, absence of barriers, weather, lighting conditions etc.)
- The qualities of the *transport system* (general traffic features, public transport qualities).

At the *tactical* level pedestrians' travelling behaviour is induced by precursory decisions and the following travel contextual factors:

- Individual W+S needs, task abilities and perceived opportunities related to the momentary travel motives, context and feelings
- Characteristics of nearby people and traffic
- Route and environmental characteristics (i.e. rain, heat, wet road, looks of surroundings)

[150] perceived by the pedestrian

- For those who decided to use other modalities: the accessibility and attractiveness of the mode they had in mind (a car, the bus, the train).

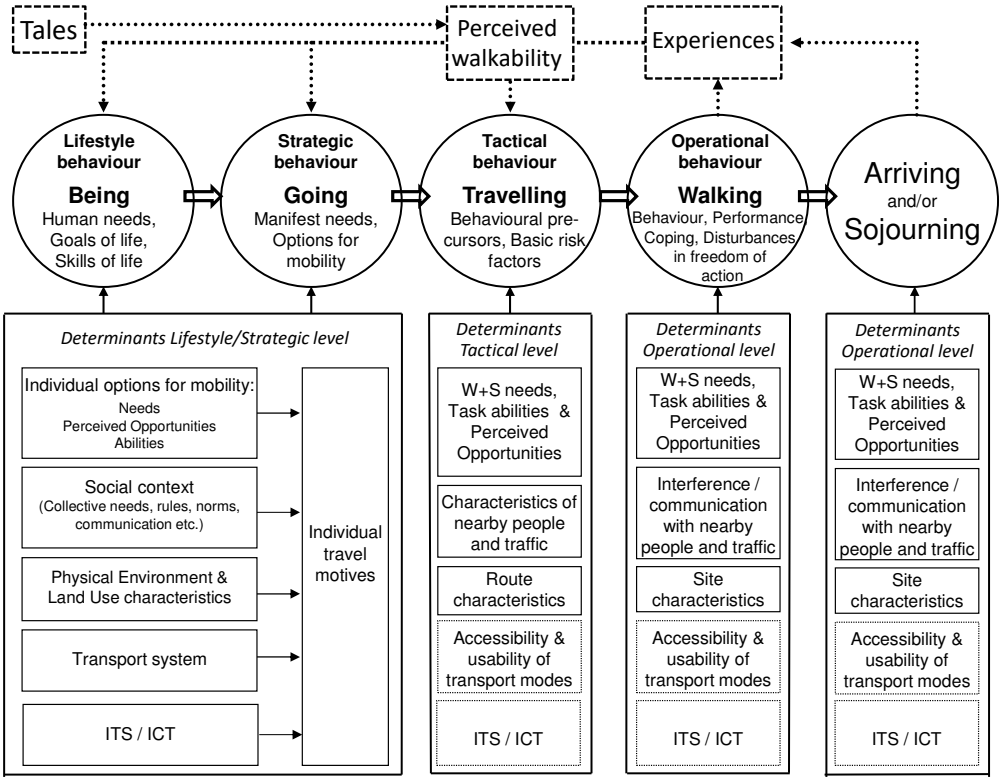

Figure 3.11. Conceptual Framework Pedestrian Behaviour

Factual walking *(Operational* level*)* and arriving and/or sojourning reactive and intuitive behaviour is influenced by:

- Individual walking needs, task abilities and perceived opportunities related to the W+S motives, context and feelings
- Encounters with, or interferences of nearby people and traffic, weather conditions, time limits etc.
- Site characteristics, i.e. availability and quality of pedestrian facilities in relation to the pedestrians needs, abilities and perceived behavioural options
- For those that decided to transfer to other modes: accessibility and attractiveness of those modes.

This thesis assumes that ultimately W+S policy development aims at creating wealth and well-being of communities (groups of citizens) and the nation as a whole (impact). In this context pedestrian behaviour is taken at a more general level than the individual's behaviour. The question is what controls policy agents have regarding the pedestrian travel and sojourning

system, including the behaviour of (groups of) pedestrians (cf. the subtitle of this thesis): how can the system be optimized to deliver more wealth and well-being.

From my theoretical considerations and current knowledge about the system, I expect that system impacts can be improved by offering more adequate W+S opportunities, i.e. facilities and services. In this regard, to begin with, system deficits, dis-qualities and system failures (like non-mobility, non-sojourning, accidents, damage, casualties) should be tackled. As hinted before, such conditions reveal themselves only through operational activity level W+S behaviour. This does not mean that causes are also to be found on the operational level; they can be found at the precursory activity levels as well. Changing the pedestrian's behaviour, however, is another matter, as it is only partly controllable. Almost all operational behaviour is subconscious, automatic behaviour, which is extremely difficult to change. This can be achieved by changing factual W+S conditions, or, more difficult, by raising awareness to instigate conscious decisions, which most of the times concerns the Lifestyle activity level.

From the considerations in this chapter it can be concluded that, theoretically, the main controls that policy agents can apply concern:

- The *policy context*, specifically the effort delivered to affect the walking and sojourning system;
- The *stationary physical environment* for walking and sojourning, including mitigation of atmospheric and climatic influences on walking and sojourning;
- The *transportation options* connecting to walking and sojourning in public space;
- The *position of the pedestrian* in interactions in public space (including social-normative environment[151]);
- The *characteristics of ITS/ICT* for the support and management of walking and sojourning;
- The *citizen's perception* of the importance of walking and sojourning, and options to travel and sojourn in public space on foot.

In the next chapters the potentials of these general controls will be explored. A more concrete picture will be formed about what is required for supporting walking and sojourning adequately, what the status quo is and what conditions can and need to be improved. This will lead to additional insights in what controls governments truly have to support the wealth and well-being of communities and the nation by improving walkability; it will also lead to insights in the added value of such policies.

[151] The social-normative environment involves the pedestrian's legal position, values and norms regarding behaviour in public space, as well as communication, promotion and enforcement of prevailing legislation, norms and values.

4. WALKABILITY SYSTEM REQUIREMENTS

4.1. Introduction

Chapter 3 elaborated on the first step of this thesis' policy development process model (see Figure 1.2): conceptually modelling the walking and sojourning in public space (W+S) system. In this context system approach was introduced and the conceptual framework of the W+S system was presented. The current chapter deals with the second step featured in the policy process model: specification of system requirements[152]. The leading question is:

What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation?

To answer the above question this thesis explores what conditions indirectly and directly affect (potential) pedestrians' behaviour in public space, with a focus on conditions in The Netherlands. Chapter 3 pointed out that W+S behaviour generally arises within a context of *environmental settings.* Pedestrian behaviour is governed by needs, opportunities and abilities. While needs and abilities together underlie the search (i.e. demand) for W+S opportunities, the factually offered W+S arrangements underlie perceived W+S opportunities. The W+S arrangements represent the supply-side of the W+S behaviour equation (cf. Figure 3.7. NOA-model, adapted from Steg & Vlek, 2009). The quite general and abstract human *needs* as discerned by Lapintie (2010; see also table 3.4) seem to underlie the more concrete strategic *reasons and motives* to go outdoors and walk and sojourn in public space, as well as pedestrians' tactical and operational behaviour, but how that works is not entirely clear.

[152] In this thesis a requirement is a documented characteristic of what a particular product or service should be or do (supply-oriented). In this thesis the word Need will only be used for needs that individuals or groups of individuals have (demand-oriented). A requirement defines the desired performance of a system, facility or service. Requirements derive from demands from users.

The aim of this chapter is to be able to present arrangements which optimally support (potential) pedestrians regarding their walking and sojourning contemplations, decisions and behaviour, in such a way that the pedestrians themselves, communities and the (Dutch) nation benefit from it in terms of prosperity and well-being.

This leads to the following four research questions to be dealt with in this chapter:

1. *In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?*
2. *How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?*
3. *How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?*
4. *What W+S[153] arrangements are required to offer a heterogeneous population of (potential) pedestrians adequate and tempting W+S opportunities, now and in the next decade?*

Following the Design for All principle, the (potential) pedestrians' characteristics, particularly those of the least endowed and most demanding (potential) pedestrians, form this thesis' starting point for W+S policy development research. The logic is that when the needy are best provided for, the less needy benefit anyhow, and wealth and well-being of communities and the population is best served. It is however very difficult to tell to what degree (potential) pedestrians will actually recognise and seize W+S opportunities related to W+S arrangements meeting expertise based requirements. In absence of such insights for the moment the author assumes that available evidence regarding pedestrians' behaviours in the past and experts' judgements are a good proxy for what is required to optimally facilitate walking and sojourning in public space.

In the next Section 4.2. Methodology the applied research methods regarding this chapter's research questions are elucidated. The methodology not only covers assessment of the various objectively observable functionalities, but also perceptions and the dynamics of trends towards the future. This comprehensive approach is taken because measures should be demonstrably effective, efficient and fair, not only at the time of their implementation but also later on under evolved conditions. Behaviour is mainly based on perceptions of reality: people in many cases do not have accurate insight in the actual traffic and safety conditions and decide relying on their (subjective) appraisals and habits. Measures should also comply with foreseeable changes in W+S (pre)conditions.

The first three of the four research questions about precursors for walking and sojourning decisions are dealt with in Section 4.3. The pedestrian population. In this section first the pedestrian's environmental settings, needs and abilities are translated into associated reasons for walking and sojourning in public space and into general W+S requirements for walking arrangements associated with these reasons. The heterogeneous (potential) population is segmented into groups regarding their W+S relevant needs and/or wants and abilities, specifying their characteristics and what kinds of arrangements are needed to enable them to go outdoors on foot. Furthermore, following Asmussen (1996), a 'New Reference Standard

[153] 'walkability' describes the overall walking conditions, in the widest sense (Litman, 2003).

Pedestrian' is constructed as reference for defining walking and sojourning system requirements that befit the Design for All / Universal Design principles[154].

The fourth research question concerns both the opportunities offered by an exemplary W+S system to (potential) pedestrians as well as influences on the W+S system exerted by the W+S institutional framework. Section 4.4. Exemplary W+S system arrangements aims to deliver general insight, guidance and reference for the assessment of the status quo of the W+S system and of the Institutional Framework. Research questions[155] and - where feasible - indicators and test criteria are produced. Chapters 5 and 6 report on the results.

Section 4.5. Conclusions and discussion summarises conclusions drawn in the Sections 4.2, 4.3 and 4.4, presents key messages and discusses uncertainties and gaps in knowledge.

In sum, this chapter deals with precursors, factors that generally affect walking and sojourning decisions and more or less predict them, but not the result of these decisions in terms of pedestrian activities (mobility, sojourning) and consequences like safety or satisfaction. That will be the subject in Chapter 5.

4.2. Methodology

4.2.1. Introduction

In Chapter 3 pedestrian behaviour and relations between the system components are conceptually modelled. In this methodology section methods applied to answer the research questions presented in the introduction of this chapter and general process results are described.

The current chapter focusses on the identification of major determinants of W+S behaviour and suitable W+S arrangements to adequately support W+S. In other words: the ambition is to broadly explore determinants and requirements, and sketch the most important ones. From the NOA model (Figure 3.7 adapted from Steg & Vlek, 2009) presented in Chapter 3 it follows that pedestrian behaviour is governed by environmental settings, needs, abilities and opportunities presented. Because of their different natures, the exploration of each of these factors demands dedicated research approaches. In the following subsections the research approaches with regard to each of the W+S system components are presented.

The dedicated collection of documents is the main source for this thesis' research (see section 2.1). Very few of the scientific publications cover and offer direct evidence regarding the (detailed) research questions of this thesis' research. This leaves many white spots in coverage of the domain. Consequently the research needs to fall back on exploration and finding *best fits* through consulting and analysing the available documents, expert assessments and seeking analogies (i.e. not always fully accurate results from the 'abduction' form of reasoning)[156]. It concerns so called *scoping review*, aiming to rapidly map key concepts underpinning a new research area through analysis of available documents and experts' assessments (cf. Dijkers, 2015). Thus in total the research results can be expected to result in a first step towards solid

[154] see for example: http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/
[155] The research questions are recapitulated in Appendix 3 Detailed research questions.
[156] N.B.: following this reasoning, the author consistently used the term 'abduction' of 'abduces' instead of the in common parlance used 'deduction' or 'deduced'

overview and best estimate insights in the volume, qualities and determinants of walking and sojourning in public space. In other words, most of the results will need to be complemented and validated through further research.

In this chapter successively attention is given to methodology with regard to research into the pedestrian population and walking arrangements (social-normative, physical, transportation and information technology arrangements; cf. the Pizza Model as in Figure 3.16). In the following Subsections 4.2.2 to 4.2.5 research questions and ambitions, research approaches, utilized sources and process results regarding the above W+S system components requirements are sketched. The research results are presented in the Sections 4.3, 4.4 and 4.5.

4.2.2. Pedestrian population

4.2.2.1. Introduction

This subsection deals with the chosen research approach to the exploration into the demand side of walking and sojourning in public space[157], to find out what the major features are that define the volume of demand for walking and sojourning in public space (cf. the first leading research question mentioned in the introduction of this chapter). Largely following Steg & Vlek's NOA-model, the main elements to look at in this regard are 'environmental settings', 'needs' and 'abilities'[158]. The research approaches regarding these elements, their characteristics and effects on walking and sojourning as well as basic conditions for creating more suitable walking and sojourning opportunities, are described below. Sub-studies in this regard concern environmental settings, walking needs, walking abilities and suitable walking opportunities. Each of these topics is elucidated below, describing a) dedicated research questions and ambitions regarding research results, b) research approaches and motivation, c) utilized sources and d) process results regarding the sub-studies.

4.2.2.2. Environmental settings

The first subject approached was the exploration of environmental settings with regard to W+S (potential) pedestrians' needs and abilities. This concerns living conditions and lifestyle that either limit or extend behavioural options with regard to walking and sojourning in public space. These living conditions can be considered environmental settings i.e. personal or group attributes preconditioning strategic, tactical and operational walking and sojourning behaviour.

a. Research question and ambition

With regards to environmental setting the research question in this sub-study is:

In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?

The ambition is to systematically explore what the most influential environmental factors are that precursor and affect W+S needs and abilities so that valid conclusions can be drawn

[157] In this thesis a pedestrian is anybody who walks and sojourns in public space. Consequently (potential) pedestrians do not only comprise a county's citizens, but also visitors and tourists from abroad.

[158] In their model Steg & Vlek refer to societal developments affecting needs, opportunities and abilities. In this thesis a broader spectrum of influences is considered, including environmental conditions, natural, spatial, physical conditions. Such influences are also part of the individual's personal context of their (felt) needs, opportunities and abilities.

regarding clues for and urgency of improvement of W+S conditions on the lifestyle and strategic behaviour levels.

b. Research approach

The first step in the research into environmental settings affecting W+S needs and abilities was to globally search the W+S documents database regarding general classifications and what conceptual models are described and applied, by scanning titles and selecting relevant documents. This approach was chosen to on the one hand make efficient use of the substantial batch of dedicated scientific and grey documents on W+S collected over a period of about 30 years, and on the other hand enable filling in possible gaps in the database and acquire the most recent figures on the attributes. This approach was expected to be more effective and efficient for acquiring overview than literature searches through Google Scholar, Science Direct and Scopus databases alone as this way also valuable insights from 'grey' literature on matters not yet covered by scientific research[159] can be included.

From the tentative results a classification of population attributes is abstracted. The identified population attributes were substantiated by applying the Topical Questions 5W+H[160] principle, adding a special paragraph on what the significance of the attribute is for W+S policy making; for all attributes the questions are:

a. How can the attribute be defined and what is the scope and/or relevance regarding W+S?
b. Which groups of pedestrians can be distinguished in this regard?
c. Why does the attribute affect W+S?
d. Where and when does the attribute affect W+S?
e. How does the attribute impact on W+S needs, abilities and behaviour?
f. What is the significance of the attribute for W+S improvement policies?

For all attributes the questions were answered by taking four steps:
1) the W+S database was broadly searched for information to answer the above questions, 2) based on this information, for each of the attributes more specific sub-classifications were devised, 3) a further literature check was carried out on the internet (using Google for general questions, national public databases and Google Scholar for finding complementary general information and publications[161]), and 4) for substantiation of importance, statistics were collected on group volume, incidence and impact of the attributes. Whenever available such statistics were obtained from Statistics Netherlands (CBS Statline website), otherwise from national knowledge institutes and/or renowned and reliable specialised organisations. In some cases missing data could be filled in by relatively fair[162] estimations (assumptions and calculations: see Appendix 5). In this context the indicator *walking propensity* is introduced[163]. This indicator is meant to picture the degree of freedom or lack of alternatives to choose to walk over choosing other travel modes, i.e. the inevitability of walking. The indicator is expressed in stars, where five stars means 'high propensity to walk' and one star means 'very low propensity to walk'. The scoring is carried out by the author based on knowledge about general

[159] Most pedestrians experts agree that W+S is not adequately covered in scientific research (cf. the in this thesis often mentioned WALK21, COST PQN and OECD/ITF working groups).
[160] The Topical Questions are: Who is it about, What happened, When did it take place, Where did it take place, Why did it happen, and How did it happen (Spencer-Thomas, 2012; 5 W's +H)
[161] Found publications were added to the digital library folder and corresponding Excel database.
[162] When data are lacking, in this thesis, estimated margins of about 25% are considered fair.
[163] Following Elliot Fishman's idea: a Bike Use Propensity Index. He detailed the idea for the City of Adelaide in Australia (Fishman et al., 2017).

levels of abilities to ride or drive a vehicle, average access to alternative modes of transport and dominant travel motives.

c. Utilized sources
To answer each of the above questions specific kinds of sources have been turned to.

For question a - the definition, scope and relevance of the attributes several sources were consulted: Oxford dictionaries, Wikipedia (for orientation), specialised and highly esteemed institutions (WHO, World Bank, United Nations, national planning agencies and knowledge institutes and when applicable websites of reliable specialised organisations in the Netherlands). The scopes and relevance of the attributes for W+S were abducted from documents in the W+S database as well as the conceptual models presented before.

For question b - identification of pedestrians groups with regard to the attributes, a selection within the W+S database (subject 1 coded '1 - Population', referring to about 950 documents) was broadly scanned on relevant group classifications. The findings were noted and reviewed on practical use in policy development. Criteria for the group classifications are 1) relevance for W+S behaviour and the provision of W+S facilities, 2) retraceable in national statistics published by CBS (Statistics Netherlands), one of the national knowledge institutes or renowned specialised organisations.

To find answers to question c, d and e, respectively why the attribute affects W+S (reasons), where and when the attribute impacts W+S (incidence, time and place distribution), and impacts on walkers (in what ways, mechanisms, severity), information was searched by scanning the W+S documents database and additional searches through Google, Google Scholar and relevant national databases on the internet. After writing the first draft of the sections the references were completed or corrected through keyword searches in the database, Google Scholar and Googled (keyword = subject in sentence). All thus found documents were added to the W+S documents database and digital collection.

After completing questions a-e the answers to question f on the significance for W+S improvement policies were abducted from the findings for those questions, focussing on the volume and severity of limitations of W+S options, system impacts and (potential) ways to solve misgivings.

d. Process results
The research on environmental settings regarding W+S behaviour is carried out in the period of March to September 2018. The study concerns a first attempt to systematically outline lifestyle level environmental influences on walking and sojourning decisions. Documents and (Dutch) statistics on the subject are collected; general features of the documents (see Appendix 2) are included in an Excel database, which is available for further research and policy making. The study yields a comprehensive, but still imperfect sketch of what is known and what is not known about general influences[164] on walking and sojourning decisions and behaviour, how these influences vary, and how heterogeneous the pedestrian population is regarding their background. The research results are not always conclusive; in most cases further research is needed to acquire more validity, certainty and detail. Important gaps and uncertainties in knowledge are noted. Research results are presented in Subsection 4.3.2. of this thesis. Draft

[164] The study is not limited to a specific domain like transport, economy, social well-being, health or law – norms and values.

reporting and especially table 4 has been reviewed, corrected and complemented by 11 external experts (see Appendix 4).

4.2.2.3. Walking needs

The second subject with regard to the W+S population approached was how general human needs (cf. Table 3.4.: subsistence, psychological, aesthetical, social and/or political needs (Lapintie, 2010)) translate into pedestrian quality needs, i.e. what kinds of conditions, facilities and services the diverse groups of (potential) pedestrians need for walking and sojourning, as a means for satisfying general human needs. This concerns identification of reasons and motives for walking as well as finding out what kinds of conditions, facilities and services (potential) pedestrians consider suitable for enabling, supporting and persuading them to walk and/or sojourn in public space for achieving their general targets.

a. Research questions and ambition

With regards to the translation of general human needs into walking needs the research question in this sub-study is:

How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?

This research question is detailed into in four parts (detailed research questions):

- *How do general and abstract human needs (as classified by Lapintie, 2010) relate to concrete motives and reasons for walking?*
- *Which motives and reasons do (potential) pedestrians have for walking and sojourning in public space? How should they be sorted?*
- *What trip types and groups can be distinguished regarding W+S needs, motives and reasons?*
- *What kinds of conditions, facilities and/or services can (potential) pedestrians be expected to feel necessary or most suitable for achieving their general targets?*

The ambition is to broadly explore, list, classify and describe the most likely functional need-based *demand* for walking and sojourning in the Netherlands: what major groups of (potential) pedestrians want to be able to do and achieve, when, where and how. In a later Section (4.4. W+S arrangements) more concrete design requirements, based on evidence from literature, regarding the physical, social-normative, transportation and information technology environments will be considered. In that section the focus lies on the effect of the *opportunities* offered by specific arrangements on the volume and quality of walking and sojourning, given the expressed or normative needs[165] and abilities of (potential) pedestrians.

b. Research approach

The research approach for this thesis' part is built on results and conclusions of earlier projects on pedestrian quality needs, such as the PQN (Methorst et al., 2010) and the OECD/ITF project on pedestrian safety, urban space and health (OECD/ITF, 2011). As far as the author knows there are no studies that systematically describe how the various general human needs translate

[165] normative needs: needs as identified according to a norm, usually set by experts (Bradshaw, 1972); in this thesis it is not an option to ask people what they feel is needed (felt needs).

into W+S needs; there are however many studies on problem, group or situation specific requirements (often called needs), like requirements for pedestrian road crossings, traffic safety, accessibility, needs in business districts, safe facilities for blind and deaf people, comfort needs, space needs at bottlenecks etc[166]. Some of these studies (implicitly) hint to general human needs.

At first sight an obvious approach for researching the above questions would be to carry out a questionnaire survey amongst a representative sample of inhabitants of the Netherlands. Because of practical and budgetary reasons this was not an option for this thesis. As literature search did not deliver the sought-after insights, the author chose to bring together and consult experts. A group process was expected to stimulate and inspire the participating experts to bring out tacit knowledge. With help and support of Rijkswaterstaat Water, Traffic and Environment an expert workshop on Pedestrian Needs was organised on the 19th of June 2013. Apart from the author, 13 experts participated in the workshop.

The workshop was prepared by the author and moderated by an experienced process moderator. Beforehand the workshop attendants received a workshop program and a background paper, referring to system approach (Methorst, 2010-2), the NOA-model (Steg & Vlek, 2009), the COST 358 Pedestrian Quality Needs (PQN) project results (Methorst et al., 2010), specifically human needs classification (Lapintie, 2010) delivered for the PQN project, and the activity levels concept (Michon, 1979). The aim of the workshop was indicated as shedding light on the degree to which human needs play a role in walking and sojourning choices, and what this means for W+S system requirements.

Apart from an introduction, the workshop included 4 sub-sessions: 'Listing motives', 'Classification of motive-target groups', 'Identification of W+S system requirements' (in sub-working groups) and 'Conclusion'. As the working group session could not cover all questions within available time, conclusions were drawn afterwards by the author and finally authorised by the participants through the (Dutch) Workshop report (Methorst, 2013).

d. Utilized sources

For answering the walking needs research question the results of earlier projects and a variety of sources were used for building the insights and conclusions: reports from the PQN project (Methorst et al., 2010), OECD/ITF Pedestrian Safety, Urban Space and Health (OECD/ITF, 2011) and Lopen Loont (CROW, 2014); Google Scholar search (accessed in September 2014 and September 2018); theoretical considerations in the context of this thesis; the Pedestrians' needs workshop experts; literature suggested by the workshop participants.

e. Process results

Based on theoretical preparations a full-day expert workshop was held on the 19th of June 2013 at Rijkswaterstaat Water, Traffic and Environment in Delft. The workshop resulted in listing 62 different motives for going outdoors on foot, a tentative classification of motives to 'why' and 'who', general indications for activities and group related W+S system requirements, general observations regarding W+S activity classifications, and general conclusions about what is known, what can be abducted and what aspects need further attention or further research.

[166] E.g. Google Scholar search on 'pedestrian needs', repeated on 10-09-2018: 353,000 hits; the first 10 pages of 10 hits did not yield any publication about pedestrian needs in general.

The workshop focussed on needs with regard to the physical environment and paid only superficial attention to needs with regard to the social-normative, transportation, health and information technology needs and came to conclusive statements regarding pedestrian needs. Some gaps in coverage, including drawing conclusions, were dealt with after the workshop and authorised by the attendants by e-mail.

In order to draw further conclusions for this thesis the authorised workshop report was subsequently analysed on coverage and (face) validity of answers to the sub-study research questions. Through this analysis a number of gaps in coverage were found, some of which could be supplemented with findings from other sources (see above) or dealt with in other parts of this thesis. For the other found gaps further research is needed. The tentative results are described in Subsection 4.3.3.

4.2.2.4. Walking abilities

With regard to the W+S population the third subject approached was the identification of the W+S abilities of public space users in the Netherlands. Walking and sojourning in public space comprises a variety of sub- and complementary activities or tasks, from enabling future walking trips, deciding on reasons to go outdoors to actually walking, opening the door at the targeted destination and many (implicit) tasks in between. These tasks imply both mental and physical abilities of all (potential) public space users needed for (if possible) independent, agreeable and safe walking and sojourning in public space. Knowing that total population of public space users on foot is larger than the population of citizens of the Netherlands (or any other country), visitors of the country were also included in the approach. For the same reason of comprehensive coverage, other groups which are normally excluded from statistics, like professional and long distance walkers[167] are included, too. The aim was to draw valid conclusions regarding the total demand for better than standard W+S conditions on the strategic as well as tactical and operational behaviour levels, attuned to the Design for All / Universal Design principle and the United Nations resolution on the Rights of Persons with Disabilities (United Nations, 2006).

a. Research questions and ambition

With regards to the identification of W+S abilities of public space users in the Netherlands the research question for this sub-study is:

How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?

This research question is worked up in three parts (detailed research questions):

[167] In the Dutch national travel surveys trips longer than 2 hours and walking trips made by professional walkers like postmen, salesmen, road workers are excluded, mainly because these were expected to be relatively rare and not seen as 'transport' but 'work'; up to 1992 children younger than age 12 were excluded because of difficulties of interviewing them. Because of research costs and validity of answers CBS currently (2019) decided to again exclude children from the survey.

- What W+S tasks are (potential) pedestrians to perform?
- What kinds of abilities and skills are involved in W+S tasks?
- How do W+S abilities and skills translate into W+S system requirements consistent with Design for All?

The ambitions are to systematically explore what is known about walking and sojourning task abilities and, based on (triangulation of) available statistics, to find out how these are currently distributed across Dutch citizens and visitors of the Netherlands.

b. Research approach

The research builds on earlier projects which were also based on empirical evidence supplemented by expert's tacit knowledge about specific group's limitations of pedestrian task abilities and their distribution. Based on many discussions with (international) experts the author concluded that the most important contributions in this regard are the work of Sandels (1968), various traffic task analyses by the Groningen Traffic Safety Study Centre[168], Asmussen's New Reference Standard Human (1996), Fuller's model on road safety task demands (cited in Wegman & Aarts [eds], 2005), O*Net (US DOLET supported website), the PQN project (i.c. Vukmirović, 2010) and the OECD/ITF projects on Ageing and Transport and on Pedestrian Safety, Urban Space and Health (OECD, 2001; OECD/ITF 2011). The combined results were used to develop an, with respect to Vukmirović's work within PQN (2010), updated classification and substantiation of pedestrians' abilities and corresponding W+S system requirements.

The update of the W+S abilities classification was outlined through a brainstorm discussion by the author with Willem Vermeulen[169], and substantiated through searching the W+S documents database, internet searches regarding the identified (dis)ability groups and reliable statistical sources (1. CBS Statline, 2. Knowledge institutes, 3. dedicated specialised institutes). In cases that no group volume figures were available such figures were estimated by applying similarities and available statistical sources (estimation methods are described in Appendix 5).

With regard to the identified disabilities barriers to full participation in society were translated into ability-based W+S system requirements. For this, New Zealand Land Transport's, Vukmirović's and Asmussen's initial conclusions in this regard were supplemented with a search for clues from a variety of other sources in the W+S documents database. In order to rate the identified requirements in relation to (potential) pedestrians' abilities, information was gathered regarding:

- Group volumes of disadvantaged groups through available statistics and complementary estimations by expert organisations (calculations described in Appendix 5; results summarised in Table 4.11);

[168] From the 1977 - 1996 Groningen University supported a dedicated institute on social traffic science, i.e. the relation between humans and traffic including everything that non-technical sciences can learn about this relation. It was called Verkeerskundig Studiecentrum (Traffic Safety Study Centre). Central themes within social traffic science are: human behaviour in traffic, traffic safety, traffic education and traffic liveability.

[169] Willem Vermeulen was the Dutch Pedestrians Association's main researcher and until June 2020 senior researcher/advisor traffic safety behaviour at Rijkswaterstaat Water Management, Infrastructure and Environment.

- Indications of urgency of treatment regarding the various impacts of disadvantages and impairments concerning walking and sojourning through expert (duo[170]) assessment of mobility and safety risks (calculations described in Appendix 5; results summarised in Table 4.12abc);
- Indications of potential societal impacts of meeting the identified W+S system requirements through expert (duo) assessments of mobility and safety benefits (calculations described in Appendix 5; results summarised in Table 4.13ab).

c. Utilized sources

For answering the walking abilities research question the results of the above precursory projects, results from Google Scholar and statistical data from CBS Statline (particularly population and health statistics), Dutch knowledge institutes and dedicated specialised institutes were used.

For the exploration of openings for improvements the research built on theoretical principles (Design for All / Universal Design, Cascade principle and Reason's Cheese Model; Reason, 1990), the Theory of Planned Behaviour (Fishbein & Ajzen, 1975) as well as handbooks, guides and guidelines on W+S.

The research results and references to literature and data sources (CBS Statline[171]; institute and publication year) are entered in Section 4.3.4.

d. Process results

The research on the Dutch population's W+S abilities was carried out in the period of March to December 2018. The research was built on earlier projects and the collection of documents and (Dutch) statistics on the subject have been updated; general features of the documents are included in an Excel database, which is available for further research and policy making. The study delivered a broad overview of distribution of the Dutch population's (dis)abilities regarding walking and sojourning in public space on the strategic and tactical/operational behaviour levels. The study yields a comprehensive, but imperfect sketch of what is known and what is not known about (potential) pedestrian's abilities and what W+S system requirements can be formulated to ease off and remedy consequences of disadvantages that less able and skilful (potential) pedestrians experience regarding their walking mobility. The research results are not always conclusive; in most cases further research is needed to acquire more validity, certainty and detail. Important gaps and uncertainties in knowledge are noted. Research results are presented in Subsection 4.3.4. of this thesis. Draft reporting has been reviewed by a number of expert colleagues (see Appendix 4). The comments of the reviewers led to important precisions and nuancing of the findings and conclusions, in particular regarding the content of the summarising tables 4.11, 4.12 and 4.13 and their descriptions: urgency, benefit and impact scores were developed, prepared, calculated and included in the tables. The tables presented in

[170] The expert duo consisted of Wim van den Boogaard and the author. Wim is a retired mobility and safety policy advisor at Rijkswaterstaat, and is now connected to Wandelnet (the Dutch wandering association) as volunteer-policy advisor.

[171] Whenever possible the classification W+S population groups leans on general statistical classifications. W+S population volumes are calculated from CBS-Statline data (Population statistics: generation, gender, age and migration background; volume by age-years group). The volumes of the groups are calculated by summing the respective age-years groups. The data table is downloaded as Bevolking__migratiea_310818145057.xlsx. The link to the webpage is:
http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=37325&D1=0&D2=a&D3=a&D4=0&D5=0%2c2-8%2c10&D6=4%2c9%2c14%2c20-22&HDR=G5&STB=G1%2cG2%2cG3%2cG4%2cT&VW=D

Chapter 4, including the scoring results and references to sources are included in a dedicated Excel file[172].

4.2.3. Exemplary walking and sojourning arrangements

4.2.3.1. Introduction

This subsection deals with the chosen research approach to the exploration of the supply side of walking and sojourning in public space, to find out what sets of circumstances and their timing make walking and sojourning feasible and attractive, i.e. what W+S system providers should deliver to support walking and sojourning so that it optimally contributes to well-being, prosperity and sustainability of individuals, communities and the nation. Following Van Hagen (2006, see also Section 3.3.4) this concerns 1) providing for *basic conditions* to reliably enable safe walking and sojourning in public space, 2) dispelling *dis-satisfiers*, which preclude people from choosing to walk and sojourn, and 3) offer *satisfiers*, which persuade people to walk and sojourn in public space.

Linked to the research into the pedestrians' environmental settings, W+S needs and abilities (see Section 4.2.2., 4.3.2., 4.3.3 and 4.3.4.) the therefrom required basic conditions were already identified and sketched. Little attention is however paid to what dis-satisfiers and satisfiers are operative in practise, how dis-satisfiers can be dispelled and satisfiers be offered to promote and persuade people to walk and sojourn in public space more.

Theoretically 'opportunities' are shaped by the (potential) pedestrian's environment, i.c. social-normative environment, physical environment, transportation environment and information (ICT/ITS) environment (see Pizza Model in Section 3.3.4). The extent to which the status quo of these components create walking and sojourning opportunities is managed by a variety of stakeholders. Each of them have their own interests and aims, influences, practises and sources of information. W+S opportunities are not necessarily the consequence of dedication to improving conditions for pedestrians, just like '*people engage in healthy behaviour for* [other] *reasons than to be healthy'* (New Zealand Land Transport, 2019:16). The trick is to find out how interests and practises synergise to improve W+S conditions and opportunities.

In this sub-study on W+S opportunities exemplary arrangements with regard to the system components, as identified in the Pizza model (see Section 3.3.4) are explored. In this subsection the approach is elucidated, describing a) dedicated research questions and ambitions regarding research results, b) research approaches and motivation, c) utilized sources and d) process results regarding the sub-studies.

4.2.3.2. Research questions and ambition

With regard to the identification of suitable walking arrangements for the W+S population in the Netherlands the research question for this sub-study is:

What kinds of W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians adequate and tempting W+S opportunities, now and in the next decade?

This research question is worked up in three parts (detailed research questions):

[172] The Excel file (Ch4 tables.xlsx) is available on demand.

- What kinds of conditions are (potential) pedestrians looking for?
- What factors frame the genesis of W+S opportunities?
- What kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

This ambition is to broadly explore ('scoping review') and discover what aspects should be treasured and included in policies to encourage walking and sojourning in public space. In this regard findings regarding content and arguments for W+S arrangements should be classified and crudely rated in relation to the W+S system components (cf. Pizza model) 1) to offer basic conditions, 2) dispelling dis-satisfiers and 3) offering satisfiers for facilitating and promoting walking and sojourning in public space, so that conclusions can be drawn regarding the relative potentials for improvements of W+S conditions on the strategic (long term), tactical (mid-term) and operational (short term) policy levels.

4.2.3.3. Research approaches

The scoping review research approach regarding the exploration and rating of W+S arrangement requirements is based on broad analysis of relevant documents in the dedicated W+S documents database. The research focuses on analysis of internationally and nationally available handbooks, guides, guidelines, norms, proven measures and best practises concerning spatial, physical, social, transportation and policy arrangements regarding walking and sojourning in public space. A stepwise approach was followed including:

1. Broad selection of documents linked to the subject of W+S opportunities;
2. Analysis of content lists, abstracts and introductions regarding mentioning
   i) preconditions, stimuli or deterrents for pedestrian activities,
   ii) benefits from W+S that are likely to stimulate stakeholders to improve W+S conditions;
   iii) guidance regarding offering W+S opportunities;
3. Selection of documents for further analysis. Selection criterions are:
   i) concerns general walking and sojourning opportunities as a whole, not strictly limited to specific behaviours like risky street crossing, jogging etc.;
   ii) reasonably documented;
   iii) is not followed up by more recent publication;
4. More detailed analysis of the selected documents: making excerpts, checking references, and 'snowballing' or additional search on Scopus, Google Scholar or Google/Startpage.com, if information is not plausible or clear;
5. Analysis and categorisation of notes and excerpts;
6. Reporting results and conclusions.

4.2.3.4. Utilized sources

The 'scoping review' started from the dedicated W+S documents database. Scopus, Google Scholar and Startpage.com were used for searching verification and update on W+S determinants and policy guidance documentation.

4.2.3.5. Process results

The research on the Dutch population's W+S abilities was carried out in the period of December 2018 to June 2019. From the dedicated W+S documents database a list of more than 100 potentially relevant documents was compiled. Content lists and introduction sections were read to determine whether more detailed analysis could be worthwhile. After broad analysis 89 documents were selected. Where indicated, further study was carried out. Regarding each of the documents notes or excerpts were made on (potential) opportunities for walking and sojourning in public space and how to carry them through. This way mentioned principles, conditions, factors or procedures which were indicated to directly or indirectly affect the volume or quality of walking and/or sojourning in public space were captured: consequent W+S activities, convenience, comfort, ease or attractiveness, safety, primary or auxiliary motivations, barriers or experiences and side effects. Subsequently the notes were sorted on links to one or more of the (Pizza model) system components, to abstraction and policy levels, and to stakeholder relations. The results of the selections are reported in Section 4.4.2 to 4.4.8. In Section 4.4.9 conclusions regarding potential W+S opportunities are recorded.

4.2.3.6. Review of Section 4.4. Exemplary W+S arrangements

The first draft of the report on results of the scoping review of the selected overview and guidance documents (October 2019) is submitted to a small group of three experts[173]. In the current version of the section their comments and suggestions have been assimilated.

4.3. The pedestrian population

4.3.1. Introduction

According to the NOA model (Steg & Vlek, 2009) people's behaviour is governed by needs, opportunities and abilities at hand for undertaking a particular activity. Mobility and also walking and sojourning in public space (W+S) can be considered instrumental for satisfying basic and more general human needs as (for example) listed by Lapintie (2010). Needs, opportunities and abilities are affected by environmental settings. As such environmental attributes, needs and abilities underlie people's tendency to search for opportunities to become active as a pedestrian, i.e. take up the role of being a pedestrian and for any reason walk or sojourn in public space. Needs and abilities with regard to W+S are characteristics of people or the population and represent the demand side whilst opportunities represent the supply side of the equation.

This section deals with current and future characteristics of the population relevant for understanding what their needs and abilities are regarding W+S. In the next section, Section 4.4. W+S system arrangements, the offered opportunities by the (potential) pedestrian's environment, i.e. the physical, social, transport and information and communication technology, will be elucidated.

[173] Viz. Derk van de Laan (independent publicist on sustainable and active transport), Dr. Paul Schepers, former senior advisor (safety and Human Factors) at Rijkswaterstaat, and now senior researcher at SWOV Institute for Road Safety Research, and Willem Vermeulen former researcher at the Dutch Pedestrians Association and now senior advisor Human Factors at Rijkswaterstaat.

The research questions in this section therefore are:

- *In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?*
- *How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?*
- *How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?*

This research builds on earlier projects and literature about typologies of pedestrians and conceptual models of the pedestrian populations' needs, abilities and behavioural potentials, as well as sketches of desirable opportunities and spans of operational control. Successively the section deals with environmental settings for W+S behaviour (Subsection 4.3.2.), the translation of needs, wants and desires into reasons for walking and sojourning in public space (Subsection 4.3.3), translation of task abilities into functional requirements of W+S arrangements (Subsection 4.3.4). The section is rounded off by Subsection 4.3.5. on conclusions regarding W+S population based system requirements.

Ultimately the proof is in eating the pudding: the level of activities shown by the various pedestrian groups, the safety of W+S, the way the pedestrian's higher order goals[174] are met and their perceptions and satisfaction and the longer term social, ecological and economic impacts of W+S. This will be dealt with in Chapter 5 on the status quo of the W+S system.

4.3.2. Environmental settings for W+S behaviour

Needs, opportunities and abilities arise within a setting of environmental conditions[175]. In the course of time the definition of pedestrians, how they are looked at, has changed. In ancient times walking was the main mode for almost everyone. Walking was the normal way to move about. This changed fundamentally with the rise of the car (Amato, 2004; Plowden, 1971; Jacobs, 1961; Gehl, 1971; Hass-Klau, 1990; Jeekel, 2011). The subsequent life conditions set the stage for life styles, reflecting needs and relevancy of abilities connected to the life conditions. Chapter 3 concluded with a general Conceptual Framework Pedestrians Behaviour, presenting the main factors influencing W+S behaviour on the various activity levels (see Figure 3.11.). What the general model does not show is the diversity of the (potential) pedestrian population, related to individual, household, socio-psychological and neighbourhood characteristics. With their useful conceptual framework on strategic choices regarding walking behaviour Clifton and Livi (2004) underline that, apart from the (neighbourhood) physical and transportation characteristics, attention should be paid to differences in individual and household characteristics, such as socioeconomic, demographic, life cycle and health attributes, and also socio-psychological characteristics like perceptions, attitudes and lifestyle preferences. This subsection pictures population attributes that affect (potential) pedestrian needs and the relevancy of pedestrian abilities.

[174] buying grocery, have a nice time, get to the bus in time etc.

[175] With regard to the policy environment the author discerns seven (interacting) dimensions: international context, physical context, transportation context, social and cultural context, economic context, technological context, political context (see Chapter 6 on the Institutional Framework).

The research question for this subsection is:

In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?

The later Subsections 4.3.3 and 4.3.4 reproduce insights in the variety of respectively need and abilities. Together the insights regarding environmental settings, needs and abilities underlie the conclusions about general functional W+S system requirements presented in Subsection 4.3.5. In Section 4.4. requirements regarding the individual W+S arrangements, i.e. regarding the social, physical, transportation and information technology environment attributes are researched.

From processing available documents[176] regarding pedestrian population attributes the author abducted that the following (interacting) population or life style attributes in some way affect W+S needs and connected W+S system requirements: 1) everyday living environment, 2) socioeconomic status, 3) the life cycle and demographics, 4) access to transportation, 5) socio-psychological characteristics, 6) access to information and information technology, and 7) general health. In the following sub-subsections these attributes are explored.
Each sub-subsection includes[177] a. *definition, scope and relevance* of the attribute for W+S, b. which *groups* can be discerned, c. why the attribute affects W+S (*Interrelations*), d. *where and when* the attribute affects W+S, e. how the attribute impacts W+S needs and abilities (*Impact on walkers*) and f. what the *significance is for W+S policy making*.

With regard to policy development it can be useful to distinguish both steady and modifiable conditions. Although both set the stage for the individual's contemplations, decisions and actual W+S behaviour, steady conditions need to be considered as a fixed precondition, for which specification of requirements is pointless. The below sub-subsection identifies steady conditions and in general terms discusses the influence of major modifiable conditions on the arising of W+S needs, abilities and opportunities. In the later subsections more specific requirements of modifiable conditions for better supporting W+S will come about.

1) Everyday living environment

a. Definition, scope and relevance

The attribute *everyday living environment* concerns residence and other areas in which a person sojourns and moves about on a (nearly) everyday basis, such as working, school or holiday environments (so called *secondary whereabouts*). *Residence* concerns the fact of living in a particular place (Oxford dictionaries, 2018[178]).

As for scope and relevance, it must be noted that there is very little information about walking and sojourning from and towards secondary whereabouts (e.g. work place, hotel, camping), this sub-study focuses on residence, assuming that most influences on walking and sojourning volume and quality are similar. In most cases the residence is the base of operations, the place where the (potential) pedestrian travels from and after the journey comes back to. As such residence (and secondary whereabouts) affect strategic travel and sojourning choices, i.e. where to go to and whether or not to walk or go by some form of transportation, conditional upon the (independent) reach of (potential) pedestrians, their attitudes towards walking (see below under

[176] Excel database and document folder, containing in total 3,400 documents (status November 2018).
[177] The concerning explanatory texts are headed as indicated in italic letters.
[178] https://www.lexico.com/definition/residence, accessed 24-6-2020

social-psychological factors) and availability of destinations that matter within reach (Cerin et al., 2007). For pedestrians this reach varies from nihil to a couple of kilometres (on average about 1 kilometre), but depends largely on their walking abilities (Bach, 2006; Methorst, 2010). Given the limited reach of walking, the distances between residence and destinations that matter largely determine the degree of freedom of movement and mobility on foot, giving scope for W+S needs and abilities. The actual reach as representant of structural demand of Dutch pedestrians is documented through mobility surveys (N.B.: does not represent latent or suppressed demand). The Dutch travel survey data (Rijkswaterstaat MON 2004-2009; CBS OViN 2010 - 2017) show dominance of walking in short trips up to 1.0 kilometre. From older mobility survey statistics (MON 2004-2007) it is found that the share of walking in trips up to 500 meter is about 75% and in trips from 500 meters to 1 kilometre the share was a little more than 50%. In the years 2010-2017 the average share of trips on foot up to 1.0 is on a similar level of 60.8%, dropping to 20.6% for trips between 1.0 and 3.7 kilometres, where dominance is taken over by the bicycle (42.2% of these trips; see table 4.1.)[179]. In sub-mode trips, i.e. trips to and from other modes, walking is even more dominant (almost 70% of all sub-trips, viz. 5.0 sub-trips per person per day (Methorst, 2010; Van der Waard & Visser, 2018), of which about half is home based or home oriented (see also Section 5.4.2).

Table 4.1. Average shares in number of trips (2010-2017) in the Netherlands, per distance class.

	Distance classes		
Mode:	< 1.0 kms	1.0 - 3.7 kms	all distances
On foot	60.8	20.6	18.4
cycling	28.6	42.2	26.9
Other modes	10.5	37.3	54.7
Total	100.0	100.0	100.0
Source: Calculated from CBS Statline / OViN 2010 - 2017			

A tentative look at selected documents[180] in the W+S documents database learns that, in terms of mobility patterns, residences can be categorised by types of households and homes (of which e.g. Rubin & Zijlstra, 2018 give useful examples), neighbourhood characteristics and living conditions, land use, and urban form (see e.g. Clifton & Livi, 2004). Relevant types of households are discussed below under '3. Demographics'. The various *types of homes,* such as single person apartments, multi person apartments, detached, semi-detached and free standing houses, can foster different walking mobility patterns (e.g. Rubin & Zijlstra, 2018)[181]. *Neighbourhood attributes* concern urbanity (urban, suburban, peri-urban or rural), social stratification, mix or mono-functionality of properties, presence of sidewalks, pedestrian crossings, seating, greenery, and age, types and state of buildings, legibility, attraction points and landmarks (e.g. documented by Parks et al., 2006; Kerr et al., 2010; Carr et al., 2010; Manaugh et al 2011; Wang et al, 2016). *Land use* concerns the distribution of land use, such as residences, shopping, services & repair, offices, industry, recreation, transport transfer points

[179] This concerns walking as a main mode, i.e. trips without using a vehicle. The figures are calculated from MON 2004-2009 published by Rijkswaterstaat on CD-ROM and OViN data 2010 – 2017 published on CBS Statline (i.c. people mobility in the Netherlands: travel characteristics, modes and regions)
[180] Subject 2 = behaviour - performance (*mobility, sojourning)
[181] No publications have been found regarding the impacts of types of homes on walking and sojourning. It is known however that residents of homes that do not have outdoor space, if they want to be outdoors, are compelled to go to nearby parks, squares etc. to get fresh air or some sun.

(parking places, public transport stops and stations) etc. (e.g. Radbone & Hamnett, 2003; Handy, 2005; Brown et al., 2009; Abbott & Klaiber, 2010; Community Guide, 2016). *Urban form* concerns the urban zoning structure and lay-out and connectivity of transport networks, and can be typified by historic evolution of growth (cf. medieval, industrial or New Town), compactness, barriers for walking between neighbourhoods etc. (e.g. Berrigan et al., 2002; Frank et al., 2005; Schlossberg et al., 2006; Kerr et al., 2007; Barros et al., 2017). Land use and urban form in general can be considered relatively steady conditions; neighbourhood attributes are slightly more modifiable.

It needs to be noted that residence interrelates with attitudes towards walking[182], Social-Economic Status (SES) and health (see also below under Social-Economic Status, Life cycle and demographics, Socio-psychological characteristics and General Health).

b. Everyday living environment based (potential) pedestrians groups

Based on review of the variety in the available W+S documents the author concludes that several perspectives can be taken for grouping (potential) pedestrians with regard to everyday living environment and W+S decisions and behaviour. Some important perspectives for grouping are territorial position, urban form, type of housing, household type, residence suitability, and neighbourhood or area walkability scores.

With regard to *territorial position* the following major groups of (potential) pedestrians are discerned: 1) urban, 2) suburban, 3) peri-urban, 4) rural populations, and 5) foreign visitors and tourists. Within 'urban', based on mobility characteristics there can be sub-classes 'town centre urban' and 'urban ring'; within suburban, residents will have different mobility characteristics if they live in different *types of housing*, such as high rise apartment buildings, low rise detached or semi-detached, or free standing home sub-neighbourhoods (Rubin & Zijlstra, 2018). Schaap et al. (2015) found that people in very urban areas walk most (32% of their trips), then urban (24% of their trips) while rural citizens walk least (19% of their trips).

Like territorial position, the other residence groups' classifications mentioned cover different distributions of walking and sojourning decisions and behaviours. *Urban form* affects neighbourhoods and the typical characteristics of their inhabitants. Three dimensions define urban form: densities, land use patterns and street networks (Ozbil, 2009). The neighbourhoods can for example be typified as organic urban form (e.g. the old town or village) or planned urban form, such as the 19th and early 20th century developments (which have a mix of housing, services and industry), 1950s post war developments (lower density, but still a mix of functions) etc. Because of the land use mix, density and walking destinations that matter, the older neighbourhoods can be expected to be more walkable than the most modern ones, which are better suited for bicycle and car use. On the local level figures about the distribution of groups according to urban form are often available; it is however very difficult to sketch the population distribution on the national level as there is, as far as the author knows, no unifying classification and indication of volumes of the groups.

Household type and W+S behaviour can be classified as: single person household, multi person household (with or without young children, group households) and institutions. This grouping will be dealt with below under lifestyle and demographics.

[182] Persons who hate walking and prefer to drive around can choose residences without taking walkability into account.

Not everyone has control over *residence (or everyday living environment) suitability.* Some individuals or households lack freedom of choice in residence options (see e.g. Martens, 2012; Albertsen & Diken, 2001, Kinigadner et al., 2016). Important factors appear to be affordability of residences[183] (see e.g. Litman, 2018; Wu, 2012; Unia, 2018), whether people rent a house or own it (see e.g. Unia, 2018), social roots (see e.g. Albertsen & Diken, 2012) and fundamental changes in land use while living at their residence (see e.g. Jacobs-Crisioni, 2011, p 29). Furthermore, not everyone values to have destinations that matter to be within walking range (see e.g. Van de Coevering, 2012; Kortum et al., 2012). Although obviously freedom of choice in this respect is a precondition for choosing the right residence, the author did not find convenient solutions to identify people or households who have both limited options and W+S-unsuitable residences.

Table 4.2. shows the volumes of residence pedestrians in various territorial conditions. The group Foreign visitors and tourists, consists of persons who do not have a permanent residence in the Netherlands, but who have a high walking propensity[184] because they want to explore the surroundings and can be expected to favour walking for doing this. Data on numbers of people in groups regarding urban form, type of housing, everyday living environment suitability and neighbourhood or area walkability are not available on the national level, though occasionally present at research and statistical agencies in the largest cities.

Under Subsection 4.3.6. key system requirements, matching their needs, desires and abilities will be specified.

Table 4.2 Volumes of everyday living environment pedestrians groups in various territorial conditions

Pedestrian - residence groups	Volume x 1000	NL Population %	Walking propensity
Very urban	3,850	22.7	****
Urban	4,300	25.4	***
Sub-urban	3,200	18.9	**
Peri-urban	2,850	16.8	*
Rural	2,750	16.3	*
Foreign visitors and tourists	125	n.a.	*****
source: CBS Statline april 2018 - data 2016			

c. Interrelations between everyday living environments and other environmental settings

As base of operations *residence* in most of the cases determines the position relative to functional destinations and thereby the effort needed to reach such destinations. Crucial is the availability of destinations that matter within walking distance (Cerin et al., 2007). If there are no such destinations people will be discouraged to walk and will use other modes. Furthermore, for some needs, it determines whether or not certain trips are desired or necessary[185]. Apart

[183] Litman (2018:3): *'Since housing and transportation are most households' two largest expenditures, these factors significantly affect affordability'.* He corroborated this with statistics similar to Dutch statistics on the subject.

[184] Walking propensity is meant to picture the degree of freedom or lack of options to choose alternative travel modes.

[185] For example apartment residents generally do not have a garden to work or sit in; for this they need to go outdoors. Farm residents can grow their own food and do not have to buy it in supermarkets etc.

from having a base of operations, residence can have many other functions and reasons. From literature (e.g. Kortum et al., 2012; Zondag & Pieters, 2004) it is shown that one's residential status (or moving house or more than one place to live) can be connected to one's social roots, civil status, life stage, ambitions, wish for independence or dependence on others, social-economic status (SES), location of employment, responsibilities and accountability, whether one needs to rent or can own a home, political reasons, 'fate' or inertia in decisions to change residence, for example because of difficulties of selling one's home or illnesses in the family. Such conditions can affect strategic, tactical and even operational W+S decisions and behaviour.

d. Where and when everyday living environments make a difference for walkers

In centre-urban district residents and sojourners are likely to be able to reach most of their essential destinations[186] on foot via traffic shielded and paved sidewalks or low speed shared spaces, because of city compactness and function mix, at least within business hours. Suburban, peri-urban and rural residents generally will not have that luxury. Compact central urban, low rise neighbourhoods, greenery, compact cities, mixed land use, accessible properties are associated with more walking (e.g. Currie & Develin, 2002; Duncan & Nummery, 2005; Kim, 2011; Cerin et al., 2007).

Schaap et al. (2015) found that in city neighbourhoods the share of walking trips increases when there is 1) a large share of non-western population, 2) large share of low income population, 3) relative young population, and/or 4) the presence of one-person households.

For the majority of people, except maybe students and pensioners, sojourning activities are limited to leisure time, i.e. non-business hours. In low rise suburban neighbourhood, peri-urban and rural areas, but not so much in centre-urban areas, greenery is available for recreation.

e. Impact of everyday living environments on (potential) walkers

In a person’s life everyday living environment choices are relatively rare and often occur at life cycle changes (Savelberg et al., 2012). Because of financial, civil and household state, socio-cultural or legislative conditions, and possibly subconscious needs like status or personal conditions like obesity, not everyone is able to choose freely and independently where to live and determine one's own residential conditions. This way residential conditions do not always match resident's needs, preferences and abilities. Everyday living environment impacts on all of the discerned population attributes and thereby on the (potential) pedestrian's W+S needs, preferences, abilities and opportunities for walking and sojourning.

General environmental impediments to everyday living environment based walking are absence of attractive functional destinations, traffic nuisance, safety and security hazards, cold, wet and windy weather conditions (e.g. Walton & Sunseri, 2007).
Mobility data (e.g. Rijkswaterstaat MON, CBS OViN) show that urban populations tend to walk most; suburban tend to walk less; peri-urban and rural populations are likely to walk relatively little, because they have fewer functional destinations within reach, safe walking conditions are less likely to be available (fewer sidewalks, many gaps in the traffic separated foot network) and because other modes suit their travel needs better and they often have a car at their disposal.

[186] In many cases this does not apply to working places and outdoor recreation spaces.

Because society and the physical environment have been thoroughly adapted to car use, many essential destinations can no longer be reached within walking distance from everyday living environments; society has become car-dependent (Jeekel, 2011). With regard to residence (and probably also secondary whereabouts) based *mono modal walking* (door-to-door) behaviour the main determinants are the (potential) pedestrian's willingness and ability to walk distances, presence of desirable destinations within walking range, available time, walkability and accessibility of the route to and from those destinations, and access to and attractiveness of alternatives to walking (e.g. Cerin et al., 2007). With regard to residence (and probably also secondary whereabouts) based walking to and from other modes (*sub-mode walking*) towards the alternative modality transfer points the same mode choice determinants apply. Everyday living environment based s*ojourning* can only be done on foot, but the degree of 'exposure' depends on the individual's preferences and abilities, local opportunities and attractiveness for these activities.

f. Significance of everyday living environments for W+S policy making

Knowing broadly the content, persons involved, why, how and where and when the individual's residence affects W+S, policy implications can be assessed.

With regard to the *volume and severity* of impacts in relation to public property the author concludes that very urban and popular visiting places for foreign visitors and tourists are most heavily used and therefore the most cost-effective places to facilitate pedestrians. On the other hand, less densely populated and used residential areas are likely to have less and lower grade facilities and because of that more individual walker-problems. Because of their volume of demand and propensity to walk and sojourn in public space much the centre urban residence (and secondary whereabouts) population, foreign visitors and tourists deserve priority when formulating W+S system requirements.

With regard to *system impacts* the non-very urban areas can be expected to be largest and gravest, where most walking and sojourning is done. Most people have their homes outside of the city centres, most of their trips begin and end there, while the quality of facilities is less likely to be monitored and kept in a good condition[187]; also, people's day-to-day recreational walking and sojourning will take place in the vicinity of their homes. In systems-terms this means that it is most important to provide adequate facilities nearby in non-central areas, particularly in areas with a large share of captive walkers (see below under Social-Economic Status).

A *solution* to mismatches between everyday living environments and walking and sojourning and public space can probably be found in a balanced policy approach, where density of use as well as impact on overall realisation of general needs (wealth, well-being, health) by (non) walking and sojourning are explicitly taken into account. Density of use is not only determined by door-to-door (main mode) walking, but just as much by walking to and from other modes (sub-mode) and sojourning. These forms of use deserve equal attention.

[187] from looking at a variety of public space policy plans it can be seen that these focus on city centres and that (much) less attention (and money) is given to public space outside those areas.

2) Socio-economic status

a. Definition, scope and relevance

According to the Dictionary of Public Health (2007[188]) '*social economic status (SES) is a descriptive term for the position of persons in society, based on a combination of occupational, economic, and educational criteria, usually expressed in ordered categories, that is, on an ordinal scale.'* Sometimes other criteria such as place of dwelling, ethnicity, literacy, cultural characteristics are also included. '*Socio-economic factors are lifestyle components and measurements of both financial viability and social standing. They directly influence social privilege and levels of financial independence*' (Mcleod, 2017[189]; Adler, 2002). Socio-economic status is found to be an important determinant of travel mode choice in many studies (e.g. Martens, 2018; Jeekel, 2011; Björklund & Jäntti, 1999). Frequent air travel and strong car dependence for example are associated with high level income and high skilled professions, whilst low income groups cannot afford (frequent) air and (abundant) car travel; about 35% of the unemployed and 60% of the very low income households are car-less and largely dependent on walking, cycling and public transport[190]. The latter are captive walkers. Social-economic status also affects the perceptions of time and speed and thereby attitudes towards walking and walking propensity. Busy high level income and educated people are known to feel pressed for time, often have reasons to go to destinations beyond walking distance, and choose not to walk except for recreation or sports as it is perceived to take too much time.

b. Social-economic status based pedestrian groups

In this thesis, with regard to Social-economic status (SES) and walking, following the common definitions of SES, pedestrian groups are discerned concerning employment, education, occupation and household income. For each of these distinctions subgroups are discerned. With regard to employment the discerned groups are children (age 0-15), students, employed work force, unemployed, not employed and retired persons. With regard to education the discerned groups are children/students (age 0-15), primary + secondary school education, mid-level professional education, high level (sub)academic education, and retired persons. With regard to occupation distinction is made between office workers, outdoor workers, professional walkers[191], foreign visitors and tourists and domestic holiday makers and tourists. Finally subgroups were discerned regarding household income based on income level and source, respectively the five successive 20% groups with low to high incomes and the groups income from employment and income from enterprise (the latter group has the highest car ownership and dependency).

SES is a key factor in walking and sojourning propensity and attitudes, which to a large extent determines residence, vehicle ownership and walking captivity (Cerin et al., 2009; Anable et al., 2010). Table 4.3. pictures SES related group volumes, population or household number shares and estimated W+S propensity[192]. The high propensity groups are children/students (age 0-15), retired persons, professional walkers, foreign tourists, domestic holiday makers and tourists, and the lowest 20% incomes and unknown income groups. These groups can be

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188 http://www.oxfordreference.com/view/10.1093/oi/authority.20110803100515750, accessed 23-3-2018

189 https://classroom.synonym.com/list-of-socio-economic-factors-12083166.html, accessed 22-3-2018

190 based of Netherlands Statistics data, see: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81845NED/table?ts=1526199998934

191 Professional walkers include postmen, road workers, neighbourhood police patrollers, window cleaners, street vendors, parking attendants etc.

192 W+S propensity roughly rated in stars: one star means low W+S propensity, 2 stars means average propensity and 3 stars means high W+S propensity or dependence.

expected to have walking as predominant travel mode. Eurostat (2018[193]) reported that there is a downward trend in the share of persons at risk of poverty or social exclusion (in 2008 23.7% of the population was at risk, in 2017 22.5%); in the Netherlands the risk increased from 14.9% to 17.0%.

Table 4.3. SES based pedestrian groups (2015-2016)

SES group	*abs*	*% **	*W+S Propensity*
Employment		Population %	
Children (ages 0-15)	2,781,768	16	***
Students	1,228,417	7	**
Employed labour force	8,511,000	50	*
Unemployed	480,000	3	**
Not-employed	3,842,000	23	**
Retired persons (age 65+)	3,159,660	19	***
Education		Population %	
Children/students (age 0-15)	2,781,768	16	***
Primary + secondary school education	3,717,000	22	**
Mid level professional training	5,089,000	30	*
High level (sub)academic education	3,876,000	23	*
Education level not known	188,000	1	*
Retired persons (age 65+)	3,159,660	19	***
Profession		Population %	
Office workers	6,383,000	38	*
Outdoor workers	2,200,000	13	**
Professional walkers	50,000	0	***
Foreign visitors and tourists	125,000	1	***
Domestic holiday makers and tourists	185,000	1	***
Household income	# households	Car ownership %	
Lowest 20% household income	1,533,000	38	***
Second 20%	1,533,000	61	*
Third 20%	1,533,000	79	*
Fourth 20%	1,533,000	88	*
Highest 20%	1,533,000	93	*
Unknown income	not available	13	***
Income from employment	6,361,950	80	*
Income from enterprise	1,303,050	84	*

Source: calculations based on CBS Statline data 2015-2016
** Because different CBS tables and studies were used as source, and because categories overlap, percentages do not always sum up to 100%*

c. Interrelations between the pedestrians' social-economic status and other environmental settings

The attribute SES affects W+S because it strongly influences mobility and sojourning choices through financial and social position (see e.g. Schaap et al., 2015; CBS OViN, 2010-2017; Brunner et al., 2009), residence conditions (see e.g. Anable et al., 2010), vehicle and driver licence ownership (see e.g. CBS OViN, 2010-2017), worldview (norms and values, political

[193] https://ec.europa.eu/eurostat/documents/2995521/10163468/3-16102019-CP-EN.pdf/edc3178f-ae3e-9973-f147-b839ee522578

colour; see e.g. Wandelnet, 2016; Goot, 2012[194]), aspirations and perspective on walking and sojourning opportunities (see e.g. Anable et al., 2010). With regard to utilitarian main mode and sub-mode travelling high SES affects the amount of walking mostly negative; high SES chiefly boosts recreational walking and sojourning (e.g. Kamphuis et al., 2007). Yang et al. (2012) found that the effect of SES decreases if physical conditions for walking are not suitable.

d. Where and when social-economic status makes a difference for walkers

In most of the cases SES is connected with everyday living environment attributes. The Dutch Social and Cultural Planning Bureau Status scores (SCP, 2012, 2018, expressed also in the National Atlas Volksgezondheid (Public Health)) report that lower status population can be particularly found in the larger cities and in the north of the Netherlands. Furthermore developments in status scores are associated with construction period, number of single person households and share of migrants. In the larger cities the associations are stronger than elsewhere; not all ageing districts however show a decrease in status scores. Examples of the opposite are the centres of growth ('groeikernen') and 'cauliflower districts' ('bloemkoolwijken'), owner-occupied houses and pre-war built homes (Knol et al., 2012).

Property market agents in the Netherlands generally express (voiced in newspapers and other media; consultancy reports, e.g. Buys et al., 1997; SCP, 1998) that high SES scores are often associated with luxury metropolitan residences, low density suburban or rural non-farm residence locations, whilst middle class is mostly associated with middle density sub-urban neighbourhoods and low SES with outer districts of larger cities and high rise neighbourhoods. This is confirmed by checking statistical key figures for districts and neighbourhood (CBS Statline, figures for 2015) such as income distribution and housing prices[195].
From mobility data related to income (CBS Statline, travel survey figures 2010-2017[196]) it can be abducted that utilitarian walking is largely inversely proportional with SES, whilst recreational walking is more evenly distributed.

e. Impact of social-economic status on walkers

The impact of SES on utilitarian walking is mainly associated with the degree to which earning a lot of money, profit, wealth plays a role in a person's life: 'why walk if you can afford to drive'. Captive walking and travel poverty is mostly confined to low SES (Martens, 2018). Car-dependency is stronger amongst high SES. Paradoxically in wealthy neighbourhoods pedestrian facilities are generally better designed and kept; this is an important factor in status and property values. Deprivation incites greater need for quality pedestrian facilities and low quality pedestrian facilities amplify perception of deprivation. In the Netherlands there is a preference for cycling over walking, although in some migrant cultures this is the other way around as cycling is seen as a second rate travel mode compared to car use, not suitable for women (Harms, 2006), or dangerous (Verhoeven, 2009), while walking is seen as unavoidable. For recreational walking and sojourning these relations are more complex; education level, health focus and gender (females) can be expected to correlate positively with sensitiveness for recreational walking and walking for exercise (see e.g. the National Wandering Monitor by Wandelnet, 2010, 2016[197]).

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[194] Goot describes influence of political colour on public transport use.
[195] On the CBS Statline such figures can be found under 'Kerncijfers wijken en buurten'. The most recent data on income, housing prices and car ownership in the tables are for 2015. The data are not available for later years.
[196] CBS Statline, Personenmobiliteit in Nederland, persoonskenmerken en vervoerswijzen, regio. (= mobility of persons in the Netherlands, person characteristics and travel modes, regions).
[197] Wandelnet, Nationale Wandelmonitor 2010 and 2016

f. Significance of the pedestrians' social-economic status for W+S policy making

Social-economic status (SES) is a key factor in walking and sojourning propensity and therefore very relevant for W+S policy making. To a large extent it determines residence, vehicle ownership and walking captivity. Low income and education level groups are more often captive pedestrians than high SES groups (Schaap et al., 2015). For social justice reasons it seems justified to prioritise providing for low SES inhabitants, who have greatest need and lowest clout regarding environment enhancement. Application of the Design for All principle promises to support all public space users. Low SES groups walk more and they more often live in less well-kept and endowed areas although they are more dependent on walking and in need for good walking and sojourning facilities.

3) The life cycle and demographics

a. Definition, scope and relevance

The human life cycle concerns a series of structural changes during a person's life. Biologically there are four main stages of growth and development between birth and adulthood, viz. infancy, childhood, juvenile, adolescence (Bogin & Smith, 2000). Additionally for adults civil status stages are discerned: student/single adult, partnership, family (with children), family (children left home), retired from employment, widowed, very old.

Knowing about lifecycle stages is relevant for walking policy because lifecycle stages go hand in hand with walking ability stages and specific pedestrian facility requirements (cf. Design for All; Asmussen, 1996; Woollacott, 1990). Young children need to learn to walk and cope with traffic (see e.g. Sandels, 1968). At a later stage, when walking has been learned alternative mobility options come about, which also need to be learned, but when so in many cases these (new) options go at the expense of walking propensity. In families with young children the need for using prams and buggies comes about, which means that walking on sidewalks and crossing the streets is less easy, requiring wider and smoother pedestrian facilities. In old age and during and after having serious diseases or accidents, walking abilities degrade (less muscle power, lower walking speed and less balance). This makes people dependent on technical support or on other people and lessens their mobility options (see e.g. Handy, 2002; Cilio et al., 2018).

Demographics are used to describe the structure of the populations (Oxford Dictionaries, 2018[198]), i.e. their size of groups, population composition and group distribution. Everyone is a (potential) pedestrian; consequently the total number of (potential) pedestrians in the Netherlands equals the total number of inhabitants minus the ones that are institutionalised, permanently unable to walk or abroad, plus visitors from other countries. With regard to the composition of the population relevant attributes are gender, age or life stage, civil status and nationality or ethnicity.

b. Life cycle and age based pedestrian groups

With regard to the life cycle and demographics in literature and statistics, age, gender and civil status and households are generally used to distinguish target groups. For W+S age groups delimitation is generally based on notions of maturity related physical and/or mental abilities (see e.g. Erikson, 1994). Furthermore needs, abilities and opportunities and W+S behaviour differ for males and females as well as for a person's civil and household status. Important stages impacting differently on W+S are baby/toddler (0-3 years), pre-schoolchild (3-5 years), primary schoolchild (5-12 years), adolescent/teenager (~[199]13-19 years), single adult (~19-55

[198] Oxford Dictionaries, https://en.oxforddictionaries.com/definition/demographic, accessed 22-3-2018
[199] ~ means that there is spreading in age.

years), adult with partner (~19+ years), family (~25-55 years), adults with young children (use of pram and/or buggy), older couples without children (~50-65 years), pensioners (~65+), widowed (~75+), very old (80+) (adapted from Vukmirović, 2010). In this thesis main age groups are children (0-12 years of age), youngsters (12-18 years of age), young adults (18-24 years of age) , adults (25-55 years of age), senior adults (55-65 year of age), elderly (65-80 years of age) and the very old (80+). Besides the gender groups, single households, two person households, 3+ households and households with small children are discerned.
In Table 4.4a and 4.4b key population figures regarding the life cycle and demographics are displayed. The figures show that the volumes of the substantial pensioner (ages 65+[200]) age group and widowed group are increasing while the young age group slightly decreases.

Table 4.4a Life cycle / age groups in the Netherlands in 2016 and 2025

Group	age	2016 *		2025 **	
		abs x 1000	Population %	abs x 1000	Population %
Baby/toddler	0 - 3	518	3.1	523	3.1
Pre-schoolchild	3 - 5	358	2.1	349	2.0
Primary schoolchild	5 -12	1,314	7.7	1,321	7.7
Adolescent/teenager	12 - 18	1,226	7.2	1,209	7.1
Young adult	18 - 25	1,468	8.6	1,415	8.3
Adult	25 - 55	6,785	40.0	6,587	38.6
Senior	55 - 65	2,224	13.1	2,524	**14.8**
Old	65 - 80	2,209	13.0	2,814	**16.5**
Very old	80+	749	4.4	936	**5.5**
*Sources: * CBS Statline ** US Bureau of Sensus*					

Table 4.4b Households and inhabitants per age group (x 1000) in the Netherlands in 2016

Households	Age 15 - 25	Age 25 - 55	Age 55 - 65	Age 65 - 80	Age 80+	All ages
All households	404	3,903	1,355	1523	537	7,721
Single person households	328	1,219	417	593	349	2,906
Multi person households	75	2,684	937	930	188	4,814
Multi person houdseholds without children	58	646	538	829	165	2,236
Multi person households with children	17	2,038	400	101	23	2,579
multi person houdseholds without young children (estimated pram or buggy users)*	n.a.	n.a.	n.a.	n.a.	n.a.	500
other households	8	24	4	4	2	42
Civil state						
Total number of inhabitants	4,884	6,785	2,224	2,337	749	16,979
Married persons	36	3,287	1,530	1594	281	6,728
Divorced persons	1	634	340	261	42	1,279
Unmarried persons	4,847	2,828	266	131	40	8,112
Widowed persons	0	36	89	351	385	861
*Source: CBS Statline; * proxi = rounded figure children aged 0-3 years of age*						

[200] Retirement age in the Netherlands in 2020 is 67, entitling Dutch residents to receive state pension.

In the past decade the number of single person households and widowed persons increased (not shown in the tables), and this process can be expected to continue. Pensioners (from 2020: age 67+), and particularly single elderly generally walk more than most younger age groups (CBS Statline, 2010-2017 Travel Surveys). Consequently the total W+S propensity can be expected to grow somewhat.

c. Interrelations between life cycle and age, and other environmental settings

It is commonly accepted that *life cycle stages*, *gender* and *civil/household status* predispose activity patterns and consequently W+S behaviours. These are important factors in lifestyle (e.g. everyday living environment, employment, civil state, vehicle ownership, driver licence, PT card ownership, car sharing, bike sharing, child and elderly care), mobility choices and habits as they govern life needs, abilities and the search for walking and sojourning opportunities, autonomy and mode captivity. It also applies to the number and frequency of trips, travel and sojourning time, distributions of utilitarian and recreative trips.

Life cycle stages, which statistically are more difficult to discern than age, are (more or less) connected to age[201]. Life cycle stages and age connect to physical and mental maturity and later in life the decrease of general walking abilities because of decreasing muscle power, deterioration of senses, information processing speed, general health (age related illnesses) and drug/medication use as well as no longer being employed. These factors influence the degree of autonomy and need for taking up care, surveillance or escort. The mid-age groups generally can be expected to prefer car use over other modes; for other age groups this seems less clear-cut. The age groups that walk most are the groups aged 0-11, 18-24 and 65 and older (Schaap et al., 2015).

Many studies report on *gender* different propensities in risk taking, spatial awareness, travel motives and walking preferences and behaviour (e.g. Schaap, et al., 2015; Schmuck, 2012; Abadi et al., 2010; Granié, 2009, Bernhoft & Carsten, 2008). In general females walk (only) about 10% more often than males (Schaap et al., 2015).

The various *civil/household statuses* affect levels of household task delegation, which also leads to different activity and W+S behaviour propensities and patterns (see e.g. Hillman & Whalley, 1979). In large families for example household activity time pressure is large. Consequently, for efficiency reasons they can be expected to choose modes that are perceived to take least time or give more ease, for instance for transporting children, often leading to car-dependency (Jeekel, 2011).

d. Where and when life cycle and age makes a difference for walkers

In line with the Task Capabilities model (Fuller, 2005, cited in Wegman & Aarts, 2005) it can be expected that life stage and age, gender and civil status effect W+S in situations that are beyond the comfort zones of the concerned (potential) pedestrians. This can be expected to apply for 1) unfamiliar territories, where one cannot rely on routines, 2) unfamiliar and busy traffic situations, particularly where large differences in speed and mass of vehicles occur and there is time pressure to make adequate decisions, and 3) hostile conditions, where high levels of resilience are perceived to be needed. An example of a mismatch concerning unfamiliar zones are young children outside the direct home environment, where they do not understand risks and do not know how to react to such risks. As for the second point, children, elderly and

[201] In official statistics, e.g. CBS Statline, age groups, but not life cycle groups, are discerned; consequently figures are not available for all life cycle groups.

handicapped people often lack time to come up with adequate responses and choices for coping with busy and complex traffic situations (e.g. Sandels, 1968; WHO, 1980; Davidse, 2007). The younger children are, the more they are affected by visual and to a lesser degree auditory distractions (Tapiro et al., 2018). An example of effects of life stage, gender and civil status effects in hostile situations is the perception of insecurity during darkness and in derelict town situations: particularly elderly females fear being attacked, robbed or raped, not being able to defend themselves or get away in time, and therefore avoid routes through dark and derelict streets (Korthals Altes et al., 1994).

e. Impact of lifecycle and age on walkers

Literature shows that life stage, gender and civil and household status are very important determinants of differentiation of needs, desires, attitudes and behaviours, particularly on the lifestyle and strategic activity levels. Lifestyle differentiation is related to levels of maturity and education, to life stage, age, health and household status related abilities, to social-economic status and access to transportation, to culture and religion, also to residential context (Ryley, 2006 and 2008). Different lifestyles are associated with different patterns or dominances regarding W+S motives and preferences, exposure and safety perception, attitudes and risks and even life expectancy (CBS, 2018; SocialData, 2005; Ghani et al., 2016). Based on longitudinal travel survey data Rubin & Zijlstra (2018) conclude that life cycle is a more important factor in mobility choices than other factors.

Gender is associated with differences in physical abilities, life expectancies, safety perception, travel motives and distances and health characteristics and care-giving activities (cf. Clifton & Livi, 2004, Ausserer, 2014); age or life stage categories are associated with differences in health (CBS Statline - health statistics), dependency on escort and supervision, care giving and socio-economic status; nationality or ethnicity is associated with different modality preferences and culture or communication related accidents (Wegman & Aarts, 2005; Schoon, 2005).

With regard to the ageing of the population life expectancies differ for gender (on average females live longer), but according to CBS Statline[202] these differences are easing off. This will lead to a different population of elderly, where females still dominate, particularly in old-old groups (CBS, 2018). SCP (2018) found that more people will need care, but that the number of potential care-givers will decrease substantially.

f. Significance of life cycle and age for W+S policy making

The significance of the lifecycle and demographics for W+S policy making is that it, together with information on W+S needs and abilities of the various population groups, provides the necessary insights for developing lifetime proof walkability and true Design for All policies.

The stages in the human life cycle and household compositions are key factors in walking propensity and therefore very relevant for W+S policy making. At young age maturity and at old age diminishing travel abilities limit mobility options largely to walking; both the younger and oldest groups do generally not need to do work-related trips and school trips respectively social-recreational trips are most important for their Quality of Life. Household composition affects time pressure and care tasks and thereby the urge to save travel time and chose fast travel modes, but also whether or not child transportation is needed and used. With regard to W+S focus on children, the elderly, one person and multi-person households with (young) children seems most justified.

[202] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37360ned/table?dl=10917, accessed 4-1-2019

Since World War II retirement age has first changed from 65 to average 61 and now again to 66 and four months years of age (near future 67). Activity patterns can be expected to follow such trends, and consequently the perspective on walking will change as well. In general statistics this change is not yet followed up in common classifications. 65 is still the 'common' age for splitting up the population, in terms of paid labour, in 'active' and 'non-active', meaning that statistical data do not easily show the changed patterns.

4) Access to transportation

a. Definition, scope and relevance

Access to transportation concerns the possibility to enter and use transportation arrangements as alternative or complementary to walking and sojourning in public space, cf. to reach destinations beyond walking range. Important system features in this context are vehicle ownership and vehicle use, driver licencing, parking arrangements, taxi service, public transport and public transport arrangements (cf. travel card, paratransit) and ride-sharing and car-sharing (Urry, 2016; Litman, 2016). Furthermore, a relevant person related concept is transportation poverty, which concerns critical mobility obstacles to improving the economic and social conditions of low-income households (Sanchez, 2008; Martens, 2018).
Access to transportation is relevant for walking and sojourning because on the one hand mobility by vehicles is not possible without walking, and on the other hand many destinations that matter cannot be reached on foot alone (Brög, 2001).

b. Access to transport based pedestrian groups

With regard to access to transportation pedestrians can be grouped on the kinds of transportation they can gain access to, i.e. which are available to them, for which they are licenced to use and they fulfil the legal conditions (health, insurance, technical state). In this way the following grouping is worked out (see also Table 4.5.): 1) non-walkers[203], 2) captive pedestrians without or with very limited access to other forms of transportation, 3) non-captive pedestrians with access to public transport and taxi (i.e. those that do not own or have access to individual means of transport), 4) non-captive pedestrians with access to bicycle or electrical bicycle, for which

Table 4.5 Pedestrian groups based on transportation options (Netherlands, 2016/2017)

	Population		Typical exposure pppy ***					Positioning	
Group:	Abs	note	%	Trips on foot	Kms	Hours	total exposure x milion hours	% pedestrians	% persons in public space
Non-walkers	86,000	**	1	nihil	nihil	nihil	nihil	n.a.	nihil
Captive main mode walkers	2,000,000		12	1,095	1,314	548	1,095	23	14
Captive sub-mode walkers	17,000,000	*	100	1,460	146	61	1,034	21	13
Professional walkers	50,000	**	0	250	2,500	1,042	52	1	1
Foreign holiday makers and touristst	125,000	**	1	1,095	3,614	1,506	188	4	2
Domestic holiday makers and tourists	185,000	**	1	365	1,095	456	84	2	1
Non-captive main mode and submode walkers	10,500,000		62	183	548	228	2,395	49	30

Based on CBS Statline data 2016/2017
** = only partly included in travel statistics ** = not included in travel statistics *** pppy = per person per year*

[203] This group concerns people who are not able or allowed to go outdoors, such as people who are institutionalised (detained in NL in 2017: 35,000 (CBS Statline)); In 2014 there were 10,000 places in intramural care (Trimbos Institute, 2015, p. 15); in 2015 about 41,000 persons were confined to be in an hospital (in 2015 41,000 hospital beds available (Dutch Hospital Data, 2015)).

they do not need a drivers licence and insurance 5) non-captive pedestrians with access to motorised vehicles (moped, car, motorcycle, minivan, for which they need both a drivers licence and insurance) and 6) non-captive pedestrians having access to multiple transport modes, for which they have the licence and insurance covered.

c. Interrelations between access to transport and other environmental settings

Mobility is essential for supporting Quality of Life. For a majority of the population distances up to beyond 1-2 kilometres are walkable; for distances up to about 500 meters walking generally is the most convenient and therefore a preferred mode. Access to alternative and complementary transportation enables persons to transport goods and to go beyond walking distances and carry out out-of-home activities, be employable, take part in social networks, take care of needs of family and friends etc. Lack of access to transportation can be a critical obstacle to improving economic and social conditions of low income households (Sanchez, 2008; Martens, 2018).

d. Where and when access to transport makes a difference for walkers

For urban conditions, for circulation (shopping, errands, walking the dog), for trips to primary school, for social and for recreational trips and sojourning, walking often is the most preferred main mode transportation option, whilst for home-work, work and service related car, bicycle and public transport are preferred (Walton & Sunseri, 2007; Bernhof & Carstensen, 2008; McDonald, 2008; O'Fallon & Sullivan, 2011). Access to alternative transportation varies spatially and timewise. In urban situations and to a lesser extent in suburban situations public transport generally is available within 500 meters from home (e.g. O'Sullivan & Morall, 1996). In peri-urban and rural situations public transport in most of the cases is not available within that distance. For some groups (the handicapped and part of the elderly) 500 meters is beyond reach. Public transport usually is scheduled during business days at daytime; only in urban areas available in evenings, but generally not at night-time; absent information, long waiting times, lack of shielding and seating, and irregular service may inhibit public transport use. At night public transport stops can be unreachable because of perceived lack of security (Korthals Altes et al., 1994). This does not apply to taxi's, but use of taxi's can be an obstacle because of the prices.

Individual modes (bicycle, electrical bicycle, moped, car, minivan) are accessible nearby when available within the household. Motorised vehicles require the driver holding a driving license. Persons without a driving licence only have access to motorised transportation if driven by a licence holder. In central urban conditions parking, access and use of cars can be inconvenient and time consuming.

Weather preconditions affect walking and sojourning choices. Rain, wind and cold inhibit walking and sojourning except in pressing cases (Aultman-Hall et al., 2009).

e. Impact of access to transport on walkers

The impact of access to transport on walkers has changed over the years. Constant factors are that walking is the most physical activity demanding form of moving about and that there are no alternatives for some walking and sojourning kinds. Very important developments in this regard were enlarging of scale, increasing car dependence and changing attitudes towards walking, and the perception of time. Recently an increasing substitution of personal mobility by alternative arrangements like e-shopping emerged. The above main factors and developments are explained successively.

Humans, like all animals, tend to try to spend their personal energy efficiently when pursued on a daily basis. This pursuit also applies to mode choices. In this regard walking is at disadvantage because it takes more physical effort than any other travel mode to cover the same distance (Kölbl & Helbing, 2003). In this way walking is generally not the first choice, except when one wants to keep up one's health or enjoys to spend energy, or visit areas that can only be attained on foot.
Recreational walking, walking for health and circulation on foot can be done with or without support of walking aids. For these kinds of walking no alternative transportation is available, but they can be preceded or followed up by travelling by alternative modes.

With regard to developments regarding the impact of access to transport probably the most important development is enlargement of scale[204] in the spatial distribution of functions which forced people to travel longer distances, most of which now are beyond walking or even cycling distances. Jeekel (2011) found that society has become rather car-dependent. Evidently this affects the distribution of the use of travel modes. Hupkes (1977) and Zahavi (1979) put forward that people on average have a travel time budget of 60-75 minutes per person per day. Consequently more time spent on walking means less time spent on other modes and vice versa. It can however be argued that pure recreational walking does not count in this equation. Travelling generally is a means towards higher order goals (employment, education, health etcetera), whilst recreation can be perceived a purpose in itself, thus a more or less independent choice in mode and spending time.

The perception of time is not a fixed matter. It can be assumed that perception of time guides travel mode decisions, where agreeable time spending is perceived to be less of a burden than ‘wasted time’, and that particularly routine trips are measured up and reasoned as ‘wasted time’ (Grondin, 2009; Bamberg et al., 2009). Thus, time and effort spent on alternative transport modes in principle will go at the expense of the amount of (routine utilitarian) walking as a main mode; in most of the cases public transport use is complemented by walking to and from transfer points, thus promoting (routine utilitarian) walking. Apart from very short distance trips, time pressure usually goes against a choice for walking instead of going by bike, public transport or motorised transportation.

The use of alternative and complementary transport modes or substitution determines the role of walking in mobility of individuals, groups of (potential) pedestrians and the population as a whole. Access to alternative or complementary transport modes affects frequency and moment of use of alternative and complementary transportation modes, what distances can be covered, what destinations can be reached, and how much effort, time and money is spent on travelling as a whole. Recently, facilitated by the rise of the internet and mass communication, shopping and (some) entertainment trips are substituted by other logistics, where the customer gets his goods or entertainment delivered at home. The thus saved time can be used for other (travel) causes, including walking opportunities.

f. Significance of access to transportation for W+S policy making

The significance of access to transportation for W+S policy making is that it affects W+S propensity. Access to transportation enables people to go beyond walking distance. On the one hand it reduces mono-modal utilitarian walking and on the other hand it incites sub-mode walking trips to and from the other forms of transportation, particularly public transport, which

[204] Indicated by a decrease in number of retail shops, hospitals, general health practises, service and repair points, bank branches, public transport stops, municipalities (town halls), police stations etc.

largely depends on sub-mode walking. Almost all trips made with vehicles are preceded and followed by walking, although it does not fully show up in mobility statistics. It happens nevertheless and needs to be facilitated to enable other forms of transport. The author assumes that the shift towards vehicle transportation does not negatively affect the volume of recreational walking and sojourning trips as these are deliberate activities by themselves.

5) Socio-psychological characteristics

a. Definition, scope and relevance

Socio-psychological[205] characteristics concern the way in which stimuli, thoughts, feelings (i.e. perceptions, attitudes and lifestyle preferences (Clifton & Livi, 2004)) and behaviours are influenced by a person's felt or imagined social environment (Allport, 1985[206]).

Such characteristics include personality traits, shared norms and values regarding central human capabilities[207] (Nussbaum & Sen, 1993, Nussbaum, 2000; cf. Section 3.3.3.), notions and culture as well as habits based on earlier lifestyle choices[208]. Together these factors form a mindset on which amongst others W+S related decisions and behaviour are based. With regard to mindsets in relation to walking Risser (2002) found that about 70% of his respondents (in Vienna) liked to walk, and that the most important reasons for walking are that it is both sport and physical exercise, healthy, a way to see the environment, efficient and fast, inexpensive, flexible and independent and environmental friendly. The most important deterrents for walking are slow speed (55%) and weather dependence (50%); one-third of the respondents pointed to limitations of transporting goods. About 25% of the respondents did not like to walk. Main reasons for not liking walking seem to be that walking is perceived as too tiring and disagreeable, that walking is too slow, and that walking is boring.

In the Theory of Planned Behaviour (Ajzen, 1985; Fishbein & Ajzen, 1975) attitude, subjective norm and perceived behavioural control together shape a person's behavioural intentions and planned behaviour. Instead of the concept *intentions* the author favours to use the term *propensity*, as this wider concept also covers non-reasoned and non-planned behaviour, such as habitual, reactive and intuitive behaviour.

Social-psychological characteristics (mindsets) are relevant for W+S as they affect needs, preferences and propensities regarding walking and walking facilities. From the great variety in literature on attitudes, propensity and mindsets[209] the author abduces that mindsets regarding walking appear to be predominantly life cycle / age group, gender, culture and lifestyle preferences and (everyday living environment) neighbourhood related.

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[205] socio-psychological concerns the individual outlook; on a more general population level this is often called 'socio-cultural characteristics'.

[206] *Allport, G. W (1985). "The historical background of social psychology". In Lindzey, G; Aronson, E. The Handbook of Social Psychology. New York: McGraw Hill.* p.5 cited in https://en.wikipedia.org/wiki/Social_psychology.

[207] According to Oxford Dictionaries (accessed April 2015) a capability is the power or ability to do something or the extend of someone's ability. Nussbaum listed 10 basic human capabilities which society should guarantee (Nussbaum, 2000).

[208] Such as dog ownership, leading to the obligation to walk the dog, and social responsibilities inciting to take care of disabled family members or neighbours, or preference to walk together with others.

[209] Searches in Google Scholar on 'mindset - determinants – walking', 'attitude - walking attitudes' and 'walking propensity' carried out 8-10-2018

b. Social-psychological characteristics based pedestrian groups

From the United States surveys of bicycle and pedestrian attitudes and behaviour (carried out in 2002 and 2012 (Schroeder & Wilbur, 2013; Royal & Miller-Steiger, 2008)) and various other studies on socio-psychological and socio-cultural characteristics affecting walking and sojourning (e.g. Schaap et al., 2015; Quiben & Hazuda, 2015; Clifton & Livi, 2004), it shows that pedestrians can be grouped in many ways: utility and recreational walkers, the number of times people choose to walk, age groups, gender, life cycle groups, residences, ethnics and race, traffic and public safety attitudes and perception, Social-Economic Status (income, profession, lifestyles), special attitude groups (dog owners, group walkers, tourists, informal care givers) and possibly many other divisions. Below the following useful group classifications with regard to social-psychological characteristics are sketched, viz. 1) utilitarian walking, 2) reasons for (not) walking, 3) number of times people choose to walk, 4) ethnical and racial groups, 5) safety perceptions and attitudes, 6) special attitude groups. Age groups, gender, life cycle groups, SES residence groups are dealt with in other places in this subsection.

With regard to *1) utilitarian walking* it is important to lay down that walking is generally not the favourite travel choice for such efficiency-driven movements. This is accurately worded by Burgos (2008:2) in his thesis paper on the commerce of the pedestrian where he finds that "*it is very difficult to find a true pedestrian, or a person who prefers to walk. Many people try to avoid walking as much as possible. This mindset has changed the way structures are designed. These places now cater to the automobile".* Consequently most current cities are rather unattractive for having a true pedestrian mindset.

Classifications with regard to 2) *motives for walking* will be discussed in more detail in Section 4.3.3. W+S needs translated into W+S behaviour. In general it appears from American and European mobility statistics (e.g. Schroeder & Wilbur, 2013; Schaap, 2015), which generally only sketch main-mode trips, that recreation is a far more important walking motive than work, school and even shopping. In the USA the most important motives are personal errands, exercise for health, recreation and leisure; in the Netherlands recreational 'walking and touring' is by far the most important motive for main-mode walking.

The author did not find Dutch studies regarding motives for not walking. It can be expected that Dutch people do not walk for more or less the same reasons as Americans. The above mentioned US surveys mention that about one in five persons never walk or haven't walked during the past 30 days[210]. The survey yielded four main stated reasons for not walking: 'disability', 'don't need to / don't want to / lazy', 'I exercise in other ways', and 'weather / area conditions'. Women and 30+ age groups are overrepresented in the non-walkers group. 'Disability' as a reason for not walking is (conform disability rates) age related: 50% of the persons giving this reason are aged 65 and older. 'Don't need to' is also age related, but reversely. About 40% persons younger than 20 give this reason, while in the 65+ only 14% do this. The reason 'Exercise in other ways' is given mostly by persons aged 30-65 (13-14%; other age groups about 6%). 'The weather / area conditions' are for about 25% persons younger than 65 a reason for not walking; for the elderly 'Disability' is more dominant.

Sauter (2010) found that in Switzerland people experience many barriers and wield as many motives for not-walking. Main barriers (entered by more than 10% of the respondents) he found were 'it takes too long to walk', 'carrying shopping', 'prefer bicycle', 'usually in a hurry', 'health', 'don't feel safe walking' and 'lazy'. Main motivations (entered by more than 25% (!) of the respondents) for walking are 'exercise for me', 'enjoy being outdoors', 'find it relaxing', 'for

[210] This most probably does not include very short walks, e.g. less than about 50 meters, like walks to and from the car. For mobility the quality of pathways for the many short walks is important and policy relevant.

pleasure', 'enjoy environment', 'more convenient', 'quicker' and 'better for the environment'. No comparable data were found for the Netherlands, but from many signals (workshops, media comments, interviews and meeting people) the author assesses that in large Sauter's findings apply for the Netherlands as well.

In the US surveys regarding the *3) number of times people choose to walk* the population is split up in three almost equal groups: light frequency walkers (1-7 days per month), medium (8-19 days) and heavy walkers (20-31 days per month) [211].

In some mobility studies (e.g. (Schaap et al., 2015; Bristol City Council, 2012) difference in walking propensity between *4) ethnical and racial groups* is studied. Based on the ethnicity-and-walking literature the author concludes that it can be useful to discern between western European and non-western immigrants (Schaap et al., 2015; Bristol City Council, 2012), and tourists. Immigrants and tourists are generally not used to the dominant function cycling has in transport in the Netherlands; non-western immigrants are not a homogeneous group with regard to their walking preferences. Verhoeven (2009) found that on average immigrants walk more often than native Dutch people. Quiben & Hazida (2015), Pitkin Derose (2015) and the Bristol City Council (2012) conclude that there are slight differences in walking volume by ethnic population groups, but that these differences can be explained largely by income differences. This is probably true for the Netherlands as well.

Some studies (e.g. Clifton & Livi, 2004; Schroeder & Willis, 2013; Knippenberg et al., 1993) find that there are differences regarding 5) *safety perception and attitudes*, such as walking in dark or near dark, methods to make oneself visible as a walker and using sidewalks or not. Mostly it was shown that these differences are associated with other population attributes like age, gender, residence and SES factors.

With regard to lifestyles, apart from SES groups, in the collected W+S documents a number of *6) special groups* were indicated to possibly have deviating mindsets regarding walking, giving reason for longer and more frequent walks: wanderers, dog owners, duo or group walkers and informal care givers[212], professional walkers, and captive versus non-captive walkers (cf. human capabilities).

As said, the above attitudes and perceptions appear to be associated with door-to-door walking (main-mode walking) only. It needs to be remarked that (in Europe at least) sub-mode walking trips (as means to and from other forms of transportation) are foot-trips, so regardless personal attitudes and whether people like it or not. Without dedicated studies on attitudes and preferences regarding walking it is very difficult to give indications of volumes of pedestrian groups in this regard. In Table 4.6. volumes of a selection of social-psychological and cultural characteristics based pedestrian groups, about whom figures were available or relatively easy to estimate, are sketched.

[211] The author could not find comparable figures for the Netherlands; the Plausibility Report on the 2017 Travel Survey (CBS, 2018, table 6.1.1.) gives data on non-mobility. In the years 2010 - 2017 on average day 20% of the population does not travel.

[212] In Dutch: mantelzorgers; One of three Dutch citizens is informal care giver. The author expects that they often live near the care receivers and walk to that address (figures are not available). An important task is to contribute to well-being of the patient, e.g. go outdoors and do walks with the patient, who cannot do that by him/herself (e.g. Mezzo, 2018; PGGM, 2013; Accolade Zorggroep, 2013).

c. Interrelations between social-psychological characteristics and other environmental settings

From the above it can be abducted that socio-psychological and socio-cultural mindsets direct many lifestyle decisions such as choice of everyday living environment and vehicle ownership as well as (positive) behaviour towards other people in public space and risk taking (e.g.:

Table 4.6 Volumes of key groups based on socio-psychological and cultural characteristics

	Number of people x 1000		% of population	Source
Males	8,475		49.7	CBS Statline, 2016
Females	8,562		50.3	CBS Statline, 2016
Recreative walkers	10,500		61.6	Wandelnet, 2016
of which duo's or group walkers	4,830		28.3	Wandelnet, 2016
Dog owners (households)	1,456		8.5	DIVEBO, 2016
Informal care givers	414		2.4	calculated from CBS Statline
Western European immigrants	772		4.5	CBS Statline, 2016
Non-Western immigrants	1,148		6.7	CBS Statline, 2016
Foreign visitors and tourists	125	*	0.7	calculated from CBS Statline
Domestic holiday makers and tourists	185	*	1.1	calculated from CBS Statline
** = person equivalents = average number of persons present on an average day*				

walking at night, road crossing behaviour). In this way mindsets form a key factor in walking and sojourning choices on the strategic and tactical levels.

d. Where and when social psychological characteristics make a difference for walkers

Socio-psychological or cultural characteristics can affect strategic choices at home as well as tactical-operational behaviour while on the move, as a reaction to the environment (neighbourhood, urban, street, landscape, scenes, traffic, peers, etc.) (e.g. Lin & Moudon, 2010; Parks, 2006; Schoon, 2005; Sallis, 2002).

Centre-urban dwellers' attitudes towards W+S generally differ from suburban and rural residents. In suburban and rural areas distances are not so short, public transport is less available, the car easier to use and (even) acceptable (e.g. Larsen et al., 2010; Walton & Sunseri, 2010). In the centre of (larger) cities walking is the practical way to move because of traffic rush, the many traffic measures and because it is becoming more difficult to park one's bicycle, let alone a car, making walking quicker and more comfortable than other modes (e.g. Gemeente Amsterdam, 2013).

At different points in life (as child, youngster, parent, worker, etc.) often different choices are made (e.g. Alfonzo, 2008; Kim et al., 2007).

e. Impact of social-psychological characteristics on walkers

Social-psychological characteristics are formed by personality, personal experiences and influences from the social environment, and maturity. Socio-psychological and cultural characteristics affect considerations and behaviour in many ways. They function as a precursor, filter and/or guidance for observing the environment, for consciously and subconsciously considering W+S behavioural options and for more or less automatically reacting to environmental conditions. Socio-psychological and cultural characteristics are related to demographic factors (age, gender, ethnics), life cycle, social-economic status, everyday living environment, access to transportation and information as well as health.

Below first a general picture regarding person related determinants is sketched, next some lines are dedicated to the relation between lifestyles (with political colour as a lifestyle marker) and walking choices, changes over time and finally the influence of inertia.

With regard to general socio-cultural perceptions Goodman (2001) found that in the United Kingdom these in practise often function as deterrent to walking: the car has emotional hold over people and people do not like to deviate from group norms, which together leads to cultural dominance of the car on the one side and the lower status of utilitarian walking on the other side. The author assumes that this is largely true in the Netherlands as well. Goodman also found that motives for walking are more important for non-car users than for car users. Apart from the car-culture and social-economic status, weather and fear of crime are important deterrents. There are gender differences. Males are less influenced by fear of crime, traffic safety, quality of sidewalks or not having adequate time for crossing and the insight that drivers do not necessarily see the pedestrian. Other researchers (e.g. Clifton & Livi, 2004; Granié, 2009; Papadimitriou, 2012) confirmed these gender differences in risk perception and risk taking, but also found differences regarding female propensity for more walking in general, walking for social reasons, healthy walking and less likelihood of walking alone.
For different social groups walking has different meanings. For young children it is a way of discovering the world, but they are often not allowed to go outdoors alone (Sandels, 1968), for youngsters it offers freedom (Horton et al., 2014), for elderly a way to stay healthy and fit (Orru & Orru, 2010), for many adults 25-55 walking does not matter very much (but sojourning, like enjoying the crowd, does), for employed singles 18-25 walking is a waste of time, while for their peers without employment it is a necessity (e.g. Clark et al., 2016).

With regard to walking, lifestyle preferences matter for main-mode walking, sojourning and circulation choices of non-captives; captives simply have no choice but to walk. Political colour corresponds with main mode preferences (Goot, 2012). From comparing political party programs (National Election 2017) a broad indication can be obtained about the party's preferences, but it is uncertain to what extent voters actually agree with the party preferences and/or live up to voices preferences. In their party programs left wingers (e.g. Groen Links, PvdA) and particularly environmentalists (e.g. Groen Links, Dierenpartij), as well as religious people (e.g. ChristenUnie) generally have a more positive attitude towards utilitarian walking than secular right wingers (e.g. VVD), where walking does not fit well in their world view.
For recreative walking preferences seem to be more evenly distributed. Here many people see walking as fun, healthy, sociable, cosy, where slow is an advantage, not a waste of time or energy (see e.g. Speck, 2012; Wandelnet, 2015; Ausserer et al., 2013).

Over time the perception of time and space has changed. A hundred years ago most people could not afford vehicle transportation and had to walk, even for (scarce) holidays (Harms, 2008; Amato, 2004, Filarski, 2004). 'No time available' was not an argument at that time; the horizon was set at the village or neighbourhood boundaries. The car, telephone, television and internet expanded the perceived horizon enormously (De Hond & Van Elburg, 1995). Moreover, people who stay within their own neighbourhood are seen as narrow-minded.

One prominent change in perception and attitudes is that with regard to school travel; parents have become more protective of their children, resulting in a decrease of independent walking or walking with peers to school, sports and clubs and increase in transporting the children by

bike and car, leading to a 'back-seat generation' of kids (Both, 2007; Molnár, 2005; Vermeulen, 1998-2)[213].

Perceptions do not always match reality. As mentioned earlier, for behavioural decisions perceptions matter more than reality. Perceptions can be based on one's own experiences, but also on *story telling* or information delivered by other persons or institutions, e.g. on how desirable, agreeable, easy, difficult walking is in different conditions, ways, contexts. Sometimes phenomena are wrongly interpreted and understood. Governmental agencies for example can generate attention and positive reference through the media, not only regarding city centres, but also regarding suburban and rural recreational walks; artists (e.g. Daan Roosegaarde) try to seduce pedestrians to choose certain routes; etcetera.

There is also report of *inertia*: conditions may change unnoticed, whereas the former state still is perceived to be the reason for the behavioural decisions. This is particularly true for habitual (automatic) behaviour like daily trips to school, work, supermarket, walking the dog etcetera (Van Beek & La Paix Puello, 2018). Novel and incidental travel choices, like day trips, holidays, incidental visits to museums, are often less 'automatic' and more consciously made, based on specially gathered information.

f. Significance of social-psychological characteristics for W+S policy making

Social-psychological characteristics (mindsets) are important for sustaining, supporting and promoting walking e.g. regarding need for facilities and tuning to walking distance preferences as well as managing (potential) conflicts between walkers and between walkers and others. Mindsets are predominantly life cycle, gender, culture and lifestyle preferences related.

With regard to W+S, because of their propensity for walking, some groups deserve specific attention: women, dog owners, duo or group walkers, informal care givers, tourists and (non-Western) immigrants. On the one hand the W+S system can be attuned better to their needs and on the other hand lessons can be learned about how others can be persuaded to walk.

6) Access to information and information and communication technology (ICT)

a. Definition, scope and relevance

According to Oxford Dictionaries[214] information has two meanings, viz. *1) facts provided or learned from something or someone and 2) what is conveyed or represented by a particular arrangement or sequence of things.*

The latter meaning particularly concerns information and communication technology (ICT), which applies to data processed by a computing device. Additional to 'old school' information carriers (pedestrian signs, town plans, ...), dedicated information technology can support W+S decisions (Noort et al., 2013). Through using information time, energy and risk can be saved in many ways, e.g. through destination, mode, timing, route and road-crossing choices. Having or not having information determines how confident people are to be able to complete a journey comfortably, without stress and safely within their travel time budget.

[213] Consequently the children have less experience coping with (dangerous) traffic conditions; their traffic career starts (much) later and they are less resilient.
[214] https://en.oxforddictionaries.com/definition/information, accessed 4-4-2018

Three types of dedicated ICT are relevant for W+S decision making: 1) personal ICT (i.e. applications on personal computer or mobile computing device or dedicated devices[215]), 2) public ICT (i.e. ICT embedded in W+S facilities like traffic light installations and public information desks) and 3) cars and other vehicles fitted with ICT for the detection of pedestrians, injury prevention and navigation to car parking as transfer point to other modes including walking (Scholliers et al., 2016).

b. Access to information based pedestrian groups

In principle all pedestrians can find benefit from embedded public ICT facilities and dedicated in-vehicle ICT[216]. With regard to personal ICT and W+S the following population groups can be discerned: 1) passive ICT users, 2) active ICT users at home and 3) active ICT users while at home and/or in public space (Pain, 2007). The first group comprises people who do not have access to personal ICT devices and the internet, those that are not able to use ICT devices (i.e. computer-illiterates) as well as those who do not want to use personal devices themselves. The second group does not have mobile devices and/or applications to inform or guide its user on the way.

In Table 4.7. percentages of the population with internet access, use of computer devices and Information Technology education are displayed. It shows that almost all Dutch inhabitants aged 12 or older are connected to the internet and have computing devices. Regarding the use of the internet and other forms of information technology low education groups and the elderly are not as well educated and presumably skilled as medium and highly educated people younger

Table 4.7 Internet, access, use and facilities - % of population age 12+ in 2017

	Internet access	Broadband internet	Desktop PC	Laptop of netbook	Tablet	Mobile phone	IT education
	%	%	%	%	%	%	%
total population	97,1	96,1	60,3	82,0	71,7	89,0	35,4
Males	97,6	96,7	64,8	82,9	71,9	90,4	35,3
Females	96,6	95,4	56,0	81,1	71,6	87,7	35,5
Age 12 - 25 jaar	99,6	99,4	70,8	94,4	75,8	98,2	56,5
Age 25 - 45 jaar	99,8	99,2	52,8	90,2	76,0	98,4	44,9
Age 45 - 65 jaar	99,0	98,0	66,6	83,1	76,3	92,9	32,7
Age 65+	88,3	85,7	51,6	58,4	55,2	62,2	8,4
Education level: low	93,6	92,0	57,8	73,5	65,7	80,0	26,3
Education level: medium	98,5	97,8	62,8	83,9	72,9	92,4	35,5
Education level: high	99,4	98,9	61,1	89,9	79,4	95,2	45,8
Employed	99,5	99,0	62,4	89,2	77,8	96,7	43,7
Not employed	93,1	91,2	57,0	70,3	61,8	76,5	21,9
Standarised income - lowest 20%-group	96,1	94,6	53,0	77,5	58,4	86,2	35,8
Standarised income - 2nd 20%-group	91,3	89,9	52,4	70,7	58,0	78,3	24,8
Standarised income - 3rd 20%-group	97,8	96,8	61,5	80,4	72,3	88,0	31,9
Standarised income - 4th 20%-group	99,0	98,0	62,7	86,6	77,6	92,9	36,7
Standarised income - highest 20%-group	99,3	98,8	67,5	89,6	84,2	95,3	43,8
Source: CBS Statline							

[215] For example a compass, step counter, heart beat monitor, navigating device or app.

[216] Unfortunately also disadvantages: some navigation tools guide car drivers through residential areas.

than about 50 years of age. These groups can be expected to be inclined to walk most and to profit least from W+S ITS improvements.

c. Interrelations between the pedestrian's access to information and other environmental settings

ICT is a fairly new and still evolving technology and access to it is a personal (population) as well as an environmental attribute. Although the technology is already widespread adopted[217], particularly amongst youngsters and young adults, not everyone in the Netherlands has adopted, mastered and integrated it into his or her life[218]. Age is a dominant factor in the adoption and use of assistive devices (Pain et al., 2007; Kang et al., 2008). A crucial precondition for personal ICT is availability and local connection coverage. This cannot always be materialised. Cohort and social-cultural factors (peers, heritage, education, income) are determinants for adoption, mastering and integration of ICT in one's lifestyle (Pain et al., 2007; Kang et al., 2008). As can be seen in computer use statistics (CBS Statline, 2018) the older cohorts are catching up, but the level of adoption and dexterity is somewhat lower than in younger persons'. Although increasingly (top model) cars and traffic management installations have pedestrian detection, the majority is still without. Compared to cars, other modes, and particularly walking are meagrely endowed with ICT. Also in traffic management ICT, which in the Netherlands is dominantly car and bicycle traffic oriented, pedestrians are still mostly neglected (Noort et al., 2013).

Currently government as well as commercial institutions appear to generally assume device availability, connection to the internet and the ability to handle ICT opportunities[219]. This way non-adopters and lowly skilled ICT users are forced in a subordinate position. There are still many non-adopters and non-users, particularly amongst the elderly, low income and low educated populations. In order to prevent them from being socially excluded, as well as for possible internet and ICT black-outs, ‘old-fashioned’ media information needs to be available.

ICT appears to be able to create new consumer needs and desires; it can help manage the needs (OECD, 2016; Worldbank, 2013; Buxton, 2010). This way ICT is commercially attractive and can be a factor in the attraction of destinations within the everyday living environment.

d. Where and when access to information makes a difference for walkers

If available and connected, and the population is able to handle ICT, it can be used while preparing and deciding on W+S trips at home, both on computers and mobile devices. Mobile devices, fitted with the appropriate applications, can also be used while being outdoors for travel and site information, warnings, guidance, navigation, communication and entertainment.

Embedded and in-vehicle ICT can help to affect pedestrian safety and freedom of movement.

e. Impact of access to information on walkers

Information and communication technology (ICT) can set the stage for (potential) pedestrian's attitudes, decisions and behaviour in many ways. On a general level ICT can impact mobility;

[217] The Netherlands have a very high degree of internet penetration: in 2018 more than 98% of the households has an internet connection (CBS Statline).

[218] ICT for W+S tasks is still quite rare. The author could not find any (scientific) evaluation of W+S related ICT. The statements in this section are therefore based on the author's observations only and need to be validated in further research.

[219] For various reasons e.g. governmental agencies work towards contact via the internet only.

more specifically ICT can impact tactical and operational walking and sojourning choices and behaviour.

In principle ICT has the ability of both promoting and decreasing *mobility*. ICT can ease the perception of time and distance, danger and difficulties while outdoors and thereby open up new destinations and unknown routes. In practise ICT has eased destination and travel route searching and getting support when needed and available. Information about destinations, routes and conditions on the way can open up new W+S opportunities. Uncertainties and important perceived risks can be wiped out, decreasing the need for preparation. Easier communication (e.g. over the phone: 'do you have a moment?') also can incite extra walking trips. On the other hand, e-commerce and e-banking and e-services have lowered the need to travel to shops, banks and many services. Residual time can be used for other purposes including sitting on the couch, recreational walking and recreational shopping. There are other examples of impacts of ICT on mobility. ICT can indirectly support walking mobility: Gros et al. (2016) for example found that ICT can be a useful tool for general medical practitioners for diagnosis and management of restrictive disorders, thereby keeping the concerned elderly mobile. Furthermore, based on personal communication the author gets the impression that smartphone applications like step counters can stimulate people to try to walk more.

With regard to mode choice and walking tasks ICT has proved to be successful in issuing functional information, warnings and or support, but can also guide or push strategic and tactical tasks (e.g. navigation, crossing decisions) and can take over operational W+S tasks (e.g. observing, displaying the pedestrian on car drivers' devices, step counting, detecting the pedestrian at traffic lights). Users are not always aware of cues provided by ITS services, as part of its use is established and automated. Public as well as private providers can and do steer W+S behaviour unobtrusively (see e.g. Reus et al., 2008).

Mode choice is guided by preferences as well as by the degree to which persons are informed and stimulated. People more or less automatically assume that they are well informed about all travel options. When regarding walking this is not true, walking will not come into the picture and they will choose to use other modalities.

ICT opens up new travel and sojourning opportunities and destinations, and at the same time provides resilience: particularly by providing real time information it takes away anxiety e.g. uncertainty about how and when to return home, the need to get support from strangers, the option to contact people in cases of emergency, knowing that one can cross the busy street shortly etc. As such it takes away time pressure, enables some multitasking (e.g. solving problems at home while walking), opens up new destinations and incites new preferences and travel behaviours.

It needs to be remarked that ICT does not only offer beneficial opportunities, but also introduces new risks. From literature it became clear that mobile devices may also distract from traffic tasks and cause new kinds of risks (e.g. Neider et al., 2010; Stavrinos et al., 2011; Bradshaw, 2016).

As mentioned above there are three main classes of ICT, viz. public ICT, personal ICT and in-vehicle ICT, which have different impacts. In the next three paragraphs major impacts regarding these classes are indicated.

Public ICT facilities are installed for various reasons: safety and security, traffic management (e.g. pedestrian crossing lights, pedestrian detection), to efficiently inform, guide and support visitors and tourists, and various other public service reasons. In most cases the facilities are not specifically directed at walkers, but at traffic and travellers in general.
Personal ICT at home supports modal choices and can help preparing trips, including those on foot, to daily or to unfamiliar destinations. The application of mobile devices decreases the need to prepare W+S trips at home. It can support people to move about well-informed, pre-warned, safe and secure, free and independent of people nearby. It can ease walking and sojourning decisions and help to decrease risk and misjudgements. With regard to connecting transportation (particularly public transport) information is needed about the route to the line destination, how close this is to the final destination, how long it takes, at what times, how frequent and likewise information about the return trip (e.g. Shu, 2015).

Walking route information and navigation ICT is particularly workable for new, incidental and non-routine trips and journeys involving public transport, but much less for routine trips and trips in well-known territory. In practise route information is needed only for a small minority of walking trips. Most door-to-door walking and sub-mode walking is 'routine'. For sub-mode walking towards and from public transport, however, real time information is crucial. For recreational walking it can be expected to depend on the novelty of the trip. It has to be noted that mobile device navigation for walking is not yet common practise and that the applications are still 'work in progress' as not all foot paths are mapped.

With regard to *in-vehicle ICT* Van der Laan (2018, citing Tom Vanderbilt, 2009) discusses ICT in cars and other vehicles, particularly autonomous (self-driving) vehicles. Currently (2019) the car-industry is putting much effort in experimenting with autonomous (self-driving) vehicles. The vehicles are becoming more and more intelligent, but the users do not always behave as the developers meant them to behave. Supported by technology the self-image regarding the driver's competences become overly positive about their ability to cope with unexpected events like pedestrians crossing the road from behind a parked car, children chasing a ball, elderly stepping out from a clogged up sidewalk. For some a car drive has become the most complex job of the day.

With regard to walking and pedestrians there are many yet unsolved questions, like 'Can you count on cars stopping for you when you cross the street?', 'Will eye-contact and personal communication disappear when people use autonomous cars?' and 'Will there still be room for pedestrians on the streets?' Only when autonomous cars are present on a large scale researchers can say sensible things about the consequence for walking and pedestrians (Van der Laan, 2018).

f. Significance of access to information for W+S policy making
ICT is becoming increasingly important in mobility and W+S behavioural choices. W+S is still rather neglected in ICT, hampering pedestrian mobility and safety to some extent and not benefitting from all societal benefits of walking. ICT developers apparently perceive pedestrians as commercially less important than users of other modes. Although changing, amongst (captive) pedestrians there are relatively many computer illiterates, which cannot be totally changed, as W+S are activities open to all people even if they do not have computer abilities (e.g. young children, the cognitive impaired and very old people). Governmental, non-governmental and private organisations' policies are needed to detect and fill the voids.

7) General health

a. Definition, scope and relevance

According to the WHO (1948[220]) *health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.* In accordance with WHO, the Dutch National Council for the Environment and Infrastructure uses the broad definition of health, not only including physical well-being but also mental and social well-being. A narrow definition, like given in Oxford Dictionaries, that health concerns a person's physical or mental condition, particularly the absence of illnesses or injuries[221], denies that people with chronical diseases or limitations often participate fully in society and feel healthy. The broader definition connects to current national and international insights regarding health (RLi, 2018).

Bodily and mental health are relevant for W+S as these are both a requirement for and a consequence of physical activities like walking and cycling. Skeleton-muscular, neuro- and mental functionality and a healthy body mass enable people to walk, sojourn, react to and adequately deal with traffic conditions and encounters with other humans and animals in public space and use other forms of transportation and social contact and enjoy them. Physical and social health also help to enjoy being outdoors. On the other hand physical activity (e.g. walking), according to Harvard Health, and Mind, has several health benefits[222].

b. Health characteristics based pedestrian groups

Based on the batch of available documents the author abduces that with regard to health and W+S the following population groups can be discerned: 1) healthy people, 2) temporarily impaired, 3) chronically impaired, and 4) latently impaired people. Healthy people do not have walking and sojourning impairments relative to their peers and preferences, attitudes, choices. Temporarily impairments concern healable sicknesses and injuries, and mental distraction (e.g. by emotions like stress, grief, anger, urges, or under influence of alcohol or drugs). Chronical impairments concern significant physical and mental impairments which structurally impair walking and sojourning performance. In this regard motoric, visual, auditory and cognitive impairments are discerned. Latently impaired people have 'background' illnesses that the patients are mostly not aware of, but which at critical moments can affect walking abilities, performance, consequences of mishaps and resilience. Known examples are osteoporosis (increased risk of breaking bones; see below under 'impacts on walkers') and cerebral and abdominal aneurysms (which can tear under stress conditions and cause severe internal bleedings and even death).

In Table 4.8. volumes and shares in the Dutch population of pedestrians groups based on health characteristics are presented. Figures for healthy population, persons with long time disorders, the total number of chronically impaired, obesity, eye disorders and hearing disorders are based on data from the National Health surveys (CBS Statline[223]) and concern stated experiences, which may deviate from medical diagnoses. Some people with (mostly) minor disorders feel healthy and do not feel disabled. In this table mental disorders are not included, as for these

[220] http://www.who.int/suggestions/faq/en/, accessed 3-9-2018; The definition has not been amended since 1948.
[221] https://en.oxforddictionaries.com/definition/health, accessed 4-4-2018.
[222] According to Harvard Medical Publishing (https://www.health.harvard.edu/staying-healthy/5-surprising-benefits-of-walking) walking 1) counteracts the effects of weight-promoting genes, 2) helps tame a sweet tooth, 3) reduces the risk of developing breast cancer, 4) eases joint pain, and 5) boosts the immune function. Additionally Mind (https://www.mind.org.uk/media/2976123/how-to-improve-your-wellbeing-through-physical-activity-and-sport.pdf) mentions mental health improvements.
[223] Most recent figures found on the CBS Statline website - accessed October 2018

disorders no average incidence figures, i.e. how many people suffer such a disorder at a random moment of time, could be found. Relevant disorders in this regard are at least depression, anthropophobia and agoraphobia. Mental disorders differ substantially for males and females. Under e. impact of health, disorders on walking available incidence figures are given. No information about the average duration of episodes is found, but the number of patients on an average moment of the year will be a fraction of the incidence figures; the author's indicative estimate is roughly between 50,000 and 150,000 (potential) pedestrians.

Estimations for (seriously) impaired pedestrians vary from about 3.4 million persons or 19.7% of the population to about 8 million persons or 47% of the population. Estimations are difficult to make as impacts and perceptions of disorders vary from person to person, definitions of severity of impairments are difficult to decree and because many of the subjects have more than one disorder or impairment. As mentioned above, in Section 4.3.4 the groups will be further substantiated with regard to their member's W+S abilities or disabilities.
No passable assessment could be made for 'hidden' disorders except for osteoporosis (see also below under 'impact on walkers').

Table 4.8 Current and future pedestrian group volumes in the Netherlands (x1000) based on health characteristics.

	Period 2010 - 2017			2025 *	
Groups	abs	% of the populati on	Source / year	abs	% of the populati on
Healthy population	13,434	80.3	CBS Statline / 2010-2013	14,084	80.3
Person with long time disorders	7,829	46.8	CBS Statline / 2010-2013	8,208	46.8
Temporary physical-impaired people (person equivalents)	77	0.5	VeiligheidNL / 2015	80	0.5
Chronically impaired people	1,700	10.3	CBS Statline / 2008-2011	1,799	10.3
Obesity	2,067	12.1	CBS Statline / 2017	2,456	14.0
Sarcopenia	1,700	10.0	Shafiee / 2017	1,750	10.7
Cardio-vascular diseases	1,400	8.0	Hartstichting / 2015	1,453	8.0
Diabetes	1,135	6.6	CBS Statline / 2017	1,165	6.6
Eye disorders	750	4.4	CBS Statline / 2016	675	4.7
Hearing disorders	600	3.5	CBS Statline / 2016	675	3.8
Artrose (disabled)	280	1.7	TNO / 2010	298	1.7
Neurological diseases	200	1.2	Various websites / 2017	205	1.2
Cancer (affects on W+S only)	75	0.4		77	0.4
Latently impaired people	> 1,100	>6.7		> 1,200	> 6.8
Osteoporosis	1,090	6.7	RIVM	1,205	6.8
other 'hidden' disorders	p.m.	p.m.		p.m.	p.m

* Source prognoses: except Osteoposoris (source = Blokstra et al., 2007) calculated estimations (see Appendix 5)

c. Interrelations between the pedestrian's health and other environmental settings

Health is a key factor for mobility and walking. It conditions walking functionality, control, power and endurance and resilience. Good health makes it easy, safe, self-evident and a pleasure to walk. Illnesses and injuries impair abilities and propensity to walk, elevate risks involved and reduce resilience in emergencies and (critical) incidents. In this regard the nervous

system (strategic and operational movement management and reaction), skeleton and muscles (steps, stability, speed of movement), heart and lungs (endurance) and a healthy body mass are of particular importance (performance, endurance, resilience).

Health determines the range of travel and W+S behavioural options (cf. opportunity search), including (in)dependence on others, i.e. freedom of asking for support and medical and social care. Poor health and obesity tends to lead to a downward spiral regarding mobility and walking: less physical activity causes less health causes less physical activity etc. (see e.g. Rejeski et al., 2012) Good health and walking can do the opposite (cf. definition, scope and relevance).

d. Where and when health characteristics make a difference for walkers

Health affects both lifestyle/strategic (at home) and tactical-operational (outdoors) decisions and behaviour. Mental disorders particularly precondition strategic decisions and the quality of observation, information processing and reactions; physical impairments particularly affect walking abilities, but experiences with earlier walking activities also determine expectations with regard to the manageability of conditions under way, influencing strategic mobility, modality and walking choices. Impairments generally affect walking functionality most in critical operational conditions, putting (extra) time pressure on activities and reactions, making them more risky (cf. Reason, 1990). An example is that impaired persons need more time, and larger gaps in traffic, to cross a busy street. Under pressure suboptimal or even wrong decisions are made, putting them at serious risk of being run into.

e. Impact of health on walkers

Health affects walking and sojourning on different activity levels and in many ways. Health is, similar to the other population attributes discerned in this thesis, a starting condition and 'filter' for behavioural choices and chains of activities. Good health creates room for walking decisions and makes people dare to do things. Health affects the range of possible activities and desires, satisfaction, contentment, pleasure or suffering while outdoors. On the individual level interest in health determines how much a person is prepared to do for keeping up health and being physically active. Interest in health is associated with SES and life cycle (Adler & Connor Snibbe, 2003). Highly educated persons are generally more concerned about their health than others, partly because physical activity is not so much built into their working life. On the societal level it determines expenditure on medical and social services.

According to the World Health Organisation[224] moderate physical activity (e.g. brisk walking for at least 30 minutes per day, at least 5 days per week) is required to keep up health and resilience in difficult walking conditions.

Inactivity, illnesses and injuries can cause *impairments, disabilities and handicaps*. The World Health Organisation (WHO, 1980) defined and classified these concepts in the International Classification of Impairment, Disability, and Handicap. An impairment is defined as: 'any loss or abnormality of psychological, physiological or anatomical structure or function'. The *impairment* can build up to a *disability*, defined as: 'any restriction or lack of ability to perform an activity in the manner or within the range considered normal for a human being'. Finally, the disability can result into a handicap 'when an individual with an impairment cannot fulfil a normal life role'. Consequently, inactivity, illnesses or injuries and impairments can be considered a characteristic of a person, but a handicap is not. It is rather a description of the

[224] http://www.who.int/dietphysicalactivity/factsheet_adults/en/

relationship between a person and the environment (University of Iowa, [without date][225]). Disabilities and handicaps are discussed more extensively below under 4.3.4 W+S abilities translated into system requirements.

With regard to impairments above three main groups were discerned: temporarily impaired, chronically impaired and latently impaired people. Although relevant for W+S policy making, the first and last generally are not included in deliberations. The share of chronically impaired increases with age (Von Heijden et al., 2013).

Healable illnesses (e.g. fevers, the flu, bacterial infections), injuries (e.g. broken bones, cuts, sprained ankles) and restrictive and distracting mental conditions (e.g. stress, anxiety, anger, sorrow, alcohol use) can cause *temporary impairments.*

Inactivity, injuries and illnesses can also cause *chronical W+S impairments,* affecting strategic, tactical and operational behaviours. Dominant illnesses in this regard are in order of prevalence: obesity, sarcopenia, cardio-vascular diseases, diabetes, eye and ear disorders, neurological diseases and cancer. Short descriptions of their impacts and incidences are given in the next paragraphs.

Overweight and *obesity* are the most widespread health issues. WHO indicates that two out of three persons do not exercise sufficiently and are therefore more likely to become overweight, obese and become ill[226]. Overweight and obesity hamper walking propensity. In general, the higher the Body Mass Index (BMI)[227] the less the propensity for walking is, particularly from BMIs above 30, where walking becomes a burden and the risk of illnesses becomes high. Above a BMI of 27 it is very difficult to slim down without help. Currently about half of the population has overweight and about 14% of the population age 18+ suffers obesity[228]. Anorexia patients (low BMI's) often want to and do walk much to stay thin.

Sarcopenia causes loss of muscle tissue as a natural part of the aging process. Studies have shown 0.5 - 1% loss per year after age 30[229]. Physically inactive people can lose as much as 3% to 5% of their muscle mass each decade after age 30; it occurs to a greater deal in older women than men. Sarcopenia typically happens faster around age 75, but it may also speed up as early as 65 or delay till 80. It’s a factor in frailty and the likelihood of falls and fractures in older adults (Volpi et al., 2004:405-6). Even if a person is (very) active, s/he can still have some muscle loss. There’s no test or specific level of muscle mass for establishing a diagnosis of sarcopenia. Loss of muscle matters because it lessens strenth, balnce, control and ultiamtely mobility.

Cardio-vascular diseases are associated with cardio-respiratory fitness and the risk of heart failure. Apart from genetic reasons, high levels of physical activity generally lead to better cardio-respiratory fitness and vice versa lack of physical activity generally leads to low fitness;

[225] http://www.continuetolearn.uiowa.edu/nas1/07c187/Module%201/module_1_p3.html
[226] http://apps.who.int/bmi/index.jsp?introPage=intro_3.html
[227] The Body Mass Index is calculated as body weight in kilograms divided by length in meters. Values between 18 and 25 are considered healthy, between 25 and 30 is considered overweight and above 30 is obese.
[228] sources: https://www.volksgezondheidenzorg.info/onderwerp/overgewicht/cijfers-context/huidige-situatie#node-overgewicht-volwassenen and https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83021NED/table?ts=1522312658353
[229] see http://www.eatingwell.com/article/275991/how-to-eat-and-exercise-to-prevent-age-related-muscle-loss-from-sarcopenia/

physical disabilities, cognitive impairment and depressions are mentioned as cause for walking impairment such as low inclination to walk and reduced endurance with regard to (longer and sturdy) walking trips (Welmer et al., 2013; Orr et al., 2006; Heo et al., 2009). According to the Hartstichting (Heart Foundation) about 1.4 million people in the Netherlands (8.2% of the population) suffer from a cardio-vascular disease[230].

Diabetes is 'a disease in which the body's ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood' (cited from [accessed 4-10-2020] https://www.lexico.com/definition/diabetes). '*When there isn't enough insulin, or cells stop responding to insulin, too much blood sugar stays in* [the] *bloodstream, which over time can cause serious health problems, such as heart disease, vision loss, and kidney disease. There isn't a cure yet for diabetes, but healthy lifestyle habits, taking medicine as needed, getting diabetes self-management education, and keeping appointments with health care can greatly reduce its impact on one's life*' (cited from the US CDC website[231]). According to RIVM about 1.2 million people in the Netherlands (7.1% of the population) suffer from diabetes[232].

Eye and ear disorders can erode respectively vision and hearing abilities, necessary for orientation, early warnings and communication with other persons in the environment.

Neurological diseases like Parkinson's disease, dementia, ASL, can cause impairments as these diseases weaken control, body strength and balance. In the Netherlands about 200,000 persons (1.2% of the population) suffer from neurological diseases and there are about 75,000 cancer patients (0.4% of the population) who experience difficulties walking (calculations based on 2016 CBS Statline data).
There are specific mental disorders that impair walking, like agoraphobia (incidence males 2 per 1,000 adults; females 5 per 1,000 adults; RIVM, 2013 (Graaf et al., 2011)) or anthropophobia (incidence males = 31 per 1,000 inhabitants; females 43 per 1,000; RIVM, 2013 (NEMESIS-2, 2011)) but on the other hand also disorders that stimulate walking, like anorexia or amaxophobia (fear of sitting in a car). Depression patients can be temporarily impaired as well, because of exhaustion, concentration, slow thinking problems or suicidal thoughts (incidence: in 2007-2009 5.2% of adults suffered depression during the preceding 12 month at some point in time; no information could be found about the average duration of an episode).

Cancer may also weaken control, body strength and balance. Maheu et al. (2018[233]) indicate that *'cancer and cancer treatments may affect multiple systems and organs. The neurological system, muscles and bones are particularly vulnerable. Problems with limb weakness and loss, gait disturbance, imbalance and other problems affecting normal walking are common in 25%–35% of cancer patients. Fatigue and visual changes may add to these mobility challenges. Precancerous mobility impairments may be magnified by cancer and its treatment.'*

With regard to impairments, disabilities and handicaps distinction must be made between total loss of a function and limited functionality. Examples of total function loss are wheelchair users, the deaf and the blind. Examples of limited functionality are walking impairments, balance disorders, stamina disorders, visual impairments, auditory impairments, cognitive and mental limitations. Below in Subsection 4.3.4. disabilities will be discussed in more detail.

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230 https://www.hartstichting.nl/hart-en-vaatziekten/feiten-en-cijfers-hart-en-vaatziekten
231 https://www.cdc.gov/diabetes/basics/diabetes.html, accessed 31-7-2018
232 https://www.diabetesfonds.nl/over-diabetes/diabetes-in-het-algemeen/diabetes-in-cijfers
233 https://www.cancerandwork.ca/healthcare-providers/cancers-impact-on-work/effects-mobility/

Prominent causes of *latent (hidden) impairments* are osteoporosis and cerebral and abdominal aneurysms. In most cases the patients are not aware that they have such disorders. In case of incidents the disorder can seriously aggravate the outcome of minor incidents like falls or stressful events.

Osteoporosis causes decrease of bone mass and strength. The bone fractures cause pain, impairment, loss of independence and Quality of Life and even early death[234]. The prevalence of this disease is 52 per 1000 men and 166 per 1000 women of 55 years and older; this corresponds to 7% of the total population and 14% of the 50+ population. In 2015 there were about 900,000 patients in the Netherlands; in 2025 there will probably be 1,200,000 patients (RIVM, 2015). Two thirds of the patients are female. It is a silent epidemic as most people only find out that they suffer this disease when they start breaking bones. Per year about 90,000 people older than 55 break bones as a result of this disease. Determinants are '*genetic predisposition, small posture, female, high age, premature menopause, low physical activity, long-term immobilization, vitamin D deficiency, low dietary, calcium intake, cigarette smoking, excessive alcohol consumption, particular hormonal diseases and other diseases which influence calcium- and bone metabolism'* (NCBI website[235]; Schuit et al., 2004).

Like with osteoporosis, most patients of *cerebral and abdominal aneurysms* are not aware that they have this condition. Tearing of abdominal aneurysms is fatal in 80% of the cases. Although cerebral aneurysm do not often tear, if they do, the consequences are serious. One third of the patients recover, but according to the Dutch Hersenaneurysma Platform continuing symptoms, permanent invalidity and even death are associated with this syndrome[236]. Abdominal aneurysms can be detected through medical scanning, but for cerebral aneurysms this is much more difficult. In the UK men older than 65 were screened on abdominal aneurysms; 1.57% of them had a high risk, but treatable abdominal aneurysm of 3 cm or more (Vahl et al., 2015; Davis et al., 2013).

f. Significance of pedestrian health for W+S policy making

Health is a key determinant of W+S abilities and mobility options. If not protected, mitigated and promoted properly[237], impairments seriously limit mobility options and Quality of Life and thereby also impact collective well-being and wealth. This concerns a large part of the population. In 2013 about 38% of the Dutch population had one or more (chronic) physical impairments, but most of them concern slight impairments. About 12% of the Dutch population has moderate to severe health related impairments (Von Heijden et al., 2013).

Particularly due to ageing of society the number of impaired people is increasing. Dependent on the impairment, the ease of walking, using transportation, their action radius and freedom to do activities outdoors and independence is limited, causing personal as well as collective problems, e.g. the need for support, alternative services, social and financial arrangements.

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[234] see https://osteoporosevereniging.nl/osteoporose/wat-is-osteoporose/

[235] https://www.ncbi.nlm.nih.gov/books/NBK45503/

[236] http://www.hersenaneurysma.nl/index.php/hersenaneurysma

[237] Regarding strategic walking choices the RLi advised to not only protect and mitigate health, but also promote health by offering health improving facilities (RLi, 2018). Regarding operational behaviour impairments also need to be mitigated. For example eyesight can be improved by spectacles; walking aids can help to stay mobile; adapted equipment in a car can enable some impaired people to drive.

8) Conclusions regarding population attributes connected to environmental settings.

This paragraph presents conclusions with regard to the first of the three leading research questions of this section: *in what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?*

To find answers to the leading research question this subsection explored population lifestyle level attributes that function as precursors, 'ambiance' and determinants for the demand for W+S opportunities and broad indications for the elasticity in the demand, defined by W+S needs, abilities, decisions and lifestyle behaviours. The analysis does not deal with strategic, tactical and operational W+S behaviour and its impacts resulting from the precursory decision processes: that will be done in the next chapter.

In total the explorations yielded seven kinds of environmental conditions affecting W+S experiences, decisions and behaviour. In this regard population groups of (potential) pedestrians were identified; thus the environmental conditions can be considered population attributes. The following population attributes were discerned and substantiated to sketch a picture of their scope and weight of impacts. These attributes are 1) the everyday living environment, 2) social economic status, 3) lifecycle and demographics, 4) access to transportation, 5) social psychological characteristics (incl. attitudes), 6) access to information and information technology, and 7) general health.

Analysis of available and easily findable documents per attribute led to the identification of subgroups of (potential) pedestrians and impacts which the attributes had on individuals within the subgroups, such as how free or limited persons are in their mobility and sojourning choices and to go outdoors and walk.

The analysis offers cues for strategic prevention of mobility poverty, improved support and promotion of walking as solution for social-economic, safety and health issues.

The attributes appear to affect the volume and severity of W+S issues. The research identified the following pedestrian groups that stand out: very urban residents, tourists, holiday makers and visitors, residents of low-SES neighbourhoods, children aged 0-15, retired persons, professional walkers, low-income people, households with young children, transport-poverty stricken persons, recreative walkers, duo or group walkers, dog owners, women, informal care givers, (non-western) immigrants, ICT illiterates, temporarily impaired people, chronically impaired people and latently impaired people. In total more than half of the Dutch population can be expected to need dedicated or better than average facilities or services.

The findings however are far from conclusive as very few studies focus on general walking push or pull factors associated with population attributes. Most attitude studies are limited to specific strategic, tactical or operational W+S choices, e.g. health, obesity, physical activity, traffic safety, security, walking in the dark, street crossing, walking on sidewalks, shared use of sidewalks or streets, pedestrian count-down installations. This way the above observations are not more than indicative for impacts of the discerned population attributes on strategic walking and sojourning decisions. For a better assessment of the impacts targeted research is needed.

In the next four subsections pedestrian needs, abilities, population segmentation and potential windows of opportunities will be explored. Thereupon, in Sections 4.4 and 4.5. the system requirements and policy preconditions connecting to population attributes, needs and abilities

are sketched. In Chapter 5 the status quo regarding facilities for pedestrians and the actual incited W+S behaviour and impacts are investigated and described.

4.3.3. W+S needs translated into system requirements

This subsection deals with the question of how W+S needs, wants and desires translate into W+S system requirements. For this translation it is necessary to know what the actual W+S needs, wants and desires of Dutch pedestrians are and how this can be translated into an urgency weighted list of system requirements. The research question for this sub-study is:

How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?

In Chapter 3 general human needs were discussed. In this context Lapintie's classification of human needs was presented (Lapintie, 2010; see also this thesis' Table 3.3.), which in this sub-study is used as a starting point.

To explore the relations between general human needs, reasons and motives for walking and sojourning in public space and corresponding W+S system requirements, in June 2013 an experts workshop was organised (Methorst, 2013; attendance list: see Appendix 4). To organise the workshop and analyse the workshop results the above sub-study research question was worked out into four more detailed research questions:

1. How do general and abstract human needs (as classified by Lapintie, 2010) relate to concrete motives and reasons for walking?
2. Which motives and reasons do (potential) pedestrians have for walking and sojourning in public space? How should they be sorted?
3. What trip types and groups can be distinguished regarding W+S needs, motives and reasons?
4. What kinds of conditions, facilities and/or services can (potential) pedestrians be expected to feel necessary or most suitable for achieving their general targets?

In the next paragraphs findings with regard to the detailed research questions are successively presented. Successively this subsection deals with 1) the relation between human needs and W+S motives and reasons, 2) Motives and reasons for walking and sojourning, 3) Pedestrian trips and groups with regard to needs and W+S motives and reasons and associated W+S system requirements, 4) General observations of the workshop attendants, and 5) Conclusions regarding needs-based W+S system requirements.

1. The relation between general human needs and W+S motives and reasons.

This paragraph deals with the first of the four detailed research questions regarding the sub-study on general human needs, motives and reasons for walking and sojourning in public space. It gives account of the workshop's results and conclusions based on earlier findings in this regard.

The workshop attendants confirmed that general human needs, like these are discerned in Lapintie's classification of human needs, underlie reasons and motives for walking and sojourning in public space, but also that these do not directly translate into W+S reasons,

motives and W+S system requirements to adequately facilitate walking and sojourning in public space.

In this context it was argued, both above in this thesis and in the workshop, that human needs as identified and classified by Lapintie and others (e.g. see Section 3.3.3: Maslow, 1943; Alderfer, 1969; Gasiet, 1981; Graves, 1970; Hofstede, 2001) concern person or group attributes. These types of needs primarily guide lifestyle and strategic behaviour, including travel and sojourning choices. Choosing to walk or sojourn in public space corresponds with assuming a *role*, i.e. to be a pedestrian, which is anybody who walks or sojourns in public space. Indirectly the higher order human needs may also direct tactical and operational choices while walking and sojourning in public space. For example a strong need for safety will translate into a focus on safety conditions and choices that are perceived to be the safest option.

So, walking and sojourning are not primarily considered general human needs by themselves, but specific desires, wants, motives or reasons as a means towards a higher (person or group specific) end: going to work to earn a living, going to school to learn and grow up, enjoying the sun, get some exercise and be healthy, meeting people etcetera. Personal conditions and (perceptions concerning) environmental settings set the stage for choices whether or not to walk and sojourn in public space; actual W+S system conditions frame W+S tactical and operational behaviour.

2. Motives and reasons for walking and sojourning

This paragraph deals with the second detailed research question in the sub-study on general human needs, motives and reasons for walking and sojourning in public space, taking stock of motives and reasons for walking and sojourning, and how these motives and reasons can be classified. It gives an account of the workshop results in this regard, followed by an impression of common practise regarding the classification of W+S motives and reasons.

The workshop drew up an inventory of walking and sojourning in public space motives by writing imaginable walking and sojourning motives on PostIt stickers. In total 84 PostIt's (averaging 6.5 per attendant) were delivered, comprising in total 62 different motives to go outdoors on foot.

The workshop attendants agreed that a key requirement regarding the classification of the mentioned motives is that policy actors are enabled to easily detect, identify and handle the indicators for policy making. For this reason the 62 identified W+S motives were classified along two axis: the '*why*' and the '*who*'.

The '*why*'-axis concerned the degree of obligation: a) 'Fixed schedule walking from A to B', b) 'Choice trips' and c) 'Recreational walking and sojourning'.
The '*who*' axis comprised the crude age-target groups of 'Children', 'Youngsters', 'Adults' and 'Elderly (and handicapped)'.

The workshop attendants considered that needs on the lifestyle level, connected to person or group attributes, affect travel and sojourning motives. It was noted that in literature, particularly regarding shopping, distinction is made between 'fun' and 'not-fun'. Fun-shopping differs fundamentally from grocery and household shopping. In public space it is however difficult to distinguish. The question is whether 'fun' really corresponds with 'not so necessary' and 'not very urgent and policy relevant'. The same can be said for walking for health.

Other classifications were discussed, like the degree to which interaction between people plays a role, cultural differences, the walking context and abilities[238], life stage, person attributes, freedom of mobility choices. Distinction to interaction implies discerning between individual and collective walking; distinction to culture implies discerning regarding walking/cycling preferences or 'esteem needs'[239]; distinction to walking context implies discerning in urban environment, nature and mass activities[240]; identification of life stage and personal attributes, although very relevant for choice-behaviour, are difficult to identify for policy makers; freedom of mobility choices are mostly connected to abilities and will be dealt with separately later on in this thesis.

In fact, in literature several classifications of travel motives and reasons for walking are found. Two very different kinds of classifications stand out. On the one hand there are classifications with regard to travel motives, as used in travel surveys, which offer a proxy for pedestrian travel needs, covering universal main- and sub-mode walking trip motives. On the other hand there is the LAPC (1997) classification of kinds of walking, which come into being for different reasons or functions of walking and sojourning.

In the Dutch *travel surveys* the following travel motives are discerned: 'to and from work', 'business trips', 'services and personal care', 'shopping', 'education', 'visits and staying over', 'social-recreative', 'touring and wandering' and 'other'. The classification does not cover all W+S activities in public space. By definition the Dutch travel survey does not cover professional walking (postmen, road workers, tradesmen, police supervisors etc.), sojourning and recreative walking trips longer than two hours (wandering) and can be expected to not fully cover circulation; doing errands is underreported (CBS symposium 'Het nieuwe OViN', 2017). Furthermore, it only covers Dutch inhabitants and not non-Dutch visitors and tourists. Thus a significant share of W+S is not represented. As far as the author knows there are no systematic studies that comprehensively cover the total need for W+S in public space and how W+S needs translate into W+S system requirements.

The LAPC (1997) classification was introduced already in the first chapter of this thesis (see Section 1.3). The LAPC classifies walking and sojourning reasons into four kinds:

- *Access mode walking*, typified by walking from door to door;
- *Access sub-mode walking*, typified by walking to and from other modes;
- *Circulation*, typified by walking without a fixed destination, e.g. professional walking, walking the dog, posting a letter, doing errands, (window) shopping, jogging, wandering;
- *Recreation/leisure*, typified by sojourning in public space, including walking for the sake of walking, as a way of spending time in a nice way.

The author observes that in practise most research regarding W+S motives and reasons links up with the travel survey classifications and in this context available mobility and exposure data. Both the LAPC and this workshop's classification have the potential to better and more

[238] Differences in abilities will be dealt with more thoroughly in Subsection 4.3.4.
[239] The workshop attendants noted that KiM (**K**nowledge **i**nstitute **M**obility) research showed that, when walking and cycling is combined, there are no big differences between Western countries for the age group 55 - 64. When cycling and walking are separated, large differences show up, which can be explained by differences in climate, hilliness and particularly cultural differences. In the Netherlands cultural differences between ethnical groups exists regarding 'esteem needs'.
[240] For example: demonstrations, recreation, jogging, shopping, lunch-break walking.

comprehensively cover pedestrian activities, but these require dedicated research to get valid coverage, which is not (yet) common practise, and more difficult and expensive to achieve.

3. Pedestrian trips and groups with regard to needs and W+S motives and reasons and associated W+S system requirements

This paragraph deals with the third and fourth detailed research question in the sub-study on general human needs, motives and reasons for walking and sojourning in public space, i.e. 3) the segmentation of trip types and the (potential) pedestrian population regarding W+S motives and reasons, and 4) what kinds of conditions, facilities and/or services can (potential) pedestrians be expected to feel necessary or most suitable for achieving their general targets?

At the start of the workshop it was laid down that pedestrians as a group are very heterogeneous with regard to their needs and abilities (as also discussed above under Subsection 4.3.2.), even more so than any other road user group[241]. It was voiced that in practise this is often misunderstood, as shown by many national and governmental traffic and public space plans. It stroke that pedestrians usually are treated as a homogenous group having simple needs and that specific pedestrian needs and abilities are usually not considered, except when dedicated legislation applies, like for persons with disabilities. The workshop attendants concluded that the identification of W+S system requirements should start with a functional segmentation of the (potential) pedestrian population.

Following the Workshops primary classification of W+S activities, the attendants decided to split up in three subgroups (see below under 3a, 3b and 3c) to first identify what kinds of trips groups of pedestrian make and then describe what W+S system needs they have in this respect.

3a. Identification of W+S system requirements - Fixed schedule walking from A to B

The subgroup Functional Walking discerned four kinds of walking activities:

1. *Mandatory trips* following a fixed schedule, e.g. home-work trips, home-school, walking the dog and routine business trips;
2. *Mandatory trip*s following a fixed schedule, but where the target group is *dependent on escort*, e.g. young children, handicapped persons;
3. *Walking trips to and from other modes*, in particular bicycle, car and public transport;
4. *Incidental trips by appointment*, e.g. social visits, visits to a hospital or medical doctor, business trips or parts of it, safety or inspection scan trips (work).

With regard to general needs the workshop decided that the following human needs seem to play a significant role in utilitarian walking choices: to be able to live a normal life, bodily activity, objective safety, mobility in general, lack of stress and anxiety, practical reason, autonomy, play, growth/growing up, security, social needs, and political needs.

For type 1 trips people generally prefer fast and direct walking routes between home and the destination (e.g. work) or when accessing public transport or other rides, regardless of the quality of the environment (Schoon, 2019:47).

[241] For example: children, handicapped and elderly persons versus healthy and fit adults, speed walkers and hasty pedestrians versus tourists and shoppers, licenced road users verses non-licenced pedestrians, people who do not have a choice but to walk versus people who have a variety of options to choose, including the car or other motorised vehicle as a transport mode.

For *children* type 1 trips do not appear to be applicable. For other walking trips by children general needs like comfort and human rights do not seem to apply, but the need for play is however extremely important.
For *youngsters* general needs as bodily integrity, comfort and human rights do not seem to be strong motivators; the need for growth and growing up plays a role throughout most mobility decisions.
For *adults* bodily integrity and comfort are subordinate needs; social security however seems to be a dominant need, particularly in females at night.
For the *elderly* all of the general needs seem to be important in utilitarian walking trip decisions. For the elderly type 2 trips decisions seem to be rather rare.

3b. Identification of W+S system requirements - Choice trips
Subgroup Choice Trips discerned the following types of choice trips:

1. *Functional trips to a specific destination*, with freedom of choice regarding the point of time and/or location, e.g. small scale and large scale shopping, recreative shopping, going to the market, going to a café or restaurant;
2. *Circulation trips,* meant for doing something on the way, e.g. professional walking, purchases in various shops, bringing the kids to school, walking the dog, having contact with other people, walking a kid to a playfield or park or sports club, escorting a child to a playfield;
3. *Fleeing or escaping* obstacles;
4. *Physical exercise*: improving one's physical condition, jogging, walking for health, running, containing osteoporosis;
5. *Walking to relax*, relaxed walking, to chill and hanging out, time for thinking and talking to someone, walking in the woods, looking at public art.

For type 1 trips people generally look for ease of access, attractive retail or other targeted destinations, and attractive routes (Schoon, 2019:47).

With regard to *children* there is need for social and traffic safety, convenient arrangements, recognisability, clear function of the area (is it for play or for traffic?). Children need adequate nearby user (play) space; the areas need to be demarcated (zoning); the child environment needs to offer opportunities for play; in the evening the play areas should be sunny.
Youngsters need to be able to have free and shielded contact with partners in adversity; the reserve should have a challenging environment; they must be able to find each other in meeting places; there should be room for exploration, openness; privacy is important (no control by adults).
For *adults* important functional criteria are social contacts, physical well-being, psychological well-being, comfort, safety as well as being able to enjoy the environment. The main aim is to be able to satisfy primary needs (work, purchasing goods). For this nearness, accessibility and the absence of obstacles on their way are important. In route choices aesthetics plays a role; attractiveness can pull them over the line to walk.
For the *elderly* the most important requirements are comfort, peace and quietness, safety and being able to enjoy the walk and the environment. The environment should be safe (not busy, secure and safe traffic). Safe road crossings, view on other people's activities, no noise, no bad smells, and colour and seasonal differences are important environmental requirements. On longer routes resting facilities are called for. Key requirements are: even, flat, clean walking routes, shelter, hospitality, being able to find each other, clear function of the area, adequate markings and signposting and even lighting.

3c. Identification of W+S system requirements - Recreational walking and sojourning

The subgroup Recreational Walking and Sojourning discerned the following subtypes of recreational walking and sojourning:

1. *Playing* on the street and in play areas;
2. *Refreshing* walks, e.g. short lunch walks in the neighbourhood;
3. *Walks in nature,* e.g. medium and long walks in nature, including those that require transport to the natural area;
4. *Social activities*, e.g. a street party, protest march, strolling and hanging out;
5. *Enjoying the environment*: look, experience, smell the environment, sightseeing, visit a street café, be inspired by the surroundings etc.

For *children* recreation more or less equals playing. Playing is discovering and for this one needs to enter the environment. Some needs are related to playing, like the need for social and traffic safety, social control, protected area as well as zoning and having confined areas and safety of play tools, challenging play tools giving reason for playing. For very young children there must be facility for parental supervision.

For *youngsters* recreation in public space more or less equals 'chilling' and hanging out. In practise there is often transition from playing to chilling. A hang-out place can hardly be dull and desolate enough. Youngsters have a need for a compelling, isolated environment, away from social control, and preferably no contact with people that do not belong to their peer group (children, adults, elderly). Students take pleasure in visiting street cafés, lying in the grass and meeting others.

For *adults* recreation more or less equals experiencing nature and something beautiful, aesthetics, peace and quiet, leaving the world behind, freedom, unwinding. This is accomplished best if haste is left behind: traffic calm, no hectic noisy business, but also not a no-go area. This goes for shorter (lunch) walks as well as walking the dog. Greenery is attractive, but everywhere is all right just as long as it is not hectic. Aesthetics (nice environment) support the choice. On longer walks facilities on the way (ice cream, bread rolls, coffee) belong, preferably halfway the parking place or public transport stop. Not everyone has the same recreation needs. Many recreation needs and leisure activities are learned and conveyed by one's parents.

The *elderly* prefer recreation opportunities away from youngsters hanging out, but also having social contact with other people (having a look or talk). The elderly seek social contacts, certainty and security, recognition, familiarity, neighbourhood.

4. General observations of the workshop attendants

A general observation that the workshop attendants made was that insights in W+S needs help to get general insights in functional system requirements, that relatively little is needed to be able to walk, and the potentials are great. The workshop covered the most obvious walking activities, but was not able to completely cover the W+S system requirements. The workshop voiced some general observations: a) age is the most meaningful group classification criterion, b) there are pronounced differences in environmental requirements regarding W+S type and age group, c) the role of attractiveness is important only in free walking choice conditions requirement packages per age group, d) aesthetics are a maverick requirement, e) needs can both conflict and interrelate, f) walking is not a disutility, g) the initial power of physical conditions differs per country and seems to fade when habits are formed, h) researchability of W+S needs requires attention. The observations are elucidated below successively.

4a. For W+S age is the most meaningful classification criterion

At hindsight the workshop finds age the most meaningful classification criterion. It is easily explainable and a good line of approach for policy making, but probably not a panacea.

With regard to children age strongly relates to development of needs and task abilities for taking advantage of opportunities offered by the design of the physical environment. For other groups this relation is less clear and additional approaches will be needed to properly cover their needs (and abilities). There other person attributes like social-economic status, ethnicity, culture, life stage and civil state can and should play a more dominant role.

A recent policy study by KiM (Knowledge institute for Mobility questions, Berveling et al., (2011)) on target group segmentation for better use of the infrastructure was quoted. In that study age was not chosen as the discriminating factor. It must be noted that the target group for KiM (mainly car drivers) is more homogenous than pedestrians age wise.

4b. Different environmental requirements regarding W+S type and age group

From the workshop accounts the author concludes that the workshop attendants agree that there are pronounced differences in environmental requirements with regard to the W+S type and age groups. For *functional (routine) walking* system requirements generally seem to refer to subsistence and psychological needs; the attendants did not often and emphatically refer to aesthetic, social and political needs. For *choice trips* and *recreative walking and sojourning* psychological, social and political needs seem to matter most, probably because subsistence needs are assumed to be satisfied anyway.

4c. Requirement packages per age group

The workshop attendants agreed that (combinations of) needs per age group yield different packages of environmental requirements for each of the groups. Per pedestrian group need packages can vary substantially: one group (e.g. youngsters) desires closeness, privacy and isolation, whilst the other (e.g. elderly) desires the opposite. It can be assumed that more detailed group segmentation will lead to even greater differences. The workshop attendants submitted that W+S policy should aim at variation and diversity in aesthetics.

4c Attractiveness important only in free walking choice conditions

With regard to W+S system requirements the workshop observes that attractiveness particularly plays a role at free walking choices, and not so much at routine utilitarian trips. A most important factor is whether the W+S environment is traffic calmed or that motorized traffic is totally absent. This is true for both city and nature walks. A nice environment counts particularly for recreative walking and sojourning: dependent on the strategic goal of W+S. Further it was noted that playing in public space becomes more attractive when special conditions are met, e.g. a wall to kick a ball against, limiting how far the ball goes after a kick.

4d. Aesthetics is maverick

As a need *aesthetics* is maverick. It was noted that a number of studies point to its existence and importance. In most cases it is seen as a psychological need, like triggering of senses, imagination and thought. Aesthetical values vary with culture and education, leading to differences in taste. In this regard the attendants concluded that the environment should have variation, look good, well cared for, nice and well lighted.

4e. Needs may conflict or interconnect

It was found that providing for specific needs can result in conflict. Traffic safety for example can sometimes incite social unsafety. A strong separation of a footpath along a road can be

traffic safe, but also be socially insecure. Needs vary between groups and over time, e.g. at one time a person wants peace and quiet, at another moment s/he wants to meet other people. Furthermore, needs interconnectivity occurs. Children for example have a great need for play. Below this need for play however needs for freedom and challenge lurk. This does not point to a hierarchy in needs, but to interconnection between such needs.

4f. Walking is not a dis-utility

The workshop observed that in most traffic and transport economic studies trips are considered to be a dis-utility (cf. Mokhtarian & Salomon, 1998, who point to travel for the fun of it). Trips are often seen as costs; trips should be as short as possible and cost as little as possible. For walking this outlook is not correct. The workshop concluded that compared to travelling by means of vehicles, walking has added value, which is relatively low for utilitarian walking, but high for choice trips and recreational walking and sojourning. The question is whether the concept of dis-utility loss fits walking. The workshop attendants uttered that walking represents ultimate freedom, even compared to cycling, except when crossing a street, when it really is about traffic. Walking is associated with other experiences than being a car driver: 'emptying one's head', 'having a nice lunch walk', 'feeling the wind at the beach'. Walking fulfils a bridge function between that moment that one works and being home. It unwinds and helps to step from one condition to another. In this walking has added value compared to regular car trips[242].

4g. Initial power of physical conditions fades when habits are formed

In many cases the physical environment seems to dictate or allow for W+S choices and behaviour. The workshop expects that by comparing countries and looking at differences in conditions and behaviours important insights in causality of environmental factors can be acquired. It was concluded that for first-time decision whether or not to walk physical qualities like distance, gradient, shelter, flatness and walking space certainly play a role. When a habit has developed these reasons loose power. For recreative walking and sojourning the walking environmental quality stays an important determinant. There is a rather strong preference for separation of pedestrians from motorized traffic.

4h. Researchability of W+S needs

Finally the workshop attendants talked about researchability and the position of pedestrian needs within the policy cycle. It was concluded that there are several options regarding methods: asking specific target groups, observing behaviour and deducing what the needs behind it are, proxy-research amongst experts, non-experts and the general population. Such research has been carried out, but as far as known this was limited to operational behaviour and did not touch on needs, reasons and motives behind the operational behaviour. Research should play a role at the start of the policy cycle, when objectives are formulated and these can also be used as criterion for testing achievements. In the Brussels Pedestrian Plan important pedestrian needs are systematically discussed and taken as starting point for policy development.

5. Conclusions regarding needs-based W+S system requirements

This paragraph presents conclusions with regard to the second of the three leading research questions of this section: *how do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system*

[242] Some car and motorcycle trips can evoke similar feelings, e.g. cruising with an old-timer with an open roof on a sunny day in nice landscapes.

requirements? It describes what insights were gained regarding needs-based W+S system requirements and what insights still lack.

a. What general insights are gained?
With regard to the question of how W+S needs, wants and desires translate into W+S system requirements, the workshop results are based on consensus between W+S experts. Most of the insights however are not yet firmly backed up by empirical evidence. There is no clear picture of what pedestrians in general need, want or desire when it comes to walking; people's needs, wants and desires are person/group and context sensitive.

The workshop attendants agree that general human needs cannot be translated into W+S system requirements without discerning the four kinds of walking (see e.g. LPAC, 1997[243]) and target group segmentation. Pedestrians as a group are extremely heterogeneous; this is true for W+S needs as well; the needs differ per (group of) persons, place, moment and environmental conditions. Concrete W+S needs only apply after a potential pedestrian has decided to go to some outdoors destination and to do that wholly or partly on foot.

The four kinds of walking connect to the degree of freedom that (potential) pedestrians have to choose to walk as well as the degree to which quality of the environment pulls potential pedestrians over the line to actually walk. Utilitarian walking as *access mode* (door-to-door) and walking as *access sub-mode* are less affected by lack of environmental quality than *free-choice walking (circulation)* and *sojourning*, particularly recreative walking and sojourning.

From the workshop discussion the author abduces that utilitarian walking as access mode and as access sub-mode follows from commonly discerned travel motives that also apply to other travel modes: 'to and from work', 'business trips', 'to services for personal care', for shopping', 'for education'. Choice walking trips concern the commonly discerned travel motives 'visits and staying over', 'social-recreative', 'touring and wandering'. Additionally there are some motives that usually do not apply for other modes, but surely do for walking and/or sojourning: 'long walks', 'manifestations', 'playing', 'sight-seeing', 'sports', 'walking the dog', 'earning a living' and 'other'.

Apparently there is also some kind of hierarchy in W+S requirements in relation to (potential) pedestrian's needs and wants, comparable to the ideas of Van Hagen's presented in his pyramid of consumer transportation needs (Van Hagen, 2006). *Basic opportunities* (doable, safe and reliable) are conditional for all walking and sojourning activities, *dis-satisfiers* (too slow or inconvenient) push people that have a choice from choosing to walk and *satisfiers* (comfortable, healthy and nice) pull people that have a choice over the line to do recreational walking. Requirements regarding *do-ability* and *safety* largely depend on how much a (group of) person(s) is able to walk towards the destination and cope with environmental conditions under way. In the following subsection this will be discussed in more detail. The aspect of reliability can be assumed to depend on how well conditions on the chosen route suit the walker and to what degree these conditions in some way can slow down, endanger or even block passage or sojourning.

b. What general insights still lack?
From comparing the workshop results with theoretical considerations (cf. Chapter 3 and Section 4.3.1) it is clear that the workshop 1) did not cover all major pedestrians groups, 2) only broadly

[243] The four kinds are: Access Mode, Access Sub-Mode, Circulation/Exchange, Recreation/Leisure.

translated W+S needs into W+S system requirements, 3) did not cover W+S system requirements other than those concerning the physical environment, and 4) did not shed light on the relative importance of basic human needs-based W+S system requirements regarding the various pedestrian groups.

1. Not all functional pedestrian groups covered

In the workshop's classification of W+S activities professional walkers and (non-Dutch) tourist W+S activities are not (yet) included, but their main characteristics can be abducted from their assignments. With regard to professional walking trips it can be argued that these trips are essentially utilitarian walking trips, unfortunately falling outside the scope of common travel surveys as well as the workshop. Professional walkers must be healthy and vigorous to be able to walk in almost all but very hostile walking conditions; their performance will depend on connectedness, convenience (including way finding) and safety of their routes[244]. (Non-Dutch) tourists also fall outside the scope of common travel surveys. For this group aesthetics, shielding from motorised traffic, guidance and way finding, accessibility by public means can be assumed to be major W+S system requirements.

2. Relative importance of needs

The workshop resulted in very broad insights into how W+S needs translate into W+S system requirements and found that age seems to be the most meaningful criterion. In the next section it will be shown that W+S choices translate into W+S tasks. For carrying out these tasks, a person needs certain abilities matching W+S system conditions. The tasks evidently connect to achieving human needs. Knowing group disadvantages and/or impairments, the needs indeed can be translated into more detailed functional W+S system requirements.

3. Translation of needs into W+S system requirements still abstract

It needs to be remarked that the workshop focussed on requirements regarding the physical environment, but did not go into also relevant W+S system requirements regarding transportation, the social-normative environment, information technology, pedestrian abilities and organisation of W+S system management and improvement. In the following (sub)sections on W+S system requirements these aspects will be studied in relation to pedestrian abilities and be given attention.

4. Relative important of W+S system requirements still unclear

The workshop did not go into the relative importance or priorities of W+S system requirements or even how to determine such priorities. In the following (sub)sections (some) initial impetuses are developed for prioritising measures.

4.3.4. W+S abilities translated into system requirements

4.3.4.1. Introduction

In practise the transport system and specifically the road network is designed with some kind of reference standard car in mind, defining a design envelope regarding need for space, optimal curves, maximum slopes, travel speeds, service and safety provisions etc., which supports the majority of road users. This prompted Asmussen (1996) to suggest to construct a New Reference Standard Human' as a pedestrian, or better: Reference Standard Pedestrian (RSP)[245]

[244] Cf. 5 C's: *Connected, Convivial, Conspicuous, Comfortable, Convenient* (Gardner et al.,1996:15).

[245] The New Reference Standard Human is a literal translation of the Dutch concept 'Nieuwe Normmens'. Both Asmussen and the author focus on walking therefore using the term 'Reference Standard Pedestrian' (RSP) seems to be more appropriate.

and formulate general minimum requirements for pedestrian facilities in the transport system, supporting (almost) all (potential) travellers. Nowadays this is referred to as the Design for All principle.

Asmussen concluded that the most important limitation of the New Reference Standard Human (RSP) is slowness. The RSP is less quick in detection, less quick in deciding and less quick in acting than the average road user. S/he can do much, but needs more time for it. As the current transport system is geared to the car, s/he is constantly pressured for time, demanding short detection periods, large detection distances and the ability to act quickly. For motor traffic efficiency this seems to be a correct principle, but for many people on foot this seems to be a recipe for risky errors when confronted with motor traffic. Such confrontations need to be avoided. Sojourning areas, the pedestrian domain, needs to be designed from the New Reference Standard Pedestrian with all his/her limitations.

A question in this regard is how a Reference Standard Pedestrian (RSP) can be defined. Following Steg and Vlek (2008) the author postulates that, together with environmental settings and (potential) pedestrian W+S needs, walking and sojourning (dis)abilities shape the demand side of pedestrian behaviour. Whereas needs typify the population's drive to walk and sojourn in public space, abilities typify the facilitation or limitations of W+S behaviour. Although in this respect needs are connected to abilities, basic needs are relatively general, but the urgency of them relate to how capable a person is, and how much his abilities restrict his aspired behaviour, which s/he perceives as a normal human activity. The current subsection deals with the question how pedestrian task abilities translate into W+S systems requirements. In Chapter 5 the results of the exercise will be used to appraise the W+S status quo.

It is important to stress that, like regarding W+S needs, regarding abilities, the (potential) W+S population is very heterogeneous. After all, everyone is a pedestrian, and walking is the basic mode for moving about in public space. Consequently, the W+S system should be designed and managed in such a way that everyone is enabled to walk and sojourn in public space. Compared to the 'average' adult humans, many people have one or more disadvantages and/or impairments. Disadvantaged are for example children, who are still small, growing up and learning to use their capacities. Impairments concern problems with a structure or organ of the body (WHO, 2002). Disadvantages and/or impairments can render a disability to perform particular activities, which in life roles can constitute a handicap to fill a normal life role (WHO, 1980). In this thesis it is assumed that full participation in society is targeted.
In other words: not the average road user should be the reference norm for W+S system design, but the ones that have limitations or disadvantages regarding their moving about on foot. Consequently this thesis starts from limitations, impairments or disadvantages of (groups of potential) pedestrians, i.e. what even seriously limited persons are actually able to do to move about on foot.
The question is what system conditions should be offered to warrant such participation in society for (almost) everybody, regardless their disabilities.

To be able to perform such a translation insight is needed in 1) what tasks (potential) pedestrians are to perform, 2) what kinds of abilities and skills this embraces, 3) how W+S abilities and skills translate into W+S system requirements consistent with Design for All / Universal Design, i.e. enabling the vast majority of the (potential) W+S population to participate normally in society, regardless their disabilities. Below answers to these questions are successively held out.

4.3.4.2. What tasks are (potential) pedestrians to perform?

This paragraph answers the first detailed question of the sub-study into how abilities to meet the reasons and motives for walking translate into W+S system requirements. As mentioned before walking and sojourning in public space involves four behavioural stages: lifestyle, strategic, tactical and operational decisions and behaviour (cf. Michon, 1979; Hatakka et al., 1999). Tasks involving the four kinds of activities are taken from literature including the conceptual models of Reason (1990), Asmussen (1996), Fuller & Santos (2002), Clifton & Livi (2004), Vukmirović (2010) and Methorst (2010-2). Actual walking and sojourning in public space is considered to be the resultant of execution of tasks at the lifestyle, strategic and tactical stages which happen 'in the head' as mental processes.

Lifestyle is about attitudes, values, worldviews and subsequent behaviour. At the lifestyle stage important precursory tasks for W+S are making or settling decisions like where to live[246], work, go to school, vehicle ownership, life priorities, such as the importance of keeping fit, being outdoors, and forming attitudes towards walking and W+S preferences. Travel surveys show that most people prefer to use individual vehicle transport (car, bicycle) over collective or public transport or walking (e.g. Olde Kalter et al., 2016; Aarts et al., 1997). However, in most cases walking is inevitable to reach any form of transport. A task in this regard is to make sure that walking trips are feasible, for example by arranging a paved connection between the home front door and the public footpath towards the parked car, bicycle or public transport stop, acquiring a broom, snow shovel, hedge trimmer for clearing the pathway, an umbrella, a warm coat and good shoes for winter time, boots for puddles and muddy paths, a mobile phone for calling in support or help, subscription to emergency services etcetera.

Strategic activities concern factual travel decisions and pre-trip preparation to execute the decisions: to go or not to go, where to go, when, with whom and how[247]. This involves anticipation, planning, scheduling, and deciding on and preparing the use of equipment, aids or tools.
Strategic choices concern consideration of pros and cons regarding acting on needs, obligations, desires and intentions, perceived personal and environmental conditions. The outcome of the decision process depends on whether it concerns a routine or new trip, whether or not following instructions from one's companion, cognitive abilities, latent impairments, experiences and occurring opportunities (Cf. NOA-model; Asmussen, 1996). Next preparations for the walking and sojourning activities need to take place, such as gathering and putting on suitable shoes and clothing, packing one's bag, wallet, route description, walking aids etc., and planning the trip activities and arrival. With stepping out the trips begins.

Tactical activities concern intentions regarding operational behaviour (i.e. how to look at and assess the environment while on the move), the route to be taken, navigation decisions, walking speed, prudence, setting the level of intention, multi-tasking, managing distraction, where to cross, where to rest etc. At the tactical level tasks are executed while in public space. The tasks concern managing do-ability, focussing on the expected effects and impacts of the physical W+S activities.
Tactical activities take place in the head while on the move in public space, mostly in reciprocity with operational behaviour and in interaction with environmental events. The decision process works best if highly automated, i.e. skill-based (Reason, 1990; Michon, 1979). Novice walkers

[246] Residential choices impact on attitudes and transportation choices, and vice versa. Residential self-selection can take place (Cao, 2014).
[247] for example: go alone or with a companion, no luggage, carry bags or a backpack, take along walking aids etc.

and pedestrians who are explicitly aware of their disabilities and who have doubts about their capabilities to cope with their operational walking tasks, need to consider their actions consciously, so contemplate on the tactical level. Decisions are more error- and accident prone when experience and (operational) walking skills lack and decisions have to be taken with much reflection, based on (incomplete) knowledge (i.e. rule- and knowledge-based errors, cf. Reason, 1990).

The ultimate task is *operational* walking. Operational behaviour takes place while on the move and while sojourning in public space, guided by tactical intentions. Operational W+S activities concern orientation, locomotion (moving about), carrying out tactical intentions, reacting to external impulses, performing side tasks and sojourning (standing, sitting, moving without going somewhere). Operational walking behaviour is highly automated, i.e. behaviour is a skill-based response to whatever one runs into. In recognised special conditions (like heavy rain, fog, snow, ice, bad visibility, very lively traffic, emergencies etc.) slower and more error-prone rule and knowledge-based behaviour occurs (Fuller & Santos, 2002).
Operational behaviour involves a continuous cycle of tasks: observing, noticing visual, auditory, touch and smell signals, processing and evaluating cues, deciding on (counter) actions, reacting, taking steps (figuratively and literally) and controlling steady and safe movement. The process cycle continues until one arrives at one's destination, stops walking, stands still or sits down, starting sojourning. Incidentally behavioural errors are made: mostly of the slips and lapses kinds (Reason, 1990; Rasmussen, 1983) and sometimes the errors have consequences or mishaps like counter reaction of bystanders and other public space users, fright, falls, serious conflicts, collisions, damage, injuries and fatalities. In cases that something goes wrong the final task is to deal and cope with the consequences (Reason, 1990; Groeneweg, 2002[248]; Slachtofferwijzer, 2019[249]).

4.3.4.3. What kinds of abilities and skills are involved in W+S tasks?

This paragraph answers the second detailed question of the sub-study into how abilities to meet the reasons and motives for walking translate into W+S system requirements. All activities[250], including walking and sojourning, demand both abilities and skills. Abilities are capacities, viz. cognitive, sensory and psycho-motor capacities (O*Net, 2018; Vukmirović, 2010; Asmussen, 1996). Humans can master skills to execute task activities, meaning that they learn how to deal with their capacities and use them optimally, fluently and (almost) without fail. In general the executions of the majority of W+S tasks are based on earlier experiences, what was learned and what habits are formed. Depending on the novelty of a task, the tasks are done more or less automatically and subconsciously. Novel or evidently complex problems are tackled consciously, through trial and error, imitation or active consideration, i.e. *knowledge*-based. When a condition or problem recurs, most of the times humans develop *rules* or habits for dealing with them. This concerns the first stage of automation of behaviour. When a person meets such conditions regularly, like the need to cross a street, he will develop *skills* for these activities (Rasmussen, 1983). Still, even experienced walkers make errors because their skill-, rule- or knowledge-based solutions do not cover all risks (Reason, 1990). In such cases the outcome for a large part depends on their resilience, i.e. the degree to which they can deal with the consequences and compensate for or recover from such unforeseen mishaps.

[248] See Groeneweg (2002) p 220, Figure 7.5. and p 223, Figure 7.8.
[249] See https://www.slachtofferwijzer.nl/ (translated: 'guide for victims')
[250] This concerns in principle all activity levels as discerned in the previous section: see also the task descriptions and explanations below.

The US National Centre for O*Net development (supported by the Ministry of Labor) developed a useful framework for the description of general tasks, task abilities and experience and occupational requirements[251] (O*Net website, accessed September 2018). The O*Net framework inspired Vukmirović (2010)[252] to list groups of abilities, and related the abilities to relevant characteristics of (groups of) pedestrians and their impacts on pedestrian abilities.

In O*Net taxonomy abilities are subdivided into cognitive and psychomotor abilities. According to Oxford Dictionaries *cognition* concerns the '*mental action or process of acquiring knowledge and understanding through thought, experience, and the senses*'[253]. In other words: the ability to perceive, recognise, understand, interpret and respond to information. It relies on complex processes like talking, memory, learning, recognition, anticipation and planning. The same dictionary defines *psychomotor* as relating to the origination of movement in conscious mental activity[254]. Thus psychomotor abilities concern control over bodily movement, e.g. as a pedestrian.

In the O*Net taxonomy *Cognitive abilities* are subdivided into verbal, idea generation and reasoning, quantification, memory, perception, spatial and attentiveness abilities. *Psychomotor abilities* are subdivided into motor abilities, physical abilities (strength, dynamic strength, endurance, flexibility, balance and co-ordination) and sensory abilities (visual, auditory and speech).

Following Vukmirović, the author translated the O*Net outline into a taxonomy of general tasks abilities, that persons apply to walking and sojourning in public space tasks, but in slightly different ways also to other forms of moving about. The translation builds on task ability descriptions by Asmussen (1996), New Zealand Land Transport (2008) and Vukmirović (2010), and is finally proposed by the author and reviewed and accepted by a group of experts (the review experts are listed in Appendix 4). The translation is as follows:

- *Cognitive* abilities enable the '*acquisition and application of knowledge in W+S problem solving'(cited from O*Net*[255]*)*, in principle concerning all of the discerned activity levels. These abilities can be sub-divided as follows:
  - *Verbal and communicative* abilities concern verbal and non-verbal communication (Calhoun, 2011). These abilities are needed for orientation, navigation and management of potential conflicts in co-existence with other people in the environment (O*Net, Vermeulen, 1997);
  - *Idea generation and reasoning* abilities particularly concern planning and preparing trips and stays in public space, and coping with occurring problems while walking and sojourning. It bears upon decisions on where, when and how to go, imagining what one needs for the trip, such as using a coat or not, what kind of shoes, taking along a phone, route description, etc. and imagining how to take care of the preparations and

[251] https://www.onetcenter.org/content.html; in this thesis the subjects of occupational task experience and occupational task requirements are not dealt with: everyone is a pedestrians, regardless of their experience, social and communicative abilities and knowledge about rules for walkers; in principle they do not need to be licenced like motor vehicle drivers and professionals; walking and sojourning cannot be declared a profession.
[252] the article is included as Part B.1.11 of the Final Report of the Pedestrians' Quality Needs project, see http://www.walkeurope.eu/uploads/File/publications/PQN%20Final%20Report%20part%20B1.pdf.
[253] https://en.oxforddictionaries.com/definition/cognition, accessed 18-12-2018
[254] https://en.oxforddictionaries.com/definition/psychomotor, accessed 18-12-2018
[255] see https://www.onetonline.org/find/descriptor/browse/Abilities/1.A.1/

implementing that task. The ability can provide resilience, i.e. finding ways to solve novel problems when confronted with unclear situations while preparing trips and while walking and sojourning, such as reaction to oncoming traffic, potential threats, crossing a busy street, finding a place to sit etcetera (abducted from O*Net and e.g. Michon, 1979; Reason; 1990; Fuller, 2005);

- *Quantification* abilities for example help to assess how much time is needed for the trip or activities and whether there is sufficient time available, to check the number of items to bring along, gaps in traffic, traffic speeds, finding one's way in crowded situations etc (abducted from e.g. O*Net and e.g. Van der Molen, 1981; Rothengatter, 1981);
- *Memory* abilities concern recall of available information, such as how much time was needed last time, experiences from earlier situations and conditions, e.g. how car drivers reacted on one's street crossing. Distinction must be made between short term and long term memory. Short term memory is needed for evaluating current conditions; long term memory is particularly needed for recalling behavioural rules and general knowledge (e.g. analogies) for dedicated considerations in 'new' situations (abducted from e.g. O*Net and e.g. Guerrier et al., 1999);
- *Perception* abilities concern the acquisition and organisation of (visual, audio, olfactory[256] and touch) information as well as the '*ability to quickly make sense of, combine, and organise information into meaningful patterns*', the ability to identify or detect a known pattern (a figure, word, object, smell or sound) that is hidden in other distracting phenomena and events, and '*the ability to quickly and accurately compare similarities and differences among the sets of images, experiences and memories*' (cited and abducted from O*Net[257] and e.g. Van der Molen, 1981:286);
- *Spatial* abilities concern the ability to determine one's position in the environment in relation to one's planned route or to be able to determine where other persons or objects are in relation to oneself, i.e. orientation and visualisation of the position of certain landmarks, routes, boundaries, spatial textures and potential obstacles (abducted from O*Net and e.g. O*Net, and e.g. Lynch, 1960);
- *Attentiveness* concerns the ability to pay attention, i.e. selective attention to concentrate on a task, and not being distracted, over time needed, and share time for shifting back and forth between activities or sources of information (time sharing) (abducted from O*Net and e.g. Schwebel et al., 2012);
- *Learning* abilities are an important capacity of human beings[258]. Factual skills are a product of learning processes. According to Bandura (1989) human beings have the capacity to learn from their own practise, but also from observation of behaviour of others ('reciprocal determinism'). The learning takes place in interaction with the different cognitive skills mentioned above as well as mobility and sensory skills. Learning is bidirectional regarding behaviour as well as cognitive, biological and other personal factors and environmental features. It is an essential psycho-physical precondition and concerns a continuous process. Every person has unique learning results. Consequently skills vary (very much) between persons and per person over time (suggested by reviewer).

[256] Olfactory nerves detect smells.
[257] see https://www.onetonline.org/find/descriptor/browse/Abilities/1.A.1/
[258] The ability is not mentioned in the O*Net classification, but contributed by the reviewers (C. Chaloupka and R. Risser).

- *Mobility* abilities concern the (operational) ability to move about on foot. These abilities can be sub-divided as follows:
  - *Psycho-motor* abilities enable and control movement as a pedestrian (mobility) and the capacity to lead and accompany other persons, and/or manipulate and control objects while walking and sojourning, like holding a map, a bag of groceries, a dog's leash, walking aids etcetera (Abducted from O*Net, e.g. Vukmirović, 2010, Asmussen, 1996);
  - *Motor* abilities comprise abilities to move and control and co-ordinate arm, hand, lower limbs and feet, as well as reaction time and speed abilities therein (abducted from O*Net and Vukmirović, 2010);
  - *Physical* abilities comprise physical strength abilities, dynamic strength, endurance, and flexibility, balance and co-ordination, i.e. how far, long and well pedestrians can move and perform their W+S tasks. One's basic body characteristics (such as height and width, tolerances for unpleasant environmental conditions) conditions one's sight lines, i.e. the ability to look over objects and visibility of other persons, one's ability to pass through narrow passages, taking gaps and steps and tolerance for extreme temperatures (abducted from O*Net and Vukmirović, 2010).

- *Sensory* abilities comprise visual, auditory, olfactory and speech abilities. These are needed for tactical and operational tasks of orientation, positioning, routing and communication with other persons or devises in the environment and for detecting potential hazardous situations (cf. the smell of fire, the image, sound and/or trembling of an oncoming car, feel the roughness or unevenness of the pavement surfaces). Sensory abilities can be subdivided in:
  - *Visual* abilities comprise the ability to see, discern and recognise objects and persons in one's environment (O*Net; Vision 2020; Asmussen, 1996);
  - *Auditory* abilities comprise the ability to hear and recognise sounds and the location of its source (O*Net);
  - *Somatic and olfactory abilities* comprise being able to detect vibrations and surface textures, tastes and smells (somatic and olfactory senses) and the location of its source (abducted from O*Net);
  - *Speech* abilities comprise the ability to orally communicate with other persons in the environment (O*Net);
  - *Balance* abilities comprise the ability to maintain the body in balance while at rest and in motion (O*Net, Medicinenet, 2018).

Similar to workers, pedestrians can function best if they have at least basic W+S skills, cross functional skills and W+S relevant knowledge. Following Michon (1979) and Hatakka (1999) basic skills concern the ability to plan and prepare walking trips (strategic tasks), choose and navigate along a doable and safe route and to take the necessary precautions (tactical tasks), and execute concrete operational walking tasks (observe the surroundings, process and select sensory cues, react, take steps or stop, use walking aids if necessary).

It needs to be remarked that the influence of task abilities on walking and sojourning in public space are not straightforward and continuous. There are at least two factors related to task abilities and skills that play a role: the factors 'time' and 'will'[259].

[259] Christine Chaloupka, one of the reviewers, pointed the author the importance of the factors 'time', 'will' and 'learning'.

The factor *'time'* works very differently on the four different activity levels, particularly regarding do-ability and risks of error. On the lifestyle and strategic level most of the times a person can reason and decide correctly without time pressure problems. On the tactical level one is already under some time pressure, so more prone to errors and failure. On the operational level, e.g. when being at a zebra crossing with high speed traffic, waiting to cross, there is very little time to contemplate and decide. One has to be used to the system, the space, the conditions, and cannot take in a lot of information because of time pressure. Under time pressure risk of particularly rule- and knowledge-based mistakes (Reason, 1990), which take most processing time, is imminent. Having enough time is a precondition to understand what is needed, to act accordingly and to support the subjective feeling of safety, necessary for acting.

Furthermore, task abilities and skills are not absolute. The way skills play a role in walking and sojourning behaviour depends on one's perception (self-knowledge) of one's task abilities. This can be affected by a person's '*will*'[260]. Despite 'objectively' missing adequate skills, the very motivation may enable disadvantaged people to dare to go and be outdoors, with or without help of others. A strong motivation in this regard may be the will to socialise (cf. Table 3.4 on Human Needs: social needs).

The O*Net framework also mentions *cross sectional skills,* which concern social, technical and system skills, including social perceptiveness, communication with others in the surroundings, being able to adjust actions in relation to others' (re) actions (co-ordination), being able to persuade and negotiate, being service oriented, being able to select adequate equipment (such as shoes, coat, walking aids), to maintain equipment, trouble shooting, repair, and do quality control analysis. Additionally it may be useful to be able to understand, monitor and perhaps even help improve W+S facilities. W+S relevant knowledge concerns insight in the walker's position in society and public space, behavioural rules, and public and traffic safety and how to deal with dangers.

4.3.4.4. How do W+S abilities and skills translate in to W+S system requirements?

This paragraph answers the third and last detailed question of the sub-study into how abilities to meet the reasons and motives for walking translate into W+S system requirements. The above general knowledge about personal task abilities that matter for walking and sojourning, can be applied to evaluate available assessments of how mobility impairments and disadvantages are distributed across the W+S population and how the above abilities taxonomy can be applied to formulate W+S system requirements.

As mentioned above, in this thesis it is assumed that system requirements are to be formulated in such a way that they support safe mobility for (almost) all potential pedestrians, i.e. Design for All. In this context in this thesis attention is focussed on deficiencies in safe mobility task abilities, their prominence, how they are distributed across the W+S population and what can be done to ease off negative consequences. The idea is that this way the best possible W+S system conditions can be sustained, designed and created.

In order to build the case and describe a new state of the art, the author first notes how some eminent researchers approached assessing pedestrian (dis)abilities (see next subsection on Evaluation of earlier assessments of mobility impairments).

[260] Cf. NOA-Model, personality, needs, desires, emotions, attitudes and intentions; see also subsections 4.4.3. on needs and 4.3.2-5 Socio-psychological factors)

Next the author builds a more comprehensive approach to the identification of W+S system requirements (see following subsection on Towards an approach to the identification of W+S system requirements).

For assessing the relative importance of the different skills and setting priorities with regard to meeting the found requirements, information is needed about the absolute, relative and experienced impacts on the (social) functioning of individual pedestrians as well as the magnitude of the impacts on a societal (community, regional, national) level. The aim is to provide broad insights about the magnitudes of such impacts in subsection 4.4. on exemplary W+S arrangements (international experts' arguments and evidence) and in Chapter 5 about the status quo of the W+S system (evidence and best estimates regarding conditions in The Netherlands).

Evaluation of earlier assessments of general mobility impairments

Being and feeling able to travel towards the places where the action is are essential preconditions for participation in society, which to a large extent depends on feeling able to walk and sojourn in public space. It is generally agreed that not everyone has superb walking abilities and skills. Consequently it is most important to find out and focus on what kinds of openings there (theoretically[261]) are to overcome critical obstacles to walking and sojourning in public space that dissuade impaired people from participating in society.

As mentioned above the terms impairment, disability and handicaps have been used synonymously in literature, counselling and education, but WHO argued that they convey three different meanings. It was pointed out that impairments can develop into a disability to complete a W+S task. Further this can result into a handicap, when an individual cannot fulfil a normal life role (WHO, 1980). In this sub-subsection mobility handicaps, as a result of impairments and disabilities to perform ordinary walking W+S tasks are surveyed. W+S mobility handicaps are not characteristics of a person, but rather a consequence of the relationship between someone and his or her environments (see above: WHO, 2002:9). It concerns a critical combination of personal and environmental conditions for performing ordinary W+S tasks. The more unfavourable the combination, the more difficult it becomes to perform the task, the more effort it takes and when tolerances and resilience are exceeded, the risk of errors, incidents, material damage and bodily harm (injury, death) increases far beyond average risks, in many cases because of time pressure. Walking impairments become a handicap when the combination of conditions subdues mobility and thereby common activities, i.e. when walking is obstructed and the potential walker feels compelled to refrain from certain daily or essential activities. Asmussen (1996) remarked that it is very difficult to precisely indicate how serious impairments, disabilities and handicaps are, as needs, aspirations and conditions vary from person to person and from (sub-) culture to (sub-) culture; 'objectively' the same impairments are not necessarily experienced in the same way. Furthermore, complete loss of a function differs fundamentally from partial loss. With complete loss (no arms or legs, totally blind or deaf, no sense of balance) there is no falling back on rest capacities of the function in question and different kinds of support and solutions are needed to be able to function properly.

There is a number of ways to assess the distribution of such disabilities and skills, with great variety in results, leading to doubt about their accuracy and specificity. Below examples of such assessments and conclusions towards W+S system requirements are described.

[261] In Chapter 5 the actual state of affairs will be described and documented.

Socialdata (2005) conducted a survey study in the context of the Dutch travel survey MON 2004 to estimate the numbers of people experiencing mobility handicaps. The method used is to ask people whether they experience mobility handicaps, with the result that at that time 6.1% of the population said that they experience serious (walking) mobility problems. The share varied with age: amongst people younger than age 65, 2.4% indicated a serious mobility handicap, amongst people ages 65-79 the percentage was 14.9, and amongst people aged 80+ the percentage was 70.0. In the Pedestrian Quality Needs project Methorst used these percentages for prognosis (Methorst, 2010-4). In Table 4.9. the estimated numbers of mobility handicapped persons are shown.

Table 4.9 Number of mobility handicapped persons in the Netherlands * 1000

Age groups	2000	2005	2010	2015	2020	2025	2030	2035	2040
Younger than 65	332	340	344	340	337	333	326	319	314
65 - 79	246	258	282	338	380	418	441	467	463
80+	356	405	454	505	565	655	832	949	1,063
Total number of people with mobility limitations	934	1,003	1,079	1,182	1,282	1,406	1,600	1,735	1,840
% of population with mobility limitations	5.9	6.1	6.4	6.9	7.4	8.0	9.1	9.8	10.4

Source: Methorst, 2009, based on Socialdata, 2005 (MON special study)

The percentages are much lower than presented in general national disability figures, based on national health survey data[262]. On the one hand the difference might be explained by the much less detailed questions (in the Socialdata study the disorders were not assessed separately) and the 'natural' attitude of the disabled to understate the severity of their mobility impediments (Methorst, 2010-4). It is known that people assess their handicap on the basis of their own set of norms. For example: someone who was formerly clustered to a wheelchair does not feel mobility limitations when he can walk with difficulty and has special adjustments for his bicycle[263]. Martens (2018) concluded that manifested travel behaviour does not show what travel barriers people experience and what trips are forgone, i.e. trips that 'normal' people i.e. healthy, fit and able adults, can and do take upon themselves.

Another way of assessing mobility impairments is to use medical data. According to Otten (2004, based on the National Health Survey 2002) about 7% of the Dutch inhabitants suffer serious mobility limitations. Such serious mobility limitations happen mostly to the elderly. One of ten persons aged 65-75 has serious mobility impairments; for inhabitants aged 75 and older the share is about 20%. Elderly females in this regard struggle twice as much as older men (25% versus 13%). Mobility impaired (serious impairments) lose well-being and social contacts. They are three times as often less happy and satisfied with their lives compared to people without mobility impairments.

Von Heijden et al. (2013, using 2008-2011 data from the Dutch National Health Survey) found that in total 5.2 million Dutch inhabitants aged 12-79[264] suffer a physical limitation. This includes 1.7 million Dutch inhabitants (1 in 8 inhabitants) suffering a moderate to serious

[262] See for example Factsheets on impairments, disabilities and handicaps e.g. https://www.allesoversport.nl/artikel/sportdeelname-mensen-met-een-beperking-in-6-factsheets/
[263] This is a personal experience of one of the reviewers.
[264] The total number of Dutch inhabitants aged 12 – 79 amounts 13,697,254 (CBS Statline, 2018).

limitation, and 3.6 million Dutch inhabitants having less severe limitations compared to their peers[265], not including children's functional limitations, latent impairments and temporary impairments.

Regarding mobility[266] arrangements Asmussen (1996) argued that it is necessary to also take into account that children and people with temporary functional limitations experience disadvantages making use of facilities and services that are designed for the common reference standard human, i.e. a valid, healthy, vigorous and fully able adult human. Including this group sets the count on as much as one in three persons having functional disadvantages compared to that reference standard. He proposed to construct a 'new reference standard human' for designing the mobility environment. The author agrees with the idea and puts forward that, regarding pedestrians, walking and sojourning in public space the list should also include latent impairments and should not be limited to Dutch inhabitants, but expanded to foreign visitors and tourists and immigrants, who also have disadvantages regarding abilities and skills deemed normal in fully able Dutch national walkers, such as being able to read and understand Dutch, awareness of risks set by oncoming bicycles, right-side traffic etcetera. This way the pedestrian population having disadvantages making use of the W+S system grows to about half of the total pedestrian population.

Towards a more comprehensive approach to the identification of W+S system requirements

Although the author did not come across a satisfactory comprehensive inventory of W+S system requirements related to critical W+S tasks and abilities, some basic approaches that can be expanded to suit our purposes, were found.

More or less like the O*Net framework, with regard to infrastructure requirements to meet disabled user's needs FHWA (Axelson et al., 1999) distinguished three main categories of task ability groups: cognitive, sensory and mobility impairments. New Zealand Land Transport (2007) and Vukmirović (2010) added a fourth category of 'wheeled pedestrians'[267], as the use of wheels requires different abilities as well as specific environments. To complete this list of relevant groups of W+S impaired to take into account in the formulation of W+S system requirements, the author adds 'deviant postures' (very small or very big postures) and a sixth main category of 'latent impaired people'. Furthermore, the author widens the scope from focus on infrastructure to (broadly) taking into account all W+S system components discerned in this thesis conceptual framework: the pedestrian, the physical and social-normative environments, transportation and information technology.

Starting from the above task abilities grouping and the described W+S tasks abilities taxonomy and the premise regarding Design for All, an approach to comprehensive assessment of W+S system requirements was devised. The approach comprised finding answers to the following key questions:

1. What categories of (potential) pedestrians have impairments regarding the discerned W+S tasks?
2. How many people does it roughly concern now and in the near future?

[265] https://www.allesoversport.nl/artikel/feiten-en-cijfers-over-het-aantal-mensen-met-een-beperking/

[266] Asmussen's scope was not limited to pedestrians, walking and sojourning, but comprised the total of mobility options.

[267] New Zealand Land Transport and Vukmirović mean wheelchair and mobility scooters. In the Netherlands a mobility scooter, if faster than 6 km/h, can be considered a special moped, which officially is not allowed to drive on the sidewalk. Dedicated handicapped vehicles are allowed on the sidewalk if these move at less than 6 km/h.

3. How severe are W+S mobility and social-economic impacts of the various task ability impairments?
4. How and under what (general) conditions can negative consequences of deficient task abilities be annihilated or eased off? To what extent?
5. What packages of W+S system requirements are likely to fulfil the Design for All principle best?

With regard to public space and infrastructure requirements regarding physical, psychomotor and sensory abilities New Zealand Land Transport (2007) and Vukmirović (2010: pp 220-221, tables 10-12) already produced tables on critical deficiencies regarding W+S tasks performance on the operational and tactical activity levels ('characteristics'), consequences with regard to safe mobility on foot and cues for designing better facilities. To complete the picture this thesis expands the assessment to also cover pedestrian W+S tasks on the lifestyle/strategic level.

The following texts comprise the results of a quest to find answers to the above questions. Each of the texts successively describes:

a. the (hypothetical) impact of the disability on walking and sojourning;
b. identification of affected W+S population groups;
c. what functional requirements can be formulated to direct compensation, abolition or easing off the consequences of impairments.

After the texts regarding the discerned six main categories of impairments, critical abilities, their consequences and anthology of system requirements are summarised in respective tables (Table 10 a, b, c and d). After dealing with the discerned disabilities and disadvantages the subsection is closed by bunching up the found W+S system requirements into packages that would support the population's safe mobility best. The images are reviewed by a number of external experts (see Appendix 4).

a. Cognitive task abilities

Cognitive impairments can hamper the ability to think, learn, respond, anticipate, plan and prepare oneself (strategic and tactical activities) and to perform co-ordinated motor skills, i.e. slower information gathering and processing. Cognitive impaired persons have (severe) difficulties in performing strategic W+S tasks like planning and preparing trips, in tactical/operational W+S tasks and in resilience in complex conditions, e.g. coping with adversity and misfortune, unexpected events, busy traffic and fast moving oncoming vehicles. The impairments often result in impulsive and/or incoherent travel decisions, sloppy planning, poor orientation in (public) space and the walking environment, impossibility of understanding and adequately reacting on signals and information including cues regarding hazards, inability of quick reactions, inadequate assessment of traffic etc. In most cases this limits one's independent mobility, action radius and increases one's accident and injury risk.

Compared to not-impaired adults the four main groups with cognitive limitations are: (young) children, cognitive impaired adults (low IQ, brain damage, some psychiatric syndromes), advanced dementia patients and temporary cognitive impaired people, being mostly persons under the influence of psychotropic substances[268] or strong emotions.
Vukmirović (2010; FHWA, 2006) found that *children*'s limitations with regard to walking and participation in traffic generally decrease with age. *Infants and toddlers* (ages 0-4, 5.2% of the

[268] Alcohol, drugs and mind affecting medications

population in 2016 and 2025[269]) are still learning to walk and have very limited walking abilities, lack spatial abilities, are developing peripheral and depth vision, are impulsive and unpredictable, and lack insight in traffic and other people's behaviour. *Young children* (ages 5-7, 3.3% of the population in 2016 and 3.1% in 2025) can walk well, but still build up their spatial abilities, are impulsive and unpredictable, have limited peripheral vision, have trouble positioning sounds, lack experience and training in traffic, can barely estimate the relation between distance and speed, are thrilled or exited by close calls and are susceptible to darting into traffic and likely to copy adult's behaviour. On the other hand this group particularly tries to avoid confrontations with motorised traffic (Howarth, 1981). *Pre-teens* (ages 8-11, 4.5% of the population in 2016, 4.1.% in 2025) have developed many psycho-physical abilities, but still lack orientation and the ability to connect hazard cues. They have a larger action radius than younger children, increasing their risks; a heightened desire to take risks (especially boys) makes that even worse. *Teenagers* (age 12-17, 7.3% of the population in 2016, 6.3% in 2025) typically are very active, feel almost invincible, typically walk or ride and act in groups, not paying much attention to others in the environment, prefer to deviate from adult norms, and overestimate their skills. Their brains are still developing until maturity at about age 23.
With regard to the second cognitive abilities group, *cognitive impaired adults*, the Mulier institute (Factsheets about disabilities, sports and movement, 2017) recites characteristics. The institute discerns people with behavioural problems or autism disorders (respectively 2.6% and 0.7-1.0% of the population), non-innate brain damage (about 650,000 Dutch citizens), and people with a mental limitation (0.7% has an IQ below 70, of which 74,000 have a light limitation [IQ of 50-70], and 68,000 have a severe limitation [IQ below 50]).
The third group of cognitive impairments relevant to walking concerns *Dementia,* an illness that severely impairs mental capacities. When affected ordinary tasks, which before could be performed easily, are no longer feasible. It is a progressive disease, which in its early stages does not hamper walking and driving very much (e.g. Withaar et al., 2000). In later stages orientation and more complex reactive tasks become difficult to finally impossible. According to Alzheimer Netherlands[270] about 270,000 Dutch citizens have a form a dementia. About 12,000 of them are younger than age 65. More than 70,000 of them live in closed care and are no longer walking in public space without escort. About 100,000 of them are undiagnosed (mostly early stage dementia, when people overestimate their abilities).

In general the following environmental characteristics can be expected to soften the influence and impact of cognitive impairments: tailored convenient walking facilities, shielding from traffic and other hazards, forgiving environments, patronage and escorting to support mobility and decrease accident and injury risks. In this regard particularly sufficient reaction and crossing time and traffic speed regulation are important (reviewers opinion).

In the following the impacts of impairment of more specific cognitive task abilities (idea generations and reasoning, verbal and communicative abilities, quantification, memory, perception, spatial abilities and attentiveness), which pedestrian groups it concerns and what can be done to ease off the impacts on walking, sojourning and wealth and well-being of the population are elucidated. In Table 4.10a Characteristics of cognitively impaired pedestrians critical deficiencies, their consequences for walking and sojourning performance and functional W+S system requirements are summarised.

[269] The 2016 population figures in this text are derived from the CBS Statline website; the 2025 figures originate from the US Bureau of Census.

a.1. Idea generation and reasoning abilities (including immaturity, inadequate W+S skills, experiences)

Limited *idea generation and reasoning abilities* make people incapable of effectively planning and preparing trips and restrict resilience in complex situations. Immaturity is associated with inadequate W+S skills, limited idea generation and reasoning abilities and generally entails inability to control impulses, incomplete or erroneous anticipation and slower decision processes, decreasing one's resilience in unexpected, complex and difficult conditions. This often leads to inadequate W+S skills, erratic behaviour, inadequate responses to critical conditions, suppressed mobility and increased accident (both collisions and falls) and injury risk (cf. Sandels, 1968; Rothengatter, 1981; Van der Molen, 1989; reviewers suggestions and opinions).

Limited idea and reasoning abilities is particularly found in young children (aged 0-12) and also in very low IQ people, advanced dementia and brain damage patients. With age, experiences and education children become more capable (cf. Sandels, 1968; Rothengatter, 1981). Such learning does not apply to low IQ, dementia affected and brain damaged people. Based on population and impairment figures (CBS Statline; Von Heijden et al., 2013; Mulier Institute, 2017) the author estimates that in the Netherlands in 2012 at least 3.4 million people (20%) had limited idea and reasoning abilities.

People with limited ideas and reasoning abilities need (much) more time for adequate W+S decisions, which often leads to time pressure and consequently hasty, sub-optimal responses to potentially risky situations. In extreme cases such persons need to be, and most of the times are, escorted and supported by their guardians, but in general they need destinations that matter within action radius and shielded spaces for W+S activities, unambiguous, self-explaining, manageable and forgiving W+S conditions, extra time for street crossing, ample time and space for corrective actions, restricted traffic volumes and speeds. Standardisation of design and rules regarding complex situations can help decrease error-proneness, stress and risks of accidents and injuries (cf. Wegman & Aarts, 2005; CROW, 2013; Vukmirović, 2010; reviewers comments).
Schoon (2019:47) stipulates that children (RM: and other people with impaired idea generation and reasoning disadvantages or impairments) require *"...a high level of segregation from motorised traffic and/or other measures to reduce the dominance of motor vehicles, such as speed reduction, together with good passive surveillance from other users. These are important factors where ... [they] ... make independent journeys, especially journeys to school."*

a.2. Verbal and communicative abilities

Verbal and communicative abilities are related to maturity and cognitive impairments, both chronical and temporary, but may also concern speech and language competences and (severe) autism. This can lead to miscommunication, non-communication, misunderstanding, conflicts and counter-reactions of bystanders, risk of errors by counterparts and risk of non-response. In traffic, non-verbal communication abilities are of utmost importance, especially in volatile communication between vehicle drivers and pedestrians. Eye contact and gestures are the main means of communication; this is hardly trained and is easily subject to misunderstanding.

Additionally to children and cognitively impaired people, sensory impaired, foreign language speakers, non-western script-foreigners and illiterates can be expected to have difficulties in orientation, navigation and management of potential conflicts in co-existence with other public space users. Bijlsma et al. (2016) indicate that about 1.9 million people older than age 16 in the Netherlands in 2012 have trouble reading and writing Dutch language; about half of them are immigrants. The prevalence of (diagnosed) autism is 60 - 100 per 10,000 inhabitants, slightly

less than 1% of the population. According to Van Heijden et al. about 115,000 persons suffered autism; no figures are available regarding severity of the impact on social function.
Based on the figures and population data regarding children aged 0-12 the author estimates that about 2.4 million people have limited verbal and communicative abilities, of which about 750,000 persons have (some) difficulty participating as a pedestrian in public space.

For non-cognitively impaired adults orientation and navigation difficulties can be eased by using mobile navigation devices. In other cases mis- and non-communication and consequently misunderstandings, conflicts and counter reactions of bystanders, risk of non-response or wrong reactions by counterparts and accident risks thereof can only be excluded if the opponents are understanding, empathetic and forgiving (abducted and proposed by the author; reviewed).

a.3. Quantification abilities

Quantification impairments generally mean that one has more than average difficulties assessing numbers, traffic speeds, gaps in traffic, street width etcetera. As a consequence such persons often misjudge at what point along the way action must be taken (e.g. turn right) or how much time and space is needed for activities (e.g. time needed for a trip there and back, time needed to cross a street or to avoid other hazards).

Quantification limitations or impairments can be expected to be found in (young) children, cognitive impaired and elderly 80+ people. Indicative in this regard is also that in 2012 2,1 million people had limited abilities regarding calculation (Algemene Rekenkamer, 2016, p.5). Based on population data (children aged 0-12) and calculation of abilities the author estimates that at least 4 million people in the Netherlands (25%) have limited quantification abilities, which may sometimes, in busy and complex situations affect walking safety.

Risks of impacts of quantification impairments can be expected to be limited by offering unambiguous, non-complex, shielded and forgiving conditions, i.e. standardised design and rules for critical situations (e.g. standard crossing length, self-explaining environments and traffic rules), protected crossing facilities, traffic speed control (e.g. at pedestrian encounters lower than 30 km/h) and forgiving traffic conditions (e.g. ample room and time to flee, low traffic speeds). Certain groups can be learned to choose safe and shielded routes to certain destinations (cf. marked school routes)(abducted from O*Net, Algemene Rekenkamer (2016), Wegman & Aarts (2005) and reviewers' comments).

a.4. Memory abilities

Brain damage, e.g. as a result of an accident, advanced dementia and intoxication can affect memory abilities. Such people have difficulties in recapturing information and images[271]. This way they miss (correct) references. Dementia patients have gaps in their short term memory regarding their experiences. With intoxication long term memory behavioural rules and agreements can be (temporarily) impaired. Brain damage can affect both short and long-term memory. This may hamper orientation, making people feel lost, unable to remember what they were doing or supposed to do or even how to (automatically) act in risky conditions.

Based on the numbers the innate brain damaged and non-institutionalised advanced dementia patients the author estimates the number of people having slightly limited memory abilities (CBS Statline; Mulier Institute, 2017; https://www.alzheimer-nederland.nl/dementie) to be at 750,000 people (4% of the population).

[271] This is may also be true for children who lack experiences.

The burden of memory loss can often be decreased by repetition of messages and reminders, help of artificial memory (e.g. notebook, smartphone), and emergency equipment enabling people to ask for help, e.g. a mobile phone or emergency button (abducted from O*Net, OECD, 2001, Brouwer (1989), Mulier Institute, 2017 and reviewers' comments).

a.5. Perception abilities

Perception impairments can be expected to generally lead to a wrong focus and wrong interpretation of signals, bad interpretation of speed and gaps in traffic and missing cues for orientation and hazards. Consequently the so impaired are not always able to correctly search for cues for orientation, navigation, easy and safe passages and timely reaction to or anticipation on oncoming hazards.

Compared to healthy adults, children, people with cognitive or perceptive impairments and elderly aged 80+ have limited perception abilities. Based on population data the author estimates that in 2016 at least 4 million people in the Netherlands had limited perception abilities.

They are best supported by unambiguous cues, low complexity of situations and homogeneity in complex situations, as well as additional hazards warning signals, additional attention triggers and possibly artificial hazard detectors and sometimes special aids (abducted from O*Net, Vukmirović (2010), Brouwer (1989) and reviewers' comments).

a.6. Spatial abilities

Impairment of spatial abilities can lead to navigation problems and being lost and stress thereof.

Children younger than 12 and cognitively impaired (together about 3.4 million people) have limited or reduced spatial abilities, particularly in spatial situations that are unfamiliar to them. In the Netherlands in 2012 about 2.5 million people age 16+ have trouble reading, writing and/or calculation, of which about half are immigrants (Bijlsma et al., 2016; Algemene Rekenkamer, 2016). It turns out that spatial abilities relate to reading and mathematics. Problems with reading and mathematics can easily lead to problems with spatial orientation (Van der Sluis et al., 2005). Based on the figures regarding cognitive impaired and illiterates the author estimates that in the Netherlands at least 5 million people (30% of the population) have limited spatial abilities.

Persons with limited spatial abilities need a high level of connectedness and clear cues to tell them where they are, such as easily detectable landmarks including variety in streetscapes, connectedness and unambiguous routes towards their destinations, clear boundaries of pedestrian space and city districts and recognisable urban texture (cf. Lynch, 1960). For most people in unfamiliar situations well readable street signs and house numbers are important for orientation.

a.7. Attentiveness

Attentiveness impairment usually means that one has a relatively short attention span or that one is easily distracted. These limitations can be expected to increase the risk of missing sensory clues, error-prone W+S decisions, slips and lapses and also may increase fall risk, particularly in the elderly.

Particularly children younger than about age 12, cognitive impaired people, intoxicated people, elderly (aged 80+) have a relative short attention span or are even unable to pay attention. Incidentally everyone can have a lack of adequately focussed attention or be distracted, e.g. by

being engaged in multiple activities or by a non-walking focus, such as shopping, company of people or pets, mobile entertainment devices, having strong emotions. It is impossible to keep attention to traffic all the time.

Based on population data (children 0-12, elderly aged 80+) the author estimates that in 2016 at a random moment up to 4 million people in the Netherlands are distracted or have impaired attention. The author estimates that additionally, at a random moment in time, roughly 500,000 people (~ 100,000 under influence of alcohol or drugs [SWOV, 2018[272]], ~ 400,000 seriously distracted and or having strong emotions [Stelling-Konczak & Hagenzieker, 2012]) are temporarily attention impaired.

Inattentiveness risks can be eased of by shielding from critical and hazardous traffic situations[273], clean, safe and stimulating (diverse) streetscapes, eye- and/or ear catching attention triggers at critical and risky conditions. In unambiguous situations less reaction time is needed for corrective action. In some cases it can be assumed that attentiveness can be heightened by enforcement of pedestrian friendly and safe walking behavioural rules and legislation, which as by-product can also underline the value and importance of walking and respect for walkers (abducted from O*Net, Mwakalonge (2015), Schwebel et al. (2012), Bungum et al. (2005), SWOV (2018) and reviewers' comments).

a.8. Learning impairments

An important capacity of human beings is the ability to learn (Bandura, 1989). This capacity is not included in the 'static' O*Net, which appears to support the assessment of actual human competence, but not the dynamics of achieving the actual competences. One of the reviewers, C. Chaloupka-Risser, pointed to this deficiency in the proposed taxonomy of cognitive abilities. A learning impairment implies that such a person is not (fully) able to learn from one's own experiences, instructions and observed behaviour and prevent repeating errors. This restricts resilience.

Learning impairments happen mostly amongst non-innate brain damage patients, advanced dementia patients and people with very low IQ's. The author estimates that it concerns about 750.000 persons.

For people with learning impairments risks can be eased off by shielding them from critical and hazardous situations, clean, safe and stimulating (diverse) streetscapes, eye- and/or ear catching attention triggers at critical and risky conditions. In extreme cases such persons need to be escorted and supported by their guardians (abducted by the author, with help of the reviewers).

b. Mobility abilities

Mobility disabled pedestrians comprise all (potential) pedestrians having limited psychomotor, motor and/or physical motor abilities with regard to walking as an operational activity, i.e. actual walking and reactions to environmental conditions, traffic, other people and animals. *Psychomotor abilities* enable and control movement as a pedestrian (mobility) and the capacity to lead and accompany other persons, and/or manipulate and control objects while walking and sojourning, like holding a map, a bag of groceries, a dog's leash, walking aids etcetera. *Motor* abilities comprise abilities to move and control and co-ordinate arm, hand, lower limbs and feet,

[272] https://www.swov.nl/feiten-cijfers/factsheet/rijden-onder-invloed-van-alcohol
[273] cf. Swiss Cheese Model (Reason, 1990) and 'missing barriers' to accidents (Groeneweg, 2002).

Table 4.10a Characteristics of cognitively impaired pedestrians

Critical ability difficiencies	Resulting in	System requirements
All cognitive impairments	- Slower information gathering and processing	- Sufficient reaction and crossing time - Traffic speed regulation
Immaturity, impaired reasoning and planning	- Inadequate W+S skills and experiences - Inability to control impulses - Erratic behaviour - Lack of resilience; inadequate responses to critical conditions - Increased risk of mental overload - Suppressed mobility - Increased accident and injury risk (collisions and falls)	- Shielded spaces for W+S activities - Destinations that matter within action radius - Simple and self-explaining conditions - Forgiving social and physical environments - Support, help, guidance, escort, protection - Extra time for street crossing - Time and space for corrective actions - Restricted traffic volumes and speeds - Standardisation of design and rules
Impaired communication	- Miscommunication - Non-communication - Misunderstanding - Conflicts and counter-reactions of bystanders - Risk of errors by counterparts - Risk of non-response	- Self-explaining conditions - Workable channels and communication aids - Forgiving social and physical environment - Standardisation of design and rules
Quantification deficiencies	- Misinterpretation of speeds and gaps in traffic - Misprioritising	- Protected crossing facilities - Traffic speed control (<30 km/h) - Forgiving traffic conditions
Memory deficiencies	- Missing (correct) references	- Repetition of messages/reminders - Artificial memory facilities - Contact/alarm and rescue equipment
Perception deficiencies	- Wrong focus - Wrong interpretation of signals - Missing hazard signals - Bad interpretation of speed and gaps in traffic	- Unambiguity of cues - Low complexity or homogeneity in hazard cues - Additional attention triggers - Artificial hazard detectors
Inadequate spatial awareness	- Navigation problems - Being lost	- High level connectedness - Unambiguous routes, landmarks, boundaries and urban texture
Short attention span	- Risk of missing sensory clues - Error-prone W+S decisions - Slips and lapses - Increased fall risk	- Unambiguity, simplicity and shielding from critical and hazardous situations - Diversity in streetscapes and walking conditions - Attention triggers at risky conditions - Clean, safe and stimulating streetscapes - Enforcement for raising the value of walking - Need for education on the value/importance of walking
Learning impairments	- Repeated errors - Restricted resilience	- Forgiving social and physical environments

Source: O*Net classification, Vukmirović (2010), analysis/abduction, reviewers

as well as reaction time and speed of proper action. *Physical* abilities comprise physical strength abilities, dynamic strength, endurance, and flexibility, balance and co-ordination, i.e. how far, long and well pedestrians can move and perform their W+S tasks (Abducted from O*Net[274]).

Mobility disabilities are usually a result of congenital conditions, illnesses, disorders or injuries. Based on the Dutch National Health survey 2008-2011 Von Heijden et al. (2013) estimate that in total about 20% of the population aged 12-79 (2.7 million people) have some motor or psycho-motoric mobility limitation, and about 6% of this population (162,000 people) have a moderate or severe limitation.

With regard to the translation of the impairments into W+S system requirements New Zealand Land Transport (2008) and Vukmirović (2010) combined the three subcategories and concluded that with regard to W+S system requirements mobility disabilities in pedestrians emerge in six ways 1) they have to spend more effort and energy to move about, 2) they need to use mobility aids to be able to walk, 3) they have decreased agility, balance and stability, 4) they have reduced stamina, 5) they might have reduced manual dexterity and coordination, and/or 6) have been injured and are temporarily incapacitated. Below the characteristics, consequences and functional requirements are described, see Table 4.10b.

ad 1) In principle all physical disabilities mean that, compared to fully able persons, people having them spend more energy and effort to move about. Without using mobility aids this usually means that walking speeds are (much) lower than average (mostly below 4 km/h). In turn this affects how far a person can and is willing to walk. It also affects his/her tolerance for surface quality defects, stairs and gradients. Detours are dreaded.
Consequently distances from origins to destinations that matter need to be direct and short; pedestrian crossings should be short and crossing lights should allow for walking speeds below 1.0 meters/second[275]; walking pavement surface quality should be very good (flat, firm, clean, anti-slip, without gradient). Schoon (2019:47) stipulates that *"...disabled persons requires level, clearly defined easy access and careful attention in the design and placement of street furniture, including resting points. Satisfying these requirements will also satisfy the needs of all other users, especially older people, people with heavy shopping bags/young children and people with temporary impairments or low levels of fitness."*

ad 2) Although mobility aids are meant to increase mobility, they also have side effects. First of all the pedestrian's dimensions, i.e. use of walking space increases, meaning that more footpath width than the 'standard' 150 cm[276] is needed to move about. It also means that one needs to learn to use the instrument; the instruments have their own design and use characteristics and requirements, which usually are less versatile than a healthy human body is. Especially when using a rollator and having to cross the street, the pedestrian must take into account time and effort to lift the rollator from and onto the curb. For using a cane, walker or wheeled device (rollator) firm, flat and non-slippery foothold is needed, kerbs, steps, grates and

[274] see https://www.onetonline.org/find/descriptor/browse/Abilities/1.A.3/ and
[275] In the Regeling Verkeerslichten (=Dutch Regulation Traffic Lights: Rijksoverheid, 2019) 1.2 m/sec (6km/h) is set as reference norm for pedestrian crossing time. In practise designers apply 1.0 m/sec as reference for crossing time starting with green light and ending with flashing green light (Lopen Loont, CROW, 2014).
[276] In the general design guidelines CROW for sidewalks advises a minimum width of 150 cm; fortunately in their dedicated walkability guide 'Lopen Loont' (English: 'Walking Pays Off') 180 cm is adopted, corresponding with 90 cm effective width per pedestrian. This can be seen as an absolute minimum, enabling one pedestrian per direction OR two side by side without redress space. For many elderly arm-in-arm walking is easier than using walking aids.

gaps are more difficult to handle and obstructions are more difficult to pass. Furthermore, there are often psychological obstacles for the use of mobility aids. Many people find it humiliating (to be seen) using walking aids and for many it is a very big step to switch to using walking aids ('I can still manage...") (Gooberman-Hill, 2007; Volkskrant 24-02-2014; Trouw 28-09-2006).
Otten (2004) found that elderly females, starting from age 55 increasingly use a cane, crutches, walker or rollator, about twice as much as elderly males. Four out of ten females 75 or older use walking aids. Using Otten's percentages it can be estimated that in 2016 about 700,000 Dutch inhabitants use walking aids; in 2025 this number will probably comprise about 825,000 inhabitants (about 4.7% of the Dutch population).
Regarding walking distances Schoon (2019:131) recommended to use 50 meters as acceptable walking distance for mobility impaired using a stick and 100 meters for walking aid (rollator, walker) users.
In sum, W+S system requirement supporting the use of walking aids comprise an effective footpath width (without obstacles) of more than 180 cm, firm, flat, even, non-gradient walking routes. Escort can be helpful and agreeable.

ad 3) Another characteristic of walking mobility-impairments can be decreased agility, balance and stability. This leads to difficulties or disabilities regarding changing levels or coping with uneven and low-grip surfaces, high kerbs, and steep stairs and gradients. These disabilities can be caused by sarcopenia and other muscle disorders as well as arthroses and neurological disorders like Parkinson's disease. Such persons have an increased risk of falling and fall injuries.
Based on incidences of sarcopenia, other muscle disorders, neurological disorders and cancer the author estimates that at least 1.5 million Dutch inhabitants (9% of the population) have reduced agility, balance and/or stability.
Handrails and other grasp facilities are required at narrow and steep stairs and gradients. The absence of steep gradients, low kerb height, availability of 'lazy' steps and ramps, and occasional handrails decrease the burden of such widespread disabilities. Escort can be helpful and agreeable. Easily accessible emergency rescue facilities (e.g. emergency button, mobile phone support) are required.

ad 4) Particularly obesity, cardio-vascular, lung and cancer and advanced sarcopenia patients suffer from decreased stamina. Such patients are only able to cover (very) short distances on foot without having rest on the way. Schoon (2019:131) found that about 55% of them can stand for 10 minutes or more, but for 45% less than one minute standing time is the limit. Linked to this resting places (seating of some kind every 200 meters) and shelter are required.
Asmussen (1998) estimated that apart from persons using mobility aids, at least 400,000 Dutch inhabitants suffer from severely decreased stamina (impaired endurance). Based on the chronically impaired figures in Table 4.8 the author assesses that 6-800,000 patients (about 5% of the Dutch population) is likely. Furthermore, a special group with regard to lack of stamina are people with stomach, liver or intestines diseases (about 2 million patients, about 12% of the population), who need to be able to find (public) toilets within short distances[277].

ad 5) Reduced manual dexterity and coordination reduces the ability to operate complex devices, like pedestrian push-button activated traffic lights, writing, holding a bag, buttoning up one's coat, navigating by mobile phone and opening gates. It concerns specific motoric impairments such as paralysis, muscle coordination disorders, muscle strength disorders,

[277] The Dutch Stomach-Liver-Intestines Foundation advises to provide a public toilet every 500 meters (Maag Lever Darm Stichting, 2018).

tremors, missing limbs, malformation of bones and joints (rheumatism) (New Zealand Land Transport, 2009; De Haan, 2011). Often there is a neurological cause like nervous disorders or brain damage from cerebral haemorrhage or accidents. No Dutch indicative figures for these impairments were found. In the USA (US Census 1997, cited by Georgia Tech, 2018) about 5.7% of the population suffers from limited use of hand(s). Assuming that the population shares in the Netherlands are similar, the author estimates that about 950,000 Dutch inhabitants have manual dexterity impairments to some degree (including arthritis, polio, traumatic brain injury, amputees, muscular dystrophy, multiple sclerosis and spinal cord injuries).
Automated traffic signals, locks and door handles (e.g. by using infra-red, radar or video image detection) are a solution for reduced manual dexterity and coordination.

Table 4.10b Characteristics of mobility-impaired pedestrians.

Ability characteristic	Resulting in	Impacting on *
All mobility-impaired	- Slower walking speeds	- Reaction times - Crossing times - Need for speed regulation
Extra energy expended in movement	- Slower walking speeds	- Action radius - Effect of detours - Minimum surface quality requirements
Use of mobility aids	- Increased physical dimensions - Identifiability of impairment - operational limitations	- Minimum footpath width - Effect of obstructions - Road user behaviour - Accessibility of walkway and transportation - Effect of gaps and grates - Step depth - Minimum walkway requirements
Decreased agility, balance and stability	- Difficulties in changing level - Difficulties coping with uneven and soft surfaces - Unsteady gait	- Need for steps/ramps - Maximum kerb height - Maximum gradients - Need of (hand)grip, support and forgiving environments - Minimum surface quality - Minimum pathway width
Reduced stamina and/or physical perseverance	- Shorter journeys between rests - Strong need to visit sanitary facilities	- Need for resting places - Need for nearby sanitary facilities - Need for shelter
Reduced manual dexerity and coordination	- Reduced ability to operate complex mechanisms	- Need for automated traffic signals, locks and doorhandles

Source: O*Net classification, Adapted from NZ Land Transport (2008) and Vukmirović (2010)
Note * Because of great variety in severity of impairments it is difficult to formulate strict norms.

ad 6). According to VeiligheidNL in the Netherlands yearly about 2,000,000 people need to visit a walk-in hospital clinic or general practitioner for emergency medical treatment (severity of MAIS1+). On average such injuries incapacitate people for about two weeks. Based on these

figures the author estimates that at a random moment in time about 75,000 people (0.4% of the population) are in some way walking impaired because of injuries[278].

c. Sensory impaired pedestrians

In the thesis six kinds of sensory impairments are discerned: vision, hearing, somatic senses (~ touch), taste and smell (olfactory senses), speech[279] and sense of balance. For tactical and operational activities people generally rely most on what they see or have seen, somewhat on hearing and to a lesser extent on information from other senses[280]. At the same time smells and tastes may come in, and somatic receptors may detect heat, cold, the feel of surfaces and objects, and give pain signals. Apart and together these senses can give cues, warnings or help to complete the picture. Sight and hearing seems to be associated more with doing and performance of unavoidable walking, while somatic senses, taste and smell are more indicative for attractiveness and appreciation, together with aesthetics decisive for voluntary recreational and sojourning choices.

Commonly people associate sensory disabilities with being totally blind of deaf, but partial loss of eyesight and hearing is much more common (Vision 2020 NL, 2005). In cases of total sensory function loss there are virtually no rest capacities to fall back on or to enhance or compensate. Far reaching and often difficult and expensive adaptations of the W+S system are needed to facilitate such person's mobility. Due to the relative low numbers of people having total sensory function loss, generic W+S system adaptations to facilitate these groups often is not a realistic option; in such cases dedicated special services like personal assistance, individual guide-dogs, dedicated assistive devices (electric wheelchair, prosthetic limbs, navigation devices etc.) are more feasible, except in situations where a number of people with loss of sight or hearing live and come together.
Regarding walking distances, Schoon (2019:131) recommended to use 150 meters as acceptable walking distance.

In cases of partial function loss, where persons in principle are able to partly compensate their impairment by enhancing rest-capacities and additionally reverting to other capacities: custom made spectacles and/or hearing aids, special apps for the mobile phone etc.

In this thesis sensory impairments can comprise both total or partial loss of eyesight, hearing, touch, sense of balance (i.e. organ of balance) and the ability to detect the position of one's own body in space. Such individuals can have difficulties in orientation, detecting potential hazards and navigating through complex environments, like streets, and might become lost more easily than other people.

c.1. Visual impairments

A person having an acuity of vision of less than 5% is considered to be blind (Vision 2020, 2005, following WHO guidelines). In 2005 this comprised 76,000 Dutch citizens. About 223,000 had a visual acuity of 5 to 30%, which is considered visually impaired. According to Vision 2020 NL (2005) main causes of visual impairments in the Netherlands are cataract (83,000 people), refraction defects (69,000 people), age related macular degeneration (68,000 people), diabetic retinopathy (19,000 people) and glaucoma (13,000 people). 85% of all visual

[278] Calculated as 2 weeks / year * 2,000,000 = ~ 75,0000 people
[279] In general senses are defined as kinds of probes for sensing environmental signals. Speech concerns the ability to produce sounds and messages for communication.
[280] Very little information is available about W+S consequences of touch and smell impairments. The author assumes that impairments regarding these senses rarely hamper a person's safe mobility.

impairments concern people aged 50 and older. Compared to males, females are twice as often visually impaired[281]. The highest prevalence occurs in elderly in nursing care homes (44% = 70,000 persons), mentally handicapped (19% = 20,600 persons), and independent living elderly aged 50 or more (2% = 198,000 persons). Vision 2020 expects that, because of ageing of the population, in 2020 the number of visually impaired people (visual acuity below 30%) will increase to 354,000 people. Von Heijden et al. (2013), using a different definition, found that 725,000 people (2011; aged 12 to 79; based on the national health survey 2008-2011) are considered moderately or severely visually impaired.

According to Vukmirović (2010) and New Zealand Land Transport (2009), with regard to visual impairments, there are three important characteristics to be taken into account: lack of contrast resolution, reduced vision and severe vision impairment. *Lack of contrast resolution* leads to reduced ability to distinguish objects. Legibility of visual scans and detection of small changes in level can become problematic. *Reduced vision* leads to reduced ability to scan the environment for orientation, to form a consistent image of the streetscape and to detect kerbs, crossing locations, potential hazards. *Severe vision impairment* decreases streetscape legibility and necessitates the use of mobility aids, escort, guide dog and/or tactile feedback for navigation.
Another defect is colour blindness, which in most cases means that the colours red and green cannot be discerned. About 8% of the males and 0.4% of the females are colour blind in some way, in total 715,000 people.

The blind need alternatives for visible cues and are helped by tactile feedback (cobble stones, edges, tactile tiles), guidance support by bystanders, escort or guide dog or the new technical devices like talking white sticks. For partial vision loss consistent streetscapes are important and the walkway should be free from obstacles, flat, even, anti-slip; height differences should be clearly marked (i.e. contrast and/or dot/stripe marked (Brinker et al., 2007)); all orientation, instruction or warning marks should have strong contrast in colour/black-white, large and straight forward lettering and adequately lighted. Common facilities like traffic lights, kerbs, zebra crossings, roundabouts should have the same lay-out. For instance it turns out that the operating button for pedestrian lights varies in place, height and way of operating. This still needs standardisation (see also under ad d.) (Abducted from O*Net, Vukmirović (2010) and reviewers' comments).

c.2. Hearing impairments

According to WHO a *hearing impairment* is indicated when having a loss of more than 25 decibel, (averaged measurement at 1.2 and 4 kHz)[282]. Having a loss of 40 - 80 decibel is considered a moderate to severe hearing impairment; if a person has a loss of more than 80 decibel s/he is considered deaf. Reduction of hearing ability leads to missing auditory clues in traffic. The clues can partly be substituted by visual information (Vukmirović, 2010).

Kramer et al. (2006) based assessment of number of hearing impaired people in the Netherlands on general practitioners' registration, which does not cover the issue totally, and find that this comprises 533,600 Dutch inhabitants suffering from noise and ageing hearing loss. Based on additional research they estimated that 1,256,000 inhabitants are hard of hearing. Based on the national health survey 2008-2011 Von Heijden et al. (2013) estimated that in 2011 about 2

[281] According to Vision 2000; the statement concerns total number of persons, and is not corrected for age. If corrected for age women are still overrepresented but not so strongly.
[282] http://www.who.int/pbd/deafness/hearing_impairment_grades/en/, accessed 8-8-2018

Table 4.10c Characteristics of sensory-impaired pedestrians

Ability characteristic	Resulting in	Impacting on *
All sensory impairments	- Missing cues for behaviour - Slower information gathering	- Reaction times - Crossing times - Need for speed regulation
Reduction in hearing ability	- Missing audible clues to traffic	- Need to reinforce visual information
Lack of contrast resolution	- Reduced ability to distinguish objects	- Scan legibility - Small changes in level
Reduced vision	- Reduced ability to scan and capture the environment	- Detection of kerbs - Finding of crossing locations - Detection of trip hazards - Consistency of streetscape
Severe vision impairment	- Use of mobility aid, guide dog and/or tactile feedback to navigate	- Streetscape legibility - Use of tactile elements in pavement and verges for guidance
Colour blindness	- Unability of distinguishing between certain colours	- Trafffic signs and signal legibility - Non-colour based hazard warning

Source: O*Net classification, Adapted from NZ Land Transport (2008) and Vukmirović (2010)
Note * Because of great variety in severity of impairments it is difficult to formulate strict norms.

million people (14%) were hard of hearing, of which 280,000 (2%) people have a moderate auditory impairment and 119,000 people (1%) are considered deaf (severe impairment; similar to Kramer et al.'s estimation of 7 per 10,000 people).

In order to be able to orient and be warned deaf and the hard of hearing need either personal hearing aids or clear visual clues like flashing lights at danger points, written, digital or tactile (e.g. a vibrating phone) information for navigation and pre-warning (Abducted from O*Net, Vukmirović (2010) and reviewers' comments).

c.3. Deafblind

Deafblind concerns a combination of not being able to hear and see well. In connection with the cumulated effects it is defined differently from the either deaf or blind, as having a hearing loss of 35 decibel or more and vision of less than 30% and/or a field of view of less than 30 degrees (Vaal & Schippers, 2004). This combination of impairments makes it very hard to orient, communicate, access information and be mobile.

Vaal & Schippers (2004) estimate that in the Netherlands about 35,000 people are deafblind.

To be mobile the deafblind need specific personal arrangements to be escorted or supported while on the way. As far as the author knows there are no generic solutions available for them. Even with escort the walkway should be free from obstacles, flat, even, anti-slip and clean (Abducted from Vaal & Schippers (2004).

c.4. Somatic senses

Somatic senses comprise skin senses for the detection of heat, cold, the size, contours and feel of surfaces and objects (haptic senses), and give pain signals. These senses can be impaired by

neurological problems (spine, nervous system, skin disorders) and in some cases may lead to injury accidents. Apart from visual and/or hearing impaired persons, in general pedestrians do not rely strongly on their haptic senses for orientation and preventing or managing accident risks (Abducted from O*Net and reviewers' comments).

c.5. Sense of balance

The *sense of balance* (i.e. organ of balance located in the mid ear) senses the position of the body in its environment. Through the nervous system it works together with the visual system, muscles, bones and joints to control the position of the body at rest or in motion (Medicinenet[283]). Balance problems can have many causes. It may be the result of an underlying illness or disease, or it may be a normal physiological condition: anaemia, blood loss, dehydration, heat cramps or exhaustion, side effects of medication, alcohol and/or narcotics use, pregnancy.

With regard to mobility, incidence of loss of balance is not registered; the author could not find assessments of consequences for walking mobility and injury risks of sense of balance impairments, but assumes that such impairments are implicitly covered above under the psycho-motor disabilities characteristic agility, balance and stability, where sarcopenia plays an important role.

W+S system requirements for supporting persons with balance impairments are use of walking aids, availability of (hand) grips, forgiving environments, good surface quality and lack of gradients, steps or ramps. In serious balance impairment cases escort and/or walking support are required (Abducted from O*Net, Vukmirović (2010) and reviewers' comments).

d. Wheeled pedestrians

Sidewalks and footpaths are not only legally used by a great variety of walkers, but also by 'wheeled' pedestrians, of which part is made up by walking impaired persons, using wheels out of necessity (wheelchairs, electric wheelchairs, mobility scooters and other narrow disabled vehicles). The majority of the 'wheeled pedestrians' however are wheeled users out of convenience (larger action radius, less tiring, transportation of goods) or choice, such as skaters, children on tricycles and other wheeled toys, parents with prams, elderly with trolleys or carts and occasionally Segway-like electronic people movers. Micro-cars (wider than 110 centimetres) and Segways (if not used as handicapped vehicle) are not allowed on footpaths (cf. Reglement Verkeersregels en Verkeerstekens[284] (= Dutch Traffic Code)).
Use of wheels places demands on the environment and tolerance of fellow road users. Compared to 'normal' pedestrians wheeled pedestrians effectively use more sidewalk space, are less stable (greater potential for over-balancing and more difficulty coping with cross fall), have a lower seating and vision level (problems reaching pedestrian activated signs), are less agile (increased turning radius and turning circle, less reach forwards and sideways) and are more susceptible to effects of gravity and route gradients (have more mass, slower speeds travelling uphill, faster speeds on level spaces and downhill (New Zealand Land Transport, 2009)). In interaction with walking pedestrians they pose more of a threat.

According to De Klerk et al. (2012) in 2011 the number of wheelchair users is not exactly known. Regarding 2011 the number is estimated to be 225,000 - 250,000.
Before the introduction of the legislation of the Wet maatschappelijke ondersteuning (Wmo) mobility scooters were rather freely provided by health care agencies. This led to a fleet of

[283] https://www.medicinenet.com/dizziness_dizzy/article.htm
[284] https://wetten.overheid.nl/BWBR0004825/2018-07-01

about 250,000 mobility scooters in 2011 in the Netherlands (1.5% of the population). Since then health care budgets have been cut and now individuals mostly have to pay (partly) for the purchase of such a vehicle themselves. Although prices have dropped because of competition, many handicapped people cannot afford to purchase a mobility scooter. No current figures are available about the total number of mobility scooters, but the author estimates that, related to the ageing of the population, the number has slightly increased to about 300,000 (2025). The number of pram-users is estimated on 500,000 in 2016 and 2025 (~ number of children aged 0, 1 and 2 in 2016, CBS Statline). The number of children using toy vehicles in public space is estimated on 350,000 in 2016 and 2025 (~ number of children aged 3 - 5 in 2016, CBS Statline). About other devices (skates, trolleys, carts, electric steps, nine-bot) no figures are available, but thousands of them were sold. The author estimates that their number exceeds 250,000; most of these are not often used on public roads.

Table 4.10d Characteristics of wheeled pedestrians

Ability characteristic	Resulting in	Impacting on
Application of wheels	- Susceptible to pavement irregularities / comfort and steering influences	- Need for level, smooth and rigid pathway
Wider body than ordinary pedestrian	- Wider track for moving and passing others	- Required route widths (including accross roads) - Positioning of street furniture
Reduced stability (elevated centre of gravity)	- Greater risk of overbalancing	- Up stand / sudden changes in gradient - Cross fall - Maximum forward and sideward reach to pedestrian activated traffic signals
Height/user is seated	- Lower level of view and reach	- Location of pedestrian-activated traffic signals - Position requirements of signs - Risk of being overlooked
Reduced agility	- Increased turning radius (and turning circle)	- Need for places to turn around - Maximum horizontal alignment (water shed)
More mass - more susceptible to effects of gravity	- Slower speeds travelling uphill, faster speeds travelling on level surfaces and downhill	- Maximum route gradients - Interaction with walking pedestrians
Higher moving speeds and mass	- Danger for other sidewalk users, particularly walking pedestrians	- Movement and risks of walking pedestrians
Source: O*Net classification, Adapted from NZ Land Transport (2008) and Vukmirović (2010) Note * Because of great variety in severity of impairments it is difficult to formulate strict norms.		

W+S system requirements for supporting persons using wheeled devices are level, smooth, clear, non-slippery pathways, obstacle free pathway of 2.00 meters (enabling two wheel chair users to pass each other = 2 x 0.9 m plus room to move (Schoon, 2019:132)) and 2.5 meters height, height of push traffic light buttons and handles at 0.60 meters (reachable while seated (Schoon: 2019)), no stairs in the route, gradient of maximum 2%, less than 0.5% cross fall, availability of turning places (better than 2.00 x 2.00 meters), maximum route gradient of 5%, street furniture outside pathway. (Abducted from O*Net, Vukmirović (2010), FWHA (2006); CROW (2014), Schoon, 2019) and reviewers' comments). According to Schoon (2019:131) for wheelchair users 150 meters can be considered an acceptable distance.

e. Deviant postures

Pedestrians come in different postures and sizes. The extremes are small children and giant, obese persons. Deviating posture places demands on the environment and tolerance of fellow road users. Small persons, like little children behind cars, lack height to be able to detect oncoming traffic and cannot be seen by the drivers as well; very large and obese persons are too wide to be able to use 50 cm sidewalks. Very tall persons have the risk of bumping against roofs and the like.

Children shorter than 1.25 meter (~ younger than 7 years of age; TNO, 2010) are easily hidden behind cars[285]. According to CBS Statline population statistics children up to 7 year make up about 7.5% of the population (1,2 million people in 2016); in 2017 about 11% (1.8 million persons) of the Dutch inhabitants have severe overweight (obesity) and about 60,000 persons (0.3%) are longer than 2.00 meters. In total in 2012 there were about 3.1 million people having a deviant posture compared to average Dutch adults.

W+S system requirements for supporting persons with deviant posture and persons using wheeled devices are level, smooth, clear, non-slippery pathways, obstacle free pathway of 1.80 meters width (enabling two wheel chair users to pass each other = 2 x 0.9 m) and 2.5 meters height, height of push traffic light buttons and handles at 0.60 meters (reach while seated), no stairs in the route, less than 0.5% cross fall, availability of turning places (at least 2.00 x 2.00 meters), maximum route gradient of 5%, street furniture outside pathway (Abducted from O*Net, Vukmirović (2010) and reviewers' comments).

Table 4.10e Characteristics of deviant posture pedestrians

Ability	Resulting in	Impacting on *
Very small posture	- Being hidden from drivers	- Visibility and conspicuity (lines of sight) - Need for shielding and parking restrictions
Very large posture	- Increased risk of head injuries	- Maneuvrability - Higher obstacle free headroom
Very wide posture	- wider track for walking and passing others	- Maneuvrability - Required route width

Source: Adapted from Vukmirović (2010)
Note * Because of great variety in severity of impairments it is difficult to formulate strict norms.

f. Latently impaired people

Latently impaired pedestrians are pedestrians who have undiagnosed disorders and illnesses which do not directly affect tactical and operational walking abilities, but can pose a resilience risk as a disaster waiting to happen. Examples are osteoporosis (erodes bone strength, and as a result falls more often result in broken bones), early dementia (can make it more difficult to remember what to do in emergencies), and abdominal and cerebral aneurysms (in stressful emergencies increased risk of blood vessel rupture, subdural haematoma or having a stroke).

Based on indications of specialist organisations and available diagnostic data the author estimates that there are at least 400,000 people having an elevated risk of severe injuries or worse from crashes and falls.

[285] This became more of a problem as the share of large personal cars (Multi-Purpose Vehicles, Sports Utility Vehicles) increased since the 1980s; sales did drop somewhat however since 2017 (https://autorai.nl/marktaandeel-suvs-voor-het-eerst-in-jaren-gedaald/).

A way to ease of the consequences is to organise adequate early warning and alarm systems and to have quick emergency rescue services in place.

Table 4.10f Characteristics of latently impaired pedestrians

Ability	Resulting in	Impacting on
Osteoporosis	- increased risk of breaking bones	- need for forgiving environments - need for early warning systems - quick emergency services
Abdominal and/or cerebral aneurysms	- in stressful situations increased risk of bleeding out and death	- need for early warning systems - quick emergency services
Early stage dementia	- resilience risk	- need for early warning systems
Other latent impairments	- ?	- ?
Source: abducted from Mulier Institute (2017)		

4.3.4.5. Consolidated results regarding distribution of W+S abilities and translation into W+S requirements

Above the results of the explorations into the distribution of W+S abilities and translation into W+S requirements per ability category have been presented. In this paragraph the results are consolidated in three tables: a) group volumes of impaired (potential) pedestrians [Table 4.11], b) list of critical abilities of a Reference Standard Pedestrian (RSP)[Table 4.12] and c) general W+S requirements to outline a Reference Standard Pedestrian (RSP) to flesh out Asmussen's (1996) homonymic concept [Table 4.13].

a. Group volumes of impaired (potential) pedestrians

From Dutch general health statistics (CBS Statline) it appears that, paradoxically, 80.3% (13.7 million persons) of the population sees themselves as very healthy and 53.2% indicate to have no long time disorders. Consequently 46.8% of the population (8.0 million persons) appear to have one or more long term disorders (2013 data of the National Health Survey[286]), which may affect their walking abilities in some way. In 2016 14.8% of the population aged 19 and older indicated to have one or more disabilities[287]. As such these indications justify exploring possible consequences for their W+S task abilities.

Table 4.11 pictures the group volumes of impaired (potential) pedestrians, whenever possible excluding institutionalised persons like severely cognitive impaired persons and dementia patients admitted to health care institutions. The figures come from many different sources, which differ in quality and of which most do not specify the severity of the disadvantage or impairment. Where such information is missing question marks are put in the table. This mainly applies to very specific disadvantages or impairments; for aggregated classes general information is available. Anyway, the figures are rough indications of the volumes of the groups; more precise figures are not available.

[286] CBS Statline table 'Gezondheid, aandoeningen, beperkingen; leeftijd en geslacht, 2010-2013'.
[287] Dutch: 'functiebeperkingen', CBS Statline - Gezondheidsmonitor; bevolking 19 jaar of ouder, 2016

Table 4.11 Group volumes of disadvantaged (potential) pedestrians (~2011-2016) in NL

Groups	all levels		light		moderate + severe		Urgency score #	Source ##
	abs x 1000	*%*	*abs x 1000*	*%*	*abs x 1000*	*%*		
Cognitive disadvantaged	**3,400**	**20**	**1,700**	**10**	**1700**	**10**		Calculation
of which children < 12 years	2,392	14	956	6	1,436	8	*****	CBS
of which persons aged 12-79	140	1	74	0.45	68	0.41	**	Von Heijden e.a.
of which autism	119	1	?	?	?	?	*	Von Heijden e.a.
of which non-innate brain damage	650	4	?	?	?	?	***	Mulier Inst
of which severe dementia and not institutionalised	100	1	?	?	?	?	***	Calculation
re. Idea and reasoning abilities	3,400	20	?	?	?	?	*****	Calculation
re. Verbal and communicative abilities	2,400	14	?	?	?	?	*****	Calculation
of which immigrants	800	5	?	?	?	?	****	Bijlsma e.a.
of which Non-Dutch persons (person equivalents)	125	1	?	?	?	?	**	Calculation
re. Quantification abilities	4,000	25	?	?	?	?	*****	Calculation
re. Memory abilities	2,600	15	1,800	10	750	4	****	Calculation
re. Perception abilities	4,000	25	?	?	?	?	*****	Calculation
re. Spatial abilities	5,000	30	?	?	?	?	*****	Calculation
re. Attentiveness	4,000	25	?	?	?	?	*****	Calculation
One or more physical impairment	**5,200**	**38**	**3,600**	**26**	**1,600**	**12**		Mulier Inst
Psycho-motor	2,749	20	1,836	13	867	6	*****	Mulier Inst
of which use of walking aids	700	4	?	?	?	?	***	Otten
of which reduced stamina	1,100	7	?	?	?	?	****	Otten
of which manual dexterity	348	3	89	1	259	2	****	Chorus
Sensory	3,000	18						Calculation
Visual	2,611	19	1,911	14	726	5		Mulier Inst
of which blind (visual acuity < 5%)	76	0.5	n.a.	n.a.	76	0.5	*	Vision 2000
of which deafblind	35	0.2	n.a.	n.a.	35	0.2	*	Doofblind.nl
of which visual acuity 5-30%	354	2	n.a.	n.a.	354	2	****	Vision 2000
of which colour blind	714	4	714	4	?	?	***	Kleurenblind.nl
Hearing	1,924	14	1,600	12	351	3	***	Mulier Inst
Sense of balance	500	4	?	?	?	?	***	ASHA
Deviant posture	3,101	19	?	?	?	?		Calculation
of which children less than 1.25 m	1,241	8	?	?	?	?	****	Calculation
of which persons longer than 2.00 m	60	0.4	?	?	?	?	*	Commercial
of which obese persons	1,800	11	?	?	?	?	****	CBS
Wheeled pedestrians	1,500	**9**	?	?	?	?		Calculation
of which wheelchair user	250	2	?	?	?	?	***	De Klerk e.a.
of which mobility scooter	250	2	?	?	?	?	**	Poort e.a.
of which use of prams	500	3	?	?	?	?	***	Calculation
of which personal electronic transporters (e.g. Segway)	250	2	?	?	?	?	**	Calculation
Latent impairment	300	**2**	?	?	?	?	**	Calculation
Temporary cognitive impairment (person equivalents - roughly)	**500**	**3**	**400**	**2**	**100**	**1.00**	**	Calculation
Temporary physical impairment (person equivalents - roughly)	**75**	**0.4**	?	?	?	?	*	Calculation
Estimated total at least (= sum bold figures, excluding doubles)	**9,000**	**54**	**5,700**	**35**	**3,400**	**21**		Calculation

NOTES:
 # Rounded urgency score, calculated from 'group volume' x 'type of risk (mobility = 1; safety = 0.75)' x 'propensity of risk'
Calculations are described in Appendix 5

From the above explorations it appears that in total about 9 million (potential) pedestrians (54%) have impairments which in some way can affect their ability to easily, comfortably and safely walk and sojourn in public space. Approximately 20% of the population has long time cognitive impairments[288], 38% has one or more physical impairments, 3% has temporary cognitive impairments and 0.4% has temporary physical impairments. The majority of them have light impairments (5.7 million people, 35% of the population), causing inconveniences and increased risks. A substantial group (3.4 million people, 21% of the population) however has moderate to severe impairments, causing them to subdue going outdoors and participate in social life, and seriously limiting productivity and quality of life. In sum, the majority of walkers and sojourners have impairments requiring W+S system qualities beyond what is needed for 'normal' healthy and fit adults.

It needs to be remarked that the severity of the discerned disadvantages varies quite a bit. In order to roughly express the urgency of attending to the advantages the urgency was scored regarding individual mobility and safety benefits and Urgency Scores were calculated (Group volume x type of risk x propensity of risk) and converted into a number of stars, expressing the urgency i.e. impact on the mobility and safety of the group members relative to the group volumes[289] (see also Appendix 5). From the scoring it appears that attending to the following (overlapping) disadvantaged groups seems to be most urgent:

- children younger than 12 years of age
- those who are disadvantaged regarding idea generation and reasoning (includes children < 12 years)
- those who are disadvantaged regarding perception abilities (idem)
- those who are disadvantaged regarding attentiveness abilities (idem)
- those who are psycho-motor disadvantaged, particularly stamina and manual dexterity impairments
- deviant posture, particularly children (< 1.25 m) and obese persons
- those who are disadvantaged regarding verbal and communication abilities (incudes children < 12 years of age)
- those who have severe memory impairments
- those who have low visual acuity.

b. List of critical abilities of a Reference Standard Pedestrian (RSP)

This thesis follows Asmussen's (1996) notion and explanation that a so called Reference Standard Pedestrian (RSP) can and should function as reference for W+S system design and management. The translation follows from systematic analysis of the W+S task and subtasks[290] which are presumed to be ordered hierarchically in four levels: life style, strategic, tactical and operational. Observation, decision and reaction time budgets increase from operational level to lifestyle/strategic level. In principle the RSP tries to compensate limitations that occur at higher

[288] Not counting distraction and limited spatial abilities.

[289] The author assumes that, despite adherence to the Design for All principle, in practise it is necessary to select priorities.

[290] Asmussen himself did a tentative task analysis, but did not yet systematically list walking tasks, subtask and critical abilities. Regarding *operational* task performance accessibility and road safety literature offers many cues; much less is written about tactical and strategic W+S task abilities. Based on the above explorations regarding pedestrian needs and abilities the author abducted what critical task abilities are on the four activity levels; draft results were reviewed and amended by a number of pedestrian experts (see Appendix 4) and then processed into the current text.

activity levels, e.g. when walking is difficult (operational level), s/he will walk slower (tactical level) or restrict the number and length of walking trips (strategic level).
It needs to be remarked that the characteristics of an RSP to be applied in design and management should relate to the actually relevant potential user groups. For *public* space this means that in principle no-one should be excluded[291]. If the design specifically targets at certain user groups, for example children or the elderly, the design can focus on specifically meeting their functional needs. This thesis does not make difference, but targets at Design for All.
Below the four W+S activity levels, critical abilities and the related group volumes and general policies to ease off or even remedy consequences of not meeting critical abilities pass by.

Lifestyle task abilities
As mentioned above, *Lifestyle* is about attitudes, values, worldviews and subsequent behaviour (cf. Michon, 1979; Hatakka et al., 1999). At the lifestyle stage important precursory tasks for W+S are making or settling decisions like where to live, work, go to school, vehicle ownership, life priorities, such as the importance of keeping fit, being outdoors, and forming attitudes towards walking and W+S preferences. A critical lifestyle level W+S task ability is to be able to take care that (intermediate) destinations that matter can safely, securely and comfortably be reached on foot.
The author assesses that ability to perform depends on personal capabilities as well as social and physical environmental conditions: cognitive abilities (i.e. perception, imagination, reasoning and planning), behavioural independence, financial means, spatial conditions, psycho-motor abilities, transportation options, self-knowledge, risk awareness etc. Restrictions in this regard at least apply to the ability groups ‘children’, ‘cognitive impaired adults’ and ‘dementia patients’, in the Netherlands totalling approximately 20% of the population (NL: 3.4 million people).
People who are not able to take care that (intermediate) destinations that matter can be reached, need to be protected against consequential risks. For this reason parents and guardians generally do not allow these people to go outdoors independently if the area and/or conditions are not expected to be doable and safe for them. Traffic calmed and safe sojourning areas (cf. road classification in Sustainable Safety (Wegman & Aarts, 2005)) enable children and cognitive impaired adults to move about with minimal supervision.

Strategic task abilities
Strategic activities concern travel decisions and before-trip preparation to execute the decisions: to go or not to go, where to go, when, with whom and how[292]. Strategic choices take place in the head or in discussion with company, and concern consideration of pros and cons regarding acting on needs, obligations, desires and intentions, perceived personal and environmental conditions. Next preparations for the walking and sojourning activities need to take place, such as gathering and putting on suitable shoes and clothing, packing one's bag, wallet, route description, walking aids etc., and planning the trip activities and arrival. With stepping out the trips begins.
With regard to strategic walking mobility tasks Asmussen (1996) indicates that:

> *'Especially children and the elderly, but also many handicapped persons travel along a limited number of fixed routes. This creates clear expectation patterns. There are few*

[291] In practice the Design for All cannot be applied to the full and at all costs, and needs to be nuanced. In Section 4.6 under Discussion this matter is raised.
[292] for example: go alone or with a companion, no luggage, carry bags or a backpack, take along walking aids etc.

surprises. This changes when new destinations are chosen. Due to increasing uncertainty, they get into trouble. This often has consequences for their mobility and thus for social functioning. Consequently the Reference Standard Human especially needs additional information for trips to new destinations.[293]'

Asmussen adds that this additional information should be provided, taking their limitations into account. He implicitly assumes that people are free to independently travel anywhere they want. In practise this is not true for children up to 12 years, chronically cognitive impaired adults and advanced dementia patients, who generally will not be allowed to walk and sojourn independently in conditions that are not deemed doable and safe for them.

From the above explorations of (potential) pedestrian task abilities the author abduces (confirmed by the reviewers) that on the strategic level critical W+S task abilities regarding independent mobility, including trips to new destinations, are:

1. Self-knowledge, i.e. awareness of (consequences of) actual cognitive, physical, mobility, sensory, and if applicable wheel use abilities and latent impairments;
2. Experience with and ready knowledge about the tactical and operational W+S task at hand;
3. Deciding a feasible and safe walking and sojourning strategy to suit one's travel motive, i.e. adequately weighing options and consequences of prevailing conditions for walking and sojourning;
4. Hazard and risk management, i.e. adequately imagining and assessing obstacles, misfortunes, hazards and risks that might occur during the trip and to what degree one is able to cope with those events (skill-, rule- or knowledge-based resilience: customs, algorithms, rules for prevention or easing off consequences);
5. Planning and preparation of the walk, i.e. adequately planning, imagining what is required for easily and safely navigating the system on foot and for eventually sojourning underway or at the end of the trip, and gathering such means for the use during the walk.

The above task abilities are associated with fairly well developed cognitive abilities. As indicated, children (age 0-12), chronically cognitive impaired adults and advanced dementia patients can have trouble to meet requirements and often need support, but this also applies to temporarily cognitive impaired persons. Traffic calmed and safe sojourning areas (cf. 'woonerf', 30 km/h areas compliant with the road classification in Sustainable Safety (Wegman & Aarts, 2005)) enable children and cognitive impaired adults to move about with minimal supervision. In less favourable spatial conditions particularly unescorted temporarily cognitive impaired persons will be at risk.

Tactical task abilities

Tactical activities take place in the head while on the move in public space, mostly in reciprocity with operational behaviour. Tactical activities concern intentions regarding operational behaviour: how to consider and assess the environment while on the move, the route to be taken, navigation decisions, walking speed, level of intention and multi-tasking, where to cross, where to rest etc. The decision process works best if highly automated, i.e. skill-based and subconscious. It is more error- and accident prone and takes more time when experience and (operational) walking skills lack and decisions have to be taken as 'trial and error' or consciously, based on (incomplete) knowledge. Founded on the above explorations the author abduces (confirmed by the reviewers) that critical tactical W+S task abilities are:

[293] translated from Dutch.

1. Rational and social intelligence, i.e. the ability to imagine risks and rationally consider conditions ad hoc, decide on options *en route*, walking behaviour, rests and sanitary stops, as well as being able to communicate and collaborate with fellow public space users;
2. Awareness of what matters and needs to be dealt with (potential aggressors like bicyclist, car and heavy vehicle traffic, obstacles, discontinuities, bad weather, nasty persons, dogs etc.).
3. Self-knowledge, i.e. awareness of one's walking and sojourning abilities and abilities to cope with emergencies (resilience), i.e. insight in (consequences of) one's real cognitive, physical[294], mobility, sensory and if applicable wheel use abilities and latent impairments[295];
4. Spatial positioning and navigation, i.e. recognise safe and walkable corridors, landmarks, navigation signs, safe crossing and resting locations, potential assistance and escape routes etc.;
5. Hazard and risk management;
6. Ready knowledge about and compliance with applicable social and behavioural rules ('how to react').

Like strategic behavioural task abilities, tactical task abilities are associated with fairly well developed cognitive abilities and walking experience. Tactical abilities however also strongly interact with and depend on operational task abilities such as visual and auditory stimulus processing, psycho-motor, posture and ability to go about with wheels, move within the offered spatial margins, tackle height differences, slopes, trip length etc.
In this context the author assesses that particularly moderately to severely disadvantaged and/or impaired pedestrians (cf. table 4.11) will have trouble to meet functional (critical task) requirements. Consequences of functional misfits can be expected to be eased off or remedied by a walking environment design envelope that takes needs of (potential) walkers who cannot meet the above critical abilities into account:

- The structure of built-up areas and walkway patterns are clear, continuous (= apart from road crossings, without discontinuities and obstacles) and accessible;
- Walking routes avoid unsafe situations, are as direct and short as possible and the shortest and safest route coincide (cf. Sustainable Safety principles, (Wegman & Aarts, 2005)). If not, information about detours should be conspicuous;
- (Intermediate) destinations that matter are reachable and accessible within walking distances applicable for disadvantaged (potential) pedestrians;
- Walking corridors (including path segments and intersections) are adapted to visual, spatial, accessibility and wheeled pedestrians' needs (FHWA, 2006), i.e. wide enough for two big pedestrians to walk together (min. 1.5 meters), obstacle free, clean, level, even and flat, with usable ramps, curb ramp slopes and counter slopes, street furniture and easily readable signs, absence of distraction at critical locations;
- Crossings are conspicuous and adapted to low walking speeds (maximum 1.0 m/sec) and (where needed) with push buttons at functional height (about 0.6 m. high);
- Guardians and care takers can guide, support and protect pedestrians who are not able to move about independently without difficulties and (high) risk;

[294] including correctly imagining one's stamina and perseverance.
[295] This includes recognition and management of potentially stressful conditions (situation demanding abilities beyond ones capabilities), such as tiredness, 'calls of nature', narrow escapes, disappointments and adversity.

- Dedicated information for navigation is available: functional cues and signs (unambiguous, big and clear enough to be readable by all significant[296] groups of users), real-time follow-on transport information, maps / mobile navigation apps;
- Shelter and escape routes are easily findable;
- In much used compact public spaces rest options (seating) are provided and findable every 200 meters (CROW, 2014) and sanitary provisions every 500 meters (Maag-Lever-Darm Stichting, 2018);
- (Potential) navigation mistakes and other tactical errors are met by forgiving environments, e.g. shortcuts, traffic speed control, soft verges, emergency response and aid facilities, social arrangements for stress relief.

Operational task abilities
Operational behaviour takes place while on the move and while sojourning in public space, and is guided by tactical intentions. Operational W+S activities concern orientation, locomotion (moving about), carrying out tactical intentions, reacting to external impulses, performing side tasks and sojourning (standing, sitting, moving without going somewhere). Apart from novice walkers and pedestrians, who are notably aware of their disabilities and who have doubts about their capabilities to cope, operational walking behaviour is highly automated, i.e. behaviour is a skill-based response to whatever one runs into. In recognised special conditions like rain, fog, snow, ice, bad visibility, very lively traffic, emergencies, the slower and more error-prone rule and knowledge based behaviour occurs. Critical operational W+S task abilities in this regard (confirmed by the reviewers) are:

1. Memory:
   - Awareness of the purpose of the walk and behavioural intentions;
   - Awareness of consequences and limitations of one's posture, mobility, sensory abilities and use of wheeled devices;
   - Awareness of earlier experiences, knowledge, behavioural rules and analogies (rule- and knowledge-based behaviour, proven routines);
2. Ability to concentrate on activities at hand, resist distraction and control impulses;
3. Sensory abilities:
   - Visually (or audio) scan, read and oversee the walking environment (i.e. visual acuity, contrast, wide angle of vision/peripheral vision; hearing; interpretation) for orientation (streetscape, street names, road signs, landmarks, orientation cues, how to react?); observation of pathway characteristics; detection of obstacles and potential encounters, physical and or emotional 'problems' for walking, navigation, risks, rewards; distinguish persons, forms, objects, boundaries (contrast detection);
   - Detect oncoming traffic, distance, speeds and gaps in traffic (depth vision);
   - Distinguish colour (detection of kerbs, traffic signals and traffic lights);
   - Detect tactile information;
4. Walking skills:
   - Control movement: walk or run forward, turn, halt and walk backwards (in some cases sideways, jump and bend, counterbalance trips and slips);

[296] See also Section 4.5 under Discussion

- Walk a 'standard' walking corridor of at least 90 x 210 cm[297] (width x height);
- Keep one's heading;
- Walk at the required walking speed (e.g. at signalised crossing > 0.9 m/sec[298], keep up with company or crowds adapt speed to oncoming traffic when crossing);
- Keep one's balance both in general and in limited spaces (cf. unsteady gait; risk of falling, falling into traffic);
- Cope with differences in level; cope with uneven and soft surfaces, grades and stairs: i.e. not falling over unevenness and being able to change levels and walk stairs;
- Fine motor abilities i.e. the ability to open doors and operate complex machinery (handles, push-buttons for traffic lights, evolving doors or gates, electronic person movers, touch panels etcetera);
- Stamina and perseverance: cf. action radius related to the need for rests and/or sanitary facilities;
- Stand out in the environment (cf. be conspicuous);

5. Reacting to external cues, impulses and mishaps:
   - Cope with (extreme) temperatures, wind, rain, snow, ice, ...;
   - Avoid obstacles, i.e. avoid bump-in and fall risks;
   - Detect and recognise hazards, risk awareness and management abilities;
   - Recognise visual and auditory warning signals;
   - Recognise safety zones, i.e. know where to turn to;
   - Cope with complex situations and manage stress;
   - Social awareness and intelligence: adequately respond or react to other people and traffic in public space, understand speech, the language, tone, accent, and socialise, communicate with others and traffic, persuade others to help;
   - Cope, avoid or manage encounters, conflicts, emotions and emergencies with other walkers, cyclists, cars, lorries etc.;
   - React timely (cf. reaction speed, psycho-motor abilities);
   - Resilience in emergencies; call in help or support;
6. Special abilities and/or performing secondary tasks:
   - Multi-tasking abilities (distraction by mobile devices, portable audio, listen or talk to someone);
   - Carry or push goods (on person (in pockets, backpack), carry luggage or bags, push or pull a wheel cart or pram);
   - Accompany/guide/support other persons;
   - Access and make use of public transport, taxi, car etcetera;
   - Walk a dog;
   - Guide and use support of guide or help dog (blind, severe physical handicaps);
   - Read tactile feedback (blind, severe visual impairments);
   - Use mobility aids (cane, rollator, walker);

[297] Width = space needed for use of wheel chair (FHWA, 2006) and very large persons in one direction; for two directional pedestrian traffic 2 x 0.9 meters = 1.8 meters is needed; height = average height of young adult males + 3 x Standard deviation (= 1.84 + 3 x 0.08 meters = 2.08 meters (TNO, 2010)); Schoon (2019:175, based on DfT design guidelines, 1993) applies 2.30 meters.
[298] Average walking speed of older people (65+) (Schoon, 2019:51).

- Ride (powered) wheeled devices (wheelchair, mobility scooter);
- Use digital devices, e.g. mobile phone, navigator.

Many people will have trouble to meet one or more of the above required operational task abilities. This does not necessarily mean that they cannot move about in public space. Not in all cases all the above abilities are required; some shortcomings can be compensated by other abilities. When the abilities however *are* needed, it means that they are not able or with (great) pain able to perform. In order to allow all pedestrians to easily and safely navigate system measures need to be taken to ease off or (rather) remedy disadvantages. Table 4.12 presents a tentative overview of tasks, disadvantaged groups and an initial sketch of system requirements regarding accessible system design to allow all pedestrians to easily and safely navigate the system (cf. American Disabilities Act ADA [see CALTRAN, 2014, 2018]; UN declaration of rights of people with disabilities; Asmussen, 1996; Vukmirović, 2010). Apart from 'common' infrastructural adjustments of sidewalks, ramps, street furniture, push buttons, curb/wheelchair ramps, curb ramp slopes and counter slopes (FHWA, 2006), also network, land use, public space maintenance and management, social organisation, social norms, transportation system and information technology are indicated.

General W+S system requirements regarding Reference Standard Pedestrian

The Reference Standard Pedestrian is developed to set a standard for minimum W+S requirements for enabling the vast majority of the (potential) pedestrian population to safely and comfortably walk and sojourn in public space[299]. The vast majority comprises all persons who have at least such cognitive, mobility and sensory abilities that they, under adapted conditions, are able to safely reach destinations that matter on foot through public space, provided these are within walking distance[300]. In practise feasible generic W+S system requirements cannot cover relatively rare cases of persons with full function loss (e.g. totally blind, deaf-blind, no legs or paralysed). These persons are probably better served with dedicated individual provisions (e.g. a guide dog, individual escort, intelligent electric wheelchair etc.) and appropriate training to enable them to walk and sojourn in public space. For example it will technically and financially be very difficult to give every totally blind of deafblind person all they need for their independent mobility. For a blind or deafblind person a guide dog or a personal escort can be more practical, cost-effective and acceptable solution than guide lines, fencing and beacons everywhere (cf. Table 4.13c).

Based on information pictured above Tables 4.12 a-c have been compiled to pinpoint W+S system requirements related to critical walking and sojourning tasks[301]. The tables show the identified critical walking tasks on the lifestyle, strategic, tactical and operational levels, what major consequences are if a person cannot comply, what (kinds of) conditions ease off or remedy the consequences, which groups of (potential) pedestrians can be included by adopting the indicated conditions and an indication of how large the group is. The information of Tables 4.12 a-c is input for Tables 13 a-b picturing generic Reference Standard Pedestrian-related W+S system requirements.

[299] In accordance with the United Nations Convention on the Rights of Persons with Disabilities, 2006.
[300] Walking distance concerns how far an average person is willing to walk and depends on his travel motive, time available and effort needed to comply. Usually one kilometre is seen as maximum walking distance, but for the walking of impaired persons this is much less (cf. Design for all-principle!)
[301] Critical in this regard means: when a person is not able to perform such a task walking and sojourning in public space becomes (extremely) difficult or unsafe.

A critical lifestyle level task concerns arranging for personal walking conditions (see Table 4.12a). With regard to inclusion of disadvantaged groups four groups of potential pedestrians are identified. Children, (structurally and temporary) cognitive impaired persons, and the low-density urban, peri-urban and rural populations (particularly if they are children or cognitive impaired) can be called disadvantaged when it comes to ensuring useful preconditions for walking and sojourning in public space. Together the groups make up more than a third of the population. For preconditioning their participation and mobility on foot they depend on the benevolence, support and actions of more advantaged people and institutions: their guardians, road and public space authorities, transport providers and services that matter. Inconvenient and unsafe conditions may deter them from walking, which in turn can increase risks of health related impairments, disabilities and handicaps. Even more so than for other groups, their safe mobility builds on a pedestrian friendly and compassionate culture, compactness of cities and villages, mixed land use, walkable neighbourhoods, connection and accessibility of follow-on transport, conveniently connected and safe walking networks, walking shielded from vehicle traffic. Children and (chronical) cognitive impaired persons also need supervision, guidance and protection by their parents or guardians. It needs to be noted that, although probably advantageous, for temporary impaired such guardianship generally is often not a realistic option.

Like lifestyle level tasks, do-ability of strategic level W+S tasks, is associated with a person's mental capacities (see Table 4-12a). In this regard particularly children and the (both chronical and temporarily) cognitive impaired are disadvantaged and especially in need of supportive preconditions for their safe mobility on foot. On this activity level critical tasks concern self-reflection and self-knowledge, recalling walking relevant experiences, rational consideration and decision of walking and sojourning in public space, hazard and risk management, and planning and preparing the walk. Inabilities may lead to navigation errors, misperception of efforts, hazards and risks, discomfort while walking and not reaching the aspired goals of life. W+S system requirements in this regard are availability of guardianship (guidance, support, escort), walkable neighbourhoods and traffic calming and speed control, self- explaining social, home, walking, transportation and destination conditions restricting risky choices, targeted transport education, and if necessary walking aids.

Tactical level W+S activities also take place in the head and are conditional upon mental capacities (see Table 4-12a). At the tactical level there is more time pressure regarding reactions on what the walker encounters while on the move. Apart from children and the cognitive impaired, persons having (slowly) decreasing abilities, first time visitors, tourists and new immigrants and foreigners are disadvantaged, together accounting for about 20% of the walkers. Some of them may not be sufficiently aware of potential difficulties and how much time is needed for mental processes and coming to adequate decisions and reactions, forcing them to hasty environmental scans, missing navigation cues and hazards like oncoming cars, misjudging, traffic speeds, taking improper decisions, risking conflicts, dangerous encounters and accident and injury risks. For everyone, and especially the disadvantaged groups, tactical walking task deficiencies are relieved by convenient land use, walkable environments, traffic calming and crossing facilities, self-explaining roads and spatial design, clear boundaries of walking, sojourning and traffic spaces, fair, simple and self-explaining social and traffic rules, conspicuous navigation cues and devices, adequate traffic education, information and training. Table 4.12a and the later tables 4.12 b and c also summarise validation status and potential societal benefits, i.e. Benefit Scores, based on scores regarding expected individual benefits regarding mobility and safety impacts, assuming full implementation of the required measures.

Table 4.12a Reference Standard Pedestrian - task abilities summary - Lifestyle, strategic and tactical activity levels

Critical tasks	Consequence of non compliance	Requirements	Vali-dation #	Benefit score ##	Disadvantaged groups	Group vol. %
Lifestyle activity level						
Arrange for personal walking conditions	Dependence on other people	- Pedestrian friendly and compassionate culture	G	****	- Children	14
	Restricted participation	- Compact cities and villages	S	*****	- Disabled persons	12
	Surpressed mobility on foot	- Mixed land use	S	*****		
		- Walkable neighbourhoods	S	*****		
	Walking discomfort and risks	- Follow-on transport	S	****	- Low-density suburban population	19
	Risk of health related impairments, disabilities and handicaps	- Conveniently connected	S	*****		
		- Safe walking networks	S	****		
		- Walking shielded from traffic	S	****		
		- Guardianship, support, escort	G	**	- Peri-urban and rural population	16
Strategical activity level						
Self-knowledge	- Navigation errors	- Safe mobility education	G	***	- Children	14
	- Misperception of hazards	- Guardianship, support, escort	E	*	- Cognitive impaired	4
Walking experience	- Misperception needed effort and risks	- Walkable neighbourhoods	S	**	- Young Children	8
		- Guardianship, support, escort	E	*	- Physical impaired	6
		-Walking aids	S	*	- Revalidation patients	0.3
Rational consideration and decision	- Navigation errors	- Self-explaining conditions	S	*	- Children	14
	- Misperception of hazards	- Restriction of risky choices	E	***	- Cognitive impaired	4
Hazard and risk management	- Increased risks	- Walkable environments	S	***	- Children	14
		- Speed control	S	***	- Cognitive impaired	4
Planning and preparing the walk	- Discomfort	- Safe mobility education	E	****	- Children	14
	- Not reaching goals of life	- Guardianship, support, escort	E	*	- Cognitive impaired	4
Tactical activity level						
Rational and social intelligence	- Error-prone behaviour	- Self explaining roads/space	S	*	- Children	14
		- Self explaining rules	E	**	- Cognitive impaired	4
Awareness of required actions	- Error-prone behaviour	- Self explaining roads/space	S	**	- Children	14
		- Self explaining rules	E	*	- Cognitive impaired	4
Self-knowledge about abilities	- Error-prone behaviour	- Safe mobility education	S	****	- Children	14
					- Cognitive impaired	4
		- Training	E	**	- Slowly decreasing abilities	5
Spatial positioning and navigation	- Lose way	- Convenient land use	S	*	- Children	14
		- Clear boundaries	S	*	- Cognitive impaired	4
	- Panic Stress	- Navigation cues / devices	E	****	- First-time visitors, tourists	1
Hazard and risk management	- Increased hazard and injury risk	- Safe mobility education	S	**	- Children	14
					- Cognitive impaired	4
		- Training	E	**	- Slowly decreasing abilities	5
Knowing social & behavioural rules	- Increased risk of conflicts, hazards and injuries	- Pedestrian safety legislation and information	S	****	- Children	14
		- Safe mobility education & training	S	**	- Cognitive impaired	4
					- (New) immigrants, foreigners	5

Notes
S = Scientific literature G = Grey literature E = Expert opinions
Score = Group volume x type of risk x benefits from intervention

Similar to the approach regarding table 4.11 on disadvantaged groups, the scores are expressed in one to five star ratings, where five and four star ratings reflect the largest potential societal benefits. With regard to disadvantages on the lifestyle, strategic and tactical W+S activity levels highest impact potentials are expected from 'compact cities and villages', 'mixed land use',

'walkable neighbourhoods', 'conveniently connected', 'pedestrian friendly and compassionate culture', 'safe walking networks', 'walking shielded from traffic', 'safe mobility education', 'navigation cues', and 'pedestrian safety legislation and information'.

Tables 4-12b and c summarise critical task abilities and related W+S system requirements at the operational level. In Table 4.12b attention is given to memory, concentration, orientation, observation and detection (sensory abilities) and walking skills; in Table 4.12c adaptation to actual conditions and special task demands abilities are attended to.

Critical tasks with regard to *memory* are awareness of purpose of the walk and behavioural intentions, awareness of one's ability limits, reproduction of memories of relevant experiences and analogies from other contiguous activities like cycling, how to deal with conflicts, memory of routes and crossing points etc. Young children and cognitive impaired persons, including (early) dementia patients and intoxicated persons are disadvantaged in this regard. Consequences of memory deficiencies can be disorientation and losing way, panic, stress, error-prone behaviour, and thereby endangerment of oneself or others in the vicinity. To ease off, prevent or mitigate awareness problems regarding the purpose of the walk and behavioural intentions, the walking networks should be (very) convenient and easy to navigate, with clear orientation cues to find the way back, and either restrictive or forgiving with regard to traffic encounters. Awareness of ability limits and relevant experiences can be heightened by lifelong traffic education and dedicated advise and training.

Critical tasks with regard to *concentration* are focussing on the walking task at hand, resisting distraction and impulse control. Children and cognitive impaired persons are not always able to concentrate for long, are easily distracted and particularly children have not fully learned to control their impulses. Consequences of lack of concentration can be, particularly in new and unfamiliar situations, losing way, stress, misjudgement of what happens around oneself and erroneous actions endangering oneself and possibly others. Readability of the environment, i.e. unambiguity of routes and forgivingness of the environment, e.g. through traffic calming, can ease off the consequences of failure to concentrate.

For all movement *orientation, observation and detection* (i.e. sensing: vision, hearing, touch, smelling, balance) are important to know where one is, keep balance and heading, and detect (potential) obstructions, joys, hazards and dangers. With regard to walking critical tasks are orientation on walk-space, observation of walkway conditions, detection of obstacles, detection of oncoming traffic and estimation of traffic distance, speed and usable gaps in traffic and other potential dangers. Most important in this regard are eyesight and sense of balance (i.e. feeling and knowing what is up and down). Sounds, vibrations and smells can complementarily support observations, but not totally replace eyesight and sense of balance. Disadvantaged groups in this regard are children and sensory impaired persons. Children mostly have good senses (eyesight, hearing etc), but their brains are not fully developed to understand the meaning of what is seen, heard or felt, and to co-ordinate the input of the various senses. Consequences of non-compliance and impairments are disorientation which may lead to stress, panic, bumps and falls, risk of (serious) conflicts, collisions, being overrun and injuries. To ease off or mitigate orientation, observation and detection deficiencies environments should be easily readable, i.e. easily detectable and recognisable regarding the meaning of what is to be seen, heard, felt or smelled. Unique identity and familiar cues[302] can simplify recognition of where one is (positioning). Walking is also made easier when the intended route and direction is obstacle-

[302] for example standard design, contrast and colours of road signs, street names, house numbers, street lighting, pavement configuration etc.

free and walking surfaces are flat, even and clean, and there is no or little traffic, moving at low speeds. For street and road crossing, conspicuousness is obviously important: to see and be seen. Footpath extensions can help to prevent block-out accidents when e.g. parked cars or trees obstruct the line of sight. Traffic education and training are essential for learning to recognise critical situations and for mitigating slow decrease of detection and reaction capabilities.

With regard to walking and sojourning *walking skills* are critical. The skills concern 1) walk, run, turn, halt and walk backwards (in some cases walk side-wards, jump and bend), 2) exploit a 'standard' walking corridor of 90 cm wide (= width of a pedestrian or wheelchair plus a little manoeuvring/balancing space), 3) keep heading, 4) walk at minimum 'normal' pace of 1.0 m/sec. (CROW, 2014), 5) keep balance, 6) handle level differences, uneven or soft surfaces, grades and stairs, 7) fine motor tasks like opening doors, operating complex machinery like computer key boards, 8) endure the trip (stamina and perseverance), and 9) stand out in the environment.

With regard to walking skills disadvantaged groups are children, physically impaired (psychomotor, sensory, balance, manual dexterity, reduced stamina and perseverance, revalidation patients), elderly females 70+ and elderly males 80+, wheeled pedestrians, duo or group walkers[303], persons carrying bags or goods, walking aid users and the very old, and people wearing dark clothes. Apart from the latter group, the author estimates that about a third of the pedestrians has one or more disadvantages for easy and safe walking and about a fifth has serious disadvantages (significantly hampering mobility and safety of their walking and sojourning in public space); consequences of not meeting the 'norm' are low walking speeds, restricted range, unsteady gait and fall risks, suppressed mobility, restricted resilience, walking in the street instead of on the sidewalk and risk of being overrun (increased accident/injury risks), need for above-norm walking space, conflicts with wheeled traffic, inability to complete the walk.

In Table 4.12 b and c measures targeting operational W+S activities that are expected to deliver the highest societal benefits are 'crossing', 'footpath extensions', 'convenient paving', 'flat, even and sturdy walkway surfaces', 'level crossings', 'rich contrast background', 'fall prevention training', 'escort', 'detection aids', 'self-explaining conditions', 'simplify walking tasks', 'in critical conditions' restrain second tasks and enforce', 'conveniently connected safe walking networks', 'clear orientation cues', 'lifelong traffic education', 'dedicated advise and training', 'unambiguity of routes', 'pedestrian detection', 'extended crossing time', 'forgiving verges', 'sun, wind and rain shielding' and 'warning/detection signs (regarding elevated risks)'.

For including the above disadvantaged (potential) pedestrians, dedicated and recognisable pedestrian space, obstacle free sidewalks/routes of minimum 1.80 meters wide, easy (route, curb ramp, drainage) slopes, convenient paving, hand grips at strategic sites, fall prevention training, forgiving environments (verges, boundaries), level street crossings, extended crossing time when needed, automatic pedestrian detection (e.g. pressure mats, radar, infrared, video) and crossing permission, seating every 200 meters (~ 8 per km2), sanitary facilities every 500 meters (~ 4 per km2), and solid and/or coloured backgrounds at (dangerous) crossing locations are needed.

[303] According to Wandelnet (2018) 28.3% of the recreational walking population are duo or group walkers; estimated exposure = 0.283 x 0.10 (28.3% of the recreational walkers, 32% of walking is recreational, of which 10% is done as duo or group: 0.283 x 0.32 x 0.1 = 0.9%

Table 4.12b Reference Standard Pedestrian - task abilities summary - Operational activity levels - *Part 1*

Critical tasks	Consequence of non compliance	Requirements	Vali-dation #	Benefit score ##	Disadvantaged groups	Group vol. %
Memory						
Awareness purpose and intentions	- Lose way, panic, stress, endangerment	- Conveniently connected safe walking networks	S	****	- Children	14
		- Clear orientation cues	E	****		
Awareness ability limits	- Error-prone behaviour	- Lifelong traffic education	S	****	- Cognitive impaired	4
Recall experiences & analogies		- Dedicated advise and training	E	****		
Concentration						
Concentration; resist distraction; control	- Lose way, stress, endangerment	- Unambiguity of routes	S	****	- Children	14
		- Traffic calming	S	***	- Cognitive impaired	4
Orientation, observation and detection (sensory abilities)						
Orientation on walk-space	- Lose way;	- Readable environments	S	*	- Sensory impaired people	5
		- Clear environments identities	S	*		
Observation pathway conditions	- Stress, conflicts, bumps and falls,	- Obstacle-free walkways	S	**		
		- Flat, even and clean surfaces	S	**		
Detection of obstacles	- Bumps and Falls	- Obstacle-free walkways	S	**		
Detection of oncoming traffic, estimate traffic distance, speed and usable gaps in traffic	- Risk of conflicts, being overrun	- Traffic calming	S	***	- Children	14
		- Crossing: footpath extensions	S	*****		
		- Safe mobility education and training	S	**	- Sensory impaired people	5
Walking skills						
Walk, run, turn, halt and walk backwards	- Low walking speed and range	- Convenient paving	G	*****	- Young children	8
	- Suppressed mobility	- Support (handrails etc)	G	***	- Physically impaired	12
	- Restricted resilience	- Forgiving environment	S	**	- Revalidation patients	0.3
Exploit 'standard' 0.9m walking corridor	- Walk on the street or don't walk	- Obstacle free sidewalk of > 1.8 m wide	G	***	- Wheeled pedestrians	9
					- Duo or group walkers	1 ###
					- Persons carying bags, goods	1 ###
Keep heading	- More space needed, conflicts	- Channelling pedestrian space	G	**	- Young children	8
					- Visually impaired	5
		- Forgiving verges/boundaries	E	**	- Balance impaired persons	4
Walk at > 1.0 m/sec	- Risk of conflicts, being overrun				- Young children	8
		- Pedestrian detection	E	****	- Walking aid users / the very old	4
		- Extended crossing time	G	****	- Wheelchair users	2
Keep balance	- Fall risk	- Flat, even and sturdy walkway surfaces	G	*****	- Balance-impaired	4
	- Unsteady gait	- Fall prevention training	G	****	- Elderly (females ~70+, males ~80+)	~10
	- Slow pace, restricted	- Forgiving verges/boundaries	E	***		
Handle level differences, uneven /soft surfaces, grades and stairs	- Limited walking range, falls	- Level crossings	G	*****	- Psycho-motor impared	20
		- Easy (curb ramp) slopes	G	***		
		- Forgiving verges	E	****		
		- Handrails	E	**		
Fine motor abilities: open doors, operate complex machinery	- Resticted accessibility	- Automatic pedestrian detection and permission	G	*	- Manual dexterity-impaired	2
	- Inability to crossing the street					
Stamina & perseverance	- Risk of not being able to complete the walk	- Seating every 200 m	G	**	- Reduced stamina persons	7
		- Sanitary facilities every 500 m	G	**		
Stand out in environment	- Risk of being overrun	- Crossings: sidewalk extensions	S	*****	- Children	14
		- Rich contrast background	E	*****	- Walkers wearing dark clothes	>50

Notes
S = Scientific literature G = Grey literature E = Expert opinions
Score = Group volume x type of risk x benefits from intervention
Concerns person equivalent = estimate corrected for exposure

Another critical task ability is being able to *adapt to actual conditions*, which includes 1) adapting to climatic conditions (cold, heat, wind, rain, snow, ice), 2) avoiding obstacles, 3) hazard detection, 4) detection and recognition of warning signals, 5) identification of safety zones (refuges), 6) coping with complex (busy, hectic, crowded) situations and managing stress, 7) social awareness, 8) handling encounters, conflicts, emotions and emergencies, 9) reacting timely, 10) resilience in emergencies and ability to seek help.
Disadvantaged groups with regard to adapting to actual conditions are in principal all walkers, but particularly children, cognitive impaired, visually impaired, psycho-motor impaired and increasing portions of persons older than age 80. They suffer the following consequences: lack of comfort (for some to the level of discouraging walking and especially sojourning in public space), bumps and falls, risk of collisions with wheeled traffic, conflicts with fellow public space users, critical errors, stress, panic and (severe) discomfort.
For easing off, preventing and/or mitigating such consequences the following W+S system characteristics are indicated: self-explaining walking conditions, shielding from abundant sun, wind, rain and snow (e.g. by trees alongside the walkways), systematic clearing of snow and ice, anti-slip footwear, escort, contrastive backgrounds, (selective) warning signs, hazard detection aids, emergency services, adapted traffic speeds, adapted sight lines (both for walkers and traffic) and traffic education.

Apart from 'normal' walking tasks specific groups of pedestrians need to perform special tasks, for which they need *special task abilities*. The special task abilities concern multi-tasking, carrying or push goods, guiding companions, walking a dog, reading tactile information, accessing follow-on transport (car, public transport, taxi, ...), using mobility aids (cane, rollator, walker) or (powered) wheeled devices, and using digital devices (phone, navigator, remote control, music player, ...).
Multi-tasking may lead to distraction from normal walking tasks and increased accident risk. Most people think that they are able to carry out two tasks at the same time (like phoning and texting while walking), which however inevitably leads to less attention to what happens around and possibly bumps and falls. In critical conditions (like crossing a busy road) in principle the secondary task needs to be prohibited and maintain the prohibition to limit the consequences.
Failure to carry goods or push a heavy cart may lead to loss of independence. The person him/herself can solve this by acquiring and using a (light) rollator or wheeled bag. Delivery services can solve the problem on a generic level.
Not being able to *guide companions* or *walk a dog* may lead to loss of independence, too. Children cannot always be trusted to guide other children, particularly in non-traffic calmed areas; guardianship and in some cases escort services can solve this privation. Dog owners may lose competence to walk their dogs; (private) dog walking services can take over the task.
In some cases blind and severely physically impaired persons can benefit from the *guide or help dogs* to detect hazards, to find guidance while being outdoors and to fetch things. The user however needs to learn how to communicate with the dog; for this s/he needs training.
In places with a lot of public (e.g. around train stations) tactile information is offered to help the blind and severely visually impaired to orient on their route. There are auditory apps that support orientation on routes for the blind and visually impaired. This concerns about 2% of the walking population. Absence of readable or insufficient tactile information may lead to orientation errors, bumps and falls. To be readable the tactile information should be well placed and uniformly designed and maintained. Tactile information can on some points be completed by auditory information (for instance announce at what platform the train, tram or bus leaves).
Without *access to follow-on transport* handicapped persons and transportation-poor persons have severe mobility limitations. This concerns about 12% of the population. Follow-on transport needs to be affordable, reachable and accessible.

Table 4.12c Reference Standard Pedestrian - task abilities summary - Operational activity levels - Part 2

	Consequence of non compliance	Requirements	Vali-dation #	Benefit score ##	Disadvantaged groups	Group vol. %
Adapt to actual conditions						
Adapt to climatic conditions (cold, heat, wind, rain, snow, ice)	- Lack of comfort	- Sun, wind and rain shielding	G	****	- All walkers, but limited time	~ 100
		- Clearing snow and ice	G	*		
		- Anti-slip footwear	S	*		
Avoid obstacles	- Bumps and falls	- Fall prevention training	G	*****	- Visually impaired	5
	- risk of injuries	- Escort	E	*****		
Hazard detection	- Risk of accidents and injuries	- Rich in contrast backgrounds	E	***	- psychomotor impaired	20
		- (Selective) warning signs	E	****		
Recognise warning signals		- Detection aids	E	*****	- Children	14
Recognise safety zones	- Risk of accidents and injuries	- Escort	E	*****	- Cognitive impaired	4
		- Warning/direction signs	E	****	- 'Strangers'	1
Cope with complex situations and manage		- Escort	E	*****		
		- Self explaining conditions		*****		
Social awareness	- Risk of conflicts	- Escort	E	***	- Children	14
		- Safe mobility education	S	*	- Cognitive impaired	1
Handle encouters, conflicts, emotions, emergencies	- Critical errors, stress, panic, discomfort	- Escort	E	*****		
		- Detection aids	E	**	- Children	14
		- Emergency services	E	***	- Cognitive impaired	1
React timely	- Risk of accidents and injuries	- Adapted traffic speeds	S	***	- Elderly (80+)	5
		- Adapt sight lined	G	***		
Resilience in emergencies; seek help	- Stress, panic, discomfort	- Safe mobility education	S	***		
		- Emergency rescue services	E	**		
Special abilities						
Multi-tasking	-Distraction from walking task; hazards risk	- Simplify walking tasks	G	*****	- (almost everyone)	>80
		- (In critical conditions) restrain second task and enforce	E	*****		
Carry or push goods	- Loss of indepenence	- Rollator	E	*	- Elderly (80+)	5
		- Wheeled bags	E	*		
		- Delivery services	E	*		
Guide companions	- Unfit to guide disadvantaged	- Guardianship	E	***	- Children - cognitive impaired	15
		- Escort services	E	***	- Blind people	
Walk a dog	- No dog-walking	- Dog walking services	E		- (Some) dog owners	9
Use a guide/help dog	- Insufficient hazard detection	- Guide dog use training	E	*	- Blind people	0.5
	- Conflicts, bumps and falls				- Severely visually or physically impaired	~ 1
	- Loss of indepenence					
Read tactile information	- Orientation errors, bumps, falls	- Uniform tactile guiding	G	*	- Blind people	0.5
					- Severely visually or physically impaired	~ 1
Access follow on transport (car, public transport, taxi, ...)	- Mobility limitations; restricted range	- Accessible transport	G	**	- Handicaped persons	12
Use mobility aids (cane, rollator, walker)	- Mobility limitations - Risk of falls	- Ergonomic design	G	*	- (part of) psycho-motor impaired	4
		- Social pressure, education and training	E	*		
Use (powered) wheeled devices	- Mobility limitations	- Ergonomic design	G	*	- Wheeled pedestrians	3
		- Training				
Use digital devices (phone, navigator, remote control)	- Mobility limitations	- Ergonomic design	G	*	- Young children	4
					-Cognitive impaired	1
	- Limited resilience	- Training	E	**	- Computer illiterates	~ 5

Notes
S = Scientific literature G = Grey literature E = Expert opinions
Score = Group volume x type of risk x benefits from intervention

About 4% of the population uses mobility aids (cane, rollator, walker) to move about, to extent their range and prevent them from falling. In practise many (elderly) persons are (very) reluctant to start using walking aids because they think it is awkward, inconvenient and it makes them look handicapped. To stimulate such persons to overcome the hesitation and increase their mobility attractive ergonomic design, education, training and positive examples and social pressure are needed.
About 3% of the population *use (powered) wheeled device* for their mobility. To be able to use such devices these need to be both attractive and ergonomically designed; the users need training to use the devices properly and safely.
In the last decade (2010s) *digital devices* have become indispensable for communication, situational information, navigation and remote controlled access of premises. The author estimates that young children, cognitive impaired persons and computer illiterates (together about 10% of the population) are disadvantaged with regard to use of digital devices. Not being able to use such devices limits mobility, access to places that matter as well as resilience in cases of emergency; information, education and training of their use is required. Walking related apps, compared to other modalities, are still rather rare, but it can be expected to catch up in the near future.

Table 13 a and b summarise what kinds of functional requirements with regard to the W+S system components (cf. Pizza Model, see Figure 3.8) are mentioned above. In total 70 functional requirements were identified; the requirements sometimes overlap; such a large number of items cannot be fitted in a one page table, therefore the table is split up, setting the largest class of requirements apart, i.e. requirements regarding the physical environment. In the table the abstraction levels regarding the various system components are indicated from top (= 1) to bottom (= 3):

1. For the system component *Pedestrian* the levels are 1) all (potential) pedestrians, 2) specific groups of pedestrians, and 3) individual pedestrians;
2. For the *Social-normative environment* the levels are 1) Values, 2) Norms and rules, and 3) Encounters / companions;
3. For the *Transportation environment* the levels are 1) mobility, 2) travel mode / class, and 3) vehicle / unit;
4. For the *Information technology* environment the levels are 1) mass communication, 2) group communication, and 3) person to person / device;
5. For the *Physical environment* the levels are: 1) land use, 2) network, and 3) site /section /intersection.

It must be remarked that requirements and consequences sometimes interrelate and overlap. Mobility and safety are intimately related to each other so that, e.g. perceived safety problems can result in mobility problems, mobility problems stemming from an unfriendly culture can go hand in hand with more severe safety problems (for instance because there is no inherent respect for pedestrians etc.). Furthermore, the various task abilities each have their own field of application and effects; different abilities can influence and even compensate each other, but we do not know how these influence each other and to what degree it happens. For some groups, e.g. blind people, it is known that they can orient themselves better than others on sounds and their internal compass, so that they know when to turn etc. In this context it is very difficult to tell what lacks of abilities lead to bigger barriers to go about on foot. Sometimes they do, sometimes they don't. An important factor is how restrictive personal disadvantages or impairments are in the (potential) pedestrian's own perception.

Table 4.13a Reference Standard Pedestrian related W+S system requirements per system component and level - Part 1

#	Functional requirement	Disadvantages groups	Group volume %	Impact score
	Pedestrian			
2.2	Safe mobility education	Children, Cognitive impaired	20	**
2.2	Safe mobility training	Children, Cognitive impaired	20	****
2.2	Lifelong safe mobility education	All disadvantaged walkers	54	***
1.3	Walking aids - availability	Elderly, Motor impaired	20	***
1.3	Anti-slip footwear	All walkers	100	*****
1.3	Rollator	Elderly, Motor impaired	5	**
1.3	Wheeled bags	Elderly, Motor impaired	5	*
	Social-normative environment			
2.1	Pedestrian friendly culture	All disadvantaged walkers	54	*****
2.2	Restriction of risky choices	Children, Cognitive impaired	20	**
2.2	Simplify walking tasks	Children, Cognitive impaired	20	***
2.2	Ergonomic design of walking aids	Elderly, Motor impaired	20	**
2.2	(In critical conditions) restrain second task and enforce	All disadvantaged walkers	54	***
2.2	Self explaining rules	Children, Cognitive impaired	20	***
2.2	Pedestrian safety legislation	All walkers	100	*****
2.2	Communication on pedestrian safety legislation	All walkers; all road users	100	*****
2.2	Self-explaining conditions	Children, Cognitive impaired	20	**
2.3	Guide dog use training	Blind, severely handicapped	1	*
2.3	Fall prevention and training	Elderly, Motor impaired	20	***
2.3	Dedicated advise and training	Elderly, Motor impaired	20	***
2.3	Training of walking abilities	Physical impaired	40	***
2.3	Delivery services	All walkers	100	*
2.3	Dog walking services	Dog owners	5	*
2.3	Guardianship, support, escort	Children, Cognitive impaired	20	****
2.3	Information, social pressure, education & training of walking aids use	Elderly, Motor impaired	25	***
	Transportation environment			
3.2	Accessible transport	All walkers	100	*****
3.2	Follow-on transport	All walkers	100	*****
	Information technology environment			
4.1	Digital devices - ergonomic design	Children, Cognitive impaired, elderly	25	*
4.2	Emergency (rescue) services	Cogintive impaired , elderly	20	**
4.3	(Personal) hazards detection aids	Elderly, Motor impaired	25	***
4.3	Information, education, training of digital devices use	Elderly, Motor impaired	25	**
#	Code for system component and abstraction level concerned: .1 = macro, .2 = medium, .3 = micro			

From Table 4.13a and 4.13b it appears that the following measures score highest on societal impact:

- User targeted (*pedestrian*) measures: safe mobility training of children and cognitive impaired persons and active promotion of anti-slip footwear;
- Social environment targeted measures: pedestrian friendly culture (all disadvantaged walkers), pedestrian safety legislation and active communication on pedestrian safety legislation, and information, social pressure, education & training of walking aids use of the elderly and motor impaired;
- Transportation environment targeted measures: accessible transport and follow-on transport reachable for all walkers;
- Physical environment targeted measures: traffic calming, speed control, walkable neighbourhoods/environments, sun, wind and rain shielding, clearing snow and ice, rich contrast backgrounds, obstacle free walkways, forgiving environments, extended crossing time (for all impaired), compact cities and villages, convenient land use, conveniently connected safe walking networks, walking shielded from motorised traffic, flat, even, sturdy

and clean surfaces; convenient paving, obstacle free walkway > 1.8 m wide, forgiving verges/boundaries and equal level crossings.

Table 4.13b Reference Standard Pedestrian related W+S system requirements per system component and level - Part 2

Table 4.13b Reference Standard Pedestrian related W+S system requirements per system component and level - Part 2				
#	Functional requirement	Disadvantages groups	Group volume %	Impact score Mobility
		Physical environment		
5.1	Compact cities and villages	Captive pedestrians	25	****
5.1	Convenient land use	Captive pedestrians	25	****
5.1	Clear environments identities	Children, cognitive impaired	20	***
5.2	Walkable environments/neighbourhoods	All disadvantaged walkers	54	*****
5.2	Clear boundaries	Children, cognitive impaired	20	**
5.2	Conveniently connected safe walking networks	All disadvantaged walkers	54	****
5.2	Unambiguity of routes	Children, cognitive impaired	20	**
5.2	Traffic calming (speed regulation)	All impaired	54	*****
5.2	Readable environments	Children, cognitive impaired, visually impaired	25	***
5.2	Seating every 250 m	Reduced stamina	10	**
5.2	Sanitary facilities every 500 m	Reduced stamina	10	**
5.2	Walking shielded from traffic	Children, Cognitive impaired	20	****
5.3	(Selective) warning signs	Children, Cognitive impaired	20	*
5.3	Automatic pedestrian detection and permission	Elderly, Motor impaired	25	***
5.3	Sun, wind and rain shielding	All walkers	100	*****
5.3	Clearing snow and ice	All walkers	100	*****
5.3	Clear orientation cues	All walkers	100	***
5.3	Rich contrast background	All walkers	100	*****
5.3	Speed control	All impaired	54	*****
5.3	Self explaining roads/space	Children, Cognitive impaired	20	***
5.3	Obstacle free walkways	Physical impaired	40	*****
5.3	Flat, even, sturdy and clean surfaces	Physical impaired	40	****
5.3	Crossing: footpath extensions	Children, Cognitive impaired	20	**
5.3	Convenient paving	Physical impaired	40	****
5.3	Support (handrails)	Balance impaired	5	*
5.3	Forgiving environments	All disadvantaged walkers	54	*****
5.3	Obstacle free sidewalk >1.8 m wide	All disadvantaged walkers	54	****
5.3	Deliminated pedestrian space	Children, Cognitive impaired	20	***
5.3	Forgiving verges/boundaries	All disadvantaged walkers	54	****
5.3	Pedestrian detection	Elderly, Motor impaired	25	**
5.3	Extended crossing time	All impaired	54	*****
5.3	Level crossings	Elderly, Motor impaired	25	****
5.3	Easy (curb, ramp) slopes	Elderly, Motor impaired	25	***
5.3	Handrails	Balance impaired	5	*
5.3	Adapted traffic speeds	Children, Cognitive impaired	20	**
5.3	Adapted sight lines	Children, Cognitive impaired	20	***
5.3	Uniform tactile guiding	Visually impaired	5	*
5.3	Navigation cues / devices	Children, cognitive impaired, computer illiterates	25	**
#	Code for system component and abstraction level concerned: .1 = macro, .2 = medium, .3 = micro			

From the overview offered in Table 4.13 it appears, not unexpectedly, that for easing off and mitigating disadvantages and impairments of pedestrians an adequate physical environment incites the most five and four star societal benefit scores. Following Cambra (2012) with regard to the physical environment CROW in 'Lopen Loont' ('Walking is Worthwhile') discerns 6 basic requirements, the so called 6 C's, which - be it in more detail - are assimilated in the requirements list of table 4.13b:

- connected: reachable destinations that matter and a contiguous network, because the chain is as good as the weakest link;
- convenient: walking should be doable, and particularly this means that destinations that matter should be found within walking distance;
- conspicuous: walkways, pedestrians and traffic should stand out;
- comfortable: not stressful, not demanding much effort, resting and sanitary options available; no noise, no glare, no clutter; well maintained;
- convivial: the environment should be healthy, attractive and socially safe;
- co-existence: two-way communication and in the frame of traffic safety encounters should not be risky or dangerous.

4.3.5. Conclusions - towards a 'Reference Standard Pedestrian'

Section 4.3 The pedestrian population explored what needs, tasks and task abilities (potential) pedestrians as public space users have and what the W+S system theoretically should be able to supply to enable pedestrians to easily, comfortably and safely walk and sojourn in public space, i.e. what functional W+S system requirements should be met in this regard. This subsection recapitulates results and makes further connections regarding the first three leading questions of this chapter (see Section 4.1 Introduction):

- *In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?*
- *How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?*
- *How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?*

The research regarding the three questions is inspired by an eclectic collection of theoretical concepts, viz. the NOA model (Steg & Vlek, 2009), the Activity Levels model (Michon, 1979; Hatakka et al., 1999), the 5W+H principle (Spencer-Thomas, 2012), Lifestyle Attributes Compilation (Methorst, 2018, see Section 4.3.2), Task analysis (Van der Molen, 1981; O*NET, 2008, 2018), Design for All (EIDD, 2004; CEUD, 2007), the Reference Standard Pedestrian ('Nieuwe Normmens' by Asmussen, 1996), and the Pizza Model (Methorst, 2000/2010).

The study presented in this section was meant to yield a general picture of the demand for walking and sojourning facilities, which above all should be useful for research planning and give direction to strategic policy development and implementation regarding walking and sojourning in public space.
This subsection describes what general insights were gained regarding the above research questions and what insights still lack.

a. What insights are gained?

The general picture regarding the demand for walking facilities is that the (potential) pedestrian population is very heterogeneous regarding their walking needs, tasks and task abilities, and that more than half of the population has one or more disadvantages, impairments or mobility restraints regarding walking. The heterogeneity is greater than for any other mode, because everyone is a (potential) pedestrian, walking is unavoidable and walking is part of (almost) all

trips, and that there is more to walking than walking (Gemzoe, 2001; Gehl, 2011[304]). The latter is illustrated by facts concerning the idea that walking comprises four 'roles' or kinds: 1) Door-to-door walking (Access mode), 2) To and from other modes (Access sub-mode), 3) Circulation/Exchange (e.g. shopping, walking the dog, posting a letter, recreational walking, professional walking, wandering), and 4) Recreation/Leisure (e.g. waiting for the bus, sitting in the park, demonstrating, ...). Other modes more dominantly have function as access or sub-access mode[305]. As walking is (almost) unavoidable, in principle (almost) everyone can be considered a captive pedestrian, at least for walking to and from other modes. Furthermore, for traffic safety reasons deficient task abilities regarding motor vehicle use can lead to disqualification from driving. No-one can be disqualified from walking (or cycling) however; it is considered a basic right. Consequently, from a justice point of view, everyone should be enabled to move about and sojourn in public space, regardless of their impairments or deficiencies (Design for All principle). This means that steps should be taken to ensure that on the one hand pedestrians are optimally equipped (mentally and means-wise) and on the other hand that the pedestrians environment should be adapted to prevent, remedy or at least ease off disadvantages and handicaps as much as possible.

The research yielded general insights regarding:

- How (theoretically) pedestrian behaviour arises and what factors may restrict behavioural choices and task performance;
- What lifestyle level conditions can precondition walking and sojourning in public space decisions;
- How general human needs, and walking and sojourning motives and the four kinds of walking[306] interrelate;
- What tasks (potential) pedestrians are to perform and what kinds of abilities and skills are needed for this;
- How abilities and skills are distributed across the (potential) pedestrian population and what this means for their walking propensity and competences;
- How key concepts need to be defined for supporting improvements in walking (and sojourning) policy making (definitions are included in Appendix 1 Glossary of terms);
- What groups (=who) what kinds of walking problems experience and why, where and when, i.e. what the impact *can be* on their participation and societal consequences (economy, health, environment, socially). Because ability impact, severity and the perception of it vary, it is unclear how choices turn out in reality and what their impact is on both the individual and collectively.

Overseeing the research results, important, more specific conclusions are:

- Walking and sojourning concerns a multitude of tasks and task abilities. Successively the tasks are orientation, consideration and enabling walking (lifestyle), next to go outdoors and walk towards a chosen destination or transport mode, planning and preparation of the trip (strategic choice at home), followed by plotting a route and choosing how to behave (tactical choices while on the way), then actually taking steps and reacting to actual conditions and finally accessing the (sub) destination and sojourning at the destination, meaning doing

[304] https://sf.streetsblog.org/2011/06/14/danish-architect-jan-gehl-on-good-cities-for-walking, accesed 28-2-2019.
[305] Admittedly, driving or riding for fun also takes place. 'Driving for fun' seems to be declining, but riding a bicycle for fun is quite popular, though in the Netherlands not a primary function of the mode.
[306] The four kinds are: Access Mode, Access Sub-mode, Circulation/Exchange, Recreation/Leisure

something there (operational behaviour). The concerned task abilities comprise cognitive, mobility and sensory abilities, conditioned by posture and/or the use of wheels and latent impairments;

- *Lifestyle conditions* set the stage for walking and sojourning in public space and largely determine captivity and the quantity of walking and sojourning in public space, while operational conditions largely determine their quality and outcomes;
- A person's agenda, actual events and conditions and self-knowledge about one's abilities largely determine strategic walking and sojourning decisions; captive pedestrians do not have a choice regarding door-to-door trips and most sub-mode trips; there is a rather general preference for other modes (easier, faster, less effort) and society is strongly adapted to and dependent on car use (Jeekel, 2011); for captive pedestrians the quality of W+S is decisive for their easy and safe mobility, for non-captives it plays a role in their decisions whether or not to walk. Strategic decisions largely concern mental processes; children and the cognitive impaired (both chronical and temporary) are disadvantaged in this respect, needing special attention regarding environmental qualities; this comprises 18 - 20% of the population;
- *Tactical W+S behaviour* is prompted by both strategic behaviour and observed operational conditions. Like strategic behaviour this is about mental processes, disadvantaging children and the cognitive impaired (18 - 20% of the population);
- *Operational W+S behaviour* results from (implicit, mostly 'automatic') strategic and tactical decisions. Those who did not (yet) master walking, cognitive impaired and physically impaired are disadvantaged, i.e. restrained in their mobility and have increased injury risk (collisions and falls), which may induce (some) stress. This comprises about 50% of the population;
- The travel motives discerned in the Dutch national travel survey (respectively OVG, MON, OViN) do not adequately cover the wider range of motives for walking and sojourning in public space;
- Pedestrian safety comprises more than pedestrian traffic accidents. In this thesis it comprises all hazards that a pedestrian may experience, including falls, social safety, fear and exposure to other external causes;
- In theory W+S attitudes and intentions determine W+S behaviour. In practise it is extremely difficult to capture such attitudes. The concept of W+S propensity appears to be more practical and realistic as it can be expressed by applying statistical data regarding a group's walking and sojourning characteristics;
- The results regarding walking needs, tasks, task abilities, functional disadvantages and the translation of the disadvantages into what functionalities the W+S system needs to offer lead to general insights into what the W+S system should be like to enable the Reference Standard Pedestrian (= a fictive person who is marked by a lack of all situation relevant abilities) to participate and contribute to society (do-ability requirement) and lead a life that matters. In principle this means that all (potential) pedestrians are enabled to complete their journeys and/or sojourn in public space. For persuading non-captives to walk and/or sojourn in public space this may not be sufficient (see next Section 4.4, where more concrete requirements regarding the five system components and their interrelations are discussed), but meeting do-ability requirements can be seen as pre-conditional for more advanced policies;
- Environmental requirements regarding the concept of the Reference Standard Pedestrian are not universal, but depend on which population it actually concerns, i.e. whose use is

targeted. If for example the probability of children being somewhere is very low, requirements regarding children need not to be given priority on that spot.

b. What insights still lack?

The W+S research and policy domains are still in their infancy. There is very little academic literature on a conceptual level. The aim of this thesis is to present a provisional overview and finger exercise regarding the broad W+S domain. It aims to offer a tentative fundament for W+S research programming and impetus for policy making, setting first priorities. In most of the cases the presented figures regarding the distribution of task abilities and associated requirements are best estimates, not 'hard figures'.

Compared to adjacent domains, e.g. cycling, sustainability, scientific research and available statistical data do not cover the domain adequately; evidence is still scarce, sketchy and incomplete, i.e. often missing, inexact or inaccurate. Out of necessity this explorative study is partly based on grey literature, tacit knowledge, indications from research projects with narrower scopes than this thesis and on analogies from adjacent fields. Although the results may have face validity, part of it is still unproven and in need for data and further empirical research:

- With regard to (potential) pedestrian populations the exact volumes and qualitative aspects, walking propensities (attitudes, intentions) and consequences of shortcomings and impairments are mostly unknown. In the absence of better figures, the presented figures in this thesis most of the times are crude indications of the order of magnitude.
- What ranking the (potential) populations attach to their experienced disadvantages and what priorities can and should be set for solving the disadvantages is not unveiled in this subsection and is as yet unclear;
- The presented list and description of W+S system requirements must be considered a first finger exercise and contains tentative indications of their potential impacts and is not yet formulated SMART[307]. Furthermore, the research for this chapter was limited to identification of disadvantages and what can be done to ease off or even remedy the negative impacts, but did not go into their relative importance, their impact on the individual's or collective functioning and impacts on wealth and well-being of the population. For assessing the relative importance of the different skills and setting priorities with regard to meeting the found requirements information is needed about the absolute, relative and experienced impacts on the (social) functioning of individual pedestrians as well as the magnitude of the impacts on a societal (community, regional, national) level. In the next subsection on exemplary W+S arrangements international experts' insights, arguments and (some) evidence for assessing the importance of recommended requirements are presented. Furthermore, the aim is to provide available evidence and best estimates about the magnitude of demand for better W+S facilities in Chapter 5 about the status quo of the W+S system;
- For validity reasons a draft of the proposals is submitted to 10 experts in the field (see Appendix 4). Clearly more knowledge, data and statistics (for formulating the requirements specific and measurable), debate (for acceptability, realism and time-specifity) is needed to formulate the W+S system requirements in a SMART way.

[307] SMART = Specific, Measurable, Acceptable, Realistic and Time specific.

4.4. Exemplary W+S arrangements

4.4.1. Introduction

This Thesis' section focuses on the identification of exemplary arrangements of facilities and services that can be expected to create opportunities to better support (potential) pedestrians to walk and sojourn easily, comfortably and safely in public space, in order to optimally contribute to well-being, prosperity and sustainability of individuals, communities and the nation. The aim of this section is to offer an impetus for advancing the normative framework for W+S policies.

Outline of this section

This introduction subsection successively deals with the definition and scope of opportunities in this thesis, research questions and how the research questions are answered. In the then following subsections successively the first sub-question is answered by picturing a classification of arrangements supporting to W+S opportunities (Section 4.4.2.). Next general findings regarding the scoping review research are presented (Subsection 4.4.3.). Findings with regard to the second sub-question on preconditions for the genesis of W+S opportunities are presented in Subsection 4.4.4. Next findings with regard to the third sub-question concerning requirements for suitable W+S arrangements are delivered in Subsection 4.4.5., 4.4.6. and 4.4.7. respectively on basic arrangements, convenient arrangements and tempting arrangements. The chapter ends with a conclusions Subsection 4.4.8.

Definition of opportunities in this thesis

Oxford Dictionaries defines opportunities as a time or set of circumstances that makes it possible to do something[308]. Windows of opportunities concern suitable offers, at the right time and place. With regard to walking and sojourning in public space this concerns physical environmental, social, transport and ICT conditions, facilities or services and/or combinations of them.

Pedestrians interpret W+S opportunities of factual, real world conditions in the context of their needs, desires and abilities. Not all potential opportunities are recognised as such. People occasionally make a mistake and act on a non-existing opportunity and get disappointed or worse.

The scope of opportunities in this section

With regard to the scope of W+S arrangements considered in this thesis, it needs to be remarked that in most policy documents walking is confined to *walking for transportation,* also called *utilitarian walking*. The scope of the thesis, however surpasses walking for transportation (cf. Gemzoe, 2001 and Jan Gehl (2011): 'there is more to walking than walking'). It also includes walking for recreation and health (= circulation), and sojourning in public space. Walking for transportation or utilitarian walking generally concerns both door-to-door [= main mode walking] and walking to and from other modes [= sub-mode walking]). To complete the picture, this thesis also includes professional walking (= circulation) and sight-seeing by (foreign) visitors, which generally stays out of sight in mobility surveys and W+S policies.

[308] https://www.lexico.com/en/definition/opportunity, accessed 10-7-2019.

Three dimensions of opportunities can be discerned: 1) current functional utility value, 2) current perceived value, and 3) durability and expected future prospects (RaRo, 1990; Methorst et al., 2010 p9; Brouwer, 2019).
Functional utility value concerns 'objective' functionality or dis-functionality. When a condition is labelled 'functional' this means that, following 'objective' Design for All norms, such a condition factually allows pedestrians to walk and sojourn in public space, almost regardless of their disadvantage or impairment, be it with some irritation or lack of attractiveness.
Perceived value determines what opportunities will be recognised as such. As perceptions vary per person and per situation and is difficult to assess, this thesis cannot go beyond general findings regarding (potential) pedestrians perceptions.
Durability and expected future prospects value concerns future functionality. For this thesis this is an important value as functionality of conditions and the perception of it in relation to needs and abilities can change over time. Because of these dynamics (real) functional utilities need to be maintained on at least standard level, protected, and tuned to future demand: the durability and future prospects dimension. How in future this kind of functionality will be perceived is virtually impossible to predict.

Research questions in this section
Taking the above deliberations into account, the central question in this section is:

What kinds of W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians a suitable variety of W+S opportunities, now and in the next decade?

For the work of this thesis the central question is split up in three sub-questions:

- What kinds of conditions are (potential) pedestrians looking for?
- What factors frame the genesis of W+S opportunities?
- What kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

How the research questions are answered
The three sub-questions are concisely answered in the below subsections. The answers are based on *scoping review* of literature available in the dedicated documents database[309], particularly on W+S policy guidance and advise reports, charters, and (review) literature on determinants of W+S behaviour. With regard to opportunities based on spatial arrangements there are already a number of well-founded policy guides and websites. The aim of this section is to sketch a comprehensive picture of arrangements, covering the full range of opportunities, including also the social-normative, transportation, and information and communication technology arrangements to support and promote walking and sojourning in public space. With regard to each of the categories of arrangements attention will be given to three dimensions of opportunities: 1) functional utility (i.e. the experts perspective), 2) perceived value (i.e. the [potential] pedestrians' perspective, and 3) durability and future prospects (i.e. the dynamic perspective, limited to the experts' perspective).

[309] Up to September 2019 the database was continuously replenished with new findings, including those that were found during the stepwise execution of this sub-study (cf. Section 4.2.3).

4.4.2. Classification of W+S opportunities

4.4.2.1. Introduction

This subsection deals with the first research question about the search for suitable opportunities for walking and sojourning opportunities, based on W+S needs and abilities (cf. NOA-model, Steg & Vlek, 2009):

- What kinds of conditions are (potential) pedestrians looking for?

The research comprises a quest into what conditions appear to encourage and/or persuade potential pedestrians to walk and sojourn in public space, and enable them to move about easily, safely, comfortably and with pleasure, taking into account that the needs and abilities of the population, decision contexts, and decision processes are heterogeneous. In order to classify W+S opportunities, the research needs to broadly explore what factors and what arrangements of conditions play a role in W+S behaviour, and how this works. In the past, based on empirical evidence, relevant theories were developed. In the next paragraphs a selection of relevant theories are adduced (Subsection 4.4.2.2) and applied to develop a classification of W+S arrangements (Subsection 4.4.2.3). With the classification in mind a scoping review study was carried out to identify exemplary W+S arrangements (Subsection 4.4.2.4).

4.4.2.2. Theoretical considerations

Theoretical inspiration for exploring W+S opportunities and exemplary arrangements

The approach to exploring W+S system requirements and exemplary arrangements in this regard, is inspired by a number of theories, namely Steg & Vlek NOA-model (2009), Cognitive Dissonance and Task Performance theory (Festinger, 1957; Rasmussen, 1983; Reason, 1990), the Klantenwenspiramide (Customer desires pyramid, Van Hagen 2006), Activity Levels theory (Michon, 1979; Hatakka et al., 2002), Walking Behaviour Conceptual Framework (Clifton & Livi, 2004), and the Pizza-model (Methorst, 2010).

Link to the NOA-model

The NOA-model (Steg & Vlek, 2009) renders that consumer environmental behaviour is governed by needs, opportunities and abilities, which takes place within in a context of environmental settings and developments. It is assumed that this theory applies to pedestrian behaviour, too.

The theory states that needs and abilities together underlie opportunity search. In the above Section 4.3 general environmental settings, and W+S needs and abilities were explored. An important conclusion of the quest was that the (potential) pedestrian population' needs and abilities are heterogeneous, and that a substantial number of people experience disadvantages and impairments regarding walking and sojourning in public space. Following the Design for All principle, the W+S system should be designed to at least enable (almost) everyone to participate. Therefore the exploration also included looking for ways to remedy or ease off the negative consequences of disadvantages and impairments which some people have in this regard.

The pedestrians' behavioural context, needs (including facilities for disadvantaged and impaired people) and abilities constitute the (basic) demand side of the W+S behaviour equation. The current section deals with the fourth factor of the NOA-model: opportunities for walking and sojourning, constituting the supply side of the equation. In Steg & Vlek's theory opportunities

and needs together underlie the *motivation* to perform, whilst opportunities and abilities together underlie behaviour control, i.e. the *feasibility* of taking advantage of opportunities.

Link to Cognitive Dissonance and Task performance theory
In this thesis' Chapter 3 the below general behavioural theories have been summarised; it was concluded that decisions are based on perceptions of reality, which not always match objective reality. Furthermore, even if perception of reality matches objective reality, this does not automatically mean that strategies will match such knowledge. A person may seek to reduce discomfort of not following the path of an objectively appropriate strategy by bringing cognitions into harmony through discharging one or more of the dissonant cognitions, i.e. weighing counter arguments differently (Cognitive Dissonance Theory, Festinger, 1957). These cognitive and perception principles affect the way in which (potential) pedestrians walk and sojourn in public space. Another important insight in this regard is that awareness and behaviour depends on the degree to which a person weighs experiences and arguments consciously. According to Rasmussen (1983) and Reason (1990) skill-based behaviour is generally subconscious, whilst rule-based, knowledge-based and considered task implementation are generally mostly consciously deliberate behaviour. With the exception of considered behaviour, behavioural errors are unintended and concern respectively slips and lapses, rule-based mistakes, knowledge-based mistakes and deliberate breaches of rules. Only the latter are culpable actions mostly justifying educational countermeasures.

As most people have mastered the art of walking, operational behaviour is almost fully automatic, whilst tactical behaviour is automatic except in unfamiliar situations and emergencies. Even strategic and lifestyle decisions are mostly habitual and automated. Automated, subconscious decision processes are very hard to influence and change, particularly if these not (subconsciously) arise in reaction to current events and conditions. In new, unfamiliar situations and under time pressure, when no ready behaviour solutions are mentally available, persons, when possible, fall back on an iterative strategy using intuition or otherwise trial and error, just 'God Bless the action'.

In conclusion: the actual pedestrian behaviour may not match the intended functionality of actual W+S arrangements; 'perfect' arrangements are no guarantee that pedestrians behave as intended by the providers. Arrangements need to be very tolerant for misunderstandings and capability envelopes.

Link to Van Hagen's Customer desires pyramid
Pedestrians can be considered consumers of W+S opportunities. In this perspective Van Hagen's (rail) transportation consumer needs model (2006; see also Section 3.3.) teaches that three classes of opportunities and associated quality levels can be discerned: basic opportunities arrangements, dis-satisfiers (calculative and proactive damage control arrangements), and satisfiers (proactive and generative revenue arrangements).

The *basic opportunities* class concerns do-ability, safety and reliability of services. In this thesis do-ability is linked to the Design for All principle, implying that conditions should be so good that all (potential) pedestrians, including disabled and disadvantaged persons, and particularly people who do not have a choice but to walk, are enabled to easily, comfortably and safely walk and sojourn in public space and reach destinations that matter to them. In the previous section do-ability related system requirements were identified. In this section arrangements that aim to meet the Design for All principle linked requirements are considered to be basic W+S opportunities arrangements.

Better-than-basic arrangements of facilities and services can help to encourage and persuade people who have a choice, i.e. non-captive pedestrians, to walk and sojourn in public space more and more often than just for their basic needs sake. The Van Hagen theory implies that by remedying dis-satisfiers (convenience) and/or offering niceties non-captive pedestrians can be tempted to walk and sojourn in public space more and more often.

Dis-satisfiers concern qualities of opportunities which, if not met, can irritate and discourage people to walk and sojourn in public space. Irritations can arise even if basic do-ability requirements have been met, for example in an ugly, dirty, messy, unkept, noisy and busy environment, when there are relatively long waiting times at traffic lights, narrow passages etc. Such irritations can be a reason for choosing not to walk and sojourn at a particular place in public space, but travel by other modes, choose another route or time, and/or sojourn in public place elsewhere or not at all. Policies to remove or abate causes for W+S irritations and dislikes in this thesis are considered calculative and pro-active damage control policies (cf. Hudson, 2001, Groeneweg, 2002). These aim not to discourage potential pedestrians who have a choice (non-captive pedestrians), and keep them from choosing alternative modes and/or sojourning places, and consequently potentially favourable e.g. not overcrowding other modes or losing business. Such policies generally arise from a highly developed sense of duty to provide for, maintain and improve pedestrian facilities, in response to monitoring conditions, complaints, media signals, and explorations regarding potential W+S issues.

By contrast, *satisfiers* concern niceties, which sweeten walking and sojourning in public space. Related policies aim to persuade (potential) pedestrians to walk and sojourn more and more often at particular places in public space. By offering superior conditions stakeholders hope to receive more and better revenues, and experience other positive secondary effects like standing out in the competition regarding visitors, population, employment between regions, cities and neighbourhoods, more contended citizens, better public health, lower health costs, less congestion, less pollution, increasing population, commerce and number of businesses. Such more elaborate arrangements can only be fully effective if do-ability and damage control arrangement requirements have been met to a more than just acceptable level. Arrangements that aim to attract pedestrians by offering W+S excellency and niceties are considered generative revenue W+S arrangements.

Following the Van Hagen model, four quality levels are discerned: a) not acceptable, b) just acceptable if absolutely needed, with some nuisance and irritation, and dislike, c) acceptable without irritation, but not really liked or disliked, and d) pleasant and liked conditions. If a person has a choice of alternatives, conditions that are liked stand the better chance to be taken as an attractive W+S opportunity, whilst disliked conditions stand more chance of being avoided.

Link to the Activity Levels theory; consequences for the relations within the NOA model

With regard to mobility, including walking and sojourning in public space four levels of behaviour are discerned: lifestyle, strategic, tactical and operational behaviour (Michon, 1979; Hatakka et al., 2002). In principle lifestyle and strategic level behaviour take place before going outdoors, while tactical and operational activities manifest while moving about. The behavioural levels determine what range of potentially relevant options are considered. The NOA model is not intended to cover lifestyle/strategic choices between alternatives for walking and sojourning in public space, like using a bicycle or motorised transport. Such choices however are relevant for policy making; with some extensibility, competition between alternatives for walking and sojourning in public space can be taken as environmental

influences on W+S choices, which is covered by the model. Lack of attractiveness of opportunities for walking and sojourning in public space can make alternatives (even) more attractive; this way the relation between W+S opportunities and environmental influences can be bi-directional.

Link to the Pedestrian travel & sojourn system and Pizza model

This thesis aims to comprehensively cover arrangement options to sustain and/or improve the quantity and quality of walking and sojourning in public space. In this thesis the Pedestrian Travel & Sojourn System Model (see Figure 3.5) and the Pizza model (see Figure 3.8) are introduced to enable and promote comprehensive coverage of the W+S system components and interrelations from lifestyle/strategic, tactical and operational activity and policy perspectives. The two conceptual models of the W+S system both feature five interrelating components: the pedestrian, his social-normative, physical and transportation environments, and information and communication technology. The individual pedestrian's strategic walking and sojourning choices are governed by both the 'inside' needs and abilities and 'outside' opportunities at hand (Steg & Vlek, 2009). The decisions take place in a context of the (potential) pedestrian's individual and household factors, social-normative environment, physical environment, transportation environment, and information & communication (cf. Pedestrian Travel & Sojourn Model [Figure 3.5] and Pizza model [see Figure 3.8]). Main factors in the search for walking and sojourning opportunities are on the one hand the 'inside' needs and abilities associated with the individual's characteristics (such as age, gender, perceived competences and abilities, social-economic status, education, cultural background, preferences, driving licence, vehicle or transport subscription availability, experiences, interests, expectations, state of mind), and on the other hand the 'outside' social-normative environment, physical environment, transportation environment, and information & communication, which can affect strategic (when and where to walk to or not to walk) decisions as well as the tactical (route, mindset) and operational walking and sojourning behaviour.

4.4.2.3. Link to the concept of walkability

In this thesis the concepts of *W+S opportunities* and *walkability* are intimately connected, but not similar. Walkability concerns the condition of the physical environment, whilst opportunities, according to Oxford Dictionaries, concern a time or set of circumstances that make it possible to do something[310], i.e. a suitable environment *and* opening hours, matching behavioural schedules, social acceptability etcetera. Walkability is a precondition for walking opportunities. If the physical environment is not walkable, there are no true walking opportunities (cf. Gemzoe, 2001 and Gehl, 2011: *'there is more to walking than walking'*[311]). The author adheres the broad definition given by Litman (2003/2007:1) who defines walkability '*as the quality of walking conditions, including safety, comfort, and convenience*'. Walkability describes overall walking conditions, in the widest sense. In this thesis walkability takes into account the pedestrian's abilities and competences, quality of pedestrian facilities and services, roadway conditions, weather conditions, land use patterns, community support, security, comfort of walking and connectivity to the transportation system. Walkability scores should indicate how well the pedestrians' needs regarding all pedestrian activities in public space (the four kinds of walking) are taken into account.

[310] https://www.lexico.com/definition/opportunity, accessed 25-6-2020

[311] https://sf.streetsblog.org/2011/06/14/danish-architect-jan-gehl-on-good-cities-for-walking/, accessed 25-6-2020

A large body of literature on 'walkable' and 'walkability' is published. A tentative search in Scopus on 'walkability' (23-4-2019) delivered more than 1,500 hits; at the same time a search in Google Scholar delivered an immense 30,500 hits, excluding patents and citations. The number is growing solidly by about 4,000 documents per year. The volume is too large to review within the context of this thesis, but there are a number of reviews, of which particularly Clifton & Livi (2004), Abley (2005) and Maghelal & Capp (2011) describe how the concept is defined in current literature.

All three walkability literature reviews noted that in literature there is no consensus on the definition of 'walkability'. *'Walkability' and 'walkable' are terms that have become common in the fields of engineering, planning and health, partly because walking is widely recognised as having benefits for the social, health and economic well-being of a society. The term 'walkability' was defined in 2005 as '…the extent to which the built environment is walking friendly' (Abley, 2005:3), and this definition was incorporated into the NZTA's Pedestrian planning and design guide (New Zealand Land Transport, 2007/2009). The Design Guide also noted that walkability is '…a useful way to assess the characteristics of an area or a route, although it can be subjective'* (cited from Abley, 2011:11).

Maghelal & Capp (2011:1) reviewed 25 walkability indices '*that were developed in the past two decades to generate comprehensive and detailed measures of built environment variables related to walking'*. The indices *"... rank a location segment or an area as 'less or most suitable to walk"*'(Maghelal & Capp, 2011:5). From the reviewed documents they produced a list of 53 objective, 21 subjective and 11 distinctive variables used in the 25 walkability indices, which are likely to be helpful for the identification, rating, provision and improvement of W+S opportunities.

A problem is however that *".... the lack of detailed and accurate data on both behavioural and objective measurements of environments likely represents the single most important issue to address future attempts to isolate single groups or environmental predictors of walking..."* (Moudon & Lee, 2003, cited in Maghelal & Capp, 2011:6). Maghelal & Capp also mention that the relevance of the generated measures and indices for assessing walking propensity is not always (adequately) validated.

From crudely analysing walkability indices literature (e.g. Clifton & Livi, 2004; Abley, 2005; Maghelal & Capp, 2011) the author concludes that walkability indices offer aggregated ratings, which on the one hand do not cover all (major) factors affecting the convenience, easiness, comfort and safety of walking and on the other hand do not adequately consider the heterogeneity of the pedestrian population and multi-facetted walking activities, among which sojourning in public space. Edwards & Dulai (2018) for example notice that stairs, which are a significant walking impediment for older persons, are seldom included in walking measures. Walkability indices can be useful as an instrument for walking promotion, provided the selection of environmental variables on which the walkability index in question is based, matches target group characteristics.

4.4.2.4. An advanced W+S arrangements classification

In the recent Dutch manual on walking routes W+S criteria for arrangements are captured in a theoretical model on influences and (successive) choice moments regarding walking (CROW, 2019 - p16-Figure 2). The model sketches major factors affecting (potential) pedestrian's walking decisions, how intention to walk establishes, successive arguments (criteria) for not

walking, unpleasant and pleasant walking. The ideas are based on a Van Hagen model derived pedestrian needs pyramid.
In the model main factors affecting walking decisions are 1) individual factors (gender, age, education, physical mobility, preferences, experiences, knowledge, interests, expectations and mindset), 2) cultural background, 3) social factors, and 4) situational factors. The main factors on the one hand affect the intention to walk through attitude towards walking, subjective norm and perceived abilities, and on the other hand arguments used in successive walking choices.
The model highlights criteria for walking routes matching five successive choice moments: 1) feasibility of completing the intended walking trip, 2) accessibility of the route, 3) social and traffic safety of the route, 4) comfort of pavement and hindrances on the route, and 5) attractiveness (conviviality, tidiness and maintenance) of the route. Inadequacies regarding the first three criteria lead to *no walking*; lack of comfort or attractiveness leads to *unpleasant walking*; if all criteria are perceived to be met adequately, this leads to *pleasant walking*.

With regard to the development of general W+S policies the CROW theoretical model has its limitations. While this thesis aspires to cover all components of the W+S system (cf. this thesis' system models pictured in the Figures 3.5 and 3.8), the CROW model aims at measuring quality aspects of walking routes only. Although the list of main factors seems to be comprehensive (it is similar to Clifton & Livi's conceptual framework (Clifton & Livi, 2004)), it does not match this thesis' perspective. Furthermore, compared to the criteria discerned in the 5, 6 or 7 C's (cf. respectively LPAC, 1997; CROW, 2014; Cambra, 2012) the author misses the convenience criterion, and finds the conspicuousness criterion incompletely integrated.

Inspired on the challenging CROW (2019) model, an advanced conceptual model for the classification of W+S arrangements for the broader W+S systems perspective is developed, entering the above theoretical considerations. Similar to the CROW model the advanced conceptual model recapitulates influences on (potential) pedestrians' decisions, criteria with regard to W+S opportunities, consequences of inadequacies, but also classes of requirements (Basic, Convenience, Tempting). Walking and sojourning take place in the physical environment, but the social-normative and transportation environments, and information & communication also (pre-) condition walking and sojourning behaviour (see Figure 4.1). The idea is that walking and sojourning opportunities can be improved by targeting all of the components in a synergetic approach.

Central in the conceptual model are six requirements associated with the Transportation Consumer model (Van Hagen, 2006): 1) Reachability/feasibility, 2) Accessibility, 3) Safety, 4) Convenience, 5) Comfort, and 6) Attractiveness. The first three requirements are considered *basic requirements*; 'convenience' and 'comfort' are considered *convenience arrangements*, and 'attractiveness' is considered *tempting arrangements*.

It needs to be emphasized that for individuals the meaning of adequacy of particularly the basic criteria vary with (perceived) abilities, subjective norms and attitudes regarding walking and sojourning in public space. For example vital and healthy pedestrians can walk greater distances, have little problems with accessibility, and can cope with most dangers. In practise generally these people also have a wider range of choices between alternatives for walking. Assuming that the basic requirements are adequate, the choice to walk depends on convenience, comfort and attractiveness of walking conditions (in the widest sense).
Furthermore, objectively measurable there are different levels of accessibility and safety (it is not a dichotomous question). Consequently adequacy margins also vary for both the individual's abilities, norms and attitude reasons, and factual conditions. In practise there is a gradual

transition of the weights and consequences; in the model this is represented by a gradual change in colour.

A. Basic requirements: Reachability/feasibility, Accessibility, Safety.
Almost all trips begin or end with some walking. Without walking, transport is not possible. Being enabled to walk is a basic requirement for meeting general human needs such as societal participation. The most basic requirements are successively reachability/feasibility, accessibility and safety. These can be assumed to be particularly important for (potential) pedestrians who do not have an alternative for walking, i.e. captive pedestrians, especially those who have difficulties walking and need to restrict their walking to trips that cannot be avoided. This will apply to utilitarian walking only; for them recreational walking or walking for fun is not an option anyway.

'No walking' can mean that no trip at all is made, but also that the individual chooses to make the trip by other means (bicycle, car or public transport), or seeks alternative ways of satisfying his or her needs (e.g. physical exercise in a gym or through gardening, e-shopping instead of going to a physical shop, phoning friends instead of visiting them). In Figure 4.1. the decision of 'no walking' is rendered by the red colour in the right-side column and reddish colour in the Opportunities column.

A.1. Reachability / feasibility
The first decisive argument concerns (factual and perceived) *reachability and feasibility.* Reachability concerns the maximum distance that a person can cover under adequate accessibility and safety conditions. This is about true walking distance, not distance 'as the crow flies', and directness, perceived physical and mental exertion, and the person's endurance (impedance) to reach the destination. Such factors determine whether destinations in principle can be *reached.* Reachability / feasibility assessment takes place at the origin, and concerns assessment before starting the (walking) trip.

A.2. Accessibility
Even if the intended destination is considered to be within walking distance, lack of (perceived) *accessibility* can be an argument against choosing for walking. This may concern known difficulties on the way, such as steps, stairs, elevation, steep ramps etc. Accessibility concerns walkability in the strictest (operational) sense: feasibility of going on foot, eventually with help of walking aids or other forms of support (e.g. wheelchair, accompaniment, navigation aids); it also concerns 'readability' of the physical environment for orientation within public space, and finding and following a suitable route towards the intended destination.

A.3. Safety
If walking seems do-able accessibility-wise, the next critical argument is *safety*, in a broad way: absence of increased risks of injury, anxiety, stress and damages. As people generally do not have insight in factual risks, they subjectively assess safety risks (i.e. traffic safety, fall risks and accidents, personal and public safety, and security) by observing their walking environment and (subconsciously) recalling earlier experiences and warnings.

B. Convenience arrangements - Convenience, Comfort.
If the basic requirements are adequately met, there might still be annoyance and irritation because of 'little' functional inconveniences. These matters can make walking unpleasant, but do not necessarily lead to stop or avoid further walking. Amongst non-captive pedestrians it

can however grow to be an argument (a dislike) for not walking later on. In terms of the Van Hagen model (2006) these conditions concern dis-satisfiers. In this thesis measures to avoid or remedy such inconveniences are considered *convenience arrangements*, in the model represented by the colour yellow. Convenience arrangements take away irritations and can dissuade non-captive pedestrians who at least do not dislike walking to choose alternatives for walking. Theoretically two kinds of dis-convenience arrangements are discerned: arrangements that demand extra effort (detours from straight line walking, short steep slopes to combat, long waits before one can cross the street), and arrangements that cause (minor) discomforts, like having to wait on a noisy street corner, at a spot without seating or hand support, having to push a sun-heated crossing button. In practise the two can be difficult to differentiate.

B.1. Convenience
Convenience W+S arrangements are (structure) arrangements to correct for detected (small) irritations and annoyances and make walking easier: less effort, less annoyance and irritation while walking and sojourning in public space.

B.2. Comfort
Comfort W+S arrangements go beyond convenience arrangements and concern dedicated and operational measures to remedy detected (minor) discomforts and make walking more comfortable.

C. Tempting arrangements: Attractiveness
When basic and convenience requirements are adequately met, demand for walking and sojourning functionality is tended for. Tempting W+S arrangements offer extra's, like super-comfort[312] and/or a fun or pleasant surprise factor. The aim is to persuade even people who normally are not so much impelled to walk or sojourn in public space.

Because their effectivity is less predictable than curative arrangements, pro-active tempting W+S arrangements are more difficult to realise. The quality and attractiveness of such arrangements goes (far) beyond what (potential) pedestrians think of themselves. The attraction comes from functionality *plus* good looks *plus* the expectation of (very) pleasant experiences.

4.4.2.5. Application of the W+S arrangements classification

In the above paragraph this thesis' W+S opportunities classification is described in general terms. The scheme outlines that reachability, feasibility, accessibility and safety are most determinative for walking and sojourning in public space. Overall this may be true for disadvantaged and vulnerable (potential) pedestrians groups, but people who do not find themselves restricted in these regards, most of the times can take less-than-perfect preconditions for granted. For them utility or recreational value will matter most. In practise there are substantial differences in obviousness of opportunities, associated with needs or motives for walking and walking abilities. Based on above characterisations, the author concludes that with regard to need for W+S opportunities three key groups of pedestrians (extremes) stand out:

1. utilitarian walkers with (severely) limited abilities;
2. children;
3. recreational walkers and sojourners (walkers for the fun of it).

[312] For example free drinks on the way, a comfy chair to sit in when tired, oral explanation of the amenities, a cool spot when hot weather, medical assistance during an organized walking tour etc.

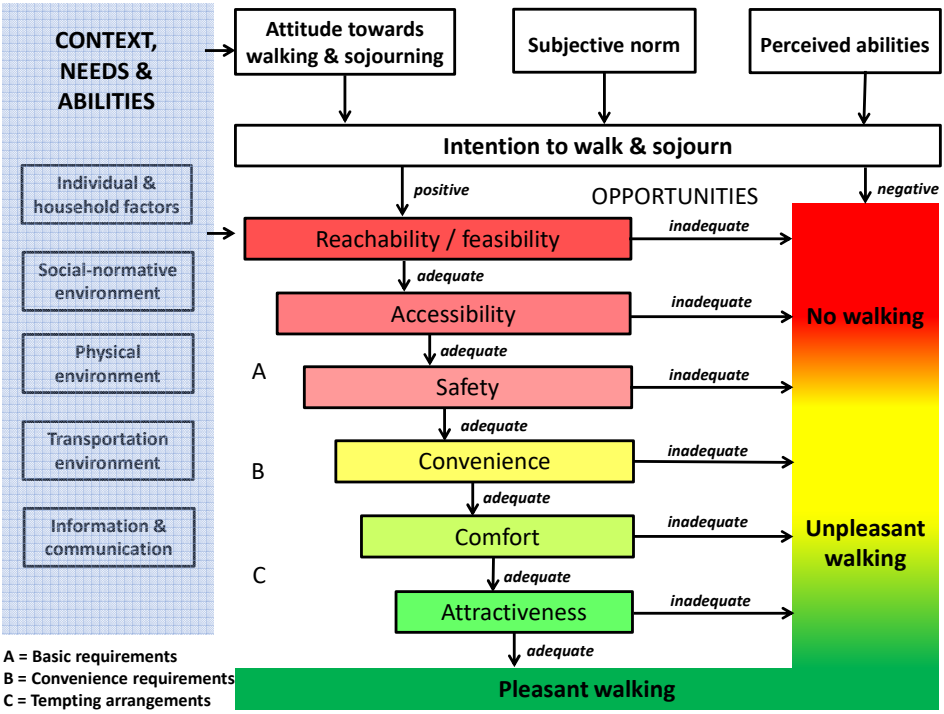

Figure 4.1. Conceptual model pedestrian W+S behaviour choices and outcomes (inspired by CROW, 2019 / Molster, 2020)

This thesis did not yet present clear norms regarding the six classes of opportunities. In the following sections scoping review is applied to substantiate the still abstract theoretical considerations with research evidence, experiences and guidance to support effective, efficient and fair W+S policy making.

4.4.3. General scoping review findings

4.4.3.1. Introduction

To find answers for the central question, the thereof derived sub-questions, and substantiation of the discerned classes of W+S opportunities, a stepwise documents study was carried out (see Section 4.2.3.). In this paragraph the main characteristics of the sample are successively described: criteria for selection and the size of the sample, variation in document aims, coverage of aspects and perspectives on offering W+S opportunities (i.e. user-stakeholder; objective-subjective-durability and future prospects; benefits), comprehensiveness of the documents; themes, system components, measure types; activity/planning level focus).

4.4.3.2. Selection criterions for documents regarding W+S requirements

From the dedicated W+S documents database 89 documents were selected and analysed. The criterions for selection were that 1) a document deals with pedestrian and walking and

sojourning in general, 2) covers a broad scope of relevant issues and 3) specifies what (kinds of) policy is required and/or recommended. Documents concerning specific pedestrian behaviours e.g. street crossing in suburban conditions at night, traffic safety measures on intersections etc., were put aside.

Variation in document aims
The sample of 88 documents includes 40 guidance documents, 18 explorative studies regarding walkability, 13 notes focussing on design/policy principles, nine documents on (general) best practises, five literature reviews, two (comprehensive) strategic plans, and one comprehensive university course on (bicycle and) pedestrian transportation.

Coverage of aspects of and perspectives on offering W+S opportunities
This scoping review aims to cover the full ranges of pedestrian activities, mobility and safety performances, their strengths/benefits, weaknesses/problems, threats as well as opportunities there are for improving W+S conditions. The batch of selected documents was analysed on coverage of perspectives (user or stakeholder interests, objective-subjective-durability and future prospects), impacts, comprehensiveness [themes, system components, measure types], and activity/planning level. The results are presented in the next paragraphs (see also Table 4.14).

User-stakeholder; objective-subjective-durability and future prospects; benefits
Most of the documents focussed on the 'general' stakeholders' perspective from an 'objective' utility perspective; attention to perception, durability and future prospects perspective appears to be scarce; only a few documents give insight in user (read: pedestrian) perspectives as starting point for improving W+S opportunities. Most of the documents (70%) pointed out impacts (benefits) of improving W+S opportunities.

Comprehensiveness of the documents
Only one of the documents completely covered all aspects which the author tested for: the broad report for the COST-C6 project (Town and infrastructure planning for safety and urban quality for pedestrians - Strategies for creating a walking-friendly city), by O. Gunnarsson (2001). Documents missing only two aspects are the 2012 OECD/ITF report 'Pedestrian Safety, Urban Space and Health' (missing attention to *ICT* and *Enforcement*), the 2013 report by the GOAL-group 'Transport needs for an ageing society - Action plan' (missing on *Circulation/sojourning* and *Enforcement*), and the 2015 BWVIT 'Master Plan Gehen' (missing on *Falls* and *Pedestrian characteristics / competences*). Other comprehensive publications that stood out because of their thoroughness were the FWHA 'University Course on Bicycle and Pedestrian Transportation' (Turner et al., 2006), 'Pedestrian network planning and facilities guide' (New Zealand Land Transport, 2009), 'Lopen Loont' (CROW, 2014), 'Walkable City Rules - 101 steps to making better places' (Speck, 2018), 'Pedestrian Facilities - Geometric design for safety and mobility - second edition'[313] (Schoon, 2019), and the Victoria Walks website[314].

Themes, system components, measure types
Although the sample is probably not fully representative for the total of policy literature on walking and sojourning in public space, it shows that almost all W+S policy documents in some way deal with pedestrian mobility, the pedestrian's physical environment or infrastructure, and

[313] Contrary to the limitative title, the book also covers legislation, driver and pedestrian characteristics, pedestrian flow, capacity and simulation models.
[314] http://www.victoriawalks.org.au/professionals/, accessed 10-6-2019.

planning and engineering aspects. Walking for transport, accessibility and traffic safety were more commonly dealt with than walking for recreation, circulation, sojourning, and security. It also appears that dealing with influencing pedestrian characteristics or competences, social-normative conditions, and transport system conditions was less common. Very few documents mention opportunities from information & communication technology.
Regarding general types of improvement measures, engineering gets attention most often; evaluation of conditions and measures, encouragement of (political) awareness of W+S needs, and the organisation of W+S improvements are also relatively often dealt with in the selected documents; opportunities coming from education, legislation and enforcement are dealt with less frequently.

Table 4.14 Coverage of subjects within the selected documents (N=89)

Perspectives	Checked for content regarding:	Dealt with by % of documents
Impacts	Benefits of walking and sojourning	63
Themes	Mobility - walking for transport	96
	Walking for recreation, circulation/sojourning	45
	Acccessibility	69
	Pedestrian traffic accident & risks	72
	Pedestrian falls & risks	16
	Security / public safety	38
	Health preconditions and/or consequences	29
System components	Pedestrian characteristics / competences	66
	Social-normative system, component	52
	Transport system	47
	Physical environment / infrastructure	99
	Information & communication technology	9
Measures	Engineering	93
	Education / learning	25
	(political) encouragement	46
	Legislation	29
	Enforcement	20
	Evaluation of conditions and measures	63
	Organisation W+S improvements	60

Activity/planning level focus
What furthermore stood out was that strategic guidance (i.e. land-use planning, legislation, [national or state] strategic policies), focussed on *increasing the volume* of walking, was most often health (physical activity) or sustainability motivated, whilst tactical and operational planning guidance, focussed on *solving operational problems*, was mostly transport (engineering) and traffic safety motivated, focussing on the network and street levels. In the latter traffic safety generally is a leading issue, and the guidance is directed at local government (county, city) and focussed on city or neighbourhood networks, or individual street section and intersection projects. The difference in focus can be explained by a difference in interests: health and sustainability profit from a shift to more walking, or keeping people walking enough now and in the future, whilst the magnitude of operational problems strongly relates to exposure: with more people walking the total volume (and urgency) of incidents and accidents increase; less pedestrians means less operational problems and less reason to take action.

4.4.4. The genesis of W+S opportunities

4.4.4.1. Introduction

In the preceding section general results of this thesis' scoping review into exemplary W+S arrangements were dealt with. In the current subsection the context of preparing and delivering arrangements for W+S opportunities is illuminated. The central question in this subsection is:

What factors frame the genesis of W+S opportunities?

Like W+S needs and abilities, W+S opportunities do not come about in a vacuum. Opportunities are shaped by providers who somehow have a stake in or duty to pedestrians, walking and sojourning in public space. What arrangements stakeholders offer depends on what they are willing and able to allow for towards pedestrians. This in turn depends on formal and informal tasks and authorities, interests, counter-interest, but also beliefs. This willingness is subject to knowledge and point of view, in particular actuality, i.e. the status quo impacts on the stakeholders position and activities, feedback from persons and institutions that matter, reward or punishment. The sum of benefits and their future prospects (if at all considered) should outweigh the sum of financial, positional and emotional costs. 'What's in it for me' can be expected to be a dominant factor.

This subsection successively presents scoping review findings with regard to general developments regarding demand for walking opportunities, the general utility of walking and sojourning in public space, institutional obligations regarding walking and sojourning in public space, the pedestrian experience, major future developments affecting W+S opportunities, and finally conclusions about what factors frame the genesis of W+S opportunities. In the then following subsections, with this knowledge in mind, exemplary system arrangements for walking and sojourning in public space are researched, to determine what kinds of W+S arrangements can be expected to enable and/or motivate people to walk and enjoy W+S.

4.4.4.2. General developments regarding demand for W+S opportunities

This paragraph is about why and how the demand for W+S opportunities evolved over time. It summarises findings from a scoping review on the subject. It offers a general picture of changes with regard to the position of walking and sojourning.

Amato (2006) concluded that, in the course or time, walking evolved from being virtually the only option for travel and transportation, to, for most people, becoming a choice. Amato also found that likewise developments took place regarding recreation in public space. While formerly necessary for recreation, nowadays there is an abundance of alternatives for recreation in public space: watching movies at home and on the phone, theatres or festivals, meet friends in bars, playing computer games at home etc. There are now many alternatives for walking for transport: the bicycle, the car, public transport, etc. Another development affecting the volume of walking and sojourning in public space is the trend towards smaller families (particularly one-child families and singles) (Kuitert & Maas, 2017; Statline, 2018). Many children cannot find play mates nearby; because of thinning out of neighbourhoods people have to put more effort in socialising than decades ago (Childstreet, 2006). Increasingly parents fear for the safety of their children and transport them by car (Childstreet, 2006; Vermeulen, 1998-2).

Contrary to the old days, physical activity, needed for keeping in shape, does no longer follow from normal life, activities and work. Much physical activity has been taken over by mechanisation. Mankind did not evolve that fast and is not yet adapted to this new kind of life. The decreasing physical activity is a major risk factor for poor health (Baum, 2016; Guthold, 2018). Nowadays keeping fit means planned physical exercise.

These changes consolidated in policy making, utility, form, perception, social and design norms regarding walking and sojourning facilities. Public space and society are no longer set up for walking but for (motorised) transportation mainly, causing urban sprawl. For example commercial developments scaled up their branches and neighbourhoods were cleaned up from nearby small establishments (Speck, 2006). Many destinations that matter can no longer be found within walking distance. In the Netherlands the bicycle, and lately the electric bicycle, for mid-range distances (2.5 - 7.5 kilometres) are a strong alternative for walking; on longer distances the car wins. In general people became car-dependent (Jeekel, 2011). Sidewalks become less walkable because of parked cars and bicycles, garbage containers, sign posts, charging stations and the like. Walking has decreased, pedestrians became less dominant and conspicuous in public space, affecting their self-awareness and bargaining power, to become 'second rate traffic participants' (Risser, 2002; Hydén et al., 1998).

Side effect of less walking and sojourning in public space is movement poverty and vast increase in number of overweight and obese persons, corroding public health (e.g. CROW, 2014; Turner, 2006). The current population spends large amounts of money on mobility; without wheeled transportation it has become difficult to participate in social life. Being able to walk is no longer sufficient for socialising (Jeekel, 2011; Amato, 2006). The average time that children play outdoors has decreased substantially, which has negative consequences for their growing up and their health (Kantar Public/Jantje Beton, 2018; CROW, 2014).

4.4.4.3. General utility of walking and sojourning in public space

The majority of selected overview and/or guidance documents on walking and sojourning arrangements (56 out of 89 documents) point out general benefits (strengths) of providing for pedestrians. The *Masterplan Gehen*[315] (BMVIT, 2015) goes a step further by also listing weaknesses, opportunities and threats for Austrian conditions. This thesis' Section 1.4. already presented an anthology of benefits of walking regarding transportation, spatial strongpoints, accessibility, safety, the economy, health, the environment, quality of life, social benefits and community goals, and tourism and recreation. Below some contra-indications or weaknesses are indicated; BMVIT-mentioned opportunities and threats regarding walking and sojourning in public space are brought up below in b-Subsection 4.4.4.6. Major future developments affecting W+S opportunities.

Contra-indication or weaknesses of walking and sojourning in public space

Assuming that the selection of overview and guidance documents is representative for all such documents, it is remarkable that only one of the documents, the Austrian Masterplan Gehen (BMVIT, 2015), goes into weaknesses of walking and sojourning in public space and/or (political) contra-indications regarding providing more and better W+S arrangements. According to BMVIT these weaknesses are (BMVIT, 2015 - p23 - citation translated from German):

[315] English: (national) Masterplan Walking

- *"The need for segregation and increasing the distances between areas of activity reduces the possibilities to walk;*
- *Walking is the slowest of all possible means of transport;*
- *Pedestrians are not able to transport large quantities and weights of goods;*
- *Walking is very sensitive to weather conditions;*
- *Walking is not given sufficient consideration in the daily local planning decision-making (including public transport infrastructure and node planning);*
- *In mobility surveys, walking is usually considered as part of a journey (see stepping-stone concept);*
- *Walking is characterized by a high risk of injury in the event of an accident due to a missing crumple zone;*
- *A large part of walking accident figures are 'in the dark' (falls, recreational accidents);*
- *In modal split, walking has a longtime decreasing share;*
- *Other traffic participants (in particular motor traffic, but also bicycle traffic and public transport) have not treated pedestrians with the necessary respect."*

Other contra-indicative developments found in the selected documents are:

- Mobility surveys and statistics (e.g. CBS Statline) show that, for transportation, in the majority of trips people did not choose for walking as a travel mode, but for less strenuous (wheeled) modes (Methorst et al., 2010; goes to relevance);
- According to Amato (2006) society is no longer arranged for walking, and re-adaption will take many changes and will be quite expensive (goes to feasibility);
- The general (policy) focus on innovation and progress mismatches with the 'old school' mode of walking, which apparently lacks the *grandeur* and appeal of progress defined by technology. From mobility surveys and policy statements it appears that walking does not appeal much to the young (who the media and most politicians consider 'the future' and prime reference standard; cf. 'induced demand', Speck, 2018), but mainly to a more elderly population (who many politicians [secretly] consider as less important for progress, old-fashioned and perhaps even out of date, and disproportionately expensive) (goes to desirability);
- Common (adult) walking for transport is often associated with 'negative' attributes like vulnerability, risk, weakness, impairments, slowness, time in-efficiency (goes to desirability). Stakeholders are more sensitive and interested in 'doing nice things' to pamper pedestrians[316], than clearing up a mess (cf. Bax, 2011);
- Increasing individualism can be expected to be associated with increased preference for modes of transport in which one does not have to meet other people (so mainly the private car, which offers separated space).

The above weaknesses of walking and contra-indications can be expected to be powerful deterrents for arranging for better W+S conditions and need to be dealt with before proposals for the improvement of W+S conditions are submitted for realisation.

[316] Examples are the Rotterdam City Lounge concept (Gemeente Rotterdam, 2007), the popularity of the Placemaking concept and the many adherents of Gehl Architects (cf. https://gehlpeople.com/), which are focussed on attracting (profitable) recreational walkers and sojourners.

4.4.4.4. Institutional obligations regarding walking and sojourning in public space

Walking and sojourning takes place in public space, which is owned by public authorities (governmental agencies and delegated services). Legally only the owner/manager can initiate or make changes and can regulate its use. In this respect ownership and taking care of the pedestrian and his/her needs is a legal and moral responsibility[317].

This responsibility goes beyond designing, building and keeping up the built environment, infrastructure and greenery. It also concerns regulation of access, use, potential conflicts and (traffic, personal [falls] and public) safety and security, for all of its users, both for transport, and recreation and other sojourning purposes. This implies setting behavioural rules and norms, organising enforcement of these rules and norms, organising, guiding and coordinating transportation and traffic, communication and information, and environmental conditions, such as water and air quality (micro dust, NOx, CO2, toxins)(see also Chapter 6).

An important responsibility with regard to walking and sojourning is knowing what problems pedestrians experience with regard to their ease of mobility, accessibility, conflicts and safety, convenience, comfort, health, and (lack of) pleasure (cf. the six levels of opportunities), and monitoring developments in this regard (see also next paragraph).

In Chapter 6 on the status quo of the institutional framework authorities and responsibilities are dealt with in more detail.

4.4.4.5. The pedestrian experience

This paragraph deals with pedestrian experiences. A comprehensive overview on pedestrian experiences literature is published by New Zealand Land Transport (2018, p1), aiming to answer "*...why or why not people walk, what encourages walking and what hinders it, and importantly what research gaps need to be filled to answer these questions."* They found that *"Pedestrian experience is not easily captured as it is shaped by who is walking, why they are walking, where they walk, and their attitudes and beliefs etc. While there are consistencies in the literature in terms of what encourages and discourages walking from the individual perspective, there is also an underrepresentation of the full extent of human diversity in much of what is available, it is important this gap is remedied. There are also inconsistencies across literature in what is measured, and there is almost no literature on rural pedestrians [...] there is disparity between the many available design guidelines [...] and the real world physical barriers still faced by pedestrians."*.

All of the analysed documents mention (or implicitly refer to) multiple pedestrian, walking and sojourning issues, and most of them provide guidance for solving such issues. In the documents issues (read: problems[318]) are defined by the perspectives taken by the authors of the documents, how they demarcate the domain and the stakeholders' duties, interests and competences. The demarcations are generally stipulated by commonly accepted definitions and understandings so that the analyses do not address issues outside the scope of these definitions. Examples of pedestrian topics that fall outside commonly used definitions are sojourning in public space (apart from recreational walking and city centres walking and sojourning), falls, W+S risks of professional walkers and tourists, traumatic experiences, hindrance of social contacts. These are often filtered out and disregarded. In this thesis' Section 1.5.2 comprehensive lists of

[317] In the Netherlands occasionally local governments encourage citizens and businesses to take over responsibility for keeping up public space.
[318] A problem is only a problem if it is *perceived* as a problem.

pedestrian problems delivered by Gunnarsson [1995, 2001], Risser [2002], OECD/ITF [2013] and most recently by Schoon [2018] are summarised.

Why choose to walk?

Importantly, Speck (2012, 2018, p13) remarks that "*people will not walk unless it serves a purpose*". If a (potential) pedestrian feels that a trip needs a purpose, captive pedestrians go walking simply because they somehow feel they have to and that they do not have a choice. Following Van Hagen (2006), non-captive pedestrians, the ones who do have a choice, only go on foot if they need to go somewhere while preconditions for walking are favourable relative to other choices, i.e. deterrents are not paramount and/or it is somehow an attractive thing to do. Preconditions such as weather conditions, public space and aesthetics are considered of special interest (Kaufmann et al., 2010). Vukmirović (2010) discerns two kinds of arguments in the choice to walk: spatial and person dependent. With regard to spatial factors the needs of pedestrians can be broken into the 5, 6 or 7 C's (LPAC, 1996; CROW, 2014; Cambra, 2012). Person dependent arguments concern walking distances, motives, attitudes, perceptions and suitability of walking (or availability of alternatives) (Vukmirović, 2010).

With regard to walking for transport (utilitarian walking) most overview and guidance documents do not explicitly refer to the pedestrians' perceptions, preferences and dislikes[319]. This may be due to the habitual nature and inevitability of walking for transport. However, for recreational walking these perspectives are decisive, as recreational decisions are taken more consciously and thus are less based on habits and inevitability. Such decisions are particularly influenced by positive aspects (attractive, safe, interesting), weather, aesthetics, accessibility, location, not hilly (NZ Land Transport, 2018). Speck (2012, 2018) adds that street life is an attraction factor, that there are many physical and social rewards for walking in the city and that '*the main reason to spend time in a city is to live the life of a citizen' (Speck, 2012:8).*

According to Risser & Ausserer (2010) the preparedness to walk (for transport) can be enhanced by offering incentives (e.g. Public Transport tickets, bonus points), financial benefits (e.g. allowances, tax reduction) and non-financial benefits (e.g. dress code, hours off), and stressing the importance of financial (e.g. time is money) and non-financial (e.g. loss of prestige) impacts.

Where choose to walk?

Mobility surveys strongly suggest that most door-to-door walking trips either start and/or end at home. Walking also is the key to inter-modality (e.g. New Zealand Land Transport, 2018; Schoon, 2019; Turner, 2006). Pedestrians require continuity of the network, including the ones of connecting modes (car, Public Transport). The most important factor is walking distance. Other relevant quality factors are physical access: accessibility, safety and security, convenience, comfort and attractiveness. Additionally there are 'soft' factors: trip purpose, personal fitness and moods. There are trade-offs between distance, quality and ‘soft’ factors (Monterde-i-Bort & Methorst, 2010).

Barriers to walking

Based on their literature review New Zealand Land Transport (2018) concludes that commonly cited barriers to walking are: poor design, lack of comfort, safety, attitudinal and social barriers, and barriers to walking to school. These factors will be substantiated in the following subsections on basic and convenience requirements.

[319] Specifically no explicit reference to 'the costumer is king' was found with regard to walking for transport.

4.4.4.6. Major future developments affecting W+S opportunities

This paragraph on expected future developments affecting W+S opportunities touches on the dimension of durability and future prospects. Attention for this dimension is important because on the one hand current measures can be expected to have lasting impacts on future conditions, and on the other hand because expectations with regard to future conditions can be drivers for developing change policies. Four of the selected documents explicitly take up the subject of future developments. Their conclusions are included below.

In 2006 the author presented a tentative prognoses of the future of everyday walking by systematically looking at trends with regard to the pedestrians social context, the transport system, the physical environment and pedestrian characteristics (cf. Pizza Model). The author concluded:

- *The importance of everyday door-to-door walking will decrease, mainly because the number of destinations that matter within walking distance will drop. This will partly be compensated by multi-modal walking. Thus the amount of time spent as a pedestrian will probably not decrease much.*
- *For the majority of the population a diminishing quality of pedestrians facilities is not an important issue, since they do not really need high quality facilities and they have ample alternatives. On the other hand, walking will become more difficult and more risky for a growing part of the population: people with limited mobility, and those who cannot fall back on car use. Their quality of life is at stake.*
- *Awareness of the [the importance of the] problem is crucial. Politicians and policy makers do not get a fair representation of [it] [...]. The growing importance of multi-modal walking, circulation and sojourning in public space is invisible; foreseeable problems and the (evident) benefits of walking are not systematically documented. Therefore politicians and policymakers can have no idea that there may be an upcoming pedestrian problem; as yet there is no compelling reason to do something about it."* (citation of Methorst, 2006:1)

In their book 'Prettige plekken' (English: 'Pleasant Places') Kuitert & Maas (2017) summarise important trends and themes affecting the role and meaning of public spaces for pedestrians. In this regard they highlight a number of general trends:

- More regard to compactness of cities, enabling sustainability, active transport, use of public transport and attractive and lively cities;
- More competition between cities for attracting businesses, employment and citizens, tourism, conferences etc.;
- Increasing application of flexible working: people can work on-line almost everywhere and at any time, and combine this with recreation and socialising. This means that public space will be used more intensively;
- More focus on sustainability: air quality is increasingly problematic (NOx and micro particles cause illnesses; greenery can be a solution), oil and gas cause climate change, which can be lessened by energy neutral transport and living;
- An increasing share of the population suffers from lifestyle diseases and obesity: active transport can help controlling deterioration;
- Household delusion: families are no longer the standard; singles go outdoors more often;
- Increase social dichotomy: there is a growing gap between the highly educated and the lower educated (polarisation). The latter have less opportunities to change their lifestyle,

have poorer health, less money, and are more dependent on the adequacy of public space for utilitarian, recreational walking and sojourning;

- Technological developments: the term *smart city* is often mentioned. In such cities computers, networks , techniques and applications are applied for traffic, transport, energy, participation, waste disposal and many more uses. Such conditions stimulate other uses of public space (sojourning!).

Another important development, not mentioned by Kuitert & Mass, is the continuing remediation of commercial services and shift towards e-shopping (and home delivery) and digital services (Morgen, 2016). In many cases digital services replace or at least lowers the need for trips to physical shops, banks and other (public) services. For these services reachability and accessibility (have) become less relevant and crucial.

Furthermore, with regard to institutional manoeuvring space Methorst (2011) concluded that ageing of the population implicates that governments will lose resolving power and influence because they have to do more (the elderly need better facilities) while their budgets will be lower (there are less people who have to pay taxes). Consequently there will be more competition for a lower public money budget. This could mean that there is less room for 'new' W+S arrangements.

4.4.4.7. Conclusions

In this subsection preconditions regarding the genesis of W+S opportunities are explored. From the findings it became clear that it concerns a complex frame, where pedestrians are dependent on the goodwill and policy space of providers. Other conclusions are:

- Over time total demand and bargaining power of pedestrians has decreased, while the needs of some groups have substantially increased;
- The demand for W+S opportunities is very heterogeneous. On the one extremity there are the ones who need opportunities that strictly match their limited abilities, on the other extremity there are the healthy and fit adults who can walk almost everywhere and perhaps want to 'climb the Kilimanjaro'. Children are a special group: because of their immaturity they need both safe environments (protection), and inviting and exciting opportunities to play;
- Society, and particularly public space is no longer set up for walking, but for motorised traffic. Especially less able captive pedestrians suffer in this regard; for non-captives it 'only' means a that there is a limited range of suitable W+S opportunities;
- There are many reasons why stakeholders should facilitate pedestrians, and improve walking and sojourning. Many of the stakeholders however do not fully realise what they can gain by upgrading their W+S arrangements policies or what they miss out on when they do not. Benefits may concern amongst others accessibility, community goals, economy, the environment, public health, social benefits, spatial challenges, transport, tourism and recreation.
- There are also some counter-indications regarding providing for pedestrians, such as a political need for spatial segregation, slowness of walking, inability to transport heavy or bulky goods, weather sensitivity, neglects of walking, biased statistical figures and definitions and a decreasing modal share (see Chapter 5);
- There are a number of future developments affecting walking and sojourning, preconditions for W+S arrangements and their impacts; some travel reasons will be substituted by

alternatives, particularly e-services and home delivery. This can make room for more recreational walking, provided that W+S arrangements are adequate and inviting;

- A crucial precondition for improving W+S conditions is that stakeholders are aware of the volume of demand and qualities required for W+S arrangements, i.e. the motives, needs, abilities, risks of the (potential) pedestrians. Insights in pedestrian experiences are needed to give direction to policy development and implementation regarding W+S arrangements;
- It is to be expected that the number of and share of people who experience (serious) difficulties walking and/or sojourning in public space will increase.

4.4.5. Towards advanced requirements for W+S opportunities

4.4.5.1. Introduction

After having broadly pictured what general conditions for the genesis of W+S opportunities are and how insights regarding required W+S arrangements can be ordered, this section sketches scoping results with regard to the question:

- What kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

To answer this question the selected overview and guidance documents were analysed on research results, insights, and recommendations with regard to the six kinds of W+S opportunities that were discerned in Subsection 4.4.2. (cf. Figure 4.1.): reachability/feasibility, accessibility, safety, convenience, comfort, and attractiveness.

In Subsection 4.4.4.7. the author concluded that there are three key pedestrian groups which have very different requirements profiles: persons with limited abilities (elderly), fit and healthy adults, and children. The analysis of the documents also took up this aspect.

Another aspect that was looked for was indications, recommendations or suggestions on urgency or priority of meeting the mentioned requirements, i.e. what quality levels, e.g. levels of service or perfection, should be reached to achieve intended impacts with regard to wealth and well-being of individuals, communities and/or the nation. Where available requirement quality levels like excellent, good, reasonable, mediocre, bad/not acceptable are suggested.

In the following three Subsections 4.4.6., 4.4.7. and 4.4.8. the three Van Hagen based quality levels of W+S arrangements, based on the scoping research regarding the 6 kinds of W+S opportunities, as well as the ability related requirements presented in Subsection 4.3.4, are proposed. The subsections include paragraphs on general scoping results, (key) issues to be dealt with, and on the five W+S system components, abstraction/activity levels, and criterions and impacts regarding the key target pedestrian groups of persons with limited abilities, super-fit, and children. Section 4.4. is completed with Subsection 4.4.8. Conclusions.

In each of the paragraphs the subjects are discussed on the basis of the six 6 topical questions: what is it about, who is it about, why do issues occur, where do they occur, when do they occur, and how can issues be remedied (= requirements); furthermore in each of the paragraphs an indication is given of W+S policy relevance.

As mentioned before, needs and abilities of the various pedestrian groups, and even within those groups, are heterogeneous. Consequently, in concrete situations, the provider needs to know how the users population is put together and what key needs and limitative abilities characteristics of the actual user groups are (cf. context sensitive solutions (ITE, 2006)). Furthermore, in most cases (much) more research is needed to draw sharp lines regarding the required W+S arrangements. This (explorative) thesis is therefore restricted to qualitative indications of W+S requirements. The below indications are meant to serve discussions on standards regarding W+S policy making in the professional domain. To further substantiate and direct the discussion on W+S policy making, Chapter 5 presents available statistical data on the status quo of walking and sojourning arrangements and the pedestrian's behaviour.

4.4.5.2. Considerations regarding requirements for W+S arrangements

The leading considerations for the development of requirement specifications for W+S arrangements follow from this thesis' objective and central research question (see Section 1.2). The thesis' objective is to provide building stones for a system approach to walkability policy development and implementation; the choice of measures should be generative, whereby the proposed policies should be effective, efficient and just (equity) (Rue de l'Avenir/Wiedmer-Dozio, 2004; Van Wee, 2011). The intention is to reveal what is possible and desirable at various urgency or Level Of Service levels, and inspire and guide change (Cf. Global Designing Cites/GDCI, 2016) concerning improvements regarding all activities of a pedestrian: door-to-door walking, walking to and from other modes, circulation, and sojourning in public space. As such walking is multi-dimensional; the dimensions cannot and should not be separated from each other; main mode mobility is just one facet[320].

Effectiveness of interventions implies that development starts with the identification of *problems* and its *causal* factors. These *objectives*[321] need to be formulated. The next step is to develop *solutions* for the problems that match the objectives and remedy the causes of the problem. Thereafter, the solutions have to be properly put into action and should be evaluated, to inspire and support future policy developers (ROG, 2002; Methorst, 2000[322]). Clearly, in this thesis the latter stage is only an option in so far such evaluations already have taken place; the proposals presented below are evidence based as much as possible, but as a whole the proposals are not yet evaluated. With regard to effectiveness RAUHALA ET AL. (2003) acknowledges that walking is difficult to predict, walking concerns shorter trips, and all walking and sojourning in public space conditions need to be improved consistently. Another aspect of effective solutions is that such solutions balance out functionality, perception, and durability and future prospects.

Effective solutions should be implemented *efficiently*. According to the Cascade of interventions principle (Hendriks et al., 1998; Methorst, 2000; see also Appendix 9, Figure IX-10) this implicates that only effective solutions are implemented, and that the measures are integrated in a larger framework of interventions, starting from a rigid fundament of policy

[320] Sojourning is unfairly often seen as 'no mobility'. It stands to reason to include it in policy making because 1. government is policy responsible for all behaviour in public space, and 2. it is similar to parking of a car or bicycle: it would be unthinkable to cut that lose from mobility policy; it is by the public generally perceived as integral part of mobility; sojourning is an integral part of mobility, too.

[321] The author realises that setting objectives is a political task, and not a researchers task. In this thesis objectives with regard to walking and sojourning are justified by contemporary legislation and common political points of view on wealth and well-being of the population.

[322] In Dutch this intervention approach is called PODOE-approach: acronym for Probleem-Oorzaak-Doelstelling-Oplossing-Evaluatie; in English the name would be PCOSE)

preconditions, followed up successively by strategic and existential level interventions (focussed on travel preconditions), tactical level interventions (focussed on latent problem causes), and finally operational level interventions (focussed on traffic and sojourning behaviour). An integral approach should also be comprehensive, not only matching intervention levels, but also promoting cohesion between interventions regarding the W+S system components, i.e. user groups, physical environment, social-normative environment, transportation, and information and communication, and involves engineering, enforcement, education, empowerment, and organisation (Cf. Figure 3.8. Pizza-model).

In this thesis the *justice or equity* consideration concerns a balance of power, interests and cultural interpretation. Equity means that all road and public space users should be treated as equals. "*The right to walk is a fundamental element in a considerable body of public policies. Although its contribution to the wider transport network is often underestimated, the importance of walking should not be ignored. [...] Under common law everyone has the right to travel unimpeded along all public roads, except where legal restrictions have been imposed (such as prohibiting pedestrians from motorways)."* (New Zealand Land Transport, 2009:11). This way equity infers that collective, common and universal interests prevail over provider's or individual politician's or political party's interests. Leading interest is Quality of Life, and improved and sustainable wealth and well-being of individuals, communities and the nation (cf. sustainability trinity: People Planet Prosperity).
Over the years the car became more and more normative in transport and public space policy and use (Verkade & Te Brömmelstroet, 2020; Methorst et al., 2010; Filarski, 2004; Knoflacher, 1995; Hydén et al., 1998); lately in the Netherlands the bicycle caught up; in most cases space, facilities and right-of-way for both car and bicycle use were provided at the expense of pedestrian space (De Bruijne, 2016). In order to re-instate a just balance reverse design of policies is justified. The (potential) pedestrian's interests, needs and abilities are starting point for developing policies and (re)shaping the W+S system (GDCI, 2016; CROW, 2012; Molenaar, 2009). In connection with this experts proposed to change the sequence in design approaches into: *pedestrians, cyclists and transit riders, people doing business and providing city services, people in motorised vehicles* (e.g. GDCI, 2016:54; CROW, 2012, Linssen, 2009), meaning a shift *from the typical point of view of automobile movement and safety to include access, safety and mobility for all users, environmental quality, economic benefit, enhancement of place, public health and overall quality of life (GDCI, 2016:XVII)*. Furthermore, based on international consensus and ratified legislation (UN Convention on the Rights of Persons with Disabilities, 2006), the Design for All principle is leading[323]. Mobility and safety are universal rights; similar injuries of different road (and public space) users should be treated and prioritised equally.

4.4.6. Requirements for basic W+S opportunities

4.4.6.1. Introduction

This subsection concerns basic requirements[324] regarding W+S conditions that need to be met to enable people to walk and sojourn in public space, regardless of their ability limitations. The basic requirements focus on the needs of captive and disadvantaged pedestrians regarding utilitarian walking (walking for transport); the interests of those who have a choice are assumed

[323] Kuitert & Maas, 2018 describe Design for All as the design principle that starts from the idea that the environment is such that 95% of the population can function there without problems.
[324] as defined above in paragraph 4.4.2.3 and Figure 4.1.

to be served if basic requirements have been met. Thus the aim of this subsection is to lay down broadly what kinds of W+S arrangements are required to offer basic W+S opportunities to the vast majority of potential (utilitarian) walkers and sojourners in public space. The scope is limited to *functional* system and system component requirements (i.e. why what should be arranged). Indications will be given of what this means for design specifications (form). Detailed design requirements can be found in dedicated guides, and whenever possible reference will be made to (relatively) recent publications in this regard. As this subsection concerns basic system requirements, reference will be made to minimum level of services in functional terms with regard to the identified three key pedestrian target groups: people with walking impairments, children, and the fit and healthy ones.

It needs to be noted that captive and disadvantaged pedestrians also are a heterogeneous group; it concerns people who have no alternative for door-to-door walking (main mode walking) as well as those who do not have an alternative for walking to and from other modes (sub-mode walking); the walking population varies with local, demographic and functional conditions, lifestyles and preferences. Consequently the factual basic requirements regarding reachability, accessibility and safety are context sensitive, can vary somewhat within certain margins, and cannot be cast in concrete. Therefore any W+S policy project should start with taking stock of the actual (potential[325]) walking population and their needs and ability characteristics. W+S arrangements should then match the requirements of the most needy group of (potential) pedestrians.

In the following paragraphs first general scoping results for basic W+S arrangements and next pointed results concerning requirements for basis W+S arrangements are presented with regard to reachability/feasibility, accessibility, and safety. The texts follow the general scheme of answering the six topical questions and indicating W+S policy relevance, particularly consequences of non-compliance and what the aggrieved risk groups are. In the deliberations the findings with regard to needs and abilities related system requirements, presented in Section 4.3., are assimilated.

4.4.6.2. Some general considerations

With regard to issuing requirements for basic W+S arrangements important general considerations were found in the selected documents regarding the lifecycle of design principles, a cascade of interventions, variety in weights for urgency, equity as a selling point, not to restrict to physical environment measures only, and the necessity of broad support (domains) of W+S requirement standards.

Schoon (2019) considered that *design principles* are developed over many years or even decades. Unplanned developments and growth in traffic often dictated predominant town planning, network and street features and dimensions. There is considerable delay in adaption to new realities with regard to matching changed walking and sojourning needs, and distribution of (potential) pedestrian groups. This is not only true for physical pedestrian facilities, but for the W+S system as a whole, and the functionality of definitions and linked research and policy making (Methorst et al., 2017a).

As stated above, this thesis adheres the *Cascade of interventions* principle. Apart from the 'Handleiding Looproutes' (English: 'Instruction manual walking routes', CROW, 2019) none of

[325] This means that insights must be gained about people who want or need to walk, but are somehow restrained from doing so.

the selected documents reasons in terms of a cascade of requirement themes as presented in Figure 4.1. This thesis does not share the point of view taken in most of the documents, that reachability/feasibility, accessibility and safety are taken as aspects that together affect the choice of to walk or not to walk, while premonition and foreknowledge about inaccessibility, dangers or great risks can make walking trips impossible (CROW, 2019).

With regard to the decision whether or not to walk the *weights* of the (objective) accessibility and safety requirement vary with the urgency and the degree to which the trip can be avoided, the (potential) pedestrian's ability to assess the risks, and how well s/he is physically, mentally and emotionally able to cope with dangers. Consequently, for some people dangerous conditions are factually restricting their mobility, but for others they 'only' cause anxiety and irritation, which in future cases might lead to more strict walking choices.

Speck (2018:8) introduces *equity* as an important selling point for (basic) walkability: walkability gives elderly a new release on life; gives children independence; serves the poor and minorities; public transport disproportionally serves the poor and minorities; walkability disproportionally well helps the differently abled.

Although there is great variation in perspectives taken in the selected guidance and overview documents, and many toolboxes are introduced and substantiated, it stands out that by far the most interest, attention, research and detailed suggestions concern the *physical environment*. It seems like the other system components (equipment of the pedestrians, the social-normative environment, transportation and information & communication) are relatively unexplored. The question rises to what degree non-physical environmental approaches can contribute to supporting and promoting walking and sojourning in public space.

Walsh (2012:54) discerned five interconnected *domains* of public policies for implementing walkability requirements, and evaluated the effectivity:

1. Public right-of-way engineering and geometric design guide lines: effective when compulsory, often subject to scrutiny and discretionary authority of agencies at county, state, federal level;
2. Architectural and urban design guide lines: effective if mandatory and when lead agency requires incorporation of guidelines;
3. Planning and land development regulations: effective when local community expressed substantial support, but some lead agencies had considerable outreach;
4. Financing mechanisms: many examples of successful funding, many benefit from creative implementation;
5. Operations, maintenance and enforcement measures: successful if ample community outreach and if collaboration between relevant agencies is realised, including engineering and police.

From the bulk of selected documents a number of conclusions from other domains of public policies affecting walking and sojourning in public space can be drawn:

1. General legislation on behaviour in traffic and public space: effective if supported by practitioners, communication, information, empowerment and enforcement (e.g. Schoon, 2019; Litman et al., 2008; Turner et al., 2006; Schwartz);
2. Information, communication and education: effective if evidence based and touching on emotions (e.g. Roughton et al., 2012; Litman et al., 2008; Turner et al., 2006; Risser, 2002);

3. Enforcement policies and practice: effective if generally accepted and behaviour in public space by and towards pedestrians is adequately monitored (Roughton et al., 2012; Litman et al., 2008);
4. Co-ordination, integration and monitoring: effective if (fully) accepted by policy participants (e.g. Roughton et al., 2012; Turner et al., 2006).

4.4.6.3. Requirements for reachability/feasibility

a. What general issues should set the stage for basic W+S reachability arrangements?

Reachability and feasibility of destinations that matter relate to how far a person is able, allowed and/or willing to walk, i.e. one's action radius, with or without aids, and assuming that route accessibility and safety are adequate. Reachability and feasibility of reaching the destination that matters is the most powerful argument to go about walking or not.

Reachability is about factual maximum walking distance, and not measured in terms of 'as the crow flies'. With regard to *walking distance* among others CROW (2012) and Olszewski (2007) indicate that on average 1,000 meters can be considered an acceptable walking distance. Schoon (2019) indicates that in general walking distances up to 800 meter (0.5 mile) are preferred. OTAK (1997) finds that walking distances up to 400 meters are acceptable, but that site designers should use 90 meters as standard; distances between street crossings should not be more than 120 - 180 meters; for Public Transport stops and Park & Ride sites the norm should be maximum 300 meters, for mobility impaired 230 meters, and for commuter train stations maximum 535 meters.

According to Olszewski (2007) between 1975/76 and 1994/96 acceptable walking distances for trips to work, education and shopping trips decreased by about 10%. The average acceptable distance for all walking trips also dropped by about 4% to 0.96 kilometre (UK, 1994/96). As acceptable walking distances apparently change over time, standards should be matched to actual acceptable walking distances associated with walking motives, ability and area characteristics.

b. Which groups of (potential) pedestrians are normative?

As mentioned before, pedestrians are a heterogeneous population, and for different groups different requirements apply (e.g. (Schoon, 2018; Vukmirović, 2010; CROW, 2019). Age has a direct bearing on walking behaviour. Children are the largest group (Demetsky & Perfater, 1975; see also Chapter 5).

For children, the elderly and impaired persons reachability and feasibility of reaching a destination that matters are dominant considerations for going outdoors on foot, both for utilitarian and recreational motives. On the other hand, for healthy and fit adults, the other half of the population, choosing for walking trips up to about 2 kilometres, reachability is not a matter of ability, but a matter of willingness, a choice between (many) alternatives, and preferences; for utilitarian walks destinations that matter need to be within walking distance of about one kilometre; for recreational walking generally reachability on foot is not an issue, but reachability by other modes (car, public transport) to the starting point of the walk may matter.

For children playing outside is important. Van den Bogaard (1999) indicates that children up to 3 years of age have an (allowed) action radius of about 40 meters from home, children in the age of 4-6 years of 100 meters, and in the age of 6-12 years of 300 meters. Spatial requirements for age 1 - 3 are a wide sidewalk, back paths and a square, that their parents or guardians can

survey; for ages 4 - 6 open space of 10 - 500 meters, that their parents or guardians can oversee is required; for children aged 6 - 12 years open space of 2 - 3000 meters or a plot that they can safely reach, is desirable. As mentioned before, for children older than 4 years of age walking distances of more than 1.6 kilometre (1 mile) has little impedance (Demetsky & Perfater, 1975).

According to GOAL (2013) the degree to which the elderly participate in travel and traffic is associated with the elderly's profile: Fit as a Fiddle (50-59); Hole in the Heart (50-75); Happily Connected (60-75); The Oldie but Goodie (80-90); the Care-Full (85-100). The first group does not have special requirements regarding reachability; the last group is no longer independently walking. The groups in between have reachability limitations, particularly regarding walking distance.

c. Why do the reachability issues occur? What factors and mechanisms affect reachability?
In the selected documents different determinants for reachability or feasibility to reach destinations that matter and differentiations therein are mentioned. The main criterion is walking distance, depending on (built) environment and personal variables. According to Ewing & Cervero (2010:267) built environment variables regarding walkability (here: reachability) are the seven D's: *Density, Diversity, Design, Destination accessibility, Distance to transit (Public Transport), Demand Management, and Demographics*.
In the selected guidance and overview documents and in the above Section 4.3 also personal factors are identified: travel motive, walking speed, physical endurance, available aids, self-reliance and efficacy, and perceived route impedance. The weights of these determinants vary for different (potential) pedestrian groups, whereby children, the elderly and impaired persons, and healthy and fit adults can be considered key groups. Reachability and feasibility of reaching a destination that matters provide opportunities for self-control and social power (RLi, 2018).

Built environment or area variables (after Ewing & Cervero, 2010:267)
Density concerns the number of people and/or building units that can function as attraction per unit of area (e.g. hectare). The more people or user units there are in an area, the lower the average walking distances between the units will be, and the higher the activity density can be.
Diversity concerns the land use mix, i.e. number of different land uses there are in a given area and the way these are distributed across the area. The more variety, the higher walking propensity will be.
Design concerns how the street network within an area is designed: as dense or wide urban grid, straight or curved urban streets, highly or lowly interconnected, block size, building setback, number of street crossings, street trees, route consistency, discontinuities and obstacles etc. This variable goes to (objective) route impedance.
Destination accessibility concerns the ease of access of an attraction, such as the distance to the city centre, or directness of the connection between a public transport and parking facility to the city centre or other attraction points. This variable also goes to route impedance.
Distance to Public Transport also concerns route impedance, particularly for residents and visitors from areas beyond walking distances.
Demand Management concerns active policies to attract, direct or preclude people from areas beyond walking distances to visit the area. Examples are parking supply and costs, and free or low cost, frequent and quick transfers to the city centre. Furthermore, although some routes are physically possible these may not be an allowed option: walking along a motorway, train tracks and on private properties is not allowed (CROW, 2019).
Demographics concern the distribution of population groups (age, gender, social-economic backgrounds, cultural or ethnic groups) across the area. Population groups each have their own walking propensities (preferences, walking trip rates, action radius). Demetsky & Perfater

(1975) found that for adults distances up to 400 meters were acceptable, but that for children 1.6 km (1 mile) has little impedance; for the latter group attractiveness of the route and destination are more important factors than distance.

Person variables
According to Olszewski (2007) and Leidelmeijer & Damen (1999) walking *motives* are associated with different acceptable walking distances. For home-work trips a little more distance (UK, 1.12 kilometres in 1994/96) is acceptable than for shopping trips (UK, 0.80 kilometres in 1994/96)(Olszewski, 2007). Wandelnet (2016) mentioned that the average recreational walk in 2015 was 7 kilometres (based on stated performance); De Haas & Hamersma (2019) based their indications on the Dutch National Travel Survey 2017 (OViN 2017) and found that an average walking trip amounts to 1.5 kilometres; the recreational walking trip average is 2.1 kilometres. While the work trip average is 1.4 kilometres, the education related trip average is 0.9 kilometres, and the shopping trip average is 0.95 kilometres.

Olszewski (2007) found that typical free-flow walking *speeds* vary from 0.9 to 1.5 m/sec; De Haas & Hamersma calculated that 1.25 m/sec is the overall average walking speed in the Netherlands in 2017. Children and walking impaired persons walked slower than average: 0.6 - 0.9 m/sec. Apart from impacting on acceptable walking distances, walking speed is important for determining street crossing times, i.e. green times at signalised crossings.

Under Section 4.3.4 it was already indicated that *physical endurance* characteristics affect walking abilities and propensity, resting and toilet needs, and whether or not a wheelchair or walking aids need to be used. Recently De Haas & Van den Berg (2019) concluded from their research that health, expressed in terms of the Body Mass Index (BMI), is associated with the propensity for walking and walking distances covered. Healthy persons (BMI = 18-25) walk more often and substantially farther than overweight and obese persons.

Another factor influencing reachability and feasibility of desirable destinations is *self-reliance and efficacy*. This particularly concerns children and mentally impaired persons, as these generally are not free to go about in public space. They need permission because of perceived risk (by their parents or guardians) of getting lost and not being able to cope with the dangers of traffic (e.g. Childstreet, 2006).

Above the main 'objective' environmental factors regarding reachability were already mentioned and explained. There may also be many personal reasons why destinations that matter are not perceived to be reachable or people do not feel enabled to reach such destinations on foot. The (perceived) offer of destinations may not match with:

- personal walking distance (beyond one's perceived physical walking distance: *perceived route impedance*);
- the personal estimation of time needed to go on foot compared to available or disposable time;
- freedom to choose (e.g. not allowed by parents or guardians or only reachable during hours that the person cannot get escort);
- availability of (reassuring) information about the route or accessibility of the destination;
- cultural impediments (e.g. 'women cannot go outdoors unescorted', 'not acceptable after dark');
- prominent fears and anticipation regarding (serious) inconveniences on the way.

Perceived route impedance can be expected to affect perceived reachability and feasibility of completing a walking trip. It concerns felt resting needs, route directness, accessibility and safety quality, and the degree to which the trip is perceived to be stressful (out of one's comfort zone; expected barriers and inconveniences on the way, uncertainties about the trip and way finding, and uncertainties about accessibility of the destination). In this respect the chain is as strong as the weakest link; the question is what weaknesses (e.g. volumes and speeds of motorised traffic, criminality), and obstacles on the routes are known in advance.

d. Where do the reachability issues particularly occur?
From nearness of services data on CBS Statline[326] and the CROW website it can be concluded that reachability issues occur mainly outside compact urban areas: rural, peri-urban and urban development which were designed primarily with the car in mind (most post 1960s residential developments); compared to compact central urban areas there is lower than average density, less mixture of land uses, larger grids or tree-like networks, and longer distances to public transport stops.

e. When do the reachability issues emerge?
It can be assumed that at night, or outside business and shop opening hours, on official holidays and in the weekends reachability problems are more prominent than during business hours. Utilitarian trips are mostly made within business hours, while recreational trips are dominantly made during free hours, outside business hours.

f. How can reachability issues be remedied?
In this paragraph the above question is unravelled and answered in three sub-questions: 1) what are the main targets to be reached, 2) what kinds of tools are available to remedy reachability issues, and 3) what W+S arrangement requirements can be indicated?

Reachability and (the perception of) feasibility of reaching destinations that matters concern strategic walking and sojourning decisions about where and when to go outdoors and walk towards the intended destination. This means that interventions on the one hand should target on a factual decrease in walking distances and their impedance, and on the other hand on getting knowledge across about real improvements therein and combatting dis-functional perceptions and realities, like *'walking is not a serious form of transport*' and *'walking is irrelevant to city transport problems because it does not cause pollution, accidents, noise or congestion*' (Tolley, 2003/1990).

Remedial policies in this regard are:

- Strategic and mid-term land use planning (e.g. 'Omgevingsvisie[327]') to match urban form (patterns, foot network, quality of streetscape) to walking activities (New Zealand Land Transport, 2009), i.e. diversify suburban land use and support street life (Schwartz, 2012; OTAK, 1997), promote *that most aspects of daily life are located close at hand*, within walking distance (Speck, 2012:11; ITE, 2006), promote population density and uses, proximity and access of buildings (e.g. Zegeer et al., 2002), and placing housing for the elderly (and impaired) in high density areas nearby community service centres (grocery,

[326] Cf. https://opendata.cbs.nl/statline/?dl=348F7#/CBS/nl/dataset/84718NED/table, and https://www.crow.nl/duurzame-mobiliteit/home/duurzaam-economisch-groeipotentieel/nabijheid-en-voorzieningen, accessed 28-6-20.
[327] Within the context of the so called new Dutch Omgevingswet (physical environment law) governments are obliged to develop a 'Omgevingsvisie' (area vision on the physical environment).

medical services, pharmacy, package delivery points)(e.g. Taylor & Damen, 2001; Gunnarsson, 2001);

- Strategic and mid-term transport and traffic plans, amongst others to create Transit Oriented Development and management of parking to promote walking (Schwartz, 2012; CROW, 2012; Zegeer et al., 2002; OTAK, 1997);
- Subsidies and other incentives regarding continuation and/or establishment of low threshold public and commercial services;
- Investment in affordable housing in high density, mixed land use neighbourhoods (Speck, 2018);
- Promotion of continuation and/or establishment of schools, parks, low threshold services (Speck, 2018);
- Promotion of healthy life styles, participation and social cohesion (RLi, 2018; Speck, 2018; Brouwer, 2019)
- Contracts with Public Transport services to unlock and access attraction points for walking (RLi, 2018; Wandelnet, 2016);
- Legislation (law and regulations) regarding housing, traffic, and locations of medical and commercial services (Taylor & Damen, 2001);
- Enforcement of regulations and rules of use and behaviour in public space (e.g. Schoon, 2019; Turner et al., 2006; Gunnarsson, 2001);
- Facilitation of school routes (e.g. OTAK, 1997) and support of escort of schoolchildren (e.g. Walking Bus), elderly and impaired persons;
- Enforcement and communication (e.g. Schwartz, 2012; Turner et al., 2006);
- Ensure that transportation is affordable, available, reliable, comprehensible, complementary, comfortable, safe and secure (TRACY, 2013);
- Information and communication on norms and values (e.g. lack of respect, social barriers)(Risser, 2002; Kantar Public, 2018);
- Mobile phone applications regarding walking mobility, e.g. navigation on foot, access characteristics and opening hours of services.

Reachability issues are often hard to combat because they are caused by reactions to unplanned developments (like car dependence and upscaling of services) and the subsequent application of structure design principles (like disentangling land uses and development of low density mono functional neighbourhoods and districts) (Schoon, 2019), and promotion of home-ownership over large scale public housing[328].

Basic requirements of W+S arrangements for reachability cannot easily be formulated in general and absolute terms; as indicated, what is required in specific situations needs to be related to the existing walking population's needs and abilities. Even then nuancing is possible, depending on the distribution of needs and abilities, and the Levels of Service (LoS) requested or to be offered (cf. CROW, 2019:25-Figuur 13). Within the scope of this thesis, because of lack of information, it is not possible to formulate concrete measures regarding levels of service for the full range of reachability factors. As an example, based on Table 4.11 the author estimates that about 80% of the population can endure walking over a distance of 1,000 meters, 90% 500 meters and 95% 250 meters. In this regard walking distances to a neighbourhood

[328] Home-ownership causes fragmentation in landownership. In public housing areas land ownership is in one hand, relatively easy enabling quick changes in network structure and public space design.

community services centre (housing basic medical, public and commercial services) of 250 meters could be called 'excellent', 500 meters 'good', 1,000 meters 'reasonable' and 1,250 meters moderate and more than 1,250 meters 'not acceptable'. Another approach could be to fall back on crude Walkscore assessments based on street connectivity, residential density, access to public transport provisions and crime, as proxy for reachability (Carr, 2010). Such assessments appear to be quite universally available in the USA, and are becoming more popular elsewhere as well[329].

g. Policy relevance

Improving reachability and feasibility of reaching destinations that matter on foot is relevant for spatial, health, environment, equity, social, transport and economic goals and tasks. Real opportunities for independent walking and sojourning help saving on major expenditure on (amongst others) health costs, personal support costs, transportation and traffic facilities costs and maintenance.

4.4.6.4. Requirements for accessibility

a. What general issues should set the stage for basic W+S accessibility arrangements?

Accessibility relates to how well the pedestrian's environments are adapted to operational walking impairments and disadvantages. While reachability requirements capture pedestrian behavioural needs on the strategic level, focussing on physical endurance, accessibility requirements concern tactical and operational behavioural needs and abilities. Accessibility requirements are to match posture, sensory, psycho-motor, and use of wheeled pedestrian movements of impaired and disadvantaged pedestrians (cf. Table 4.11 and e.g. Schoon, 2019; Nabors, 2007; Turner et al., 2006; OTAK, 1997). This is about inclusive mobility of more than 20% of the population (even 50% if children are included). After reachability, accessibility is the most powerful argument to go about walking or not.

b. Which groups of (potential) pedestrians are normative?

Accessibility requirements need to match posture, sensory, psycho-motor characteristics of the impaired and disadvantaged pedestrians, users of wheeled pedestrian carriers, prams, carts and persons carrying goods i.e. the heterogeneous population of children, the elderly and impaired and W+S disadvantaged[330] persons. The latter category also includes temporary impaired persons. In total about half of the population has one or more impairments or disadvantages regarding walking and sojourning in public space, but the other half of the population can be expected to benefit from excellent or good W+S accessibility as well.

c. Why do the issues occur? What factors and mechanisms affect accessibility?

Accessibility issues can be expected to occur when the design, equipment, arrangements, management and maintenance of the pedestrian facilities do not match W+S requirements to accommodate postures, sensory and psychomotor abilities, carrying goods, and the use of wheeled devices to carry oneself, children and impaired (e.g. wheelchair, rollator, pram), or goods (push or pull luggage cart, suitcase on wheels, wheelbarrow) along footways.

In 1990 the American Congress passed the Americans with Disabilities Act (ADA)[331]. In 2010 an updated version of the official Guidance on the 2010 ADA Standards for Accessible Design

[329] See for example https://www.walkscore.com/TX/Nederland (accessed 17-10-2019)

[330] Compared to healthy and fit adults.

[331] see https://www.eeoc.gov/eeoc/history/35th/1990s/ada.html and https://www.eeoc.gov/eeoc/history/35th/thelaw/ada.html (accessed 17-10 2019)

(ADAAG) was published (US Department of Justice, 2010, 2019). The American guidance on accessibility is exemplary, and internationally accepted and often copied into public space and infrastructure guidance documents (e.g. Schoon, 2019; CALTRANS, 2014; Turner et al., 2006; CROW, 2004). CALTRANS (2014) published a practical checklist based on the ADAAG 2010[332]. The checklist includes a comprehensive set of requirements regarding accessible route basics, ramps, scaffolding, pedestrian push buttons, and audible information devices, including temporary pedestrian facilities (CALTRANS, 2014:8-17). In catchwords the checklist comprises:

- Paths: stable, firm and slip resistant;
- Surfaces: smooth and continuous hard through the entire length; no abrupt changes in grade or terrain;
- Surface discontinuities (cracks): less than 1.25 cm wide;
- Route joints and gratings: surface openings less than 1.25 cm wide;
- Cross slope less than 1:50 (2%);
- Running less than 1:20 (5%);
- Path width: if possible at least 150 cm; 150 x 150 cm wheelchair passing space every 65 meters;
- Path clear width: no less than 120 cm; no fixed objects to further reduce path width;
- Signs, other devices mounted lower than 210 cm: intrusion less than 10 cm;
- Objects must not protrude into the path;
- Vertical clearance: 200 cm minimum;
- If 180 degrees turn required: at least 150 x 150 cm turning area;
- Access to nearby temporary transit stops must be provided;
- Pedestrians may need temporary night-time lighting;
- Ramps: cross slope less than 1:50 (2%); running slope less than 1:12 (8.33%); levelled landings at the bottom and top; land width at least 150 cm length; edge protection;
- Curb ramps: maximum slope 1:10; 1:12 allowed for 15 cm; 1:8 allowed for max 7.5 cm rise;
- Scaffolding: good condition, no intrusions of devices, equipment or constructions into usable width; overhead covering to protect from falling objects; rails as side protection;
- Pedestrian push buttons: unobstructed reach; mounted between 37.5-100 cm;
- Audible information devices: speech messages by activation preferred.

In the selected overview and guidance documents important W+S accessibility issues are mentioned regarding the lack of basic connectivity, continuity, convenience and safety of walkers. An anthology:

- Main considerations on network level, often neglected, are proximity and continuity, overall route and desire line definition, widths, and configuration (particularly at junctions) (Schoon, 2019);
- Lack of space for walking, escort and/or turning (width and height dimensions) on the footway (e.g. Schoon, 2019);

[332] The handbook is downloadable from https://dot.ca.gov/-/media/dot-media/programs/construction/documents/contract-administration/temporary-pedestrian-facilities-handbook-a11y.pdf (accessed 17-10-2019).

- Misuse of footways by parking (car, bicycle), loose objects (e.g. waste containers, waste, billboards), overhanging green (e.g. Schwartz, 2012);
- Weak links and barriers in desire line of pedestrian routes ('the route is as strong as the weakest link') (e.g. Schoon, 2019; Nabors et al., 2007);
- Inadequate access from common pedestrian routes and footways to destinations that matter (including public services, transfer to public transport and car parking) (e.g. Speck, 2018; Nabors et al., 2007; OTAK, 1997);
- Barriers caused by fast and busy traffic on main roads (e.g. Turner et al., 2006);
- Lack of public rights of way that are signposted and easy to use (e.g. Schoon, 2019);
- Inappropriate pedestrian signalised crossing facilities with long standing and waiting times (e.g. Schoon, 2019; Zegeer et al., 2002);
- Inappropriate reach distances of push buttons, door handles etc. (e.g. Schoon, 2019);
- Unbridgeable differences in level of pavements, hampering crossing the road, driveways or (front) doors of buildings (e.g. Turner et al., 2006);
- Sharp edges perpendicular to the walking direction[333] (e.g. CALTRANS, 2014);
- Lack of maintenance, uneven and or slippery pavements, lack of snow removal (e.g. Turner et al., 2006; Zegeer et al., 2002; ITE, 2006);
- Strong gradients (slope, cross grade) and stairways in walking routes (e.g. Schoon, 2019; Edwards, 2018; CALTRANS, 2014);
- Lack of resting places (seating, leaning)(e.g. Turner et al., 2006; Schoon, 2019);
- Shielding of (small) pedestrians by parked cars, street furniture and greenery (e.g. Childstreet, 2006);
- Discontinuities in walking routes;
- Lack of means for orientation (insufficient contrast, lack of guiding lines and signs);
- Deficient street lighting (e.g. Schoon, 2019; New Zealand Land Transport, 2009);
- Unsafe school zones (e.g. Zegeer et al., 2002);
- Lacking or inappropriate temporary measures at road and building works (e.g. CALTRANS, 2014).

d. Where do the accessibility issues particularly occur?

According to most of the selected documents, accessibility issues appear to arise in a great variety of conditions. An anthology:

- In general the chain is as strong as the weakest link, and in the vast majority of problems they occur where facilities do not match W+S requirements of (particularly) impaired and disadvantaged persons;
- There is a (strong) relation between the establishment era of an area and accessibility. Before the dominance of car use neighbourhoods, walking was the norm for network and infrastructure design. With growing focus on car use in land use development (1960s - 1990s), distances between attraction points increased and attention to W+S accessibility decreased, even in formerly adequately designed areas (cf. Amato, 2006); in the most recent developments the value of W+S is rediscovered (cf. Speck, 2012/2018; CROW, 2014);

[333] A sharp edge as little as 1.0. cm high can cause falls in elderly pedestrians; the older and more unstable one gets, the more difficult it becomes to lift one's foot 2 or more centimeters.

- Compared to city centres the outskirts of towns and industrial areas are poorly endowed for pedestrians. In the documents there is little attention for this phenomenon. Politically city centres are much more in the picture and best endowed regarding accessibility because these attract more pedestrians than other districts, and have substantially higher turn-over rates (cf. Gehl, 1997/2011; Speck, 2012);
- Where there is strong competition for space and/or not much space left for pedestrians (i.e. main roads through smaller towns and central business areas (CBA)) W+S accessibility is under pressure (e.g. Van der Veur, 2013);
- Intersections in main (high traffic volume) roads have priority for wheeled traffic: long pedestrian waiting times and crossing lengths; turning left to the other side of the road (if at all possible) generally means waiting at least twice;
- On peripheral roads, in villages and around peripheral (mid-line) public transport stops and train stations pedestrian facilities are scarce (out of sight politically; little attention for in the documents);
- Hilly streetscapes, particularly steep streets, large difference in level, where stairs are often applied as a 'logical' solution for pedestrians, are very problematic for elderly pedestrians (Edwards, 2018);
- Busy and hectic exchange or transfer locations (e.g. bus stations, transferia, park & ride locations) often have sub-optimal accessibility conditions.

e. When do the accessibility issues emerge?

Accessibility because of its link with the physical environment is hardly time bound, but in wintertime (snow, slipperiness) and during or after heavy rains accessing destinations on foot can become especially difficult. At off-business hours operational W+S accessibility issues can be expected to be most prominent because there are very few people to assist in emergencies, while in rush hours busy traffic causes difficulties to continue one's route, and people are less prepared to be of assistance.

f. How can accessibility issues be remedied?

In this paragraph the above question is unravelled and answered in four sub-questions: 1) what kinds of improvement strategies can be followed, 2) what kinds of tools are available to remedy accessibility issues, 3) what quality indicators are discerned, and 4) what W+S arrangement requirements can be indicated?

Improvement strategies

In principle accessibility issues can be remedied either reactively or pro-actively, i.e. as reaction on complaints and/or clear signals from the media, research or partners, or, through planned dedicated inspections, accessibility audits and other kinds of explorations, and preferably a cascade-like approach to solving issues found[334].

Tools

The question of how accessibility issues can be remedied also concerns what tools providers (in principle) have to detect, assess and solve W+S accessibility issues. It stands out that, among experts, there is consensus that the ADAAG (DoJ, 2010) or similar guidance on Design for All or Universal Design (CALTRANS, 2014; CROW, 2004/2012) form a good starting point for

[334] Cascade approach: deal with proximity (reachability) -> deal with network issues > deal with operational aspects (Hendriks et al., 1998).

remedying accessibility issues. From the analysis of the selected overview and guidance documents the author derives the following 'tools':

- *Network design*: hierarchy, street configurations, length of sections, directness (short-cuts), continuity & connectivity, avoid presence of steps and stairs, improve sightlines, crossing facilities (e.g. Schoon, 2019);
- *Geometric design*: street design, presence, designs and placement of sidewalks, walkable shoulder, width & capacity[335], separation and buffers from travel lanes, curbs, boundaries desirable for visual impaired, ramps as alternative to stairs, visibility on sidewalk, driveways, signs and pavement markings, crossings, footpaths, ramps and steps, driveways, shared use paths, kerb ramps, refuges, medians, kerb extensions, pedestrian platforms, crossing assistance for school children, zebra crossings, signalised intersections, grade separation, railway crossings, presence of guiding stripes and lines (e.g. CROW, 2019; Schoon, 2019; New Zealand Land Transport, 2009; Nabors et al., 2007; Turner et al., 2006);
- *Lighting & street furniture*: presence of seating and leaning facilities, route guidance/way finding, street trees (e.g. CROW, 2019; Nabors et al., 2007);
- *Construction and effectuation* (e.g. Schoon, 2019; Turner et al., 2006);
- *Monitoring accessibility* (e.g. Schoon, 2019; New Zealand Land Transport, 2009);
- *Project planning* (e.g. Schoon, 2019; Turner et al., 2006);
- *Public space use management, maintenance & repair*: Quality, condition and obstructions: snow storage and disruption, clear of temporary and permanent obstructions, not too steep, grade-cross slope, surface adequately maintained (e.g. Nabors et al., 2007);
- *Transportation and traffic management* (including route management, public transport line organisation, traffic & flow management; Traffic characteristics: are there any conflicts between bicycles and pedestrians?) traffic regulation / traffic lights, pedestrian detection (e.g. CROW, 2012/2019; Nabors et al., 2007);
- *Regulation and inspection of temporary facilities* in case of building activities (e.g. Caltrans, 2014);
- *Legislation and traffic codes*: redefine, reposition pedestrian as an equal road user: a search for equity. Necessary rules: Schoon, 2019:25; highway code;
- *Organising guided walking*, e.g. Walking School Bus, guided walking for the blind, mentally impaired; informal care, - school crossing patrols (e.g. DfT, 2018);
- *Surveillance and supervision*: supervision of crossing difficulties (e.g. DfT, 2018);
- *Management and distribution of information* (e.g. DfT, 2018; Walsh, 2012);
- *Participation and consultation*: combatting conflicts of interest (e.g. Walsh, 2012);
- *Education, communication and training* of elderly pedestrians, children, get children back on the streets; communication tools and personnel (e.g. DfT, 2018);
- *Vehicle technology*: drive assist, vehicle speed control, pedestrian friendly fronts (popularity of SUV's is not a favourable development).

W+S arrangement requirements

From comparing W+S accessibility requirements described in the selected overview and guidance documents it appears that there is a rather clear image of and consensus on what these requirements are. An exemplary summary is given by Caltrans (2014:8-17):

[335] Pole and signs are often overlooked (CROW, 2014; Zegeer et al., 2002)

"Accessible route basics

- *The path must be stable, firm and slip resistant. Pedestrian facilities must be surfaced with asphalt concrete, portland cement concrete or timber. Dirt is not acceptable on the surface.*
- *The surface should be smooth and continuous hard through the entire length (...). No abrupt changes should exist in grade or terrain that could cause tripping or be a barrier to wheelchair use.*
- *Surface discontinuities must not exceed 1/2 inch [1.25cm] maximum. Vertical discontinuities between 1/4 and 1/2 inch should be beveled at a maximum of 2:1 or flatter, and bevels should be constant across the entire level change. New surfaces must not have vertical surface discontinuities. Curb ramps, landings, and gutter areas must not have surface discontinuities. (...)*
- *On pedestrian access route joints and gratings, surface openings must not permit passage of a sphere larger than 1/2 inch. Place surface openings so that long dimension is perpendicular to the dominant direction of travel.*
- *The cross slope must be no greater than 1:50 (2 percent).*
- *The running slope must be no greater than 1:20 (5 percent). Otherwise, meet the ramp requirements discussed below. For street facilities, the running slope may follow the adjoining street.*
- *When feasible, a width of 60 inches [150 cm] should be maintained.*
- *When it is not possible to maintain a width of 60 inches [150 cm], a 60x60-inch passing space must be provided at least every 200 feet [600 meter] to allow individuals in wheelchairs to pass. (...)*
- *The path must have a clear width of no less than 48 inches [120 cm]. Verify that no fixed objects (cabinets, poles and so forth) will reduce the path width at any point. (...)*
- *Signs and other devices mounted lower than 7 feet [210 cm] above the temporary pedestrian pathway should not project more than 4 inches [10 cm] into accessible pedestrian facilities. (...)*
- *Objects must not protrude into the path. (...)*
- *Vertical clearance must be 80 inches [200 cm] minimum.*
- *If the path requires a 180-degree turn, the turning path must be at least 60 inches [150 cm] deep. (...).*
- *Access to nearby temporary transit stops must be provided.*
- *Pedestrians may need temporary night-time lighting. (...)*

Ramps

- *The cross slope must be no greater than 1:50 (2 percent).*
- *The running slope must be no greater than 1:12 (8.33 percent).*
- *Each ramp must have level landings at the bottom and top. A landing must be as wide as the run leading to it and have a minimum length of 60 inches (...).*
- *Ramps must have hand railings and edge protection.*
  Curb ramps to be constructed on sites or facilities where space limitations prohibit the use of a 1:12 slope or less have slopes and rises as follows:
- *A slope between 1:10 and 1:12 is allowed for a maximum rise of 6 inches [15 cm].*
- *A slope between 1:8 and 1:10 is allowed for a maximum rise of 3 inches [7.5 cm].*
- *A slope steeper than 1:8 is not allowed.*

Scaffolding

- *Pedestrian facilities must be maintained in good condition and kept clear of obstructions.*
- *Traffic control devices, equipment, and other construction materials and features must not intrude into usable width of the sidewalk, temporary pathway, or other pedestrian facility. Signs and other devices mounted lower than 7 feet [210 cm] above the temporary pedestrian pathway should not project more than 4 inches [10 cm] into accessible pedestrian facilities.*
- *Where pedestrian openings through falsework are required, a temporary pedestrian facility with protective overhead covering must be provided during all construction activities.*
- *Hand railings on each side of temporary facilities must be provided as necessary to protect pedestrian traffic from hazards due to work activities or adjacent vehicular traffic.*
- *Protective overhead covering must be provided as necessary for protection from falling objects and dripping from overhead structures.*

Pedestrian Push Buttons

- *The pedestrian push button must have an unobstructed forward reach. (...)*
- *If the push button requires a side reach, obstructions at the bottom cannot extend more than 24 inches [60cm] from the base. (...)*
- *A pedestrian push button used to provide TTC[336] information to pedestrians with visual disabilities should be equipped with locator tone to notify them that a special accommodation is available and help them locate the button.*

Audible Information Devices
A wide range of pedestrians might be affected by TTC zones, including the young, elderly and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path. (...)"

A question is: what Levels of Services (LoS) are minimally needed? This depends on what use can be expected; there seems to be consensus amongst experts that the system should at least allow for 'normal' activities. For example, walking side by side requires at least 180 cm clear width (2 x 70 cm person width + 2 x 10 cm manoeuvring space for use of arms and carrying bags; if a path is regularly used in both directions by wheelchair or pram users, 180 cm (2 x 90 cm) clear walking path is scanty)(cf. Schoon, 2019; CROW, 2019; CALTRANS, 2018; CROW, 2012).

With regard to walking routes CROW (2019) discerns five levels of service: excellent, good, fair, mediocre and bad. The latter two levels appear to just enable the group of healthy and fit adults, but is not compatible with a Barrier Free Design, needed to enable mobility impaired and disadvantaged persons to participate.
In a number of the selected guidance documents detailed requirements and levels of service are discussed, for example in CROW, 2019, Schoon, 2019, Langen, 2018 and Turner et al., 2006.

g. Policy relevance
Urgency and policy relevance of providing for W+S accessibility is indicated in several ways, among other things:

[336] TTC = Time, Trigger and Control.

- In most Western countries it is unlawful[337] if providers discriminate against disabled persons and so public providers are obliged to make reasonable adjustments (e.g. Schoon, 2019:129-150; FDOT, 2018; CALTRAN, 2018; CROW, 2004/2012);
- In-accessibility brings along substantial public costs for supporting those persons who cannot participate, in the Netherlands e.g. based on the Wmo (NL Law for societal support, 2007);
- Public Transport relies on accessibility on foot, and public transport stops are the key to accessible public transport (KPVV, 2005);
- Accessibility on foot is a key determinant for competitivity of cities to attract inhabitants and employment (Speck, 2018).

4.4.6.5. Requirements for safety

a. What general issues should set the stage for basic W+S safety arrangements?

In this thesis pedestrian safety concerns all dangers to, and incidents, accidents, injuries and fears thereof that pedestrians may encounter while walking and sojourning in public space. The aim in this regard is to protect pedestrians from damage and injuries due to exposure to harmful conditions and/or substances, and decrease harmful emissions, clean up dangerous situations and as much as possible exclude nuisance (Brouwer, 2019). In this regard there are several kinds of safety:

- Traffic safety, concerning incidents with moving traffic on wheels on public roads;
- Falls, concerning incidents where a person is injured because of a fall while moving or standing in public space;
- Social or public safety and security, concerning fears of threats, damage and being hurt by other people in public space (subjective perspective), and security, which concerns (actual) criminal activities against people in public space (objective perspective);
- Health impacts from harmful emissions and noise.

The causes, effects, consequences and measures to deal with criminality and health-attacks because of harmful emissions and noise are beyond the scope of this thesis.

Traffic safety

In modern road safety policy the safe system approach, derived from the earlier Sustainable Safety (Wegman & Aarts, 2005) and Vision Zero (Kristianssen et al., 2018) is the exemplary approach to road safety issues. Both approaches are closely linked to the internationally agreed definition of a road traffic accident: *a road traffic crash on a public road involving at least one moving vehicle* (United Nations, 1949; Methorst et al., 2016:2298; https://data.oecd.org/transport/road-accidents.htm). About three-fourth[338] of the pedestrian traffic accidents concern crossing the road (e.g. CROW, 2006/2014; Zegeer, 2002). After reachability and accessibility, traffic safety is a major argument to go or not to about on foot.

Fall safety

Fall safety concerns fatal or injury from stumbles, slips, wrong steps, falls from heights, stairs and ladders as a pedestrian in public space (WHO, 2016: ICD-10 codes W00-W19). Falls are

[337]) E.g. Disability Act [UK], ADA [USA], ratification of the UN Convention on the Rights of Persons with Disabilities - Optional Protocol, 2006

[338] Data from the Netherlands: CROW, 2016:10 mentions 77% in 1998; VBV, 1987:11 mentions 79%)

not covered in police reporting and general road safety statistics because this kind of accidents is excluded in the definition of a road traffic accident (UN, 1049), and is also not included in other general safety statistics brought to the attention of road and public space providers. From Walk-In clinics and hospital admittance data it is clear that, compared to pedestrian road traffic accidents, there are about four times as many (seriously) injured pedestrian casualties due to falls. Already in 1998 Harris mentioned this deficit in statistics and research; since 1992 the Dutch Pedestrians Association until its cancelation lobbied for inclusion of the subject; in 2010 it re-emerged in the COST 358 Pedestrian Quality Needs and OECD/ITF Pedestrian Safety, Urban Space and Health projects, and at the same time in Sweden, Austria and Switzerland (Methorst et al., 2010; OECD/ITF, 2012; Methorst et al., 2016; Methorst et al., 2017a).

Social safety / criminality
Social or public (related to criminal activities) safety is about the safest possible use of public space, without fear of or impairing personal integrity (Van der Voordt & Van Wegen, 1990) and protection against threats and crime caused by people. It concerns a combination of intended and unintended (improper, unwanted) use of public space, and is therefore primarily a social quality (Kuitert & Maas, 2017; Luten, 2011). It concerns a feeling or perception of safety mostly, and is experienced mostly after dark and by women. The fear of getting assaulted and hurt is a major reason for women not to go out walking after sunset over paths shielded from the public eye, particularly those through derelict, unattended and graffiti-invested urban areas. In this it is better to have intrinsic safe paths than surveillance secured areas (e.g. Luten, 2011; Kuitert & Maas, 2017).
Criminality may underlie social or public safety, but appears to be a quite rare phenomenon in pedestrian exposure. Kuitert & Maas (2017) find that the police, politicians and citizens overestimate the volume of criminality. According to criminality figures (CBS Statline website) in the last decennia the Netherlands has become safer; nevertheless, many citizens experience it differently (Kuitert & Maas, 2017:24).

Health impacts from harmful emissions and noise
Health can be threatened by harmful emissions (e.g. car or factory exhausts, or constant loud noise) (Schepers, 2015). The aim should be to minimise the pedestrian's exposure to such substances. In the selected overview and guidance documents this aspect is strongly underexposed. The causes, effects, consequences and measures to deal with health threats-safety (= harmful emissions) are largely beyond the scope of this thesis.

b. Which groups of (potential) pedestrians are normative?
Vulnerable groups like children, elderly, and the impaired feel the burden of traffic safety and falls stronger than others. The older one gets, the higher the risks of (serious) injury and death from falls in public space are. Social or public safety is particularly experienced by (mid-aged and older) women. Criminality can touch everyone, but again (mid aged and older) women are subjectively affected most. Health threats from emissions and loud noise particularly affect the youngest and less-resistant elderly.

c. Why do safety issues occur? What factors and mechanisms affect safety?
In principle safety issues are the product of a chain of critical circumstances (Groeneweg, 2002; Wegman & Arts, 2005; Reason, 1990). The operational errors, safety settings, accidents, damage and injuries, and their consequences are preconditioned by lifestyle, strategic and tactical conditions and decisions. Structure and strategic precursors are for example personal competences, poor (perceived) choice of travel time, a complex, unclear and tiresome network,

lack of maintenance and design faults; examples of tactical level risk factors are traffic volume and speeds, lighting conditions, bushes and shielding by parked cars, obstructing lines of (two-way) view.

Traffic safety
According to the recently updated Sustainable Safety vision main factors in road safety are (SWOV, 2018; Aarts & Wegman, 2005):

- The *functionality* of roads: the degree to which the road network is mono-functional (= traffic purposes) and hierarchically build up;
- *(Bio)mechanics*: the degree to which speed, direction, mass, dimensions and protection of road users are attuned;
- *Forgivingness* of the environment and road users between themselves[339];
- *Abilities and needs*[340]: the degree to which the traffic environment and road user competences are attuned;
- *Responsibilities*: the degree to which responsibilities are effectively invested;
- *Learning and innovation*: the degree to which both system providers and users are able to learn and innovate.

With regard to the first principle it needs to be said that this principle is at odds regarding functionality for pedestrians, for whom traffic and transport is not the sole functionality of public space. For them public space needs to be usable for circulation and sojourning activities as well. In this regard the forgivingness principle is paramount, particularly in sojourning areas like residential streets, city centres, parks. In this regard the author adheres what the Australian Government in its National Road Safety Strategy states:

"There are several guiding principles behind this [Safe Systems] *approach:*

- *People make mistakes. The system must accommodate these. It should not result in death or serious injury as a consequence of errors on the road;*
- *Human physical frailty. There are limits to the amount of force that bodies can take before one is injured.*
- *A 'forgiving' road transport system. A Safe System ensures that forces in collision do not exceed the limits of human tolerance. Speed must be managed so that humans are not exposed to impact forces beyond their physical tolerance. System designers and operators need to take into account the limits of the human body in designing and maintaining roads, vehicles and speeds."* (https://www.roadsafety.gov.au/nrss/safe-system.aspx, accessed on 18-10-2019).

According to Nabors et al. (abstracted/cited from 2007:103) universal pedestrian traffic safety perspectives are:

- The needs of all pedestrians: seniors, children and handicapped;
- Connectivity and convenience: are safe, continuous and convenient paths provided along pedestrian routes throughout the study area?;

[339] The forgivingness principle comes from the 'old' second version of the Sustainable Safety vision. The author is not satisfied that this important principle is not covered in the updated vision.
[340] SWOV unnecessarily limits the factor to 'psychologies', but does mention competence in their explanation. The author means that safety not only depends on mental factors, but also how well one is endowed physically.

- Traffic: are design speeds posted and operational speeds compatible with pedestrian safety?;
- Behaviour: do pedestrians or motorists regularly misuse or ignore the addressed facilities?;
- Construction: have the effects of construction on all pedestrians been assessed adequately?;
- School presence: is the safety of children in school zones adequately considered?

From road traffic accident analysis it is clear that on average about three-fourth of the pedestrian traffic injury crashes happen while crossing a road or bicycle path (CBS Statline: CBS manoeuvres 811, 812, 813, 821, 822 and 823 in: VBV, 1987; table 2 in CROW, 2006). The other fourth happens while walking along a road or walkway. Main factors regarding pedestrian crossing accidents are traffic volume and (actual) speed, whether or not there are traffic lights for pedestrians, road width and number of lanes top cross, conspicuousness and convenience of the road crossing for pedestrians (CROW, 2006/2014; Zegeer et al., 2002).

Falls
Falls also result from a chain of critical circumstances, but here traffic and the traffic environment plays a subordinate role; it is mainly a question of mismatch of psycho-motor abilities and physical environment conditions. In the Netherlands the majority of falls concern tripping and stumbling (43% in 2018), unspecified falls (32%), spraining (14%) and slipping (6%) (VeiligheidNL, 2019 on 2018 falls reported by Emergency Departments of hospitals). In at least two thirds of the accidents the quality of the footpath surface played a role. Other factors are walking abilities and needs, the functionality of the physical, social-normative, transportation and communication environments, and forgivingness of the environment.

Being kind of a new subject in W+S policy making, falls, stumbles and slips are not adequately covered in the selected overview and guidance documents; this thesis serves as an impetus for inclusion. In general the main factors of road safety and the Safe Systems principles also apply to falls, be it that falls are single accidents, where no moving vehicles are involved, and that it applies to the wider area of public space than road space, i.e. including spaces that are not accessible for moving vehicles.

Social or public safety
Social or public safety and security, or better: fear from threats, strongly relates to visibility and to less well-kept environments. Although mostly subjective, its impact on walking-or-not decisions is substantial. According to Kuitert & Maas (2017) and Luten (2011) combined most important requirements, related to basic fears are:

- well-arranged and clearly visible;
- 'Eyes on the street';
- Adequate (street) lighting after sunset;
- Clear what the place is for and for whom: are conditions unambiguous and is zoning clear, and is it (unique) accessible for the target group and not accessible/attractive for 'crooks'?;
- The environment is designed logically, so that the user can easily find her/his way;
- Facilities are undamaged, and clean and well-kept.

d. Where do the safety issues particularly occur?
Per encounter risks[341] of *traffic safety* are highest on rural roads (very few walkers and no separation or protection from fast moving traffic), main roads (motorised traffic volumes and speeds) and then particularly at intersections and places where relatively many pedestrian cross the road (where there are high traffic volumes, complexity and lack of predictability) and lowest on well separated footways and pedestrianised areas.

Contrary to traffic accidents, where pedestrian traffic crashes mainly occur on the carriageway, *falls* happen mainly on sidewalks, paths and other public areas where no wheeled traffic is allowed, and not so often while walking on the carriageway or while crossing.

Social or public safety and security issues mainly concern rather deserted and shielded paths and areas, where bystanders and traffic do not have good view on what happens on the footway.

e. When do the safety issues occur?
The number of *traffic accidents* strongly relates to normal human activity times, traffic volume and speed and visibility characteristics. At rush hours and at dark risks are higher (cf. Chapter 5).
Fall risks relate to walking exposure hours and road conditions (winter: slipperiness) (e.g. Den Hertog et al., 2013).
Social or public safety issues are almost completely related to lack of daylight and low activity hours, when very few people are around and surveying public space.

f. How can safety issues be remedied?
In this paragraph the above question is unravelled and answered in two sub-questions: 1) what kinds of improvement strategies can be followed, 2) what kinds of tools are available to remedy safety issues, and what (qualitative) arrangement requirements can be indicated? The latter question is subsequently dealt with for the assessment of safety issues, traffic safety issues, and social safety issues.

Improvement strategies
Like with accessibility issues, in principle safety issues can be remedied either reactively or pro-actively, or as a practical combination of both. So, as reaction on complaints and/or clear signals from the media, research or partners, or, through planned dedicated inspections, accessibility audits and other kinds of explorations, and preferably in partnership with use groups and in a cascade-like approach to solving issues found, where site and person or special groups focussed measures are positioned within broader tactical and strategic policy frameworks and conditions[342], and where technical/engineering measures are matched with education, communication, empowerment, legislation and enforcement (CROW, 2014; ITE, 2006; Turner et al., 2006). In the end the latter approach can be expected to warrant safety best. In line with this idea, Walsh (2012) pitches lessons learned from evaluating local policies and practices:

[341] Although no concrete exposure data are available in this respect it is generally known that there are very few walkers along rural roads, and that crossing main roads is much more risky than crossing residential roads.
[342] Cascade approach: deal with proximity (reachability) -> deal with network issues > deal with operational aspects (Hendriks et al., 1998).

- There is no one universal approach to pedestrian safety;
- At all of the studied pedestrian safety projects high-level policy guidance played an important role in setting the trajectory of departmental or agency action';
- At each of the studied locations design guidance played a critical role.

The question of how safety issues can be remedied also concerns what tools providers (in principle) have to detect, assess and solve W+S accessibility issues and what minimum requirements should apply. In the following paragraphs scoping research results on tools and minimum requirements regarding detection and assessment of road safety issues, and for solving road safety, falls and social safety issues are presented.

Tools for detection and assessment of pedestrian safety issues
In the selection of overview and guidance documents several kinds of sources and tools, covering pedestrian traffic safety and social safety, were dealt with:

- Complaint desks (e.g. Voetgangerspunt.nl [Utrecht, 2017]; New Zealand Land Transport, 2009; Victoria Walks, 2013; Walsh, 2012);
- General road safety databases and applications (e.g. police road accident reporting databases and dedicated road accident applications (e.g. https://www.via.software/);
- Pedestrian road safety audit tools, including causes of traffic safety, falls, and pedestrian security (e.g. Nabors et al., 2007 comprising a master prompt list, detailed prompt list and guidelines for audits on general aspects, streets, street crossings, parking and adjacent development and transit areas);
- Child safety checklists (e.g. Kips et al., 2007: KISS checklist regarding protection, walkability, cyclability, freedom of movement, perception value and value for play);
- Social or public safety measures checklist (e.g. Luten, 2011: checks regarding visibility, clarity, accessibility and attractiveness).

With regard to falls no checklists or tools were found, apart from national Walk-In clinics and hospital admittances databases.

Tools and minimum requirements for solving traffic safety issues
Pedestrian traffic safety is rather comprehensively covered in overview and guidance literature. Issues that came about are:

- *Land use and network planning*
  Regarding the relation between land use and traffic safety only one tool was found: the so called Conflictogram approach (Methorst, 1995). This tool was developed to, on a neighbourhood level, calendar what the most frequent and risky trips on foot are and what land uses concerned do not match well with traffic. Main principles are to restrict accident risks by limiting walking distances to destinations that matter, by separating pedestrians from wheeled traffic as much as possible, and by not allowing shared use of public space at vehicle speeds above 30 km/h.
  Most of the guiding documents touch on network planning, aiming at area-wide speed reduction and/or traffic calming projects, and/or the establishment of an integrated walking network (Safetynet, 2009). Exemplary in this respect are Dutch documents on Sustainable Safety. Based on the classic Buchanan - Traffic in towns report (1963) Koornstra et al. (1992) presented a format for a mono-functional road network classification featuring three classes of roads: access roads, collector roads and trunk roads. On the class of access roads, i.e. roads in traffic calmed sojourning areas, vulnerable road users have primacy. On the

collector (=connections between neighbourhoods) and trunk roads (connections between cities) motorised traffic has primacy. Between 1997 and 2002 all roads in the Netherlands were assigned to one of the three road classes. Pedestrian travel is not allowed on collector and trunk roads except for on separated walkways.
With regard to network features three issues stand out: positioning of pedestrian crossings, public transport connectivity, roundabouts, and under- or overpasses.
Among others Schoon (2019) and CROW (2014) indicate that signalised pedestrian crossings are needed 1) when needed for vehicle traffic, and 2) with high volumes of pedestrians.
Zegeer et al., 2002 indicate that special attention should be paid to how people get from transit to their destination: no matter how convenient the trip is, people will not chose to go if they don't feel safe, even for short distances.
With regard to connecting collector class roads roundabouts are a well-known solution (CROW, 2012). E.g. Taylor & Damen (2001) however warn that a roundabout is disadvantageous for pedestrians. Walking is allowed in both directions, and this increases the risk of not being detected. Furthermore, there may arise misunderstanding about who has priority in case of right turning vehicle traffic.
Demetsky & Perfater (1975): warned that underpasses of high volume roads are undesirable. If there is a reason to cross, people will cross through heavy traffic rather than going through an underpass;

- *Geometric design*

  In (all) guidance documents geometric design of pedestrian facilities by far gets most attention. Speck (2012:10) states that "*the street is designed to give pedestrians a fighting chance*". Main aspects are road design, intersection design and traffic calming (e.g. Schoon, 2019; Zegeer et al., 2002; Wegman & Aarts, 2005). Generally there is a strong focus on crossing treatments. E.g. in the Australasian Pedestrian Facility Selection Tool (Abley et al., 2018) design options are related to exposed crossing distance, estimated pedestrian crossing time (exposed) and total peak hourly vehicle flow. Design options are: no facility, platform, kerb extension, median refuge, platform and kerb extension, kerb extensions with median refuge, and grade separation. Main considerations for the positioning of pedestrian crossings are: 1) the crossing must be positioned in a logical pedestrian route, 2) zebra or more advanced arrangements are needed only if traffic *and* pedestrian volumes are high, 3) conspicuousness of both traffic and pedestrians, 4) crossing distance in one go no more than 2 lanes, otherwise a refuge is needed (e.g. Schoon, 2019; CROW, 2014; New Zealand Land Transport, 2007);

- *Signs, markings and signals*

  Signs and signals are meant to guide vehicular and pedestrian behaviour, and should match geometric design. Usually signs, markings and signals have a legal basis (e.g. in the Netherlands 'Reglement Verkeersregels en Verkeerstekens' = 'traffic code') and should be applied as ordained;

- *Lighting*

  E.G. New Zealand Land Transport (2007:148-151) has a special section on lighting the pedestrian network. Functions of lighting are to illuminate '*potential hazards so pedestrians can avoid them'*, to be able to '*read signs'* so pedestrians can '*orient themselves'*, to impact '*feelings of personal security and comfort*, to enable *drivers to see pedestrians and thereby* improve *their safety'*, to '*enhance the walking environment'*, to make the '*network continuously available, not just during* the *hours* of daylight' and to encourage pedestrians '*to use certain routes over others'*;

- *Road management, maintenance and repair*

  All pedestrian facilities require adequate management (e.g. CROW, 2014; New Zealand Land Transport, 2007; Turner et al., 2006). The documents point out that lack of management and maintenance can result in un-usability for pedestrians, obstructing their movement, or worse: forcing them to make use of the carriageway and putting them at risk. It can also be a deterrent for walking;

- *Traffic management*

  Traffic management aims at controlling flow and vehicular parking. Traffic management directly and indirectly affects pedestrian activities and movement. As an instrument, pedestrian traffic lights are installed to control pedestrian crossing behaviour and minimise their risks in traffic encounters. Special attention should be paid to conspicuousness of pedestrians, equal treatment in the phasing diagram, and risk of non-compliance. By systematically dealing pedestrians with (unreasonable) long waiting times, they are stimulated to negate red lights, increasing their injury risk. Parking management can affect both pedestrian visibility and pedestrian behaviour by obstructing their walking routes;

- *Education, training and communication*

  Safety of vulnerable groups (children, elderly, impaired persons) can be enhanced by endowing them with strategies and competences to cope with encounters with vehicular traffic through education, training, and communication. Such tools can also be applied to teach drivers to respect and carefully approach pedestrians. Unfortunately most educational, training and communication efforts are not evidence based and/or scientifically evaluated (Twisk et al., 2014). Education, training and communication is mostly directed to follow formal traffic rules whilst habits play an important role in moving about and in encounters. More attention should be paid to this fact;

- *Legislation and enforcement*

  New Zealand Land Transport (2019:10) writes that *"legislation and enforcement include acts of parliament, as well as regulations made by individuals or organisations to whom parliament has delegated this power"*. Enforcement of traffic rules with regard to pedestrian behaviour in public space and behaviour towards pedestrians (e.g. 'tort' or wrongful acts) are consigned to the police; rules with regard to other uses of public space (e.g. regarding greenery, placing billboards, building activities) with consequences for pedestrian traffic safety generally are issued and consigned to be enforced by licensing authorities and inspection authorities like city management and BOA's (=extraordinary investigators in governmental service). Schoon (2019:19) concludes that '*the highway code should be rewritten to place greater emphasis on the multiple use of streets, rather than mainly vehicle movement*';

- *Other measures*

  Other tools that came about through the selection of overview and guidance documents and scoping were 'safeguarding the school environment' (Zegeer et al., 2002), the establishment of an (municipal or n.g.o. serviced) emergency number (e.g. Burgerpanel Rotterdam, 2018), and the promotion of personal equipment (e.g. retro-reflection bracelets[343]).

[343] safety bracelets are available from a number of shops on the internet e.g. https://www.internet-sportandcasuals.com/en/outdoor/on-the-road/reflection-bracelets/

Tools and minimum requirements for solving fall issues
Although no dedicated guidance on controlling fall risks was found in the selection of overview and guidance documents, based on accessibility guidance and contacts with VeiligheidNL the following tools can be indicated:

- *Geometric design*

  In the Caltrans (2014:8-9) document on Temporary pedestrian facilities, based on the Americans with Disabilities Act Accessibility Guidelines some relevant footway design and maintenance aspects can be identified: 1) the surface should be smooth and continuously hard, 2) discontinuities in the footway, such as sharp edges, or grate-openings, should not exceed 1/4 inch [0.65 cm]; higher edges should be beveled or rounded at a maximum of 2:1 or flatter, 3) opening (joints, gratings) should be less than 1.25 cm, 4) cross slope, inciting disbalance, should be less than 2 percent, 5) stairs should be avoided as much as possible; if not avoidable handrails are necessary;
- *Footway surface management, maintenance and repair*

  To prevent fall incidents a reactive 'beep' system regarding discontinuities in footways is not good enough. Active inspections in high risk areas (where relatively many elderly are to be found), particularly at and near building sites, are more appropriate (Rational Road Management);
- *Education, training and communication*

  Because of the strong increase in number of fall incidents and injuries VeiligheidNL developed approaches to fall prevention. Such approaches need to be promoted and applied in high risk groups such as elderly women;
- *(Promotion of) personal equipment*

  In Sweden, where winter conditions are quite severe, an increasing share of the elderly use personal anti-slip devices (Berggård, 2010). These devices are proven to be effective. Promotion in less wintery countries like the Netherlands is probably more difficult, as awareness of risk is associated with real winter conditions;

  A new kind of devise is a hip-placed fall-activated airbag[344];
- *ICT*

  Information and communication technology related tools can expected to be helpful regarding emergency calling, incident notification, and incident monitoring purposes.

Tools and minimum requirements for solving social safety issues
The below tools and requirements are mostly drawn from Luten (2011) and Kuitert & Maas (2017), but other guidance documents that deal with social safety are CROW (2014), Speck (2012), New Zealand Land Transport (2007), DETR (1999) and Alexander (1977/1995). From these documents the following tools and indications of requirements are drawn:

- *Town planning and architecture*

  Town planning and architecture can create good quality environments and thus affect both pedestrian densities and 'natural' surveillance and the 'threat' of being detected as a 'crook' e.g. from windows looking out on the streets and adjacent cycle paths and footways (e.g. Kuitert & Maas, 2017; Speck, 2012; Luten, 2011; DETR, 1999; Gehl, 1978; Jacobs, 1961);

[344] see for example Hip'Safe advertisement: https://www.youtube.com/watch?v=payFUAQbjXE

- *Transport and traffic planning*

  E.g. New Zealand Land Transport (2009) indicates that lateral separation from traffic can increase feelings of unsafety and insecurity, because then there is no 'natural' surveillance towards the footway. In this regard pedestrianisation and shared use of paths by bicyclists also increases 'natural' surveillance (e.g. CROW, 2014; Turner et al., 2006, DETR, 1999). '*In rural areas quiet routes and Greenways are developed, but there is a potential conflict between the need for quiet and the fear for isolation and fewer opportunities for informal surveillance'* (DETR, 1999:92);

- *Landscaping, and public space management and repair*

  Greenery and bushes should not shield pedestrians (e.g. Luten, 2011). Environmental quality is a key issue in pedestrian security. The walking environment should be clean, undamaged, unobstructed and free of graffiti (Luten, 2011; Kuitert & Maas, 2017);

- *Lighting*

  Proper public lighting at dusk and dark is essential for detection of potential threats and misuse of public space (e.g. Schoon, 2019; CROW, 2014; New Zealand Land Transport, 2009). According to New Zealand Land Transport (2009) studies have shown that pedestrians prefer lighting that mimics daylight; low-pressure sodium lights have a high level of colour distortion and should be avoided, and lighting at underpasses requires specific attention: there should be a bright appearance (New Zealand Land Transport, 2009);

- *Surveillance*

  DETR (1999:92) indicates that on-street assistance through 'representatives' or wardens can '*guide, assist and reassure pedestrians, especially those unfamiliar with the area'*. Other instruments are CCTV surveillance and Help Points;

- *Legislation and enforcement*

  In the UK the exemplary Crime and Disorder Act 1998 *"places a statutory duty on local authorities and the police to produce in partnership a strategy for tackling crime and disorder in their area. It also presents an important opportunity for the personal security concerns of pedestrians to be addressed as part of this strategy."* (DETR, 1999:92);

- *Campaigns*

  DETR (1999:91) indicates that walking promotion campaigns should not only focus on the positive features of walking, but also address personal security, as otherwise '*the success of some campaigns will be jeopardised'*. Safer route to schools campaigns could also be helpful.

g. Policy relevance

The care for traffic and public safety and security is generally seen as primary public task. The magnitude of accident and social costs as well as the needed equity are compelling arguments for policy activities. From many studies it has become clear that investing in safety brings (much) more than it costs (e.g. Van der Linde & Van Donkelaar, 2012; SWOV, 2011; Wesemann & Devillers, 2003).

4.4.7. Arrangements for W+S convenience opportunities

4.4.7.1. Introduction

In the previous section basic arrangements, focussing on the needs and abilities of captive pedestrians, i.e. those who do not have a choice but to walk or stay at home, were central. The idea is that if requirements for basic arrangements are adequately met, both captive and non-captive pedestrians can be assumed to be *enabled* to relatively safely reach and access destinations that matter to them. However, if all requirements for basic arrangements are met, it does not necessarily mean that people are satisfied with how convenient and comfortable the arrangements are. They might be dissatisfied with certain aspects even to the point that they rather not walk or use certain walking facilities. It is more about an acceptable level of service than pure usability. Satisfaction is about suitability in relation to one's own (group) standards. While basic arrangement make walking doable and feasible for those who do not have a choice, convenience is rather measured from non-captives standards. They expect better and nicer materials, and more absolute safety, cleanliness, comfort, ease of use. In this regard attention is needed for example for possible inconvenience from having to wait for oncoming pedestrians or cyclists at a local narrowing of the footway or having to wait several minutes for a traffic light or having to cross a busy road to access a building, or the discomfort from having to stand in the rain while waiting for the bus.

The current subsection focusses on preventing or taking away inconveniences, discomforts and irritations. While regarding basic W+S arrangements captive pedestrians are the key for determining requirements, for W+S convenience arrangements non-captives, i.e. those who have a choice whether or not to walk, or go by other means, are the key group, more or less regardless what the interests of providers are. W+S convenience arrangements do not (yet) target to persuade people to walk more and more often, but simply to facilitate both captive and non-captives who like to walk and sojourn in public space, without expecting some kind of reward or nicety. The latter will be dealt with in the next Subsection 4.7.8 on tempting W+S opportunities.

Like in the previous subsection on basis arrangements requirements, the scope is limited to *functional* system[345] and system component requirements (i.e. why what should be arranged). Indications will be given of what this means for design specifications (form). Detailed design requirements can be found in dedicated guides, and whenever possible reference will be made to (relatively) recent publications in this regard. As this subsection concerns convenience system requirements, reference will be made to an optimal level of services in functional terms with regard to non-captive pedestrians, the fit and healthy pedestrians as the key pedestrian target group. It is assumed that this possibly also takes care of some inconveniences, discomforts and irritations experienced by people with walking impairments, children and their parents or guardians.

In the following paragraphs first general scoping results for W+S convenience arrangements and next pointed results concerning requirements for W+S convenience arrangements are presented with regard to suitable convenience and to comfort. The texts follow the general scheme of answering the six topical questions and indicating W+S policy relevance, particularly consequences of non-compliance and what the most sensitive groups are.

[345] Cf. Langen (2000): take care of inconsistencies regarding the trinity FUNCTION - USE - SHAPE.

4.4.7.2. Some general considerations

In this sub-subsection a number of general considerations with regard to W+S convenience opportunities are put forward: lack of attention to the pedestrians' irritations, relation between inconvenience, discomforts, irritations, abilities and context.

Difference between convenient and comfortable?

While drafting this subsection a theoretical distinction was made between *convenience* and *comfort*. If not adequate, both can arouse feelings of discontent, irritation or even anger. Oxford Dictionaries define convenient as *fitting in well with a person's needs*, *activities, and plans, involving little trouble or effort, situated so as to allow easy access to, and helpfully placed or occurring*[346]. This should translate to being a quality of facilities that is experienced as indispensable and/or normally available, directly enabling walking and sojourning activities; when requirements are adequately met, this generally does not lead to feelings of satisfaction, ease, or conviviality. It is just experienced as okay, in order. It does not stand out.

Comfort, on the other hand concerns "*a state of physical ease and freedom from pain or constraint"*, and *as "things that contribute to physical ease and well-being"*[347]. Contrary to convenience, it generally does incite feelings of easiness, satisfaction, conviviality, or even delight.

Although theoretically the difference can be made, in practice this is difficult. In most concrete policy development situations there is not enough information on irritations and comfort sensations of (potential) pedestrians to go on. Furthermore, the distinction is gradual; while drafting this subsection it was found that requirements are similar to a large extent. Therefore the distinction is abandoned.

Lack of attention to the pedestrians' irritations and comfort sensations

From analysis of the selection of overview and guidance documents it appears that the great majority of documents do not explicitly refer to pedestrians' experiences and sensations, likes or dislikes, let alone display what irritates them. In general guidance appears to be based on either evidence on associations of the 'objective' travel patterns, gender, age, abilities, safety experience with physical environmental features or 'professional judgement', i.e. the expert's view or consensus among experts (see e.g. New Zealand Land Transport in their review of literature on the pedestrian experience (2019). Only two of the documents, viz. Ausserer et al. (2013), and Risser (2002), referred to original consultation of pedestrians on their likes and dislikes while regarding walking conditions. Both Auserer and Risser did their research in Austria (particularly Vienna). There are some other sources taking a broader perspective (viz. citizen's perspective in a neighbourhood setting) like the Dutch CBS Safety Monitor, which also asked about irritations in public space, as a resident in their neighbourhoods. In other words, there is not much evidence to start from regarding the pedestrian's irritations.

Like in campaigns, surveys tend to keep it pleasant and rather ask questions in positive terms (satisfaction, and not explicitly dissatisfaction or irritations). With regard to personal security (social safety) DETR, 1999:91 argued that '*the effect of a campaign will be lessened or even jeopardised if the* [actual] *impact of fear for personal security is not recognised and addressed'*. Although fear is a stronger emotion than irritation, it can be expected to hold true for irritations as well.

[346] https://www.lexico.com/en/definition/convenient, accessed 25-10-2019
[347] https://www.lexico.com/en/definition/comfort, accessed 29-10-2019

Relation between inconvenience, discomforts, irritations, abilities and context

As said before, pedestrians are a (very) heterogeneous groups with regard to needs, abilities, and emotions. In general it can be concluded that issues regarding reachability, accessibility and safety are commonly shared, but are a serious problem for someone with a mobility impairment or disadvantage, while often no more than a (minor) inconvenience, discomfort or irritation for non-captive pedestrians such as healthy and fit adults. But even this group is heterogeneous. It concerns people who have an alternative for door-to-door walking (main mode walking) as well as those who do have an alternative for walking to and from other modes (sub-mode walking); the walking population varies with local, demographic and functional conditions, lifestyles and preferences. Also, operational conditions vary over time and space: the weather, traffic volume and composition, time pressure, emotions, etc. Consequently the factual W+S requirements are context sensitive, can vary within broad margins, and cannot be cast in concrete. Therefore any W+S policy project on convenient W+S arrangements should start with taking stock of the actual (potential[348]) walking population and what kinds of walking conditions cause inconvenience, discomfort and/or irritation W+S arrangements should then match the requirements of the key group of (potential) pedestrians, e.g. residents, tourists, shoppers, strollers, holiday makers, fair or festival attendants.

4.4.7.3. Findings with regard to W+S dislikes and irritations:

This thesis assumes that the research results regarding walking affinities and dislikes from Ausserer et al. (2013)[349] and Risser (2002), largely confirmed by the more general Safety Monitor results (CBS Statline website, 2018) are universal.

Ausserer and Risser both found that about 60% of the population like to walk, 20-25% do neither like nor dislike it, 13% do not favour it at 6% actually dislike walking. In other words, about 15-20% of the population will be difficult to persuade to walk more and more often.

According to Ausserer (2013) matters that keep people from walking are the following dislikes or irritations:

- cars (speed, exhaust and noise, violations of right of way) 46%;
- traffic lights (waiting & crossing times) 17%;
- dog excrements (on the footway) 14%;
- infrastructure (narrow & shared paths) 13%;
- cyclists (on the sidewalk) 10%.

Wishes of interviewees are:

- Less car traffic (31%: Ausserer et al., 2013);
- More green areas in public space (28%: Ausserer et al., 2013);
- Considerate car drivers, slower car traffic (22%: Ausserer et al., 2013);
- Better enforcement and surveillance (Clifton & Livi, 2004);
- Facilities for sitting and sojourning (20%: Ausserer et al., 2013);

[348] This means that insights must be gained about people who want or need to walk, but are somehow restrained from doing so.

[349] Survey carried out in Vienna, 618 street interviews, 18 in-depth interviews and 2 focus groups sessions in 2013.

- Well illuminated sidewalks at night - for security (18%: Ausserer et al., 2013; Clifton & Livi, 2004);
- Clean sidewalks (17%: Ausserer et al., 2013; Clifton & Livi, 2004);
- More public toilets (13%: Ausserer et al., 2013);
- Shorter waiting times at crossings (11%: Ausserer et al., 2013; Clifton & Livi, 2004);
- More possibilities to cross the street (8%: Ausserer et al., 2013; Clifton & Livi, 2004);
- Wider sidewalks (5%: Ausserer et al., 2013; Clifton & Livi, 2004);
- More trees (Clifton & Livi, 2004);
- More bus stops (Clifton & Livi, 2004);
- More stores (Clifton & Livi, 2004).

From Risser (2002) and New Zealand Land Transport (2019:19, citing Bean [2006] and Living Street [2016], Sugiyama et al. [2008]), RAUHALA ET AL. (2003), and DfT (2018)[350] additional dislikes and irritations, not covered above under Basic Opportunities and the above wishes of interviewees, can be drawn:

- Weather (rain, wind, snow, ice, heat, cold)(Bean, 2006);
- Topography (hilly) unpleasant or challenging (Bean, 2006);
- Aesthetics, such as retail design (Bean, 2006);
- Poor design (of the infrastructure; lack of facilities (toilets, places to rest)(RAUHALA ET AL., 2003);
- Lack of comfort, depending on surroundings, the situation and the individual, obstructions (advertising boards, wheelie bins, parked cars: put pedestrian at risk by forcing him/on the street); significant predictors of the time spent outdoors for 65+ are '*presence of seats, toilets, cafés and shelters in neighbourhood open space'*; accessible toilets too small for wheelchair and often locked; footpath should be '*clean: no mud, splash, dog'* mesh, '*trash or litter on the pavement; older pedestrians'* have strong needs for resting seats and meeting places (New Zealand Land Transport, 2019:22, 44);
- Attitudes and social climate: i.e. '*individual's attitudes and emotional response'* to the different travel modes (the imago of walking: Walking is considered as 'alternative', 'other' or 'for the poor'), lack of respect towards walkers (Risser, 2002) and mutual understanding between all road users (DfT, 2018); wish for '*higher levels of compliance with law and rules of the road*' (DfT, 2018:21);
- Social (status) and social-economic barriers preventing walking to school (New Zealand Land Transport, 2019);
- Lack of participation in planning for W+S improvements (ITE, 2006).

4.4.7.4. Arrangements Requirements for convenience and comfort

a. What general issues should set the stage for optimal W+S convenience arrangements?

Convenience and comfort W+S arrangements relate to the degree to which walking and sojourning is easy to do, and to how suitable arrangements are in relation to one's needs and abilities in terms of risk of irritation, damage or injuries, and one's sensation of comfort.

[350] DfT, 2018:4: *"ask people what they want from the transport system and they will say convenient, clean, effective and safe travel, with less congestions and better air quality"*

In relation to the indicated (major) dislikes and irritations, convenience concerns are:

- Encounters with other road users (congestion, car drivers, cyclists) (e.g. Schoon, 2017; Risser, 2002);
- Pathway conditions: clean width, cleanliness, state of repair, obstacles (e.g. Schoon, 2017; Kuitert & Maas, 2017);
- Crossing facilities (availability, adequacy) (e.g. CROW, 2014; Turner et al., 2006);
- Availability (and adequacy and cleanliness) of resting and toilet facilities (e.g. Maag Lever Darm Stichting, 2018; Kuitert & Maas, 2017);
- Illumination during dusk and darkness (e.g. Schoon, 2019);
- Topography - hilliness (e.g. New Zealand Land Transport, 2017);
- Retail availability and aesthetics (e.g. Kuitert & Maas, 2017;
- Connection to public transport (e.g. CROW, 2014).

Project for Public Places (2018[351]) discerns five indicators for comfort:

1. *Body language*

   "A person's posture slackens. Their pace slows and even their eye movements may change, as they shift gears from moving through a place to participating in that place."
2. *All people at all times*

   "A truly comfortable space is comfortable for people of all ages, genders, and abilities. And if it's not, the people most affected will simply not be present." This features a place to sit, well located and universally accessible.
3. *Affection*

   'When people are able to relax in a public space, they also relax around one another. That is why proximity, sharing, touching, smiling, eye contact, and public displays of affection are not only good indicators of fondness, but reliable indicators of comfort, too."
4. *Improvisation*

   "On one hand, more spontaneous social interactions and activities happen when people feel safe, welcome and comfortable. On the other hand, improvisations can also be a sign that something is lacking in a space."
5. *Habitual Use and Domestic Behaviour*

   "...bare feet are one of the best indicators of a comfortable space. That is because people treat great public spaces like another room in their house."

The latter indicator is further illustrated by Speck (2012) who sees building and landscaping as a means to shape urban streets into 'outdoor living rooms'. The City of Rotterdam applies a City Lounge Concept to make the city centre more attractive. CROW (2014:46) indicates some important characteristics of 'comfort':

- Minimal number of level changes in a route (thresholds, curbs, steps and stairs, bridges);
- Good air quality and little noise pollution;
- Sufficient capacity of pedestrian facilities, not too busy;
- Good illumination (of walking route and surroundings);
- Protection against (undesirable) weather influences.

[351] https://www.pps.org/article/get-into-your-comfort-zone, accessed 30-10-2019

b. Which groups of (potential) pedestrians are normative?

Moura & Cambra (2017) found clear differences in walkability scores for different groups. What is adequate for mid-aged people is not necessarily good enough for senior or impaired; effort (hilliness) and pavement quality are more important for seniors. Because of their limited abilities and resilience it can be expected that in general the elderly, and impaired persons experience most inconveniences and/or discomforts while walking and sojourning in public space. On the other hand, non-captive healthy and fit adult, who are less dependent on walking environmental qualities, are most likely to draw consequences from their irritations about experienced inconveniences and choose not to walk but use alternative transportation, go somewhere else or do something different. As this conflicts with the aim to let people walk more and more often, they can be considered the key group.

Inconveniences can be issue, context and group specific. For example for tourists the unavailability of toilets in public space can be very irritating. Currently urban tourism is increasingly taking advantage of the development of the 24 hour city. Being able to access (public) toilets is becoming important for entertainment and nightlife industry. It may even become an attraction in its own right (Hall et al., 2018). Another example is street cafés, which are popular in youngsters, but can be irritating for elderly persons (Scholten, 2014).

c. Why do the issues occur? What factors and mechanisms affect the experience of inconveniences?

Most of the pedestrians' irritations and discomforts are related to shortfalls in the physical environment, and organisational and institutional issues. Comfort can be seen as a special attribute of convenience, matching a person's state of physical health, abilities and mindset in a relaxing, reassuring way. In fact, in the analysed overview and guidance documents in most of the cases 'comfort' is not clearly defined and often used as a synonym of 'convenience'. Discomfort occurs when conditions evoke pain and anxiety from muscle overload, overload of the senses (eye-sight, hearing, touch, smell, balance) or the brain's processing capacity (too many impulses, too complex patterns).

From analysis of the selected overview and guidance documents it appears that traffic and other interests (e.g. commerce, retail, entertainment) take the lead in walking and sojourning investment and intervention choices (e.g. Global Designing Cities initiative, 2016; CROW, 2016; CROW, 2014; Walsh, 2012; ITE, 2006). Attention to walking and sojourning is sensitive to political movements. It appears that pedestrian interests and interests of stakeholders do not always run parallel. The pedestrian is only one of the many interests that need to be satisfied. Priorities are generally directed by expected gains and benefits compared to the investments and costs, in a context where walking is not a primary concern. Attention for walking and sojourning in public space competes with attention for other modes, where car use and public transport are dominant, and the bicycle is a rising star, at the expense of pedestrian space, convenience and freedom of moment, and safety. Policy attention evolved to a general subordination of the pedestrian in investments, economy, power basis, public space and traffic policy, health, and infrastructure, and policy making, investment, public space and traffic management, and maintenance of pedestrian facilities (Risser, 2002). This subordination shows in many ways: land use planning resulted in longer distances; other modes of transport are prioritised; lack of knowledge and expertise regarding walking and sojourning in public space; tolerance of obstructions of pedestrian movement; difficulties in quantifying changes; difficulties of '*justifying walking schemes through 'traditional' economic criteria, businesses paying mileage travel allowances to car drivers for very short trips, lack of research*',

insufficient resources allocated to walking schemes, and interaction between these elements (New Zealand Land Transport, 2007:22) [352].

d. Where do the convenience issues particularly occur?

Walking and sojourning convenience and comfort can be under pressure almost everywhere. Inconveniences occur particularly in high density areas like inner cities, where there is a lot of competition for space and right of way. For example in Amsterdam and other larger Dutch cities like Utrecht, pedestrian space has been taken over by facilities for bicycle use, leaving only the barest minimum sidewalk width and rights of way available for pedestrians (Van der Veur, 2013). Accommodating larger flows of pedestrians (e.g. more than 25 passages per normative hour per day) is virtually impossible without stepping into the carriageway. Particularly crossings of traffic arteries are associated with relatively long waiting times. Other locations where inconveniences are paramount are building sites, where temporary building activities, materials and vans block the footway, with little respect for the freedom of movement and safety of pedestrians.

Discomfort often relates to a person's limits of physical endurance (e.g. walk is too long or strenuous because of slope or hilliness), but also in (very) open spaces and where walking and sojourning facilities are poorly or roughly designed, shaped and fabricated, offering little protection against weather extremes, pollution and nasty smells and sounds, extreme light, glare or darkness, and/or people and/or traffic in the environment are threatening or loud.

e. When do the convenience issues occur?

Walking and sojourning inconveniences can occur at any time of the day, but are most pressing at travel and shopping peak hours. In winter time snow and iced pavements can deteriorate walkability (e.g. Risser, 2002; Den Hertog, 2013).

In general discomforts are most pressing when the temperatures are outside comfort ranges (depending on how well one is protected), precipitation is cold (less than about 15 degrees Celsius), encountered materials are rough, sounds are loud, winds are strong, smells are repulsive, when lights are blinding or there is too little light to see properly, and/or encountered persons are intimidating (e.g. Schoon, 2019; Turner et al., 2006).

f. How can convenience issues be remedied?

In this paragraph the above question is unravelled and answered in three sub-questions: 1) what kinds of improvement strategies can be followed, 2) which tools are available for the detection of W+S convenience issues, 3) what kinds of tools are available for optimal W+S convenience arrangements?

Improvement strategies

In order to achieve that pedestrians are satisfied with the convenience and comfort of W+S conditions, at least basic reachability, accessibility and safety requirements (as indicated above) should be met. Non-captive pedestrians can be expected to be less tolerant to sub-optimal conditions, like only 90 cm clear footway width, having to wait for oncoming pedestrians or having to search for a spot to cross the street outside their line of travel. Because of their better physical condition they are also less susceptible to discomforts that the elderly and impaired persons experience. They will demand a higher Level of Service to be satisfied (and chose to walk and enjoy it) than captive pedestrians.

[352] In Chapter 6 more attention will be given to such processes (Cf. policies in Amsterdam and Utrecht).

W+S convenience and comfort issues are context and group sensitive. From the analysis of the selected overview and guidance documents it appears that, apart from for general accessibility and convenience requirements, there is no systematic overview and awareness of discomforts as a full-fletched key issue regarding the provision of W+S arrangements. Consequently little attention is paid to detecting and tackling W+S discomforts; the argument for minimalizing discomfort is seldom made. For achieving better (local, situational) standards it is therefore justifiable, effective and efficient to start improvement projects with actively exploring pedestrian experiences regarding discomforts, or explore in what situations physical effort, sensory input and complexity is outside tolerance ranges of key groups of pedestrians. Alternatively experts' assessment can be carried out to determine what inconveniences, why, where and when pedestrians can be expected to experience, in order to develop a dedicated set of interventions.

Physical endurance related discomfort can be limited by reducing exposure to strenuous acts, e.g. by shortening walking distances and reducing the number of level changes in a route (cf. CROW, 2014; New Zealand Land Transport, 2009); discomfort from overload of senses requires measures to limit their causes, protect the pedestrian from their unwanted consequences, or promote the use of protective devices (e.g. umbrellas, sunglasses, earplugs or hearing aids, ant-slip devices, gloves, pillows).

Tools for the detection of W+S convenience and discomfort issues
The best way to find out what inconveniences and discomforts pedestrians experience, is to interview them, preferably at home (this will include those who feel impeded to walk), on the street, in a focus group setting, or have them survey and score their most important walking routes. Although probably a number of municipalities and NGO's indeed do research on inconveniences, there are, apart from Ausserer et al. (2013) and Risser (2002), hardly any results publicly available. Such information can be useful for other policy actors, too.

With regard to inconveniences in the selection of overview and guidance documents a number of (experts) approaches are mentioned, e.g. CROW Walking routes quality measurements (CROW, 2019), the Australasian Pedestrian Facility Selection Tool (Abley et al., 2015), Leitfaden zur Qualitätsmessung des Fußverkehrs (Langen, 2018), Fußverkehrs-Checks / Fußverkehrs-Audits and checklists (Fuß e.v., 2017), the 7 C's approach (Moura et al., 2017), NutzerInnenbefragung (Ausserer et al., 2013), PERS (TRL, 2009), the RSA Pedestrian Road Safety Audit Guidelines and Prompt Lists (Nabors, 2007), KISS (Childstreet, 2006/2009).

With regard to assessment of discomforts that (groups of) pedestrians experience or fear, inhibiting them to choose to walk and sojourn in public space or enjoy the perspective of a nice walk, no tools were found. Abstracted from Gunnarsson (2001) potential issues are:

- The length or difficulty level of the walk;
- Weather conditions (rain, sun, wind, temperature);
- Inadequate design of facilities (roughness, hardness);
- Too much or too little light, or glare (sun, spotlights);
- The sound level, tone and distortion;
- Bad smells and pollution;
- Vibrations and other causes for imbalance.

Alternatively tentative experts' or common sense assessment can by carried out on the above subjects to determine what discomforts, why, where and when pedestrians can be expected to undergo, and what kinds of solutions might prevent or minimize discomforts and make conditions tolerable, or even better: pleasant, for a larger group of (potential) pedestrians.

Anyway, to acquire adequate knowledge about the distribution of discomforts amongst various W+S conditions, its causes, and tolerances of the most affected groups of pedestrians, more dedicated research is needed.

Tools and optimal requirements for W+S convenience arrangements
Most of the above assessment and audit tools also provide *solutions* for designated W+S convenience issues; there is a number of guidance documents that, without explicitly referring to causes of, or mechanisms behind discomfort, do take comfort into account. Examples are the exemplary Global Street Design Guide (GDCI, 2016), 'Prettige Plekken' (= 'Pleasant Places', Kuitert & Maas, 2017), and the comprehensive 'A Pattern Language' by Alexander et al. (1977; 1995). Apart from basic W+S requirements (dealt with above in Section 4.4.6) advisable convenience and comfort arrangements are found to be the walking and sojourning context, dedicated spatial structure (town planning) approaches, street design to direct and manage multiple uses of public space, directing irritating encounters, tackling detours, tackling an insubordinate position of the pedestrian, the role of parking of cars, clean widths of streets, landscaping, enforcement of rules, and information and communication technology applications. These themes are successively dealt with below.

Walking and sojourning context
The Global Streets Design Guide (Global Designing Cities Initiative (GDCI), NACTO, state that (2016:64) *"...context is a crucial, yet often overlooked, factor in designing streets. Densities, land uses, and travel characteristics can shift as the street traverses the city from one neighbourhood to another. Street design should respond to and affect the desired character of the public realm. As the need and uses along a street change, street designs should respond and adjust accordingly."*
The author agrees, but means that this probably is not only true for physical space interventions, but for all measures that focus on operational behaviour. Future prospects are also often overlooked.

Spatial structure approaches
Town planning helps to provide favorable contextual conditions for W+S comfort by taking weather, limits to endurance, potentials footway obstacles and sojourning characteristics into account. Preconditions for better comfort can be shaped by strategically positioning sources of air or sound pollution, e.g. down-wind positioning of polluting industry and sound pollution sources. By thoughtful orientation and shaping of street blocks and building characteristics with regard to the dominant wind direction, and wind breaking objects (walls, trees, hedges, fences) much discomfort from strong headwinds can be avoided (Kuitert & Maas, 2017; Bottema, 1999). Awnings can protect walkers against sun, rain and snow (GDCI, 2016). Shielded waiting facilities at Public Transport stops tackle potential discomforts (e.g. Schoon, 2019; GDCI, 2016; CROW, 2014).

Street design for multiple uses
Stores and other businesses need to be supplied with their merchandise. This usually happens on the sidewalk, blocking it. Discomfort thereof can be minimised by planning exchange spaces or buffer zones near the delivery points; a dedicated and confined frontage zone at the front of

shop and cafés, a dedicated and confine street furniture zone and a buffer zone next to the sidewalk (e.g. a cycle path, grass, greenery) against the driveway (GDCI, 2016:78). Separate freight networks (and back entrances) relief pedestrian discomfort at the front-end even more (e.g. GDCI, 2016).
With regard to convenient and comfortable street design GDCI advises to create bicycle facilities, and add seating, energy efficient lighting, organise transit, green infrastructure, provide street furniture and climate protection. Speck (2018) finds it important to make firm edges, not ever to allow front parking, and to enclose sidewalks with building fronts, use lighting to enhance urbanism, do not let megalomaniac architects make up the design your city.

Directing irritating encounters
One of the pedestrians' most important irritations concerns encounters with other road users, particularly abundant fast moving, noisy and smelly cars, inconsiderate car drivers, and cyclists on footways (Ausserer et al., 2013). Relevant design controls in this respect are design speed, traffic and pedestrian volumes, and functional road classification (ITE, 2006). Schoon (2019) advises against shared use of sidewalks with cyclists, particularly for the sake of convenience for elderly pedestrians. He also thinks that traffic practitioners are overconcerned about inconvenience for car drivers if pedestrians get priority at the crossing (by having a zebra or green phase priority).

Tackling detours
Other irritations concern detours (Taylor & Damen, 2001), which should be limited. Pedestrians appreciate shortcuts, e.g. halfway through a block, and need good connections to public transport (Speck, 2018; GDCI, 2016; Ausserer, 2013).

Tackling an insubordinate position of the pedestrian
Ausserer et al. (2013) conclude that infrastructure often lacks free space, is unclear and unsafe, and mirrors the subordinate role and position of the pedestrian in the road users hierarchy. People want to feel welcome: apart from having enough space, visually attractive elements are important. Topography (hilliness) can be a deterrent.
Following Jan Gehl, Transport for London (2008b:8) advises to '*create pedestrians streets and pedestrian priority where many people already walk to improve conditions for walking and city life, as well as reduce* [vehicle] *traffic'*. A good example is the 'streets of gold'-concept, where key walking routes to local attraction destinations are improved, including widening and improving footways, increasing pedestrian directness, revised and improved pedestrian crossing, measures to reduce speed and impact of motor traffic, de-cluttering of street furniture, pedestrian legibility and environmental enhancements, hard and soft landscaping, walking street audits, and legible London wayfinding.
Ausserer et al. (2013) point out that a lack of respect or be respected as a full-fletched road user, and discrimination can arouse both incertitude and irritation, and spoil the pleasure of walking. In driver education attention can be drawn towards the high need of pedestrians for safety. The social environment can support individual pedestrians to strengthen self-determination and independence.

The role of parking of cars
According to Speck (2012:76) '*street parking [...] plays an essential role in calming traffic and supporting mixed land use'*, and he advised to put curb (parallel or angled) parking almost everywhere. He thinks it can be the key to walkability, which needs to be designed properly. In the USA this may be true, but in The Netherlands, where space is scarce, the general idea is to limit street (car) parking in the old cities as much as possible (cf. Amsterdam, Utrecht), rather

use that space for walking and bicycle facilities (e.g. Gemeente Amsterdam, 2015; Gemeente Utrecht, 2012), and ask high fees for parking a car on the street and less in parking garages; parking regulation is vigorously enforced. In Amsterdam and Utrecht even bicycle parking is seen as an issue, to be solved by off-street parking facilities. In suburban conditions it is true (free) street parking is the norm, but even there local authorities sensibly set a limit to the ratio of parking places per home (sometimes less than one per home[353]). Although this may irritate car owners and users, residents generally can accept it; pedestrians are better off this way.

Clean widths of streets

In most of the guidance documents the importance of clean width, cleanliness, state of repair, absence of obstacles is stressed (e.g. Schoon, 2019; CROW, 2014, Turner et al., 2006). For many people (particularly the elderly) dog excrements and litter on the footway are a source of irritation; for the 25-45 year old parking problems, such as parking on the sidewalk, stand out (CBS Statline website, 2018).

To keep the clean width of footways adequate, the walking infrastructure needs to be surveyed regularly on obstructions, such as light and sign poles, street furniture, waste bins, advertisement boards, overhanging greenery and expanded hedges, puddles and mud, litter, dog mesh, and parked cars, vans and bicycles. Municipal reporting points can also be a good source. The found deficits need to be dealt with shortly after these have been reported, or even better: dealt with in the course of regular street service. Many people find the absence of resting facilities and (working) toilets irritating. For todays' tourism this can be a serious lack (Hall et al., 2018; GDCI, 2016). Resting places (seating) and sanitary facilities need to be cleaned on a regular basis.

Landscaping

Landscaping, i.e. designing and managing the streetscape, is an important means to make streets attractive and comfortable. For example Speck (2012/2018) and GDCI (2016) stress the importance of green infrastructure, climate protection and the role of trees in fitting up streets and places. Trees offer guidance (when put in as lane), protection against a burning sun, rain, snow and dampen wind and sounds; seating and waiting under trees is preferred by many people.

Comfort of street furniture and handholds depends on its lack of roughness and insensitivity to conduct heat or cold. Surfaces should be smooth and be coated in such a way that seating and handgrips do not feel (very) hot or cold.

An important favourable property of greenery is that it absorbs rain water and dampens sound and thus improves comfort.

Light and Lighting

After sundown lighting is important for walking convenience and comfort. Schoon (2019) and Turner et al. (2012) indicate that illumination at night is crucial for feeling safe and for orientation. In many cases however light poles reduce clear footway space, often below the width needed for walking together. In some cases this can be remedied by suspending the fixtures. GDCI (2016) guidance for lighting design concerning illumination of footway and sojourning places for comfort says that energy efficient lighting is preferred, and that light poles should be low compared to carriageway lighting, and be between 4.5 and 6 meters, whereas spacing between the poles should be 2.5 - 3 times the height of the pole and light cones should slightly overlap. Both sun and artificial light can cause discomfort if low sun rays or light beams

[353] CROW ASVV 2012 guidelines advises 2.7 parking places per privately owned free standing home down to 1.5 for a small flat. Den Haag sets limits on 0.5 parking place per small flat (< 70 m2) up to 1.4 for large homes (>160 m2) (Gemeente Den Haag, 2011:19)

shine direct into a person's eyes (glare). In such cases personal protection measures (sunglasses) are most obvious.
In some specific cases personal protection and safety devices can relief discomfort and anxiety: e.g. sunglasses when low sun glare; anti-slip devises at snow and ice on pavements; fluorescent and retro-reflection vests when walking, running or jogging at dusk and dark. Public and social media can be enabled to alert people to acquire and use such personal devises for their own safety and comfort.

Enforcement of rules
The Global Designing Cities Initiative (GDCI, 2016) advocates to enhance enforcement of behavioural rules towards pedestrians, i.e. meeting right of way rules at zebras and straight-on walkers and parking rules.

Information and communication technology
Turner et al. (2006) indicate that Information and Communication Technology measures that can help to lessen walking and sojourning inconveniences are in roadway warning lights (like flashing LED-lights to draw drivers' attention to crossing pedestrians at zebra crossings as well as informing pedestrians that they can cross), animated eyes display, countdown signals, and detection devices (microwave, infrared or camera detection; illuminated push buttons).

g. Policy relevance
Taking care of W+S convenience and comfort for both captive and non-captive pedestrians is important to get more people to walk more, and keep and attract visitors, and thereby supporting the (local) economy and well-being of citizens. If W+S facilities are convenient and comfortable, people are likely to walk more and more often. W+S convenience and comfort arrangements aim to secure that walking is adequately supported and promoted. Besides proper facilities that are evidently well kept can be expected to support and improve confidence in local authorities. Involvement, co-operations and partnerships with NGO's and (local) interest groups can intensify the positive effects.

4.4.8. Arrangements for tempting W+S opportunities

4.4.8.1. Introduction

The previous subsections dealt with *Basic* requirements and *Convenience* arrangements, respectively focussing on facilitating the needs and abilities of captive pedestrians (those who do not have a choice but to walk or stay at home), and on preventing or taking away inconveniences, discomforts and irritations (Cf. Van Hagen, 2006: dis-satisfiers). This subsection concerns arrangements for tempting W+S opportunities, i.e. the third group of opportunities that focusses on delivering satisfiers (Cf. Van Hagen, 2006). Both basic and convenience arrangements concern reactive approaches, aiming to remedy system deficiencies. When such requirements are adequately met, in principle demand for walking and sojourning functionality is tended for. This may suit the functional needs for utilitarian walking nicely, particularly daily and habitual walking, but it can still lack attraction for walking for the sake of it, i.e. recreational walking, and not be a reason enough for sojourning (including children playing) in public space. Tempting W+S arrangements, as a positive contra-template regarding attitudes and preferences, can fill this void.

Tempting W+S arrangements aim to *persuade* more people to walk more and more often. Recreational walking will only arise if walking and sojourning is expected to be smooth,

pleasant and/or rewarding. The class of tempting W+S arrangements (pleasure and fun) embraces recreational walking and sojourning in public space or adjacent recreational facilities (cafés, restaurants, clubs, cinemas, theatres, shops, markets, playgrounds etc.).

Persuading people to walk or come to baiting places and attractions takes special effort, and generally is not directed at the general population, but place, time and target group bound, e.g. for special events, for special groups of people (music lovers, tourists, day trippers etc.), having special interests and preferences; it rarely concerns the poor, vulnerable, impaired or disadvantaged, who have little to spend or need special arrangements. Consequently requirements regarding basic and convenience W+S arrangements are less stringent. Besides, a number of health programs successfully get more people with (former) health problems on their feet (cf. Van der Laan, 2018).

In the following paragraphs first general scoping results for tempting W+S arrangements are presented. Next, to give foothold for guidance on developing tempting W+S arrangements, a tentative overview is given of what people like about walking and sojourning in public space. The subsection is concluded with a paragraph on what tempting W+S arrangements encompass.

4.4.8.2. Some general considerations

Most of the selected overview and guidance documents deal with ‘hard’ requirements for W+S arrangements, to solve what is somehow wrong with the support of walking and sojourning in public space. Only a few go beyond this perspective and sketch ‘soft’ niceties to persuade people to walk and sojourn in public space more and more often, like Gehl (1971), Alexander et al. (1995), Amato (2004), Gehl & Gemzø (2006), and Kuitert & Maas (2017).

Amato (2004) described that there is less and less need for streets for entertainment, as there are plenty alternatives. As early as in the 1970s Jan Gehl argued that empty streets are bad for social coherence, safety and security and that stakeholders should pursue restoring the lost role of the street as meeting place and place to experience people (Gehl, 1971/1978). In later publications with Gemzø he argued that reclaiming public spaces is custom work, answering to special needs and desires of the customers (Gehl & Gemzø, 2006).

Responding to earlier concepts of this thesis Risser and Chaloupka commented that one can never be sure that (potential) walkers look at things in the same way as experts do. This can only be known out of a systematic dialogue with the users or keen behavioural observations.

4.4.8.3. Findings with regard to 'likes' of walking and sojourning in public space

For developing tempting W+S opportunities it is useful to know what (potential) pedestrians like, what pleases them. Although there appears to be many studies on determinants of preferences regarding walking, the documents rarely explicitly deal with what (potential) pedestrians like or what pleases them. In the selection of overview and guidance documents only Ausserer et al. (2013 = A), Clifton & Livi (2004 = C), and Risser (2002 = R) explicitly point out ‘likes’. These are (percentages of ‘likes’ between brackets):

- Nice surroundings (A: 76%);
- Easy and uncomplicated walks (A: 72%);
- Being active (A: 70%);
- Walks being environmental friendly (A: 58%; R: 3%);

- Walks being a sound/most convenient transportation solution (A: 55%; R: 13%; C: males 31%, females 25%);
- Is at the same time sports and movement (R: 48%; C: males 48%, females 53%);
- Having a gratification for walking (A: 47%);
- Cheap compared to the car (A: 42%; R: 7%; C: males 17%, females 14%);
- Enjoy nature (C: males 33%, females 28%);
- Walking is healthy (R: 27%);
- Walking is stress free and relaxing (R: 17%; C: males 31%-females 36%);
- You can look at the environment (R: 17%);
- Walking a pet (C: males 11%, females 14%);
- Walking is flexible and independent (R: 5%);
- Parks (A);
- Street with little traffic (A).

Ausserer et al. and Clifton & Livi demonstrate that likes and preferences differ for groups. Health and being environmental friendly is a major pro for all. Ausserer indicates that walking is a pleasant travel mode for persons younger than age 60, but not so much for the elderly; youngsters (age 0 - 25) find it dangerous in general, but adults do not; it is communicative/a social activity for all, but slightly more for those aged 26-60. General pros are: walking is fast and optimal for short distances, flexible and independent, and promotes physical exercise. Above differences in experiences for males and females found by Clifton and Livi are shown between the brackets.

To check the results of the limited number of findings from the selection of overview and guidance documents, a tentative search on the internet was carried out on what is nice about walking. This search delivered 10 relevant hits in English and one in Dutch (Hits in Dutch referred to running mostly, and not so much to walking)[354]. Found arguments were similar to what was found by Ausserer et al., Clifton & Livi, and Risser: Looking and feeling great; Getting out of doors; Seeing the sights and discovering new places, sense of adventure; Saving money; It's sociable, enjoyable exercise; You can explore more; It makes you happy; Walking does the body good (3x); Because of evolution (is the natural way); Walking reduces stress and cheers you up; Walking clears your brain; Walking induces creativity; Walking makes your bones stronger; Walking improves concentration; A great way to enjoy the weather; Good for blood sugar, blood pressure; Good for your mind; Enjoy nature; Wow moments; Walking the dog; Lose weight.

From the analysis of the combined results the author concludes that (potential) pedestrians are particularly tempted when the offer is financially attractive, supports well-being and health, gives fun, relaxation, excitement, opportunity to meet people, and is good for the environment.

4.4.8.4. Arrangements for tempting W+S opportunities

a. What general issues should set the stage for tempting W+S arrangements?

As stated in the introduction of this subsection, tempting W+S opportunities concern W+S arrangements that exceed responding to normal 'manifest' demand for walking, offering both

[354] Search question: 'what is nice about walking', 'wat is er leuk aan lopen', Search on 3-11-2019 using 'Startpage.com'.

pleasant experiences and opportunities for socialising. Van der Laan (2018:39) identified three basic principles for achieving that people walk more and more often:

- *"**Easy**: Going on foot must be an easy option, encouraged and appreciated by your environment. Regular walking can become a habit, recognized as something normal by family, friends or media around you.*
- ***Beneficial**: Going on foot must match your wallet. A contribution to your financial well-being.*
- ***Rewarding**: Going on foot in a growing world must be attractive to many people and rewarding for them. When many people do walk, they easily take up a position.*"

Tempting W+S arrangements concern functions and forms that are extremely nice to have. Elements can be attractive because of pavement quality, street furniture, maintenance and upkeep, well-kept greenery or water, architecture, vistas, or something to look at, discover or do (CROW, 2019), amplified by promotion activities stressing benefits. Tempting W+S opportunities can be considered a weapon in spatial competition between areas and stakeholders, in the battle against ill-health, environmental matters, traffic congestion, the decline of city centres and more.

Several kinds of tempting opportunities can be discerned: (semi) permanent place related attractions, event based attractions and route based attractions (walking for the fun of it), and combinations of two or all three.

Examples of place related (semi) *permanent attractions* are child play facilities, cultural heritage, natural environment and recreational facilities such as sport facilities, theatres, cafés, street cafés, bars, clubs, parks, central squares, beaches, touristic market halls; examples of *event based W+S opportunities* are fairs, music and theatre festivals, horse days; examples of *route based attractions* are guided city tours, nature trails, marked out theme walks, e.g. a route along houses of the rich and famous; examples of *combinations* are weekly markets and flower fairs, the yearly Nijmegen Four Days Marches.

In the selected overview and guidance documents most attention is devoted to place making, i.e. shaping W+S opportunities by the design (form and function) of the physical environment. In this context Speck (2012) argues that 'walkable cities' are not just nice, but very profitable ones. According to Kuitert & Maas (2017:7-8) pleasant places need to meet four requirements: safety, variation, sojourning and seating, and free movement of people without being bothered by traffic. OTAK (1997) summarises temptation requirements slightly differently: comfort & shelter, access to transit, interesting things to look at while walking, and social interactions. Yet another perspective on design qualities is presented by the Robert Wood Johnson Foundations (cited in NYC, 2010) regarding the five design qualities that are critical for walking and physical activity:

"These characteristics were defined qualitative and then related to the physical features of the street environment:

1. ***Imageability** is the quality of a place that makes it distinct, recognizable and memorable. A place has high imageability when specific physical elements and their arrangement capture attention, evoke feelings, and create lasting impression.*
2. ***Enclosure** refers to the degree to which streets and other public spaces are visually defined by buildings, walls, trees and other vertical elements.*

3. ***Human scale*** *refers to size, texture, and articulation of physical elements that match the size and proportions of humans, and equally important, correspond to the speed at which people walk.*
4. ***Transparency*** *refers to the degree to which people can see or perceive objects and activity - especially human activity - beyond the edge of a street.*
5. ***Complexity*** *refers to the visual richness of a place. The complexity of a place depends on the variety of the physical environment."* (In: NYC, 2010:23)

In her study of a walking tour of elderly in Utrecht Scholten (2014) found that three kinds of factors determined their experiences: physical factors, functional factors and social factors. With regard to physical factors positive experiences were incited by historic buildings, green and the absence of new developments, and negative ones by uneven pavement and modern buildings; positive functional factors were the availability of a library and small shops, whilst negative values were assigned to chain shops and catering industry aimed at youngsters; social factors
that matter positively were the conviviality of presence of many other people, while social safety issues were valued negatively.

The Belgian Vademecum Voetgangersvoorzieningen (= Pedestrian facilities) (Meert, 2003) also mentions the degree to which social interaction takes place and security, but additionally he mentions environmental friendliness and cost price as determinants.

The author finds that together the Kuitert & Maas, OTAK and the Robert Wood Johnson Foundation nicely cover what physical space factors count for tempting place making. Scholten triggers to also take into account what function elements in the physical environment have and what the social context is; Meert justly adds environmental friendliness and financial preconditions. In this respect non-physical aspects of W+S temptations should be identified, viz. qualitative aspects of function, event and group related variables: 1) 'for each his own', i.e. in a setting of one's interest and budget (e.g. function: nature, cultural heritage, music, theatre, etc.), 2) meeting at least basic functional W+S requirements of reachability, accessibility, safety and security, 3) at the right moment (social context: when people are sensitive to temptation and free to come), and 4) social interactions (social context: together with like-minded and interesting people).

b. Which groups of (potential) pedestrians are normative?

What is attractive for one group may not work that way for or even repel others. Temptation can be expected to be determined by what is offered and the needs or sensitivities of the target group(s). This means that the provider should offer what is attractive to children and other target groups who are equipped and sensitive to make use of such opportunities. For growing up, children need to be tempted to play outdoors. Other captive pedestrians, i.e. the poor, the elderly and the impaired, in general can be expected to be less sensitive or in a position to give in to temptations than healthy, fit and employed adults: utility walking already takes up so much energy that little is left for 'fun'. As they do not respond much to the recreational arrangements offered, they will be targeted less and less often. Also, people who dislike walking will not be easily tempted.

From known W+S arrangements meant to persuade potential pedestrians to come and walk more and more often (e.g. Municipalities of Amsterdam, Barcelona, New York, Rotterdam,

Vienna) it appears that providers of such arrangements generally are dedicated stakeholders[355], who, depending on their (legal and felt) duties, responsibilities, competences and the feasibility of organising and helping, are most sensitive to (latent) desires of the various potential target groups.

c. The why: what factors and mechanisms affect the degree of temptation?
Temptation is fed by emotional appeal and sense of prospects evoked. What it takes and brings (functionality), and likes and dislikes (appreciation) can be expected to set the stage for the selection of opportunities (by potential pedestrians) as well as animation to arrange for opportunities (by potential providers). As mentioned before contextual factors like the perceived reachability, accessibility and safety, the weather, available free time and budgets also frame what triggers and what animates.

Factors on the providers' side are on the one hand felt responsibility, span of control, competence and feasibility. On the other hand experiences and perceptions of rewards are important. With regard to the Place Making Game the Project for Public Places (2007) argued that such arrangements attract multiple and various user groups, contribute to regular occurrence of positive interaction between other user groups, confirm and promote local identity and social cohesion, contribute to successful entrepreneurship of local businesses and stimulate it, heighten appreciation of the pleasure of being outdoors.

Concerning complaints, the media and research reports generally focus on problems (accidents, danger and risks, injuries, discontinuities, delays, barriers, traffic nuisance, obesity & the costs of not-walking), whilst stakeholders are likely to be more sensitive to and interested in 'doing nice things' to pamper pedestrians, than clearing up a mess (cf. Bax, 2011). A good example of such 'nice things' is the Rotterdam City Lounge concept (Gemeente Rotterdam, 2007) based on contact with amongst others the pedestrian guru Jan Gehl; other examples can be found in the WALK21 Charter for Walking (2006), Speck (2012, 2018), Kuitert & Maas (2018), Brouwer (2019) and the project www.healthydailywalking.com (Van der Laan, 2018). Speck (2018) mentions impacts regarding positioning the city, earning money and delivering a message, and argues that walking arrangements can effectively be 'sold' on arguments of wealth (property values, attraction of talents, more and better jobs, car culture does not pay any more), climate change, and health and communities (slimmer citizens; lower health care costs; saves lives; air pollution deaths are also an outcome of community design).

d. Where should W+S temptation opportunities occur?
With regard to places where W+S temptation arrangements are most needed three kinds of areas stand out: around homes (and work places), the city centre, event areas, and nature in (semi) rural areas.

Van den Bogaard (1999) and others (Kuitert & Maas, 2017; Childstreet, 2005; Gehl, 1971) underscore the importance of arranging for opportunities *around the home* for children to play outside (street, school square, parks, grass fields, sport areas, skate tracks, meeting places, ...); others like Major of London (2017), Wandelnet (2015) and Rijkswaterstaat (2014) point to the importance of short (1 - 4 km) walks around the home and workplaces for relaxation.

[355] E.g. city officials, their advisors, health professionals, the retail and the recreation industries, volunteer-walking route developers and managers etc.

City centres are the main nodes for cultural heritage, the entertainment industry and retail, and places that naturally welcome most (crowds of) people on foot, where spatial qualities are generally at least at convenience level (e.g. Scholten, 2014). The same applies to *event areas* outside city centres.

From perception research it is known that *walks in nature* are a favourite for many people (Ausserer et al., 2013; Clifton & Livi, 2004). Organisations like Wandelnet[356]
put much effort in developing and managing the popular long distance walking trail and special walking routes.

e. When should W+S temptation arrangements be developed and arranged for?
Temptation arrangements connect strongest to free time activities: evening, weekend, holidays, holiday-season (summer, Christmas, school holidays). However, what works today, may not work tomorrow, when surprise has faded or fashion, taste or emotions have changed. People can get spoiled and bored.

Common practice shows that even dedicated stakeholders will not be alert to external signals all the time. In this regard 'windows of sensitivity' matter, i.e. moments when conditions are suitable to receive, process and value incoming messages, when the stakeholder is focussed and in the mood to detect and receive messages, and the stakeholder's organisation is most able to do something about it (cf. Poulter et al., 2009).

f. How can W+S temptation arrangements be developed and arranged for?
In this paragraph the above question is unravelled and answered in two sub-questions: 1) what kind of improvement strategies can be followed, and 2) what kinds of tools are available for tempting people to walk more and more often.

Improvement strategies
In general evidence based arrangements are most effective. With regard to W+S temptation arrangements accurate insights will be a good starting point for developing strategies for tempting W+S arrangements. These concern insight in functional desires ('what is it good for?'), abilities, and 'likes' and 'dislikes' regarding walking and sojourning in public space.

A next step is to determine what goals can be set. From practice it is known that dedicated stakeholders are more often triggered and animated by concrete signals from the outside (complaints, media messages, accident reports etc.) than by reading guidance documents (Bax, 2011), or while exploring solutions to broader issues like traffic flow, road safety, competition with other cities, city renovations, accessibility, and public health. This way they will be pointed to concrete operational pedestrian, walking and sojourning issues mostly. Less direct tactical and strategic level issues like way finding, missing or weak links in walking routes, health threats from lack of physical activity are more abstract and less appealing. The latter kinds of problems generally surface only in research reports, expert's media columns and blogs.

A third step can be to explore what experiences other stakeholders have, and what good practise examples there are with regard to strategies to achieve the set goals, and accommodate these to one's own reach. For the moment (2019) good practises are available from among others Rotterdam, Copenhagen, New York City, Vienna, Toronto, Barcelona. In most cases success was booked because of sound co-operation and partnership arrangements.

[356] https://www.wandelnet.nl/, accessed 30-6-2020

Providing for demanding groups requires creativity and the promise of exquisite experiences: not only should the walking or sojourning experience be very pleasant, the experience should be fantastic and memorable. Keeping the temptation alive requires active perception and satisfaction monitoring, creativity and the means to bring about changes.

As walking and sojourning policy concerns a relatively new and unexplored domain, it is of utmost importance to document experiments, experiences, evaluate achievements and disseminate them.

Tools for tempting W+S opportunities
The selected overview and guidance documents focus mainly on tools to improve the physical environment, matching the stakeholders' town planning, or traffic, transport perspectives and aims. Insights regarding other tools and arrangements to persuade pedestrians to walk and sojourn in public space more and more, are often more sketchy. In this paragraph first some general scoping results with regard to tools for place making and tempting the general populations are presented. Following that a tentative sketch is given regarding dedicated approaches matching (a selections of) specific group needs, abilities and motives.

General place-making tools
General place-making tools give form to attractions, such as city life, child play, recreation, entertainment. The current state of the art regarding place-making are (among others) captured in the 'Global Street Design Guide' (Global Designing Cities Initiative GDCI, 2016), 'Prettige Plekken' (= Pleasant Places), a handbook on people and public space by Kuitert & Maas (2017), and the 'University Course on Bicycle and Pedestrian Transportation' by Turner et al. (2006).

In the Global Street Design Guide (2016:16-17) the authors indicate that the streets (public space) can be improved by the following approaches: '*invite street activity, change street geometry, create cycle facilities, add seating, improve pedestrian crossings, add energy efficient lighting, improve signals, enhance enforcement, integrate public artwork, connect walking networks, upgrade materials, reduce speed limits, add green infrastructure, provide street furniture, include wayfinding, activate ground floors,* [and] *provide climate protection'*.

Kuitert & Maas explicitly take the users' perspective, and indicate that there are four basic preconditions for pleasant places: safety, variation, sojourning, and movement. They adhere the Design for All principle. Their book provides (new) place making guidelines on the street-block, neighbourhood, and city levels. Each of these deals comprehensively and in detail with attractiveness, safety, accessibility, child friendliness, and green infrastructure.

With regard to persuasion Turner et al. (2006) propagate ambiance, shade and other sidewalk, public space, and plaza enhancements. For sidewalks the tools are: street lighting, landscaping, trees, pavement stones (stable, slip resistant, consistent surface), awnings (to create shade, protection from rain and snow, and add colour and attractiveness to the street), kiosks. Regarding public spaces they mention: outdoor cafés, alleys and narrow streets, public areas and art, pedestrian streets, transit streets, pedestrian malls, shops, benches, planters, water fountains, kiosks, street cafés, shelter. The best place for pedestrian plazas is where there is good sun and little wind exposure, protected from traffic noise, easily accessible from streets and shops, having a centre *and* sub-centres.

Physical active cities approaches
Nowadays the health sector realises that walking and sojourning in public space are forms of physical activity supporting and promoting health. In the exemplary Active Design Guidelines (NYC, 2010:4) environmental design and health guidelines for '*those responsible for the planning and construction of buildings, streets and neighbourhoods'* are presented, aiming to make cities more attractive from the health point of view. NYC refers to the 5 D key variables (Ewing & Cervero, 2010:267-268) that together create tempting W+S arrangements: '*Density, Diversity, Design, Destination and Distance to transit'*. They argue that, for creating an active city, the following aspects (tools) should be dealt with: '*Land use mix, Transit and parking, Parks, open spaces and recreational facilities, Children's play areas, Public plaza's, Grocery stores and fresh produce access, Street connectivity, Traffic calming, Designing pedestrian pathways, Programming streetscapes, Bicycle networks and connectivity, Bikeways, Bicycle infrastructure'*.
The Amsterdam Beweeglogica (= 'motion logic' ~ 'physical activity logic', Gemeente Amsterdam, 2016) is similar to but more concise than the NYC guidelines, referring to the tools or building blocks of high density, mixed land uses / facilities level, network, routes, attractive public spaces and making space for physical activity.

Non-physical space and integral approaches to tempt W+S activities
In the selection of overview and guidance documents very little attention is given to suggestions and guidelines for non-physical space approaches to tempt W+S activities, such as entertainment and organising events, traffic/transport management, partnerships and co-operation, education and communication, narratives, information and communication technology, legislation and enforcement (e.g. traffic rules, Land Use legislation [in the Netherlands 'Omgevingswet'], permits and licences). With regard to communication Dudley (2013) mentions that introduction, justification, and argumentation are important issues and that communication and marketing approaches often takes the form of narratives.
It appears that for general integral approaches stakeholders have to rely on their own insights mostly.

Tools for dedicated approaches
Although some of the overview and guidance documents mention that they take the users' perspective, they above all restrict their approach to their domain (e.g. pleasant places, traffic, traffic safety) and do not start from a wider perspective of (potential) pedestrians' needs, what they desire to do and aim to achieve, as is the intention of this thesis. Starting from (potential) pedestrians' needs, desires and aims calls for a different taxonomy of tools. When it comes to (free) choice walking, for starters, the following groups of motives are discerned: children's play outdoors, family day trips and holidays, short round walking trips for relaxation and/or exercise, going out in the city, touristic sight-seeing (day or multi-day) trips, and hikers' walks of one to several kilometres. These items are successively dealt with below.

Children's play outdoors can be seen as a public task and is discussed in a number of the selected documents. It is a central issue in the Childstreet publications (2005, 2006, 2007), Kantar Public (2018), and a major subject in Kuitert & Maas (2017). The latter produces guidelines for child friendly residential areas, school squares, green school squares, healthy school squares and traffic safety around schools, opportunities for safe childrens' play per age group, and traffic safety, social safety, and sports and play opportunities in neighbourhoods with regard to their distribution, equipment, delimitation, variety, seating, subsurface, greenery, accessibility, age groups, and playing in nature.

Family day trips and holidays, short round walking trips for relaxation and exercise, and *going out in the city* are good for a fair share of journeys on foot and physical exercise. As such these walks contribute to health and well-being; in many cases the walks have economic benefits (walkers spend money on food, drinks, entertainment etc.) as well. Although, according to travel surveys, many people do such walks, it can also be assumed that many others are not in the position to do so. In the selected overview and guidance documents no guidance on this phenomenon is found. Apparently stakeholders take this for granted and see no reason to actively support and promote these kinds of walking.

Touristic sight-seeing (day or multi day) trips generally concern visiting cultural heritage places and shopping/entertainment areas. Particularly local tourist offices, which normally are partnerships between local authorities and the entertainment industry, attend to the visitors. Touristic walks, although clearly profitable, however, seem to be a blind spot in the walking policy domain. The selected overview and guidance documents do not offer tools in this regard.

Hikers' walks of one or more kilometres are the speciality of NGO's like Wandelnet, promoting the use of hiking trails and cultural heritage connections like rural church paths and nature trails. On the internet many wandering NGO's and tourist offices offer suggestions and route information for nice short round trips of 1 - 5 kilometres[357], but this kind of round trips requires transport to the starting place. This is true also for longer marked routes as developed, negotiated, marked and kept by Wandelnet volunteers. Route descriptions are communicated and promoted through its central office, websites and local tourist offices.

g. Policy relevance

There is a constant competition and friction between cities, attractions, policy objectives where the number of attracted pedestrians matter. In this regard tempting people to walk more and more often is important for achieving economic, social, health and well-being, safety and environmental goals.

4.4.9. Conclusions regarding exemplary W+S arrangements

4.4.9.1. Introduction

This subsection explored what kinds of W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians adequate and tempting W+S opportunities, now and in the next decades. Three sub-questions were explored: what kinds of conditions are (potential) pedestrians looking for; what factors frame the genesis of W+S opportunities; what kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S? Main conclusions based on the results of the three quests are sketched in the next paragraphs.

4.4.9.2. What are (potential) pedestrians looking for?

The quest into what (potential) pedestrians are looking for is based on a number of theoretical considerations. From the NOA-model (Steg & Vlek, 2009) it was found that opportunities and needs together underlie the motivation to perform, whilst opportunities and abilities together underlie behaviour control, i.e. the feasibility of taking advantage of opportunities. In general

[357] see e.g. https://www.wandelzoekpagina.nl/ommetjes or https://www.middendelflandvereniging.nl/40-ommetjes/

pedestrians are performing intuitively, and are not consciously aware of their needs and abilities. Under pressure they fall back on iterative strategies or 'trial and error' and 'God bless the action'. From Van Hagen's Customer Desires Pyramid (Van Hagen, 2006) this thesis adopted the idea that pedestrians first of all need to feel enabled to safely reach and access the destinations that matter to them (meeting Basic requirements). If the trip is feasible, pedestrians also appreciate that they can walk and sojourn without irritations from inconveniences and discomfort while walking and sojourning (meeting convenience requirements). Furthermore, pedestrians can be tempted to walk more and more often if they can detect (very) appealing walking and sojourning conditions (meeting Tempting arrangement requirements). In this regard it contrives that pedestrians more or less successively assess opportunities regarding reachability, accessibility, safety, convenience, comfort, and attractiveness.

4.4.9.3. Factors framing the genesis of W+S opportunities

W+S opportunities are offered by persons, institutions and private organisations that are aware that they have a stake in walking and sojourning in public space. Over time the demand for such opportunities has changed from a pure necessity to a choice, even to the level that pedestrians became 'second rate traffic participants' (Risser, 2002). From an absolute low in the 1960s, the status of the pedestrian is rising again. Lately the many benefits of walking and sojourning are again appreciated and voiced. In overview and guidance documents the many benefits are sketched: accessibility, contribution to community goals, the economy, environmental quality, good health, Quality of Life and liveability, safety, social cohesion and equity, spatial challenges, transportation efficiency, and tourism and recreation. Of course, walking and sojourning does not only have benefits, it has some weaknesses as well, such as the modern need for segregation of functions, thereby creating larger distances, low travel speed, hidden nature of walking and sojourning, and inferior position in competition between the various travel modes.

Awareness of the importance of walking in itself is not sufficient to ensure that adequate W+S opportunities are created. In fact there are institutional obligations to create and safeguard such opportunities because of legislation and moral responsibilities.

Another factor framing the genesis of W+S opportunities is the pedestrian experience, i.e. why people walk or don't walk, what encourages walking and what hinders it (New Zealand Land Transport, 2018). Many shortfalls in walking and sojourning conditions and knowledge (research) are identified. On the other hand, there is also a choice of reasons and stimuli for walking and sojourning in public space. This knowledge can be applied to create better W+S opportunities.

4.4.9.4. Required arrangements to enable and/or motivate people to walk and enjoy W+S

First of all W+S arrangements should be effective, efficient and just, both from the perspectives of the stakeholders that offer the opportunities and their 'clients'. The effectiveness and efficiency seem to be rather obvious, but, because of the lagging priorities regarding walking and sojourning *and* ageing of society, equity is becoming more and more of an issue.

Design principles were developed over many years. Unplanned developments and growth in vehicle traffic dictated predominant town planning, network and street features and dimensions (Schoon, 2019). There is considerable delay in adaptation of new realities with regard to matching changed walking and sojourning needs, and the distribution of (potential) pedestrian groups. This is not only true for the physical pedestrian facilities, but for the W+S system as a

whole, and the functionality of definitions and linked research and policy making (Methorst et al., 2016, 2017a, 2017b).

Basic W+S requirements concern reachability, accessibility and safety. Reachability concerns how far a person is able, allowed and/or willing to walk. Accessibility relates to how well the pedestrian environment is adapted to walking impairments and disadvantages. Safety concerns all dangers to, and incidents, accidents, injuries and fears thereof that a pedestrian may encounter while walking and sojourning in public space. The latter includes traffic safety, falls, social or public safety, criminality and health safety. Particularly falls, because of ageing of society, deserve (more) priority.
With regard to Basic W+S requirements captive pedestrians, in particular children, the elderly and the impaired, are key reference groups.

Reachability depends on built environment and person variables. Proximity is the key word. Important built environment variables are *density* of users, building units and attractions per area, *diversity* in the land use mix, *design* of the network, *destination accessibility*, *distance* to public transport, *demand management* and *demographics*. Important person variables are motives, free-flow walking speeds, physical endurance, self-reliance. and perceived route impedance.

Reachability issues occur particularly outside compact urban areas, i.e. in low density suburban, semi urban and rural conditions. Outside business hours reachability problems are most prominent.

Tools to improve on reachability particularly concern structure development (strategic, mid and long-term planning, investments in housing, schools etc, and legislation on distribution of land uses and networks).

Accessibility requirements need to match posture, sensory, psycho-motor characteristics of the impaired and disadvantaged, users of wheeled pedestrian carriers, prams, carts and persons carrying goods.

Following the American Disabilities Act, there are many exemplary (national) guidelines for design, management and maintenance regarding accessibility. Such guidance can and needs to be followed up locally. One of the most important requirements concerns clear footway width. As footways need to be suitable for walking in both directions, these have to offer two times the width needed for one pedestrian or wheelchair. This means that 1.80 meters clear width is needed. The route should be stable, firm and slip resistant. Other important requirements concern access and crossing facilities, lack of discontinuities, slopes and stairs, illumination and sharp edges.

Major problems with regard to safety are dis-functional definitions and associated lack of data and awareness of the volume and severity of falls and security incidents.

Traffic safety is strongly related to the presence of and speeds of car traffic. Under the influence of Sustainable Safety measures (road categorisation and traffic calming in sojourning areas) pedestrian risk can decrease substantially.

Through the lack of knowledge falls are more difficult to tackle. Awareness of prominence is essential; policy development is still in its infancy.

Security or public safety concerns risks of assaults, street robbery etc. Main requirement is that walking routes are clearly visible, clean and free from dark spots where offenders can hide. Surveillance and presence of nearby persons is also important (Kuitert & Maas, 2017).

The care for traffic and public safety and security are generally seen as primary public tasks. The magnitude of accident and social costs as well as the need for equity are compelling arguments for policy activities. From many studies it has become clear that investing in safety brings (much) more than it costs (e.g. Van der Linde & Van Donkelaar, 2012; SWOV, 2011; Wesemann & Devillers, 2003).

If all basic requirements have been met, it does not necessarily mean that people are satisfied with how convenient and comfortable arrangements are. They might be dissatisfied with certain aspects to the point that they rather not walk or use certain facilities. It is more about an acceptable level of service than pure usability.

Non-captive healthy and fit adults are most likely to draw consequences from their irritations about experienced inconveniences and discomforts. They can be considered the key reference group for developing improvements.

Convenience W+S arrangements concerns the quality of facilities that is experienced as indispensable and/or normally available, directly enabling walking and sojourning activities. When requirements are adequately met, this generally does not lead to feelings of satisfaction, ease, or conviviality. It is just experienced as okay, in order. It does not stand out.

Comfort, on the other hand concerns '*a state of physical ease and freedom from pain or constraint'* (Oxford Dictionaries[358]) Contrary to convenience, it generally does incite feelings of easiness, satisfaction, conviviality, or even delight.

From the analysis of overview and guidance documents it appears that (potential) pedestrians particularly dislike or are irritated by car traffic, traffic lights, dog excrements, narrow footways, and cyclists on the sidewalk.

The best way to find out what inconveniences pedestrians experience, is to interview or observe them. Although many stakeholders will have done such investigations, documentation is hard to find.

Tools for convenience and comfort arrangements are: the walking and sojourning context, spatial structure approaches, street design for multiple uses, directing irritating encounters, tackling detours, tackling an insubordinate position of the pedestrian, the role of parking of cars, clean widths of streets, landscaping, light and lighting, enforcement of rules, and information and communication technology.
Contrary to basic and convenience arrangements, tempting W+S arrangements in principle concern new, by the (potential) pedestrians as yet unfamiliar opportunities, discoveries or attractions, that are created for the purpose of persuading the (potential) pedestrian to walk and sojourn in public space and to visit an attraction. This class of W+S opportunities originates from the creativity of the stakeholder-providers and will be directed to specific target groups, that are attractive to the initiator.

[358] https://www.lexico.com/definition/comfort, accessed 29-10-19.

Tempting W+S arrangements can be derived from general 'likes' expressed by (specific groups of) pedestrians. Some general 'likes' are nice surroundings, easy and uncomplicated walks, being active, having a gratification, cheap compared to the car, and streets with little traffic.

In literature arrangements for tempting W+S opportunities are virtually limited to physical environment phenomena; there is a strong focus on place making. Some documents however refer to other possibly persuasive reasons to walk and sojourn in public space: conviviality of presence of other people and social interactions, attractive functions like libraries, lack of chain-chops, environmental friendliness and financial reasons (cost price, savings of car expenses, bonus money).

With regard to placemaking imageability (=distinct, recognizable, memorable), enclosure, human scale, transparency and complexity are found to be compelling (NYC, 2010). Pleasant places need to be safe, have variation, be useable for sojourning and sitting down, and enable free movement without being disturbed by traffic (Kuitert & Maas, 2017).

Tempting W+S arrangements can be considered a weapon in the competition and friction between cities, attractions, and policy objectives where the number of attracted pedestrians matter. In this regard tempting people to walk more and more often is important for achieving economic, social, health, safety and environmental goals.

4.5. Conclusions and discussion regarding W+S system requirements

This chapter aimed to provide comprehensive, state of the art insights in what (pre) conditions are required to present pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation. The quest was structured and inspired by the Needs-Opportunities-Abilities (NOA) model (Steg & Vlek, 2009) and first explored the demand based on pedestrian needs and abilities and next the supply side based on opportunities offered by stakeholders.

The basic truth that one can only find what one is looking for was a leading axiom. For this reason much attention was given to definitions of key concepts regarding pedestrians, and walking and sojourning in public space. It became clear that in many cases conventional definitions and delineations did not fully cover what was relevant for pedestrians, and walking and sojourning. Conventional definitions and/or delineations regarding mobility and traffic safety cover less than half of the pedestrians' activities and safety: walking can be associated with many matters that are not or poorly registered and statistically reported, like walking done by professionals (postmen, public space workers, vendors etc.), foreigners and tourists, walking to and from other modes (sub-mode walking), sojourning, long distance walking, falls. What is worse: Statistics Netherlands now again excludes children younger than age 6 (pedestrians by excellence) from mobility statistics. More or less the same can be said regarding modern conventional policy making, where the promotion of walking and sojourning in public space, however commendable, is almost exclusively limited to place-making and walkability, which sounds like the long-time obsolete scientific school of physical determinism.

The quest pictured the walking and sojourning policy domain and revealed its huge complexity as well as a large number of cues for improvements in supporting walking and sojourning in public space. The pedestrian population, their needs and abilities are extremely heterogeneous. It also made clear that there is a huge lack of data and validated insights on many aspects of pedestrians, walking and sojourning. This way it is very difficult to present an accurate and true picture of what pedestrians, walking and sojourning are about, and what precisely is required to improve pedestrian conditions. This thesis can do no more that lifting a tip of the curtain and kick-off further developing the domain. Clearly, a lot more can be done and achieved than current pedestrian, and walking and sojourning policies show and promise to achieve. In this regard, apart from a research agenda, and advanced conceptual framework for policy development are offered.

This chapter has important limitations:

- The approach largely concerns abduction and scoping research, and does not include original (empirical) research. Many of the statements are 'hypothetical' and could not (yet) be documented and validated from literature;
- Data and documents do not offer direct or complete answers to many of this thesis' research questions;
- There is no accurate assessment of severity or importance of disadvantages of suggested strategies and measures;
- Most of the research concerned walking and not (yet) sojourning in public space;
- Very little could be said about the importance of 'lifestyle' and only a little more on strategic level activities; most attention could be devoted to tactical and operational level walking;
- Although the Design for All principle can be considered the best devise for equity in (W+S) policy making and design, it cannot be taken literally. In general what is good for the needy, is also good for the more fortunate, but policies and interventions needs to be tuned to contexts, limitative needs and abilities of *user* populations, and impacts on individuals, communities and the nation;
- With regard to W+S requirements this thesis focuses on what is required in a country like the Netherlands. This country is different from other countries in many relevant ways: climatic conditions, spatial conditions (land use, compact cities and villages dominant), and the importance of cycling, which in mobility replaces much walking common in other countries.

The author concludes that a precondition for kicking-off and ensuring effectiveness, efficiency and justice of pedestrian, and walking and sojourning policies is to make the pedestrian more visible in statistics, in narratives and in real life conditions. This will take years. In the meantime this thesis' systematic explorations aim to support a transition to better W+S policy making.

The following Chapter 5 will, as far as data are available, provide insights into what is found regarding the status quo of pedestrian behaviour in the Netherlands, its societal impacts, including general indications of benefits and issues of costs of walking and sojourning to be taken by the various stakeholders. Chapter 6 then will provide insights into the status quo of regarding the W+S institutional framework, and what conditions are likely trigger, animate, justify and bring about improvements for pedestrians, and for walking and sojourning in public space.

5. STATUS QUO OF THE W+S SYSTEM

5.1. Introduction

The previous chapters introduced and motivated this thesis' subject of improving conditions for walking and sojourning in public space (W+S). A step-by-step process design for the thesis (and W+S policy development in general) was proposed (see Figure 9 on page 41). The first step in the process concerned conceptually modelling the W+S system. In Chapter 3 this was done, and a theoretical framework was laid out. Next, W+S system requirements were described in Chapter 4. The third step of the policy process covers surveying the actual state of the system and its policy inputs, to assess how suitable the arrangements are for walking and sojourning as a source of wealth and well-being.

The leading research question in this chapter is:

How well are pedestrians enabled to walk and sojourn in public space, and which interventions in this regard can further contribute to wealth and well-being of individuals, communities and the nation?

To answer the above question this thesis explores the case of existing arrangements in the Netherlands to support walking and sojourning (Section 5.3), and then how the existing W+S system performs (Section 5.4), i.e. what activities pedestrian do or do not perform, what risks, inconveniences, discomforts pedestrians suffer and what pleases them, what impacts walking and sojourning have on the wealth and well-being of individuals, communities and the nation (Section 5.5), and finally conclusions and discussion, what (kinds of) interventions can be expected to help improve the impacts (Section 5.6).

To assure adequate coverage of the subject, the research is based on four of the conceptual models introduced in Chapter 3 and 4, viz. the *Assessment model for measuring walking* (Figure 3.4, Sauter & Tight, 2010) and the *Pedestrian travel and sojourning system* (Figure 3.3.), the *Pizza model concerning factors inducing W+S behaviour* (Figure 3.8), and the *Conceptual model on pedestrian behaviour choices and outcomes* (see Figure 4.1.).

In the *Assessment model* and the *Pedestrian and sojourning system model* the change process is presumed to start with input towards the W+S system, leading to concrete changes (i.e. output, embodied by hardware, software and orgware products), inciting changes in pedestrian behaviour (i.e. outcome regarding mobility, accessibility, safety, satisfaction), and ultimately longer term impacts on society, like social, ecological and economic and health impacts (cf. 'People – Planet – Prosperity'). Because policy making is generally based on awareness of (critical) developments in a system, and there is not yet an firmly established tradition of W+S policy making, it makes more sense not to treat policy making as a starting point, but as a reaction. Therefore, contrary to the sequence presented in the assessment model (input – output – outcome – impact) this chapter assesses (research on) *outputs,* i.e. what is actually offered, *outcomes* i.e. resulting pedestrian activities or performance, behaviour and perceptions, and *impacts*, i.e. bottom-line effects, benefits of the evolving W+S system. Subsequently the later Chapter 6 deals with change *input* to the W+S system, i.e. the state of affairs regarding policy activities delivered by the W+S institutional framework.

The next Section 5.2. Methodology broadly describes methodologies, sources and limitations of the approaches to assess the status quo, the functioning of the W+S system and potential improvements of walking and sojourning in public space. Assessments are based on available literature and statistical data. Specifications of research approaches, results and comments are presented in the successive content sections of this chapter.

Section 5.3. W+S arrangements aims to assess how suitable the existing arrangements in the Netherlands are for walking and sojourning. It explores what information is available or missing about how current conditions came about and what is actually offered for pedestrians now and in the near future. This concerns how arrangements at the service of pedestrians evolve, showing what opportunities for agreeable, safe and healthy walking and sojourning in public space are and are not offered by existing W+S arrangements (cf. *system output*). The *Pizza model* was used to structure this assessment of current W+S arrangements. The status quo of the component 'pedestrians' was already dealt with in Section 4.3. Therefore Section 5.3. can narrow to assessment of the other four interacting components, viz. the physical and social environments, transportation, and Information and Communication Technology (ICT). Distinction is made regarding lifestyle/strategic, and tactical/operational pedestrian activities; the adequacy of the offer is weighed against the general requirements as identified in Chapter 4.

Section 5.4. aims to identify pedestrian behaviour 'outcomes' in the Netherlands, and what changes therein can be expected. The assessment structure was inspired on the *Conceptual model on pedestrian behaviour choices and outcomes.* It includes assessment of what is known about pedestrian activities, mode shares, volumes and activities in the public realm, safety and security, perceptions, satisfaction regarding convenience, comfort and attractiveness of W+S arrangements.

Originally, conform Sauter & Tight's assessment model for measuring walking, the idea was to also explore what impacts pedestrian performance. Recently CROW-KPVV published a

comprehensive exploration into the effects of investing into walking in general and in the Netherlands. They found effects regarding health, social cohesion, accessibility, economic vitality, reducing emission of harmful substances and noise, efficient use of city space and many more. It is going too far to show the many results in this thesis. Moreover, a follow-up is being prepared. For the record, reference is made to that publication (CROW-KPVV, 2018[359]) and follow-ups to be published by CROW.

The chapter is concluded by Section 5.5. Conclusions and discussion, comprising general evaluation findings, gaps in knowledge and research and matters for discussion.

5.2. Methodology - the general approach in this chapter

The role of assessing the status quo of the W+S system is to provide adequate support of policy development for improving walking and sojourning conditions and impacts. This necessitates complete coverage of walking and sojourning in public space.

In the course of time the position of the pedestrian in society and related research and policy making has changed. Before the introduction of the car walking was the main mode for almost everyone, and there was little competition. This changed fundamentally with the rise of the car (Amato, 2004; Plowden, 1971; Jacobs, 1961; Gehl, 1971; Hass-Klau, 1990; Jeekel, 2011). Policy making and linked research started to focus on the new transportation mode, its promises and solving problems that stood in the way of progress. Pedestrians were largely neglected in research, problem and statistical definitions. For example in mobility research and statistics walking to and from other modes was either not included or given a secondary role; in Dutch mobility statistics frequent professional walking, foreign visitors, walking tours of more than 2 hours, and children younger than age 6[360] are excluded in mobility statistics; in some countries (e.g. the UK in the 1990s) walking trips of less than 400 meters were excluded; round trips on foot (e.g. walking the dog, nature walks) are generally underreported; while there is ample attention for parking cars, sojourning in public space is not reported; internationally, by definition road safety statistics only include accidents where a moving (or even a motor) vehicle is involved.

This thesis' aim of complete coverage of walking and sojourning in public space means that the assessment, and evaluation of its status quo, needs to pick up on the wider scope of information on walking and sojourning in public space including:

- All relevant kinds of pedestrian activities, regardless of distance covered, role in mobility or function of the activity: door-to-door (main mode) walking, sub-mode walking, circulation, and sojourning;
- All relevant groups of (potential) pedestrians, i.e. people who at the given moment do not use motorised vehicles or pedal cycles, regardless of age, gender, nationality, or period or motive for being outdoors in public space on foot;
- Actual and avoided exposure (mobility, sojourning), risks (safety, security), and satisfaction (convenience, comfort, attractiveness);

[359] See the free download: https://www.crow.nl/downloads/documents/kpvv-kennisdocumenten/crow-kpvv-k-d060_verkenning-effecten-van-investere, accessed 28-5-2020
[360] As of 2019 in Dutch travel surveys children younger than age 6 are no longer represented.

- Major impacts of walking and sojourning in public space;
- Insight in past and future developments regarding walking and sojourning in public space.

In order to realize a more complete coverage of the subject, three main approaches are applied:

1. *Build on a range of precursory projects*

   Relevant precursory projects are the Dutch Pedestrians' Association's research for advisory work and symposia (1990-2000), Asmussen's 'Nieuwe Normmens' project (1996), the European WAlCyNG project (Hydén et al., 1998), the Dutch national Vulnerable Road Users project (2002-2003), the COST358 Pedestrians' Quality Needs (PQN) project (2006-2010), and the OECD/ITF projects on elderly in transport, pedestrians and achieving ambitious road safety targets. All these projects aimed at more fully capturing and improving aspects of the state of art regarding W+S policy making. The projects yielded a wide range of literature scans and reviews, empirical data, conclusions, and frontrunner insights in the domain. In the results sections of this chapter the most relevant findings are summarised.

2. *Qualitative approach line*

   Since his working time at the Dutch Pedestrians Association in 1990, the author collected documents (abstracts, reports, articles and blurbs[361]) relevant for W+S policy making. These documents were collected actively from various sources: specialist journals and newspapers, references in books and journal articles, conference proceedings, professional newsletters[362], exchanges within the professional network. With the merger of the Dutch Pedestrians Association and two other road safety NGO's into 3VO in 2000 much of this collection of dossiers was lost. The complete library of the Dutch Pedestrians Association was transferred to Rijkswaterstaat AVV in 2000. The new owner had the opinion that it was not possible to integrate the library into the (digital) Rijkswaterstaat library. The books and reports were finally destroyed around 2008. The digital library catalogue (over 3000 titles), however, still exists.

   From his transfer to Rijkswaterstaat AVV in 1999 the author privately persevered in collecting W+S policy relevant documents[363], and from the preliminary work for this thesis items were (when possible) digitally stored in a digital W+S folder (PDF, Word, Excel and TXT files, with uniform filenames ('first author' 'year of publication' 'short title') and entered in an Excel database[364], including a selection of pre-2005 documents. The database contains more than 3,800 entries (state August 2020).

   Records in the database contain fields regarding entry number, authors, year of publication, title, source/publisher; additional fields include codes and scores regarding various policy relevant factors (see Appendix 2 for the full list and explanations of the fields in the database):

   - Source of the entry (Scopus, Science Direct, Other sources (= Google Scholar, various library systems, private collection));

[361] Blurbs: notes and references from publishers, W+S related NGO's and the author's professional network.

[362] Including: Austroads RoadWatch Alert, CROW, CROW-KPVV, ICTCT, IFPedestrians-NET, Gemeenten.nu, www.healthydailywalking.com, KiM, Mobile Lives Forum, NASEM TRB e-newsletter, NRSO Road Safety Update, Pedestrian & Bicycle Information Centre Newsletter, Platform31 nieuwsbrief, Project for Public Spaces, Safetylit, SWOV, Verkeer in Beeld, Verkeerskunde, Verkeersnet, Victoria Walks, VTPI News.

[363] From 2000 – 2015 the scope was widened to road safety and vulnerable road users in general.

[364] This Excel database is available for future W+S researchers.

- Scientific quality (Scientific = peer reviewed or dissertation; Grey = institute report, governmental report, consultant's reports; Media = specialist journals, newsletters, newspapers);
- Relevance of the publication for specific thesis subjects;
- Main subjects;
- Pedestrian Activity level;
- General underlying policy aim (not specified; Accessibility; Health; Mobility; Liveability/sojourning; Safety; Sustainability [People-Planet-Prosperity]);
- Special groups (not specified or 'all'; adults; car; child; drivers; limited mobility; elderly; various; women);
- State of the Art or review;
- Origin and representativeness of the study (NL, Europe, Western world, Global);
- Relevancy scores per specific thesis subject (tentatively scored 0 to 4 based on abstracts by the author, ranging from 'not relevant', 'heuristic', 'evidence based description', 'evidence based explanation', 'evidence based prediction of system dynamics').

For orientation on the various aspects of the status quo of the W+S system selections are drawn from the database and listed. The abstracts of the listed documents are studied; in some cases the full texts are analysed; in specific cases additional Google Scholar searches are carried out to complete the picture and/or the database. In the results-sections of this chapter the qualitative results of the examination of the W+S database and available documents as well as the additional searches are reproduced.

3. *Quantitative approach line*

Although data on walking and sojourning are relatively scarce, the available (statistical) data on the status quo in the Netherlands are searched, analysed and broadly evaluated regarding their validity, representativeness and reliability; where possible multiple sources are used and triangulated.

In this thesis national statistics from renowned national statistical agencies and knowledge centres are used, i.e. CBS Statline datasets on population, death causes, mobility (OVG, MON, OViN), traffic casualties, LMR/LBZ hospital admittances databases, LIS Emergency Department casualties treatments, BRON traffic accident datasets, Security Monitor surveys, Sociale Staat van Nederland. For some W+S aspects only special survey or non-official data were available; if available these were used as proxy or to fill the gaps and estimate the volume of a phenomenon, e.g. Continu VrijeTijds Onderzoek (NBTC-NIPO, 2015/2017/2018) Wandelmonitor (Wandelnet, 2012/2016), Voetgangers Cijferboek (1992, 1998), Voetenwerk (Methorst, 2005). When applied complete references are given in the text.

5.3. Dutch W+S arrangements

5.3.1. Introduction

In Chapter 4 presented an advanced classification of W+S opportunities (Subsection 4.4.2.3 and Figure 4.1.), viz.:

- *Basic requirements*: 1) reachability/feasibility, 2) accessibility, and 3) safety and security;
- *Convenience requirements*: 4) convenience and comfort;
- *Tempting arrangements*: 5) attractiveness.

Established arrangements regarding the classes of W+S opportunities can be considered assets, i.e. publicly available items of property or services regarded as having value and available to provide opportunities for walking and sojourning in public space[365]. This section's research question is:

What is documented and entered up about prominent arrangements established in the Netherlands to offer opportunities for walking and sojourning in public space, their distribution, and roughly how well these arrangements can be expected to serve the needs and abilities of the Dutch population of (potential) pedestrians.

The exploration follows the structure indicated by the five classes of W+S opportunities, and touches on the main domains of pedestrian facilities, i.e. the spatial, social-normative, transportation, and Information and Communication Technology contexts.

The results offer insights in the status quo at a specific moment in time, viz. spring 2020. The W+S policy field is in motion in many ways. On the one hand there are important national initiatives like 'Ruimte voor Lopen' (~ Room for Walking; see also Chapter 6) putting a lot of measures in the pipeline, and on the other hand the world experienced the Corona Crisis. The impacts of the latter are unsure and may unsettle pedestrian needs and requirements regarding W+S arrangements and conditions altogether.

In the next Subsection 5.3.2 methodology is outlined. Subsection 5.3.3. describes the results of the explorations and 5.3.4. presents conclusions regarding insights into the status quo of Dutch W+S arrangements, including the need additional data and suggestions for further research.

5.3.2. Methodology

This thesis part's research targets on broadly capturing *what is documented and entered up in statistical accounts about the status quo of arrangement to provide opportunities for walking and sojourning in public space.* It concerns *scoping review*, i.e. internet searches, to capture what quantitative and qualitative information is publicly available on actual W+S opportunities in the Netherlands. The search started from requirements indicated in Section 4.4. and focussed on national statistics, surveys on distribution, coverage and functionality of arrangements regarding the four main domains, reviews of experiences with implemented improvement policies and measures, and some anecdotic information about current conditions. Policy intentions are explicitly excluded, as these are not (yet) effectuated into opportunities for walking and sojourning in public space. The search results are captured in crude dossier folders and summarised below.

[365] cf. the definition of assets in Oxford Dictionaries of 'asset': "*An item of property or services owned by a person, company or institution regarded as having value and available to meet debts, commitments, or legacies"* (https://www.lexico.com/definition/asset, accessed 10-5-2020)

5.3.3. Results

5.3.3.1. Introduction

This subsection presents results from scoping review on what is offered regarding the three main groups of requirements, i.e. basic requirements, convenience and comfort, and tempting arrangements. Each of the following paragraphs broadly explores what the status quo in 2018/2019 is regarding documented prominent characteristics of walking and sojourning arrangements. The paragraphs on reachability/feasibility (5.3.3.2), accessibility (5.3.3.3), and safety and security (5.3.3.4) focus on a level playing field regarding major characteristics of established arrangements for enabling walking and sojourning for all kinds of (potential) pedestrians, but particularly vulnerable groups (cf. Design for All). Subsequently paragraph 5.3.3.5. tentatively deals with the status quo of arrangements to seduce (potential) pedestrians to walk and sojourn more and more often. Contrary to basic requirements this concerns a more segmented playing field. The arrangements target specific groups, with specific characteristics regarding their abilities, needs and interests, and are set up to persuade people who have a choice between walking and sojourning and other ways to pass time.

5.3.3.2. Reachability / Feasibility

Chapter 4 concluded that the key to reachability is proximity, and that reachability and feasibility of walking depend on a variety of factors, such as the *density* of users, building units and attractions in the area, *diversity* in land use, *distance* to (public and other secondary modes of) *transport*, *destination accessibility*, *demand management*, *demographics and person variables,* and *network lay-out and directness*. In this paragraph main results from scoping review on the status quo of reachability and feasibility with regard to these factors are presented.

a. Proximity

Proximity can be expressed in distance to be walked, and in time or energy needed to cover the distance towards the destination in question. With regard to proximity of services, CBS (Statistics Netherlands) keeps up statistics on average distances in kilometres from home and work towards a variety of much visited services. On the Statline website proximity data are available on the national, regional and local level for the period of 2006 - 2019[366]. The statistics do not cover time and energy needed for covering the distances. The latter could be important as people can be assumed to have a time and/or energy budget, and the time and/or energy needed to complete the activity of walking towards and from the destination must fit with their budgets.

If a distance of 1.0 kilometre is considered reachable on foot, in the Netherlands on average[367] (semi) public greenery, primary schools, children's day care and school care (0.6 - 0.7 kilometre), cafeterias and restaurants (0.8 kilometres), supermarkets (0.9 kilometres), and cafés and medical general medical practices and public parks (1.0 kilometre) are found within walking distance (CBS Statline[368]). In 2017-2019 there were on average 2.0 primary schools, 3.6 children's day care and 2.6 school care services, 7.1 cafeterias, 4.6 cafes, 2.0 supermarkets, and 1.7 general medical practices. No information is available on the average distances towards

[366] cf. https://opendata.cbs.nl/#/CBS/nl/dataset/80305ned/table?ts=1589205618064, accessed 12-5-2020.

[367] This concerns the average distance of all residents in an area from the nearest facility, calculated on the (paved) roads.

[368] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80305ned/table?ts=1590906793336, accessed 12-5-2020

social contacts, but it can be assumed that on average these will be shortest (cf. neighbours) and most numerous.

Proximity of destinations evolved over time. Over the past 15 years (2006 - 2019) in the Netherlands the average number of public greens, general medical practices, children's day care and primary schools (slightly) decreased, while the number of supermarkets, cafes, cafeterias and school care services (slightly) increased.

b. Density of users, building units and attractions per area
In national statistics several kinds of density are documented. On the macro level cities are classified regarding urbanity, i.e. density of addresses[369]. In Table 5.1. developments regarding number of inhabitants in the Netherlands 1998-2018 are presented. The table shows that in twenty years the urbanisation strongly progressed. The number of inhabitants in (very) strongly urbanised municipalities increased from 6,291,000 to 8,310,000 people (32%), whilst the number of inhabitants in less urbanised municipalities decreased by 5%, from 9,363,000 to 8,871,000 inhabitants.

Table 5.1. Development in number of inhabitants in the Netherlands 1998-2018 per urbanity class

Urbanity class	number of addresses per square Kilometre	inhabitants x 1000		Change %
		1998	2018	
Very strongly urbanised	more than 2,500	2,896,230	4,007,600	38
Strongly urbanised	1,500 - 2,500	3,394,550	4,302,400	27
Moderately urbanised	1,000 - 1,500	2,723,630	2,955,690	9
Little urban	500 - 1,000	3,177,280	2,969,950	-7
Rural	less than 500	3,462,500	2,945,450	-15
Source: CBS				

Ritsema van Eck et al. (2009, cited in Snellen et al., 2010) mentioned that in urban municipalities in the Netherlands (including business parks, sport parks, construction areas etc.) housing density on average is 11.5 homes per hectare; in residential areas the average home density is 19 homes per hectare and in very urban residential areas around city centres average 78 homes per hectare. Central city residential areas typically have a high level of density of homes and employment, and a varied mix of services, combined with high quality public space, inviting walking and sojourning in public space (Province of Noord-Holland, 2020[370]). Typically these central city areas comprise more than 27,500 households, 46 homes per hectare, and 97 shops per 1,000 households.

Inhabitants of (very) urbanised municipalities and particularly city centres have a larger number of addresses within walking distance of 1.0 kilometre and walk more and more often than those in less urbanised municipalities (Traffic Test, cited in CROW, 2017).

[369] cf. https://opendata.cbs.nl/#/CBS/nl/dataset/70072ned/table?ts=1589271249099, accessed 12-5-2020
[370] http://www.handreikingwoonmilieus.nl/, accessed 12-5-2020.

c. Diversity in land use
Amongst others CROW (2014) and Kuitert & Maas (2017) indicate that diversity in land uses, particularly in high density areas, increase opportunities for walking. No Dutch statistics were found in this regard however.

d. Distance to public transport (and other modes)
Based on a (small) diary travel survey amongst pedestrians Methorst (2005) found that on average a foot trip towards or from local public transport (bus or tram) amounts to about 400 meters, while a foot trip from destination to a train station is about 750 and about 700 meters from a train station to one's residence.

On the dedicated CLO website (CLO = Compendium voor de leefomgeving = Compendium for the living environment, 2016[371]) Dutch National government presents data on nearness of public transport to inhabitants and to jobs in the Netherlands[372] for the years 2003, 2008, 2013 and 2017. As public transport users accept larger distances towards and from train stations than metro, tram or bus stations, and moreover also accept larger distances at the origin side than at the destination side, norms for 'near', i.e. the maximum distances to and from the stops, are different. The CLO uses maximum distances as the crow flies, and does not discriminate for use of modes towards or from the public transport stop. In practise in the Netherlands most distances over 800 - > 1,000 meters are not covered on foot but by bicycle. CLO assumes that:

- For residents the maximum distance to metro/light rail is 1,000 meters and 600 meters to a bus or tram; the maximum distance to an ordinary train station is 2,000 meters and an inter-city train hub is 3,000 meters;
- From job locations the maximum distance to an ordinary station is 1,000 meters and 1,500 to an inter-city train hub.

Based on information from public transport users, Table 5.2. shows how well residences and job locations are serviced by public transport. On average about 30% of Dutch residents during business hours have access to all kinds of public transport services, at a frequency of four times per hour. Another 20% can make use of metro, tram or bus services only, at a frequency of four times per hour. About 8% of Dutch residents do not have public transport available within acceptable distances, and 30% have access to half hour frequency public transport. For job locations conditions are slightly worse.

e. Destination accessibility
Accessibility is dealt with in the next paragraph (5.3.3.3.)

f. Demand management
Through scoping review no statistics and qualitative information are found on demand management arrangements regarding walking trips.

g. Demographics and person variables
In the period 1998 - 2018 the Dutch population increased from 15.7 million to 17.2 million people (see Table 5.3). Like most Western countries the Netherlands has an ageing population. Figure 5.1. shows developments in the shares of life cycle groups in the Netherlands. The graph shows that the shares of the life cycle groups aged 55-64, 65-79 and 80+ years increased about

[371] https://www.clo.nl/
[372] https://www.clo.nl/indicatoren/nl214003-aanbod-van-openbaar-vervoer

Table 5.2. Availability of public transport in the Netherlands from homes and from job locations 2003-2017

	Train, metro, tram or bus 4x per hour	Metro,tram or bus 4x per hour	Train and bus 2x per hour	Bus 2x per hour	Train and bus less than 2x per uur	Bus less than 2x per hour	Train	None	Total
To residents									
2003	31.7	18.9	10.2	13.7	4.8	9.4	3.0	8.3	100.0
2008	33.4	20.5	9.9	13.0	4.4	8.0	3.1	7.8	100.0
2013	32.6	19.9	11.5	12.4	4.7	8.2	3.1	7.6	100.0
2017	32.4	20.7	10.5	11.9	5.2	8.1	3.4	7.9	100.0
From job locations									
2003	26.1	29.9	3.8	14.4	2.0	10.1	1.6	12.1	100.0
2008	26.4	31.1	3.7	14.8	1.5	8.6	1.7	12.2	100.0
2013	26.4	30.1	4.3	15.4	1.6	8.8	1.7	11.8	100.0
2017	26.2	30.6	3.7	14.4	1.8	9.4	1.8	12.1	100.0
Source: PBL based on OV9292, CBS and LISA, 2016 (updated version 2018)									

40% at the cost of the share of the mid-life group (aged 25-54) and children up to 12 years of age, which shares decreased by 15%.
The most important indicator for ability to reach destinations on foot is whether a person perceives him/herself to be mobility handicapped. Based on indicative percentages of mobility handicapped persons per age group (SocialData, 2005) the author estimates that the percentage of persons with mobility handicaps increased from 6.1% in 1998 to 7.4% of the population in 2018 (from 933,000 to 1,280,000 people, an increase in numbers of 37%).

Table 5.3. Development in volumes of life-cycle groups in the Netherlands 1998 - 2018

	1998	2003	2008	2013	2018
baby's and toddlers (0-2 years)	575,389	616,370	552,632	540,522	515,746
pre-scholers (3-4 years)	393,978	406,243	393,095	371,680	352,353
primary school (5-11 years)	1,369,161	1,390,650	1,398,440	1,354,657	1,303,023
secundary school (12-17 years)	1,099,274	1,180,200	1,201,945	1,196,634	1,214,974
adolescent (18-24 years)	1,356,901	1,348,364	1,372,095	1,463,967	1,493,341
Adults (25-54 years)	7,248,255	7,219,101	6,987,076	6,860,796	6,771,283
Young elderly (55-64 years)	1,501,515	1,811,188	2,085,290	2,166,974	2,291,248
Elderly (65-79 years)	1,616,527	1,676,486	1,799,337	2,121,525	2,460,202
Very old (80+ years)	493,192	543,970	615,489	702,820	778,914
Total	15,654,192	16,192,572	16,405,399	16,779,575	17,181,084

h. Network lay-out and directness
CROW guidelines with regard to pedestrian networks and infrastructure are widely accepted by municipalities. There are however no data available on what facilities and arrangements are in place, and/or to what extent conditions comply with prevailing legislation or guidelines.

From general publications about pedestrian networks it is known that in pre-car city developments pedestrian networks are more often fine-meshed than in recent city developments

(e.g. Bach, 2006; Gemeente Utrecht, 2015). Consequently detour factors in modern developments are generally higher than in older parts of cities, particularly old city centres.

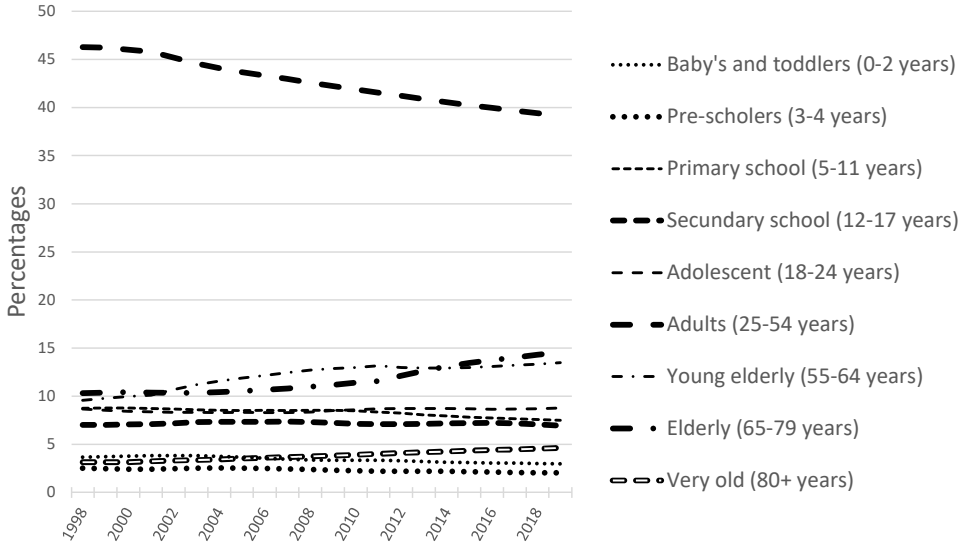

Figure 5.1. Developments in shares of life cycle groups in the Netherlands 1998-2018

5.3.3.3. Accessibility

This paragraph of the thesis deals with the question what kinds of arrangements are in place to support that public space and destinations are accessible for pedestrians in the Netherlands.

In order to be accessible, first of all public space for pedestrians needs to be spacious enough to move about on foot. Liere et al. (2017) calculated that on average about 33% of public space is reserved for pedestrians, 12% for bicyclists and 45% for car-use. From these figures it *appears* that the needs for space for pedestrians is well taken care of.

The high percentage of reserved space for pedestrians however does not necessarily mean that such space is in fact available and accessible for walking and sojourning in public space, i.e. feasibility of going on foot and readability of the physical environment for orientation within public space, and finding and following a suitable route towards the intended destination (cf basic requirements formulated in Chapter 4, devoid of discontinuities). Pedestrians are enabled to access and exit foot space even when they are unable to mount curbs and stairs, that footpaths are wide enough (at least 1.80 meters) to enable two pedestrians to walk next to each other, and flat, even and skid resistant enough to prevent tripping, stumbling, slipping and falling etc. In practise this leaves a lot to be desired. Interest groups and the media have produced a variety of anecdotical documents on how sidewalks and footpaths are cluttered with sign posts, street furniture, parked bicycles, overgrowing greenery and other obstructions (e.g. route towards a hospital in Den Bosch; obstacles in Amsterdam[373]; Asmussen, 1998; Voetgangersvereniging VBV 1990).

[373] Examples: https://www.bd.nl/den-bosch-vught/lopend-naar-het-jeroen-bosch-ziekenhuis-dan-heb-je-heel-wat-hindernissen-te-nemen~a83cf306/ and https://www.parool.nl/amsterdam/amsterdam-is-ontoegankelijk-elke-straat-is-een-hindernisbaan~b28d650b/

According to Vermeulen (1998) over one third[374] of municipal road length is equipped with sidewalks or footpaths. Especially in the larger cities almost all roads have sidewalks or footpaths. In small cities and villages in semi-rural conditions sidewalks generally lack. Sidewalks do not form a closed network, but are interrupted by roadways, streets and other discontinuities. There the pedestrians need to cross the road or use the (more dangerous) vehicle lanes. A further problem is that exclusive use of sidewalk and footpath space is not stipulated or warranted. Road authorities can allow shared use of certain categories of vehicles, and allow parking of cars on the sidewalks; in most cases parking a bicycle, moped or disabled vehicle is allowed anyway. Furthermore displays, street furniture, greenery and waste containers take up place for walking.

From municipal transport and traffic plans and interviews with municipal policymakers (see Chapter 6) it is known that it is general practise that municipalities follow international (cf. USA's ADAAG by DoJ, 2010) and national CROW accessibility guidelines[375] when designing, reconstructing and keeping up footway infrastructure and sojourning areas. Many municipalities developed and apply dedicated accessibility handbooks and guidelines for their territory[376]. Some of them systematically reviewed parts of their cities (mostly the city centre, e.g. Utrecht, Amsterdam, Zwolle, Rotterdam); the results however are not made public (i.e. no such documents were found on the internet). This way it *appears* that most municipalities do not *systematically* review, keep up statistical data on assets regarding walking and sojourning in public space in general and accessibility in particular or report on improvements made; if they do, such work is mostly limited to the city centre.

It needs to be remarked that most municipalities have neighbourhood teams, that keep up public space assets and constantly monitor conditions. Unlike traffic lanes, footways are rarely systematically inspected and maintained, but most municipalities have, apart from monitoring by neighbourhood teams, some kind of 'beeping system' and allow or invite citizens to report complaints, e.g. regarding loose tiles, pollution, obstructions etc. Public feedback on what is done to solve the reported problems is not common, however.

Another important feat is that since 2008 (almost) all bus and tram stops have been reconstructed to comply with national legislation (the Accessibility of Public Transport Decree[377]). For routes towards the bus and trams strict rules did not apply, and although organisations like CROW and Vilans strongly advised to deal with these routes also, most of the routes do not match accessibility standards.

Upon the entry into force of the UN disability treaty in the Netherlands, the College Rechten van de Mens (= Human Rights College) has been designated as supervisor of compliance with the treaty. Within its supervisory task, the College protects, promotes and monitors the rights of people with disabilities. Every year, the College publishes a report on the state of affairs

[374] This concerns 1995 conditions; the percentage relates to kilometres of roads; newer assessments are not available. The assessment is probably outdated: most probably it now is more than half of the municipal roads

[375] https://www.crow.nl/publicaties/asvv-2012

[376] see for example the comprehensive accessibility test list published by the municipality of Zwolle: https://toegankelijkestad.zwolle.nl/ontwerprichtlijnen/voetpaden-en-trottroirs (accessed 15-5-2020)

[377] Besluit toegankelijkheid van het openbaar vervoer: https://wetten.overheid.nl/BWBR0029974/2015-01-01

regarding compliance with the treaty[378]. With regard to physical accessibility in 2019 the College concluded:

- *Accessibility is being worked on in many places. The government has a program: Unlimited participation. This program contains a clear plan for improving accessibility. [...] Trains and buses are usually accessible. Museums, theaters, cinemas and libraries too. It is becoming more and more a habit to arrange this properly. [...] People with a disability think about this.*
- *The environment of buildings and trains and buses is often not accessible. For example, roads to bus stops or stations. Or access roads to homes. ATMs are hard to find for the visually impaired. Existing buildings and houses are often not accessible, especially small shops and restaurants. But also some schools are not accessible with a wheelchair. The Commission believes that schools should be quickly made accessible for people with disabilities.* (College voor Rechten van de Mens, 2019:3[379]).

5.3.3.4. Safety and security

This paragraph deals with the question of what prominent generic arrangements are established to warrant pedestrian needs for safety and security in the Netherlands.

Broadly speaking, what is said about accessibility assets is true for safety and security assets as well. No solid assessments or statistics were found on e.g. the number and distribution of dedicated pedestrian safety assets like formal pedestrian crossings (zebra or regulated crossings), hard separation from traffic, Woonerf, or what schools deliver traffic education on the safety of pedestrians. From conversations with policy makers (see Chapter 6) it came out that in most cases concrete safety and security issues of pedestrians are generally dealt with *ad-hoc,* based on incidental reports and complaints.

a. Traffic safety

In this sub-paragraph generic traffic safety arrangements for walking are outlined. Successively arrangements with regard to the physical and social-normative environments, behavioural support and transfer to other modes will be touched on.

Physical environment

Traffic safety received prominent attention in the Netherlands through the national Sustainable Safety Starting-Up Program (1998 - 2005). A major accomplishment regarding pedestrian traffic safety is the realisation of extensive 'verblijfsgebieden' (sojourning areas), i.e. 30 km/h areas. The sojourning areas are part of a generally implemented three-level road classification, featuring networks of *access roads* covering full neighbourhoods, *collector roads*, and *trunk roads*. In the sojourning areas non-motorised traffic has primacy, and 30 km/h is the maximum speed on almost all streets within built-up areas; outside city limits the maximum speed on access roads is 60 km/h. *Collector roads* collect traffic from sojourning areas and connect the neighbourhoods with each other at a maximum speed of 50 km/h within city limits and 80 km/h in the countryside. *Trunk roads* are accessible for motorised traffic only and connect cities with each other at higher driving speeds (80-100/130 km/h). More than 85% of the streets in sojourning areas have been adapted to 30 km/h. The low speeds and more cautious driving resulted in a substantial decrease in number of pedestrian casualties (Wegman & Aarts, 2005).

[378] cf. https://mensenrechten.nl/nl/oordeel/2020-9 and https://mensenrechten.nl/nl/vn-verdrag-handicap, accessed 15-5-2020

[379] see https://mensenrechten.nl/nl/publicatie/5de636e4b55daa48dd78be31, accessed 18-5-2020

In general the most important safety measure for pedestrians is separation of walking from vehicle traffic. As mentioned above, in cities nearly all roads have sidewalks or separated footways; in villages this could not be realised. Within sojourning areas some streets are furnished as shared space (e.g. Woonerf [living street-yards], or Winkelerf [shopping street-yards])[380] at very low driving speeds of less than 15 km/h, or even accessible for pedestrians [and cyclists] only. Within sojourning areas typically no formal street crossing measures (like zebra crossings) are taken. On collector roads pedestrians typically need to cross at junctions; guidelines discourage mid-block crossings. Non-regulated junctions within built-up areas can be equipped with zebra crossings; however, in some municipalities (e.g. Breda) all zebra-crossings have been removed (CROW, 2014; see also Chapter 6).

Social-normative environment
Rules for behaviour in traffic (both by pedestrians and towards pedestrians) are captured in the Reglement Verkeersregels en Verkeerstekens 1990 (RVV 1990 = Dutch Highway Code)[381]. In the Besluit Administratieve Bepalingen voor het Wegverkeer (BABW) national legislation for traffic arrangements is laid down. The legislation focusses on safeguarding traffic safety for all traffic participants, including pedestrians. The legislation is sharpened by jurisprudence, in which the position of vulnerable groups is strengthened: in case of an accident in principle children younger than age 14 and handicapped persons are not liable for damage, unless intentional misbehaviour can be proved (which in practise is extremely difficult).

Behavioural rules in RVV 1990 concern:

- *Definition*: anyone who walks, drives a disabled vehicle, wheelchair or moves on objects that are not considered to be a vehicle (e.g. skates, skateboard)' is considered a pedestrian;
- *Place on the road*: the pedestrian is obliged to use the sidewalk or footpath; if there are no sidewalks or footpaths, the pedestrian must use the bicycle path; if there is no bicycle path the pedestrian uses the outer roadsides; on an Erf pedestrians are allowed the full width of the road;
- *Restrictions:* pedestrians are not allowed to walk on motorways and roads that are formally closed for them by a sign (sign C16);
- *Where to cross the road*: in principle a pedestrian can cross the road anywhere, but s/he is advised to cross the road on a right angle. Only on official pedestrian crossings (zebra crossings; regulated crossings when the traffic lights for them are green) pedestrians must be given right of way. Using a zebra crossing to cross is not mandatory if a detour of more than 30 meters is necessary;
- The use of a *mobile phone* while driving a disabled vehicle is forbidden;
- *Parking a car* on a sidewalk or footpath is forbidden, except for marked parking spaces.

Behavioural support
With regard to pedestrian traffic crashes the three dominant casualty groups are children, the elderly and persons with limited mobility. Behavioural support concerns on the one hand educational measures and on the other hand accompaniment.

Scoping review findings are that educational measures focus on children; for users of mobility scooters introduction courses are organised; with regard to traffic education of other pedestrian risk groups no significant practical experiences were found.

[380] marked by sign G5 defined in the Dutch Highway Code (RVV 1990).
[381] see https://wetten.overheid.nl/BWBR0004825/2020-01-01, accessed 10-5-2020

In the Netherlands traffic safety education concerns mandatory lessons, included in the primary school curriculum (SWOV, 2017[382]). In practise the obligation is not enforced and not fully implemented. Studies about the effects of traffic education found that crossing behaviour of children can be improved, but also that this does not automatically lead to a lower risk of accidents (Duperrex, Bunn and Roberts, 2002).

When children are walking to school accompanied by adults, *children's* risk is significantly lower than when the walk to school proceeds independently (Roberts et al., 1994). In the Netherlands traffic brigades can be counted as accompaniment; on the basis of article 56, paragraph 2 of the BABW traffic brigades can be appointed by the Mayor. Veilig Verkeer Nederland (= the Dutch association for traffic safety) asked for attention to the fact that the number of traffic brigades decreased in eight years from 55,000 to 27,000 in 2014 (Veilig Verkeer Nederland, 2014).

Transfer to other modes
Apart from being accessible, transfer to other modes (bus, tram, metro, car etc.) needs to be made safe for both the persons who transfer and for fellow pedestrians. Although design requirements are provided in public space designs guidelines, in situations of competition for space safety of pedestrian is not always given priority (see e.g. Visser, 2017).

b. Fall safety
In the scoping review no dedicated policies, measures and assets were found regarding the prevention of pedestrian falls; measures and assets regarding security are treated similar to pedestrian safety assets: CROW guidelines and local public space management handbooks are the norm, and monitoring, maintenance and measures are executed by the municipal neighbourhood teams (see also Chapter 6).

c. Security
With regard to security (public safety) no statistics about implemented security arrangements were found. According to Wittebrood en Van Beem (2004:18) in general concrete measures focus on reducing opportunities for criminal activities by controlling access to an area, increase the chance of being caught (especially camera surveillance), reduce benefits of crimes, prevent situations that trigger crime, and do not give opportunities to introduce excuses. From conversations with policy makers (cf. Chapter 6) it appears that when security complaints are reported municipalities generally apply these principles.

5.3.3.5. Convenience, comfort and attractiveness

Above the status quo regarding basic requirements are described, i.e. requirements that need to be met so that all pedestrians, including those who do not have a choice but to walk and those who have mobility limitations, can walk and sojourn in public space easily and without unnecessary restrictions. The current paragraph focusses on arrangements to persuade for (potential) pedestrians who do have a choice to walk or not to walk, or to walk more and more often. Convenience and comfort arrangements in this regard concern remedy of irritations regarding walking and the walking environment. These irritations do not necessarily make walking impossible, but can impede choosing walking as a mode; attractiveness arrangements concern measures and services that are capable of persuading people to choose to walk and sojourn in public space more and more often, instead of choosing other competing activities.

[382] https://www.swov.nl/feiten-cijfers/factsheet/verkeerseducatie

Such requirements transcend basic walking and sojourning requirements that, in the perspective of this thesis, need to be met anyway to enable those who have difficulties to walk far and often. Very able (potential) pedestrians can sometimes do without the indicated basic quality walking and sojourning arrangements. For example fit and fully able wanderers do not need perfectly paved, flat, wide footways. In some cases they even prefer rugged and hilly terrain, because it can have a nicer look and is sportively more challenging.

In this regard two kinds of convenience, comfort and attractiveness arrangements can be discerned: those that make life easier and nicer for all pedestrians including those who do not have a choice, and requirements attuned to walking for recreation and for special groups of pedestrians, such as healthy and sporty adults seeking exercise and fun, wanting to do day hikes, spotting wildlife, joining events with peers etc. Especially tempting walking and sojourning arrangements may concern dedicated packages that sometimes are not suitable for (slightly) impaired utilitarian walkers. Below a selection of non-exhaustive highlights is given about arrangements to improve on convenience, comfort and attractiveness.

a. Status quo of W+S convenience and comfort arrangements

From scanning review on irritations in public space it came out that bad quality of the physical environment, traffic nuisance, nuisances by other people and services, and a variety of uncertainties can discourage walking.

Physical environment

In public space, and safety and security surveys questions are asked about public space conditions, but not specifically about walking conditions. In some municipalities walking route surveys have been conducted, but the results are generally not made public.

With regard to sojourning in public space much mentioned irritations are junk on the streets, dog excrements, physical degeneration (graffiti, ill kept street furniture, ill kept greenery), and obstacles on the sidewalk (carelessly parked bicycles, displays, street cafés, merchandise). Public appreciation scores show modest improvement over the years, but there seems to be ample shared urgency for improvement. Better maintenance and public space management, more green in the streets, better shielding from wind, rain and sun, and possibly works of art and water fountains seem to have potential to improve on convenience and comfort for pedestrians (e.g. CBS Security monitor, Kuitert & Maas, 2017).

Traffic nuisance

In city centres, particularly in the larger cities, traffic nuisance has decreased significantly over the last decades (CBS Statline[383]). According to their most recent city centre plans, The Hague, Utrecht, Amsterdam and Rotterdam are extending their pedestrian zones and decreasing the volume of street parking spaces, giving them back to the pedestrian (see also Chapter 6), reducing traffic bustle and non-human aspects of the busy city. This is true for some mid-sized cities (e.g. Nijmegen, Zwolle, Groningen, Tilburg, Breda, Maastricht) as well. Apart from Sustainable Safety-reconstructions and occasional traffic speed limit enforcement actions, very little however is found regarding combatting traffic nuisance and improving convenience and comfort in residential and industrial districts, despite the fact that most walking and sojourning takes place there (especially apparent during the Corona Crisis).

[383] In the Security Monitor of 2008 all scores for traffic nuisance were about 4 percent points higher than in 2019, except for in non-urban conditions, where nuisance increase from 25% to 36% of the population who experienced (moderate tot serious) traffic nuisance.

Transfer to other modes (public transport stops, car parks)
Because of equity legislation and government programs almost all (except temporary ones) bus, tram and train stops have elevated platforms for easy access to the vehicles, and waste bins, elementary seating and bicycle racks[384]. The most stops offer shielding against rain, wind and sun. The waiting facilities generally are not heated in wintertime, and most of them do not have (accessible) toilets. Transfer points for cars are more basic, and mostly offer no shielding from wind, rain or sun. General data about distribution of these arrangements are not available; some apps (e.g. NS Reisplanner) offer insight in availability of facilities at (major) public transport transfer points and train stations.

Social nuisances
The National Security monitors and some local surveys and media report on nuisances from drunk people, drug use and trade, homeless people and neighbourly and catering facilities nuisances. Remedies offered are neighbourhood surveillance (e.g. communicated by WhatsApp groups), hangout facilities for youngsters, events and coaches to keep youngsters busy, and surveillance by the police and extraordinary investigating officers (BOA's). No data and information are available about volumes and distribution of these arrangements.

Arrangements to tackle walkability uncertainties
Lack of information on reachability and accessibility of walking routes and conditions on the way (e.g. availability of toilets), unnecessary long waiting times at traffic lights, can be tackled by Information and Communication technology, such as modern smartphone applications and traffic lights computer arrangements.

Developments regarding information technology and the pedestrian are going fast. On the one hand road authorities increasingly use information technology to improve traffic management (traffic lights and guidance systems). Regulated pedestrian crossings are becoming smarter. Traditionally pedestrians needed to push a button to get green light at the crossing and were left in the dark on how long it would take before the lights change. Though still not mainstream, increasingly traffic control is serviced by automatic detection (radar, infrared, camera, Bluetooth), shortening waiting times substantially, but also enabling relatively slow or impaired pedestrians to reach the other side of the street without risk. Other positive developments in this regard are variants of count-down signals to inform about waiting time left.

In 2019 92.1% of the Dutch inhabitants of 12 years and older own a mobile or smartphone (CBS[385]). Up until recently the pedestrian as target group was considered a niche, but recently the ICT market discovered the pedestrian as opportunity. There already is a wide choice in (free) navigation apps (Google, Waze, TomTom), Weather forecasting (e.g. Buienradar.nl), and dedicated traffic light commander apps (e.g. Crosswalk by Dynniq). In the near future, more importantly, the phones (if GPS is on) are detectable by smart cars, that this way can either in time warn drivers that a pedestrian is on collision course, or make the car autonomously avoid, brake or stop to prevent collision.

[384] for example: https://www.denhelder.nl/actueel/nieuws/aanpassing-8-bushaltes; http://www.togtilburg.nl/?q=node/89; http://www.rtvkrimpenerwaard.com/web/nieuws/r-net-bushaltes-komende-maanden-omgebouwd-en-frequentie-verhoogd/, accessed 25-5-2020
[385] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83429NED/table?ts=1590063428997, accessed 20-12-2020

b. Status quo of tempting W+S arrangements

In Chapter 4 (paragraph 4.4.8.4.) general requirements for tempting arrangements are indicated. Distinction can be made between individual and collective walking, and sojourning arrangements.

Individual and collective recreative walking arrangements

Wandelnet, the Dutch umbrella organisation of wandering and hiking associations, monitors individual recreational walking arrangements. The 2016 Wandelmonitor (= National Recreational Walking Monitor) mentions the following arrangements:

- Long distance hiking trails;
- Regional hiking trails;
- NS (National Railway) trails;
- Marked nodes hiking networks;
- Tools for orientation: GPS, on-the-spot information (information panels and marked trails), signs regarding regional nodes networks; National Railway trail descriptions, trail guides;
- Organised hikes and events (e.g. Nijmegen Walking Four Days, Tourist Office's holiday resort's and camping's organised hikes);
- Internet websites: Google, ANWB (Dutch Tourists Association), Natuurmonumenten (Nature Monuments Association), Tourist Offices, Route.nl, Wandelnet.nl.

With regard to the walking opportunities, according to the Wandelmonitor 2016, the following environments are preferred: woods and forests (24% of the respondents), one's neighbourhood and surroundings (22%), centre of city or village (21%), rural / agrarian environment (18%).

45% of the hikes start from home. Modes towards the starting point of the hiking route, trail or event are covered on foot (26%), by car (21%), by bike (3%) and by other means (including Public Transport: 3%).

No information is available on the number of distributed walking route guidebooks or flyers, and guided or coached hiking tours. With regard to bottlenecks in recreative walking Wandelnet (2014) finds that the wanderer is not enough in the picture in national policies, that wandering has become more popular, but the offer of walking routes decreased, that large scale infrastructure often block wandering routes causing impregnable detours, and that in many region fine-meshed walking (rural) networks are missing (Wandelnet, 2015)[386].

Tempting sojourning arrangements

Although clearly there are many examples of tempting sojourning arrangements, these are mostly place, time and group specific. According to Stadslente (2017)[387], based on Place Making literature, there is a Top Ten (in alphabetical order) regarding tempting sojourning arrangements. Main conditions are 1) activities, 2) architecture, 3) accessibility, 4) comfort, 5) place diversity, 6) colour, 7) room for pedestrians, 8) clean, not broken, safe and cosy, 9) play elements, and 10) seating and hanging out facilities.

[386] https://www.wandelnet.nl/feiten-cijfers, accessed 18-5-2020

[387] http://urbanspringtime.blogspot.com/2017/08/how-to-make-inviting-and-attractive.html

5.3.4. Conclusions regarding Dutch W+S arrangements

The section on Dutch W+S arrangements (5.3) explored the question of what arrangements there are in the Netherlands for walking and sojourning. The research aimed to capture what is documented and entered up in statistics and qualitative accounts about the status quo of arrangements to provide opportunities for walking and sojourning in public space. Following the classification of W+S opportunities presented in Chapter 4, the study comprised scoping review regarding reachability / feasibility, accessibility, safety and security, and convenience, comfort and attractiveness or W+S arrangements.

General Statistics Netherlands data and land use research offer fair insights into appreciation of public space in the country. With regard to walking and sojourning in public space, however, very little is documented and entered up in statistics and qualitative accounts about the status quo of concrete arrangements. This way it is difficult to assess how well the quantity, quality and coverage of arrangements adequately suits the pedestrians' needs. In most cases the assessment cannot but rely on indirect evidence and give a broad impression of the status quo.

Below found indications for *strengths* and *weaknesses* of W+S arrangements are summarised. In general opportunities for improvements of W+S arrangements can be expected to occasion by development of long-term spatial plans, general infrastructure and public space reconstruction projects and changes in public attitudes towards walking and sojourning in public space; threats to the suitability, quantity and quality of proper W+S arrangements are decreasing budgets and financial positions of providers, as well as demographic developments like ageing of the population. The latter incite increased quality needs, decreasing feasibility because of the higher costs of the measures.

Reachability / feasibility arrangements

General requirements

- Destinations that matter should be found within a maximum of 1.0 kilometre (flat) walking distance.

Strengths

- Due to compactness of urban areas in the Netherlands (density, diversity in land use, fine meshed areas) and the flatness of the country on average the most important basic destinations (public green, primary schools, children's day care and school care, cafeterias and restaurants, supermarkets and general medical practices) can be found within walking distance of less than 1.0 kilometre;
- In highly urbanised areas public transport is available and reachable.

Weaknesses

- Destinations which are not within walking reach for people with limited mobility;
- Because of ageing of the population the number of people with limited mobility increased by almost 40% in 20 years (from 6.1% to 7.4% of the population). This means that a growing number of people needs basic destinations to be very near;
- Unknown key figures are the average detour factors for different city development types, feasible distances to destinations that matter per ability group, demand management arrangements for walking, the role of land use diversity in reachability.

Accessibility arrangements

Strengths

- For healthy and fit adults (ages 18-75) there are very little limitations in place accessibility;
- Generally adapted accessibility lay-out of Public Transport stops;
- Within urban areas sidewalks are commonplace;
- General availability of complaints helpdesk and neighbourhood teams to manage public space deficits.

Weaknesses

- The walking environment towards buildings, trains, buses, homes, ATM machines, shops, restaurants and schools are often not accessible for people with limited mobility;
- In rural areas and villages sidewalks are often missing;
- It is unclear what part of the walking network meets basic requirements of width (>1.80 meter), condition (flat, even and skid resistant) and absence of route discontinuities;
- Although there are signs that some municipalities conducted systematic reviews of the status quo of pedestrian facilities, such reviews are not publicly available; this way no well-founded statement can be made about accessibility of public space;
- Design, management and maintenance lack focus on the needs of elderly, children and the handicapped.

Safety and security arrangements

General requirements

- Important generic road safety measures regarding walking are traffic calming, the Sustainable Safety road classification featuring 30 km/h sojourning areas, shared-space Woonerfs, and zebra and regulated pedestrian road crossings.

Strengths

- In the Netherlands traffic calming in residential and shopping streets is the norm. More than 80% of these streets are transferred into 30 km/h street', 'Erf' or pedestrian area;
- Behavioural rules are set in the RVV 1990 Highway Code; important sharpening is that children younger than age 14 and the handicapped in principle are not liable in case of an accident.

Weaknesses

- No general generic overviews or statistics regarding dedicated pedestrian safety and security arrangements are found. Apart from the realisation of 30 km/h areas, the quantity, distribution and quality of safety provisions are unknown;
- Collector and trunk roads create a barrier for walking;
- Although traffic safety education is mandatory, this obligation is not always taken seriously and enforced;
- Traffic brigades for school children are appointed, but their numbers strongly decreased;
- No dedicated arrangements and statistics thereon regarding fall safety and security in public space are found.

Convenience, comfort and attractiveness

General requirements

- For non-captive pedestrians convenience, comfort and especially tempting arrangements concern dedicated packages for targeted groups;
- Main preconditions for sojourning in public space are organised activities, nice architecture, accessibility, comfort, place diversity, colourfulness, ample space for pedestrians, clean, not-broken, safe and cosy space, play elements, and seating and hanging-out facilities;
- In general extended pedestrian zones, decreasing the volume of street parking, adequate maintenance, abundant green, shielding against wind, rain and sun, art, and water fountains, reducing uncertainties regarding transfers to other modes and feasibility of the walking trip after exiting public transport or the car, can improve convenience and comfort for pedestrians.

Strengths

- There are many dedicated arrangements for hiking and tempting sojourning arrangements and events, particularly in the larger cities;
- Fit and fully able non-captive pedestrians do not always need and prefer basic W+S requirements like footpath width, pavement quality and absence of discontinuities therein;
- The Wandelmonitor offers insight into what is available and attractive for recreational hiking. It shows how important opportunities from home are: in total 71% of the hikes start from home.

Weaknesses

- In developing tempting walking and sojourning arrangements the elderly, handicapped people and children are (too) often neglected;
- Unkept physical environment, traffic nuisance, nuisance by other people (e.g. hanging-out locations of youngsters) and services and a variety of uncertainties can discourage walking;
- Shielding against weather conditions is often missing;
- Uncertainties regarding availability of (too few) toilets and resting facilities;
- Long waiting times at traffic lights;
- Automatic pedestrian detection is rare compared to car traffic and bicycle detection;
- Public space maintenance and management is reactive/ad-hoc, and not quality driven.

5.4. Dutch W+S system performance

5.4.1. Introduction

In the above Subsection 5.3 an impression is given of the quantities and qualities of arrangements that are available for (potential) pedestrians to make use of. The current subsection discusses the practical utility.

The *research question* regarding the assessment of W+S behaviour is:

How do pedestrians interact with their W+S environment, and what are the consequences?

It explores what information is available about how pedestrians actually use the available system and perform their activities, how it affects them and what major impacts the outcomes have on the wealth and well-being of individuals, communities and the nation (W+S system impacts). It also explores what improvements can be expected to have even better impacts on the system and its stakeholders.

In this section Dutch W+S system performance is explored along the lines of Chapter 4's Conceptual model of pedestrian W+S behaviour choices and outcomes (cf. Figure 4.1):

1. *Mobility on foot and sojourning in public space*, describing the extent to which reachability, feasibility and accessibility are materialised, (dealt with in Subsection 5.4.2.)
2. *Safety and security*, describing what mishaps occur while walking and sojourning and what risks are involved, i.e. the quality of mobility and sojourning (dealt with in Subsection 5.4.3.);
3. *Convenience, comfort and attractiveness*: viz. lacks in user friendliness, that can impede walking and sojourning in public space, i.e. dis-satisfiers, and user quality as an asset or motive for walking and sojourning more and more often, i.e. user quality as a satisfier (dealt with in Subsection 5.4.4.);

5.4.2. Mobility and sojourning in public space

5.4.2.1. Introduction

This paragraph explores how the attention to the role and function of walking and pedestrians evolved over time. It explains how knowledge about pedestrian activities gradually matured to the current state of the art, how pedestrian activities are defined and what the scope of this thesis' research in this context is, and outlines the rest of this subsection on pedestrian mobility and sojourning in public space.

The evolution of knowledge on the pedestrians' activities

Since the 1970s in many countries research for national mobility statistics was started up to underpin national and regional transport and land use policies. Those policies focussed on the one hand on supporting motorised (car) traffic and on the other hand public transport. Data on non-motorised traffic (walking and cycling) were more or less considered by-catch, and did not (yet) need to be complete. Since then several calls for attention were made for better data on and insights into walking (and cycling). In this introduction developments are explored.

Statistic Netherlands (CBS) started to conduct travel surveys in 1985[388]. In 1992 the Dutch Pedestrians Association VBV (Voetgangersvereniging) described the extent to which the travel survey sketched an incomplete image of walking. The CBS travel survey excluded children below the age of 12 and did not count sub-mode trips (to and from other modes). A dedicated VBV survey on walking, including children and sub-mode trips, showed that respondents in 1992 on average made 2.8 trips per person per day, of which 1.1 were main mode walking trips and 1.7 were sub-mode walking trips, whilst CBS counted only 0.6 main mode walking trips, and no sub-mode trips. On average the respondents walk slightly less than half an hour per person per day, about one third of the average total travel time of 80 minutes per person per day

[388] This travel survey was called Onderzoek Verplaatsingsgedrag. https://www.scp.nl/Onderzoek/Bronnen/Beknopte_onderzoeksbeschrijvingen/Onderzoek_verplaatsingsgedrag_OVG

(Knippenbergh et al., 1992). Partly as a result of this study CBS decided to include children in the travel survey, starting from 1994. The call for specification of sub-mode walking was not (yet) honoured.

In 1997 the UITP (Union Internationale des Transports Publics) conducted a survey into 'transport demand of modes not covered by international transport statistics'. On behalf of the Federation of European Pedestrian Associations (FEPA) a contribution was made regarding assessment of the volume of sub-mode walking in the European Union, building on the above VBV study. A simple model was used to estimate the number of sub-mode walking trips and distances covered: it was assumed that every car trip goes together with on average 50 meters walking (in two sub-trips), and public transport trips go together with on average 1000 meters of walking (in two sub-trips). In 1994 and 1998 this line of reasoning was adopted in the 'Het Voetgangers Cijferboek' (= the 'Pedestrians Numeric Book' (Voetgangersvereniging VBV, 1994; Kavsek, 1998)). The calculations took into account that different travel motives are associated with different average walking distances, as found in the above Knippenbergh et al. study and a dedicated study on shopping routes quality (Steenaert, 1996). The studies showed that home-work car trips go together with on average 120 meters walking, business trips with on average 200 meters, visiting trips with on average 40 meters, shopping trips with on average 270 meters, recreation and other motives trips with on average 170 meters. Rietveld (2000) published a scientific article using the 1998 Pedestrians Numeric Book.

Although many pedestrian experts realised that 'there is more to walking than walking' (Gemzoe, 2001 and Gehl, 1978/2011), apart from main mode and sub-mode, generally no other key types of pedestrian activities were discerned. In 1997, as mentioned in Chapter 1, the London Planning Advisory Committee (LPAC) identified four key types of walking: access mode, access sub-mode, circulation/exchange, and recreation/leisure. In this thesis the content of the key types of walking is redefined into main mode walking, sub-mode walking, circulation, and sojourning.

In 2005 Methorst developed new indicators for sub-mode walking through the study 'Voetenwerk', in which 123 people reported on their main and sub-mode walking trips in 2005. The study showed that the average distances between home and car are about 30 meters; between car and work/shop address about 150 meters; between home and train about 750 meters, and from train to final destination about 600 meters; between bus/tram/metro and home or final destination about 400 meters. The found indications for sub-mode walking seem to be comparable to other high income countries. Based on the Norwegian 2005 travel survey, Berge (2010) found average distances similar to the Dutch figures (150 meters to and from a car; 430 to 460 meters to and from bus/tram and 760 to and from a train station).

Definition and scope

Based on the above explorations and acquired insights it became clear that pedestrians typically perform the following four types of activities:

1. Main mode walking for transport (i.e. A to B [door-to-door] walking, excluding walking for recreation and professional walking);
2. Sub-mode walking (walking to and from other modes);
3. Circulation (round-trip walking [A to A], both for recreation and for professional walking);
4. Sojourning (activities on foot, not aimed at getting somewhere or recreational walking).

This subsection successively deals with these four kinds of activities that pedestrians perform or, to some degree, are inhibited to perform, i.e. avoided or suppressed mobility. The latter is relevant because it may go at the expense of the populations' Quality of Life and/or economic and social well-being of individuals, communities or the nation.

In order to effectively, efficiently and fairly support pedestrians to perform their activities, insight needs to be acquired into the real volume and main characteristics of the pedestrians' activities.

This subsection focusses on how pedestrians in fact perform their role in society. The exploration aims to cover available statistics and results from dedicated studies, estimate their validity and completeness, and combine sources to sketch the real absolute and relative volumes of the pedestrian activities and their meaning.

Outline
The following paragraphs sketch the volumes and main characteristics of walking. Originally the aim was to include a description of developments over time and provide exposure measures e.g. to position the activities and their risks of accident and injuries. Due to significant trend breaks and other imperfections in the available (mobility) databases this was not feasible. Whenever possible absolute and relative volumes or distributions are shown. Furthermore a tentative indication is given of expected future developments regarding the four kinds of walking.

5.4.2.2. Main mode walking (A to B walking)

Main-mode walking in this thesis concerns door-to-door walking for transport, where no other mode of transport is used. This kind of pedestrian activity is measured and described reasonably completely in the continuous Dutch national travel survey OViN (2010 - 2017) and its predecessors MON (2004 - 2009) and OVG (1992 - 2003). The OVG and OViN surveys were executed by Statistics Netherlands (CBS); the MON survey was executed under responsibility of Rijkswaterstaat by SocialData. Statistics based on these surveys are publicly available on the Statistics Netherlands Statline website; for researchers the underlying datasets are available through DANS[389]. Starting in 2018 Netherlands Statistics uses a new research approach for the national travel survey OdiN. In this thesis data from the OVG, MON and OViN from 1994[390] - 2017 are used; OdiN data were not yet available.

Statline statistics are available to the general public. However, the meaning and scope of the Statline statistics on walking are not totally clear. Consequently misinterpretations are lurking. Firstly because Statistics Netherlands performed several selections and calculations on the raw survey data to arrive at the statistics. The presented total 'production' of walking in billion kilometres is the result of (not clearly indicated) imperfect reporting, using correction weights and adding estimated holiday kilometres that are not reported in the survey itself. It is also easily misunderstood that the travel survey does not cover all walking in public space, but a specific selection of it: walking by Dutch residents. So trips by visitors of the Netherlands, frequent walking trips (e.g. circulation by professionals like postmen or salesmen), and holiday trips are excluded (and in last instance again stepped up in the totals, but not in the underlying tables such as about trip numbers). Forms of recreational walking beyond holiday, such as dog walking, are not explicitly excluded. However, the set-up of the travel survey diary is focussed

[389] Data Archiving and Networked Services to be contacted through info@dans.knaw.nl
[390] Only from the research year 1994 children younger than 12 years were included in the travel survey.

on travel from A to B, which results in underreporting of recreational walking. Furthermore (young) children are questioned indirectly through their parents or guardians, resulting in less complete and reliable coverage of the children's mobility on foot. Therefore, in reality the 'production' is substantially larger than indicated by statistics.

In this paragraph an attempt is made to present statistics regarding main mode walking that approximate the real volumes and shares. Successively the following aspects are discussed: the share of main mode walking in main mode travel statistics, the volumes of main mode walking, distribution of travel motives, main mode trips across gender and age groups, spatial distribution of main mode walking trips, distribution of main mode walking trips over time (years, months, time of day).

Share and volume of main mode walking for transport

As a main travel mode, the share of walking in distances covered has decreased significantly over the past century. Although no reliable statistical data are available about travelling on foot for the periods before the early 1980s, it is common knowledge that before 1850 the vast majority of travelling was on foot. Only a very small minority had access to means of transport like horses and carriages. Up until 1850 towing boats were used for intercity travelling[391] and by the end of the 19th century some public transport (railways, trams) existed, but this transport was too expensive for use by common people. Based on these insights, it is likely that in 1900 still more than 75% of all passenger kilometres were made walking (cf. Filarski, 2004, citing Pooley and Turnbull on modal spilt in the UK, where walking took up 60%; in the much poorer Netherlands bus, tram and metro were available and affordable). With the introduction and diffusion of the bicycle and the motor car this share dropped to about 30% just before World War II. In the war walking again became more important, as bicycle, public transport and car use became more difficult. After the war the bicycle and particularly the car took over and the share of walking in passenger kilometres gradually dropped from about 40% to the current 2.8% share (see Figure 5.2).

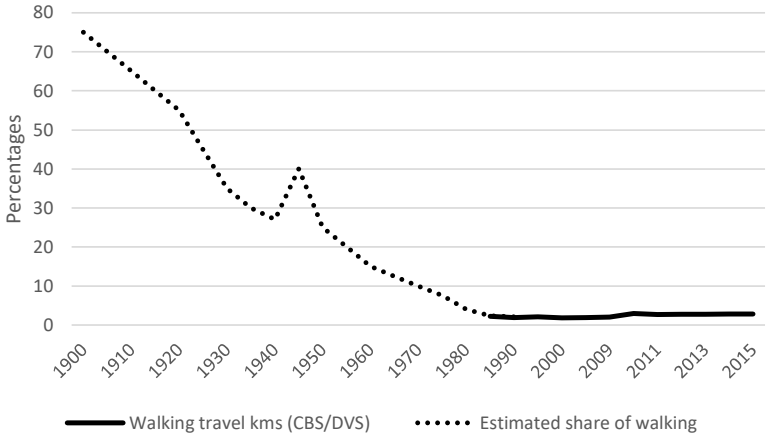

Figure 5.2. Estimated share of walking in passenger kilometres 1900 - 2009 in the Netherlands (percentages)

[391] in the year 1700 approximately 100.000 passengers were moved by towing boats; after that year the numbers slowly decreased. This equal about 1 trip by towing boat per 18.5 persons in a year.

In national mobility statistics generally no difference is made in walking for transport and walking for recreation. Furthermore, as mentioned, walking by visitors from abroad and professional walking is not included. Of all reported main mode *trips* in 2017 in OViN 18% (169 trips per person per year; 54 hours travel time per year; trip average 1.7 kilometres) concerned main mode walking (De Haas & Hamersma, 2019; see also table 5.3). In MON and OViN travel survey data this share in mobility is relatively constant and was in 1997 also 18% (MON/OViN dataset; Rietveld, 2000). Particularly short trips are often made on foot. Of all trips of less than 2.5 kilometres in 2017 39% was made on foot. The share of the bicycle in these short trips was 37%, whilst the share of car use (drivers + passengers) was 22%. For trips up to one kilometre the share is even almost 80% (De Haas & Hamersma, 2019).

The general national mobility statistics published on Statline[392] show the totals regarding the 'production' (distance) of the various modes of transport, including sub-mode travel and a 'holiday estimation'. The share of walking in the total number of passenger kilometres in the period 2010 - 2017 is 2.8% (5.5 billion kilometres walked as part of the total number of passenger kilometres of 195.9 billion kilometres). Main mode walking concerns both main mode walking for transport and for recreation[393]. The walking for recreation should be considered circulation, and subtracted from the total.

In Table 5.4. the share of walking for transport as a main mode is calculated by subtracting kilometres walked as sub-mode (0.63 billion kilometres), the 'holiday estimation' (0.68 billion kilometres, which should be considered 'circulation'), and walking for recreation (i.e. 'touring and hiking', amounting to 1.75 billion kilometres). Main mode walking for transport (A to B) thus amounts to 2.5 billion kilometres (1.3% of the total of passenger kilometres), representing 90 main mode walking for transport trips per person per year.

Based on OViN data main mode walking for recreation (i.e. 'touring and hiking') is 1.75 billion kilometres per year in the period 2010-2017. An additional reason for treating recreational walking separately is that walking for recreation appears to be seriously underreported (Maas, 2011). Below, under circulation, a more comprehensive estimation of the 'production' of walking for recreation is presented.

Table 5.4. Estimation of main mode walking for transport per year in 2010-2017

	Passenger kilometres (billion)	distance pppy	trips pppy	% distance	% trips	Source
1. Total mobility volume	195.9	11,623	920	100.0	100.0	CBS, 2019
2. Total of OViN reported walking	5.5	288	169	2.8	18.4	CBS, 2019
3. Holiday estimation	0.7	40	21	0.3	2.3	CBS 2019 and SWOV, 2019c
4. Difference trips - sub-trips	0.6	38	19	0.3	2.1	Raw OViN data
5. Touring and hiking	1.8	104	39	0.9	4.2	CBS, 2019
6. Main mode walking (all motives)	4.9	291	150	2.5	16.3	# 2 -# 4
7. Main mode walking for transport	2.5	106	90	1.3	9.8	#2 - #3, 4, 5

With regard to the future share of main mode walking for transport in mobility prospects for growth do not seem to be favourable. Contra indications are 1) developments in technology (the

[392] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83497NED/table?ts=1575623038384

[393] By definition main mode walking for recreation is not preceded or followed up by travel towards place where one starts the walk. Consequently it begins and ends at the starting point, viz. home or place where an overnight stay was had.

continuous introduction of competitive new forms of transport as alternative for walking, including new light electric vehicles), 2) spatial distribution of attractions (less and bigger retail and services access points because of a commercial focus on retail and building efficiency), 3) smaller households which in total take up more space for the same number of people (larger average distances between contacts; friends, family, services beyond walking distances), 4) ageing of the population (smaller action radius, lower number of trips per person; ill health as deterrent). These future developments will probably not be sufficiently compensated by policies to increase walking (the trend in public space policies is that in central parts space for cars will be released for cyclists and pedestrians) or a public awareness that walking as a main mode is very healthy; because of ageing of the population there will probably be less money available to solve pedestrian problems as governments will be increasingly challenged to do (much) more with less money.

Distribution of motives for walking trips

The national travel surveys offer insight into the distribution of motives for main mode walking trips. Although travel survey data are available since 1985, trend breaks in methodology make it unfeasible to validly detect developments in what motives Dutch inhabitants had for walking. Therefore this thesis' analysis of the distribution on motives for walking is restricted to the recent OViN travel survey for the years 2010-2017.

Motives for walking differ from motives for travelling by other modes in many ways. Main motives for walking are going to a shop (one quarter), free-time destinations (one quarter) and walking for recreation. The share of walking to and from school is slightly less (see Figure 5.3). Compared to other modes shopping and walking for recreation are overrepresented in walking. Least popular motive for walking is going to work, because most work places are available beyond walking distance. The graph shows main mode walking and does not show walking trips that are preceded by a sub-trip towards and from walking tours.

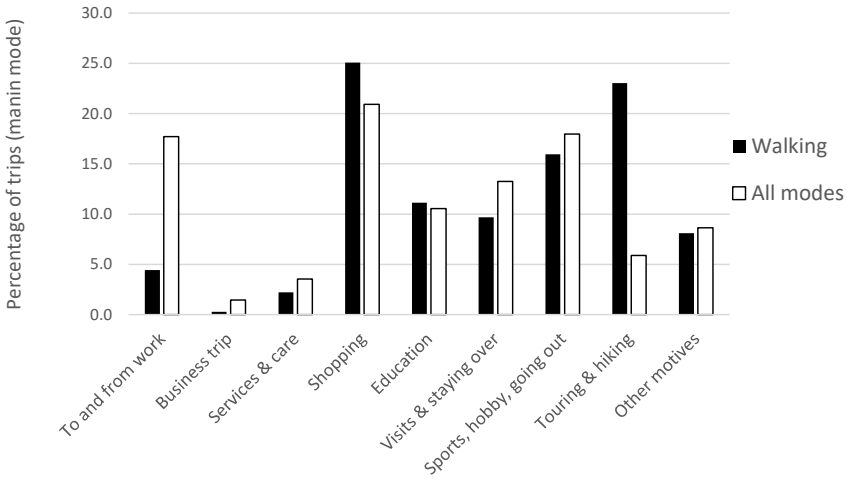

Figure 5.3. Percentage of trips per motive for walking and for all modes (OViN 2010-2017)

Another illustration of the importance of walking for recreation is given by Figure 5.4., which shows the shares in distances covered on foot for the discerned walking motives. Walks for recreation (touring & hiking) takes up 36% percent of all main mode walking and concerns

comparatively long trips (2.7 kilometres). The few people who walk to and from work and for business reasons however have to walk relatively far; the total distance covered on foot per year for this motive is about the same as an average Dutch inhabitant walks to and from school (22.5 kilometers per year), which on average concerns relatively short trips of 1.2 kilometers.

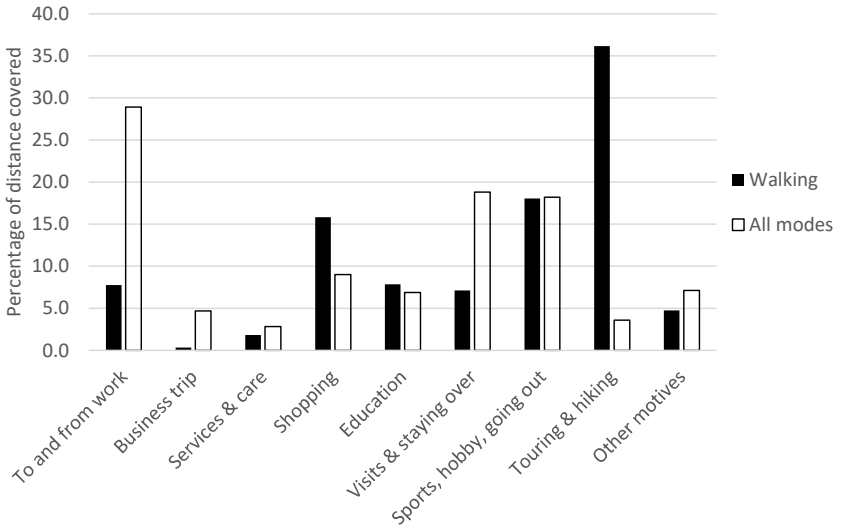

Figure 5.4. Percentage of total distance covered on foot and all modes per motive (OViN, 2010-2017)

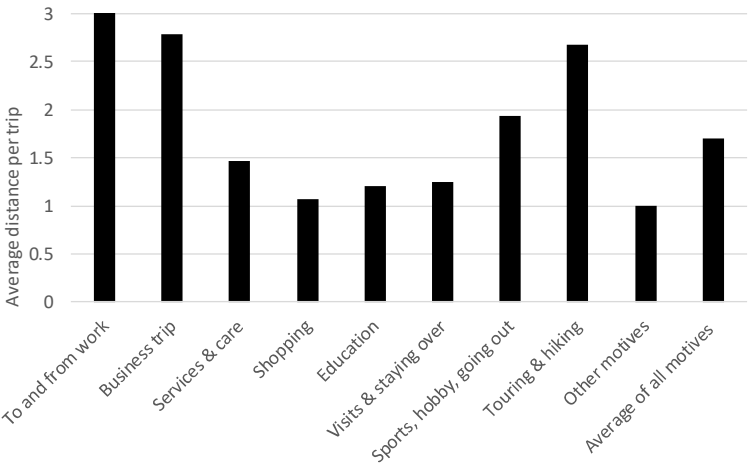

Figure 5.5. Average distance per trip covered on foot, per motive (OViN, 2010-2017)

Main mode trips across gender and age groups

Chapter 4 showed that needs, abilities and risks of children and the elderly differ from those of adults (age groups 25 - 65). Children and the elderly are especially vulnerable because they are more dependent on walking for their mobility and because their abilities are either in

development (children) or decreasing and because they are more fragile (elderly). As a pedestrian as traveller is unprotected these groups are more vulnerable in case of encounters and falls. In this regard it is important to discuss the relation between walking, and age and gender.

Figure 5.6 shows the number of trips per person per year per age group and travel modes. This way differences between their mobility per travel mode and exposure to traffic can be compared. Children walk relatively often. Regarding the youngest ones this includes transport by prams. From the age of 12 the use of bicycles increases and walking decreases. From the age of 25, during the rest of their lives, the average number of trips on foot is rather constant. Only after the age of 75 the number of walking trips per person per year decreases, but not as strongly as for other modes. In Figure 5.7 the yearly covered distances on foot per person are broken down to age and gender. In youngsters and the elderly on average males and females on foot cover similar distances. Females between the age of 25 and 65 however walk about one fourth more kilometres than males. With growing age the number of kilometres walked in females decreases stronger than in males.

As more detailed statistics on the share of walking per age group are not available through the Statline website, OViN 2010-2017 survey raw data were used to compile a graph on the share of walking in the modal split of age groups. Figure 5.8. shows better than Figure 5.6. that the share of walking in modal split increases with age and decreases only slightly when people get older than 90 years. The share of cycling substantially decreases from the age of 80, showing that the elderly keep on walking longer than they keep on cycling. From 80, and even stronger from 90 years of age, the share of trips with handicapped vehicles increases, presumably for the elderly who are not moving well on foot. In the age 17-24 years bicycle use dominates. For 25+ the share of public transport highest at for 18-25 year olds, and decreasing from that age. At the same time the share of car use for 25+ is high; with growing age the elderly more often are car passengers instead of drivers. This is probably due to decreasing abilities and a lower driver licence rate amongst elderly women. This way the elderly are more often dependent on walking or the support of others for undertaking activities.

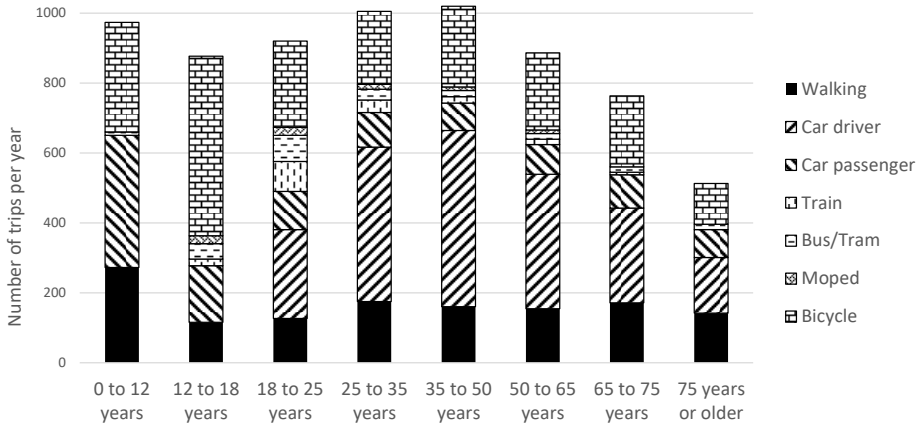

Figure 5.6. Number of trips per person per year - main mode and age (OViN 2010-2017)[394]

[394] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83499NED/table?dl=28A40

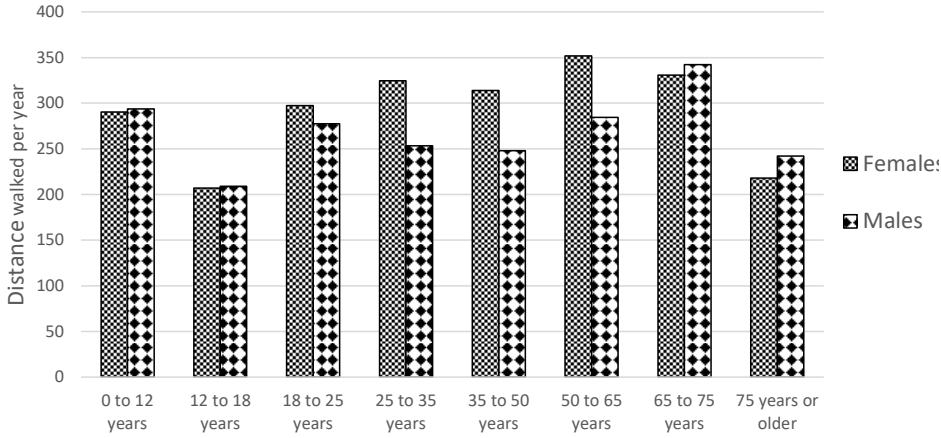

Figure 5.7. Distance walked per person per year - age and gender (OViN 2010-2017)[395]

The figures 5.1 - 5.8 do not differentiate on travel motive or kind of walking, but only on main mode walking (both for transport and for recreation/circulation). Based on OViN data De Haas & Hamersma (2019) estimate that in particular the group ages 50 - 75 relatively often walks (hikes) for recreation and walks relatively long distances. Analysis of CVTO shows that 40% of the recreational walks are performed by people aged 55 and older (Wandelnet/Fietsplatform, 2018). Available literature on analyses using CVTO does not provide more detail.

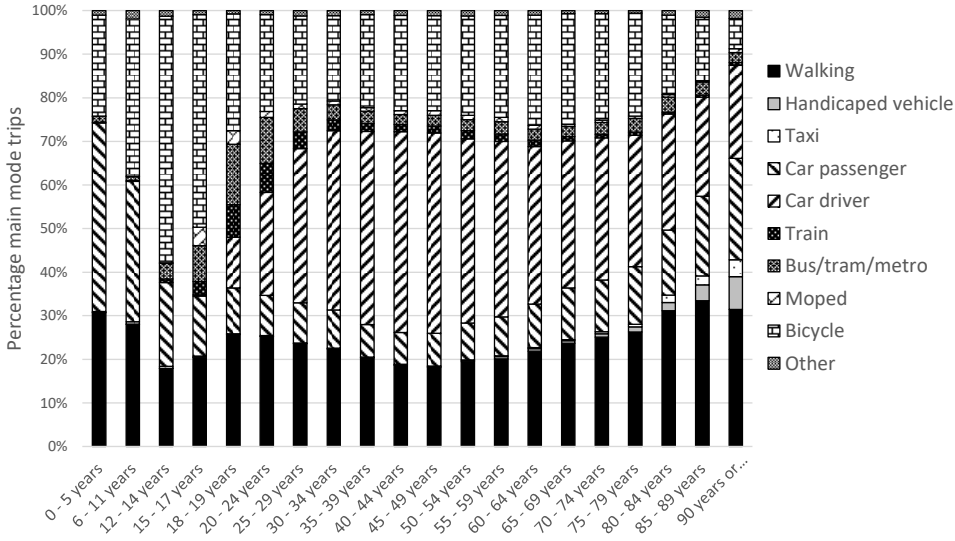

Figure 5.8. Percentage of main mode trips per mode and age group (OViN, 2010-2017)

[395] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83499NED/table?dl=2A5F4

Spatial distribution of main mode walking trips
In Dutch large cities public transport is more readily available, stops are closer and there more walking takes place than in less urbanised areas. In the four largest cities in the Netherlands the shares of walking in the modal splits varies round 30%, while the Dutch average is 18%. In South Limburg walking is relatively popular (De Haas & Hamersma, 2019). The importance of walking is partly due to more frequent use of public transport, inciting sub-mode walking.

Less is known about the spread of other forms or walking (walking for recreation and sojourning). City walks are taken relatively often in the centres of the bigger cities (CELTH/CBS/NBTC/NRIT, 2017). In the provinces of Limburg, Gelderland and Flevoland walking also is relatively popular; this can be linked to the attractive natural environments in those areas (Wandelnet/Fietsplatform, 2018).

Distribution of main mode walking trips over time (months, time of day).
This paragraph explores to what extent patterns in mobility on foot stand out when compared to other modes. The observations are based on OViN 2010-2017 data as published on Statline[396]. The conclusions concern main mode walking, i.e. walking trips starting at home or a stay-over place, door-to-door or as circulation trip. Walking (sub-)trips that were preceded by use of other modes (car, public transport or bicycle) in principle are not included; CBS reports trips as main mode trips, whereby walking is taken as main mode only when no other modes are used.

With regard to distribution of walking over the year it stands out that in January and February more walking trips are made than in other months, and that the distribution is similar to the distribution of trips by all modes (see Figure 5.9). This is also true for distances covered and travel times. Figure 5.10 shows the models split of walking and all modes together. While most of the year the share of walking in the modal split is around 17.5%, in the first two months it is about 20%.

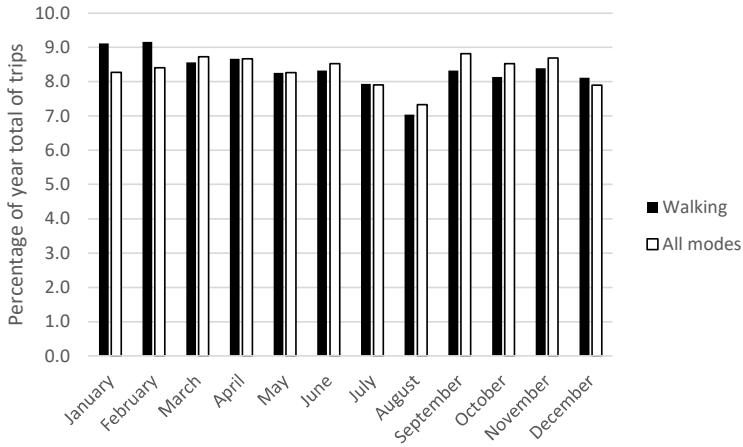

Figure 5.9. Percentages of walking and all modes trips over the months of the year (OViN 2010-2017).

[396] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83498NED/table?ts=1576246676755, accessed 7 -12-2019

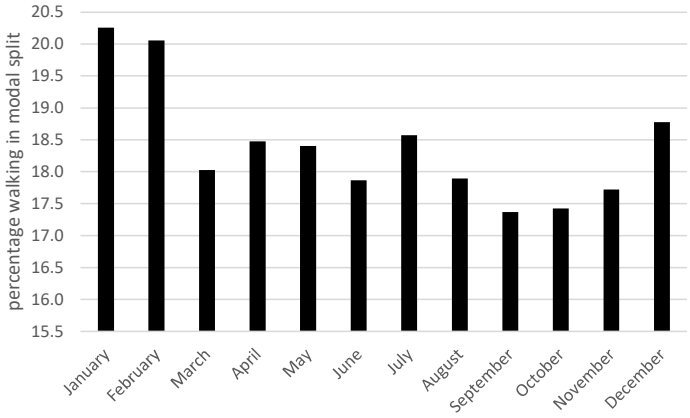

Figure 5.10. The average shares of walking in the modal split (trips) per month in the Netherlands in 2010-2017 (OViN 2010-2017).

A likewise distinctive pattern is found for the distribution of walking over the days of the week. On Sundays, and to a lesser extent on Mondays, and Tuesdays Dutch citizens walk more and more often than during other days of the week (see Figures 5.11 and 5.12).
Compared to all modes walking is also distinctive regarding the distribution of trips, covered distances and travel times over the day. Figures 5.13 and 5.14 respectively show the distribution (percentages) of walking trips over the day and the modal share (trips) of walking in the different parts of the day. Both graphs show that pedestrian exposure peaks at midday and is relatively high in the evening.

With the aging of the Dutch population it is to be expected that the differences in walking exposure will decrease somewhat. The elderly have less need to reserve walking to the weekend and evening; OViN data show that their walking is more spread over the week. Furthermore, it can be expected that new, affordable vehicular alternatives for walking will substitute (some) walking.

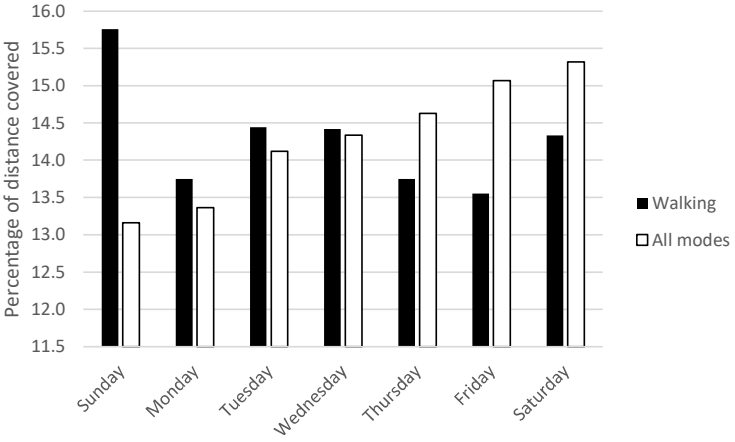

Figure 5.11. Percentages of distance covered on foot per day of the week in the Netherlands 2010-2017 (OViN, 2010-2017).

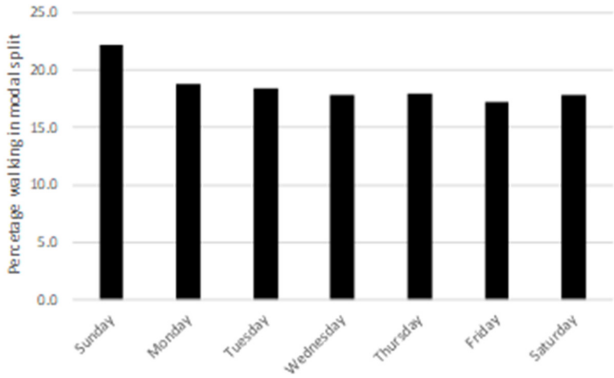

Figure 5.12. Average shares of walking in the modal split (trips) over the days of the week in the Netherlands 2010-2017 (OViN 2010-2017).

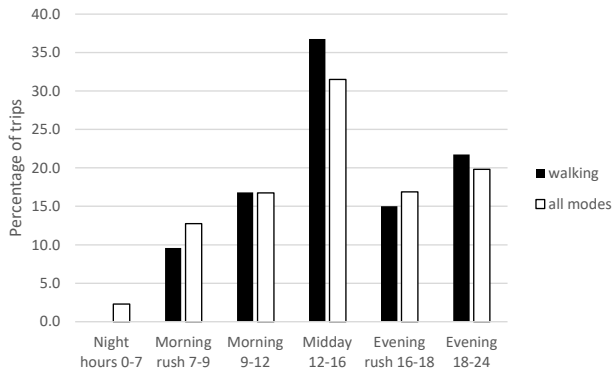

Figure 5.13. Percentages of walking trips made in the course of the day in the Netherlands 2010-2017 (OViN 2010-2017).

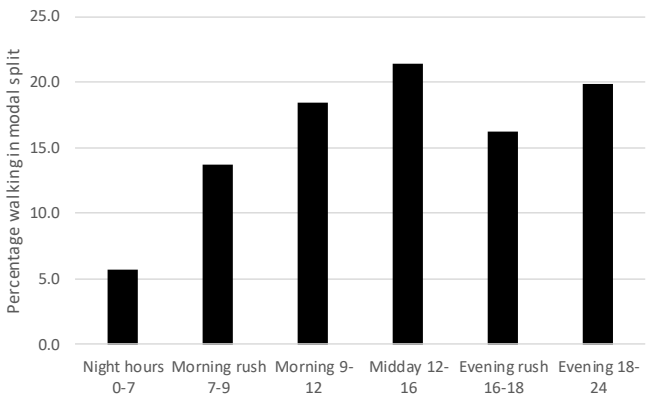

Figure 5.14. Average shares of walking in the modal split (trips) over the course of the day in the Netherlands 2010-2017 (OViN 2010-2017).

5.4.2.3. Sub-mode walking

This paragraph describes sub-mode walking trips, i.e. trips to and from vehicles that are considered the main transport mode to and from a destination. Although such sub-mode trips are essential for vehicular trips, and are partly over public roads, this walking to and from other modes is severely underreported in mobility statistics. This is mainly due to the fact that respondents often forget to tell about short trips. Somewhat longer sub-mode trips to and from public transport are often reported, but the shorter trips to and from the parked car are reported in statistics (Methorst, 2005; Rietveld, 2000; UITP, 1997; Voetgangersvereniging VBV, 1994). Rietveld (2000) estimated that in the Dutch case the total number of walking trips including sub-mode walking trips is six times higher than the number of main mode walking trips found with standard travel survey approaches. Data from calculations by Methorst (2010-4) point to an even larger multiplier of 8.4 (3.6 billion main mode trips and 29.9 billion (main and sub-) mode walking trips in 2007 in the Netherlands (Methorst, 2010-4:161)). Both Rietveld and Methorst find that the total distance covered walking is a little more than 40% more when sub-mode walking in public space is included; UITP (1997) found that in 1996 the total distance walked was 33% more than for main-mode walking alone.

Based on OViN main-mode walking figures and Rietveld's multiplier the number of sub-trips are estimated at:

- about 845 trips per person per year (6 x 169 - 169: cf. Table 5.4);
- about 100 kilometres per person per year (40% of 4.2 billion kilometres = 100 kilometres per person per year).

Consequently it can be estimated that Dutch residents in 2010-2019 in total walk about 1.7 billion kilometres per year to and from other modes. In comparison: the OViN statistics report 0.6 billion sub-mode walking kilometres (yearly average over 2010 - 2017 (CBS, 2019[397]).

According to Rietveld (2000) the number of sub-mode walking trips increased strongly because of the increasing number of car trips. About 70% of the total distance covered by sub-mode walking is realised by trips to and from cars, whilst about 30% is realised by trips to and from public transport. Additional research into trips to and from train stations shows that people relatively often go to the station by bicycle, whilst the walk to their final destination from the arrival station (Keijer & Rietveld, 2000). Based on Dutch Rail data KiM (2018) concludes that this is still the case for 2017. In trips to and from train stations the share of walking is almost one-fourth, whilst they share in trips away from the stations is about 45%. Between 2005 and 2014 these shares were more or less constant. The share of the bicycle in sub-mode trips has increased, while the shares of car and bus/tram/metro towards stations has decreased.

It can be expected that sub-mode walking will increase both in terms of numbers of sub-trips per person and covered distances in the coming decennia. Indications for this increase are growing average distances towards and from destinations that matter (more often beyond walking distance because of upscaling of services and further decrease in housing occupation) and larger distances towards and from parked cars and public transport (increase in numbers of cars and more competition for nearby parking; economizing PT schedules results in average larger distances between PT stops).

[397] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83497NED/table?dl=13FC7

5.4.2.4. Circulation (A to A walking)

In 2011 Maas compared the CBS statistics on day recreation to statistics from the MON travel surveys and found that the travel survey seriously underreported trips for recreation, probably due to the question in the travel diary used for the travel survey. In the meantime the CBS day recreation statistics discontinued. Since 2015 the 3-yearly Continu VrijeTijdsOnderzoek CVTO (English: Continuous Free Time Research) was started. This research estimated that the Dutch residents made 441 million walks for pleasure in 2015, with average distances walked of 7.6 kilometres, amounting to a total of 3.6 billion kilometres (CELTH/CBS/NBTC/NRIT, 2017; Wandelnet/Fietsplatform, 2018). This study concerns day recreation activities of minimally one hour duration (excluding travel time). Visits to family, friends and acquaintances as well as activities during holidays or activities involving an overnight stay are disregarded. Because of the duration limitation of one hour, walking the dog, as a frequent sort of walking, is only partly included. Research by HAS Hogeschool and the University Utrecht (2015) showed that about 1.5 million households own a dog. Walking the dog takes on average 23 minutes (Christian et al., 2013). Walking speed can be estimated at about half average walking speed of 4 km/h. Consequently a dog walker walks almost 300 kilometres per year (25 kilometres per Dutch inhabitant per year), totalling 0.4 billion walking kilometres by dog-owner households.

Not only Dutch inhabitants, but also visitors are often on the way for recreation. The Trend Report Tourism, Recreation and Free Time 2017 (CELTH/CBS/NBTC/NRIT, 2017) shows that the Netherlands are visited by almost 16 million tourists, who in total booked 40 million hotel stays. Additionally 18 million business hotel stays were reported. With 6 million hotel guests (in 2016) from abroad Amsterdam is a big draw in the Netherlands. Other major attractions are the coastal areas. Various forms of walking are popular pastime. In the top 20 of most popular activities city walks (54%) rank first. 'Walking' (43%) ranks 3rd, 'fun-shopping/shopping' ranks 4^{th,} 'beach visit and walk' (20%) ranks 13th, and 'Nature areas and woods' (20%) ranks 14th. If on average visitors walk 5 kilometres per overnight stay, visitors in total walk 0.2 billion kilometres per year. Most of these kilometres can count as circulation kilometres.

Professional walking is not covered in the Dutch travel surveys (OViN and predecessors). According to CBS Statline[398], in the second quarter of 2019, there were 86.000 newspaper deliverers and garbage collectors; the number of postmen decreases after the merger of PostNL and Sandd, but in the beginning of 2019 there were still 34,000 postmen. If these professionals walk 2 hours during 5 days of the week at 2 km/h, in total they would 'produce' 0.1 billion walking kilometres per year.

In Table 5.5. the estimations of numbers of trips, covered distance and exposure time are shown. With regard to exposure time different walking speeds are assumed: for recreational walk an average walking speed of 4 km/h is assumed; for walking the dog 2 km/h; for touristic walks 2.5 km/h; and for professional walks 2 km/h.

Due to ageing of the population and active health policies walking for recreation and health can be expected to increase.

[398] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82808NED/table?dl=28A79

Table 5.5. Estimation of trips, covered distance and exposure times for circulation on foot

Facet of circulation	*trips pppy **	*Kilometres pppy **	*Total kilometres (x billion)*	*Exposure time pppy **
Recreational walks	28	225	3.6	56
Walking the dog	34	25	0.4	2
Tourists & visitors	7	18	0.3	7
Professional walkers	2	7	0.1	3
Total	71	275	4.4	69
* converted into national population equivalents per person per year				

5.4.2.5. Sojourning in public space

Sojourning in public space (almost) always is preceded by some walking. Sojourning concerns a destination or a stopover, and begins when deliberate movement on foot to arrive there stops. Contrary to the other types of pedestrian activities, sojourning cannot be expressed in terms of kilometres travelled, but in terms of time spent or number of times done only. Hardly any statistics about sojourning in public space were found. Some statistics are available regarding outdoor activities of children, regarding the presence of homeless people, and number of visitors of (free) events.

Although there are indications that nowadays (2019) children play outdoors less than earlier generations (e.g. 1960-1970), still 70% of the children play outdoors for an average of one hour (Mabelis, 2012; Van den Boorn, 2007). Playing outdoor mainly occurs in (private) gardens and schoolyards, and partly in public space on the street, playgrounds or parks. Assumed that 70% of the children aged 3 - 12 years play outdoors in public space for 20 minutes per day, this amounts to 84 hours per child per year (0.33 x 0.7 x 365). This is even more time than they spend on main mode walking (72 hours per year)[399].

In literature a number of reasons for the decrease of playing outdoors are mentioned: options for play outdoors in urban areas have diminished, while new alternatives like gaming and social media come up, and children are more often placed in school care facilities due to increasing of labour market participation of women (Mabelis, 2012; Smit & Louwerse, 2011; Van den Boorn, 2007). The research suggests that children still spend much time in public space, but statistics are not detailed enough to do national assessments in this regard.

Homeless people are a notable group of sojourners in public space. In 2009 CBS made a first estimate of the number of homeless people aged 16 - 65. In 2009 the number of homeless people was about 17,800, which grew to 27,300 in 2012. In the following four years it seemed that the number stabilised, but in 2018 it again increased with 12,000 to 39,300 homeless people. 84% of them are males, and more than half of them have a non-western migration background. The latter's share increased from 36% in 2009 to 47% in 2018. The non-western homeless are often young (37% was aged 18 -30, compared to 27% of Dutch or western background); more than half of the non-western homeless sojourn in the four largest cities (Amsterdam, Rotterdam, The Hague, Utrecht)(CBS, 2019[400]).

[399] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83499NED/table?dl=28AD3
[400] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80799ned/table?ts=1575192999532

Each year research agency Respons publishes a Top 100 Event Monitor. The ranking is based on numbers of visitors. Event organisers are very keen to get on the list, because this helps acquiring funds. The numbers of visitors reported by the organisers are rarely accurate (NOS, 2016[401]; NOS, 2015[402]). For many years the International Four Days Marches Nijmegen is first on the list (1.5 million visitors). Other high ranking events are the Rotterdam Marathon, Tilburg Fair, Amsterdam Light Festival, Flower Parade Burb region, GLOW Eindhoven, Pride Amsterdam, 3FM Serious Request / Glass House, Weert Fair.

Other forms of sojourning in public space are not reported in Statistics Netherlands or other governmental agency statistics. This way no reliable statistics are available on how much time, when and where people spend in public space, e.g. waiting for a bus or tram, visiting flea markets, festivals, sunbathing or fishing in a park or talking to the neighbour. Based on discussion in the PQN project Methorst (2010-4) estimated that this way up to 100 hours per person per year are spent in public space. In Table 5.6. shows updated estimations regarding average time spend on sojourning in public space. The average exposures for members of the various groups are converted into estimations in average time spent (hours) per person per year for all pedestrians in the Netherlands. By far the largest group of professional sojourners is 'outdoor workers'. This groups includes amongst others workers around building sites, gardeners, road and public space maintenance workers, market and street venders: everyone who works in public space.

With regard to major future developments, growing awareness of health and well-being, ageing of the population and decreasing employment opportunities can be expected to offer more opportunities, reason as well as social need to go outdoors for socialising, entertainment and sports.

Table 5.6. Estimated average sojourning exposures in hours per person per year in the Netherlands 2010-2017

Group	Activity	Populations		NL average
		Group size	Hours pppy *	pppy *
Children 3-12	Play outdoors	1,718,200	72	7
Youngsters 12-18	Hanging out	1,203,500	25	2
Adults 18-80	Large events	12,813,800	5	4
Adults 18-80	local events	12,813,800	8	6
Adults 18-80	Socialising	12,813,800	5	4
Adults 18-80	Waiting	12,813,800	10	8
Outdoor workers	Working	2,200,000	300	39
Tourists/visitor	Sight seeing	125,000	750	6
Homeless	Day spending	27,500	3000	5
Total population	Miscellaneous	16,854,300	10	10
Total	**n.a.**	**16,979,300**	**n.a.**	**90**
* pppy = per person per year; population data source: CBS Statline				

401 https://nos.nl/op3/artikel/2080492-bezoekersaantallen-van-evenementen-kloppen-zelden.html, accessed 11-12-2019

402 https://nos.nl/artikel/2055502-evenementen-rommelen-met-bezoekersaantallen.html, accessed 11-12-2019.

5.4.2.6. Transport poverty and social exclusion[403]

According to Van Wee et al. (2014) as yet little is known about avoided mobility leading to 'transport poverty' or social exclusion. Problems in relation to avoided mobility are schematically shown in Figure 5.15. It can be assumed that healthy people will only rarely avoid to go outdoors for a walk because of lack of reachability, accessibility or safety. Almost 80% of the Dutch population experiences walking as pleasant, and almost three quarters of them thinks that it is safe (Haas & Hamersma, 2019). Such positive associations towards walking have been found in Flanders (Belgium) as well (De Vos et al., 2016). Avoiding walking can be considered a problem because people do not profit from the health benefits of walking (Kelly et al., 2014). The consequences are even worse if people lack alternatives and cannot participate in 'normal' activities. According to Martens et al. (2011) in such cases there is transportation poverty, which internationally is studied as part of social exclusion, which amongst others arises from a lack of travel opportunities. In the Netherlands this problem is relatively marginal, thanks in part to the role of the bicycle (Martens et al., 2011), but this only applies to those who (still) can cycle. In order to prevent transport poverty in the Netherlands, for specific groups there is informal care and provision of individual walking aids and various forms of group transport.

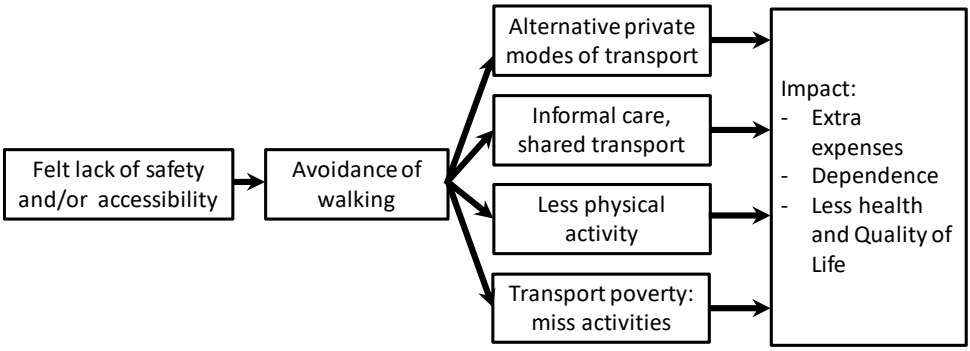

Figure 5.15. Schema avoided mobility and possible consequences

For many children walking is an important mode for growing up, including independent travel. De Vries (2009) showed that perceived safe traffic conditions is a more important reason for physical exercise than the availability of playgrounds and greenery in a neighbourhood. For children's parents security and traffic safety are main factors in the decision to let them go to school independently or take them to school by car (Saelens & Handy, 2008; Van Twuijver, Schreuder & Jansen, 2006). When taken by car the children do not profit from health benefits of active modes (Merom et al., 2006; Schoeppe et al., 2013). In this context there is talk about a backseat-generation. As yet it is unclear whether this development continues. The differences between going to school on foot or by bike in the age group 0 - 11 years between 1994-1996 and 2015-2017 are small (CBS, 2019; SWOV, 2019c). How big the impact of perceived traffic safety is, is hard to estimate because other arguments can play a role in chain trips too, such as using the car for home-work trips and delivering the kids on the way. Children without option to walk to school independently are extra dependent on transportation and run a chance of not being able to participate in activities (Kampert et al., 2018), but it is unknown to what degree this applies. Subjective lack of traffic safety as reason for not letting them go about

[403] This paragraph is co-authored by Paul Schepers as part of a Quick Scan report Pedestrian Safety for the Ministry of Infrastructure and Water Management, November 2019.

independently applies mainly to exposure to motorised traffic (Lam, 2001; Saelens & Handy, 2008; Sanders, 2015; Van Twuijver, Schreuders & Jansen, 2006).

For people with limited mobility, including many elderly, who cannot (anymore) drive a car or ride a bicycle, walking is one of the last remaining options, also in combination with making use of public transport. Figure 5.16. shows the share of Dutch inhabitants that suffer from limited eyesight, serious overweight (Body Mass Index of more than 30), mobility limitations or using walking aids (cane, crutches, rollator, walker, wheelchair or mobility scooter). These limitations and the use of walking aids go together with walking difficulties and reduced walking (Fairclough et al., 2012; Simonsick, Guralnik & Fried, 1999; Viljanen et al., 2009). In young people the share of serious overweight is already substantial (e.g. 8% in the group aged 20 - 30) and the share increases to almost 20% of inhabitants of 55 years and older. The share of people having movement problems is substantial: more than 5% of population aged 40 years or older. One third of the group of 75+ and an almost equal part use walking aids (e.g. walking stick, Nordic Walking-stick, walker, rollator). Compared to these problems the share of the age group 75+ having eyesight or hearing problems is lower, although it still concerns almost 10% of the group. With increasing age people also have multiple limitations. In the group 65+ on average people have slightly more than 2 limitations (CBS Statline, 2019).

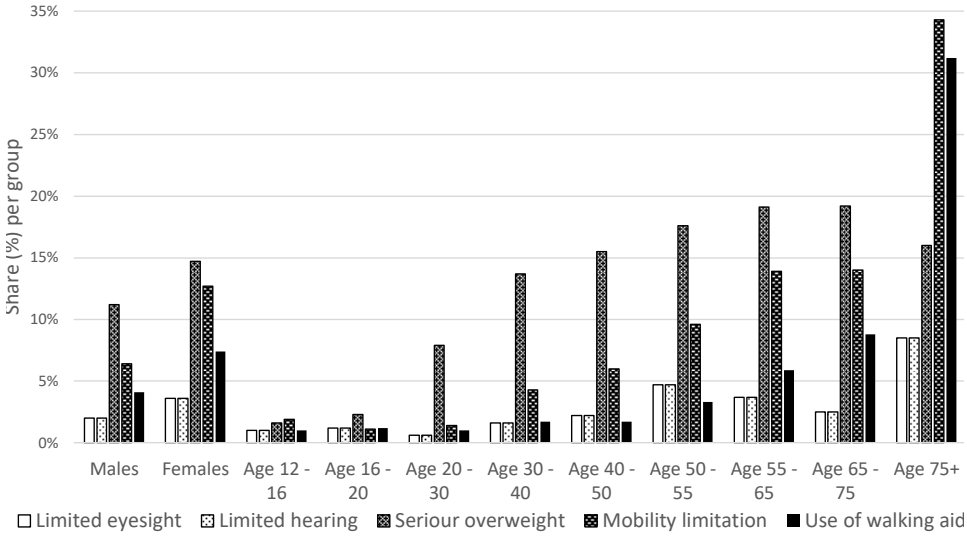

Figure 5.16. Share of persons older than 12 years of age having health problems and/or using walking aids to gender and age in the Netherlands, 2019 (CBS Statline, 2019)

In a follow-up questionnaire of the Dutch 2004 national travel survey (MON 2004) inhabitants were questioned about their physical or mental limitations and what these mean for their independent mobility. For 2004 this share was estimated to be 6.1% of the Dutch population (Socialdata, 2005; Bakker & Van Hal, 2007). Based on the MON 2004 indicators and ageing of the population Methorst (2010-4) estimated the share of mobility handicapped in 2020 to be 7.5% (1.26 million inhabitants in the Netherlands). Zijlstra & Bakker (2016) estimated the number slightly lower on 1.1 million people in 2016 and 1.2 million in 2030.
Apart from the MON 2004 study, no empirical studies on avoidance of walking and related social exclusion in the Netherlands were found. In Finland Rantakokko et al. (2009) carried out

longitudinal studies on 'fear of moving outdoors'. More than 700 independently living, mobile elderly aged 71 - 81 were followed 3.5 years. Of the female participants 65% suffered from fear to walk outdoors, and 62% actually avoided walking outdoors. In male participants the percentages were lower by half: 29% suffered fear, whilst 26% actually avoided walking outdoors. Such fears occurred mainly in persons having joint and muscle problems, a lower walking speed and a low social economic status (SES). Contributing factors were the design and maintenance of streets, gradients (hilliness), lack of resting places, and heavy traffic. In another longitudinal study Rantakokko et al. (2010) found that 56% of the elderly (589 elderly aged 75 - 81) struggled with fear to go outdoors and that their quality of life had decreased. They found similar relations between health and environmental factors. The fears of the elderly inciting avoiding walking outdoors concerned both traffic and fall accidents in public space (Rantakokko et al., 2011). In another study Kerr et al. (2012) found that elderly with fear of falling walked less outdoors.

As part of research on restriction of activities Schoene et al. (2019) reviewed studies on avoidance of walking. The studies show that fear of falling is a dominant factor. How much fear of falling the elderly report varies from study to study (from 23% to 29%), and is partly dependent on the chosen research approach. The research shows that fear of falling occurs more often in elderly with ill-health, females, and people who had serious fall accidents before. Elderly who fear falling generally go outdoors and walk less (Lachman et al., 1998; Yeung, Chou & Wong, 2006; Li et al., 2003). Ill-health (joint- and muscle problems and low walking speed) go together with fear to walk outdoors. Research into fall accidents suggests that elderly who are less healthy than their peers, avoid walking to such an extent that they are less often involved in fall accidents. Fear of walking outdoors is related to footway maintenance and design, and heavy traffic.

As shown from studies by Rantakokko et al. (Rantakokko et al., 2009, 2010, 2011) avoiding to walk outdoors depends both on personal and environmental characteristics, and even more results in transport poverty (and social exclusion). As long as a person can drive a vehicle or cycle, most destinations remain reachable. If driving or cycling is no longer an option, the question is not only whether a person can walk, but also whether destinations that matter and public transport stops are close enough to reach on foot.

To acquire information in this regard, Statistics Netherlands (CBS) started to develop neighbourhood level indicators to assess the risk of transport poverty (Kampert et al., 2018). This indicator takes the following variables into account:

- The shares of elderly and youngsters (younger than age 15 and older than age 65) and households getting support from the Social Support Act (as indicator for persons with limited abilities);
- The share of households possessing a motor vehicle (car, motor cycle, moped);
- The share of the 40% lowest household incomes;
- Nearness of essential provisions (share of households living more than one kilometre from a general practitioner and a supermarket);
- Nearness of public transport stops (share of households that do not have a public transport stop within 500 meters).

Van der Bijl & Van der Steenhoven (2019) unravelled the transport justice in subordinated districts in the largest cities in the Netherlands (Amsterdam, Rotterdam, The Hague, and Utrecht). They found that two kinds of thresholds exist, viz. regarding the social context and

regarding 'internal' obstacles. The first class includes demographics and culture, health and education, income and unemployment, and housing and facilities. The second class concerns 'internal' obstacles: perceived social safety and traffic safety, distances and barriers, legibility and comprehensibility, physical accessibility, affordability, and reliability. These factors curtail (potential) transport users' perception of availability and usability of transport modes, and thereby the reachability and accessibility of destinations, and determine the risk of transport poverty. In some districts in Rotterdam and The Hague about 20% of the population suffer transport poverty; in the Utrecht and Amsterdam cases the situation is slightly better. Van der Bijl & Van der Steenhoven concluded that it is justified to soon put transport justice on the political agenda and carry out a further exploration of the issue. They advise to lessen car-dependence in combination with providing alternative transport options, to increase accessibility and affordability of public transport for those at risk of transport poverty, to improve bicycle systems, to enhance safety, and to reduce social-cultural segregation.

According to CROW (2014:81) one kilometre is considered to be an acceptable walking distance for most people. De Haas & Hamersma (2019) mention that acceptable distances for bus stops, express tram and metro, and train stations are respective 350, 750 and 1,000 meters.

In the Netherlands part of the mobility limitations problem is tackled by provisions regarding individual walking aids and dedicated transport. Main arrangements for target transport are: collective Social Support Act transport (Wmo), Long-term Care Act (Wlz), Valys (a kind of low-cost transport card), Seated Patients Taxi, and Student transport. KiM calculated that in 2015 under these arrangements at least 600 million passenger kilometres were travelled, amounting to 680 million Euros net public expenditure, of which one third concerned collective Wmo transport (Zijlstra & Bakker, 2016). In 2011 2.5% of the Dutch population made use of individual mobility provisions; 2% received either a wheelchair or a mobility scooter. Other individual provisions were amongst other three wheel bicycles and adaptations to private cars. In total private mobility provisions amounted to 350 million public expenditure. This way about one billion Euros public money is spent on supporting persons with limited mobility, which is about equal to what is spent on subsidies to city and regional (bus and tram) transport (CBS statline, 2019). In this regard it is remarkable how little deliberate effort is made to get rid of obstacles to support the use of the mobility facilities. In recent years several studies were carried out to intertwine target transport with public transport; one of the main obstacles proved to be that many of the target transport users are not able to reach and access public transport on foot (Kahman, Schmidt & Tang, 2001; Zijlstra & Bakker, 2016). SGBO (2012) indicates that many target transport users have trouble accessing public space and that some municipalities arrange in written agreements on improving physical accessibility of spaces, buildings and public transport.

5.4.3. Safety and security

5.4.3.1. Introduction

This paragraph explores how the attention to the safety and security of pedestrians evolved over time. It explains a) how knowledge about pedestrian safety and security gradually matured to the current state of the art, b) how pedestrian safety and security issues are defined, c) what the scope of this thesis' research in this context is, and d) outlines the rest of this subsection on pedestrian safety and security.

a. The evolution of knowledge on pedestrian safety and security

Up until about 1990-2010 road safety policies were (almost) totally defined by police reported accidents. Since 2010 more policy developers, primarily at the national level, became aware that, because of underreporting, these records did not cover pedestrian safety problems adequately. Around 2009 in Dutch police accident reporting 'crashed' resulting in extreme under-reporting rates, making changes in safety policy development strategies inevitable.

Since the beginning of police accident reporting pedestrian collisions and incidents are significantly underreported. As early as 1989 Harris at SWOV Institute for Road Safety research compared police reported crashes with hospital-admittance and ED databases, and found that particularly pedestrian and cyclist accidents were seriously underreported, and that pedestrian falls while walking in public space, though very numerous, were hardly reported at all. Falls are not included in the definition of road traffic crashes[404], and still are not included in road safety statistics in the Netherlands.

Learning about Harris' report and conclusions, the Dutch Pedestrians Association VBV asked then Stichting Consument en Veiligheid (=Consumer Safety Foundation) for data from their PORS[405] database on ED patients who had a so called private accident in public space and received medical help at a medical emergency departments (ED) at a selection of Dutch hospitals. Based on PORS data it was estimated that the true number of injured pedestrians in 1993 was 70,000, and not 3,267 as reported in 'official' road safety statistics. The VBV published this figure in the first Voetgangers' Cijferboek 1994 (‘Pedestrians Numeric Book 1994' [Kragten, 1994]). Meanwhile in Sweden similar research was done and published (Öberg, 1998). In 1997 Sweden included single pedestrian accidents (accidents whith no other road user involved = falls) in the STRADA[406] database; in the Netherlands in 1998 the LIS database[407] followed up the PORS database, extending the scope from private accidents to all (private, traffic and industrial) accidents reported by the ER clinics of 13 hospitals, considered a representative sample for the Netherlands as a whole.

One of the main effects of the Harris study was that standards regarding statistical information for road safety policy development improved structurally. The Dutch SWOV Institute for Road Safety research was commissioned to structurally compare police reported traffic injury accidents with medical and death causes databases (the national medical registration (LMR) covering *hospitalised* casualties from road traffic accidents, and the national statistical database on death certificates and death causes). This way the degree of under-reporting and the real numbers of road traffic casualties, specifically the seriously injured and fatalities could be established. Over the years 2000 to 2009 police reporting on traffic accidents degraded significantly, to the point that determining the real number of traffic accidents and casualties became precarious. A partnership was established between SWOV, the police, road administrators and the association of insurance companies to acquire alternative datasets, and measures were taken to improve registration by the police. The data acquisition on road traffic accidents came back on track, but still does not include insurance data; in 2018 the dataset was again on acceptable quality level, be it that non-motorised accidents (both bicycle and pedestrian crashes) are still seriously underreported (Weijermars et al., 2019; Bos et al., 2019).

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[404] following Davis (2001) the term ‘accident’ is not used because of the connotation of accidents of being accidental, while in reality most of them are preventable.

[405] PORS = Privé Ongevallen Registratie Systeem = Private Accidents Registration System.

[406] Swedish Traffic Accident Data Acquisition

[407] LIS = Letsel Informatie Systeem = Injury Information System, managed by the Consumer Safety Foundation, now VeiligheidNL).

An important reason for this is that non-motorised road users do not have vehicle insurance; their accidents do not require insurance company involvement; medical treatment is dealt with separately by the health care system, regardless of vehicle-related insurance. Because of this relatively few records are available on accidents without motor vehicle involvement.

For the support of the COST 358 Pedestrians' Quality Needs project and the OECD/ITF project Pedestrian safety, Urban Space and Health a dedicated study on injury accidents of pedestrians and cyclists was carried out (Methorst et al., 2010-3), making use of three databases on injury accidents: BRON (police reported road traffic accidents), the LMR and the LIS databases. Per accident case the BRON dataset gives most detailed accident information, including accident location, accident circumstances, and road user information. The medical databases LMR and LIS do not record accident location, circumstances and causes, apart from basic injury mechanisms, like being in a traffic accident with a motor vehicle or not, or falling, burning, poisoning etc. conform agreed WHO instructions (in 2010: ICD9, from 2012 ICD10). The medical databases are particularly useful for assessing the numbers of casualties per mode, gender, age, injury type and severity. Additionally the Consumer Safety Foundation (VeiligheidNL) carried out LIS follow-up questionnaire research regarding a sample of LIS accident cases of pedestrians and cyclists to seek out accident causes. The project resulted in the first 'triangulation' report that covered 1) both traffic and fall accidents of pedestrian, 2) the different injury severities (slightly injured and treated in an emergency department of a hospital; seriously injured and admitted to hospital; fatalities), and 3) assessment of the true number of casualties (correcting for underreporting).

Since 2018 the General Data Protection Regulation (EU 2017/679, elaborated in the Implementation Act General Data Protection Regulation, 2016) complicates access to statistical databases containing privacy sensitive information[408]. In this context the national death causes and hospital admittance databases are no longer directly accessible for all but a few authorised researchers. Database outputs are strictly controlled by CBS (Statistics Netherlands) regarding privacy sensitive information, restricting in-depth analysis of general database tables output.

b. Definition of pedestrian safety and security issues[409]

"Safety is generally defined by the absence of risk or - less strict - the absence of accidents and potentially harmful incidents. One has to bear in mind however that absolute safety is not possible. Traffic safety is a special class of safety, which restricts inclusion of pedestrian safety to accidents where at least one moving vehicle is involved. In [this thesis] *pedestrian safety is taken in the broadest sense, including all other (potential) accidents and harmful incidents that can happen to a pedestrian in public space[410]."*

"As regards pedestrians, the common definition of traffic accidents falls short. The sizable issue of single pedestrian accidents (see below) is not covered in this definition, because there is no moving vehicle involved. Consequently these accidents will not be paid proper attention to in road safety research and policy development, although the managers of public space (government) do have a policy responsibility. This study therefore aims to picture an image of all travel (and sojourning) accidents in public space, including accidents without involvement of moving vehicles."

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[408] https://autoriteitpersoonsgegevens.nl/nl/over-privacy/wetten/algemene-verordening-gegevensbescherming-avg

[409] The first four paragraphs of this paragraph were published in the COST358 Pedestrians' Quality Needs Final Report, Section B.5.9. (Methorst. 2010-4: 167-168).

[410] *see also Methorst et al., 2017a*

"Security is a condition, where one is protected against danger from the outside. The dangers are usually related to criminal activity, harassments or threats. The difference with safety is that safety does not focus on threats from the outside: a person can act unsafe himself.

As walking is the only mode that is (or should be) open for all persons, the safety and security of pedestrians must always be seen within the context of mobility and accessibility. If danger, whether it is actual or perceived danger, inhibits mobility or accessibility, the consequences outreach 'normal' individual risk consequences. In the past safety was sometimes achieved by excluding pedestrians and/or making places inaccessible for them [....][411].

In practise (local) authorities are or can be informed about traffic safety and security issues in their jurisdiction. The main source of traffic safety information is accident data, through statistics or directly through the police. Information about security issues comes from the police, security firms (CCTV and surveillance) and the media." (op cit. Methorst, 2010-3).

c. Magnitudes, severities and risks

Pedestrian safety and security can be characterised and measured in a number of ways. For policy development and implementation choices it is particularly important to know how weighty a safety or security issue is. Common indicators in this regard are the magnitude and severity of risks that pedestrians run, in absolute and relative terms, and the consequences of crashes and incidents that amounted into injuries. For the development of policies also developments in safety over time and the prospects for the future are relevant. Strongly decreasing magnitudes, severities and risks ('the problem is likely to solve itself') generally do not deserve as much endeavour than increasing ones, where the problem and consequences grow in magnitude.

Magnitudes are expressed in numbers or percentages of specific mishaps or casualties due to such mishaps. With regard to pedestrians major kinds of mishaps are collisions with moving vehicles (pedestrian traffic collisions) and single pedestrian mishaps such as falls and bumps into stationary objects or walls. Sometimes the kinds of mishaps are rated concerning their impacts, like their severity, impact on individuals, community or society, news value etc.

Severity can be expressed in many ways. Police accident reports generally distinguish between 'material damage only', 'slightly injured casualties (not taken to a hospital)', 'casualties transported to a hospital' and 'fatalities'. Although simple and clear, for policy purposes such crude distinctions are often looked at as inadequate. With regard to pedestrian mishaps material damage (to clothing and accessories) generally is insignificant. In this thesis therefore material damage only is passed over[412]. With regard to visits to medical emergency departments (ED) difference can be made regarding treatment without hospital admittance (minor injuries), hospital admittance (i.e. observation, or moderate, serious and severe injuries), and regarding diagnoses and related medical costs (e.g. based on DBC-codes [Diagnosis Treatment Combination codes]). With regard to hospital admittances a common measure is the so called

[411] For example: in the city of Chapel Hill (USA, North Carolina) a pedestrian crossing over a major collector road was declared a no-go zone for pedestrians. Consequently school children had to take a bus to cover the 400 meters distance, which takes them some 30 minutes and takes up a substantial amount of tax payers money. Other examples: fences to prevent road crossing (on main roads a relatively common practise in the UK) and causing detours of several 100 meters, making destinations at the other side difficult or impossible to reach for the elderly.

[412] The author acknowledges that material damage only can incite strong feelings of unsafety and travel avoidance, but does not see options to take up this issue.

MAIS scale, which is an abbreviation of Maximum Abbreviated Injury Scale. The Abbreviated Injury Score (AIS) was developed by the Association for the Advancement of Automotive Medicine, and is a globally accepted tool for ranking injury severity, particularly of traffic accident injuries (AAAM, 2019[413]). The ranking is *'based on 'threat to life' associated with an injury'*(Department for Transport, 2015:8). Table 5.7 explains the Abbreviated Injury Scale. The concept of MAIS is used because in most cases multiple injuries are incurred; MAIS focusses on the most severe injuries (= Maximum).

Table 5.7. Abbreviated Injury Scale (DfT, 2015:8)

AIS-Code	*Injury*	*Example*
1	Minor	Superficial laceration
2	Moderate	Fractured sternum
3	Serious	Open fracture of humerus
4	Severe	Perforated trachea
5	Critical	Ruptured liver with tissue loss
6	Maximum	Total severance of aorta
9	Not Further Specified	

It needs to be noted that the MAIS ranking does not cover severity in other meanings, like long term consequences for the patient, the burden of the damages and injuries on public and private expenditure, or the emotional and social consequences of the accident. As the MAIS score is well-known and accepted and no other commonly accepted measures are available, this thesis follows consensus amongst traffic safety experts and policy makers and applies the MAIS scale whenever possible for indicating injury severity. In this thesis the following simplified grouping in injury severity classes is used: fatalities, moderate and serious injuries (MAIS2+ admitted to hospital, excluding fatalities), and minor injuries (ED patients who are not admitted to hospital, but medically treated and classified MAIS0, 1, 2, or 9). In this thesis additionally information will be given about the length of the stay in hospital.

Risks are defined as danger divided by exposure. In this regard mobility measures (number of trips, total travel kilometres, and particularly time as a pedestrian in public space) theoretically seem to be the most suitable measures for exposure. Unfortunately due to the many trend breaks, and limited coverage, inaccuracy and questionable reliability, mobility data are in fact not suitable as exposure measures (see above). Therefore *risk* is expressed in numbers of casualties per million inhabitants as a proxy for number of users of public space. The numbers of inhabitants are very accurately and consistently recorded, but not totally valid for all pedestrian groups as exposure measure: some groups are known to walk more (e.g. children, elderly, those that do not have access to alternative transport) than others (e.g. adults, car owners).

Out of necessity this thesis relies on available statistical data sources; carrying out original research into the magnitude of dangers, impacts and risks is beyond reach. Consequently validity (do the data measure what is needed?), reliability (do the data have the same meaning throughout the period of measurement?) and representativeness or coverage (how well do the data cover pedestrian groups or problems?) of the available data sources need to be looked into to ensure that magnitudes, severities, and risks regarding pedestrian safety and security are captured accurately and consistently.

[413] https://www.aaam.org/abbreviated-injury-scale-ais/, accessed 20-12-2019

d. Outline of the rest of this subsection

This thesis builds on the approach and results of the PQN project (viz. Methorst et al., 2010) and aims to present an updated comprehensive assessment of pedestrian safety using more recent available and accessible data. With regard to pedestrian security/public safety no national (exposure) data are available; therefore the subsection restricts to pedestrian traffic safety and falls. The following subsections deal with the used data sources and their main characteristics (Subsection 5.4.3.2), a broad analysis of the combined data regarding traffic accidents (subsection 5.4.3.3) and regarding pedestrian falls in public space (Subsection 5.4.3.4), and exploration of pedestrian security experiences in public space (Subsection 5.4.3.5).

5.4.3.2. General results based on national safety datasets

a. Introduction

Common statistics, like those on the Statline website (administrated by CBS Statistics Netherlands) and most (traffic) safety literature, for various reasons, rarely attempt to completely and accurately cover and position pedestrian safety and security. Up to recently, using the common definition of a road accident, the police, Rijkswaterstaat, the Ministry of Infrastructure and the Environment, SWOV and KiM restricted their reports and policies to road traffic safety, i.e. dealing with (injury) accidents where at least one vehicle is involved. Following the Dutch Pedestrians Association, Rijkswaterstaat (the then Traffic and Transport Research Institute AVV) in 2003 published a wider scope report ('fact sheets') on vulnerable road users, including various groups of pedestrians (Methorst, 2003). The first 'official' report taking a wider perspective on pedestrian safety was delivered in 2010, for the purpose of the COST 358 Pedestrians Quality Needs project (Methorst et al., 2010; Methorst, 2010-4). This subsection, inspired by the 2010 study, aims to completely cover and accurately position pedestrians safety and security.

With regard to pedestrian safety and security the following data sources were (conditionally) available: the Dutch residents death causes database, the Dutch hospital admittances database (LMR/LBZ), the medical emergency departments of hospitals ED trauma clinics admittances database (LIS), LIS follow-up surveys, BRON road traffic accidents database. Below the sources and their main characteristics are successively sketched to outline magnitudes and severity of pedestrian risks. Each of the paragraphs describes the dataset's definition and scope, administration, accessibility and availability of the dataset, timeframe of data, validity, reliability (consistency) and completeness or underreporting of the dataset regarding pedestrian safety and possible changes therein. With regard to fatalities, moderately and seriously injured, and minor injuries the numbers of casualties and risk per million Dutch inhabitants are compared with other travel modes. The subsection is closed by an overview of magnitudes of severity classes of pedestrian casualties and risks.

b. Dutch Death causes dataset

The national death causes database ('doodsoorzaken statistiek') contains basic personal and causal information about deaths of Dutch residents. CBS (Statistics Netherlands) is administrator of this dataset and statistics. The data system aims to cover all deaths of Dutch residents and their main death causes. The dataset contains personal and medical data coded conform the World Health Organization WHO International Statistical Classification of Diseases and Related Health Problems (ICD). It does not specify accidents location addresses or precursors of accidents.

From 1996 the statistics use the tenth revision of the ICD (ICD-10). The data registration was started in 1901 and is continued consistently. It covers (almost) all deaths of Dutch nationals, in 2017 98.3% of the connected to death certificates supplied by medical doctors[414]. By definition it excludes fatalities of non-Dutch residents and foreign visitors; the 'official' statistics based on the death causes database exclude non-Dutch pedestrians, but include Dutch casualties from crashes abroad. The magnitude of the over- or underestimation, however is unknown, and cannot be corrected for.

General data (3 digit codes) is publicly accessible through the national statistics website Statline (see below); for this thesis data regarding 4 digit codes (viz. the type of location of accidents being streets or roads [coded xxx4] as proxy for 'public space') were requested[415] and granted by courtesy of VeiligheidNL[416]. There are no codes for public space beyond 'street or road space'; thus there is no way to find out how many pedestrian (fall) fatalities there are on e.g. publicly accessible squares, courtyards, parks, footways, special footpaths and trails. With regard to the location of fatal traffic accidents in the Netherlands the data are almost completely validated, reliable and representative for Dutch nationals. Part of the records of fall accidents however are incompletely coded regarding the kind of location of the accidents and/or death causes. A significant part of records about accidents on streets or roads causes are coded as 'location unknown' (viz. = 4th digit code3 '9') and/or coded X59 (= 'unknown causes'); in 1999 the kind of location of 74.4% of the fall accidents was unknown, but by 2017 this share decreased to 23.3%. Thus reliability and consistency regarding data on pedestrians fall fatalities on streets were debateable, but improving significantly. On average pedestrian fall accident on 'streets or roads' (= 4th digit code '4') concern about 3% of all fall related deaths; in other words: a small minority of fatalities because of falls are known to happen in public space; most of such accidents happen in private areas (i.e. mostly inside buildings or private properties). In this thesis the figures for pedestrian fatalities are adjusted for underreporting regarding kind of location by adding an equal share of number of 'location unknown' (4th digit is coded '9') of known falls on streets or roads (4th digit is coded '4') in the total number of falls of falls with specified location (4th digit coded '1', '2', '3', '4', '5', '6', '7', or '8').

In the period 1998-2002[417] the average yearly combined number of falls and traffic fatalities was 208. In the course of time the total number decreased to 130 per year in 2014-2018. The five-year average number of traffic fatalities amongst pedestrians steadily decreased from 120 in 1998-2002 per year to 54 in 2014-2018; in the same period the number of fall fatalities decreased from 88 (1998-2002) to 62 in 2006-2010, and then slowly increased again to the current (2014-2018) level of 76, thereby surpassing the number of traffic fatalities amongst pedestrians (see Figure 5.17 and 5.18). Because of missing kind of location coding and the definition limitations ('street or roads' as proxy for public space; non-Dutch residents excluded) the true numbers of pedestrian fatalities in public space can be expected to be underreported

414 https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/korte-onderzoeksbeschrijvingen/doodsoorzakenstatistiek, accessed 26-12-2019.

415 The request did not include fatalities from crimes incurred in public space. The need for such data only came up after looking more closely into pedestrian security in public space. In advance the expectation was that this matter would be insubstantial, comprising less than 10 fatalities per year. From more close exploration it was found that the number of fatalities from crimes in public space moves on the same levels as fatalities from pedestrian traffic crashes and fall: see Subsection 5.4.3.5 on pedestrian security.

416 The author is very grateful for the help, support and free of charge delivery of the tables by VeiligheidNL, particularly from Christine Stam and Karin Klein Wolt.

417 To allow comparison with the LIS dataset (see below), the graph is limited to 1998-2018; earlier data for 1996 and 1997 are available.

and may be larger than the above numbers. Crime related fatalities are dealt with separately in Section 5.4.3.5.

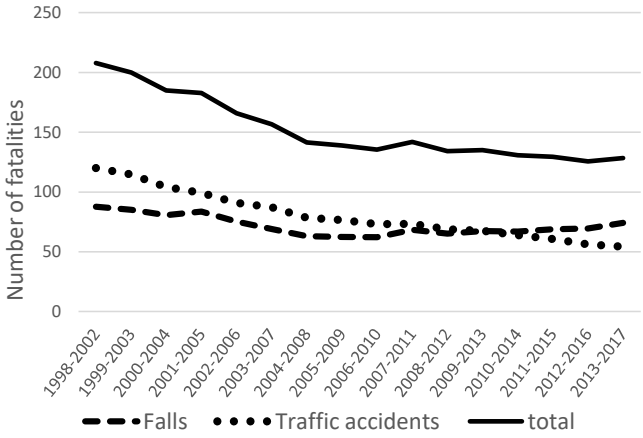

Figure 5.17. Adjusted 5 year averages of pedestrian fatalities for falls, traffic accidents and total (excluding fatalities from crimes)

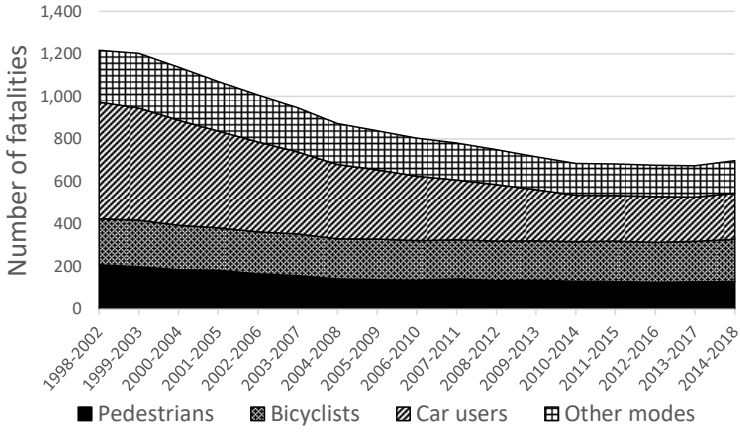

Figure 5.18. 5-year averages per year of fatalities in public space per mode

It needs to be stressed that a small minority of fall fatalities are due to accidents in *public space*; most of them occur in private space (i.e. indoors homes, institutions, offices, and outdoors non-public spaces). In 1998-2002 the average percentage of pedestrian fall fatalities that are indicated to be due to falls in public space (i.e. not counting accidents on unknown locations) was about 5.3%; in 2013-2018 this share decreased to 2.4%. During the same period registration improved significantly; the percentage of cases with 'location unknown' decreased from 50.5% to 23.3%, whereas both the number and percentage of fatalities due to accidents in private space increased substantially, from a low in 1998 of 385 fatalities in private space to 2,613 in 2017[418] (see Figure 5.19 and 5.20).

[418] The 2018 figures were not available to the author when the text of this section was written.

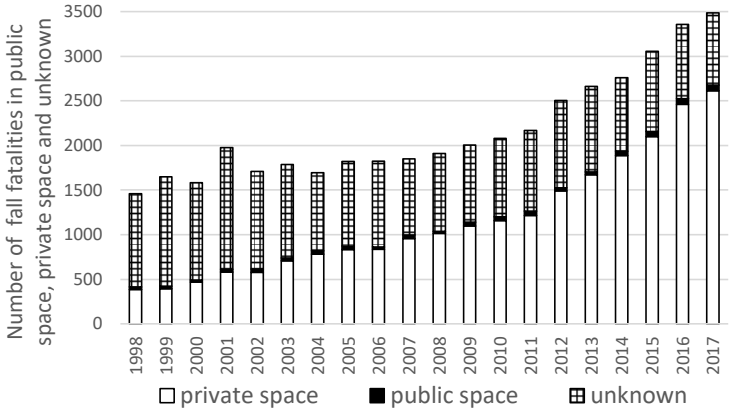

Figure 5.19. Context: total numbers of fall injuries in *public space*, private space and location unknown

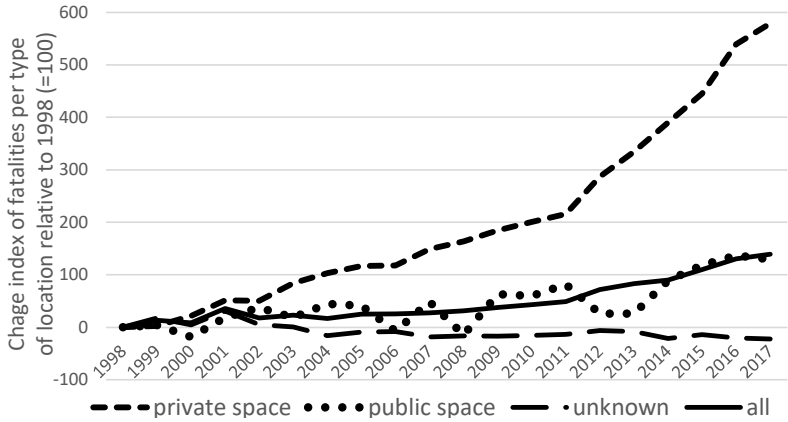

Figure 5.20. Increase in numbers of all fall fatalities per kind of location relative to 1996

Compared to other modes, for pedestrians the total numbers of fatalities and risk per million in the Netherlands are in the low to average range (see Table 5.13). The risk of getting killed as a pedestrian (13.1 fatalities per million inhabitants per year in first 5 year period 1998-2002 and 7.7 in the 2014-2018 period) is low compared to all other modes. This relates to relatively low average impact speeds. Particularly car users, generally exposed to much larger mass and impact speeds, suffer relatively high fatality risks: respectively 548 per million inhabitants in 1998-2002 and 215 in 2014-2018 (see Table 5.13). Over the years the numbers and risks of fatalities decreased substantially for all modes, except bicyclists, who in this respect benefitted least.

c. LMR/LBZ hospital admittances datasets

The national hospital admittances databases LMR (Landelijke Medische Registratie = National Medical Registration) and LBZ (Landelijke Basisregistratie Ziekenhuizen = National Basic registration of Hospitals) in principle cover all accident casualties who were admitted to and medically treated in a Dutch hospital, including non-Dutch casualties. The LMR dataset

concerns data up to 2014 coded conform WHO's ICD9 standard. In 2014 the national medical registration system upgraded from ICD9 to ICD10; the new dataset was renamed to LBZ (Landelijke Basisregistratie Ziekenhuizen = National Basic registration of Hospitals). Both datasets were administrated by Dutch Hospital Data (DHD). In order to have full coverage of the total number of the hospital admittances, DHD supplemented the missing records in the LMR dataset by copying existing records of the first months of the year up to necessity. This supplementation causes a validity issue, as e.g. typical winter accidents differ from accidents in warmer weather; in the dataset fatalities are most probably overrepresented[419]. The number of supplemented records varied greatly over the years. Before 2004 the supplementation in the available selection of casualties was limited to less than 50 records per year, but afterwards the numbers increased substantially to 2,974 (27.7% of the dataset) in 2012, and decreased again to 0 in 2013. In the LBZ dataset a different (better) approach is taken: the records are weighted up to safeguard validity and simulate completeness.

For this thesis both LMR and LBZ data were used. SWOV Institute for Road Safety Research supplied a LMR database selection comprising (all) records of hospital admittances after a pedestrian's traffic accident or fall during 1992 - 2014, and a set of tables derived from a similar selection of the LBZ database 2014-2018[420]. The LMR dataset included 573,311 records. Variables are year of admittance/discharge, e-codes, MAIS, gender, age, fatality, hour, day and month of admittance, diagnoses, hospital days, and correction weights for underreporting of location of the accident. The function of the correction weights is to correct for underreporting because of unknown kind of location of the accident (i.e. records coded '9' for 'location unknown'). The weights represent a proportional allocation of the fraction of 'location unknown' to 'location = street or road'; the formula was also used in Methorst et al. (2010).

Because of to the data protection legislation[421] LBZ data are only accessible at CBS (Statistics Netherlands). Under supervision of CBS authorised staff SWOV and VeiligheidNL can access the 'raw' datasets and produce tables without privacy sensitive information. The available LBZ data concerned 30,731 hospital admittances during 2014 - 2018, and contained information on the variables number of admittances, gender, ages, MAIS, diagnoses, number of days in hospital, and time, days of the week and month of hospital admittance. Like the LMR records, the LBZ records were weighted to correct for underreporting of the intended location selection (= street or road) of the accidents.

Figure 5.21 shows developments between 1998 and 2018[422] in numbers of hospital admittances after pedestrian accidents (traffic accidents + falls), distributed over severity classes. The 5-year average total number of hospital admittances after pedestrian accidents increased from 4,672 in 1998-2002 to 7,470 in 2014-2018. In 2010 winter conditions caused a peak in number of hospital admittances (9,253 admittances), dominantly MAIS2 severity falls. The share of hospital admittances for serious (MAIS3+) within moderate to serious injuries (MAIS2+)

[419] In the supplemented dataset the number of fatalities peaks in 2012 and by far (38%) exceeds the number of reported fatalities in the National Death causes statistics, whilst in the National statistics no peak exists in 2012.

[420] The author is very grateful for the help, support and free of charge delivery of the huge LMR dataset and LBZ tables by SWOV Institute for Road Safety Research, particularly from Niels Bos.

[421] https://autoriteitpersoonsgegevens.nl/sites/default/files/atoms/files/verordening_2016_-_679_definitief.pdf accessed 14-4-2020

[422] To allow comparison with the LIS dataset (see below), the graph is limited to 1998-2018; earlier data for 1992-1997 are available.

appears to be increasing marginally from 38% to 40%, mainly caused by an increase in severity of traffic accidents; the average severity of falls is more or less stable.

The total number of fatalities amongst pedestrians admitted to a hospital is more or less stable, whereby a decrease in traffic accident severity is compensated by an increase in severity of falls. It needs to be noted that 'fatalities' in the LMR/LBZ datasets are defined differently than those in the National Death Causes dataset. In the latter non-Dutch fatalities are not included; in the LMR/LBZ pedestrians who died before they could be admitted to a hospital are excluded. In both cases it concerns small minorities.

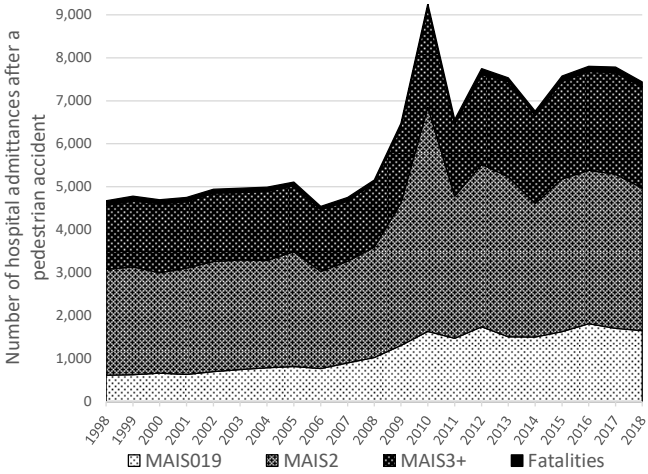

Figure 5.21. 1998-2018 Developments in numbers of pedestrian casualties admitted to a hospital and severity classes (ignoring DHD data supplementation)

While the 5-year average of traffic accident hospital admittances dropped from 1,483 per year in 1998-2002 to 1,324 in 2014-2018, in the same period the 5 year averages for fall casualties almost doubled from 3,283 per year in 1998-2002 (3 times the number of pedestrian traffic casualties) to 6,146 in 2014-2018 (5.6 times the number of pedestrian traffic casualties) (see Figure 5.22).

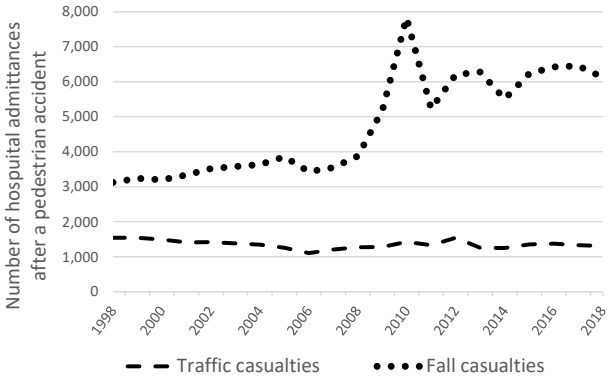

Figure 5.22. Developments in numbers of hospital admittances after pedestrian traffic and fall accidents in the period 1998-2018 (ignoring DHD data supplementation

Another remarkable feature is the strong increase in number of hospital admittances for class MAIS 0, 1 or 9 injuries[423]. In 1998-2002 the 5 year average of hospital admittances classed MAIS019 was 375 admittances per year, increasing to 1,355 on average per year in the period 2014-2018.

Compared to other modes in total pedestrians run a moderate to high risk of getting moderately or seriously injured while walking (see Tables 5.13 and 5.14 at the end of this subsection). The total risks of a pedestrian to suffer moderate to serious injury (MAIS2+) increased from 278 per million inhabitants in 1998-2002 to 335 in 2014-2018, while the car users' risk decreased from 196 in 1998-2002 to 126 per million inhabitants in 2014-2017[424]. The pedestrian injury risks are mainly due to falls in public space (increasing from 204 in 1998-2002 to 277 per million inhabitants in 2014-2018; for traffic accidents risk decreased from 74 to 58 per million inhabitants). The risk of bicyclists increased most, viz. from 377 to 738. Car drivers benefitted most; their risk decreased from 196 to 126 per million inhabitants.

d. LIS emergency department (ED) admittances dataset

The LIS database (Letsel Informatie Systeem = Injury Information System) comprises records on trauma casualties who are treated in emergency departments of Dutch hospitals. VeiligheidNL (= the Dutch Consumer Safety Institute (VNL)) receives and manages data from 14 hospitals spread over the Netherlands, forming a representative sample of hospitals and accident injury cases in the country. LIS started in 1998 as an improved follow up on the former PORS database (Persoonlijke Ongevallen Registratie Systeem = Personal Accident Registration System). The LIS database comprises general medical and type of accident data only; the data are similar to the general data in the LMR/LBZ database, but also extend to non-hospitalised patients (out-patients); the data do not include the accident location addresses or precursors of the accident. For each year increment factors are calculated and added to the records to enable estimations of magnitudes on the national level. In principle the processed data are not privacy sensitive.

For the research of this thesis VeiligheidNL (VNL) supplied a LIS database selection comprising all available records of (ED) injury treatments after traffic accidents (all modes) and pedestrian's 'private' accidents in public space covering twenty years of ED admittances (1998 - 2018)[425]. De dataset included records of 391,015 casualties, of which 317,445 from traffic accidents and 73,570 from pedestrian falls in public space, representing respectively 3,357,000 casualties from accidents in public space, of which 2,724,000 from traffic accidents (including 104,000 pedestrians) and 633,000 from falls. Based on the dataset it can be estimated that in the twenty year period at least 737,000 pedestrians were treated in emergency departments at hospitals for injuries sustained in public space (see Table 5.8).

Because of a change in the data acquisition there is a (small) trend break in the dataset at the beginning of 2014 - 2018 period. For this thesis' analysis the consequences are minimal, as the weights of the records for the earlier period have been adjusted (by VNL) to fit the analysis outcomes regarding 2014 - 2018.

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[423] The codes MAIS 0, 1 and 9 generally correspond to hospital admittances for ‘observation’ or for keeping a single patient because there is no care at home. This particularly applied relates to the growing elderly population.

[424] 2018 numbers were not yet available when writing this report.

[425] The author is very grateful to the kind, expert and patient support and free of charge delivery of the huge LIS datasets by Huib Valkenburg and Karin Klein Wolt.

Table 5.8 Size of the dataset on ED admittances and primary total period casualties estimates for 1998-2018 in the Netherlands

	N in sample	Representing
Casualties from accidents in public space	391,015	3,357,000
Traffic casualties	317,445	2,724,000
of which pedestrians	12,188	104,000
Pedestrian falls	73,570	633,000

Variables in the available LIS dataset are year of admittance/discharge, location code, travel mode, gender, age, hour, day and month of treatment, MAIS2+ (yes/no), fatality, hospital admittance (yes/no), hospital days, diagnoses and injury mechanisms, (modelled) medical costs, and correction weights for incrementing to national level magnitude. The LIS variables partly double the LMR/LBZ variables, enabling validation of the LIS data, by looking at dissimilarities between the LIS and LMR/LBZ figures.

Similar to LMR/LBZ some of the records in the original database have missing codes for the kind of location where the accident happened. This applies to private accidents only; by definition traffic accidents happen on roads or streets. In the original datasets of private accidents of 1998 - 2015 the percentages of 'other location' and 'missing' varied between a high 51% (286,853 records in 2000) and low 25% (92,878 records in 2013; source: separate explanatory spreadsheet delivered by VNL). After 2013 the number of 'other location' and 'missing' increased somewhat again. Contrary to LMR/LBZ, possible variations in representativeness of 'street or road'-coded records in the samples impede calculation of reasonably valid increment factors per record. With regard to estimating real totals of numbers of pedestrians casualties however broad indications can be calculated, using figures on location coding of private accident records and incremented casualties estimates, as delivered by VeiligheidNL. On average in LIS underreporting regarding type of location of pedestrian falls on streets or roads amounts to about 22,000 pedestrian casualties per year in 1998-2002, and about 25,000 casualties per year in 2014-2018. These figures can be added to the totals of fall casualties as found from analysing the LIS dataset.

Another peculiarity surfaced after comparing the LMR/LBZ and fatality dataset totals with the (incremented) LIS data totals. According to LIS data both the 5-year averages for pedestrian traffic casualties per year and for pedestrian fall casualties treated in an emergency department of a hospital, dropped significantly respectively from 6,400 per year (1998-2002) to 3,700 per year (2014-2018) for traffic accidents and from 33,400 to 23,900 per year for fall accidents.

With regard to coverage of pedestrian injuries sustained in public space it needs to be remarked that developments regarding total numbers of casualty cases in LIS are not consistent with those of LMR/LBZ datasets. LIS data for 1998 towards 2018 indicate a strong decrease in total casualty numbers (all severities): pedestrian traffic casualties -49% and fall casualties -39%. LMR/LBZ figures for the same period are different: the number of hospitalised pedestrian traffic casualties decreased -15%, and hospitalised pedestrian fall casualties numbers showing an increase of 96% (see Table 5.9).

A plausible (part) explanation can be found in health care system changes. Since the introduction of the national 2005 Health Care Law, insurers (strongly) promote that casualties who do not need to be transported by ambulance avoid emergency departments (ED) at hospitals, but be treated by a medical general practitioner, because of the (much) lower medical costs. Below this explanation is substantiated.

Table 5.9 Indicated numbers of casualty cases in LIS and LMR/LBZ - 2018 compared to 1998

Changes in number of treated casualties	2018 compared to 1998
LIS all casualties	-22%
LIS pedestrian traffic casualties	-49%
LIS pedestrian fall casulaties	-39%
LMR/LBZ all casualties	not available
LMR/LBZ pedestrian traffic casualties	-15%
LMR/LBZ fall casualties	+96%

Figure 5.23 shows developments in indexes regarding all casualties in the available LIS dataset (all traffic mode's casualties, pedestrian traffic casualties [by definition on streets], and pedestrian fall casualties of accidents in public space [i.e. streets, squares, parks]). In 2010 the number of pedestrian falls cohere with exceptional winter conditions, causing a peak in the graph. The number of pedestrian casualties, both traffic accidents and falls, decrease more strongly than the number of casualties attending emergency departments of hospitals from other modes (decrease 22%).

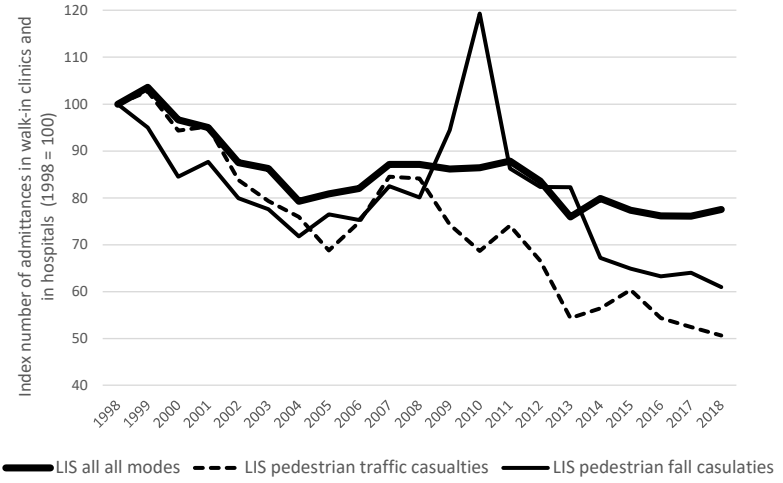

Figure 5.23. Casualties indexes - traffic (all modes), pedestrian traffic, and falls (LIS 1998 = 100)

In the LIS database records are coded regarding MAIS019 and MAIS2+ (MAIS2+ yes/no) as well as coded for both hospital admittance (yes/no). The algorithm for assigning the MAIS scores that VeiligheidNL uses is slightly different from the LMR/LBZ databases delivered by SWOV, but if the LIS records are filtered for 'hospitalised' .and. 'MAIS2+' LIS and LMR/LBZ year and accident group (traffic, falls) totals for MAIS2+ should be similar. Quality control research commissioned by the Ministry of Health (Gommer & Gijsen, 2015) yielded that the LIS representativeness and validity regarding coverage of the population of patients of the emergency departments (ED) at hospitals units are excellent[426]. In this regard the author assumes that real numbers of minor and moderate injuries stand in a more or less fixed ratio to

[426] According to unpublished research for the Ministry of Health by RIVM in 2013.

the number of hospitalised MAIS2+ injuries. Consequently numbers of hospitalised casualties as well as of those receiving medical treatment, but not admitted to hospital, are expected to keep pace with the LMR/LBZ MAIS2+ registration numbers. In the light of the results of the quality control research, the strong drop in numbers cannot be explained by decreasing quality of the data collection; it needs to be explained by something 'external'. The LIS database can be considered valid and representative for what happens in medical emergency departments (ED) of hospitals, but it might not be valid and representative for the larger (real) numbers of less severe injuries and the total number of casualties. A probable explanation is that health care system changes, causing a (gradual) transfer to general treatments of the less severe injuries by general practitioners. This hypothesis is confirmed by comparing the complete LIS 1998 data on less severe injuries, which can be expected to be treated adequately by medical general practitioners, with the complete LIS 2018 dataset on such injuries (see Table 5.10[427]). If treatments would not have been transferred, and their numbers and conditions would have been the same as in 1998, the total number of ED treatments of traffic and pedestrians fall casualties could be expected to increase by about 20%, resulting in a *provisional* estimate of the overall 2018 total of 225,000 medically treated casualties of traffic crashes and pedestrian falls.

Table 5.10. Comparison of LIS data on primary injury diagnoses (all records) 1998 and 2018 on minor injury treatments which might be transferable from ED to medical general practitioners

Type of primary injury	1998	2018	2018 minus 1998	change %
10 Superficial injury	81,602	26,987	54,615	-67
11 Open wound	16,816	6,308	10,508	-62
14 Distorsion	13,950	6,311	7,639	-55
17 Blood vessel injury	145	47	97	-67
18 Muscle- or tendon injury	3,204	3,008	196	-6
40 First degree burn	24	0	24	-100
98 Other	9,129	2,084	7,044	-77
Total transferable treatments	124,870	44,745	80,124	-64
Other diagnoses	62,417	100,489	-38,071	61
Actual total number of casualties	**187,287**	**145,234**	**42,053**	**-22**
Provisional estimate of overall number of medically treated casualties	187,287	225,358	38,071	20

In the above provisional estimate it is assumed that the 'real' numbers of treatments of 1998 and 2018 traffic and fall casualties that might be transferrable to medical general practitioners are a constant. This is questionable as the number of non-transferable treatment has increased substantially from 1998 to 2018 (by 61%). Therefore a more advanced estimation of the total numbers of minor injury treatments is calculated, assuming that the number of MAIS2+ treatments (reported in LMR/LBZ datasets) represent the 'real' trends in numbers of treatments of minor injuries (casualties that are medically treated, classed MAIS019 or not admitted to a hospital for treatment), i.e. that the ratio (LMR/LBZ MAIS2+) to (MAIS019 and not hospitalised MAIS 2 casualties) has been constant for the last 20 years. Taking 1998-2002

[427] Please note that this table does not only concern pedestrian casualties, but also all reports of treatments of traffic accident casualties from other modes.

figures adjusted for underreporting[428] as reference, the 'real' magnitudes of minor injury pedestrian falls and traffic casualties per year in 2014-2018 are calculated.

Table 5.11 sketches the *advanced* estimates for the 'real' total numbers per year of minor injury and moderate to severe injury casualties amongst pedestrians. The table includes rounded figures for the 5 year averages of 1998-2002 and 2014-2018. The estimated total of all pedestrian casualties that needed medical treatment increased from average 62,000 per year in 1998-2002 to 87,000 per year in 2014-2018, i.e. almost 40%. While in this period the number of pedestrian traffic casualties has decreased by 16% (from 6,100 to 5,100 casualties per year on average), the total number of pedestrian fall casualties has increased by 46% (from 56,000 to 82,000 pedestrians per year average); the number of seriously injured pedestrians (MAIS2+) after a fall in public space increased slightly more (from 3,200 to 4,700 = 47%).

Table 5.11. Estimated real numbers of pedestrian casualties in the Netherlands 1998-2018 (5-year averages per year - rounded figures)

	5 year averages	
	1998-2002	2014-2018
Adjusted total number of minor injury pedestrian casualties	***58,000***	***81,000***
LIS reported minor Traffic casualities (= < MAIS2 and not hospitalised)	4,900	2,600
Estimated number of health system related underreported traffic casualties	= reference	1,500
Adjusted total number of minor traffic casualties	*4,900*	***4,100***
LIS reported minor Fall casualties (= < MAIS2 and not hospitalised)	30,800	20,700
Estimated number coding related underreported minor fall casualties	21,900	25,500
casualties	= reference	30,600
Adjusted total number of minor fall casualties	***52,700***	***76,800***
Total number of moderate and severe injuries (MAIS2+ in LMR/LBZ)	4,400	5,700
of which LMR/LBZ reported Traffic casualties MAIS2+	1,200	1,000
of which LMR/LBZ reported Fall cassualties MAIS2+	3,200	4,700
Ratio for TRAFFIC accidents - minor : MAIS2+	4.2	4.2
Ratio for FALLS - minor : MAIS2+	16.3	16.3
Estimated total number of pedestrian casualties in public space	*62,000*	*87,000*
of which Traffic casualties	*6,000*	*5,000*
of which Fall casualties	*56,000*	*82,000*

Compared to other modes in the period 1998-2002, total minor injury risks of pedestrians per million inhabitants (including the estimate of injuries treated by general practitioners) are superseded by those of bicyclists only. Towards the period of 2014-2018 the risk of minor injuries are estimated to increase for all modes, except pedestrian and car users' traffic accidents, which appear to be decreased by 35%. The risk for bicyclists appears to be almost doubled (+93%); risk of minor injuries because of falls also increased, by about 35%. Total risk of minor injuries per million inhabitants increased by 35% (see Table 5.12 two pages below).

[428] This only concerns missing location codes in the LIS pedestrian falls dataset; for traffic casualties location code 'streets or roads' underreporting corrections are not needed, as by definition traffic accidents happen on public roads.

e. Follow-up LIS surveys

In order to find out what circumstances and causal factors underlie cyclist's and pedestrians' accidents, VeiligheidNL carried out a number of LIS follow-up questionnaire studies called CLVO (abbreviation for Continu LIS Vervolgonderzoek) amongst (about 7%) samples of the original ED patients of the LIS registrations, anonymised by the hospital ED unit (respectively Sman & Eckhart, 2003; Ormel & Oldenziel, 2006; Den Hertog et al, 2013). Between 2003 and 2007 603 accounts of pedestrian accidents are delivered. The surveys offer unique insights into self-reported causes of pedestrian falls. LIS follow-up survey reports, detailing the surveys, are available from the VeiligheidNL website[429].

f. BRON road traffic accidents dataset

The national BRON accident database contains all road traffic accidents recorded by the police. The database is compiled by Rijkswaterstaat of the Ministry of Infrastructure and the Environment[430]. The database contains forty characteristics of accidents and casualties, drivers and modes involved. It specifies the severity of the crash in terms of number of fatalities, casualties taken to hospital or being slightly injured, and (a limited number of) material damage only crashes. Importantly the database contains specified locations, coupled to the national roads database (Nationaal Wegen Bestand NWB). Vehicle information is added from the centrally registered license plate dossiers.

For local authorities who are in fact responsible for maintaining pedestrian safety, BRON is the main source which suits their needs best. Other sources like national death causes and the main national medical registrations do not specify crash conditions and the crash location pinpointing the local authority's jurisdiction.

Data are available from 1976. The BRON database offers insights in traffic accidents situations and circumstances, which the medical databases LMR, LBZ and LIS lack. The database covers only road traffic accidents (where at least one moving vehicle is involved) and does not include pedestrian single accidents (falls). With regard to pedestrian accidents for the period 1998-2018 BRON covers 10,310 cases of hospitalised pedestrians and fatalities. The road traffic accident registration is not complete.

For various reasons the police does not record all (road traffic) accidents. The degree of completeness is indicated by the 'degree of registration', picturing the share of real number of casualties that are recorded in BRON. The degree of registration relates to the accidents severity (the more serious, the better the registration) and whether or not the casualties are in or on a motor vehicle. With regard to traffic accident fatalities the database is about 90% complete; less severe accidents are less complete and accurately recorded (Harris, 1989; Weijermans et al., 2016; Methorst et al., 2017b). Overall the number of hospitalised casualties in the LMR/LBZ datasets is about 4 times as large as the number of injured[431] in the BRON dataset.

Between 2009 and 2016 coverage of traffic accidents is extremely low. During all years pedestrian and cyclist traffic casualties are seriously underreported; the number of pedestrians' cases dropped to an all-time low of less than 500 per year; in 2017 and 2018 registration seems to be better organised again. Single accidents of pedestrians are not included, and single

[429] https://www.veiligheid.nl/organisatie/publicaties, accessed 29-12-2019

[430] see https://www.swov.nl/feiten-cijfers/fact/bron-bestand-geregistreerde-ongevallen-nederland, accessed 29-12-2019.

[431] Up to 2009 distinction was made between accidents resulting in hospitalised casualties and minor injuries. Currently accidents are classed 'material damage only', 'injured' or 'fatality'. In practise all injury accidents that prompted an ambulance are classed injury accidents, regardless of treatment.

accidents of cyclist are (very) rarely recorded (cf. Harris, 1989). Furthermore, the police is not always able to accurately assess injury severity. With regard to the numbers of casualties from traffic accidents the LMR database (see above) offers a more valid image. Because of its severe limitations with regard to pedestrian accidents, in this thesis BRON data are used only for pinpointing major characteristics of causes and conditions of pedestrian traffic accidents.

g. Statline - general statistical data for exposure

The Statline website (https://opendata.cbs.nl/statline/#/CBS/en/) offers a wealth of data on the Dutch economy and society. In this thesis' subsection particularly population security data are used. Population data are used to calculate risks per million inhabitants of the Netherlands and proxies for public space users from outside the Netherlands. Data on security are drawn from the National Security Monitor, of which data are posted on the Statline website.

The Statline website is administered by CBS (Statistics Netherlands) and contains 'official' statistics, i.e. data from strictly controlled, representative and validated sources. It needs to be mentioned however that definitions of subjects can vary for specific statistics, and that this way, with regard to pedestrian safety and security, validity issues may arise. In most cases the table populations are limited to Dutch inhabitants, excluding visitors from outside the Netherlands, or other groups (e.g. children, the very old elderly [aged 80+] and institutionalised people [mentally handicapped, prisoners]). Whenever the author found such limitations regarding pedestrians, such limitations are indicated in descriptions of the analysis.

h. Overview and conclusions on magnitudes of pedestrian casualties and risks

In this subsection general findings from available sources with regard to coverage, magnitudes and pedestrian fatalities, injuries and risks are presented. A complete account cannot be drawn from one single source, but needs to be (and are) compiled and triangulated from a variety of sources, such as the national death causes statistics, national medical databases (LIS and LMR/LBZ), accident databases (limited to pedestrian traffic accidents only) and various general national statistics published on the Statline website of Statistics Netherlands (Centraal Bureau voor de Statistiek CBS). Objective and specific information about the pedestrian's security (public safety in the role of pedestrian) is not available; information is limited to self-reported experiences and perceptions of security reported in the National Security Monitor.

The available data on fatalities and moderate to serious travel[432] casualties (MAIS2+) concerns (almost) complete registrations of injuries incurred while moving or standing on roads and paths and can therefore be expected to represent actual numbers of casualties; not all cases are completely coded regarding the location of the accident (i.e. 'street or road' or other public place), but this can be adequately compensated by using correction factors. This is not true for the more numerous casualties with minor injuries. Due to changes in the medical systems there is a significant shift in visiting emergency departments (ED) at hospitals towards treatment by general medical practitioners' units, making the data from the emergency departments (ED) less valid for estimating the number of minor injury casualties. This validity problem is tackled by calculating broad estimates on the assumption that in 1998-2002 (almost) all accidents casualties were treated at emergency departments of (then more spread out, accessible and permissive) hospitals, and that in practise the ratio of MAIS2+ to minor injuries is a constant.

[432] Travel risk includes both traffic and fall accidents and risks.

Table 5.12 summarises the calculated estimates regarding 1998-2002 and 2014-2018 yearly averages of fatalities, serious and moderate injuries, minor injuries and totals of casualties, and developments therein. The table indicates the numbers of casualties of pedestrians, broken down in numbers of fall and traffic accident casualties. For positioning significance of pedestrian casualties and safety it also offers context information regarding the numbers of casualties amongst bicyclists, car users and users of other modes, such as moped, bus/tram/metro, lorries, handicapped vehicles. In Table 5.13 the numbers are converted into risk figures, i.e. number of casualties per million inhabitants of the Netherlands.

Table 5.12. Calculated estimates of real magnitudes, severity and trends in number of travel casualties in the Netherlands 1998 - 2018 (rounded)

	Fatalities		Seriously injured MAIS2+		Minor injuries (MAIS019 and ER)		Total number of casualties (rounded)		Est. increase in asualties 1998-2002 to 2014-2018		
	1998-2002	2014-2018	1998-2002	2014-2018	1998-2002	2014-2018	1998-2002	2014-2018	MAIS2+	all injuries	%
Pedestrians	208	131	4,400	5,700	58,000	**81,000**	62,000	**87,000**	1,300	25,000	39
of wich traffic casualties	120	52	1,200	1,000	5,000	**4,000**	6,000	**5,000**	-200	-1,000	-18
of wich fall casualties	88	80	3,200	4,700	53,000	**77,000**	56,000	**82,000**	1,500	26,000	46
Bicyclists	218	199	6,000	12,500	63,000	**132,000**	70,000	**145,000**	6,500	75,000	108
Car users	548	215	3,100	2,100	35,000	**24,000**	39,000	**27,000**	-1,000	-12,000	-32
Other modalities	244	155	4,000	4,500	28,000	**32,000**	33,000	**36,000**	500	3,000	11
Total	1,218	700	17,500	24,800	184,000	**269,000**	204,000	**295,000**	7,300	91,000	45
*Note: the **bold** figures are estimated numbers based on ratios **Minor injuries : MAIS2+ injuries** for 1998-2018*											

Table 5.13. Calculated estimates of risk of getting injured or killed while moving in public space per million inhabitants in the Netherlands 1998-2018

	Fatalities		*Seriously injured MAIS2+*		*Est. minor injuries (MAIS019 and ER)*		*Total estimate of casualties (rounded)*	
	1998-2002	*2014-2018*	*1998-2002*	*2014-2018*	*1998-2002*	*2014-2018*	*1998-2002*	*2014-2018*
Pedestrians	*13.1*	*7.7*	280	360	3,600	***4,800***	3,900	**5,100**
of wich traffic casualties	*7.6*	*3.0*	75	60	300	***250***	400	**300**
of wich fall casualties	*5.5*	*4.7*	200	300	3,300	***4,500***	3,500	**4,800**
Bicyclists	*13.8*	*11.7*	380	790	3,700	***7,800***	4,400	**8,500**
Car users	*34.5*	*12.7*	200	135	2,200	***1,400***	2,500	**1,600**
Other modalities	*15.3*	*9.1*	250	285	1,800	***1,900***	2,100	**2,100**
Total	*76.7*	*41.2*	1,100	1,560	11,600	***15,900***	12,900	**17,400**
*Note: the **bold** figures are estimated numbers based on ratios Minor injuries : MAIS2+ injuries for 1998-2018*								

In the last twenty years the number of fatalities amongst pedestrians has decreased. This is mainly due to a decrease in number of fatalities from traffic accidents. The number of fatalities from falls is more or less stable, but seems to be on the increase again since 2015.

Developments regarding moderate and serious injuries (MAIS2+) are not favourable. Although both the number and risk of moderate and serious traffic injuries has decreased from 1,200 to 1,000 per year (17%), the number and risk of fall casualties has increased substantially from 3,200 to 4,700 per year (45%). The share of pedestrian MAIS2+ casualties in the total number of travel casualties has decreased from 32% to 30%, but this is due to an exceptionally large increase in number of bicycle MAIS2+ casualties, whilst car use has become 31% safer.
Figures with regard to minor injury casualties are indicative calculated indications. The significance of numbers of minor injuries lies in their bulkiness; in total the large number of minor injuries bring over (very) substantial individual suffering, costs and societal impact. The figures are to illustrate the absolute and relative impacts of pedestrian accidents, which does

not (yet) reach the level of societal impacts of bicycle injuries, but vastly overrises the numbers of casualties and thereby social impacts and costs of motorised traffic.

In this thesis calculations were made to assess the total costs of travel related crashes in the Netherlands per year concerning averages of 2014-2018. The calculations are similar to the ones made by Methorst et al., 2010[433]. Table 5.14 represents the results. The costs of fatalities are set at the Value of a Statistical Life for the Netherlands in 2019 (i.e. figures from table in Kip Viscusi & Masterman, 2017 [p.246] corrected for inflation from 2015 to 2019 [6.2%] as published by CBS[434])[435]; costs of hospitalised and minor injuries are set on figures set by AVV (2006) and De Wit & Methorst (2012), corrected for inflation from 2003 to 2019 (as published by CBS)[436]. It shows that the total (societal) costs of pedestrian injury crashes amount to almost 3.8 billion Euros; 22.6% of the total costs of travel related fatalities and injuries concern pedestrian crashes. Of these 79% (3 billion Euros) concerns pedestrian fall related costs and 21% (0.8 billion Euros) costs of collisions with moving vehicles (traffic crashes). The magnitudes of crash costs of bicycle crashes are almost twice the amount of pedestrian crash costs, but both are significantly more than the sacrifices of car users.

Table 5.14. Estimated yearly accident costs in 2014-2018 (x million Euros)

	Fatalities		Hospitalised casualties		Minor injuries		Rounded total costs
	Numbers	Costs (million €)	Numbers	Costs (million €)	Numbers	Costs (million €)	(million €)
Pedestrians	**131**	**1,075**	**5,700**	**1,850**	**87,000**	**870**	**3,795**
of wich traffic casualties	52	425	1,000	325	5,000	50	**800**
of wich fall casualties	80	650	4,700	1,530	82,000	820	**3,000**
Bicyclists	199	1,630	12,500	4,065	145,000	1,450	**7,145**
Car users	215	1,765	2,100	685	27,000	270	**2,720**
Other modalities	155	1,270	4,500	1,460	36,000	360	**3,090**
Total	**700**	**5,740**	**24,800**	**8,060**	**295,000**	**2,950**	**16,750**

In this paragraph the absolute and relative magnitudes of pedestrian unsafety were assessed. It was shown that none of the available sources represent the full picture of pedestrian safety problems, but also that, with the exception of objective figures on pedestrian security, reasonable precise estimations of the order of magnitudes with regard to the extents of total pedestrian risks, traffic safety and falls in the Netherlands could be delivered and elucidated.

[433] The report on casualties of pedestrians by Methorst et al, 2010, commissioned by the Dutch Ministry of Transport, was prepared for the PQN and OECD/ITF projects on pedestrian safety in the years 2005-2010. The calculations are based on national key figures regarding societal costs due to fatalities, hospitalised and ED treated minor injuries from traffic crashes (AVV, 2006; De Wit & Methorst, 2012).

[434] https://www.cbs.nl/nl-nl/visualisaties/prijzen-toen-en-nu, accessed 24-3-2020

[435] Although QALY (Quality Adjusted Life Years) is probably a better proxy, Value of Statistical Life is used as measure because of availability of data for this measure; the author does not have access to data to apply QALY.

[436] Later AVV road accident costs assessments are based on the 2003 figures published in this report. In 2009 the last costs assessment (internal) report was delivered; the author was one of the authors.

In order to assess policy significance[437] and find clues for improvement policies, the following Sub-subsections 5.4.3.3. - 5.4.3.5. take a closer look at pedestrian traffic injuries, falls, and perceptions regarding pedestrian security, and elucidate major characteristics of the casualties, like their policy significance, and where, when, why and how they happen.

5.4.3.3. Pedestrian traffic injuries and precursors

This paragraph deals with the main characteristics of pedestrian traffic injury crashes[438] and casualties in the Netherlands, based on available statistical data sources on the national level. Up to 2019, policy and research wise, pedestrian safety was almost exclusively defined as a traffic safety issue, and the principal source in this regard were traffic crashes reported by the police, i.e. the BRON database, both for central government and municipalities. For the latter, except for dedicated research, no suitable alternative sources exist for acquiring insights in the issue within their jurisdiction.

Completeness, reliability, limits of available data

As argued above, with regard to pedestrian crashes police reporting is far from complete, consistent and reliable over time. For acquiring general information about where, why and how the collision happened, however, it offers unique insights into the matter.

For assessing magnitude and severities of pedestrian injury mishaps, gender and age distribution, injury mechanisms and injury specifications medical databases (i.e. LMR/LBZ and LIS) appear to be the most suitable and reliable sources. Detailed volume specifications within adjusted samples however cannot be given validly (e.g. when numbers are corrected or augmented for missing location codes or shift in treatment towards general practitioners). In such cases true impacts per group or crash type might be different, e.g. related to severity, local conditions or unspecified injury mechanisms etc.

Because of dataset limitations and data protection regulation death causes statistics cannot be used beyond general figures on numbers, gender and age classes (see above).

Outline of this paragraph

This paragraph presents results of the analysis of the available datasets regarding characteristics of pedestrian traffic injury mishaps. Successively the following aspects of pedestrian traffic crash injuries will be dealt with: a) magnitude of the phenomenon, b) gender, age and injury severities, c) major location characteristics of traffic collisions with pedestrians, d) dominant time aspects, e) main injury mechanisms, f) counterparties in pedestrian traffic crashes, g) injury specifics of pedestrian traffic casualties, and h) conclusions regarding policy significance of pedestrian traffic injuries.

a. Magnitude and severity of pedestrian traffic crash injuries

Three kinds of measures are used to express (relative) magnitudes and severities of pedestrian traffic injury crashes: 1) the number of casualties per MAIS class, 2) the number of days that casualties spend in a hospital, and 3) medical costs of the treatment of injuries.

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[437] In this thesis policy significance is assumed to depend on the relative magnitude and severity of mishaps, approachability and the (lack of) developments therein.

[438] Most injury incidents in public space have influenceable causes, and thereby cannot be considered an 'act of God', haphazard or accidental. In this context Davis (2001) proposes to use the term 'crash' instead of 'accident'. For pedestrian falls 'crash' however does not seem appropriate; the author therefore knowingly uses the term 'mishap'.

The above Tables 5.13 and 5.14 already broadly outlined magnitude and severity of pedestrian injuries from collisions with moving traffic per MAIS class, and developments therein. This paragraph presents further documentation based on LIS, LMR/DHZ, and CBS Death causes statistics to perspective the LMR/DHZ figures on fatalities. In the below Table 5.15 magnitude and severity are expressed in the volumes of numbers of pedestrian traffic crash volumes and risks per million Dutch inhabitants. Three main classes are distinguished: 1) casualties who were medically treated, but not hospitalised, 2) hospitalised casualties, and 3) official numbers of traffic fatalities.

In the top row of Table 5.15 the *estimated* total number of injured pedestrians treated in an emergency department (ED) at a hospital, who were discharged after treatment and not hospitalised is shown. The data indicate that in twenty years the number of pedestrian non-hospitalised traffic casualties decreased from 5,300 to about 4,000 persons (25%); risks decreased from 309 to 241 per million Dutch inhabitants (22%). The next row shows the numbers of these injured pedestrians as these are reported in the LIS dataset. This dataset indicates a larger decrease from 5,300 to 2,500 non-hospitalised casualties (53%), corresponding to a decrease in risk from 309 to 153 per million Dutch inhabitants (50%). The differences in the figures are, as mentioned above, due to a shift in the medical system towards first-line treatment of trauma patients by general practitioners. It needs to be stressed that such estimations cannot be validly given for breakdown tables e.g. regarding gender and age, location of crashes, when the crash happened, injury mechanisms and injuries suffered.

Table 5.15. Pedestrian traffic casualties numbers and risks per million inhabitants per year in the Netherlands 1998-2018 (reported in LIS, LMR/LBZ and CBS Death causes statistics)

	Number of pedestrian traffic casualties		5 year average number of casualties per year		Risk per million inhabitants	
	1998	2018	1998-2002	2014-2018	1998-2002	2014-2018
Casualities not treated in a hospital						
Estimated total number of treated injured pedestrians	**5,300**	**4,000**	**4,900**	**4,100**	**309**	**241**
Non-hospilalised casualties reported in LIS	5,300	2,500	4,900	2,600	309	153
Hospitalised casualties						
Minorly injured (MAIS019)	248	281	266	303	17	18
Moderately injured (MAIS2)	888	591	821	595	52	35
Seriosly injured (MAIS3+)	369	397	358	390	23	23
Fatalities - after being admitted to hosptal (reported in LMR/LBZ)	49	43	42	37	3	2
Totals LMR/LBZ	**1554**	**1312**	**1488**	**1324**	**94**	**78**
Fatalities reported in CBS Death causes statistics						
Fatalities - adjusted Death causes statistics	**132**	**54**	**120**	**54**	**8**	**3**
Source: LIS, LMR/LBZ datasets; CBS Death causes statistic; calculations						

With regard to severity of pedestrian traffic crashes LMR/LBZ data show that only the numbers of moderately (MAIS2) injured pedestrians in traffic crashes and fatalities decreased from 821 average per year in 1998-2002 to 595 in 2014-2018 (28%), and fatalities from 42 per year in 1998-2002 to 37 in 2014-2018 (12%). The numbers of minor injuries (MAS019) per year increased from 266 to 303 (14%) and serious injuries (MAIS3+) from 358 to 390 (9%). The

LMR/LBZ fatality figures (respectively 42 per year in 1998-2002 and 37 in 2014-2018) differ from the death causes statistics (respectively 120 in 1998-2002 and 54 in 2014-2018) because the first do not include fatalities of pedestrians that were not admitted to hospital (e.g. instantly killed at the crash) but do include non-Dutch nationals admitted to hospital who deceased there. This pattern also shows in risk per million inhabitants (see Table 5.15 and Figure 5.24).

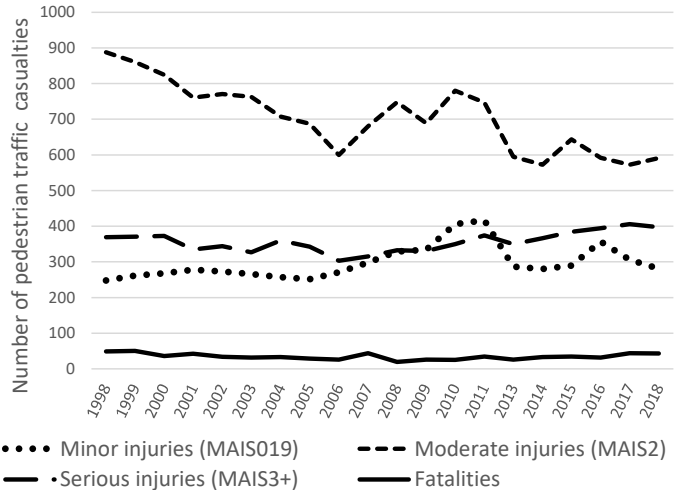

Figure 5.24. Number of pedestrian *traffic* casualties admitted to a hospital per MAIS class in the Netherlands 1998-2014 (2012 excluded; source: LMR/DHZ)

The second measure to express magnitude and severity of crashes concerns the distribution of numbers of days that the casualties spend in hospital. From the hospital admittance data it can be concluded that the total number of days that pedestrian traffic casualties spend in hospital after collision with a moving vehicle decreased substantially more (>30%) than the total number of casualties decreased (11%). The total number of hospital days in short hospital stays (1 - 5 days) in 1998 and 2018 are about the same (increase from 2,425 to 2,990), while the number in longer stays decreased disproportionally (decrease from 8,000 to 4,625). The average number of days in hospital of pedestrian traffic casualties decreased from 7.0 days in 1998-2002 to 5.8 days in 2014-2018 (see also Table 5.16). Consequently the decrease in total number of hospital days cannot be explained by a decrease in number of casualties; a change in hospital admittance policies is more plausible. Due to economizing medical costs the medical staff was urged to limit the stay in hospital without endangering the patient's life, health or quality of life. Furthermore, ideas on optimal treatment changed to 'a shorter stay in hospital for the same kind of injuries is good for economizing medical costs as well as the well-being of the patient'[439].

The third measure to express magnitude and severity of crashes concerns an indication of costs of medical treatment at emergency department (ED) treatment. To acquire such insights VeiligheidNL developed injury burden factors, which for this thesis' selection of the LIS database were added to the records. Results of analysis of the concerned medical costs, including reference to costs of treatment of casualties of other modes, are presented in Table

[439] Source: website Nederlandse Zorgautoriteit (= Dutch Health Care Authority), website accessed 27-3-2020 (https://www.nza.nl/zorgsectoren/kortdurende-zorg).

Table 5.16. Number and period of hospital stays after pedestrian traffic crash 1998-2018 in the Netherlands

Number of hospital days *per casualty*	5 year averages per year				Increase %
	1998-2002		2014-2018		
	Number of casualties	*Collective* number of hospital days (rounded)	Number of casualties	*Collective* number of hospital days (rounded)	
1	205	200	263	265	28
2-5	636	2,225	647	2,270	2
6-10	251	2,000	216	1,725	-14
11+	396	6,000	195	2,900	-51
Total	1,488	10,425	1,321	7,160	-31
Source: LMR/LBZ datasets					

5.17. The average total costs of treatments of pedestrians in the ED post decreased 8% from 116 million Euros in 1998-2018 (2019 prices) to 106 million Euros in 2014-2018. The decrease regarding costs of treatment of pedestrian traffic casualties was 31%, whilst treatment of fall casualties only marginally decreased (3%). At the same time treatment of bicyclists rose by 69%; total treatment costs decreased most: for car occupant casualties minus 40% and for other modes (e.g. moped, motorcycle, van, bus, lorry) even 53%. It needs to be remarked that the decreases are to a large extent due to the afore mentioned shift in the medical system, whereby an increasing share of the minor and moderately injured casualties are first treated by general medical practitioners.
The vast majority (70-80%) of expenses concerns casualties who are admitted to hospital after being accepted in the ED (see Figure 5.25).

Table 5.17. 5 year averages per year of total medical costs of treatments at ED post (x million Euros)

	1998-2002	2014-2018	change %
Pedestrians	116	106	-8
of which traffic casualties	21	15	-31
of which fall casualties	94	91	-3
Bicyclists	133	224	69
Car users	89	53	-40
Other modes	33	16	-53
total	371	399	8

b. Personal characteristics and severity of pedestrian traffic crash casualties
This paragraph presents results from analysis of the LMR/LBZ and LIS datasets and supplementary exploration of international research on personal (gender, age, abilities) and severity characteristics of pedestrian traffic crashes. Successively it deals with developments regarding gender and number of MAIS2+ casualties, the relation between gender, age and number and risk of being involved in a pedestrian traffic crash, developments regarding number of MAIS2+ casualties, gender and age, and scoping review of the relation between abilities and

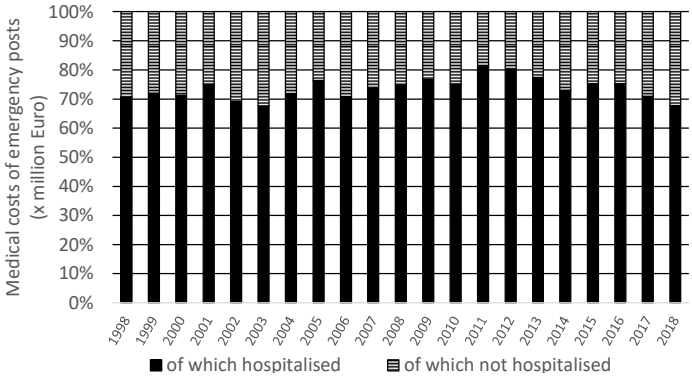

Figure 5.25. Percentages medical costs of treatment in ED posts related to a pedestrian traffic casualty being hospitalised or not - 1998-2018 in the Netherlands

risks. Because of the shift in where minor injury casualties are treated (medical emergency department of a hospital or general practitioner's posts) the real developments in the total numbers of minor injury casualties could not be captured in the LIS database. Therefore sketches of developments are restricted to MAIS2+ casualties only.

Developments in number of MAIS2+ casualties by gender.
In the period 1998 - 2018 the total numbers per year of pedestrian traffic casualties decreased both for males and females. The number of LMR/LBZ reported male casualties decreased by 30% from 708 in 1998 to 495 casualties in 2018. The 5 year averages per year decreased slightly less, from 671 - 508 (24%). For females the numbers decreased by 10% from 550 to 493; the 5 year averages per year decreased by 7% from 512 - 476. While in 1998 male pedestrians were more often involved in traffic crashes (56% were male casualties versus 42% female), the difference in numbers of casualties between males and females vanished by 2018. Figure 5.26 shows the developments per year. It knowingly does not include data for 2012, the year of the transition of LMR/LBZ from ICD9 to ICD10. Because of data supplementation the number of cases in the dataset in the first quarter of the year an unreal peak of numbers was caused, perverting real developments.

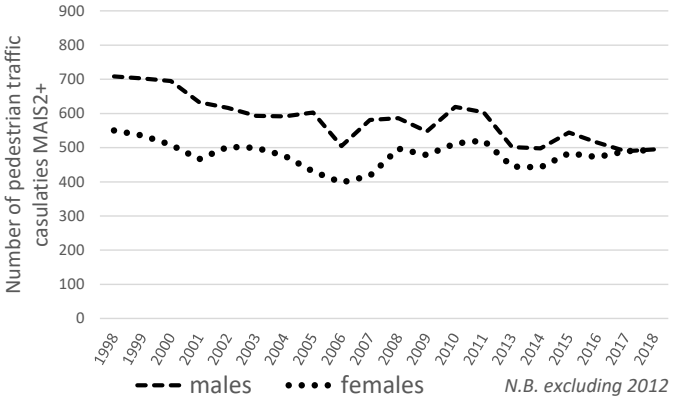

Figure 5.26. Development in gender numbers of pedestrian traffic casualties MAIS2+ 1998-2018 in the Netherlands, excluding 2012 (LMR/LBZ)

The relation between gender and age in pedestrian traffic crashes.
Figure 5.27 and 5.28 respectively show the total numbers of 22 year of serious injury (MAIS2+) pedestrian traffic casualties by age and gender, and similar figures for pedestrian minor injury traffic crashes. Because the data concern a very large period the images have limited validity: in such a period significant changes group characteristics (e.g. mobility abilities, health, mobility needs) and exposure may have happened. Literature and statistics do not offer clear insights in this regard. Mobility statistics do not show significant changes in exposure, e.g. the number of walking trips and distances walked. But, as mentioned above, due to trends breaks in data acquisition, time series of pedestrian mobility statistics are not very reliable. With regard to health there are mixed signals: an ageing population (increasing the number of vulnerable people) and data that show that on average older people are more healthy than 20 years ago. The best available proxy for exposure appears to be the number of inhabitants in the Netherlands. Therefore the risk of being involved in a pedestrian traffic crash is expressed as the number of casualties per million Dutch inhabitants of concerning age and gender groups. Being compiled by Statistics Netherlands, population statistics are assumed to be accurate enough for this purpose. The author assumes that this way, broadly speaking, the visualisations show real relations.

Figure 5.27 shows the distribution of numbers for a period of 22 years of pedestrian MAIS2+ traffic casualties by age and gender. The graph clearly shows the relatively large number of seriously injured children as pedestrians (especially boys). From about the age of 25 the total numbers more or less stabilise, and decrease from age 80. With regard to average total numbers the patterns for males and females aged 50+ differ structurally. In males the average total numbers of injured due to pedestrian traffic crashes decreases, while the average total number of females sustaining injuries in such crashes increase towards age 80; for both males and females the average total numbers decrease from age 80.
Figure 5.28 shows a similar graph regarding minor injury pedestrian traffic crashes. Apart from the patterns of people aged 50+ this graph also shows a difference in pattern for people younger than 25 years of age. The number of males peaks twice: at age 6 and age 20, while in women the numbers peak at 15-20 years of age on the same level as males.

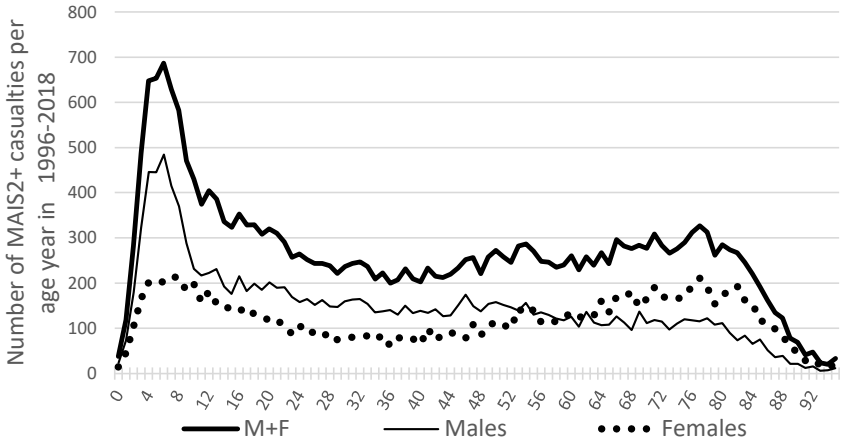

Figure 5.27. Distribution of total numbers of MAIS2+ pedestrian traffic casualties by age and gender in the Netherlands in the period 1996-2018 (LMR/LBZ)

Figure 5.28. Distribution of the total numbers of minor injury pedestrian traffic casualties by age and gender in the Netherlands in the period 1998-2018 (LIS)

Figures 5.29 and 5.30 show the same data corrected for population group sizes, i.e. the risk per million inhabitants. The average risk of being injured as a pedestrian in traffic is 121 per million Dutch inhabitants; the risk for (all Dutch) males is 123 per million inhabitants, and for females 118 per million inhabitants (LIS - all pedestrian casualties figures). For both genders it produces a clear u-shaped distribution regarding MAIS2+ pedestrian injury casualties, and a less clear u-shaped distribution of minor injury casualties. For males at high ages a very irregular pattern is shown; this is due to the large variation in small population numbers within the group. Compared to the total numbers the population group size corrected risk figures magnify the difference between young male and female pedestrians. It appears that young females run about half the risk of young males. The lower risk of females continues up to about 60 years of age, when female risk increases more than male risk. From age 80 the risk of females decreases more than risk of males. This can partly be explained by comparing to mobility statistics. These show a significant stronger decrease of per person exposure for females than for males. Furthermore, from age 80 the number of males decreases faster than of females.

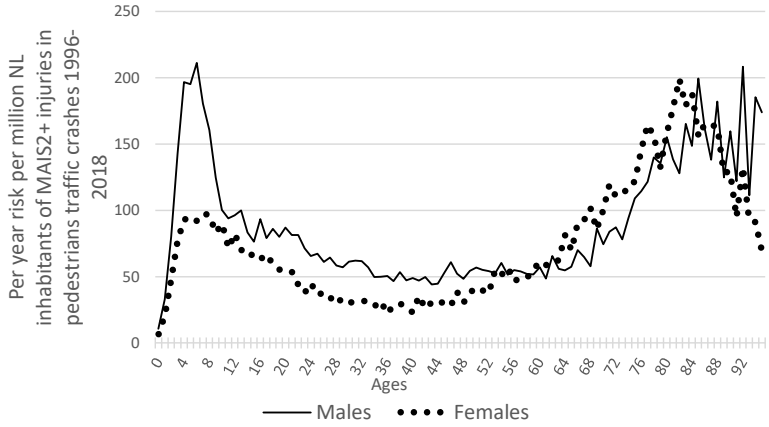

Figure 5.29. Distribution of risks per million NL inhabitants of MAIS2+ pedestrian traffic casualties per age year and gender in the period 2016-2018 (LMR/LBZ)

Figure 5.30. Distribution of risks per million NL inhabitants of minor injury pedestrian traffic casualties per age year and gender in the period 1998-2018 (LIS)

Development in numbers of MAIS2+ pedestrian traffic casualties
Figure 5.31 pictures developments in 5-year average numbers of casualties in the period 1998-2018. The decrease in numbers is largest for the age group 0-24; from age 45 the number of female casualties increases, while for males this turn appears about 10 age-years later. The patterns can partly be explained by similar population growth patterns. In the course of time differences between males and females decreased.

Relation of casualties data results with pedestrian needs, abilities and behaviour.
With regard to pedestrian needs, abilities and behaviour this thesis discerned three main risk groups: children, the elderly and persons with limited mobility.

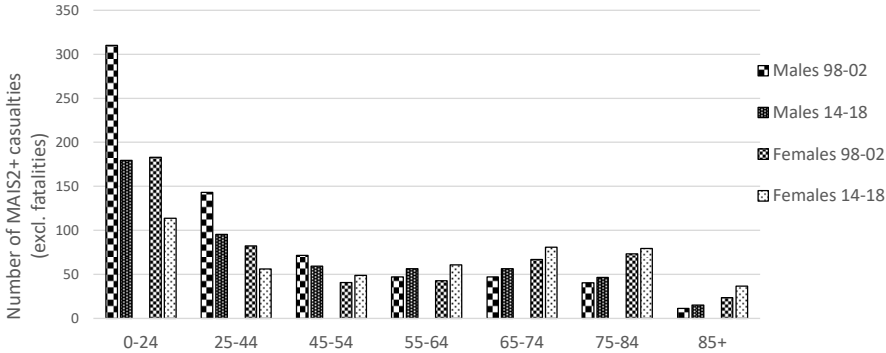

Figure 5.31. Development in number of pedestrian traffic casualties MAIS2+ differentiated to gender and age groups - 5 year average numbers per year 1998-2018, excluding fatalities, (LMR/LBZ)

With regard to *children* the casualties data confirm that in the Netherlands children are the largest group of injury casualties (cf. Figure 5.30), but there are few fatalities amongst them. In international literature children as pedestrians are highlighted as attention group (Stoker et al., 2015). As mentioned before, their physical and cognitive traffic abilities are under

development. Their behaviour is less predictable for others, and because children are smaller than adults, they are less noticeable, and view of them can more easily be obstructed by e.g. parked cars.

The elderly's increased risk being involved in pedestrian traffic crash is also confirmed by the available casualties data (cf. Figure 5.29). Research literature mentions the following explanations:

- In general the elderly scan traffic less often and accept smaller gaps in traffic at crossings than younger pedestrians;
- The elderly walk slower. They cross the street less quickly and cannot always reach the other side of the street within the green phase of traffic lights;
- The elderly are less able to react quickly to dangerous situations;
- Apart from these contributing factors elderly are more vulnerable physically, and are more often and more severely injured in traffic crashes than younger persons.

The pedestrian traffic crash casualties data to not inform on incidence and risk of *persons with limited mobility.* These are often elderly, but also younger people can suffer mobility limitations. According to Xiang (2006) handicapped persons age 5 - 17 have a five times higher risk to be involved in a pedestrian traffic crash than their peers. Possible explanations are that visually handicapped have more trouble finding their way through busy traffic and while crossing multiple lanes (Guth et al., 2005).

c. Location of pedestrian traffic crashes

LMR/LBZ and LIS datasets do not provide insight in where pedestrian traffic injury crashes happen. The only source in this regard are police reported crashes included in BRON datasets. These show that almost 90% of the pedestrian traffic crashes happen within built-up areas. Figure 5.32 presents BRON data that, apart from the years 2009-2015 when police registration collapsed, clearly show this dominance of built-up areas. During the period of 1998-2018 (ignoring unknown cases) the share even grew from 84 to 92%.

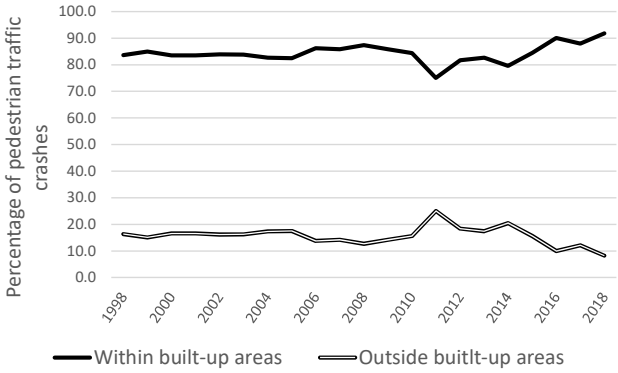

Figure 5.32. Distribution of pedestrian traffic crashes over inside/outside built-up areas in the Netherlands 1998-2018 (excl. unknown location)

A more detailed indication of locations where pedestrian traffic crashes occur concerns under what traffic speed regime crashes occur. The vast majority of the crashes occur in the 50 km/h

traffic speed regime. From 1998-2005 the so called Start-up program Sustainable Safety was carried out, featuring a massive transition of access (sojourning) streets from the 50 km/h regime to the 30 km/h regime. More than 70% of the streets (SWOV factsheet 30 km/h areas, 2018)[440] moved to the 30 km/regime. This on the one hand led to a substantial decrease in number of crashes and casualties, and on the other hand there was a shift in number of crashes and casualties to the 30 km/h regime. The graph in Figure 5.33 shows the decrease in number of pedestrian casualties fallen on 50 km/h streets and an (lesser) increase in numbers on 30 km/h streets. The vast majority of roads and road lengths in the Netherlands are now 30 km/h[441].

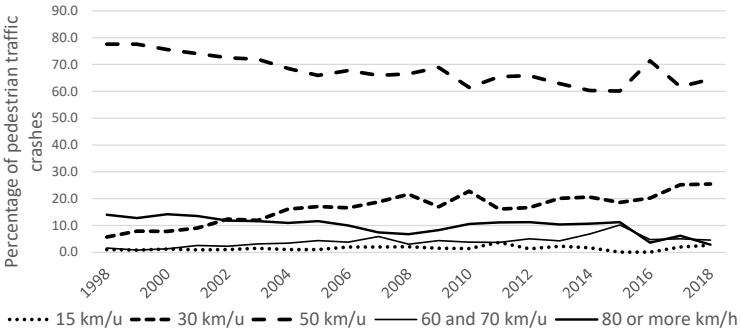

Figure 5.33. Distribution of pedestrian traffic crashes over the various speed limits of roads (excl. unknown location)

d. When pedestrian traffic accidents happen

All of the available casualties datasets contain information about when traffic accidents happen. The datasets were analysed to detect exceptional years, dominant months, days or part of the days and lighting conditions. Below main results of the analysis are shown.

Exceptional years

In order to detect 'exceptional' the year totals of the number of pedestrian traffic casualties in LIS and LMR/LBZ were compared with previous months. None of the years deviate more than 10% from the previous year.

Average distribution and developments of pedestrian traffic crashes over the months of the year

From comparison of 5-year average numbers per year of minor injury (LIS) and MAIS2+ pedestrian traffic casualties (LMR/LBZ) for the periods 1998-2002 and 2014-2018 it can be concluded that figures are slightly different. On average the LIS numbers peak in June and are lowest winter months (December - February). In the course of time the pattern of pedestrian traffic crashes reported in both in LIS and LMR/LBZ has shifted (see Figure 5.34): relatively pedestrian traffic crashes are more frequent than crashes of other modes in December up to May. In the summer months crashes of other modes are relatively more frequent.

Compared to traffic casualties of all modes reported in LIS, the numbers of pedestrian traffic casualties in LIS are slightly more evenly distributed over the year; the peak in June is less pronounced. In LMR/LBZ however a peak in the more serious MAIS2+ pedestrian injury crashes occurs in the winter months (see Figure 5.35).

[440] see https://www.swov.nl/feiten-cijfers/factsheet/30kmuur-gebieden, accessed 6-4-2020.
[441] Exact year-to-year figures are not available.

With regard to the days of the weeks when pedestrian crashes occur it stood out that on Tuesdays, Wednesdays and Thursdays relatively more pedestrian traffic crashes occur, and particularly that Saturdays appear to be a relatively safe day (see Figure 5.36).

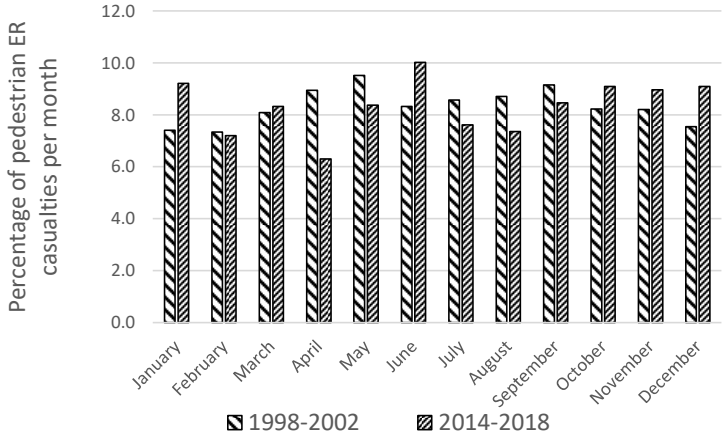

Figure 5.34. Percentages of pedestrian traffic casualties treated in an ED post per month - 5 year averages per year 1998-2018 (LIS)

Moment of the day

In Figure 5.37 the distribution of hospital admittances over the course of the day are pictured. There is a notable difference between moment of admittances during business days and weekend days. On business days there are only few admittances during night-time (00:00-7:00) and, compared to weekend days, many in morning times (08:00 - 12:00). During the afternoon and evenings the patterns of admittances of both business days and weekend days are similar.

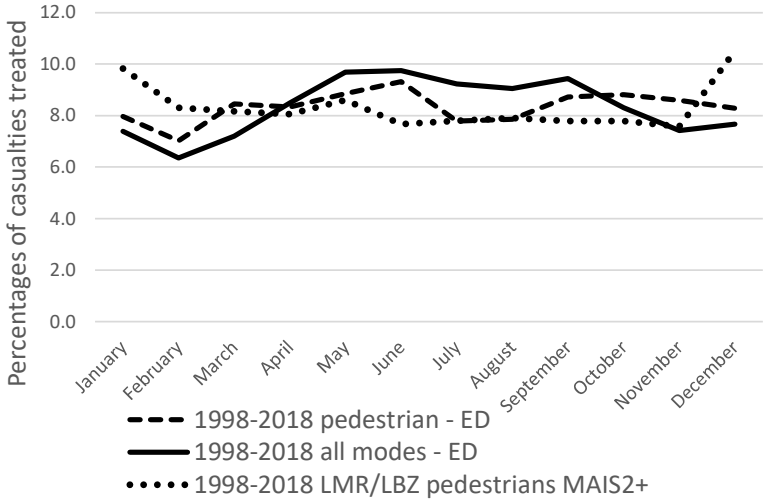

Figure 5.35. Percentages of traffic casualties treated in an ED post (all modes, pedestrians) and LMR in the Netherlands - average per month in the period 1998-2018

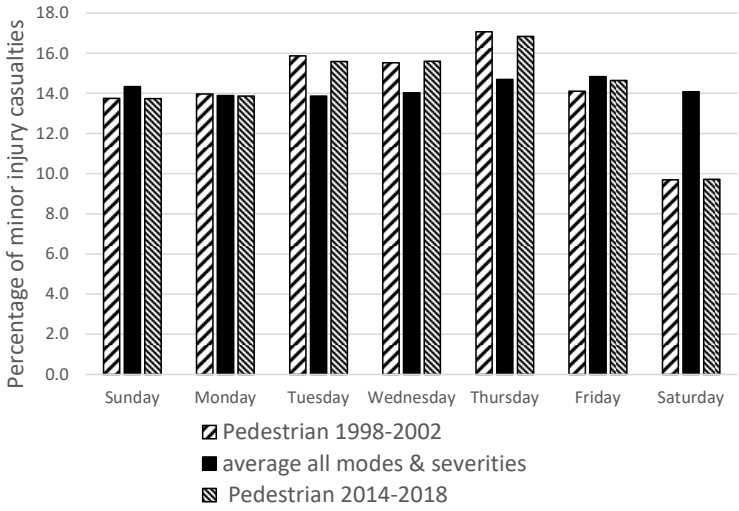

Figure 5.36. Percentages of pedestrian minorly injured traffic casualties per day of the week - 5 year averages per year 1998-2018 (LIS)

Lighting conditions

From BRON data information about lighting conditions can be drawn. On average in the Netherlands in the period 1998-2018 about 65% of the pedestrian traffic crashes occur during daylight conditions, about 30% in darkness and about 5% at dusk conditions. Although no exact exposition data are available regarding walking and lighting conditions, it appears that pedestrian traffic crashes compared to exposition as seen in mobility statistics are overrepresented during darkness; higher relative numbers of pedestrian traffic crashes in winter time support the conclusion that a lack of daylight increases risk.

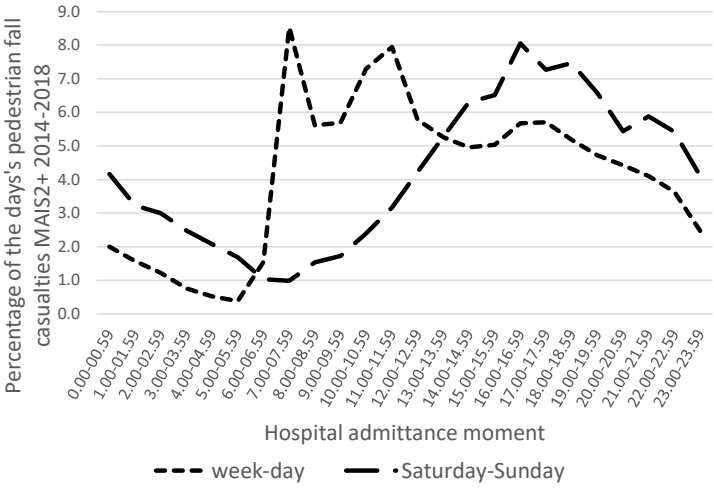

Figure 5.37. Percentages of the days' MAIS2+ pedestrian traffic casualties in the Netherlands 2014-2018 (LBZ)

e. Injury mechanisms regarding pedestrian traffic crashes

By definition pedestrian traffic crashes concern collisions between pedestrians and one or more moving vehicles. If no moving vehicle is involved, an injury mishap is regarded as fall. Injury mechanisms with regard to the latter class of mishaps are discussed separately. From older studies it is known that about 75% of the pedestrian traffic crashes concern street crossing. In about 40% of the crashes the pedestrian suddenly crosses the street; in 15% the pedestrian materialises from behind an object and another 15% of the cases concerns crossing at a zebra crossing (Vermeulen & Snoeren, 1987). CROW (2006) finds that in 1998 77% of the pedestrian crashes concern street crossing, 10% concern other collisions on the riding track, the rest mainly concern collisions near a public transport stop and moving vehicles on the sidewalk.

Due to the massive introduction of the 30 km/h zones it can be expected that mechanisms have become more diffuse. The BRON dataset shows that in the period 2011 to 2015 the police registered a very small part of the crashes (less than 250 pedestrian crashes per year in the Netherlands). From such data conclusions cannot be drawn. From 2016 the reporting rate improved, enabling tentative conclusions. It appears that street crossing still is the major mechanism for pedestrian traffic crashes (see Table 5.18).

Table 5.18. Major mechanisms pedestrian traffic crashes in the Netherlands (BRON 2016-2018)

Crash Mechanism	3 years average 2016-2018 per year	
	percentage	reported numbers
pedestrian on zebra crossing	21	143
Pedestrian on other crossings	7	46
Pedestrian near busstop	3	21
Unspecified crashes with pedestrians	52	350
Other manoeuvers	17	111
total	100	671

Behavioural factors

Pedestrian behaviour can cause crashes, but LIS, LMR/LBZ and BRON do not offer clear insights in this regard. Scoping review yielded two noticeable behavioural factors: the influence of walking under influence of alcohol and distraction. In a review of Australian research it was found that 20 -30% of the pedestrians involved in traffic crashes were under the influence of alcohol, having a *blood-alcohol level* of more than 1.5 grams per litre. In fatal crashes the levels were higher. Research in the UK found that about half of the pedestrian fatalities were under influence of alcohol (Keigan & Turnbridge, 2003). As alcohol use, as well as use of illegal and prescribed drugs in the Netherlands is quite common, it is likely that this factor also plays a role in pedestrian traffic crashes in the Netherlands, but on this matter no data are available.

The role of *distraction* is studied in behavioural research. Crossing the street while talking on the phone leads to dangerous decisions (Nasar & Troyer, 2013; Neider et al., 2010), but the relation with pedestrian crash risk is not yet researched.

f. Counterparties in pedestrian traffic crashes.

In order to get an impression of the distribution of counterparties in pedestrian traffic crashes LIS and BRON data were consulted[442]. Contrary to LMR/LBZ, LIS and BRON in principle cover both (minor) non-hospitalised and (serious) hospitalised pedestrian traffic crash casualties.

Both LIS and BRON data show that in the majority of pedestrian traffic crashes the counterparty is a car (56.3 - 63.9%). A remarkable difference between the LIS and BRON data is that LIS shows the significance of collisions of pedestrians with a bicycle, moped, bus/tram and motor cycle, whilst in BRON results direct attention to pedestrian colliding with a moped, delivery van and 'other'. In both datasets, compared to 1998-2002, in 2014-2018 the shares of pedestrian-car collisions slightly decreased, but the shares of collisions with bicyclists and users of 'other' modes increased substantially (see Table 5.19).

g. Injuries suffered from the pedestrian traffic crash

Both the LIS and LMR/LBZ dataset contain information on what injuries pedestrians suffer from traffic crashes. The datasets contain information on which part of the body is injured and of the type of injury. This paragraph distinguishes between pedestrian traffic crash injuries that were treated in a medical emergency department ED of a hospital only and those who were admitted to hospital. On average the percentage of hospitalised casualties reported in LIS increased from 25% in 1998-2002 to 31% in 2014-2018. The numbers (not included in this text and tables) and percentages of casualties are not totally comparable, particularly because decreasing coverage of minor injuries in LIS, the transfer in LMR/LBZ from ICD9 to ICD10 (some codes have changed), and because in general elderly people, whose number increased substantially, are more often seriously injured than younger people.

Table 5.19. Counterparties in pedestrian traffic crashes in LIS and BRON datasets

	LIS dataset				BRON dataset			
	1998-2002	2014-2018	average	change	1998-2002	2014-2018	average	change
Bicycle	14.5	17.1	15.2	18.5	3.9	5.3	4.6	38.0
Moped	9.0	10.3	9.3	13.8	11.6	8.4	9.7	-27.2
Motorcycle	4.5	1.2	3.0	-73.4	2.2	1.3	1.6	-37.8
Car	60.5	56.3	60.6	-6.9	63.9	61.9	63.7	-3.1
Delivery van	1.4	2.7	1.8	95.2	8.4	8.9	9.1	5.8
Lorry	1.9	1.3	1.6	-33.1	3.2	3.3	3.3	5.6
Bus/tram	5.5	3.3	4.6	-40.6	2.9	2.4	2.9	-17.9
Other/unknown	2.7	7.7	4.1	188.3	4.1	8.4	5.2	104.7
Total	100.0	100.0	100.0		100.0	100.0	100.0	

Table 5.20 shows that overall the distribution of most severely injured body parts (coded as 'Injury 1') is rather constant over the years: 22% of the pedestrians injured in a traffic accident suffer head injuries, 43% percent of the injuries concern leg injuries and in 18% of the cases arm injuries are the determinative injuries. Neck and torso injuries occur less frequently; in respectively 1 and 9% of the pedestrian traffic crashes s/he suffers neck or torso injuries. The table also shows that head and leg injuries more often necessitate hospital admittance than other injuries.

[442] In the available LMR (1998-2002) information of counterparties in pedestrian traffic crashes is not specified.

Table 5.20. Injured body part in pedestrian traffic casualties for ED treatment only and hospital treatment of pedestrian traffic crash injuries in the Netherlands 1998-2018 (resp. LIS and LMR/LBZ)

	1998-2002		2014-2018		All injuries		Change of share		Change in numbers	
	ER only	Hospital	ER only	Hospital	1998-2002	2014-2018	ER only	Hospital	ER only	Hospital
Head	18.6	28.2	17.6	28.2	21.6	21.6	-5.3	0.1	-47	-25
Neck	1.3	0.5	0.5	1.2	1.1	0.8	-59.8	137.4	-78	79
Torso	6.8	13.7	8.2	11.8	8.9	9.6	20.6	-13.5	-33	-35
Arms	22.1	9.5	22.4	13.0	18.2	18.9	1.4	37.3	-43	3
Legs	45.9	35.2	46.8	38.2	42.6	43.5	1.9	8.5	-43	-18
Several/other injuries	5.3	12.9	4.5	7.5	7.6	5.6	-15.1	-42.1	-53	-56
Total	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	-44	-25

Table 5.21 presents the percentages of the total numbers of casualties per severity class (= ER treatment only, and hospitalised) and type of injury. The table shows that the share of reported cases of superficial injury and open wounds due to pedestrian traffic casualties decreased by more than 30%, whilst all other types of injuries only slightly decreased (the types of fraction, organ injury and concussion) or increased in share. From 1998-2002 to 2014-2018 the total volume of reported not-hospitalised pedestrian traffic casualties decreased by 41% and the volume of reported hospitalised by 23%. This means that on average the *reported* cases have become more serious. This is probably entirely due to decrease in numbers of cases of superficial injury, open wounds (both not-hospitalised and hospitalised casualties) and organ injuries (in 2014-2018 no cases of not-hospitalised casualties were reported, in 1998-2002 the number was 233 average per year; in the same period the number of hospitalised decreased from 33 to 24 average per year). As mentioned above, this decrease relates to a shift in treatment towards treatment by medical general practitioners. Remarkably the share of cases of not-hospitalised concussion increased sharply, probably due to a change in hospital admittance policy (in numbers: not hospitalised from 29 to 185 average per year; hospitalised from 191 to 145 average per year).

Table 5.21. Type of injury in pedestrian traffic casualties for ED treatment only and hospital treatment of pedestrian traffic crashes injuries in the Netherlands 1998-2018 (LIS 1998-2018)

	Percentages						Change in share		Change in numbers	
	1998-2002		2014-2018		All injuries					
	ED only	Hospital	ED only	Hospital	1998-2002	2014-2018	ED only	Hospital	ED only	Hospital
Superficial injury	54	6	37	4	42	26	-33	-34	-60	-49
Open wound	8	4	6	3	7	5	-31	-35	-60	-50
Fraction	20	48	28	45	27	33	42	-6	-17	-28
Luxation	2	0	2	1	1	2	32	169	-23	107
Distortion	5	0	8	0	4	5	66	52	-3	17
Muscle or tendon injury	1	0	1	1	1	1	24	0	-27	n.a.
Organ injury	6	3	0	2	5	1	-100	-5	-100	-27
Concussion	1	15	9	15	5	11	986	-2	538	-24
Other brain injuries	1	15	1	18	4	7	60	25	-6	-4
Other injuries	3	9	7	10	5	8	119	15	29	-12
Unknown	0	0	1	1	0	1	0	0	0	n.a.
Total	100	100	100	100	100	100			-41	-23

h. Conclusions regarding pedestrian traffic crashes

From the above analysis important conclusions can be drawn to support defining policy significance of pedestrian traffic crashes:

- The number of pedestrian traffic casualties and the risk to be injured in traffic has decreased by about 25%. This is less than for users of motorised vehicles, but much better than for bicyclists, although both groups of vulnerable road users are hard to compare as the data are based on different definitions (single-bicycle crashes are defined as traffic accidents);
- The severity of crashes in terms of numbers of seriously injured (MAIS2+), number of days in hospital as well as medical costs have decreased;
- Differences in total numbers by gender for seriously injured pedestrians in traffic crashes have been settled, but there are still clear differences in age patterns. Regarding pedestrian traffic casualties young males and elderly females are dominant groups;
- The number of casualties amongst youngsters (aged 0 - 25) have decreased, whilst the number of casualties amongst the female elderly have increased substantially;
- The dominant locations of pedestrian traffic crashes are still roads within built-up areas, particularly 50 km/h roads. The share of pedestrian crashes on 50 km/h roads has decreased while it increased on 30 km/h roads;
- Pedestrian traffic crashes happen more than average in wintertime and early summer, and on Thursdays;
- Crossing the street appears to be the dominant accident type; in this the car is the dominant counterparty;
- Pedestrians traffic crash casualties mainly concern leg, arm and head injuries;
- The most frequent occurring minor injuries from pedestrian traffic crashes are superficial injuries and open wounds; the most occurring serious injuries are fractures.

5.4.3.4. Falls and precursors to falls

This paragraph deals with the main characteristics of pedestrian falls, casualties and fall injuries in the Netherlands, based on available statistical data sources on the national level. Although dedicated sources on the national level (i.e. PORS, LIS, LMR/LBZ) have been available since 1998, interest in the subject of pedestrian falls is recent. Particularly the COST358 Pedestrian Quality Needs project (PQN) occasioned spread of insights and urgency in this regard within the scientific and policy development communities. Still, there is little research and sense of urgency in this regard on the policy level; Schepers et al. (2017) found only 28 studies in English language in twenty years worldwide. The police does not register fall incidents; there is no structural information stream on falls from the medical world (general practitioners, hospitals, medical emergency departments of hospitals) towards policy makers; information is monitored on the national level only (e.g. by VeiligheidNL, MenS, and the Ministry of Infrastructure & Water Management), but not on the local (municipal) level. This way little is known and disseminated about (local) fall reasons and clues for countermeasures. This thesis aims to be a vehicle for improvement in this regard.

Similar to the case of pedestrian traffic crashes, for assessing magnitude and severities of pedestrian injury mishaps, gender and age distribution, injury mechanisms and injury specifications in medical databases (i.e. LMR/LBZ and LIS) appear to be the most suitable and reliable sources. Also similar to the pedestrian traffic crashes case, within adjusted samples for pedestrian falls (e.g. when numbers are corrected or augmented for missing location codes or shift in treatment towards general practitioners) detailed volume specifications cannot be given validly. Furthermore, dataset limitations and data protection regulations for death causes statistics preclude fatality statistics beyond general figures on numbers, gender and age classes.

This paragraph presents results of analysis of available datasets on characteristics of pedestrian falls, casualties and injuries. Successively the following aspects will be dealt with: a) magnitude of the phenomenon, b) gender, age and injury severities, c) major location characteristics of falls of pedestrians, d) dominant time aspects, e) main injury mechanisms, f) injury specifics of pedestrian fall casualties, and g) conclusions regarding policy significance of pedestrian fall injuries.

a. Magnitude and severity of pedestrian fall mishaps

Similar to pedestrian traffic crashes, in this paragraph three kinds of measures are used to express (relative) magnitudes and severities of pedestrian fall injury mishaps: 1) the number of casualties per MAIS class, 2) the number of days that casualties spend in a hospital, and 3) medical costs of the treatment of injuries.

With regard to the magnitude and severity of pedestrian injuries from falls in public space this paragraph builds and advances on Tables 5.12 and 5.13. It presents further documentation on pedestrian fall injuries based on LIS, LMR/DHZ and CBS Death causes statistics. Table 5.22 expresses magnitude and severity in terms of extent of numbers of casualties and risks per million Dutch inhabitants. Three main classes are distinguished: 1) casualties who were medically treated, but not hospitalised, 2) hospitalised casualties, and 3) adjusted official numbers of pedestrian fall fatalities.

The top row of Table 5.22 shows the estimated (cf. Table 5.12) total number of injured pedestrians who were treated in an emergency department (ED) post at a hospital, but were discharged after treatment and not hospitalised. The figures indicate that in twenty years the number of pedestrian fall casualties has almost doubled (from 34,900 to 68,000; the growth in the 5 year averages per year amounts from 30,700 in 1998-2002 to 57,500 in 2014-2018) and that a Dutch person's risk in this regard has increased by 75% (from about 1,900 to about 3,400 casualties per million Dutch inhabitants). The LIS dataset does not render these increases based on the assumption that real world numbers (and risks) follow trends in LMR/LBZ data (see second row in Table 5.22). Due to the shift in the Dutch medical system towards treatment by first-line medical general practitioners, these cases are out of sight of the administrators in emergency departments (ED), and therefore not reported in LIS, resulting in a decrease in indicated numbers and risks. The augmented figures for 2014-2018 shown in the first row cannot be validly broken down into more specific tables on gender and age, location (region) of the mishaps, when the mishap happened, what injury mechanism applied and what injuries were suffered. The author assumes that the LIS dataset accurately shows shares regarding the full total of pedestrian fall injuries.

With regard to hospitalised casualties there is no reason to doubt the validity of data on developments; in order to sketch real developments doubtful registration years because of the transition from ICD9 to ICD10 (from 2012 to 2014) and connected administrative consequences were left out. LMR/LBZ data show that the number of pedestrian fall casualties almost doubled (from 3,144 to 6,124 pedestrians admitted to hospital respectively in 1998 and 2018) and that risk per person (expressed as risk per million Dutch inhabitants) in the same period increased by 75% (from 207 to 362 hospitalised casualties per million Dutch inhabitants). The increase is not proportional to the 1998-2002 distribution of (MAIS) severities: the volume of MAIS019 class (minor injuries, increase of 270%) increased far more than MAIS2 and MAIS3+ class (moderate, serious and critical injuries, increase of about 70%). In other words, the explosive increase in number particularly concerns minor injuries. This

means that the estimations regarding the volumes of medically treated, but not admitted to hospital pedestrian (ED) casualties is probably a conservative estimation.

Table 5.22. Pedestrian fall casualties - 5 yearly average numbers and risks per million inhabitants per year in the Netherlands 1998-2018

	Number of pedestrian traffic casualties		5 year average number of casualties per year		Risk per million inhabitants	
	1998	2018	1998-2002	2014-2018	1998-2002	2014-2018
Casualities not treated in a hospital						
Estimated total number of treated injured pedestrians	34,900	68,000	30,700	57,500	1,934	3,383
Non-hospilalised casualties reported in LIS	34,900	20,100	30,800	20,700	1,940	1,218
Hospitalised casualties						
Minorly injured (MAIS019)	372	1,367	387	1,355	24	80
Moderately injured (MAIS2)	1,606	2,722	1,665	2,833	105	167
Seriosly injured (MAIS3+)	1,111	1,955	1,181	1,878	74	110
Fatalities - after being admitted to hosptal (reported in LMR/LBZ)	55	79	57	81	4	5
Totals LMR/LBZ	**3,144**	**6,124**	**3,291**	**6,146**	**207**	**362**
Fatalities reported in CBS Death causes statistics						
Fatalities - adjusted Death causes statistics	52	***80***	88	***80***	6	***5***

Source: LIS, LMR/LBZ datasets; CBS Death causes statistic; calculations; ***Death causes statistics for 2018 are not available; the figure concern 2017 respectively 2014-2017***

Different from the case of pedestrian traffic crashes, the numbers of fatalities in LMR/LBZ for pedestrian fall fatalities in the years 1998 and 2018 are similar to the (adjusted) CBS Death causes statistics for these fatalities; the 5 year averages per year however differ substantially and have seemingly contradictory trends. In the (adjusted) CBS Death causes statistics the 5 year average per year pedestrian fall fatalities decreases from 88 in 1998-2002 to 80 in 2014-**2017** (4 year average; the number of fatalities in 2018 was not available during the writing of this report). This difference can be explained by the large error margins of the correction for underreporting because of partly missing location coding.

In Figure 5.38 developments in the reported yearly numbers of casualties per MAIS class over the years 1998-2014 are shown. In this figure knowingly the year 2012 is excluded. In that year transition of registration of casualties from ICD9 to ICD10 took place; for completeness the administrator (Dutch Hospital Data) supplemented many records to correct for very substantial underreporting; the supplementation (doubling of records in the beginning of the year) produced an unlikely high peak in number of pedestrian fall casualties. In order to not destroy validity the 2012 cases were left out in the graph.
The graph shows that in 2010 the number of fall moderately injured casualties (MAIS2) peaked. This peak, which is also found in the LIS dataset, is caused by a relatively large number of falls because of exceptional wintery conditions. The graph shows that (apart from fatalities) all numbers of casualties increased substantially over the years. This increase is probably caused by the increase in number of elderly, who are more prone to fall and then are more severely injured than younger persons (see also below under b. Gender, ages and severity of pedestrian falls).

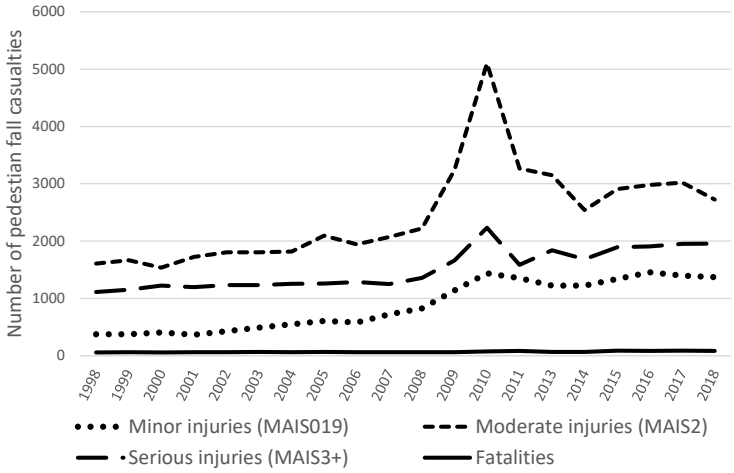

Figure 5.38. Number of pedestrian *fall* casualties admitted to a hospital per MAIS class in the Netherlands 1998-2014 (2012 excluded; source: LMR/DHZ)

The second measure to express magnitude and severity of crashes concerns the distribution of numbers of days that the casualties spend in hospital. In the period 1998-2018 policies with regard to the length of the stay in hospital strongly changed. From the hospital admittance data (LMR/LBZ) shown in Table 5.23 it can be concluded that, due to the near doubling of the numbers of pedestrian fall casualties, the collective number of hospital days also increased, but only by 15% (from about 26,550 hospital days to 30,600 hospital days). The number of long hospital stays (11 or more days) decreased; all other classes increased substantially, but the increase in number of one-day stays was largest (239% increase). The average number of days that a pedestrian fall casualty stays in hospital substantially decreased (from 8.1 days in 1998-2002 to 4.8 days in 2014-2018). Although this decrease in duration of the stay in hospital is substantial, it did not lead to a decrease in the total number of hospital days, i.e. the need for more hospital beds for this type of patients. The almost doubling of the number of casualties more than neutralised the intended decrease in demand for (expensive) hospital beds.

Table 5.23. Number and period of hospital stays after pedestrian falls in public space 1998-2018 in the Netherlands

	5 year averages per year				
	1998-2002		2014-2018		
	Casualties	# of hospital days (rounded)	Casualties	# of hospital days (rounded)	Increase %
1	444	450	1,500	1,500	239
2-5	1,083	3,800	3,100	11,000	186
6-10	597	4,800	1,200	9,500	99
11+	1,167	17,500	575	8,600	-51
Total	3,291	26,550	6,365	30,600	15

The third measure to express magnitude and severity of crashes concerns an indication of costs of medical treatment at emergency departments (ED) of hospitals.

The 5 year average per year of total treatment ED costs of all pedestrian casualties decreased from 116 million Euros to 106 million Euros (8% reduction) in the period 1998-2018. This is mostly due to a 31% decrease of costs of pedestrian traffic casualty treatment (from 21 million Euros to 15 million Euros). The 5 year average of ER treatment costs of pedestrian *fall* casualties decreased marginally from 94 million Euros to 91 million Euros (3% reduction)(see also Figure 5.39); in the same period the share of costs of ED treatment of pedestrian fall casualties in the total costs of treatment of pedestrians rose from 4.5 to 6.0 times the costs of treatment of pedestrian traffic casualties.

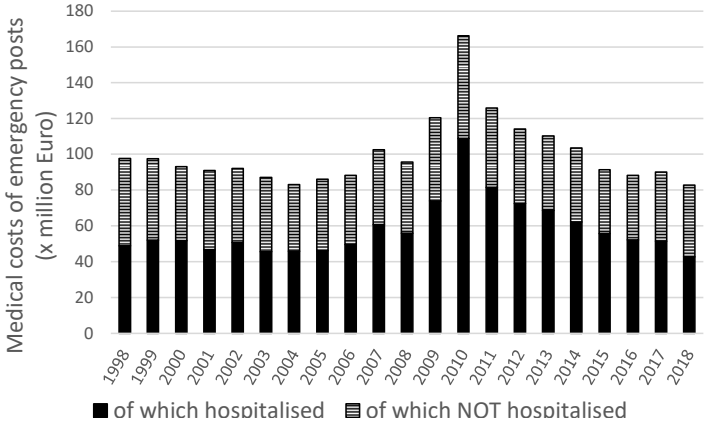

Figure 5.39. Medical costs of treatment in ED posts related to a pedestrian fall casualty being hospitalised or not - 1998-2018 in the Netherlands

On average per patient treatment costs of a pedestrian fall patient are less than those of a pedestrians traffic casualty, and a larger part of the costs are made to treat minor injuries of casualties who do not need to be admitted to a hospital (on average 43% compared to 24% for traffic casualties). Apart from wintery years (2009-2011, when injuries on average are more numerous but less severe) on average half the medical costs concern non-hospitalised patients ('outpatients'). For pedestrian traffic casualties the opposite applies: in years with cold winters the injuries are more severe and expensive. This is most probably due to the higher impact speeds in cases of collision with a moving vehicle than the impact of falling to the ground.

b. Gender, ages and severity of pedestrian falls

This paragraph presents results from analysis of the LMR/LBZ and LIS datasets on gender, age and severity characteristics of pedestrian falls. Successively it deals with developments regarding gender distribution over MAIS2+ casualties, the relation between gender, age and number and risk of being involved in a pedestrian fall, and developments regarding the number of MAIS+ casualties, gender and age. As mentioned before, because of the shift in where minor injury casualties are treated, the real developments in total number of minor injury casualties are not captured in the LIS database. Therefore sketches of developments in numbers are restricted to MAIS2+ casualties only.

Developments in number of MAIS2+ casualties by gender

In the period 1998 - 2018 the total number per year of pedestrian fall casualties has increased both for males and females. The distribution over gender is rather constant; almost two thirds of the casualties are female, with a small tendency to shift towards a smaller share of females.

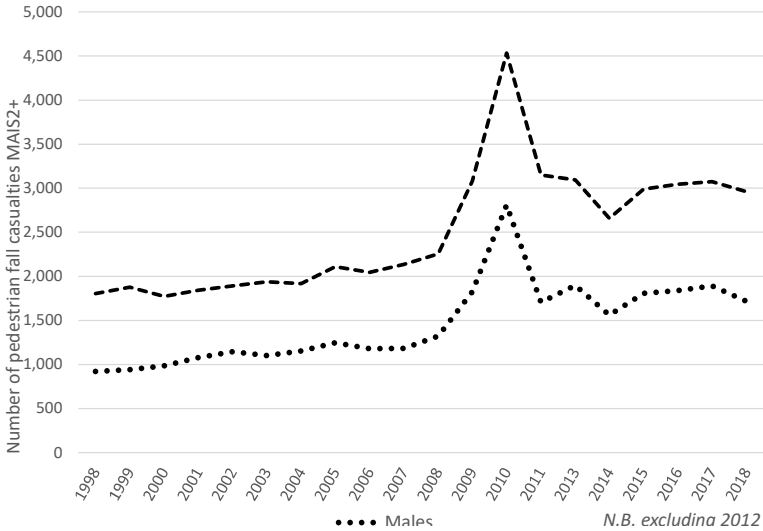

Figure 5.40. Development in gender numbers of pedestrian traffic casualties MAIS2+ 1998-2018 in the Netherlands (excluding 2012)

In 1998 66% of the casualties were females, in 2018 the percentage was 63%. In 5-year averages per year the difference almost evaporates from 64% in 1998-2008 and 63% in 2014-2018. Because of the tough winter in 2010 in the Netherlands the number of fall casualties peaked at 4,500 females and 2,800 males (see Figure 5.40).

The relation between gender and age in pedestrian falls

Figure 5.41 and 5.42 respectively show the total numbers of a 22 years period of serious injury (MAIS2+) pedestrian fall casualties by age and gender, and a similar figure for pedestrian minor injury falls. As stated above regarding pedestrian traffic casualties, the data concerns a very large period, and therefore validity of the images is limited, but no clear indications were found in this regard. The best available proxy for exposure appears to be the (average) number of inhabitants in the Netherlands. Population data are considered accurate and reliable over time.

Figure 5.41 shows the distribution of the 22 years total numbers of pedestrian MAIS pedestrian *fall* casualties by age and gender. The graph differs fundamentally from the graph for pedestrian *traffic* casualties: the peak at young ages is also present but at a much lower level. The total numbers sharply increase with age from about age 25 until about age 80, and then sharply decrease because the number of old pedestrians decreases with increasing age. The graph shows a very notable difference between the number of falls cases in females and males. While from age 8 the number of serious injury falls in females is lower than the number for males, at about age 45 the number of such falls of females surpass that of males, and keeps on increasing until age 80 (1,711 females age 80 were MAIS2+ injured in falls during 1996-2018; the figure for males is 608).

Figure 5.42 shows a similar graph regarding minor injury pedestrian falls. With regard to the total numbers the graph shows three sharp and one little peak, respectively at ages 10, 20, 53 and 78 years of age. The graph for females also shows the peaks at the same points and more or less planes between 55 to 80 years of age, while the graph for males continuously decreases from age 20, planes between 60 to 80 years, and totally lack the peaks at 53 and around 80 years

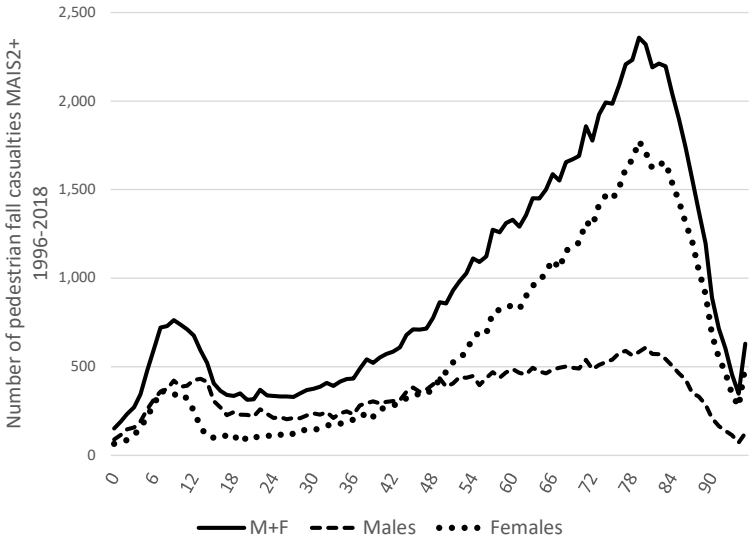

Figure 5.41. Number of MAIS2+ pedestrian fall casualties per age and gender in the Netherlands in 2016-2018 (LMR/LBZ)

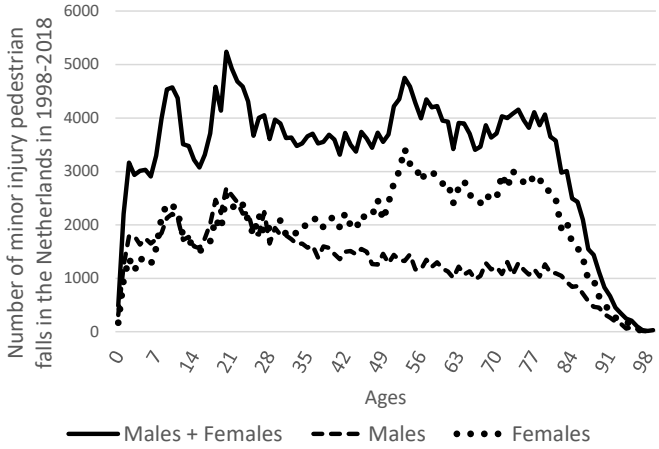

Figure 5.42. Number of minor injury pedestrian fall casualties (non-hospitalised, MAIS019) per age and gender in the Netherlands in 1998-2018 (LIS dataset)

of age. In total females outnumber males by 64,000 casualties in 22 years (*22 years total* number of female fall casualties is 196,000 minor injuries; males is 132,000 minor injuries, respectively on average 9,000 and 6,000 casualties *per year*).

Figures 5.43 and 5.44 show the same data, corrected for population group sizes, i.e. the risk of MAIS2+ and minor fall injuries per million Dutch inhabitants (a period of 22 years' average). Contrary to traffic casualties, the MAIS2+ graph for fall casualties is not U-shaped. The minor injuries graph is only vaguely u-shaped.

With regard to MAIS2+ injury fall risks (see Figure 5.43) for young males and females up to 18 differ slightly (slightly lower risks for females between 8 and 16 years of age) and afterwards are almost equally slowly rising up to age 50. The numbers take off from age 50, and like in the total numbers graph, the line for females increases faster than for males up to 80 years of age; at higher age risks are extremely high for both genders. At age 80 the MAIS2+ risk peaks at about 90 persons per million inhabitants of the age-year group.

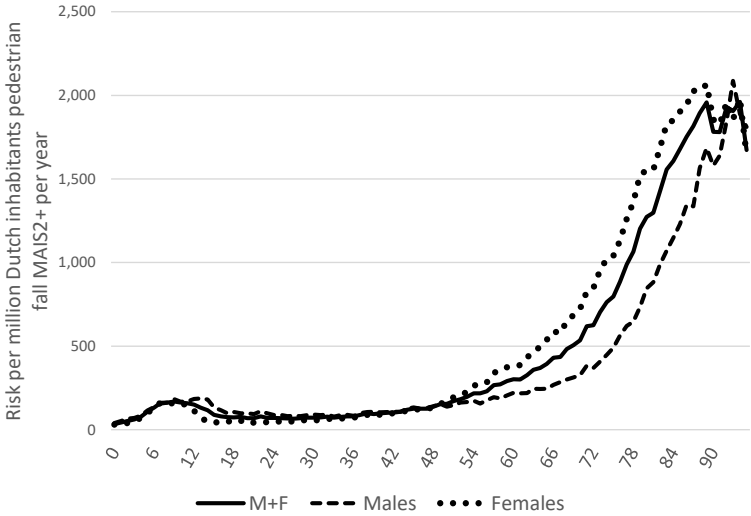

Figure 5.43. Risk per million Dutch inhabitants of MAIS2+ pedestrian fall injuries per age and gender year in the period 2016-2018 (LMR/LBZ)

Figure 5.44 pictures the risks of experiencing a pedestrian minor fall injury by age and gender. The distribution differs notably from pedestrian minor traffic casualties: the U-shaped graph is very weak, and the peak at older ages is not equal but approximately 2.5 times higher, rising to 110 persons of the age-year group per year. It is remarkable that the risk of being injured in a pedestrian fall for elderly males still increases beyond age 80 (peaks at age 95: risk of 3,654 per million male inhabitants at age 95), whilst the risk for females decreased from about that age (peaks at age 79: risk is 2,601 per million female inhabitants at age 79), probably because they limit their walking.

Development in numbers MAIS2+ pedestrian fall casualties

In Figure 5.45 developments regarding the total number of MAIS2+ pedestrian fall casualties is sketched. The general patterns emerging from Figure 5.41 show again. Additionally it stands out that the numbers of casualties aged 45 and younger, both males and females, moderately decrease. On the other hand a strong increase in numbers occurs in pedestrian aged 45+, both male and female, corresponding with their higher risks as well as ageing of the population, i.e. their larger numbers in the population. The effects of restricting walking in females is not so apparent from these figures.

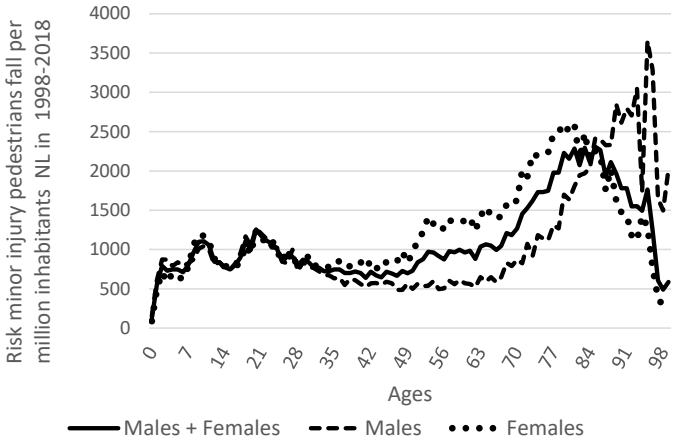

Figure 5.44. Risk per million Dutch inhabitants of minor (non-hospitalised, MAIS019) pedestrian fall injuries per age in the Netherlands in 1998-2018 (LIS dataset)

Relation of casualties data results with pedestrian abilities and risks

Pedestrian fall casualties data correlate with incidence of sarcopenia and osteoporosis in older females. Sarcopenia causes decreasing (leg) muscle power, and osteoporosis increases the risk of serious bone fractures. Leg muscle power is important to prevent falling if one stumbles or trips. Sarcopenia happens to both males and females at more or less on the same rate, but the females generally start off with less muscle power, and cross the critical limits of decreased muscle power earlier in life. Power training in combination with balance training lowers the risk of falling (Gillespie et al., 2012; Kannus et al., 2005). With ageing the risk of serious bone fractures (e.g. broken hip) increases. In females osteoporosis increases strongly after menopause, in males the process is more gradual (Cummings & Melton, 2002). Physical activity, vitamin D, calcium and specific medication are effective to combat osteoporosis (Kannus et al., 2005) (cf 4.3.2.7 on General health).

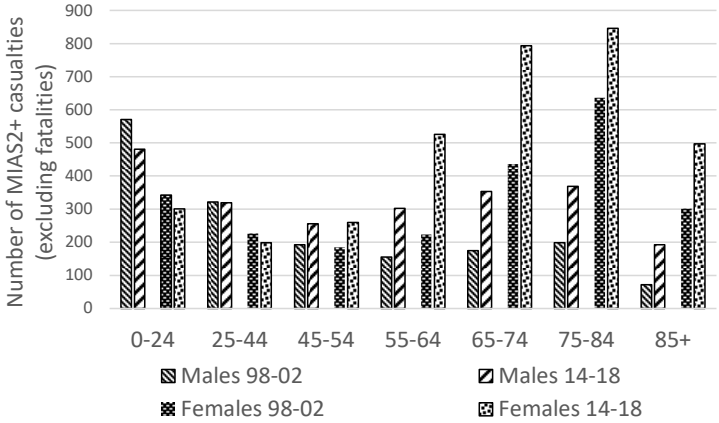

Figure 5.45. Developments in number of fall casualties MAIS2+ differentiated to gender and age groups - 5 year average numbers per year 1998-2018, excl. fatalities, (LMR/LBZ)

c. Location of pedestrian falls

The location of pedestrian falls in public space is only crudely indicated in the LMR/LBZ and LIS datasets as 'street or road'. There is no specific information, like whether or not the fall happened within or outside built-up areas, on the sidewalk, riding track, shared space or separate footpath.

In international literature Schepers & Methorst (2019) found that falls relatively often occur during street crossing and when there were a lot of people in the area, like near public transport stops and on markets (e.g. Nyman et al., 2013; Lai et al., 2011; Lai et al., 2009). In Montreal, Canada, falls were concentrated in the city centre and in shopping streets (Morency et al., 2012). In a literature review by Methorst et al. (2017) into the risk of stairs it was found that incidence in the studies varied between 7 and 17% of falls in public space. General research suggests that most of these falls occur when descending (Startzell et al., 2000).

d. When pedestrian falls happen

In this paragraph analysis results are presented regarding the moment of the fall, or better: arrival at the ED post or admittance to the hospital. The datasets were searched for exceptional years, and dominant months, days or part of the day, lighting conditions.

Exceptional years

In the period of 1998 - 2018 regarding totals of fall casualties, apart from dataset peculiarities (e.g. in LMR/LBZ the transition from ICD9 to ICD10 coding, and in LIS the gradual shift of ER treatments towards medical general practitioners) three years stood out: 2009, 2010 and 2011. In those years exceptionally tough winters occurred. Figure 5.46 shows the winter peaks in number of pedestrian injuries from falls treated in an ED post (all severities) in the winters of 2009-2010 and 2010-2011.

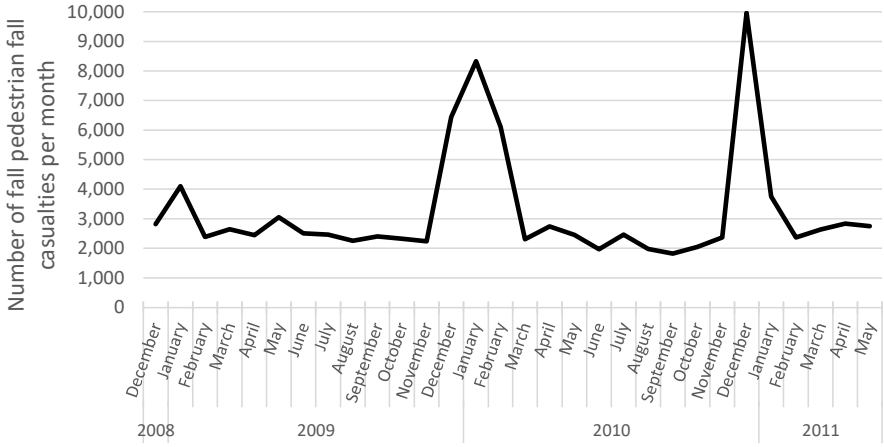

Figure 5.46. Winter peaks in numbers of pedestrian fall casualties in the Netherlands (LIS)

Dominant months

Frequencies of monthly totals of MAIS2+ (LMR/LBZ) and minor injuries (LIS - treatment of casualties not admitted to hospital) show slightly different patterns. MAIS2+ casualties dominate in wintertime (December and January, see Figure 5.47), and are slightly elevated in

May. These circumstances are enlarged in the minor injuries pattern. When compared to ED admitted casualties from all modes (LIS, all years), as proxy for exposure, it stands out that pedestrian fall injuries are more dominant in December to May and less dominant in the other months (see Figure 5.48), and that in later years (2014-2018) pedestrian falls tend to more closely follow the general exposition pattern.

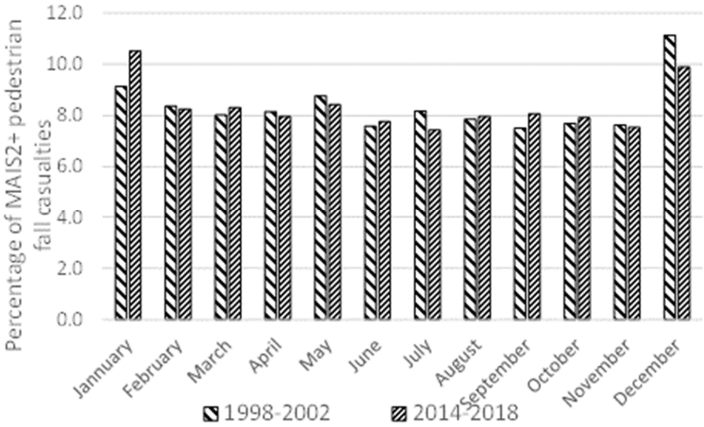

Figure 5.47. Year percentages per month of MAIS2+ pedestrian falls in the Netherlands - 5 year averages per year 1998-2002 and 2014-2018 (LMR/LBZ)

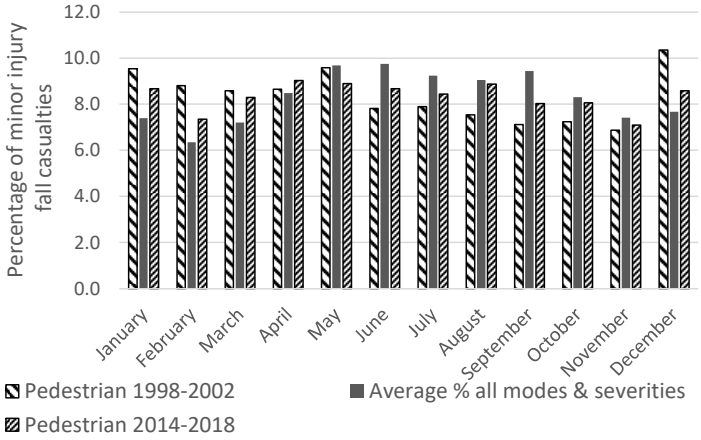

Figure 5.48. Year percentages per month of pedestrian minor injury falls - 5 year averages per year 1998-2002 and 2014-2018 compared to pattern of all modes and severities (LIS)

Days of the week

Figure 5.49 pictures pedestrian injury events patterns in relation to the days of the week. Patterns regarding MAIS2+ and minor injuries are similar (not presented in the figures). It appears that compared to other modes casualties, pedestrian fall casualties are overrepresented on Fridays and in the weekend, and underrepresented on Tuesdays and Wednesdays.

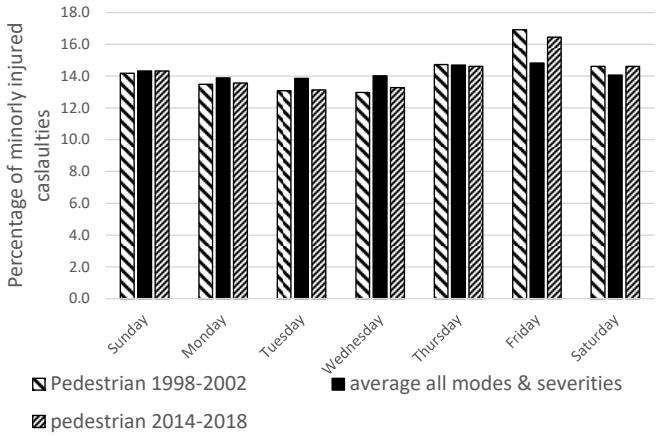

Figure 5.49. Percentages of number of pedestrian minorly injured fall casualties per day of the week - 5 year averages per year 1998-2018, compared to average all modes & severities (LIS)

Distribution of moments of admittance to hospital over the week days.
Analysis of admittance to hospital times shows different patterns for business days and weekend days (see Figure 5.50). During weekdays admittances peak in the morning hours, while admittance in the weekend peaks in the afternoon. In the weekend the number of admittances in the early hours (00:00 - 06:00) and late afternoon and evening (12:00 - 24:00) are relatively busy hours.

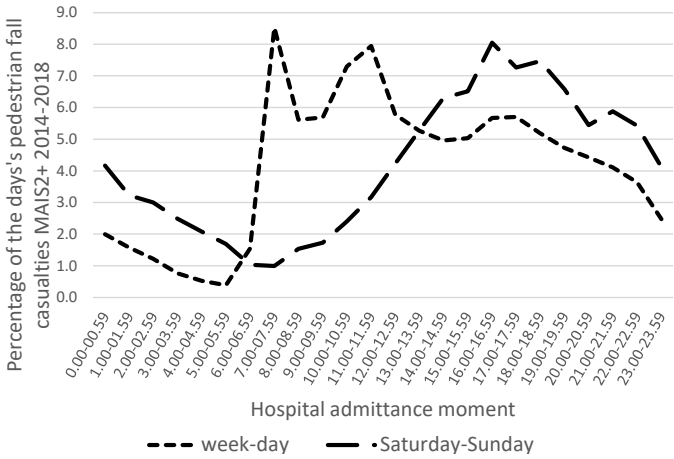

Figure 5.50. Percentages of the days' MAIS2+ pedestrian fall casualties in the Netherlands 2014-2018 (LBZ)

Lighting conditions
The LIS and LMR/LBZ datasets do not offer insight in lighting conditions. Methorst et al. (2017) found that in two studies on falls on stairs insufficient lighting was co-cause (Duckham et al., 2013 and Lai et al., 2009).

e. Injury mechanisms regarding pedestrian falls

With regard to pedestrian fall injuries mechanisms distinction can be made between mechanisms on the operational level and potential fall causes on the lifestyle-strategic level. Emergency Department (LIS) and hospital admittance data LMR/LBZ and LIS datasets offer insight in operational injury mechanisms conform ICD9 or ICD10 coding. International research on causes on the lifestyle-strategic level have been reviewed and summarised by Schepers & Methorst (2020); no Dutch studies and data were found on this perspective. Below the two perspectives are concisely pictured.

Injury mechanisms regarding falls on the operational level

Table 5.24 shows the distribution of operational injury mechanisms and developments therein regarding pedestrian falls, as reported in LIS[443]. In all years 'stumbles' are the main injury mechanism in public space (one out of 3 to 4), 'wrong steps' come second (one out of 5 to 7) and 'slips' come third (one out of 10 to 12). Over the years the distribution of mechanisms in LIS records changed, possibly related to the transfer of treatments to medical general practitioners, taking over the minor injury cases, particularly 'wrong steps' and 'slips'.

Table 5.24. Distribution (percentages) of injury mechanisms in pedestrian falls in the Netherlands in 1998-2018 (LIS 1998-2018)

	percentages		Change in
	1998-2002	2014-2018	numbers (%)
Stumble - same level	25.6	37.9	6.34
Slips - same level	11.7	8.6	-47.50
Wrong step, swivel, twist	19.8	14.7	-46.83
Leap	0.9	1.2	-1.98
Fall from fixed stairs	0.5	1.0	39.52
Fall from heights	4.2	4.7	-20.57
Other falls	37.2	31.8	-38.77
Total	100.0	100.0	-28.33

Sketch of precursors of pedestrian falls

Regarding causes (precursors) of single pedestrian accidents (falls) Schepers & Methorst (2020) distinguish between personal characteristics, behavioural factors, environmental characteristics, and shoe technology. Within personal characteristics they discern the factors age and gender (dealt with above), the relation between distance walked, health condition, depression and anti-depressives, and eyesight. Environmental characteristics comprise road layout and maintenance, slipperiness in wintertime.

Schepers & Methorst conclude that as yet internationally few studies focussed on single pedestrian accidents. The risk is especially high for elderly, particularly older females. It particularly concerns healthy elderly, who walk more than average. Less healthy elderly fall indoors mostly. Depression is one of the few factors that correlate with *both indoor and outdoor falls* (Schepers et al., 2017:231). The use of alcohol appears to play a role, but this not yet thoroughly covered in research. Environmental factors that casualties mention as co-cause are curbs, steps, stairs, loose tiles, potholes, winter slippery and waste. Individual pedestrian accidents occur disproportionately in places where people walk a lot, such as public transport boarding points, markets and pedestrian crossings. In research into the quality of shoes no correlation between quality of shoes and fall incidents was found.

[443] LIS data are used because of their availability, accessibility and coverage of the total number of falls, including both minor and serious injuries.

f. Injuries suffered from the pedestrian falls

In Table 5.25 the distribution of injuries of pedestrian fall casualties over body part is shown. Dominant injured body parts of pedestrians who were injured in a pedestrian fall are arms and legs, both in pedestrians that were treated in an ED clinic only and those who were admitted to hospital. About one in six falls results in head injuries; compared to 1998-2002 the yearly average number of head injuries treated in hospital increased from 517 to 983 in the period 2014-2018, and the share in pedestrian fall related head injuries hospital admittances almost doubled. Furthermore, the number of pedestrian fall cases where the casualty suffer more than one injury or other injuries (like damage to internal organs) increased substantially from about 1% to about 5% of fall injuries (resp. 500 per year in 1998-2002 to 1,044 per year in 2014-2018). In ED treatments the number and share of neck injuries are low (34 to 51 cases per year), but torso injuries are more frequent (on average about 700 cases ED treatment only and about 250 hospital admittance). Compared to traffic crashes the shares of arms, head, neck and torso injuries are low, while the share of leg injuries in fall injuries is similar, but their number is about three times larger than for traffic pedestrian traffic crashes.

Table 5.25. Injured body part in pedestrian fall casualties for ED treatment only and Hospital treatment of pedestrian fall injuries in the Netherlands 1998-2018 (resp. LIS and LMR/LBZ)

	1998-2002		2014-2018		all injuries		change of share		change in numbers	
	ER only	Hospital	ER only	Hospital	1998-2002	2014-2018	ER only	Hospital	ER only	Hospital
Head	16.9	15.9	15.1	30.2	16.8	15.2	-10.7	89.5	-40	90
Neck	0.1	0.3	0.1	0.1	0.2	0.1	-11.7	-80.1	-41	-80
Torso	2.4	7.1	3.0	7.5	2.8	3.6	27.0	6.5	-15	7
Arms	41.6	23.8	46.5	14.7	39.9	43.4	11.7	-38.2	-25	-38
Legs	37.5	52.2	30.4	42.2	38.9	33.3	-18.9	-19.1	-46	-19
Several/other injuries	1.5	0.8	4.9	5.3	1.5	4.4	219.9	566.5	115	570
Total	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	-33	0

Table 5.26. Type of injury in pedestrian fall casualties for ED treatment only and Hospital treatment of pedestrian fall injuries in the Netherlands 1998-2018 (LIS 1998-2018)

	Percentages						Change in share %		% Change in numbers	
	1998-2002		2014-2018		All injuries		ER only	Hospital	ER only	Hospital
	ER only	Hospital	ER only	Hospital	1998-2002	2014-2018				
Superficial injury	32	4	17	5	30	15	-47	13	-65	43
Open wound	11	4	6	4	10	6	-43	-1	-62	26
Fraction	32	72	50	60	35	52	57	-16	5	6
Luxation	2	3	3	2	2	3	39	-34	-7	-16
Distortion	18	0	11	0	17	9	-40	11	-60	40
Muscle or tendon injury	1	1	1	0	1	1	40	-55	-6	-43
Concussion	1	10	5	16	2	7	253	55	137	96
Other brain injuries	0	3	0	6	0	1	71	104	15	159
Other injury	2	2	5	6	2	5	157	122	94	205
Unknown injury	0	0	1	1	0	1	0	0	n.a.	n.a.
Total	100	100	100	100	100	100			-33	27

Table 5.26 shows what type of injuries pedestrian fall casualties suffer and how cases are distributed over minor (ED treatment only in LIS) and more severe (hospital admittance in LIS) treatment situations. With regard to superficial injuries, open wounds and distortion the reported numbers in LIS disproportionally decreased from 1998-2002 to 2014-2018, while the numbers of hospital admittances, but for open wounds, increased. On the other hand, a larger share of fractions, luxation's and muscle or tendon injuries were more often treated at ED

facilities. Both concussions and other brain injuries became more frequent, and are dominantly treated in hospitals.

g. Conclusions regarding pedestrian falls

From the above analysis important conclusions can be drawn to support defining policy significance of pedestrian fall:

- Although pedestrian falls in public space are far outnumbered by the strongly increasing number of falls in private spaces, their numbers are significantly higher than pedestrian traffic crashes and crashes of other modes, excluding bicycle single and multiple traffic crashes;
- In twenty years' time the number of pedestrian fall casualties per year has almost doubled, while the number of traffic casualties has decreased by about 40%. The share of pedestrian falls in accidents in public space increased even more;
- Although the number of medically treated pedestrian fall casualties almost doubled, the number of fatalities was about constant. This means that fatality risk when falling decreased by half in twenty years' time;
- Ageing of the population in the Netherlands is a dominant factor in the increase in the number of fall casualties;
- Medically treated pedestrian falls casualties are dominantly elderly women; important contributing factors in this regard appear to be sarcopenia and osteoporosis;
- Little is known about the locations of falls, but unevenness and slipperiness of walking space can be expected to contribute to the risk of falls in public space;
- Pedestrian falls happen more often in winter time, and on Fridays and the weekend;
- Additional information is needed about pedestrian fall casualties treated by medical general practitioners.

5.4.3.5. Security (public safety)

This paragraph broadly explores current (2014-2019) pedestrian security experiences in public space. While Pedestrian traffic crashes and falls are unintentional incidents[444], pedestrians security concerns events in which the pedestrian is harmed intentionally by other persons, i.e. crimes. The extent to which such crimes are committed can be expected to define individual pedestrians' suffering, fears and also societal costs from external threats while being outdoors on foot.

The sketches in this paragraph are based on findings from scoping review[445] of internet based sources in the Netherlands. This thesis does not take up injuries incurred from criminal acts. LIS (private accidents) and LMR/LBZ data on such injuries incurred in public space exist, but were not available to the author.

This thesis' quest focussed on finding general statistics and recent research on murder and manslaughter fatalities on public roads, pedestrian security victimhood, and security perceptions. Below these aspects are successively described. Each of the paragraphs deals with what source is used, how categories are defined, who the administrator of the data is, what the

[444] If there was a perpetrator, s/he did not have the intention to harm the pedestrian.
[445] The scoping review approach is explained in Section 4.2.1.

timeframe is and how valid and complete the data are considered to be for sketching pedestrian security.

a. Fatalities (murder and manslaughter)

Based on multiple national statistical sources CBS publishes statistics regarding murder and manslaughter victims in the Netherlands (ICD10 codes X85-Y09) on CBS Statline[446]. The figures include both residents and non-residents of the Netherlands, but do not specify whether or not the victim was a pedestrian or using some mode of transport.

In the period 1998-2002 on average 49 people per year were murdered or slain on public roads; of these 89% (49) were males. In the period 2014-2018 the numbers decreased by 34% to average 35 persons per year murdered or slain; of these 91% (32) of them were males (calculated from CBS Statline figures). The decrease in number of females murdered or slain is stronger than for males (cf. Table 5.27). The author assumes that most of them either moved about as pedestrians or sojourned in public space.

While in the period 1998-2002 24% of all murders occurred on public roads, this share grew to 27% in the period 2014-2018; this is mainly due to an increase in share of such deaths of males (from 30 to 36%); the share of females decreased slightly (from 9 to 8%). This increase in share means that murders and manslaughters has become a more public (and thereby frightening) affair.

Table 5.27. 5 year averages per year of number of murders and manslaughters in the Netherlands 1998-2018 (CBS Statline)

	1998-2002		2014-2018		Change %	
	All murders and manslaughters	On public roads	All murders and manslaughters	On public roads	All murders and manslaughters	On public roads
Males	163	***49***	90	***32***	-45	***-34***
Females	67	***6***	39	***3***	-41	***-48***
total	230	***55***	130	***35***	-44	***-36***

b. Pedestrian security victimhood

Developments in pedestrian security victimhood are considered to be an aspect of developments in criminality. With regard to assessment of criminality developments Van Noije (2019) in the recurring Social State of the Netherlands (Wennekers et al. [editors], 2019: 250) indicates:

"The answer to the question of how crime in the Netherlands develops depends on the time frame, the offense and the sources that are consulted. We look at the last decade (2008-2017) for four comprehensive crime groups. For the most complete picture possible, we compare two data sources: the victimization experienced by civilians as reported in the CBS Security Monitor[447], and police records. The disadvantage of one is the advantage of the other, which is why we present them together. For example, crime without direct civilian casualties is left out of the picture in victimization surveys, and police figures are sensitive to the extent to which

[446] https://opendata.cbs.nl/#/CBS/nl/dataset/81453NED/table, accessed 22-4-20

[447] This concerns the Veiligheidsmonitor survey. The most often used translation is Safety Monitor. As stated in the introduction of this paragraph this thesis explicitly discerns safety and security. The latter concerns intentional criminal threats from others. Therefore Veiligheidsmonitor is translated into Security Monitor, and not Safety Monitor.

crimes are discovered and how agents register them in the system (e.g. Van de Beld et al. 2019). The exact extent of crime cannot be read directly from victim surveys or police records, because much of the underworld is hidden, but the trends are informative, especially where they confirm each other." (translated from Van Noije, 2019:250, in: "Sociale staat van Nederland 2019", Wennekers et al. (editors), 2019).

This thesis follows that expertise. The results of the recurring Dutch national surveys of the Security Monitor (Dutch: Veiligheidsmonitor) offer insights into pedestrian security victimhood[448]. Through the successive monitor reports and CBS Statline website data regarding 2012-2017 and 2019 are available[449]. The survey in principle covers all crimes, and is not restricted to crimes that end op in formal police reports. On average the Security Monitors find that 42% of the crimes are reported to the police, 22% end up in police reports, and 2% in web reports. From 2012 to 2019 the percentage of reporting to the police decreased from 43.6 to 39.6%, the formal police reports from 25.0 to 17.7%, while reporting via the internet increased from 0.5 to 2.7%.

With regard to security victimhood the survey discerns three kinds of crimes, viz. violent crimes, property crimes, and cybercrime. Within these kinds several sub-kinds are discerned. With regard to pedestrian security not all of these sub-kinds of crimes are relevant, i.e. committed in public space. In Table 5.28 relevant sub-kinds of crimes, risks levels and estimations of numbers of victims are presented. The estimations are calculated from Security Monitor for the years 2012 and 2019 data on the percentages of victims per kind of crime, share of 'on street' as location of the crimes, and Statline population data on Dutch inhabitants age 15 and older.

Table 5.28 mentions three sub-kinds of violent crimes, viz. threats, physical abuse and sexual offences, two kinds of property crimes, viz. pickpocketing and robbery and 'other property crimes', and vandalism.
Threats concern threaten hitting, kicking, a gun, knife or anything else without being attacked or abused; *physical abuse* concerns actually attacking or assaulting by hitting or kicking, or using a gun, knife, piece of wood, scissors, or anything else against someone; *sexual offences* concern violence in which the perpetrator had sexual intentions; *pickpocketing and robbery* concerns (attempted) theft of, for example, a bag, wallet, telephone that was carried; 'other property crimes' concern thefts other than burglary, vehicle theft, theft from a vehicle, pickpocketing and robbery (e.g. clothes from a dressing room, tools from a boat, or items from the garden); vandalism concerns deliberate destruction or bringing damage to public or private property.

The table shows that between 2012 and 2019 exposure to all kinds of crimes, except sexual offences, decreased. The total number of crime victims decreased by 27%. What stands out is that violent crimes decreased less than average, whilst pickpocketing and robbery and vandalism decreased more than average. 'Sexual offences' throughout the years in the survey results show constant risk levels of 0.1% of affected inhabitants age 15 or older. When corrected for population developments the figures show a small increase; the calculated increase is caused

[448] In 2017 the survey is sent to about 380,000 persons age 15 or older; response is 150,000; response rate is 39.3%; in 2019 the call concerned 325,000 persons, with a response rate of 41.6%. Questions were asked about crimes experience in the year before the survey.
[449] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82464NED/table?ts=1587559323496, accessed 26-4-2020

by population growth figures only; validity margins of the survey figures are larger than the calculated increase and therefore not significant and probably not real.

Table 5.28. Pedestrian security victimhood - risk levels and estimation of number of victims per year in the Netherlands 2012-2019

	Total risk		**Pedestrian risk**: estimations regarding '**on street**' cases				
	Risk per 1000 aged 15+		Risk per 1000 aged 15+		Number of victims in NL *1000		
	2012	2019	2012	2019	2012	2019	% of change
All crimes	198	137	79	55	1,096	797	-27
Violent crimes (total)	26	20	12	9	160	132	-18
Threats	16	13	7	6	99	86	-13
Physical abuse	5	4	2	2	31	26	-15
Sexual offences	1	1	0.4	0.5	6	7	7
Pickpocketing and robbery	23	14	7	5	93	68	-27
Other property crimes (thefts)	38	24	5	3	71	50	-31
Vandalism	28	16	12	7	171	105	-39
All pedestrian crime victims	n.a.	n.a.	36	24	496	354	-28
Source: CBS Security Monitor (Veiligheidsmonitor) and population data							

c. Security perceptions

In Chapter 4 the importance of safety and security perception was highlighted. Security perceptions can influence decisions on whether or not to walk or sojourn in public space, and how to walk (routes, walking speed) and also whether or not walking or sojourning is stressful. The above mentioned Dutch Security Monitor survey includes questions in this regard. Relevant results regarding pedestrian security perceptions are summarised in Table 5.29.

Table 5.29. Perception of security of walking and sojourning in public space in the Netherlands 2012-2019

Statement	answer	% of respondents		# of Dutch inhabitants 15+		
		2012	2019	2012	2019	Change
I sometimes feel unsafe	Sometimes	36.6	31.8	5,063	4,624	-9
I often feel unsafe	Often	1.8	1.4	249	204	-18
There is agreat chance of becoming a victim of pickpocketing	(Very) great chance	3.9	2.6	540	378	-30
There is agreat chance of becoming a victim of robbery in the street	(Very) great chance	2.7	1.7	374	247	-34
There is agreat chance of becoming a victim of being assaulted in the street	(Very) great chance	2.4	1.9	332	276	-17
I sometimes feel unsafe in the neighbourhoud	Sometimes	18.0	14.4	2,490	2,094	-16
I often feel unsafe in the neighbourhood	Often	1.7	1.4	235	204	-13
In the evening it is unsafe in the neighbourhood	Often	3.7	2.9	512	422	-18
I often make a detour	Often	2.6	2.2	360	320	-11
I am afraid of becoming a victim	Often	3.4	2.3	470	334	-29
There is much criminality in the neighbourhood	Much criminality	9.8	8.6	1,356	1,251	-8
Criminality in the neighbourhood increased	Criminality increased	13.9	10.7	1,923	1,556	-19
Criminality in the neighbourhood decreased	Criminality decreased	3.9	4.5	540	654	21
Criminality in the neighbourhood is stable	Criminality is stable	50.9	52.4	7,041	7,620	8
Unsafe around entertainment venues	Sometimes/Often	25.4	19.9	3,514	2,894	-18
Unsafe where younsters hang out	Sometimes/Often	44.4	35.9	6,142	5,221	-15
Unsafe in the city centre	Sometimes/Often	18.9	14.9	2,615	2,167	-17
Unsafe in shopping areas/malls	Sometimes/Often	14.7	11.6	2,034	1,687	-17
Unsafe in public transport	Sometimes/Often	19.4	15.2	2,684	2,210	-18
Unsafe near the train station	Sometimes/Often	19.6	14.9	2,711	2,167	-20
Unrespectful behaviour on the street	Sometimes/Often	22.4	18.7	3,099	2,719	-12
Report mark safety in the neighbourhood	Average report mark	7.1	7.4	13,834	14,542	4
Source: CBS Security Monitor (Veiligheidsmonitor) and population data						

The average report mark for the security of the neighbourhood increased from 7.1 to 7.4 (4% increase). The number of Dutch inhabitants age 15 and older who sometimes feel unsafe decreased by 9%. In 2012 36.6% of the population sometimes felt unsafe. In 2019 the percentage was 31.8. In the same period they found themselves less at risk of being pickpocketed (from 3.9 to 2.6%), robbed (from 2.7 to 1.7%) or assaulted (from 2.4 to 1.9%). This is true for security perception regarding their neighbourhood as well. Whilst in 2012 18.0% of the respondents found themselves unsafe sometimes, and 1.8% often, in 2019 the percentages decreased to 14.4%, and 1.4%. The small majority of the respondents who judged that criminality was stable grew from 50.9% to 52.4%; this was mirrored by the decreasing percentage of respondents that felt that criminality had increased (from 13.9% to 10.7%) and the ones that felt that it decreased (from 3.9 to 4.5% of the respondents). With regard to unsafe locations youngsters' hangouts and entertainment venues appear to pose most threat (see Table 5.28).

According to Van Noije (2019:258) the measured and perceived security move in the same direction of more security. For some groups however there is a large gap between the two. Females and lower educated persons have a less positive perception of security and the institutions that should warrant their safety (e.g. the police and the justice system). The elderly do not particularly feel unsafe, but are critical towards law enforcement. At the same time these are the groups that themselves report the least number of victims.

d. Conclusions regarding pedestrian security

From the above explorations the following conclusions are drawn:

- The number and risk of pedestrian fatalities from murder and manslaughter that occur in public space are lower than the number and risks of fatalities from traffic accidents and from falls. In the period 1998-2002 the number of such fatalities was 55 (risk: 3.2 per million inhabitants) which dropped to 35 in 2014-2018 (2.1 per million inhabitants);
- One in three Dutch inhabitants aged 15 year or older sometimes feels unsafe and one in about 50 persons thinks that there is great chance of being assaulted in public space;
- Statistics from police reports on pedestrian security do not adequately cover pedestrian security victimhood;
- Although the risk of becoming a victim of violent and property crimes decreased substantially, these risks appear to be equal or higher than risks of pedestrian traffic crashes or falls;
- From the number of fatalities and the volume of security victimhood incidence and risks it appears that further research is needed to fill the white spot on injury casualties from crimes in public space amongst pedestrians.

5.4.4. Convenience, comfort and attractiveness

5.4.4.1. Introduction

In the above subsections the W+S system's performance regarding basic requirements for walking and sojourning were explored from the perspective of Design for All, i.e. with a focus on consequences for (potential) pedestrians who do not have a choice but to walk. The current subsection explores how the system performances with regard to convenience, comfort and

attractiveness with a focus on promoting people to walk more and more often, i.e. persuading (potential) pedestrians, i.e. non-captive pedestrians, who do have a choice.

Below first methodology, viz. scoping review, is concisely described in paragraph 5.4.4.2. In the then next paragraph 5.4.4.3. results of the exploration are sketched: a) irritations regarding walking and sojourning in public space, b) system performance regarding tempting people to walk for recreation and sports, and c) system performance regarding more and more often sojourning in public space.

5.4.4.2. Methodology

This thesis part's research targets on broadly capturing what is documented and entered up in statistics accounts about experiences and perceptions regarding convenience, comfort and attractiveness of walking and sojourning in public space. It concerns *scoping review*, i.e. internet searches, to capture what quantitative and qualitative information is publicly available on actual W+S irritations (convenience and comfort) and temptations in this regard. The search comprised searches on the internet on national statistics, surveys, and accounts of arrangements to deal with irritations and temptations regarding walking for recreations and sports. The search results are captured in crude dossier folders and summarised below.

5.4.4.3. Results

a. Irritations regarding walking and sojourning in public space

A limited search on the internet yielded 4 different lists of irritations in Dutch public space: Veiligheidsmonitor (CBS Statline 2012-2019[450]), Experiences in Amsterdam (2006)[451], Fixi (2019)[452] (see Table 5.30), and Pretwerk (2018)[453]. The latter finds that in general Dutch are satisfied with the quality of public space; no indication is available about walking conditions. On average they award 7.3 out of 10 points for satisfaction with the quality of public space in general, regardless of activity in public space (either walking or sojourning). The CBS Security monitor indicates that more than 30% of Dutch inhabitants aged 15 or older experience nuisance from traffic in general, of which 'driving too fast' scores highest: 22.2% of the respondents of the Security Monitor survey 2019 said to experience 'a lot of inconvenience', which was slightly more than in the 2012 survey, where it scored 21.8%. Second on the list comes physical nuisance (2019: 20.8%) of which 'dog excrements' scores highest, but here apparently over the years improvement is made. The Fixi list concerns aggregated complaints towards municipalities about public space deficiencies. Junk on the street, badly kept greenery, broken up streets and traffic nuisances were reported most often; the longer Amsterdam nuisances list contains percentages of reported irritations that are more or less similar to the national CBS and Fixi lists (see Table 5.30). From the scoping municipal websites it appears that (almost?) all municipalities have some kind of complaints reporting point and that most municipalities enforce rules against this nuisance and offer free plastic bags and special waste bins to put packed dog turds in.

[450] https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81924NED/table?fromstatweb, accessed 18-5-2020
[451] http://www.heinalbeda.nl/10Ergernissen.pdf, accessed 18-5-2020
[452] https://blog.decos.com/welke-ergernis-staat-in-jouw-gemeente-op-1, accessed 18-5-20
[453] https://pretwerk.nl/, accessed 18-5-20

Table 5.30. Irritations (% of 'a lot of nuisance') in public space in the Netherlands

Source	Security Monitor		Fixi	Amsterdam
Year	2012	2019	2018	2006
Physical nuisance				
Multiple kinds of nuisance	46.1	43.4	.	.
Junk on the street	6.8	7.5	21.1	14.5
Destroyed street furniture	3.3	2.6	.	.
Broken up street	.	.	12.4	5.6
Public greenery	.	.	20.8	
Grafiti	2.2	1.2	.	.
Dog excrements	19.6	15.5	.	6.0
One or more forms of physiscal degeneration	24.5	20.8	.	.
Social nuisance			.	
Drunk people in the street	3.1	2.6	.	.
Drug use or drug trade	3.7	3.9	.	.
Nuisance by neighbourhood inhabitants	5.1	5.1	.	.
Harrasment	1.7	1.2	.	.
Loitering youth	6.7	4.5	.	2.2
One or more forms of social nuisance	12.9	11.4	.	11.0
Traffic nuisance			.	.
Driving too fast	21.8	22.2	.	.
Parking problems	17.7	17.3	.	2.4
Agressive traffic behaviour	6.3	6.3	.	.
Bustle, busy city			.	3.1
One or more forms of traffic nuisance	32.3	32.2	11.2	3.3
Nuisance from catering facilities	1.6	1.5	.	.
Key: . No information available				

b. System performance re. tempting people to walk for recreation or sports

With regard to system performance of recreative walking Wandelnet's National Wandelmonitor (= National Recreational Walking Monitor, 2016) offers valuable data on characteristics of recreative walkers, profiles and motivations of recreative walkers, walking arrangements and tools, walking environments, appreciation and quality, and trends. The data and conclusions in this sub-paragraph are taken over from the Wandelmonitor (Wandelnet, 2016:11-31)[454]. Wandelnet is a key player in this domain; since 2019 many stakeholders regarding walking for recreation and sports are united in the Platform Ruimte voor Lopen (= Room for Walking).

Wandelnet draws some important conclusions regarding *characteristics of walkers, profiles and motivations of recreative walkers*:

- Walking is a popular activity for all ages: 63% of Dutch inhabitants sometimes walk for pleasure;
- A relatively small part of youngsters of 13-17 and 18-24 years of age walk for pleasure (respectively 41 and 46%);

[454] https://www.wandelnet.nl/wandelmonitor-2016, accessed 15-5-2020

- Of the elderly of 75 years and older 48% walk for pleasure. This is less than average. This is probably due to the fact that 39% of them has one or more mobility handicaps;
- Walking for sport is particularly popular amongst Dutch inhabitants aged 45-74. One in five of the Dutch inhabitants walks for sport;
- 52% of all walks are made by persons aged 45-74;
- On average walkers walk in groups of 2.2 persons. One third walks alone, and 46% walks together with one other person;
- The higher the social class, the larger the part of the population that walks;
- Most walks (24%, 104 million walks) are made by people who walk with others for social reasons; the second major group consists of people who enjoy life and being active in sports (23%, 100 million walks); the third largest group of walkers are modest people who appreciate sportive and cultural opportunities for recreation (15%, 68 million walks);
- The most important motives for recreative walking are 'wanting to be outdoors' (30%), 'leisure, reflection, empty one's head' (23%), 'physical activity' (13%), 'get away' (9%), and 'prevent ill health' (6%).

Most of the walkers find their way by themselves; they walk at random or are familiar with the area (85% of the walks). The other 15% uses one or more *arrangements or tools* for orientation of which:

- 20% get their information on the spot through information panels or marked routes;
- 20% uses node trail network markings;
- 16% uses information about Long Distance Trails;
- 13% uses (large scale) wandering maps;
- 9% walks in organised walks or walking events;
- 4% uses National Rail hiking trail information;
- 3% consults a walking trails guide;
- 3% is guided by a professional (e.g. walking coach);
- 8% uses other tools.

About 60% of the Dutch wanderers sometimes use the internet to find walking trails. One searches for a route through Google, and does not directly go to a dedicated webpage. Families less often than average search for walking trails on the internet. The most popular websites for finding information on walking and wandering trails are Google, ANWB, Tourist Offices, the National Forest Agency (Staatsbosbeheer), Route.nl, Eropuit and Wandelnet.nl.

With regard to *walking environments* Wandelnet finds that "*Dutch people walk everywhere. One time they go directly from home and / or take a walk in the neighbourhood, the next time they take the car and go for a walk in the woods. Or they take the train and take a nice city walk.*
The environment, the length of the route and the travel distance to the starting point of a route are the most important aspects when choosing a route. A good walking network, an attractive environment or interesting routes ensure that the hiker is willing to travel a little further for a walking activity." (Wandelnet, 2016:23).

Many people who walk for recreation like to walk in a forest (24%); about one fifth of the walks take place in one's neighbourhood (22%), and 21% of the walks passes through a city or village.

A rural or agrarian environment scores fourth with 18% of the walks for recreation. Other environments mentioned are a city park, along the waterfront, on the sea coast, heather or shifting sands, the dunes.

With regard to travel mode towards the starting point of the walking route 45% of the walking trips start from home, and another 26% walks to the start point. One in five walking trips is preceded by a car trip. People who go by car less often walk at random, but use information on the spot, large scale wandering maps or GPS. They go there relatively often by car to reconnoiter the area, enjoy nature or relax. Wanderers who start from home on foot relatively often want to keep in shape. Most walkers stay relative close to home and hike in their own municipality or province.

The most important factors regarding walking for recreation are:

- The surroundings (54%);
- Route length (51%);
- Travel distance (38%);
- Planning by oneself (27%);
- Accessibility (parking, station)(24%);
- Circulation walk (19%);
- A landmark or (scenic) attraction (16%);
- Dogs allowed (16%);
- Marked trails (walking without guidance) (13%);
- Facilities on the route (catering) (11%);
- Route type (adventurous, culture, nature, etc.) (10%).

Walkers younger than 55 more often like thematic routes (adventurous, culture, nature etc.), while 45+ walkers rather like accessibility of the starting point of the route, 55-75 walkers like circulation more. Almost 40% of the walkers who walk at least four times per week find it important that dogs are allowed on the trail.

c. System performance regarding sojourning in public space

Although clearly there are many examples of tempting sojourning arrangements, these are mostly place, time and group specific. A well-known source of sojourning arrangements is the Project for Public Places website[455] and organisation. The recent handbook by Kuitert & Maas (2017) excitingly describes the state of the art in this domain in the Netherlands. According to Stadslente (2017)[456], based on renown Place Making literature, there is a Top Ten regarding tempting sojourning arrangements. Main provisions or arrangements concern measures regarding 1) activities, 2) architecture, 3) accessibility, 4) comfort, 5) place diversity, 6) colour, 7) room for pedestrians, 8) clean, not broken, safe and cosy, 9) play elements, and 10) seating and hanging out facilities.

No documentation regarding the status quo of these conditions in general or developments therein is found. As owners and keepers of public space, local authorities (municipalities) are

[455] https://www.pps.org/, accessed 26-5-2020
[456] http://urbanspringtime.blogspot.com/2017/08/how-to-make-inviting-and-attractive.html

the key providers, managers and directors in this domain. Policy-wise the connection between walking, pedestrians and sojourning is not yet mainstream: walking and pedestrians on the one hand and sojourning on the other are generally considered separate domains, where walking and pedestrians belong to the traffic, health and sports domains, while sojourning is considered to be the domain of economy, tourism, land use and architects.

Lately (Spring 2020) the effects of the Corona Crisis make clear that restrictions of walking and sojourning arrangements (e.g. no street cafés, 1.5 meter society, a ban on gatherings and meetings) have enormous consequences. Instead of going to 'far away' places, people seek recreation and physical activity opportunities in their neighbourhoods, city centres, parks and watersides.

5.4.5. Conclusions regarding W+S system performance

This subsection draws conclusions about W+S system performance, i.e. aims to identify pedestrian behaviour ‘outcomes’ in the Netherlands, and what major changes therein can be expected. This subsection first presents conclusions drawn from the research on respectively a. mobility and sojourning in public space, b. pedestrian safety and security, and c. convenience, comfort and attractiveness. Subsequently the thesis' approach and research results are discussed.

a. Conclusions regarding mobility and sojourning in public space

This subsection described the different types of pedestrian activities and statistics to estimate the volumes of these activities. Contrary to other modes, pedestrian activities are poorly reported through the national travel surveys OVG, MON and OViN (Methorst et al., 2010, and this research). The most recent series of national travel surveys OViN, although improved compared with the earlier ones, cover only about 60% of all walking exposure in kilometres and number of trips, and less than half of the time spent in public space. Furthermore, the statistics concern national averages and do not inform about local conditions. Because of significant trend breaks in methodology in the travel surveys OVG, MON and OViN, valid conclusions on time series cannot be drawn. However, with help of dedicated alternative studies the picture could be completed. The following conclusions are drawn (summarised in Table 5.32):

- *Main mode walking for transport from A to B*

  This type of walking includes all walking for transport, excluding walking for recreation or fun. Based on the Dutch national travel surveys 2010 - 2017 (OViN) in terms of number of trips the share of walking in the modal split is 18%, if only main mode trips are counted. This percentage includes walking for recreation as main mode, which according to the definition of walking activities is 'circulation'.
- *Sub-mode walking to and from other modes*

  Walking is the most important mode in transport to and from other modes, not only for public transport, but also for car use. Although these sub-mode trips are predominantly very short, because of its large numbers the total distance covered this way is substantial. With a combination of research results of the Dutch Pedestrians Association VBV (Knippenbergh, 1992; Kavsek, 1998), Rietveld (2000), and the OViN travel survey sub-mode walking is estimated at about 1,000 sub-trips per person per year, totalling 1.7 billion travel kilometres.

- *Circulation - walking from A to A:*

  Circulation includes hiking, walking the dog and professional walking. An estimation is based on CVTO and additional estimates for walking the dog, professional walking, and walking by foreign visitors. With an estimated total distance covered on foot of 4.4 billion travel kilometres in 71 round trips per person per year from home, workplace or place of overnight stay, circulation appears to be the dominating pedestrian mobility.
- *Sojourning in public space*

  From the four types of pedestrian activities sojourning is least well documented, but expressed in exposure time this seems to be the most important pedestrians function. From the few available studies in this regard it can be estimated that children spend more time in public space playing than they do walking. A tentative exploration for the PQN project yielded that main sojourning activities in public space are child's play, outdoor working, visiting (large of local) events, waiting, hanging out, sight-seeing and just spending the day. In total inhabitants and visitors of the Netherlands spend about 90 hours per person per year sojourning in public space.

Transport poverty and social exclusion

People may like to but still avoid participation in all of the four above described walking activities. As yet little is known about avoided mobility leading to transport poverty or social exclusion. On the one hand 80% of the Dutch population experience walking as pleasant, meaning that about 20% do not. Avoiding walking can be considered a problem because people do not benefit from social, economic and health benefits, and on a societal level this can lead to significant economic disadvantages, loss and public expenditure, as well as negative social and health consequences. From Dutch case studies it appears that in some disadvantaged districts in large cities up to 20% of the population suffer from transport poverty. Among the factors regarding the risk of transport poverty are on the one hand demographics and culture, health and education, income and unemployment, and housing and facilities, and on the other hand perceived social safety and traffic safety, distances and barriers, legibility and comprehensibility, physical accessibility, affordability, and reliability.

Table 5.31. Summary of estimations of the 'production' of the four kinds of walking in the Netherlands 2010-2017

Facet of walking	*Trips pppy **	*Kilometres pppy **	*Total kilometres (x billion)*	*Exposure time (hours pppy *)*
Main mode walking for transport	150	106	2.5	27
Sub-mode walking	1,000	100	2.0	29
Circulation	71	275	4.4	69
Sojourning	n.a.	n.a.	n.a.	90
Total	1221	481	8.9	215
* pppy = per person per year				

b. Conclusions regarding pedestrian safety and security

Research into pedestrian safety and security led to three partial problems: 1) Pedestrian traffic crashes (collision with a moving vehicle), 2) Pedestrian falls, and 3) Pedestrian security (harm from criminal acts).

General conclusions on the safety of pedestrians are:

- In the period 1998-2002 in total on average 263 pedestrians per year died in public space because of safety and security incidents, corresponding with a risk of 16.4 persons per million inhabitants. In the period 2014-2018 the number of all pedestrian fatalities decreased to 166 pedestrians, corresponding with a risk of 9.8 fatalities per million inhabitants[457];
- With regard to pedestrians three kinds of safety risks are discerned, viz. traffic accidents (5,000 medically treated casualties in 2018, decrease 1998-2018 = 25%), falls in public space (68,000 medically treated casualties in 2018; increase 1998-2018 = 95%), and security incidents (number of medically treated in 2018 unknown, but very roughly estimated on 14,000 - 25,000[458]). Thus quantitatively falls are the most pregnant pedestrian safety issue;
- The total number of pedestrian fatalities decreased from 275 in 1998 to 169 in 2018 (39%). This decrease can be attributed mostly to a decrease in numbers of pedestrian traffic and security incident fatalities (respectively from on average 132 to 54 and from 55 to 35[459]); the number of fatalities from fall incidents decreased much less (on average from 88 to 80);
- With regard to moderate to serious injuries (MAIS2+) no data are available[460] on pedestrian security casualties. The risks of a pedestrian to suffer moderate to serious injury (excluding casualties from security issues) increased from 278 per million inhabitants in 1998-2002 to 335 in 2014-2018, while the car users' risk decreased from 196 in 1998-2002 to 126 per million inhabitants in 2014-2017;
- Total societal costs of pedestrian traffic accidents in the Netherlands are estimated on 0.8 billion Euro per year. Costs of falls are estimated on 3.0 billion Euros. In total pedestrian accident costs amount to 3.8 billion per year in 2014-2018 (224 Euros per inhabitant), which is 23% of the total travel accident costs per year (16.75 billion Euros for the country, 985 Euros per inhabitant per year). Because no data are available on casualties and damages of pedestrian security incidents, societal costs of pedestrian security could not be properly estimated, but can be expected to be substantial (possibly roughly comparable to one fifth to one third of the costs of fall accidents: 0.6 to 1.0 billion Euro, 35 to 60 Euros per inhabitant, more or less similar to the impacts of pedestrian traffic accidents).

c. Conclusions regarding W+S convenience, comfort and attractiveness

In order to persuade non-captive pedestrians to walk more and more often first of all irritations must be taken away and remedied. Clearly, most serious irritations come up if basic walking and sojourning requirements are not met. In such cases both captive and non-captive pedestrians are discouraged to walk and sojourn in public space. Captive pedestrians will have to walk notwithstanding, but non-captives simply choose other modes or activities. But if reachability, accessibility and safety do not pose serious problems, smaller dis-conveniences

[457] Compared to the number of fatalities from COVID-19 the number of fatalities amongst pedestrians is quite low. In the period of January to June 2020 more than 5,900 people died from this cause (almost 350 persons per million inhabitants).

[458] According to the Security Monitor 2018 the total number of victims in 2019 is ~ 800,000, including threats; the number of fatalities 35, which is between one third and one fifth of the number of fall fatalities; if ratio fatalities - casualties for security is similar, the total numbers would be in the range of 14,000 - 25,000.

[459] the numbers for security concern 5 year averages per year in respectively 1998-2002 and 2014-2018.

[460] The author cannot access LMR/DHZ data that specify the 4th digit code for location = road or street.

and discomforts can cause irritations that can make non-captives decide not to walk or sojourn in public space. Major irritations can be caused by physical, social, traffic or catering facilities related nuisances. Untidy streets, dog excrements and forms of physical degeneration, social nuisance, speeding traffic and parking problems are mentioned most. Remarkably the weather (wind, rain, sun) are not mentioned in most of the surveys on experiences in public space. In place-making literature however wind, rain and sun shielding are considered basic preconditions.

Tempting people to walk more and more often for recreation and sport depends on personal conditions and preferences. This is a speciality of Wandelnet and affiliated associations, but an increasing group of stakeholders (governmental organisations, public transport providers, health and sports agencies, the tourism sector, united in the Platform Ruimte voor Lopen [see also Chapter 6]) has become active in this domain. They provide targeted services, information and support with regard to attractive walking routes.

Tempting people to sojourn in public space concerns the domain of place making. The Project for Public Space and a variety of other sources offer guidance in this respect; local authorities are the key providers, managers and directors of preconditions for sojourning in public space. Policy-wise the connection between walking, pedestrians and sojourning is not yet mainstream.

5.5. Discussion on the research into the status quo of the W+S system

This thesis' section on the status quo of the W+S system comprises two main bodies of research, viz. research into Dutch W+S arrangements, and research into W+S system performance, in other words: 'what is there for walking, sojourning in public space, and pedestrians?' (= policy output) and 'How do pedestrians perform within the margins of what is offered to them?' (= outcome). Originally, conform Sauter & Tight's assessment model for measuring walking, the idea was to also study what impacts pedestrian performance. CROW-KPVV published an exploration into the effects of investing into walking (CROW-KPVV, 2018). As a follow-up publication is being prepared, the reader is recommended to visit the CROW website for further information.

With regard to data, research and information on W+S system performance it can be concluded that general statistics deficiently describe how pedestrians function in the system, and that these deliver an invalid, unreliable and fragmented picture of the pedestrians' reality. Much of the facts are hidden from first view and generally escape (policy) attention. By correcting for underreporting, using multiple sources and constructing indications by triangulation, this thesis produced 'best guess indications' for pedestrian behavioural outcomes. This was not an option for pedestrian security issues, and in many cases there was not enough information to work out what changes in behavioural outcomes can be expected. It appears that demographic trends, particularly ageing of the population and connected changes in behavioural patterns, will be most decisive for developments in walking mobility, safety and security. The current Corona Crisis (Spring 2020) however shows how tricky forecasting is.

Why do walking, sojourning and pedestrians seem insignificant in policy practices?
In this thesis many indications of the importance of walking, sojourning in public space and pedestrians were constructed and documented. When compared to this thesis' constructed

indications of aspects of the status quo, policy attention to walking, sojourning in public space and pedestrians is very low. The author thinks that this is occasioned by how policymakers, research programmers and researchers in general are informed on walking, sojourning in public space and pedestrians.

On the one hand strategic information about walking, sojourning and pedestrians can be obtained from generally available statistics and datasets. These are generally a by-product of registrations and surveys, whereby data collection on walking, sojourning and pedestrians is more or less out of focus[461] and liable to trend breaks and bias (e.g. mobility statistics, ED casualties data). Unlike cycling, walking, sojourning and pedestrian issues are not highlighted in general statistics. Although their numbers are growing (see Chapter 6), only few policymakers, research programmers or researchers bother to actively search for suitable statistics and datasets, but still most of them rely on his or her knowledge and experiences regarding the domain[462].

On the other hand, regarding operational information about walking, sojourning in public space and pedestrians the common image of reality is mainly formed by kinds of 'beep' systems, dependent on urgent calls and complaints concerning abuses, not informed by active monitoring and/or systematic surveys of conditions and behaviours. As these calls are relatively infrequent and public, the result is that walking and sojourning in public space do not seem to form much of a problem.

Validity of the available data

A closer look at the available data and statistics revealed that walking and pedestrian problems are unevenly distributed, that some groups of pedestrians are worse off than others. It appears that there are severe shortcomings in validity, coverage and reliability of data statistics and qualitative information.

In mobility data (OVG-MON-OViN) there are sudden level changes in time series coinciding with structural travel survey method changes, while others are absent (e.g. in mobility statistics distances covered are extremely constant on 0.6 km per person per day, whilst number of trips and time spend vary in level for survey type). Because of this validity/reliability issue, travel survey data cannot be used as exposure measure regarding accidents and casualties. In theory new forms of data collection, like mobile phone tracking data, can help to solve validity issues, but only if there is a problem owner who takes the initiative to collect and analyze the right data. Mobile phone tracking data are compiled anyway. For the time being, interest in policy-oriented pedestrian research is very low. Currently some larger municipalities (e.g. Rotterdam, Amsterdam , Breda) apply such data for supporting economic development of their city centers, but not (yet) for developing general pedestrian policies. If walking and sojourning are highlighted in survey results and figures are not as usual masked by assigning pre and post transport on foot to the main mode (= public transport or car travel) figures, a valid picture or mobility on foot will be created.

With regard to the LIS database validity issues regarding pedestrian casualty data relate to external causes: LIS reports on treatments in Emergency Departments (ED) of hospitals; there is a structural shift regarding relatively simple treatments towards treatment by general medical practitioners for insurance-financial reasons, causing a steady decrease in total numbers of treatments of pedestrian casualties, not corresponding with the numbers of casualties that were admitted to hospital (and included in the LMR/LBZ datasets).

With regard to traffic safety data an important cause of validity issues are common definitions of traffic, accidents and safety and security. A traffic accident is designed as an accident

[461] For example: the survey includes questions about general appreciation of public space, but not about walking and sojourning opportunities and facilities.

[462] The common attitude seems to be: everyone can walk, so how difficult can it be?

involving at least one moving vehicle. Thus a single bicycle accident is a traffic accident, while a single pedestrian accident is not (Methorst et al., 2017a). This does not do justice to pedestrians, their activities and risks, and leads to almost total neglect in main stream research (e.g. leaving walking out of the equation in mobility research and research programming).
A closer look at the datasets also reveals that there are groups that suffer serious mobility and safety and security problems, to the point that they do not enjoy the freedom of walking or worse: children, the elderly and people with limited mobility. Taking care of them is necessary, not self-evident and expensive.

Recreational walking receives more attention than utilitarian walking?
What stands out is that recreational walking (about 50% of time spent and total distance covered) is actively monitored, and supported by a relative large group of organisations volunteers, professionals and (recent) policy attention[463], and that 'ordinary' utilitarian walking misses such monitoring and support. Most walking and sojourning problems are related to utilitarian walking and captive walkers, the ones who do not really have a choice but to walk or suffer the consequences.

This thesis' figures on mobility, safety and security are not exact, but indicative
The absolute and relative figures on pedestrians accidents and casualties presented in this thesis must be considered rough indications. After all, the quality of data on traffic and fall accidents and casualties raises validity questions: do we measure what we are supposed to measure? Clearly there is underreporting of pedestrian traffic accidents and casualties. Location coding of pedestrian falls (whether or not the incident occurred in public space) of national accidental death statistics, data on treatments in emergency departments of hospitals, and admissions to hospitals is structurally incomplete. Additionally a shift in emergency treatments from emergency departments towards general practitioners is noticed. The corrections for the substantial underreporting can be considered questionable estimations. In fact VeiligheidNL, who supplied such data, does not support the correction estimations, as volumes of and mechanisms behind the miscoding and shift in treatment location are unclear.
Although the figures have relatively large margins of error, it is clear that the incidence of falls and security incidents is much more extensive than the incidence of pedestrian traffic accidents, and that there is good reason for a plea for more policy attention for both falls and security casualties. Further research is needed to better determine the volumes, risks and impacts of falls and security incidents in public space.

Convenience, comfort and attractiveness
The Dutch hikers platform Wandelnet organises monitoring of incidence and attractiveness of walking for recreation and sports. This mostly concerns non-captive walkers, i.e. people who are relatively fit and healthy, and able to select destinations within and beyond walking distance, and chose to walk, use other modes or do something else. This does not apply for utilitarian (i.e. walking out of necessity, not for pleasure, recreation or sports) and captive walkers (the one who do not have the luxury of choice). Although there are quite a lot of anecdotic accounts (in the media) of inconveniences, discomforts and lacks of attractiveness, no solid dedicated research on perceptions and experiences of utilitarian walking in the Netherlands is found. This thesis had to fall back on more general experiences and perceptions of being outdoors, for example captured in the Dutch Security Monitor. In order to better document the need for basic requirements, better support Design for All, and substantiate priority for equity policies such research is urgently needed.

[463] Cf. the composition of the national platform Ruimte voor Lopen, which is dominated by organisations that focus on the benefits of walking for recreation and sports (physical activity).

6. DEVISING W+S IMPROVEMENTS

6.1. Introduction

Chapter *3 A conceptual framework for walkability and sojourning policy development* established that the role of the institutional framework is to deliver change impulses towards the W+S system in order to manage and improve its functioning. Chapter 5 reported on the status quo of W+S conditions and what this means for pedestrians, walking and sojourning in public space. From this analysis we broadly know the status quo of W+S in the Netherlands and what issues call for attention. The current chapter describes how Dutch policy actors actually work on sustaining and improving pedestrian, walking and sojourning conditions, and what organisational changes potentially result in enhancements in this regard.

The current chapter reports on the results of research into the status quo of the W+S institutional framework's organisational activities. The leading research question is:

How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?

This research aims to give broad insight in the nature and extent of policy actors' activities regarding W+S, how the institutional framework as a whole performs, and what need and room there is for institutional improvements. The role of this insight in this thesis is to answer the central research question of what controls autorities can adjust to better support walking and sojourning in public space. This leads to the following research questions to be dealt with in this chapter:

1. *What kinds of factors and processes theoretically set the stage for bringing about improvement of W+S conditions?*
2. *What kinds of policy actors can be discerned regarding their function for sustaining and improving pedestrian, walking and sojourning conditions?*
3. *What kinds of settings outside the Dutch institutional framework can or do affect W+S policy activities in the Netherlands?*
4. *How is management of pedestrian and W+S conditions organised?*
5. *What controls can policy makers adjust to enhance W+S policy activities?*

In Section 6.2. Methodology the steps towards conclusions about the status quo and potential improvements of the W+S institutional framework are disclosed.

In Section 6.3. The Dutch W+S policy field the policy playing field is crudely conceptually modelled (cf. first research question) and described. The main stakeholders and their interrelations are identified (cf. second research question).

Section 6.4. The Dutch W+S policy context, assesses what stimuli from the environment affect or are likely to affect W+S policy activities (cf. first and third research questions).

Within the institutional framework and individual institutions conditions and services must be in place for detection of needs for change, for actively dealing with those changes and for dividing tasks amongst partners. In Section 6.5. Organising change towards better support of W+S pillars of change are identified and described (cf. first research question), assessing what major policy actors activities are engaged in with regard to these policy pillars (cf. fourth research question).

The chapter is concluded by Section 6.6. Conclusion and discussion: institutional improvement potentials (cf. fifth research question) and Section 6.7. Epilogue.

6.2. Methodology

6.2.1. Introduction

W+S has the makings of a complex policy subject: W+S as a topic is complex and there are (potentially) many actors, (potentially) many relations between them and (potentially) many aspects and approaches to be considered. Such complex matters cannot be appropriately covered in single interviews or discussion sessions. Therefore a layered and composite approach is taken, including checks on the accuracy of the research results.

In this subsection the research approach of this thesis regarding the status quo of the W+S institutional framework and potentials of the W+S institutional framework in the Netherlands is presented.

The methodological approach to assessing the status quo of the W+S institutional framework advances the approach developed for assessing the State of Safety Management for Rijkswaterstaat (reported in Methorst, 2013-2). The research includes four streams of research (see Overview in Table 6.1): a) exploring the playing field, b) research into the policy

environment, c) research into the status quo of the institutional framework, and d) identification of institutional controls and improvement potentials. For each of the streams relevant theory is explored and/or developed to answer the first research question.

Table 6.1 Overview of methodology applied for assessing the status quo of the W+S institutional framework

Objective	General approach	Methods applied
a. Assess W+S playing field (see 6.3)	Qualitative multi-method field analysis	1. Model the playing field: classification of policy actors (= theory) 2. Iterative listing of policy actors within the identified policy actors classes 3. Document policy actors' features into spreadsheet 4. Peer verification of the documentation and revision
b. Assess W+S policy environment (see 6.4)	Qualitative multi-method environment analysis	1. Start from previous W+S project results 2. Additional literature scan on contextual dimensions and factors 3. Condense factors into limited number of dimensions (= theory) 4. Document dimensions through dossier and internet search 5. Peer verification of the documentation and revision
c. Assess status quo of W+S institutional framework (see 6.5)	Qualitative multi-method actor analysis	1. Model the institutional framework (= theory) 2. Develop list of key questions for policy actors 3. Develop longlist and shortlist for policy actor interviews 4. Compile background dossiers of the policy actors on the shortlist 5. Carry out semi-open interviews 6. Organise interview results and background dossier content into policy actor dossiers 7. Peer review of the policy actor dossiers 8. Analysis of the policy actor dossiers on above key questions 9. Draft report, peer review and revision of report
d. Identification of institutional controls and improvement potentials (see 6.6.3)	Qualitative analysis	1. Abstraction of classes of institutional controls 2. Summarise status quo per control class 3. Estimate timeliness and urgency of the control class activities in relation to effectiveness, efficiency and fairness 4. Allotment activities to (groups of) policy actors

6.2.2. Exploring the W+S playing field

The first step regarding the research into the policy playing field was to advance the crude theoretical classification of policy actors in the W+S domain presented in the PQN Final Report (Methorst et al., 2010-3, Part A, p 39, Figure 7). In this original classification three kinds of policy actors were distinguished: *guiders*, *providers* and *users*. Based on discussions with various experts the terms were changed into respectively *strategists*, *facilitators* and *clients,* and the model was extended with an additional policy actor group *catalysts*. In Section 6.3.2 the playing field model is explained; policy actor profiles are sketched.

This advanced stakeholders classification was starting point for iterative listing of stakeholders in the W+S domain. The policy actor profiles connected to the playing field model were used to identify (groups of) candidates from various relevant contact lists[464] and mentions by respondents in the stakeholder interviews for this thesis' research (see 6.5). For each of the candidates basic organisational information was collected from the organisations' websites, yearly reports etc. Results were included, scored and grouped in a stakeholder analysis spreadsheet. The spreadsheet was audited by 2 experts[465]. Results of the playing field analysis are captured in Section 6.3.3.

6.2.3. Research into the Dutch W+S policy environment

To assess what stimuli from the environment (potentially) affect W+S policy activities three steps have been taken.

The first step concerned developing a structuring checklist of 'dimensions' for exploring actual and potential external influences on Dutch W+S policy making. This comprised orientation on external conditions and factors affecting W+S policy development. Starting point was the Pedestrian travel and sojourning system model, as presented in Chapter 3 (Figure 3.5) in which the main components of the system are highlighted. Additionally Google Scholar[466] was used to identify general influences from outside the W+S system; used search terms were 'external influences on policy makers and policy making', 'contextual factors influencing policy making' and 'mapping political context'. The search yielded several dozens of relevant publications, enabling derivation of a crude list of potentially relevant conditions and factors, i.e. the seven environmental dimensions (presented in Section 6.4.2.).
Next (step 2) concise dossiers with regard to each of the defined environmental dimensions' actual and potential influence on Dutch W+S policy making are compiled from results of the PQN, OECD and CROW W+S policy projects and policy actor interviews (see below), as well as from internet searches for underpinning publicly available dedicated statistics, data, surveys and documented evaluations.
With regard to the international context WALK21 conference documents, OECD/ITF documentation and personal contacts were used to identify relevant international organisations. For the description of the international context the organisations' websites and official documents were consulted. Staff from the Directorate General Mobility (DG MOVE) was interviewed to assess the influence of the European Commission on national and local walkability policy making.
For documenting the natural and man-made physical environmental context national statistical data from Statistics Netherlands and general land use and transportation planning documentation on walking and cycling policies was consulted[467].
The description of the social and cultural context is based on publications of the Dutch Social and Cultural Planning bureau (SCP) and documentation gathered regarding active W+S policy actors dossiers (see above).

[464] The author could make use of stakeholder lists compiled for the Pedestrians' Quality Needs project, the OECD/ITF project Pedestrians Safety, Urban Space and Health, the 2010 WALK21 conference invitations and the CROW working group 'Lopen Loont'.
[465] The experts were W. Vermeulen (former researcher Dutch Pedestrians Association) and D. van der Laan (publicist on walking).
[466] Google Scholar was used because, unlike Scopus or Web of Science, this search engine includes grey literature like plans and evaluation reports, particularly relevant for this research on policy making.
[467] Found through Google Scholar using 'walking and cycling policies in the Netherlands'

Main sources for the description of the transportation environmental dimension are the PQN Final Report, publications by the Dutch knowledge institute mobility (KiM) and the interviews of active W+S policy actors (see above).
For description of the economic context it is assumed that the International Monetary Fund (IMF), The Organisation for Economic and Social Development and Statistics Netherlands are the best sources for general economic figures. Their websites are searched on general statistics and evaluation relevant for W+S policy making.
The description of the technological context is based on results of the PQN, OECD/ITF, CROW projects, WALK21 conference reports and policy actor dossiers and searches on Dutch knowledge institutes regarding W+S related discourses and themes.
The description of the political context is based on analysis of national policy papers on land use, traffic and transport, road safety, and health (physical activity), and the policy actor dossiers (see above).
The dossiers were summarised into short draft texts for this thesis Section 6.4.3.

The final step was verification. In the period April to July 2017 expert colleagues were consulted to assess the draft texts; their suggestions and comments are used to finalise the descriptions of the contextual dimensions of W+S policy making. These finalised texts are included in this thesis.

With regard to reference the three kinds of sources (literature, policy actor interviews and websites) are respectively referred to as publication (Author, year), as (Numbered dossier, referring to the policy actor dossier numbers as presented in Appendix 7 Actor Analysis Tables, Table 2); websites are referred to in footnotes.

6.2.4. Research into the status quo of the institutional framework

Having broadly described the playing field and the policy environment, the status quo of the W+S institutional framework could be studied.

As far as known there was no dedicated research into the W+S institutional framework delivering comprehensive coverage of the policy domain, offering structure and guidance for broadly reviewing the status quo and potentials of the W+S institutional framework for improving walkability. There were however manuals and accounts of experiences with policy development regarding more specific W+S problems and processes in adjacent fields. This thesis chapter builds on theoretical considerations and research results acquired in the Pedestrians' Quality Needs project (Methorst et al., 2010), the OECD/ITF project Pedestrian Safety, Urban Space and Health (OECD/ITF, 2012) and the Rijkswaterstaat State of Safety Management project (Methorst, 2013). Two additional preparatory studies were carried out: a deduction study Policy Life Cycle and an explorative study into Policy Pillars (see Appendix 9, Section 1 and 2 for the full texts of these studies). Both studies were carried out to determine what questions to ask to W+S policy actors and how to position and rate their answers.

The study on policy lifecycles aimed to yield general theoretical insights in the role of awareness, commitment, competence and performance in policy making and implementation. The study into policy pillars aimed to yield a list of questions regarding the organisation of institutional frameworks for developing and implementing W+S policies and background information about W+S policy making processes. A summary of the latter study report is included in Section 6.5.2.; the (English translation of the final version of august 2015) list of

questions, based on the identified policy pillars and the Topical Questions-principle[468] (Spencer-Thomas, 2012) is included in Appendix 3.

The longlist of W+S policy actors roughly comprises 1,300 *potential* players. Of these about 450 are governmental policy agents, 17 government subsidized organisations (including 4 Non-Governmental client Organisations), 170 non-subsidized Non-Governmental Organisations (client representatives; including local organisations). There are also about 650 private (foundations and commercial enterprises) potential policy actors in the field.

Having developed a list of questions as a body of thought for semi-open interviews of active W+S policy actors, as well as a longlist of potential W+S policy actors (see Appendix 7, Table 1), a policy actor shortlist for interviews could be compiled.

The shortlist included the most active strategic and operational policy actors, user group organisations and (potential) catalysts organisations. The policy actors were selected if they explicitly targeted pedestrians and/or walking and sojourning in public space in their public information, i.e. website, reports, and/or leaflets. Of the potential 1,300 organisations, in total 35 policy actors[469] were approached to be interviewed. 33 organisations have responded, of which 19 were public (governmental) and 14 were private organisations.

The planned interviews included questions about organisations that actually or potentially affect W+S conditions. Thus policy actors who were not represented in the selection or in the used contact lists (see above under a. Exploring the W+S playing field) could ultimately be included in the Dutch W+S policy actors longlist.

In Table 6.2 the organisation type, origin and raison d'être are summarised; domain coverage is also indicated in the table.

As for raison d'être, governmental policy actors have a formal duty to take care of pedestrians[470]. The other organisations have a duty by their own choice. Client NGO's and the interviewed consultancy agency have formalised their raison d'être in their mission statements; for the other organisations the affiliation to W+S springs from their key tasks.
With regard to W+S there were seven key strategic policy sections in the national government. All of them were interviewed.
All 388 municipalities put effort in providing and sustaining pedestrian facilities[471], but only thirteen of them have been found to have developed explicit W+S policies[472]. These seven plus two less explicitly active municipalities have been interviewed.

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[468] According to Spencer-Thomas (2012) the topical questions are: Who is it about, What happened, When did it take place, Where did it take place, Why did it happen, and How did it happen. This so called 5W+H-principle was commonly used in journalism to check completeness of information. It is no longer seem to be mainstream, however, but it still forms a practical model for organising questions regarding policy preconditions and their substantiation.
[469] Including two smaller municipalities which were selected for a study on bicycle path use; see 6.5.3
[470] Governmental tasks are captured in legislation; local government owns public space, regulate its use. Central and regional government issues strategic policies and formal planning.
[471] Municipalities provide, maintain and manage use of the local road network and public spaces.
[472] From entries in specialist journals (Verkeerskunde, Verkeer in Beeld, Verkeersnet) and a Google search on 'gemeente – voetganger - plan' the following municipalities were found to have explicit pedestrian policies: Amsterdam, Delft, Den Haag, Eindhoven, Groningen, Heerhugowaard, Middelburg, Rotterdam, Tilburg, Utrecht, Waalwijk, Zwolle (state of affairs November 2017).

Table 6.2 Respondents type of organisation and domain coverage.

Type of organisation	Number	Specification	Domain coverage
Public organisations	**19**	**n.a.**	**Fair coverage of active actors**
Strategic policy maker	7	Ministerial or EC policy departments	+/- full coverage
Operational policy maker	9	Municipalities	Active actors well covered, non-active hardly covered
Law enforcement	1	Police and Public Prosecutor	Covered
Academic	1	University institute	One of the seven relevant university institutes
Professional education	1	School for applied science	One-third
Private organisations	**14**	**n.a.**	**Fair coverage of active actors**
Commercial	2	consultants, public transport companies	Very active actors covered, rest not covered
Knowledge institute	4	sectoral knowledge institutes for strategic advise	(Almost) fully covered
Client NGO	8	client support organisations	(Almost) fully covered

With regard to private organisations, key client organisations and knowledge institutes[473] were interviewed. Two commercial policy actors (one consultant[474] and one public transport (rail) enterprise) were interviewed, both of whom explicitly linked W+S to their raison d'être. Two other public transport enterprises (bus, tram) were approached, but could not be interviewed due to lack of time and priority on their side. These enterprises indicated that regional and local authorities are conceived to be responsible for the reachability and accessibility of public transport stops; W+S were taken to be outside their span of control. Consequently no direct insight in a relevant perspective from bus- and tram service providers, could be included. Indirectly insights were however acquired through input from local authorities.

In one to one-and-a-half hour semi-open interviews, the broad subject of W+S institutional activities is hard to cover within the given time space. To compensate lack of coverage general information about the interviewed policy actors was retrieved separately. Use could be made of road safety policy actor dossiers made in 2014 for an (internal) report for the Ministry of Infrastructure and the Environment (Methorst & Kuiken, 2014), based on analysis of information from the policy actor's websites and organisation documents (like annual reports, policy plans, vision documents, mission statements, histories of development of the organisation, PR leaflets). Whenever possible the original 2014 dossiers were up-dated.

The interviews with policy actors in the Netherlands were carried out between January 2015 and March 2016. In the period until August 2015, during which period 10 interviews were completed, the successive draft versions of the list of questions were used. The list of questions (see Appendix 3) was finalized in August 2015. In the final version only questions regarding raison d'être of the organisation were left out, as these answers to these questions could be

[473] Central governmental knowledge institutes established to advise central government (i.e. Mobility Knowledge Institute KiM), Central Planning Bureau CPB, Social and Cultural Planning Bureau SCP, and the Knowledge Institute Environment & Health (RIVM)) are not included as they do not directly advise the domain.

[474] The interviewee at the professional education organisation is also a very active town planning and transport consultant focussing on vulnerable road users; furthermore, there are a number of medium and large consultancy firms which when asked advise on walkability.

drawn from the organisations' websites. It was concluded that there was no reason to revisit the 10 interviewees from before August 2015.

At the end of each interview it was communicated that transcripts would be made and that the content, completed with general organisational information, would be summarized in dossiers. Because of the length of the interview transcripts (20+ pages) and because the dossiers[475] would offer uniformly structured[476] and more complete insight into the policy maker's typical features, it was decided to organise a check by respondents and informants. If the respondents indicated to be willing to react on the content, the dossiers were submitted to them. Twenty of them answered to be willing and able; ultimately 13 of them reacted to the dossiers. The dossiers that were not checked by the interviewees were audited by an expert[477]. Based on the comments the dossiers were finalised for analysis.

Research results described in the Sections 6.4.3 (policy environment) and 6.5.3 (organisation of change) of this thesis were compiled from the policy actor dossiers and conclusions from earlier studies. The dossier information was processed and analysed. Per (sub-) question of the list of questions results were listed, schematized and/or tabulated. The conclusions from earlier studies included referenced contributions by PQN and OECD working groups as well as other studies on the status quo of the W+S institutional framework, like a survey amongst governmental agencies about W+S policy plans.

The group of interviewed persons comprises the (most) actively engaged W+S policy actors. Passive W+S stakeholders, e.g. municipalities who are engaged solely in reaction to citizen's complaints are excluded. It was decided to exclude them because passive stakeholders generally cannot inform about their choices and experiences with regard to W+S policy making and implementation. This was confirmed by the responses from the two included smaller municipalities, the Association of Municipalities, the police and public transport companies. Consequently the interview results are not representative for the status quo in the W+S policy domain as a whole. In this regard only cautious conclusions are justified regarding the variety of strengths, weaknesses, opportunities and threats. Conclusions regarding volumes and shares based on the available data and information cannot be more than indicative. Details from the interview research will be presented in Section 6.3.3 on the policy context and 6.4.3 on W+S policy making in the Netherlands.

6.2.5. Identification of institutional controls and improvement potentials

This part of the research aims to answer the question of what controls policy makers can adjust to enhance W+S policy activities with regard to effectiveness, efficiency and fairness of interventions towards an better negotiation position of the pedestrian for policies to improve walking and sojourning in public space conditions. The identification and substantiation was effectuated in four steps: 1) abstraction into classes of institutional controls, 2) summary of the status quo per control class, 3) estimation of timeliness and urgency of the control class activities in relation to effectiveness, efficiency and fairness, and finally 4) allotment of discerned activities to (groups of) policy actors in the domain.

[475] The collected information, including the transcripts, data, captured webpages, is stored digitally and available for reference.
[476] structured to systematically to complete the questionnaire questions.
[477] Willem Vermeulen is an experienced researcher from the former Dutch Pedestrians Association.

The *abstraction into classes of institutional controls* is based on theoretical considerations, viz. this thesis' model on critical steps towards improvement as pictured in Figure 6.3. and evidence from policy actor interviews and explorative studies for organisation dossiers compiled for the research on the organisation regarding W+S policies and implementation (see Section 6.5). Five classes of institutional controls are discerned: fact-finding, competence building, direction and allotment, communication, and operational organisation (see Conclusions Subsection 6.6.1).

The source for the *summary of the status quo per control class* is abstracted from the W+S policy actors organisation dossiers (see Section 6.5), focussing on entries regarding the policy actors' activities regarding the discerned classes of institutional controls.

With regard to *timeliness and urgency of the control class activities* little solid evidence is available. Therefore estimations are made, based on theoretical considerations regarding urgency, effectiveness, efficiency and fairness of policy processes and measures. This thesis assumes that *urgency* is mainly determined by the volume and severity of system deficits or costs, and the volume of (social and/or financial) benefits. *Effectiveness* depends amongst others on position in the cascade of interventions [cf. Hendriks et al., 1998]), evidence regarding or plausibility of suitability of the measure, and its support base. *Efficiency* largely depends on policy maturity [cf. Hudson, 1999]. *Fairness* mainly relates to the degree to which vulnerable groups are considered, shielded and supported in policy development and implementation.

Allotment of the discerned activities is based on indications from the policy actors' organisation dossiers and their position in the policy field.

As the abducted improvement potentials should be considered as tentative and provisional recommendations ('the best we can do'), and certainly not as scientifically proven facts, the indications are not reported as conclusions, but as discussion items under Subsection 6.6.3.

6.3. The Dutch W+S playing field

6.3.1. Introduction

The first step in this research into the Dutch W+S institutional framework is to broadly picture the Dutch W+S playing field. This section investigates who the key actors in the field are, why they are actors and in general which powers they have and how they interrelate. The results of the analysis forms input for the next stage of the research: sketching the status quo of how the players formalise their roles with regard to management and improvement of walkability (see Section 6.4. Organising change towards better support of W+S).

In this thesis the W+S policy *playing field* is understood to comprise all organisations that have a stake or interest in W+S conditions and W+S behaviour, the so called stakeholders. Most stakeholders have some degree of influence on the system, either actively or passively. This thesis calls the ones that actively aim to influence the W+S system and/or W+S behaviour *policy actors*.

The following subsections first present the theoretical considerations regarding the W+S policy context. Next the methodology and sources used for the research are concisely described. The then following subsection highlights research results, i.e. who the players are, why they can be

considered players, what powers they have and how they interrelate. The section ends with conclusions, picturing the playing field, the policy actor's authorities and interrelations with regard to W+S policy making.

6.3.2. Theory

The questions to be answered are: who are the stakeholders with regard to walkability policy making, what are their roles, and what powers do they have to achieve walkability changes. A scan of literature on walkability policy literature and discussions within the PQN and OECD/ITF Pedestrian Safety, Urban Space and Health projects did not yield a systematic study into the walkability playing field. In order to organise a structured search into the W+S playing field, a theoretical model of the field was developed based on ideas presented in the PQN Final Report, Part A Introduction and theoretical framework (Methorst, 2010-3, p 39, fig. 7). Based on discussions with various experts the terms of the original model were changed and the model was extended. In the advanced model four kinds of actors are distinguished: the strategic policy makers ('strategists'), the tactical and operational policy makers and performers ('facilitators'), pedestrians, their representatives and economic stakeholders ('clients'), and active and concerned parties ('catalysts'). The four kinds of actors communicate and thereby try to influence each other's activities to suit their needs. The institutional strategists, W+S facilitators and clients interact within the W+S policy framework. Catalysts interact as outsiders, without formal stakes in the W+S system, and focus on stimulating the formally responsible leaders/strategists and W+S facilitators. They generally do not focus on operational change decisions, as these lie outside their span of control (see Figure 6.1).

With regard to interventions in principle *strategists* are in the lead. For many people national political leaders are the obvious strategists and leaders. In reality however such political leaders may not be motivated and active like that, although ultimately they are responsible and accountable for the activities and progress, or lack of them, in their playing field. Relief can be found if there is a W+S policy entrepreneur, being a highly motivated individual (or a small team) who does '*much to draw attention to policy problems,* [stimulate] *innovative solutions, build coalitions of supporters and secure legislative action'* (Mintrom & Norman, 2009:649). Such a policy entrepreneur can be a politician, decision maker or policy maker. S/he can also be an outsider, a dedicated citizen[478], researcher or a regional or local stakeholder, one who looks and acts beyond his normal span of control. Thus strategist-leaders can be self-appointed or (directly or indirectly) appointed by the other stakeholders. Such an authority cannot successfully implement policies without being recognised by and having interaction with the other stakeholders, the W+S facilitators like planners and managers of the physical environment, the police, property owners, and the *clients*, i.e. citizens, public space users, other affected persons.

The *W+S facilitators* include tactical and operational managers such as office directors, strategic planners and the sector managers who take care of the W+S conditions (transportation and public space managers, law enforcement agents). These are mostly professionals who in principle follow the political leader's lead. Depending on the leadership model, the followers have more or less freedom of interpretation and responsibilities. The followers are (sections within) the organisations that provide facilities, develop and implement the guiders' plans and

[478] An example of an influential dedicated citizen is Jane Jacobs (https://en.wikipedia.org/wiki/Jane_Jacobs).

take care of management and maintenance of the system. For this they get resources from or through the leadership organisation. In this thesis' definition they are part of the W+S system.

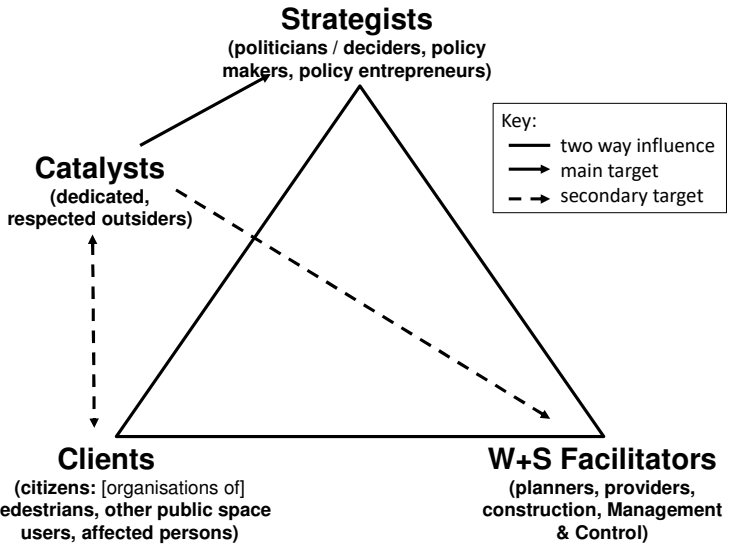

Figure 6.1. Policy actors and their relations within the policy process (generic level)

The *clients* of the system are the walkers, sojourners or their representatives, but also other stakeholders that have an interest in a functioning system, like shopkeepers, schools, offices, pubs, bicyclists, car drivers who parked their car, public transport companies, etc. As citizens they are the claimant, payer, receiver and consumer of W+S facilities. Walkers and sojourners as clients are mostly anonymous (everyone is a pedestrian, hardly anyone feels pedestrian), and in practise do not truly have a voice or bargaining power for claiming W+S facilities. The walkers' and sojourners' interests are represented by dedicated organisations and also other stakeholders who have an interest in a functional system, including the facilitators and strategists themselves.

A c*atalyst* is an organisation or person who is dedicated and knowing about improving W+S conditions, as well as respected in society and the institutional framework. S/he can function as a catalyst regarding public agenda setting, shaking up, sensitizing and mobilizing policy actors and setting the machine in motion for the improvement of W+S conditions. A catalyst is generally not part of the institutional framework establishment and can for example be a known researcher, TV personality, actor, famous medical doctor or knowledge institute etc. The catalyst generally addresses the general public for support and aims to mobilize institutional leadership and practitioners through publicity.

Strategists, facilitators and clients keep up two-way relations. In the model this is represented by black lines. In practise the interrelations between strategists and facilitators and between clients and facilitators are probably somewhat more intensive than interrelations between clients and strategists. Strategists and facilitators generally work together intensively on developing strategic and tactical plans. Facilitators generally communicate and react to reports and complaints from clients about public space conditions and behaviours in public space.

Sometimes clients call in for help from strategist politicians to solve specific problems; strategists sometimes consult clients (or their representatives) to get a feel of needs or acquire support for their policies.
Catalysts generally do not have a formal responsibility with regard to walking, walkability or walkers. They can however commit themselves to solving specific issues and generally focus their attention on the strategist as main responsible agent. Many times they also keep up relations with clients, who can inform, support or even mandate them to represent them and stand up for them towards the strategists and/or facilitators who are believed to be able to solve the indicated issues. In the model these relations are pictured by blue arrows.

6.3.3. Results

This subsection presents the results of actor analysis based on theoretical insights and publicly available sources. This analysis produced insight in which persons or organisations were potential actors in the W+S policy field, some of the official motives and basic relational patterns.

Who are the actors?
Based on participation entries in W+S related projects and conferences, statements of interviewees, available accounts of W+S policy projects as well as information from pedestrian advocates a list of (potential) actors in the domain is built. The list comprises 58 individual organisations and 32 groups of organisations, which in some cases overlap the individual organisations. The author estimated that the field roughly comprises 1,300 potential policy actors. About 950 of them can be considered (potential) key actors, the ones that can make a difference because of their competences (leadership, knowledge & professional skills, legal authority and/or resources). This list comprises 43 individual organisations that have (at least some) indication to be key player[479]; it also comprises 11 collectives (traffic and town planning experts, road authorities, municipal councils, the media, consultation boards, health boards, chambers of commerce and shop keepers, and trialogues of police, public prosecutor and local authorities). Appendix 7, Table 1 lists the identified (potential) W+S policy actors.

Strategists in principle comprise central governmental sections, European Commission Directories-General and policy entrepreneurs. The Ministry of Infrastructure and Environment and the European Commission do not have explicit walkability policies, apart from the issue being decentralised; the Ministry of Welfare, Health and Sports promotes walking for health reasons; the Ministry of Interior implicitly promotes walkability as a bringer of liveability in cities. In the Netherlands no dedicated W+S policy entrepreneur[480] could be identified; since 2010 there are however some politicians having special attention for walking and walkability. In Amsterdam municipality councillor Fjodor Molenaar presented his plan 'the pedestrian Emperor, the cyclist King' (Molenaar, 2009); in Utrecht alderwoman Traffic & mobility, sustainability and environment Lot van Hooijdonk initiated the first municipal Pedestrian Plan in current times[481].

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[479] Most of these key players have been interviewed: see Section 6.5.
[480] A policy entrepreneur is a leading actor in the policy-making process. '*They* [the policy actors] *work hard at developing close ties with people through which they can realise their policy goals and they seek to develop convincing arguments for selling their policy ideas.*' … '*The presence and actions of policy entrepreneurs* […] *can help explain* […] *innovation and policy innovation diffusion.*' (Mintrom, 1997;765). The researcher/architect Jan Gehl in Denmark and the politicians Kevin Livingstone in London and Enrique Peñalosa in Bogota are famous examples.
[481] In the late 1980s the municipality of Zwijndrecht issued the first Pedestrian Plan in the Netherlands.

Clients comprise associations and/or lobby organisations for specific pedestrians groups, more general road and public space user group interests, and economic interest groups. There were two dedicated pedestrian lobby groups: MenS (English: STREETSforALL) and Wandelnet. MenS covers utilitarian walking as a (small) networking organisation; Wandelnet covers recreational walking or wandering. The organisations complement each other. Additionally there are a number of client lobby and service organisations dealing with walkers and walkability as a spin-off from work for handicapped persons, traffic safety, mobility in general and the elderly.

Facilitators include local road and public space authorities (in 2017 388 municipalities, 3 metropole regions), the association of municipalities, advisory boards (several dozens), law enforcement organisations (Public Prosecutor, the Police, Trialogue of police-public prosecutor-local authorities), housing corporations (about 40), public transport corporations (16), consultants and specialists (60-80), engineering or road construction companies (about 250[482]).

Catalysts are mostly individual persons but can be (sub-)organisations as well. They can arise from knowledge institutes[483] (16), but can also be independent experts or come from parallel interests, like health insurance corporations, retail and real estate entrepreneurs or the media (newspapers, radio, television, web-blogs).

Why are they players?
Organisations are (potential) players if they have a formal or chosen[484] obligation to be active in the field. From a rough internet scan the following kinds of motives have been found: legal tasks, a mission to serve the client's needs, commercial interests, parallel interests[485], research interests, being educator of professionals in the (wider) field, spatial, social or health policy support, news value of walking and walkability issues. At this stage of the research (potential) players had not been asked why they are players. In Section 6.5. motives displayed in interviews of (selected) key players are discussed.

What powers do the players have and how do they (theoretically) interrelate?
In principle central governmental agencies, so called policy entrepreneurs and municipal councils can be in the lead. In theory they have the power to prepare and promote new strategies, but in practise only a few[486] exert such powers.
Local authorities, such as owners and managers of public space, have significant executive powers to facilitate walkers and improve walkability within their jurisdiction. Law enforcement agents have powers to manage behaviour. Public transport can deliver extended range to walkability.

[482] Source: Economisch Instituut voor de Bouw (2012) Trends en ontwikkelingen in de wegenbouw tot 2017.
[483] Knowledge institutes were initially classified under Facilitators, but moved to the Catalysts because they do not have direct influence on policy making and implementation.
[484] expressed in their mission statements or project programming etcetera.
[485] For example Health Boards and insurance companies promoting walking for health reasons and policy entrepreneurs who see walking as a way to manifest themselves.
[486] Ineke Spapé (NHTV/SOAB) summarised leadership positions as follows: "Central government does not take the risk; municipalities do not feel the need; CROW and NHTV prudently take initiatives; client organisations do not have the power …"

Most other organisations can have a lobby or advisory role. They can exert power by using data, information, knowledge and compelling arguments to persuade strategists and facilitators to improve conditions for walkers.
Catalysts can make waves and boost awareness, policy making and implementation by governmental agencies.
In Section 6.5 more detailed information is given about the policy actors' powers and their interrelations.

6.3.4. Conclusions

A rough inventory based on theoretical assumptions and simple internet searches yields that there potentially are many players in the W+S policy field. Strategists do not seem to be strongly represented; there are however many (potential) facilitators, clients and catalysts.
Such a rough inventory however does not provide clear and detailed insight in how active and effective players are in the field, why they are active and what interrelations there in fact are between the players. As such the results can be a starting point for a more detailed study of key player's motives, competences, resources and activities. In Section 6.5. a more in depth approach based on contacts with key players is presented.

6.4. The Dutch W+S policy environment

6.4.1. Introduction

This subsection broadly explores what kinds of settings outside the Dutch W+S institutional framework can affect W+S policy activities in the Netherlands. This knowledge is needed:

a. So that readers can position Dutch W+S policies and policy making[487], and compare these conditions with W+S policy settings elsewhere;
b. So that possible explanations can be found for current conditions in Dutch W+S policy making;
c. So that possible opportunities from and counterforces in outside worlds can be identified and strategies can be suggested.

In Oxford Dictionary the term 'context' is defined as *'the circumstances that form the setting for an event, statement, or idea'*, such as W+S policy making. Oxford Dictionaries give the enlightening example of the function of 'context' in terms of which it can be fully understood: *'the proposals need to be considered in the context of new European directives'*[488]. Likewise current Dutch W+S policies and developments therein, can only be fully understood by knowing about the status quo of walking and sojourning in the country and the historical, social, political, territorial, physical, climatic, financial etc. contexts of W+S policy making.

Environment is defined as the totality of surrounding conditions, influences or forces, by which entities (like the institutional framework, the policy actors, the W+S system) *can be* influenced and modified in their growth and development[489]. Thus the concept of environment is similar

[487] Organisational set-up pillars ('policy pillars'), interrelations and adopted policies are discussed in Section 6.4. Organising change towards better support of W+S conditions.
[488] https://en.oxforddictionaries.com/definition/context, accessed 22-11-2016
[489] Following Webster's Dictionary, accessed in 2012; the website is removed from the internet.

to context, but not exactly the same. On the one hand the concept of environment is a wider than context because it also includes factors that do not (yet) influence the alluded entities; on the other hand it is more narrow as it does not naturally cover abstract conditions like historical or legal contexts.

In order to be able to assess potentials for W+S policy making, in this thesis the author chooses to explore the policy *environment,* including abstract conditions like historical and legal context and insomuch it potentially supports W+S policy making.

In the following subsections first theoretical considerations about the W+S policy context are presented. Next the methodology and sources used for the research are concisely described. In the then following subsection research results are highlighted, i.e. what the distinctive features of the Dutch W+S context are. The section ends with conclusions, picturing distinctive opportunities, obstacles and limitations with regard to W+S policy making in the Netherlands.

6.4.2. Theory

Strategies, policies and concrete interventions are conceived within a policy context. The question to be answered in this section of the thesis is what external factors (potentially) affect W+S policy making in the Netherlands, and (potentially) how these factors affect policy making. As no studies about the Dutch W+S policy context were found, system theory, the NOA model, Country Reports on W+S and road safety policies[490] and literature on (general) policy determinants and stakeholder mapping were used to abduce what kinds of factors may influence W+S policy making, and how the context can be typified.

This thesis' Chapter 3 introduced Systems Theory. From the model of a system with its environment (see Figure 3.3) it follows that the environment has two main functions: as sender of change impulses towards and as receiver of change impulses. The first refers to *input* and latter to *output, outcome and impact* of the activity of the W+S institutional framework and W+S systems.

With regard to Dutch W+S policy making this thesis laid down that the environment of W+S policies comprises both environmental conditions within the Netherlands outside the W+S domain and environmental conditions outside the Netherlands. Conditions within the country can be seen as policy pliant, whilst conditions outside the country are mostly out of reach, to be taken up as facts to make use of or allow for.

Psychologists have concluded that (policy) decisions are primarily based on perceptions. Such perceptions include knowledge, insights, experiences, awareness and emotions and are imbedded in culture (Fisher, 1997). If decision makers are not aware of an issue or if they see it as non-significant, non-urgent and unrewarding, they will not decide to take action (O'Connell, 2002). It is also important to note that *"…policy making is essentially a social process, involving communication and negotiation between people in the context of wider change. (…) These interactions are negotiated and constrained by other decision makers, reflecting wider societal features that shape the environment…*" (Stevenson et al., 2008:1-2). According to Feitelson and Salomon (2004) in these negotiations perception of problems (crisis), experts and technical feasibility of solutions, perceived distribution of benefits and

[490] See for example the Country Reports for the PQN, OECD/ITF Road Safety and Pedestrians projects (http://www.walkeurope.eu/background_documents/default.asp) and the EU DaCoTa project (http://www.dacota-project.eu/) (accessed 28-11-2016).

costs, industry and non-business interests, discourses, social feasibility, decision making procedures, and political feasibility together play a role in adopting innovations, i.e. policy making and implementation.

Steg & Vlek's NOA Model (Boersema, 2009), also discussed in Chapter 3 and applied in Chapter 4 and 5 (see Figure 3.7), offers further insight in major drives behind policy making behaviour. In this model societal developments are taken up as determinants for Needs, Opportunities and Abilities. As all external factors that play a role in public policy making can be considered societal factors, 'societal development' can be widened to policy making context, including external hardware, software and orgware in the environment. Hence affected policy maker's Needs and Abilities together determine his *opportunity search*, affected Needs and Opportunities together determine his *motivation to perform* and affected Opportunities and Abilities together determine his *behavioural control*.

The W+S policy context has many dimensions. Search in Google Scholar using the terms: 'external influences on policy agents or authorities', 'mapping political context', 'contextual factors influencing policy making' yielded some dozens of publications featuring a variety of environmental factors. From the Pedestrian travel & sojourn system model (see Figure 3.5) and the found literature eight dimensions were identified. First of all there is the topic dimension of pedestrian system performance, featuring the presence, weakness or absence of signals about pedestrian movement, sojourning, safety, and health, economic, social and political impacts. This W+S content dimension has already been discussed in Chapter 5. Secondly, the wider environment features the status quo regarding the following seven (interacting) dimensions, their history and developments therein[491]:

a. *The international* context concerns outlooks and potency of policy actors regarding W+S policy making in general. Such outlooks and powers can open eyes regarding general W+S issues and solutions, amplify their urgency and foster policy making (i.e. innovations);
b. *The physical* context concerns the natural and built environments and facilities for mobility and sojourning on foot. It preconditions the convenience, comfort and safety of walking and sojourning options and behaviour, i.e. what W+S issues might or might not arise;
c. *The transportation* context concerns mobility facilities and options. It determines the relative connectivity, efficiency, safety and attractiveness of walking within the transport system and thus positioning walking as a transportation (sub-) mode and setting the stage for walkers' satisfaction, transportation poverty and possibly social exclusion (Martens, 2018);
d. *The social and cultural* context concerns mobility and sojourning purposes and activities, felt needs and perceived opportunities for behavioural changes, and influences by opinion makers, e.g. the media and the social media. These perceptions set the stage for social feasibility of W+S interventions;
e. *The economic* context concerns affordability of competing behaviours and measures to sustain and improve public facilities to support such behaviours. Affordability and relative (perceived) benefits and costs of W+S interventions to a large degree determine technical feasibility of W+S interventions;
f. *The technological* context refers to technology present and state-of-the-art topical knowledge and the status quo regarding W+S support measures and intervention programs.

[491] Taking the physical and transportation dimensions for granted, Cummings & Doh (2000, p. 83) discerned economic, political, social and technological environments. These dimensions are also covered in the Pizza Model (see Figure 3.8).

It defines what is technically possible to solve W+S issues; together with perceived affordability this determines technical feasibility of specific interventions;

g. *The political* context concerns international and national attitudes, legislation, rules and policies affecting W+S conditions, as well as financing, political power arrangements, general priorities and attitudes towards W+S. If an intervention is perceived to be technically feasible, political feasibility determines the adoption of such an innovation, provided it is also socially feasible (Feitelson & Salomon, 2004).

6.4.3. Results

This subsection presents the results of research on the seven contextual dimensions regarding W+S policy making, identified in 6.2.2. This information is relevant for positioning the various contextual factors regarding their influence on W+S policy making, i.e. what their reach is, how the contextual influences can be qualified and how the influences can be exploited to improve W+S conditions. The seven dimensions will be dealt with below. Each of them is defined and subsequently broken down in relevant aspects. The paragraphs that elaborate the dimensions are closed by a concise conclusion regarding opportunities or limitations for W+S policy development.

This section falls back on three kinds of sources: literature, policy actor interviews and websites. The first are referred to as publication (Author, year); the second as numbered dossier referring to the policy actor dossier numbers as presented in Appendix 7 Actor Analysis Tables, Table 2; websites are referred to in footnotes.

a. International context

International preconditions that affect or could affect W+S policy making are the walking and walkability related outlooks of relevant stakeholders: authoritative global public interest organisations, the European Commission, various European specialists organisations, pedestrian lobby organisations. Besides this thesis gives an overview of good examples around the world from international champions regarding W+S policy making. These aspects are considered below.

Global public interest organisations

From their involvement in the OECD/ITF project Pedestrian Safety, Urban Space and Health (OECD/ITF, 2012 and the preparatory working group contributions) it is known that there are several public interest organisations on the global level targeting national W+S policy makers. These organisations are the United Nations (UN), the Worlds Health Organisation (WHO), the World Bank, Organisation of Economic Co-operation and Development (OECD), and the FIA related Commission for Global Road Safety. These organisations co-operate on promoting road safety and general improvements of citizen's Quality of Life. The UN initiated the Convention on the Rights of Persons With Disabilities (2006)[492], an international agreement which is ratified by many countries, including the Netherlands. Together with the WHO the UN initiated the campaigns Decade of Road Safety[493], the Global Road Safety week[494] and various manuals

[492] UN Convention on the Rights of Persons with Disabilities (http://www.un.org/disabilities/convention/conventionfull.shtml)
[493] http://www.who.int/roadsafety/decade_of_action/plan/global_plan_decade.pdf
[494] http://www.who.int/roadsafety/week/2017/en/

and benchmarking publications[495]. The World Bank and FIA also actively promote road safety, including pedestrian safety[496]. WHO promotes active mobility and developed several supporting tools for national policies, such as the Pan-European programme on transport, health and environment (THE PEP)[497] and the Health Economic Assessment Tools for cycling and walking (HEAT)[498].

In general these organisations are authorities in their fields and their work is highly rated at national levels. Although the organisations do not have power to enforce their guidance, much of it is ratified and converted into national legislation (e.g. the above Convention) or included in national procedures (e.g. ICD rating of accident casualties).

Other relevant world-wide conventions are the Vienna Convention on Road Traffic and Convention on Road Signs and Signals[499]. Both agreements have been ratified and converted into national legislation by most (European) countries including the Netherlands.

The European Commission

The European Commission (EC) deals with economic affairs, mobility and transport, safety and health[500]. Leading principles for EC policies are 1) that the commission only develops regulations concerning matters agreed in the Treaty on the European Union and 2) the so called subsidiarity principle. The latter implies that the Commission does not regulate or execute what can be settled by the member states themselves. In many of the member states the position of the European Commission is politically under debate. Consequently the Commission is very strict in following the agreed principles. With regard to W+S policies this means that the Commission is free to inform member states and develop and implement advisory and promotional arrangements, provided that regulation is a subject included in the Treaty.

Safety, Health and Sustainable Urban Mobility are conceived shared competences. The Directorate General Mobility (DG MOVE) takes up W+S as integral part of mobility, but does not deal with it as a distinct mode. The common definition of mobility is applied; sojourning is not included. Important initiatives are the Action Plan for Sustainable Urban Mobility[501] and the Do the Right Mix campaign, the European Mobility Week being a core element. Multi-modality, including walking and cycling is promoted. In close co-operation with the member states the EC sets Road Safety Targets. Directorate General Health and Food Safety (DG SANTé) deals with Health aspects (e.g. promotion of active modes). Touristic walking is supported by the Directorate Internal Market, Industry, Entrepreneurship and SMEs (DG GROW) with a modest budget. DG GROW is responsible for type approval of motor vehicles. The car market is a global market. Technical regulations are typically defined in Geneva. With regard to W+S, some protection ('pedestrian friendly car-fronts') is regulated. Car owners are informed about the safety of cars through EuroNcap.

Another important function of the Commission is supporting knowledge building and dissemination for application in policy development in member states. The EC commissions and supports research through frameworks like Horizon 2020, the European Science Federation

[495] examples are: http://www.who.int/topics/injuries_traffic/en/ and http://apps.who.int/iris/bitstream/10665/79753/1/9789241505352_eng.pdf

[496] http://pubdocs.worldbank.org/en/806641469199679000/GRSF-Leveraging-Global-Road-Safety-Successes-07-22-2016.pdf and http://www.fia.com/fia-action-road-safety

[497] https://www.unece.org/thepep/en/welcome.html and https://www.unece.org/trans/theme_pep.html

[498] http://www.heatwalkingcycling.org/

[499] https://www.unece.org/fileadmin/DAM/trans/conventn/crt1968e.pdf and https://www.unece.org/fileadmin/DAM/trans/conventn/Conv_road_signs_2006v_EN.pdf

[500] This text is based on interviews with EC DG MOVE officers, web search and official documents, summarised in a Policy Actor dossier on the DG MOVE.

[501] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52009IP0307&from=EN

and COST. Furthermore the EC keeps up a number of websites, such as ELTIS (website for mobility planning) and the European Road Safety Observatory (ERSO). There are relatively large budgets (10 million Euro per year) for Horizon 2020 research projects. Exemplary EC research projects were e.g. WALCYNG, DaCoTa, LIVE, PROMISING, PENDANT, CIVITAS, SARTRE, VRUITS, INDEV; these projects take a wider scope than W+S; the COST Action 358 directly focussed on Pedestrians' Quality Needs as input for W+S policy development on the national level.
For policy development, the EC welcomes input from stakeholders, including NGO's. Up until now (2020) pedestrians are not represented.

European specialist organisations
Other organisations are the International Transport Forum (ITF, formerly the European Conference of Ministers of Transport, now also including some countries from outside Europe), the European Transport Safety Council (ETSC) and a number of knowledge networks like POLIS and CIVITAS. All of these adhere to evidence based solutions and aim to support the European Commission and European countries on dealing with the domains of transport, road safety, urbanism and sustainable mobility. All devote attention to walking and sojourning in public space through their publications by international experts.

International lobby groups
A number of relevant international lobby groups exist. There are three interrelated W+S lobby groups: the Federation of European Pedestrian Associations (FEPA), the globally working International Federation of Pedestrians (IFP) and WALK21. The latter focusses on networking, dissemination of knowledge and organises the yearly WALK21 conference. It published the International Charter for Walking[502]; all three groups support and promote signing of this Charter. This Charter is a modern follow up on the European Charter of Pedestrians' Rights, adopted by the European Parliament in 1988[503].
Lobbies of adjacent domains can affect W+S policy making in the Netherlands, like the European Cyclist Federation, environmental groups, urbanism groups and the UITP (Public Transport Association). However, competitive lobby groups such as the car industry in most cases outweigh pedestrian lobby in persuasion power (Kreis, 2016; EC-DG MOVE interview).

International champions regarding W+S policy making
With respect to cycling the Netherlands is often seen as a model country (i.e. Zegeer, 1994; Rietveld et al., 2004), but for walking such specific mentions are rare. From the PQN project (Country Reports and experiences in the PQN and OECD/ITF projects) it appears that in at least Norway, Switzerland, Spain and the United Kingdom and even more recently, Austria and Wales, the issue is explicitly on the political and research agenda, nationally and often also locally, whilst this is not eminent in the Netherlands (see 6.5.3). Norway, Wales and Austria issued national pedestrian plans. The Swiss Country Report (Sauter et al., 2010) pictures a State-of-the Art in walking policy, communication and research. Relative high priority to walking is given in the Switzerland. Spain has put much effort in contributing to both the PQN and OECD/ITF[504]. The United Kingdom is the home of the NGO and conference organiser on walking WALK21, and the UK Department for Transport has delivered many publications on

[502] http://www.walk21.com/charter
[503] https://www.diba.cat/c/document_library/get_file?uuid=246cdcd3-0c1b-4056-9573-115f2eb986b3&groupId=7294824
[504] The participants list of the OECD/ITF working group featured 4 experts; the PQN participants list 9 contributers.

walking for empowering local authorities[505]. In the first decade of this century a dedicated policy programme was executed on pedestrian road safety (DETR, 2000a). As a local authority, London is exemplary. Its transport provider Transport for London has a special department for accessibility, which explicitly looks after walking routes in the city. Transport for London made it happen that in 2012 the city had a consistent walking and cycling network for the Olympics (Transport for London, 2010). In Norway "Walking for life - the National Walking Strategy" was introduced in 2013[506]. In the same year Wales issued the Active Travel Act[507], and in Belgium the city of Brussels issued a strategic plan for pedestrian facilities (2013)[508]. During the 2015 WALK21 conference the Austrian central government presented its comprehensive Masterplan Gehen (=Masterplan Walking)[509] and the City of Vienna its city-wide plan STEP 2025[510], including dedicated attention to both walking and sojourning in public space. Other cities outside the Netherlands that now have exemplary pedestrian policy plans are Copenhagen[511], Barcelona[512], Toronto[513] and Munich[514].

In conclusion: internationally substantial effort is put into improving walking conditions. The results of these efforts can help Dutch W+S policy makers to catch up and make better plans for future walking and sojourning in public space.

b. The physical environmental context

In Chapter 3 it was established that the concept of physical environment covers the spatial structure, stationary elements in it and atmospheric conditions (the weather; see Subsection 3.3.2). It comprises all natural as well as man-made physical features somehow affecting W+S policy making. In Chapter 5 influences of the physical environment on walking and sojourning are assessed. Below I first position the Dutch W+S situation geographically. Then I describe less tangible aspects like municipal boundaries and functional characteristics, such as ownership, land use, barriers and accessibility.

The Netherlands is a West-European country bordering the North Sea in the West and North, Germany in the East and Belgium in the South. The Netherlands have a total surface area of 41,543 square kilometres, of which about 19% is water[515]; a large part of the land (26%) lies below sea level; most of this area concerns so called polders, land reclaimed from water. In parts of the country soils are weak, making road and sidewalk surfaces susceptible to deformation and caving in (maintenance problems). It is a flat country, except for the most southern part (South of the Limburg province). This makes walking (and cycling) easy and comfortable, especially for elderly and people with physical impairments.

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505 The most recent 3 are: 'Proportion of urban trips under 5 miles taken by: (i) walking or cycling (ii) public transport' (2011), ' The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Full Report' (2010) and ' Active travel choices' (2010).

506 https://www.vegvesen.no/_attachment/1050380/binary/1064821?fast_title=Walking+for+life.pdf

507 http://gov.wales/topics/transport/walking-cycling/activetravelact/?lang=en

508 http://www.mobielbrussel.irisnet.be/articles/de-mobiliteit-van-morgen/voetgangers

509 https://www.bmvit.gv.at/service/publikationen/verkehr/fuss_radverkehr/downloads/masterplangehen.pdf

510 https://www.wien.gv.at/stadtentwicklung/studien/pdf/b008379a.pdf

511 https://fussverkehr.ch/wordpress/wp-content/uploads/2016/09/944_kJ1jmWQff0.pdf

512 http://mobilitat.ajuntament.barcelona.cat/sites/default/files/docs/PMU_Sintesi_Angles.pdf

513 http://www1.toronto.ca/City%20Of%20Toronto/Transportation%20Services/Walking/Files/pdf/walking-strategy.pdf

514 https://www.muenchen.de/rathaus/dam/jcr:1f76e204-b0dc-43af-ba51-f35d7d3a2430/vep06_kurz_eng.pdf

515 CBS Statline – table 'Bodemgebruik; uitgebreide gebruiksvorm, per gemeente' accessed 29-9-2016

The climate in the Netherlands is 'moderate' and strongly influenced by the sea. Average temperature in winter (January) is 3.1 degrees Celsius (average highest temperature is 5.6; average lowest 0.3); in Summer (July) average temperature is 17.9 degrees Celsius (highest: 22.8; lowest: 12.8)[516]. It rains for about 6% of the time. The average number of frost days is 58; the average number of ice-days is 8, but in severe winters this number can reach 30 days (2010: 29 days) [517] [518]. In general the climate is favourable for walking and cycling.

With regard to air pollution, according to the European Environment Agency, the Netherlands scores rather average (European Environment Agency, 2014)[519], conditions being less healthy for walkers than in cleaner environments, making it a relevant issue for W+S policy development.

With 504 people per square kilometre, the Netherlands is densely populated. In the large city municipalities population density reaches more than 3,500 persons per square kilometre[520]. This density is relatively high, although still less than cities of millions[521], which are not found in the Netherlands. Related to the high population density, the Netherlands has a very dense road network and compact cities. On average, distances from home to essential destinations[522] are located within 1 kilometre walking distance. Furthermore on average hospitals, general stores and train stations are reachable within 5 km distance[523]. Nearly all urban addresses can be reached over sidewalks and footpaths, separated from motor vehicle traffic lanes. In rural area communities, sidewalks are often not present. A network of long distance hiking paths is available, particularly in rural areas, both in the densely populated and less populated regions. The high population density in the Netherlands appears to be favourable for walking.

Traditionally urban (built up) space and rural space were rather strictly separated. Because of deregulation principles over the last decades this pattern is evolving. Over the last 7 decades transportation and land use policies have gradually '*made walking less feasible and convenient'* (Pucher & Dijkstra, 2000:3). The number of road fatalities increased until 1972 and decreased until 2014 and increased again in 2015 and 2016 (SWOV, 2017[524]). Basic services (General practitioners, daily shopping, hospitals, schools) have been scaled up, on average increasing distances to beyond walking distance. Recently a significant shift to e-shopping and e-services have depleted the number of physical service points[525], decreasing cause for utilitarian walking

[516] see http://www.klimaatatlas.nl/tabel/stationsdata/klimtab_8110_260.pdf, accessed 29-9-16

[517] source: website Royal Dutch Meteorological Institute KNMI, accessed 18-12-2016, http://www.clo.nl/indicatoren/nl0004-meteorologische-gegevens-in—nederland; http://www.klimaatatlas.nl/klimaatatlas.php?wel=temperatuur&ws=kaart&wom=Gemiddeld%20aantal%20vorstdagen

[518] frost days = day with minimum temperature below zero degrees Celsius; ice day = day with maximum temperature below zero degrees Celsius

[519] https://www.eea.europa.eu/publications/air-quality-in-europe-2016/at_download/file

[520] Source: Tabel van Nederlandse Gemeenten, Wikipedia: The Hague: 6,231.3; Amsterdam: 4,990.2; Rotterdam: 3,029.8; Utrecht: 3,502.6. The figures are based on CBS data of May 2014. https://nl.wikipedia.org/wiki/Tabel_van_Nederlandse_gemeenten, accessed 18-12-16

[521] http://www.newgeography.com/content/004280-largest-world-cities-2014, accessed 9-6-17

[522] Essential services are basic medical facilities (general practitioner, pharmacy), supermarkets, restaurants, child care, primary schools, bus- and tram stops.

[523] Source: CBS Statline, table 'Nabijheid voorzieningen; afstand locatie, wijk- en buurtcijfers 2015', accessed 29-9-16).

[524] https://www.swov.nl/feiten-cijfers/factsheet/verkeersdoden-nederland, accessed 8-5-2017

[525] from 2004 to 2014 the number of bankbranches decreases from 2872 to 1371 (decrease of 52%), and from 2007 to 2016 the number of shop outlets decreased from 106.817 to 90.080 outlets (decrease of 16%). Source: Locatus consultancy (http://www.amweb.nl/archief/nieuws/2015/1/aantal-bankfilialen-in-nederland-in-10-jaar-

trips. On the other hand it appears that living in urban areas, with relative short (walkable) distances is becoming more popular (Snellen et al., 2015; Speck, 2013)[526]. Changes in land use, particularly the distribution of residences, work places and essential destinations (e.g. retail, medical, educational and public services, recreational facilities) may incite a shift in walking and sojourning patterns and are likely to affect mobility, health and safety of citizens. Policy agents are challenged to cope with social, economic and political consequences of these changes.

In conclusion: the physical environment in the Netherlands provides favourable walkability conditions, but changes in the distribution of origins and essential destinations may reduce this advantage.

c. The social and cultural context

Chapter 3 established that the concept of social and cultural environment covers human behaviour as well as awareness, attitudes, rules, norms, cultural values and social positions regarding W+S needs and abilities and walkability. General social and cultural conditions can be assumed to frame W+S policy making. These conditions specifically comprise 1) the current quality of life of the Dutch population, 2) the power of social arrangements.

Current quality of life of the Dutch population

For W+S policy making the quality of life of socially vulnerable groups is especially important, as these groups are more likely to suffer transport deprivation, i.e. more strongly depend on connectedness and walkable distances towards essential destinations. Politically there is consensus that government should be trusted to support vulnerable groups (Rutten Coalition Agreement, 2012[527]). The Dutch Social and Cultural Planning Bureau (SCP) publishes yearly reports on the quality of life in the Netherlands, i.e. current social conditions, which are seen as a combination of factual living conditions and subjective contentment regarding these conditions. Conform earlier editions, the 2015 report explores conditions of vulnerable groups[528] and reports on important lacks of resources that can lead to socially vulnerable conditions such as insufficient income, being low skilled, unwillingly being unemployed and having bad health, impairing normal life activities like going outdoors by themselves, climbing stairs, sitting down and getting up. It is estimated that in 2014 in the Netherlands about 20% of the population can be considered a vulnerable person (Bijl et al., 2015, p 33). From mobility and safety statistics it is known that vulnerable groups like children, the elderly, persons with limited mobility, the poor and unemployed walk (much) more than average; about half of them have no alternatives for their mobility and can be said to suffer transport deprivation (Martens, 2012; Martens & Bastiaanssen, 2015). Moreover, in general tourists also heavily depend on walking (Gemeente Amsterdam, 2015).

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gehalveerd-1017321; http://detailhandel.info/index.cfm/verkoopkanalen/winkels/); Statistics Netherlands figures show that the number of general practitioners within 1 km distance decreased from 1.9 to 1.8, the number of supermarkets increased from 1,7 to 1.8; the number of other daily goods shops decreased from 10.2 to 9.5 (http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=80306ned&D1=4-7,22-29&D2=0&D3=a&HDR=T&STB=G1,G2&VW=T)

[526] Infographic of the Dutch Planningbureau Liveability on their website http://www.pbl.nl/infographic/de-stad-in-trek, accessed 8-6-2017.

[527] https://www.kabinetsformatie2017.nl/documenten/publicaties/2017/10/10/regeerakkoord-vertrouwen-in-de-toekomst

[528] SCP defines (socially) vulnerable people as people who have insufficient resources to conquer difficulties and setbacks under their own power and to shape their life in a way they themselves desire (Bijl et al., 2015, p 32).

Transportation deprivation can lead to social exclusion, but with regard to the Dutch situation Bijl et al. (2015, p 321) conclude (translated from Dutch):
"The impression is that transport deprivation in the Netherlands is a relatively small problem, because of compact urbanisation, good quality of public transport and the large role of the bicycle (Bastiaanssen, 2012; Martens et al., 2011). This does not take away that it deserves more attention. An increasing number of elderly, mainly in thinly populated areas, live on their own longer. Age related physical limitations render both public transport and the bicycle less attainable as alternative to the car (Martens et al., 2011). Paradoxically the car is too expensive for the unemployed, but at the same time a precondition for their access to employment, particularly affecting lowly skilled persons in thinly populated areas."

The latter remark points to car dependency. In his doctoral thesis Jeekel (2011) described how society gradually changed by the growth of car ownership and use and subsequent extension of the road network and separation and spreading of land use functions into car dependency. He estimated that 40% of all car trips are car dependent. About 20% of the households do not have a car available, which nowadays poses liveability and walkability problems, especially in rural areas (Jeekel, 2011).

The SCP also assessed subjective contentment of living conditions. In 2012 on average the Dutch population is quite content, compared to both 2002 and to other countries. On the Better Life Index (OECD, 2015[529]) the Netherlands is positioned in the top of the range, just below Scandinavian countries and Switzerland. The Dutch population ranks contentment at 7.8 (out of 10); the 20% lowest income group values contentment at 7.3, the 20% highest income group values contentment at 8.2. Persons having a long-time disorder or disability value their contentment at 7.5, whilst those who do not have such limitations value it on 8.0. Of low skilled people 56%, medium skilled 57% and highly skilled people 60% are content with their residential environment; for traffic safety the percentages are respectively 62, 62 and 65. In cities of more than 100.000 inhabitants about 15% of the inhabitants devoted time to traffic safety improvements (often concerning walkability); in smaller cities and villages the share is slightly more than 20% of the inhabitants (Bijl et al., 2015, pp 314, 343, 346).

The power of social arrangements
After the current quality of life of Dutch inhabitants, the second social and cultural condition potentially influencing W+S policy making is social arrangements regarding walking and sojourning in public space. Common walking does not easily unite people in social arrangements like associations and social networks[530]. Recreational walking however has better cards, proven by the existence of several associations and social networks, such as Wandelnet, KNWB, 'NIVON Natuurvrienden Nederland' and 'Op Lemen Voeten'. On the internet several *blogs* on wandering and touristic walks can be found. The largest national event is the Nijmeegse Wandelvierdaagse (Nijmegen four day walking event). Apart from recreation walkers, physically handicapped persons (e.g. the blind, wheelchair users) have entered into social arrangements and associations, many of which are united in Ieder(in). Contrary to cycling which is represented by the Fietsersbond (33,000 members, 1,000 active volunteers), national and grass roots organisations regarding common utilitarian walking, uniting common walkers do not exist. The current successor of the Dutch Pedestrians Association, 'Mens en Straat

[529] http://www.oecdbetterlifeindex.org/#/11111111111, accessed 25-1-2017
[530] The former Dutch Pedestrians Association, as well as its kind in other countries, have great difficulty in recruiting and keeping members; in 1995 the association had about 3,000 individual members; raising membership fees above Hfl 15 was out of the question because of member protests.

(STREETSforALL)[531]' concerns a limited network of concerned walking experts. Another indication for lack of popular support is the measure to which the media give attention to (utilitarian) walking and sojourning in public space. A search on the websites of two national papers produced 3,392 hits for 'voetganger' (= pedestrian) and 'wandelaar' (= walker, wanderer), and 25,384 for 'fiets' (bicycle) and 'fietser' (=bicyclist)[532].

In conclusion: in the Netherlands cycling is thoroughly embedded in culture and proudly presented. Walking is less prominent on people's mind. Although danger from traffic is a concern, the majority of citizens takes walkability for granted. Lack of active support of less fortunate pedestrians limits options for W+S policy making. The popularity of recreational walking, however, opens up opportunities for walkability improvements.

d. The transportation context

The transportation environment, as far as it concerns the pedestrians' decisions, freedom and safety to walk and sojourn in public space, is described in Chapter 3. In the current subsection the perspective of the policy maker is taken to assess to what transportation environment features are likely to affect W+S policy initiatives. A number of contextual observations are made.

A first contextual observation in this regard is, as stated before, that walking is more than a main travel mode from A to B. Nearly all trips by other modes are preceded and followed up by walking (walking as a sub-mode), a substantial part concerns walking from A to A (circulation). Furthermore walking seamlessly passes over into sojourning (shopping, child's play, waiting for a moment etc.). The first and last option of a human to move about in public space, when other modes are no option, is walking. This multi-functionality is largely overlooked in transport and land use statistics and policy making; in a small minority of transport and land use policy papers, strategies and plans main and sub-mode walking, circulation and sojourning explicitly appear[533].

A second contextual observation is that mobility preferences matter for transport policy choices. For this reason the Dutch Mobility knowledge institute of the Ministry of Infrastructure and Environment (KiM) keeps track of mobility preferences. KiM does not mention walking, however. The institute concludes that the car is by far favourite, cycling comes second, and public transport is only preferred by a small minority (KiM, 2016; Olde Kalter et al., 2015; Harms et al., 2018). This ranking corresponds with Statistics Netherlands mobility survey data; the average total trip distance of a Dutch inhabitant in 2015 is 11.3 km, which is beyond normal walking distance. The average car drivers' trip is 18.1 km; a cyclist trip averages 3.56 km; for train passengers and bus/tram metro the average trip distances are respectively 42.9 and 12.76 kilometres; the average trip distance made on foot is 1.71 km (Statistics Netherlands, 2017 [534]). Because of substantial underreporting of short trips the true average distance of walking trips

[531] Mens en Straat does not have members; it comprises a network of about 100 expert volunteers.
[532] The search was carried out on the www.volkskant.nl and www.ad.nl. Search words were 'voetganger', 'wandelaar', 'fiets', 'fietser'. The search was done on 18-01-2017.
[533] In the course of research for this thesis more than Dutch 100 policy papers, strategies and plans were searched for indications of attention to walking and sojourning (search words 'voetganger', 'wandelaar', 'lopen', 'verblijven' (English: 'pedestrian', 'walker', 'walking' and 'sojourning'). The found cases of explicit policies are mentioned in this thesis.
[534] Statistics Netherlands – Statline website, (statline.cbs.nl), 2015 mobility data, accessed 18-01-2017.

is much lower[535]. The question is whether following preferences leads to the most effective, efficient and fair policies. Also, preferences do not match with travel satisfaction scores, where walking scores highest when asked about trip satisfaction (Knippenbergh, 1993; KPVV, 2014[536]; Transport for London, 2010) and 85% of walkers choose to walk for relaxation (Wandelnet, 2010, 2013).

A third contextual observation is that the various vehicle transport modalities are blessed with strong lobbies and public support[537], which walking and sojourning lacks. This is understandable as citizens and enterprises have invested much[538] in motorisation and maintenance of the stock (see also next subsection). Consequently many policy choices delivered facilities (space, comfort, rights, priorities) at the expense of space and freedom of movement of pedestrians. The result is that the road network is focussed on car traffic; other modes come secondary. Many negative consequences were 'repaired' in some way, e.g. traffic lights for pedestrians, pedestrian crossings, separated walkways, tunnels or overpasses, limited liability of non-motorised traffic participants in case of accidents[539], pedestrianisation of shopping streets. The general belief in the Netherlands now appears to be: facilities for walking and sojourning are well ordered; there are sidewalks everywhere, there are pedestrian crossings and safe traffic lights where needed; local authorities have well taken care of this matter; official statistics show that the Netherlands has about the best score regarding pedestrian safety in number of pedestrians killed in traffic. In view of the evidence presented in Chapter 5 these beliefs do not match factual conditions for vulnerable groups of pedestrians.

A fourth contextual observation, connected to the third observation, is that even in the Netherlands 'slow modes' or 'active modes' in principle include pedestrians, but in practise almost totally concern the bicycle and bicycle use. Unlike in other European countries (except e.g. Denmark) cycling was not almost totally erased in the motorisation era. From the 1990s, actively supported by the National Government's 'Masterplan Fiets' (= Masterplan Bicycle) cycling was boosted, but often at the expense of walking space[540]. The Netherlands now is a cycling country (there are now more bicycles than inhabitants). Politically the bicycle is very

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535 Most experts (e.g. CROW, 2014; Tuan, 2015; Sun, 2016) agree that 400 meters is the maximum walking distance to public transport stops and that for most people walking distance does not exceed 1.00 km. This is confirmed by Colabianchi (2007), who found that easy walking distance corresponds with about 15 minutes walking (is about 1 kilometre). It is unlikely that average walking trip distance are 70% higher than the generally found 1.00 km walking action radius: the average trip distance must be lower than 1.71 kilometres

536 http://kpvvdashboard-20.blogspot.nl/2014/10/gezondheid-en-geluk.html, accessed 26-1-2017.

537 The strength of the lobbies and public support is indicated by the relative large number of citations of car and bicycle lobbies in the media and professional journals compared to citations of pedestrian lobbies. It is public knowledge that the car and transport industry and their representatives spend large amounts of money on advertising and political lobby. Cycling lobby is supported by member associations (NL about 35,000 members, about 30 staff and able to attract project funding; see https://www.fietsersbond.nl/); pedestrian lobby is not supported by a formal organisations and as such cannot attract project funding.

538 Cars and other vehicles cost much more money than walking; what is paid is adhered more than what is not paid for.

539 In the Netherlands children, elderly and handicapped persons are not liable for damages sustained collisions with motorised traffic, except when it can be proven that they intentionally took risks.

540 This was indicated by several interviewees (see Section 6.4) as well as in newspaper articles (e.g. https://www.nrc.nl/nieuws/2017/05/27/ruim-baan-voor-voetgangers-radicale-herbezinning-openbare-ruimte-is-nodig-9337685-a1560261) and professional journals (e.g. http://verkeerskunde.nl/dossiers/verkeer-in-de-stad-vk3-2017/walther-ploos-van-amstel-hoe-krijgen-we-mensen.49851.lynkx)

important[541]. Dutch citizens are devoted to cycling, but are less expressive regarding walkability conditions. Regarding W+S, compared to other European countries, the Netherlands scores 'average', as there are many weak and missing links[542]. This heritage sets the stage for W+S policy making.

The fifth contextual observation is that public transport can be seen as a 'natural' extension of walking mobility. This is particularly true for non-car user residents in larger cities, urban areas, but less applicable in rural conditions[543]. Consequences of privatisation of public transport enterprises have largely been corrected by subsidies from governmental commissioners. Reachability and accessibility of public transport stops however are not subject to provider's evaluation and not subject in contract negotiations[544]. In rural areas public transport service is too infrequent and stops too distant to be useful for their residents; there is a tendency to increase distances between stops outside city centres to decrease the numbers of stops, increasing walking distances. Here transportation deprivation and social exclusion lies on the lurk (Martens & Bastiaanssen, 2015).

Sixth contextual observation: in rural areas recreational foot- and cycle-paths have been gradually improved over the last decennia. Most of them are well signposted, particularly long distance walking and cycling routes. Since about twenty years junction route signing ('knooppunten routes') has become ubiquitous. For the individual wanderer on foot an increasing number of tools are available on the internet and otherwise[545].

In conclusion: the transportation policy environment is not proportionally linked up to the factual role, needs and social-economic importance of walking and sojourning (except for recreation). Citizens as well as transport professionals seem to have a blind spot for them.

e. The Dutch economic context

The economic environment of the W+S institutional framework concerns the general financial position of the country, mainstream and specific economic strategies, the status quo and changes in the economic landscape affecting W+S policy making. These perspectives are taken up below.

The Netherlands is one of the most developed countries. It is one of the 20 largest economies, after world powers like the USA, United Kingdom, Germany and Japan. In 2016 the volume of its Gross National Product makes it the world's thirteenth economy[546]. Regarding the Index of Human Development it was positioned fourth[547]. The open Dutch economy is supported by a very well developed agricultural sector, service sector and international trade, particularly transit to Germany (25.2%) and Belgium (14.5%) (IMF website, accessed 29-9-2016). It can be concluded that the Dutch economic position is not an obstacle for W+S policy making.

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541 The ministry of the Environment and Infrastructure mentions the importance of cycling in almost all transport and land use planning policy papers and plans, but overlooks walking and sojourning; most Dutch municipalities issued cycling plans and have bicycle co-ordinators; as far as we could detect, less than ten municipalities have explicit walking and sojourning policies

542 This was indicated by several interviewees (see Section 6.4).

543 See e.g. Tillema & Jorritsma, 2016.

544 Source: interviews (see Section 6.4) of Ministry of Infrastructure and Environment, NHTV/SOAB and large municipalities.

545 source: interview Wandelnet; see also http://wandelnet.nl/publicaties-cijfers

546 Wikipedia: https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita; CIA: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html

547 http://hdr.undp.org/en/content/human-development-index-hdi

Costs of pedestrian facilities are taken up as a public matter, particularly to be borne by local authorities. Information on private, corporation, as well as national governmental investments into pedestrian facilities lacks; there are no accounts available about their investments. In the Netherlands local authorities, i.e. municipalities, are funded by national government from national taxes through the Gemeentefonds (Municipality Fund), which in 2017 amounts 27.7 billion Euros (Rijksbegroting 2017[548]), the Infrastructuur Fonds (totalling 5.8 billion, of which 216 million Euro is earmarked for regional and local infrastructure) and the Brede Doel Uitkering Verkeer en Vervoer (= Broad Earmarked Payments Traffic and Transport; totalling 1.6 billion Euros for 2016)[549]. Additionally municipalities can spend their own money, coming from local taxes and other revenues, like parking fees, fees for building permits, property management etcetera, totalling 8,843 billion Euros, about 40% of the municipalities' income, averaging 520 Euros per inhabitant[550]. The amount spent by municipalities on pedestrian facilities is unknown; such expenses are not explicitly budgeted and tagged in institutional accountings. Consequently it is unclear how much government is willing to spare for walking and sojourning.

Other relevant aspects of the economic environment are changes in health provisions and the retail landscape. In 2006 health care was largely privatised and subsequently economised such that mobility support provisions are no longer generously served out. Regarding retirement provision in the Netherlands scores top, even though substantial changes took place. In 2013 state pensions have been frozen, limiting financial (mobility) options for less wealthy elderly; in 2013 it was decreed that retirement age is incrementally raised from 65 to 67, changing mobility patterns of the 60 – 67 age group[551]; government increasingly appealed to volunteer aid. These changes led to a fundamental shift from governmental to private funding on the one hand and decreasing mobility options for vulnerable groups on the other hand.
With regard to the retail landscape structural changes in shopping habits occurred. For buying non-daily and bulky goods there is a shift from shopping in physical stores to e-shopping (Weltevreden, 2007; Statistics Netherlands, 2017[552]), leading to changed travel motives, choices and patterns. Shopping in city centres evolved from a mainly utilitarian into a more recreational and orientation activity.

In conclusion: in principle the Netherlands can afford super quality pedestrian networks and facilities. Investments are unknown; budgets for pedestrian facilities are not earmarked, making it difficult to monitor effects of policies. Budget cuts for health and welfare enlarge distress of persons with mobility limitations.

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548 https://www.rijksoverheid.nl/documenten/begrotingen/2016/09/20/a-infrastructuurfonds-rijksbegroting-2017, accessed 20-01-2017. The funds are largely transferred to the Provinces Fund.
549 https://vng.nl/files/vng/vng/Documenten/Extranet/Mobiliteit/Hoofdstuk-5_mobiliteitsbeleid.pdf, accessed 20-01-2017
550 source VNG (http://degemeente.nl/hoe-komt-de-gemeente-aan-haar-geld); and Netherlands Statistics (http://visualisatie.cbs.nl/nl-NL/Visualisation/Belastingopbrengsten); total income municipalities was 8,843 billion Euros, which is about 520 Euro per person or 1,400 Euros per household.
551 Until then early retirement at about 60 was normal; this changed to 65+ within about two years.
552 According to Statistics Netherlands (https://www.cbs.nl/nl-nl/nieuws/2016/03/stormachtige-ontwikkeling-webverkopen, accessed 23-1-16) form 2010-2015 the sales volume of web shops rose by 56%, whilst it rose by 8% in physical shops; form 2007-2015 the number of physical shops decreased by 7.5%, whilst the number of web shops grew by 600%.

f. The technological context

As an environment for policy development, the technological environment (in the widest sense) on the one hand comprises available technological hardware and on the other hand the content and distribution of knowledge and information about supporting and improving conditions for walking and sojourning in public space. An example of technology affecting policy making is the way how human supervision is gradually replaced by cameras and detection devices, enabling surveillance and management at a distance (Norris, 2004). The technological context in terms of knowledge concerns hardware (road and public space design, concrete pedestrian facilities, reconstruction, design and physical planning tools), software (analytical software, software for traffic management), and orgware (policy strategies, strategic planning tools, legislation, financial instruments). Prime sources for such knowledge are walkability champions amongst governmental bodies, consultancy agents, specialised university institutes and non-governmental organisations (see above under 'a. International context'). For each of the 'technical' perspectives foreign and domestic sources are available; in most cases state of the art knowledge regarding walking and sojourning in public space originates from champions outside the Netherlands.

With regard to W+S there never was a strong research tradition. Besides universities and other knowledge institutes are, similar to consultancy agents, increasingly dependent on external funding[553]. Consequently research is increasingly market oriented. Walking and sojourning are not much in demand as research issues, and therefore such projects are difficult to finance (Dossiers 03 and 04).

Since the early 1970s mobility and road safety data were extensively and systematically collected. As was pictured in Chapter 5, walking was sub-optimally included; sojourning in public space was not included at all. From the 1990s data collection is economised[554], resulting in even less reliable walking mobility and safety data. Around 2010 a nadir was reached. Since then data gathering improved marginally.

W+S specialists are rare. In curricula for future public space, traffic and transport professionals W+S is at best included subordinately (Dossier 11 and 14); in descriptions of post-graduate courses no signs of inclusion are found[555]. The public space and transport knowledge institute CROW recently published a state of the art W+S planning guidance ('Lopen Loont', CROW, 2014), which, according to this institute, is not high in demand. In less than five municipalities a W+S expert is present. The same is true for consultancy agents. Dedicated NGO's are best endowed in this regard[556]. In Section 6.5.4. the knowledge and professional skills aspect will be dealt with in more detail.

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[553] http://www.vsnu.nl/bekostiging-universiteiten.html

[554] See Chapter 5: the number of respondents in the national mobility surveys reduced over time (https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/korte-onderzoeksbeschrijvingen/onderzoek-verplaatsingsgedrag-en-mobiliteitsonderzoek-nederland); in 1994 60% of seriously injured traffic casulaties were reported by the police (Blokpoel, 1994), whilst in 2012 the police registered only 12% of the seriously injures traffic casualties (http://www.verkeerskunde.nl/registratie-verkeersongevallen-naar-dieptepunt.28428.lynkx;. Since 2012 the casualties reporting rate improved from 12% to 28% (Bos, 2016, Figure 3.6., p 39).

[555] https://www.nhtv.nl/bachelors/built-environment/introductie.html; https://www.windesheim.nl/studeren/opleidingen/techniek%20en%20ict/ruimtelijke%20ontwikkeling%20mobiliteit/inhoud%20opleiding/; https://www.nhl.nl/zoeken/verkeerskunde

[556] 'Mens en Straat', 'Wandelnet' and 'Ieder(in)' deal with W+S issues on a daily basis and have long term experts in their midst.

Important discourses touching walking and sojourning in public space concern the liveability of cities, climate change, the role and potentials of the internet and ICT, the way autonomous cars can be expected to change the mobility and safety landscape and whether priority should be given to top-down policy development (technocracy, strategic planning) or bottom-up (liveability, public spaces development), i.e. centralistic responsibility, decentralised responsibility or something in between. In these discourses consequences for walkers and walking are often overlooked.

In conclusion: although much expertise on policies and measures is available from champions abroad, actual and situational information relating to the Dutch context as well as expert professionals is scarce.

g. The Dutch national political context

The political environment for W+S policy making concerns the kind of political system that applies, the general atmosphere, and important developments surrounding policy making. Some relevant aspects are described below.

The Netherlands is a democratic state. It has a multi-party system with a low constituency threshold. Until the turn of the century the support of the dominant political parties was relatively constant. Politically it was a very stable country, where, once in power, politicians could count on being there for a number of years. From the 1970s the Netherlands could take advantage of revenues of huge natural gas reserves, enabling government to finance investments in roads and road safety[557].

This atmosphere allowed for development of long term strategies, policies and commitments. The Netherlands is co-founder of a number of multi-lateral agreements, such as the European Union, the G-10 and the OESO. A substantial part of legislation is delegated to the European Union. Domestically, influential central planning bureaus were established[558]. Furthermore knowledge institutes for the support of central and decentral policy development were set up[559]. Ministries were able to develop visionary long term plans, like the Structure Vision Traffic and Transport, the Masterplan Bicycle, Start-up Program Sustainable Safety. NGO's were subsidised to spot problems, help create public support for policy measures and to critically discuss policies in order to improve them[560].

From the late 1990's many traditionally national responsibilities regarding traffic and transport and health care were decentralised to regional and local government (Bax, 2011). Another new policy trend was deregulation. That latter was the main argument for forcing the Dutch Pedestrians Association to merge with two other road safety organisations, effectively throttling pedestrian advocacy. Decentralisation and deregulation were also intended to save

[557] These investments are supported by the Fonds Economische Structuurversterking (English: Fund for Economic structure reinforcement, see http://wetten.overheid.nl/BWBR0007788/2014-01-25)

[558] e.g. the Central Planning Bureau, Social and Cultural Planning Bureau, Rijks Planologische Dienst (=National Land Use Planning Agency)

[559] e.g. NIROV (= national institute for Land Use planning and Housing; now merged into Platform31), CROW (knowledge centre for infrastructure and public space), SWOV Road Safety Institute, RIVM (national Institute for Health and Environmental issues) and VeiligheidNL (=Consumer Safety)

[560] e.g. Veilig Verkeer Nederland (=Traffic Safety Association), de Voetgangersvereniging (the Pedestrians Association), Stop de Kindermoord (=Stop Child Murder – protect children in public space and streets), Milieudefensie (=Defence of the environment), Gehandicaptenraad (=association of organisations of the handicapped).

governmental budgets. The savings deepened by the 2008-2012 economic crisis, leaving little room for new policies, particularly pro-active policies (CPB, 2014).

At the same time new policy issues emerged. The natural gas reserves near depletion[561]. Because of sedentary lifestyles (obesity) and ageing of the population, the burden of public health and the Quality of Life costs increase substantially, thereby becoming an urgent policy issue[562]. Furthermore, wars and poverty cause sizeable migration from the Mid-East and Africa. How immigrants should be taken care of has become a matter of political dispute[563].
With regard to walking and sojourning in public space there is no dispute about its importance, though hardly anyone places it number 1 or even number 5 on their wish list (Dossiers 02, 03, 06, 20, 22, 25, 27). As said before, W+S is perceived as being well taken care of (Dossiers 06, 20, 22, 27, 28). Indeed, acute concrete problems reported to complaint offices, like uneven sidewalks, broken lamps in traffic lights of street lighting, litter on the sidewalk etcetera, are as a rule dealt with immediately (Dossiers on municipalities and enforcement); structural problems, like sidewalk parking by building contractors, missing links in routes, are generally not actively explored, remain undetected and hence unsolved.

Since the turn of the century the share of floating voters and number of political parties increased, making politics less predictable. Politics is dominated by liberal parties, focussing on the economy, a free market, a lean government, deregulation, decentralisation and dismantlement of subsidies. Encouraged by parliament, government tends to limit activities to core business and what is explicitly demanded. Policy making has become dominantly urgency-controlled ('beep-system'). Long term strategic affairs like environmental and traffic safety issues, as well as social justice matters have lost their splendour. The tradition of restrictive land use planning is relieved, delivering more freedom to develop real estate and expand built-up areas. A prominent change in this regard is the merging of all environmental and land use legislation into the so called Omgevingswet[564] (Environment Law), which concerns both decentralisation and deregulation. This extensive operation is to be completed by 2023. Detailed regulation regarding accessibility of persons with limited mobility and other vulnerable groups (like children and the elderly) has become unlikely. Still, the United Nations Convention on the Rights of Persons with Disabilities was ratified in 2016, but government made provisions to spare corporations and service institutions by issuing that if implementation goes together with excessive costs, slower implementation or adaptation is allowed. On the local level many public facilities and spaces have been sold to private parties; by the change of interests accessibility and the quality of the facilities are put under pressure.

In conclusion: politically W+S seems to be a non-issue. W+S policy making is largely decentralised. Urgent concrete problems are being solved 'on the go', but strategic planning measures are seldom considered, mostly because perception triumphs over hidden facts.

[561] source: https://www.cbs.nl/nl-nl/nieuws/2016/37/aardgas-voor-bijna-80-procent-op
[562] source: https://www.volksgezondheidenzorg.info/onderwerp/sport-en-bewegen/cijfers-context/oorzaken-en-gevolgen#node-inactiviteit-en-gezondheid
[563] Source: https://www.opnieuwthuis.nl/documents/Overheidsdocumenten/kamerbrief-over-bestuursakkoord-verhoogde-asielinstroom.pdf
[564] see ; Ministerie IenM, 2014 (Factsheet Omgevingswet) en https://www.rijksoverheid.nl/onderwerpen/omgevingswet/vernieuwing-omgevingsrecht

6.4.4. Conclusions

The W+S institutional framework and the W+S system can be affected by a variety of conditions, influences and forces in their environment. In this study seven dimensions are distinguished.

From the above assessment of the seven W+S environmental dimensions it appears that these environments in general can be seen as strengths with regard to walking and sojourning in public space and also that a number of weaknesses exist.

The Dutch W+S policy context features a number of strengths:

- A number of foreign organisations are offering key information to support national policy frameworks on W+S matters.
- International agreements supervised by respected global organisations are adopted at large.
- The physical environment in the Netherlands provides a fundament for favourable walkability conditions.
- The popularity of recreational walking incites demand for walkability improvements.
- The Netherlands is a wealthy country and as such can afford super quality pedestrian networks and facilities.
- Urgent concrete problems are being solved ‘on the go’ by neighbourhood teams.

Identified weaknesses are:

- Lack of insight in the W+S system ‘hardware’ and ‘software’ is likely to decrease the effectiveness and efficiency of W+S policy ('orgware').
- Changes in land use may reduce advantages from favourable physical environmental conditions such as nearness of essential destinations in compact cities; as there is a shift from public to private land ownership the influence of public policy becomes weaker.
- In the Netherlands walking is less prominent on people’s and policy makers’ mind than cycling. Although danger from traffic is a concern, the majority of citizens take walkability for granted. Vulnerable persons need freedom-to-move safeguards. Lack of active support of less fortunate pedestrians limits options for W+S policy making.
- The transportation policy environment is not proportionally linked up to the factual role, needs and social-economic importance of walking and sojourning. Citizens as well as transport professionals seem to have a blind spot for them.
- Investments in W+S are unknown and budgets for pedestrian facilities are not earmarked, making it difficult to monitor changes.
- Budget cuts for health and welfare enlarge distress of persons with mobility limitations.
- Although much expertise on policies and measures is available from champions abroad, actual and situational information relating to the Dutch context as well as expert professionals is scarce.
- Politically W+S is a not a top or even sub-top priority. Strategic W+S policy making is largely decentralised. Strategical planning measures for W+S improvements are seldom considered, mostly because perception triumphs over hidden facts.

6.5. Organising change towards better support of W+S

6.5.1. Introduction

Having broadly described the W+S playing field and identified key players, the actual organisation of change towards better support of walking and sojourning in public space can be studied in more detail. This section explores how Dutch individual key policy actors by themselves and as groups organise sustaining and improving walking and walkability. Thereby strengths, weaknesses, opportunities and threats regarding effective W+S policy making can be demonstrated. In order to be able to do that, similar to the above sections, first theoretical considerations and the methodological approach are presented.

6.5.2. Theory

This thesis' Section 3.2.2. introduced System approach as reference policy strategy for W+S policy making. In this approach the policy actor deals with the system systematically, comprehensively and integrally, balancing out process, context and content (Pettigrew, 1992). A question in this regard is how Dutch W+S policy making compares to the described system approach.

In order to be able to set up research into the actual role of institutions in sustaining and improving conditions for walking and sojourning in public space one needs to (theoretically) know a) how concerned they are about current W+S conditions and how certain they are about being in control, b) what critical stages in change processes are, c) on what institutional pillars effective policy approaches are built, d) what policy activities are actually carried out, and e) how do these activities compare to the proposed System approach.

With regard to the first question the author chose to use the Winsemius Policy Lifecycle model (Winsemius, 1986). This model sheds light on how a policy issue like W+S and many others can mature into an effective policy arrangement and on what this does for political concern in the successive development stages. The author did not find alternative models or theories connecting the evolution of issue-knowledge, policy attention and priority, and professional competences, and following these aspects from the discovery of the problem field to the end of the policy life cycle. The model illustrates that policy attention and thereby what politicians are willing to pay for interventions, is likely to vary along the ride.

With regard to the second question, what critical stages in the change process are, the Winsemius model was used to identify and define these stages and put them into a descriptive model for positioning current policy making[565] in the policy lifecycle and assessing appropriate institutional change priorities. This deduction is dealt with in the then following subsection.

The third question, on what institutional policy pillars are approaches built, is theoretically underpinned in the last theory subsection, leading to the description of a model on policy pillars and per pillar what questions are to be investigated in this study.

[565] In this thesis W+S policy making is targeted, but clearly the Winsemius model and its derivatives are likely to apply for most kinds of policy making. Therefore, when this applies, the adjective 'W+S' is omitted.

The fourth and fifth questions (respectively what policies are carried out and how these activities compare to the proposed System approach) are not theoretical but practical questions, to be dealt with by explorative research. Section 6.5.3 Results, Subsection d. Policies and strategies discuss these matters.

a. Maturing policy content: the policy life cycle

Above it was already determined that the role of institutional framework is to deliver change impulses towards the W+S system. With regard to change impulses it is important to remark that most of the times such impulses are reactions to system malfunctions. These come into the organisation's view and then are considered as serious problems to be tackled. In this regard Winsemius (1986) found that policy issues undergo life cycles, and that policy activities evolve with the various stages of the policy life cycle. He discerns four stages:

- Discovery phase
- Political phase
- Implementation phase and lastly,
- Management and control phase (see Figure 6.2.).

Winsemius argued that all policies go through these cycles and that at some moment in time the life-cycle comes to an end or the activities regarding the policy issue are totally integrated in standard practise. At that stage the issue no longer receives dedicated policy attention.

In the *Discovery phase* awareness and knowledge development are the key. The first signals that there is a problem usually come from society (researchers, interest groups, 'catalysts', the media, or other governmental agencies, concerned citizens). '*In this first phase there is high uncertainty and controversy regarding both the gravity of the issue, the shared urgency for change and dimensions of abatement policies. In this phase the matter is not yet a political issue'* (De Jong, 2006:1.1.2).

When the responsible authorities conclude that the matter is a problem which needs to be solved and that policy should be developed, the second phase starts, the *Political phase*. Here willingness to act is the typical factor. In this '*phase the issue is placed on the political agenda, and negotiations about possible solutions to the problem start'* (De Jong, 2006:1.1.2). Many times temporary measures are issued to contain the problem, whereby the authority shows that it seriously considers tackling the problem. This may lead to political and societal consensus and a political decision[566]. A political discussion typically focuses on the effectiveness of the solutions, not (yet) on efficiency.

In the *Implementation phase* opportunities, competences, resources and abilities set the stage for effectiveness of policy interventions. The problem is tackled by appropriate interventions, increasingly focussing on efficiency of the policy interventions. During this phase it becomes more and more clear that the desired results can be achieved more easily than initially imagined, so that re-regulation can take place. Also, it gets discovered that in many cases the tasks can be carried out more effectively and efficiently by local authorities and/or the local business community, making decentralisation a realistic option. The public, media and politician's attention decreases.

[566] Feitelson and Salomon (2004) argue that the adoption of innovations depends on technical, social and political feasibility. Political feasibility depends on social feasibility, sanctioned discourses (i.e. discussions in political fora) and decision making procedures.

When the desired improvements have been achieved and the problems have been reduced to politically and technically acceptable proportions, the fourth phase starts. In this *Management and Control phase* emphasis is laid on securing the achieved qualities, and the keyword is 'doing'. Typically public, media and political attention is low. There is no longer reason for issuing guiding policies, as the issue is internalised and integrated in normal policy activities, although it stays necessary to exercise vigilance. When new insights or complications cause trouble, additional policy needs to be developed. Normally these developments can be taken care of by complementary or adjusted policies. Less policy pressure makes a policy field liable to budget cuts, postponement of maintenance and dismantlement of knowledge building. Sometimes however new policy is indicated and a next generation policy life cycle needs to be started.

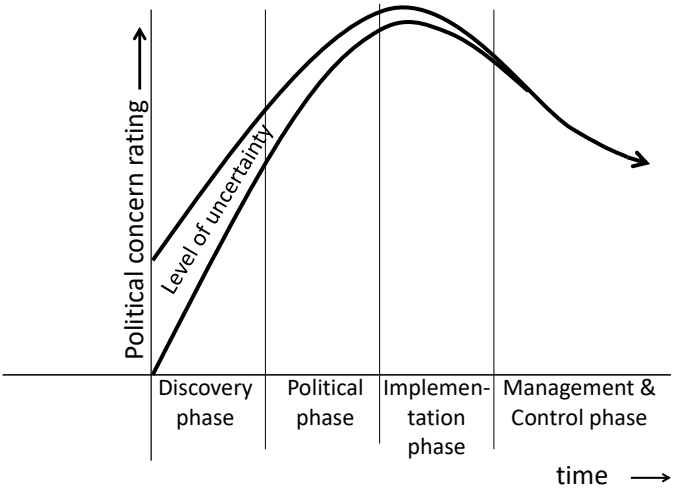

Figure 6.2. The policy life-cycle (after Winsemius, 1986)

The Winsemius Policy Life-cycle model can be used as a stepping stone for exploring policy options, as it describes probable courses of state of affairs of policy processes. It is clear that not all policy processes follow the regular course of events. The Winsemius model is a descriptive, and not a prediction model. In this respect De Jong (2006) rightfully argues:

> *" Hischemöller et al. (1998) and Groenewegen et al. (1998) have questioned the linearity of the policy cycle. They concluded that environmental problems change in structure in the course of time, but that this change is not necessarily from unstructured to structured and from conflict to consensus, as assumed in the Winsemius model. Problems may also develop from structured to unstructured, depending among others, on the emergence of new knowledge or changes in societal perception." (cited from De Jong, 2006:9).*

In this thesis' research on Winsemius' ideas the author learned that the policy life cycle can be a major factor in setting the stage for policy making. It can also be expected to help exploring how W+S in fact is positioned as a policy issue, and also help to assess future perspectives and provide clues for developing countermeasures. An imaginable policy subject can fail to pass through the initial phases of the policy life cycle when it does not attract attention, does not appeal to the policy actors, or is perceived as 'already properly taken care of'. In the latter case

the policy actors do not perceive the subject as a relevant policy subject, but as something which already transformed to the management & control phase.

b. Critical steps towards improvement

Winsemius' Policy Life-cycle model explains along what lines policy processes regarding acknowledged policy issues can develop and also what this means for political involvement and willingness to pay. The model forms a good start for deductions regarding the identification of general requirements for policy initiatives to support and promote walking and sojourning in public space.

For the Vulnerable Road Users report (Methorst, 2003) and the Final Report of COST 358 Pedestrians' Quality Needs (Methorst et al., 2010) the author translated Winsemius' linear model into a cyclical model. Winsemius' account about the main steps in the policy life cycle makes clear that a number of factors are preconditions for policy development, implementation and impact on society. The adapted model discerns the following sequence of phases which the policy agent is likely to go through for achieving improvement of conditions[567]: Awareness, Commitment, Competence and Performance (see Figure 6.3 and Table 6.3).

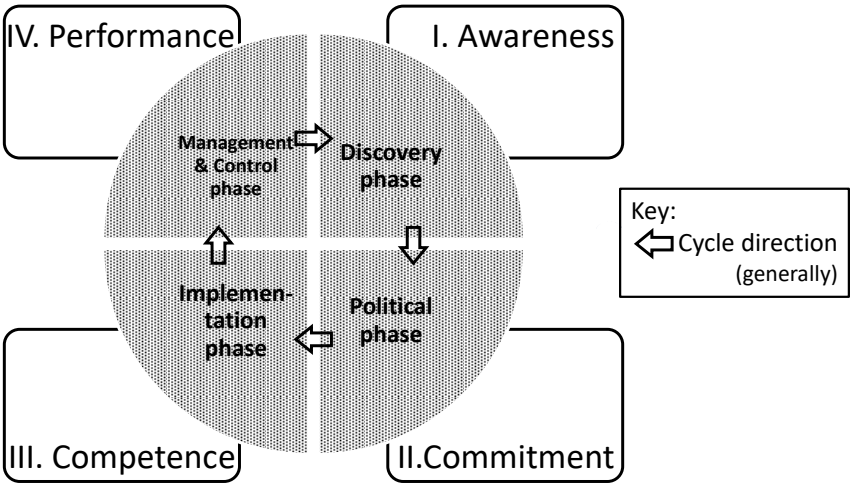

Figure 6.3. Policy Life-cycle - critical factors (adapted from Methorst, 2010 and based on Winsemius, 1986)

This thesis uses the earlier 'translations' for an advanced assessment of the critical factors for effectiveness of policy development and implementation implication. Through literature study, working group discussions, and feedback on notes and articles, the author identified and substantiated critical preconditions, opportunities, triggers, obstacles for, and counterforces against policy development. In Appendix 9 the results of this deduction study is presented. Below a summary of the results of the deduction study is entered. In each of the paragraphs below with regard to the phases, first the phase is defined, then the role of the activities in policy making and implementation is taken up, and is concisely entered what factors predetermine the

567 In the Vulnerable Road Users report the phases were called 'Know', 'Want', 'Can' and 'Do'. In the PQN report the headings were amended to 'Awareness', 'Willingness to act', 'Opportunities, competences and skills' and 'Implementation'. For this thesis again new headings were decreed.

outcome and impact of policy activities. Finally it is conveyed how the identified policy lifecycle critical factors are researched in this thesis.

Table 6.3 Conversion Winsemius' model into Policy life-cycle circular model

Winsemius - Policy Life-cycle phase		**Policy Life-cycle critical factors**
Phase	***Activity***	***Keywords***
Discovery phase	Identifying the issue	I. Awareness [Knowing, insight, conscious of, being concerned]
Political phase	Formulating (new) policy	II. Commitment [Willingness to act]
Implementation phase	Implementing (new) solutions	III. Competence [Opportunities, abilities, competences and skills]
Management & Control phase	Management & Control	IV. Performance [Doing, co-ordination, monitoring Plan-Do-Check-Act cycle]

I. Awareness
This thesis *defines* awareness as the policy agent's concern about and well-informed interest in (pre-) conditions or developments. Thus awareness comprises more than just knowledge about, insight in or being conscious of conditions: it also comprises that the policy agent is being aroused and concerned about it, perceiving the conditions as matters that need attention. It concerns knowledge that incites *emotions*, like compassion, fear, anger, joy, feeling of belonging.

The *role* of awareness in the policy process is that it stipulates policy development. It is true that, even without awareness of a condition, unwittingly and haphazardly a change agent can bring about change in the system. In some cases problems are accidentally solved that way, but one could argue that this is rather 'autonomous' than (conscious) policy driven. Thus a critical factor for the improvement of walking and sojourning conditions is awareness of the shared urgency of improvement at the stakeholder level (OECD/ITF, 2012, p85). When there is no awareness of a (potential) problem, there is no chance that tackling the problem will even be considered. Authorities and providers must know and feel that there is something wrong and, for starting an effective policy process, they also must have an *accurate* image of what kinds of undesirable events might happen (Lyons, 2003, p3), for which in the end the community gets the bill. In this context Vlakveld (2001) discerns 'knowing', including facts, procedures and insight, and 'feeling', including disposition, emotions and attention.

From the deduction study (see Appendix 9, Section 1) it can be concluded that awareness of deficits in the system that really matter is a basic precondition for improved support of walking and sojourning. This awareness is based on perception, which in turn can be based on knowledge (bits and pieces of information placed in an expertise context).
Not all phenomena are equally well recognised, acknowledged and/or researched (Atkinson et al., 1990; Steffen, 1975). Many factors potentially affect the detection and awareness of W+S system strengths, weaknesses, opportunities and threats. It is important to know what relevant

W+S determinants and conditions are not 'automatically' detected or neglected in research, and why they are not detected or researched (Rumar, 1999).
When relevant knowledge on the functioning of the system is lacking, policy actors are not likely to become aware of a shared urgency of improvement. It is critical that researchers, policy makers and providers at the right place and time know and understand what the real issues and options are; the policy actors' perception should match the objective or subjective facts (Fresco, 2011; Rumar, 1999).
Many subjects are competing for attention. This prompts researchers and policy developers to be selective. W+S determinants and conditions have proven to be rather susceptible to be marginalised (Braman, 2003)[568].

In this thesis the status quo of awareness of W+S conditions is researched by analysing the interview dossiers of the W+S policy actors regarding expressions of dissatisfaction or worries about W+S system failures.

II. Commitment
Following Oxford Dictionaries[569], this thesis *defines* 'commitment' as '*the state or quality of being dedicated to a cause, activity, etc.',* characterised by taking responsibility with regard to the change processes and a willingness to act. Commitment concerns matters of interest of which the emotional load beats competing matters in that regard, creating a significant level of urgency. A policy actor is 'committed' when the felt urgency is combined with a feeling of responsibility and accountability, and a willingness to act.

Regarding the *role* of 'commitment' in policy development and implementation, it turns out that 'awareness' in itself is not enough to produce change. Once a problem is recognised and roughly rated, the responsible authority must be willing to take action (OECD/ITF, 2012, p85). This will only come about when this authority somehow owns the problem and is stimulated to feel responsible for taking care of the issue. If the policy agent is content with the current situation, unless other powers urge the agent to act, no movement, including research into the matter, can be expected.

From the deduction study (see Appendix 9, Section 1) it became clear that in general commitment does not automatically follow up awareness. It does not happen when a passive reaction seems to suffice; only when taking action is felt imperative relative to tackling other urgent matters, commitment will happen. Commitment does not manifest in isolation. It takes place in a playing field, and the subject can choose to take up the roles of leader or follower (Ulrich, 2012).
Generally expected rewards need to balance out expected sacrifices and punishments (Risser, 2010).
Feitelson and Salomon (2004, p14) argue that innovations are not developed in response to specific problem awareness or needs, but rather as a result of political entrepreneurship. In their opinion there are two kinds of transportation (read: W+S) innovations: originating from industry interests (profit driven) and policy innovations originating from experts and professionals (expertise driven). Although '*ideas are promoted constantly, they* [can] *become concrete proposals'* in so called policy windows (Kingdom, cited in Feitelson and Salomon, 2004, p.15), when it is opportune to put these ideas on the political agenda. Decisions regarding the adoption of innovations then depend on technical, social and political feasibility, as well as

[568] Braman (2003): 'We have been on our feet too long to study the art of walking'.
[569] https://www.lexico.com/definition/commitment, accessed 1-7-2020.

the expected rewards compared to the expected effort, risks and disadvantages. Rewards can be financial benefits, but can also be enhanced image, esteem, self-esteem, desired leadership, contentment, ease of mind or feeling good, i.e. by fulfilling one's duties or achieving settled targets (Knowles et al., 2004; Risser, 2010).
Commitment is connected to feeling responsible and accountable for the improvement of conditions. Responsibility and accountability are driving forces (Geller, 2001).

In this thesis the status quo of the policy actor's commitment to improving the W+S system performance is researched by analysing their interview dossiers[570] regarding political feasibility and intentions to improve W+S conditions.

III. Competence
Oxford Dictionaries *define* competence as the ability to do something successfully or efficiently[571]. Fuller argues that a person's competences are defined by personal (here: also the institutional framework's) characteristics, education and training, and experiences, which together deliver understanding, attitudes and skills (Fuller, 2005; Wegman et al., 2006; see Figure 3.10). This thesis defines the institutional framework's (and individual policy actor's) competences wider: they also comprise legal and informal authority.

Given political or institutional willingness to take action to improve walking and sojourning, the institutional framework has to be able to successfully implement the plans. The *role* of 'competences' regarding policy development and implementation is to assure that the policy actor is capable to make use of available windows of opportunity to improve conditions and hence to support walking and sojourning in public space.

From the deduction study it can be concluded that the institutional framework needs to have proper authority, windows of opportunities, tools, skills and the necessary support to be able to improve conditions. Legal and informal authority are basic preconditions for being able to improve conditions.
In theory windows of opportunities present themselves when the agency has justification, proper authority, tools and skills, and the moment is right to take action. This right moment appears when plans are supported by the stakeholders and real rewards compensate (actual) efforts, risks and punishments.
Adequate communication is another precondition for effectiveness. Stakeholders must understand and be persuaded to support plans for improvement of W+S conditions.

In this thesis the status quo of the policy actor's competences regarding improving W+S conditions is researched by analysing their interview dossiers regarding plans and organisation of activities for improving W+S conditions.

IV. Performance
This thesis *defines* policy making and implementation performance in terms of how successfully the inherent, agreed or assigned tasks are executed.

The *role* of 'performance' regarding policy development and implementation is to condition policy outcome and impact, i.e. fully completing the planning and implementation processes.

[570] The dossier include summarise the interview transcripts, provided documentation and reports on W+S policy activities presented on the organisation's website (see Section 6.1. paragraph c).
[571] http://www.oxforddictionaries.com/definition/english/competence?q=competence [2-1-2014]

Without factual implementation and management & control, true improvements cannot happen. Provisional performance indicators in this regard concern realised system changes ('products' e.g. reconstructed intersections, new legislation, campaigns, increase of nearby medical services etc.), leading to improved system performance later on indicated by improved mobility and accessibility on foot, pedestrian safety, public health and user satisfaction (i.e. the final performance indicators).

The deduction study (see Appendix 9, Section 1) concludes that impact from improvement of conditions will only happen when policies are actually and effectively implemented. This requires planning, realization of projects, monitoring and evaluation of the execution of the plans and acting upon the findings. There are however often contextual obstacles to be overcome before W+S improvement plans are actually implemented. This is even more true for quality control of the implementation.

In this thesis the policy actors' performance regarding W+S is researched by analysing the policy actor's interview dossiers regarding implementation of W+S interventions and claimed achievements.

Cyclical process
Most of the times the process can be expected to be cyclical. In a pure cyclical process the 4 phases neatly succeed each other, and after successful implementation of measures and a management & control period the acquired insights fade away, professional skills decline and new dysfunctionalities appear. Then likely the process cycle starts again. In practice it also may happen that any of the phases are not completed and that the cycle stops on the go, e.g. when other priorities are chosen, staff is pulled out of the process and a period of relative inactivity happens.

c. Pillars of the institutional framework
Although there may be other useful classifications, I choose to use the Sauter and Tight (2010) list of system input[572] components, because it comprehensively covers the institutional framework as a system, and discerns components which are evidently crucial for the effectiveness, efficiency and fairness of interventions in the W+S system. The model was extensively contemplated, amended and finally accepted in the PQN project. However, following Winsemius' Policy Life Cycle model and the Policy Life Cycle critical steps model presented above, I will use slightly different headings and sequence. The following institutional framework *policy pillars* are discerned:

a. Leadership
b. Knowledge & Professional Skills[573]
c. Strategies & policies
d. Resources
e. Co-operation and partnerships.

Below the terms used are defined and key features to be considered in analysis of the institutional field are identified.

[572] In this case 'input' refers to input towards the W+S system, as pictured in the Figure 3.3.
[573] Sauter and Tight (2010) labelled this 'Research & Training'. Following Baart (2012) I find that 'Knowledge & Professional Skills' captures the role of this pillar in the institutional framework better.

a. Leadership
In line with Chemers (1997) and Northouse (2013) this thesis defines leadership as "*a process whereby an individual influences a group of individuals to achieve a common goal*" (Northouse, 2013:5). Leadership can be a characteristic of a person or a lead agency, whereas a leader is a person. The leader is a pacemaker and the life and soul of walkability improvements[574]. It can be said that the main challenges of leaders are 1) setting goals and 2) putting a policy process in motion towards achieving the goals, i.e. making sure that the right things are done. The latter comprises controlling the performance factors organisation (influencing and organising followers), time, money, quality and information (Wijnen et al., 1984). In this regard leadership is mainly about *encouraging and managing people* and *making choices*, and choices inevitably concern both benefits (achieving the aims) and costs (loss of freedom, money, investments, using up resources). As such leading includes morality and ethics (Van Wee, 2011). Leadership is usually associated with system responsibility and accountability for the current state of affairs regarding the system.

Harrigan & Newman (1990) found that inter-organisational co-operation and partnership is based on a) propensity, b) power and c) persistence. Leadership is about leader-follower partnership. *Propensity* relates to why and how much the leader is interested in leadership and to the leader's awareness of W+S matters. Leadership is an aspect of *power*, and it is inseparable from follower's needs and goals (Burns, 1978). Leadership is based on interaction. With regard to achieving W+S conditions change, a leader's power is associated with on the one hand responsibility for W+S conditions and related policy activities, and on the other hand accountability. If leadership is deemed responsible for (some of the) W+S conditions and related policy activities, the contraposition of this responsibility is that a leader can be held accountable for not achieving the issued and/or agreed goals (Rhodes, 1997). *Persistence,* finally, relates to the leader's enduring commitment to change conditions, in our case W+S conditions. In order to achieve aims, leadership needs to convince other policy actors, and needs to be *persistent*, even when the political decision to implement interventions has been passed long ago and achieving the aims is mainly a matter of management and control.

The explorative study (see Appendix 9, Section 2.1) concludes that the following matters regarding leadership are likely to set the stage for effective and efficient policy making and implementation:

- Leadership is necessary for 1) setting goals and 2) putting a policy process in motion towards achieving the goals. In this regard leadership is about choices and to make improvements happen. This means that the existence of leadership and its distribution are key factors for policy activities;
- Key characteristics of leadership are a) propensity, b) power, and c) persistence (Harrigan & Newman, 1990);
- Leadership is based on awareness and commitment, i.e. an emotional load regarding the W+S subject, and felt responsibility and accountability. If not properly informed by advisors, stakeholders and partners about true W+S conditions, improvement options and their consequences, W+S improvements will probably not take place;
- With regard to system interventions the leader is taken to be responsible and accountable for deciding what is important and for setting objectives and targets, deciding on intervention strategies, taking care that preconditions for achieving the targets are met,

[574] In special cases the leader can be the champion, the frontline strategist (see above under 6.2. regarding the playing field).

including the allocation of resources to policy development, implementation and monitoring, and co-operation and partnerships;

- Leadership is most needed in the early and late stages of the policy process, when decisions need to be made. Such decisions will be most effective if they are evidence based;
- The success of leadership is to a large extent conditioned by the maturity of a W+S policy culture which the leader will achieve through persistence, and on how well leadership involves and makes use of external parties (Hudson, 2001);
- Important tasks of the leader are to assure that the right preconditions are shaped, and to outweigh and correct improvement counterforces;
- The degree to which leadership is in control of W+S conditions and performance depends largely on the organisation's W+S policy maturity level.

From the above the author abduces that this thesis' research needs to deal with the status quo with regard to leadership in the W+S institutional framework on the following aspects: 1) leadership propensity[575], power, and persistence, 2) what W+S goals are formulated and decreed, and 3) how leadership is distributed[576].

b. Knowledge & Professional Skills

Weggeman (1997) defines knowledge as K = I * ESA[577]. The K in the formula stands for Knowledge. The I stands for Information, i.e. explicit, encyclopaedic or codified knowledge, whilst the ESA part stands for implicit or tacit knowledge, made up by Experiences, abilities and Skills, and Attitudes, values and norms. Simply put, knowledge is information put into context.

This thesis identifies properties and dimensions of knowledge and professional skills which potentially affect W+S policy development and implementation. These properties and dimensions (substantiated below) concern what relevant W+S knowledge and skills are, acquisition and ownership of knowledge and professional skills, professionalism as an ideology, finiteness and decay of knowledge, context sensitivity, uniqueness of organisational knowledge and skills, and dispersion of knowledge over policy actors.

In this thesis the question *what relevant W+S knowledge and skills are* can only be answered in general terms. W+S policy professionals need to have adequate understanding of the W+S context, policy process and W+S behaviour. This should include their precursors, performance and consequences (strengths, weaknesses, opportunities and threats), and how improvements can be made. As a whole this thesis aims to outline the scope of what matters regarding W+S policy development; knowledge and skills requirements are dependent on the professional's position in the institutional framework, the true impact of W+S performance[578], and his organisation's scope and responsibilities (i.e. span of control).

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575 An image of propensity answers the questions asked in the introduction of section 6.4.2. Theoretical considerations, of how concerned policy actors are about current W+S conditions and (partly) to what degree the critical stages in the change process are passed through.

576 It is perhaps unnecessary to say that there can be different leaders on different W+S areas, like the safety of children, handicapped persons, comfort, network planning etc.

577 Knowledge is more than just adding context to information; in knowledge information is also rated and positioned in a large whole. Therefore the formula K = I + ESA does not do justice to what knowledge encompasses.

578 The question is, however, who assesses what the true impacts are, and to what degree this understanding must be matched by the professional's knowledge and skills.

With regard to knowledge *acquisition and ownership*, properties of knowledge, understanding and professional skills are that these are products of learning, and that only living beings can learn. Thus knowledge and understanding are personal attributes, which cannot exist outside an individual, and cannot be passed on like a physical object; it always involves a learning process. It can 'merely' be stored as information, in systems, machines or on paper. Consequently, as an entity an organisation cannot learn (Weggeman, 1997; Caluwé en Vermaak, 2006). It can however offer opportunities to its staff to learn. Furthermore, as a collection of people aiming at the same targets, people can learn individually and collectively. Accumulated professional skills are an implicit product of what the individuals know about their (W+S) domain, their experiences, learning and education and training. It refers to how familiar the collective staff, as an entity, is with the (W+S) domain. This can be considered an organisational asset. The understanding and skills can be more or less formal or systematic (Meessen, 2007; Weggeman, 1997).

Oxford Dictionaries define 'knowledge' as *'facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject'*[579]. Contrary to what is stated in this definition, in my view there is a difference between 'knowledge' and 'professional skills'. The latter can be taken as a specific type of knowledge which is connected to the application, interpretation and association modes of knowledge (cf. the four modes discerned by Broudy, 1980, cited in Eraut, 1994). For replication, without putting the knowledge in some context, interpretation or association, professional skills generally are less important. I refer to professional skills when specific knowledge and abilities matter. Professional skills connect to professionalism, which according to Eraut (1994) can be taken as an *ideology*. Like all ideologies '*professioanlism embodies appealing values [...] service, trustworthiness, integrity, autonomy and reliable standards; it works in the interest of certain groups [...] while winning the consent of others whose interests are less certainly served by it'* (McIntyre, 1994:VIII).

Other important properties of knowledge and professional skills are 1) that their supply is *not endless*, 2) that they *decay* over time and must be kept to the required standard, 3) that they are *context-sensitive* (De Vries et al., 1993, cited in Meessen, 2007)[580], and 4) that each organisation has its own, *unique characteristic*s (Auée et al., 2001, cited in Meessen, 2007). With regard to W+S policy development and implementation tasks it has to be remarked that W+S relevant knowledge is *dispersed* over many disciplines, persons and organisations. There is no dedicated discipline which covers the complete W+S domain and knowledge needs throughout the policy process. For effective, efficient and fair W+S interventions, at all policy process stages input from a variety of knowledge and professional skills bearers is needed, and this input needs to be organised and supported by leadership decisions.

The explorative study (see Appendix 9, Section 2.2) concludes that the following matters regarding knowledge and professional skills are likely to precondition effective and efficient policy making and implementation:

- Knowledge is information put into context; knowledge consists of bits and pieces of information that are connected to each other by understanding;
- The role of knowledge and professional skills is to position, advance and underpin decisions, implementation and monitoring;

[579] https://en.oxforddictionaries.com/definition/knowledge, accessed 17-11-2017

[580] Under the 'When do W+S knowledge and professional skills come about?' question I discuss process-time-contextual aspects of W+S knowledge and professional skills.

- Knowledge and skills are a product of learning, i.e. personal attributes. When a person leaves the organisation, his knowledge and skills are lost. An organisation itself cannot learn, but it can codify what individuals learned or should learn and it can provide opportunities to learn;
- W+S knowledge and skills are scarce and do not expand easily. As in all other domains it takes years to become an expert;
- Knowledge exchange is crucial. On the international level there are W+S exchange platforms, but nationally such formal knowledge exchange lacks. There is however informal exchange of knowledge;
- Knowledge is can deteriorate over time, and it must be kept to the required standard. Each organisation has its own unique knowledge characteristics;
- W+S knowledge and professional skills are needed throughout the policy process, but the content varies with the stage of the process. Knowledge and skills demand depend on the number and volumes of projects in the domain, existing W+S policy culture, and the urgency of signals from the outside;
- The availability and quality of knowledge and professional skills relate to the maturity of W+S policy culture within an organisation. Demand for knowledge and skills also connects to the policy life-cycle stage, the W+S subdomain, and/or a specific issue in the domain. In the discovery- and political phases there usually is strong growth in what is learned, in the management & control phase the amount of learning fades out. There is a risk of under-attention and decay of knowledge and skills, and thereby effectiveness of the agency;
- Along the policy process the scope of knowledge and skills demand inevitably narrows. With respect to achieving the set aims, there is need to take care that this is kept within acceptable limits;
- The development and care of knowledge and professional skills will be most served by concentration of at least three W+S staff members; scattering staff across the agency or country will decrease learning opportunities and propensity;
- Preconditions for effective and efficient interventions are (1) adequate knowledge on both how the system works and how the system can be improved, (2) adequately educated, trained and skilled staff, and (3) an inviting, mature policy culture which promotes the use of state of the art knowledge.

From the above the author abduces that in this thesis' research the following features with regard to knowledge & professional skills in the W+S institutional framework deserve to be assessed: 1) what sources of information & knowledge exchange W+S policy actors apply, 2) what and how much knowledge the policy actors acquire about how the W+S works and how the system can be improved, 3) how knowledge & professional skills are distributed across the policy domain (positioning, levels of knowledge).

c. Strategies & policies

Oxford Dictionaries[581] define *strategy* as "*a plan of action designed to achieve a long-term or overall aim*", *policy* as "*a course or principle of action adopted or proposed by an organization or individual*", and *programme* as "*a planned series of future events or performances*", or "*a set of related measures or activities with a particular long-term aim*". Both policy programmes or strategies are made up of a number of individual policies and measures, cemented together in an integral plan. In this thesis' view a strategy distinguishes itself by aiming to gain a position

[581] Accessed 29-1-2014

of advantage over competing issues with the objective of best exploiting emerging possibilities. Mintzberg (1978:934) defines strategy '*as a pattern in a stream of decisions'*. McKeown (2015) typifies strategy as a method for shaping the future and achieve goals with available means.

Oxford Dictionaries definition of *policy* can imply that it concerns *'a principle or rule to guide decisions and achieve rational outcomes. A policy is an intent, and is implemented as a procedure or protocol*' (Anderson, 2005, 2011)[582]. According to Dunn (1981:46-47) *public policy* is "*long series of more or less related choices made by governmental bodies and officials*". Strategies and policies both concern plans or approaches (courses of action) that are needed to achieve certain goals. A policy can be based on a long term strategy, but can also concern less ambitious, more 'traditional' or 'fixed' measures, e.g. being a derivative of earlier streams of decisions without a consistent intentional pattern. Ideally both will lead to a coherent set of measures. The term 'strategy' will be used for strategic, long term plans; the term 'policy' refers to mid and short term 'fixed' structure plans and implementation plans.

The explorative study (see Appendix 9, Section 2.3) concludes that the following matters are likely to set the stage for effective and efficient W+S strategies and policies:

- The function and role of W+S strategies and policies are a frame, i.e. guidance and reference, for policy implementation;
- W+S strategies and policies are developed within a W+S policy culture and related to the position of W+S as a policy issue in the Policy Life-cycle. W+S strategies and policies are typically seen as a ‘management & control’ stage issue and are integrated in ‘umbrella’ policies. In special cases, when policy changes are indicated, dedicated W+S policies and strategies will come about;
- All decisions are made within a context. This feature determines opportunities for effective and efficient policy interventions. First of all it streamlines the policy process towards system improvements into a cascade of actions from setting goals to implementation and evaluation of interventions. This is pictured in Van den Top's generic cascade model (Van den Top, 2012). Secondly contexts mould practical options by funnelling degrees of freedom regarding mobility and safety decisions. Thus many fundamental problems cannot be solved on the operational (site, reactive behaviour) level. Consequently it is more effective and efficient to improve conditions 'upstream'. This is pictured in the Hendriks’ Cascade principle (Hendriks et al., 1998);
- There is great variety in policies and strategies. Based on a rough literature scan[583] into typologies of strategies and policies it appears that main distinguishing features are: origin of action idea, subject of the strategy or policy, whose strategy or policy it is, scope, target group and impact, political impact, intervention target, intervention method, tangibility of expected impact, activities;
- The most important policy requirements are: the policy is justified; SMART formulation and scope; it is coherent and consistent; embedded in the legal framework and organisational structures; flexible enough to enable coping with unexpected developments and policy consequences;
- For achieving W+S aims, the lead agency needs co-operation and support of other policy actors’ to develop, instrument and implement W+S interventions;

[582] A policy sets a direction or rule; a procedure outlines the steps one takes to realize the policy or move in the direction of the policy (Anderson, in 2005 and 2011 at https://www.bizmanualz.com/write-better-policies/whats-the-difference-between-policies-and-procedures.html).
[583] Search in Google Scholar on (‘policy’ or ‘strategy’) and (‘typology’ or ‘types’ or ‘classification’).

- A common adage is: do local what can be done local, and do central what needs to be done central. Some strategic policy activities, like legislation, law enforcement policy, research programming, nationwide knowledge management, proceeding against fragmentation are necessarily central tasks;
- The success of W+S policy implementation depends on the degree to which preconditions for achieving the decreed targets are met, purposeful measures are taken and implementation adapts to unforeseen and changed conditions and effects. Quality control of the W+S strategies and policies is helped by ex-ante evaluation of proposals. Evaluation should cover effectiveness regarding aims, efficiency of policies and fairness of interventions and their impacts.

From the above the author abduces that in this thesis' research the following matters with regard to strategies and policies in the W+S institutional framework deserve to be assessed: 1) what kinds of visions, strategies, policies and concrete measures are in fact issued and/or implemented, and 2) how do these activities compare to the proposed System approach criteria of a systematic process, comprehensive analysis and integral intervention strategies and 3) how can the policy activities be positioned in the policy life cycle?

d. Resources

In Oxford Dictionaries[584] the concept of resources is defined as "*a stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively*". It can also mean "*a country's collective means of supporting itself or becoming wealthier, as represented by its reserves of minerals, land, and other natural assets*", or "*personal attributes and capabilities regarded as able to help or sustain one in adverse circumstances*". In this respect resources concern the means, help and tools to support leadership, policy decisions and achieving the goals laid down in the policies and strategies. With regard to improving W+S conditions, the function of resources is to help provide building blocks for the creation of opportunities for policy development, implementation and evaluation.

The explorative study (see Appendix 9, Section 2.4) concludes that the following matters regarding the deployment of resources are likely to precondition effective and efficient policy making and implementation:

- The function of resources is to help provide building blocks for the creation of opportunities for policy development, implementation and evaluation;
- In principle there are three kinds of resources: hardware, software and orgware kinds;
- What resources are de facto needed, depends on the characteristics of the strategy or policy: its domain, scope of the plan, the volume of deployment, type and complexity, alternatives, synergy demands etc;
- New W+S policy initiatives at the national level can start from the availability of (statistical) data on W+S, urgent calls from the general public or W+S domain, and monitoring. For this end software kind resources can be of vital importance;
- For national level policy making and improvement integrated in 'umbrella' policies and projects, resources of the orgware kind, particularly funding and staff, are generally most suitable. Most effort and energy can be expected to be spent on standard procedures, i.e. keeping up, repairing and integrating W+S facilities and services;

[584] https://www.lexico.com/definition/resource, accessed 1-10-2020

- In most cases W+S quality can be improved substantially with relatively small (additional) budgets. Fitting in the measures can be a great challenge. W+S knowledge and professional skills, however are critical for the quality of the action;
- Contrary to other resources, knowledge and professional skills grow with the volume of deployment (Weggeman, 1997; Hudson, 2001). Consequently decentralisation or scattering of staff can be expected to be counterproductive, inciting 'reinventing the wheel', and ineffective and inefficient 'trial and error' actions;
- In practise it is difficult to identify how much of the budget is (to be) spent on management and improvement of W+S conditions. This weakens the argument for such actions;
- Forceful preconditions for deployment of W+S policy resources can be shaped at the national level. On the national level feeling responsible and accountable is not obvious, weakening the urgency and grounds for justification of investments at the local level. Deployment of resources is subject to perceived responsibilities and accountability.

From the above the author abduces that in this thesis' research the following matters with regard to deployment of resources in the W+S institutional framework deserve to be assessed: 1) deployment of resources, 2) distribution of applied resources across the domain, and 3) to what degree preconditions are shaped at the national level.

e. Co-operation and partnerships
According to Oxford Dictionary[585] *cooperation* "*is the action or process of working together to the same end*". Co-operation can grow to *partnership* by agreement, when the co-workers agree to work closely together in an undertaking, like a project or an organisation, and share risks and profits. Oxford Dictionaries define partnership as "*1. [mass noun] the state of being a partner or partners" and "2. an association of two or more people as partners*". Based on a literature review Brinkerhoff defines the ideal type of partnership as follows:

> *"Partnership is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labour based on the respective comparative advantages of each partner. Partnership encompasses mutual influence, with a careful balance between synergy and respective autonomy, which incorporates mutual respect, equal participation in decision making, mutual accountability, and transparency."* (Brinkerhoff, 2002:216)

In practise partnerships will not totally comply with the ideal type as formulated by Brinkerhoff. Furthermore, the justification for entering a partnership is subjective and value based; this can change in the course of time.

With regard to W+S, co-operation and partnership take place in a policy network, and can be seen as a special kind of functioning in such a network. Van Waarden (1992) discerned seven dimensions describing policy networks, which may also be presumed to *typify* co-operation and partnerships. The seven dimensions are: *1) number and types of actors, 2) function of networks [read: co-operation & partnerships], 3) structure, 4) institutionalisation, 5) rules of conduct, 6) power relations, and 7) actor strategies* (Van Waarden, 1992:29).

Co-operation can be *positioned* regarding its level of endeavour of collaboration. Based on literature, Horwath & Morrison (2007:56) discerned five levels:

[585] https://www.lexico.com/definition/cooperation, https://www.lexico.com/definition/partnership, accessed 29-1-2014

1. *"Communication: individuals from different disciplines talking together.*
2. ***Co-operation**: low key joint working on a case-by-case basis.*
3. ***Co-ordination**: more formalized joint working, but no sanctions for non-compliance.*
4. ***Coalition**: joint structures sacrificing some autonomy.*
5. *Integration: organizations merge to create new joint identity."*

The levels 2, 3, and 4 (typed in bold) fall within our definition of co-operation and partnerships. The lowest level of collaboration concerns *communication*.

The explorative study (see Appendix 9, Section 2.5) concludes that the following matters regarding co-operation and partnerships are likely to affect conditions for effective and efficient policy making and implementation:

- Co-operation and partnerships are specific forms of collaboration, where policy actors join forces, but do not give up their identity and independence. The difference between co-operation and partnership arrangements is that the first is limited to case-by-case working together, and in partnership co-ordination is characteristic;
- The function of co-operation and partnerships is combining individual spans of control to a greater whole, with better chances of achieving the aim of improving W+S conditions;
- The main reasons for entering in a co-operation of partnership are: 1) there is one or more shared reason for W+S policy activity, plus 2) the policy actors do not themselves have full control over the matter, plus 3) the policy actors expect to achieve their aims at tolerable effort. Furthermore, the co-operating agents must have an optimal mix of propensity, power and persistence;
- Success factors for co-operation and partnerships are *'trust, confidence, senior management support, ability to meet expectations, clear goals, partner compatibility and conflict* [management]*'* (Brinkerhoff, 2002:221/223);
- There are two main levels of collaborating policy agents: management (leadership) and operative (staff);
- Co-operation between the lead organisation and facilitator organisations are more obvious than co-operation between the lead and/or facilitator organisations with client organisations. This is particularly due to the low degree of organisation of client groups;
- Horizontal co-operation is primarily based on expected synergy of aims, whilst vertical co-operation is dominantly based on synergy in effort (where leadership support really matters);
- The playing field regarding W+S policy development consists of clients, strategists and facilitators. Strategists can make use of signals from various types of users and facilitators to develop W+S policies;
- What interventions a stakeholder can initiate or implement, depends on his span of control, which is not a fixed power. The latitude which a policy agent takes primarily depends on what he perceives to be his span of control. What is exercised will usually be less than what is potentially available;
- For establishing co-operation or partnerships a precursory task is to find out what policy actors there are in the W+S domain. A practical way to do this is to carry out actor analysis;

- Critical factors for setting up and maintaining partnerships are '*expert preparation, right underlying objectives,* [development] *structure, effective and efficient actions, and sustainable nature of the partnerships'* (Augustyn, 2000:344-351);
- When the lead organisation wants something done the other policy actors need to be persuaded. In many cases there are resistance and hurdles to co-operation to be taken (Knowles, 2003); in most cases some kinds of inducements ('carrots') and/or threats ('sticks') are needed to persuade policy actors into action.

From the above the author abduces that in this thesis' research the following matters with regard to co-operation and partnerships in the W+S institutional framework deserve to be assessed: 1) abilities and willingness to co-operate, 2) inducements and threats for enticing co-operation, and 3) distribution of co-operation arrangements.

6.5.3. Results

Having broadly explored the W+S policy context, the playing field, what the main pillars of policy making and implementation are, and what theoretically major success factors for achieving improvements are, a foundation is laid for the assessment of the status quo of the Dutch W+S institutional framework. The results (Subsection 6.5.3) and conclusions (Subsection 6.5.4) with regard to the raisons d'être of the organisations and the above abduced research questions regarding the policy pillars are presented in this Section 6.5, featuring strengths and weaknesses in the institutional framework. In the next Section 6.6. conclusions regarding institutional improvement potentials are drawn.

In advance it needs to be remarked that this thesis chapter's research has important limitations. The research cannot be expected to yield comprehensive insights and full coverage of the domain for two reasons.

Firstly, the study into the status quo of the institutional framework concerns explorative and qualitative research. This approach is chosen because of the weak foundation of knowledge about the W+S domain and its activities. No systematic research is found about the status quo of Dutch and other country's policy aims and activities regarding walking and sojourning in public space[586]. It is known that explicit W+S policy making is quite rare, but it is unclear what factors cause this absence of dedicated W+S policies. In such a case explorative and qualitative research approaches are a more logical choice than quantitative policy evaluation approaches.

Secondly, the study does not concern a representative sample of policy actors, but has a focus on a selection of front runners. It is found (see Section 6.4) that there are many potential players in the field; the numbers of potential strategists, client representatives and catalysts are rather limited; the numbers of (potential) facilitators however are way beyond the author's capacity to interview representatives of all such organisations. The most important group of facilitators are municipalities, of which there are 388 (1-1-2017) in the Netherlands, of which only a minority can be considered to be an active player in the field of W+S. In 2014 the author interviewed a selection of municipalities in the context of research for bicycle safety policies. The opportunity was used to subsequently ask questions regarding walking and sojourning policy activities. It proved to be pointless to draw a representative sample of municipalities to be interviewed on W+S policy activities. Municipalities which were not actively engaged in W+S policy making could not inform about their choices and experiences in this regard. The

[586] This can be concluded from the searches carried out for the above sections 6.3.3a, d, f and g.

same applies for other facilitators like consultants, public transport companies and road building and greenery contractors. Therefore it was decided to aim for (almost) full coverage of strategist, client and known catalyst organisations with regard to W+S, and to limit the facilitators interviews to active policy actors only. Also the focus was on looking for deliberate and fruitful approaches and experiences, opportunities, experienced obstacles and threats to effective W+S policy making and implementation.

This section presents results from analyses of 33 policy actor interviews and dossiers arranged under six headings[587]: basic information about the organisation's origins and raisons d'être and the five policy pillars 'leadership', 'knowledge & professional skills', 'strategies and policies', 'resources' and 'co-operation and partnerships'. Main results from this research are presented below.

a. Raisons d'être of organisations

With regard to *raison d'être* information was gathered about the reason for existence, their territories, the importance of W+S for the organisations and the domain links of the organisation, in what stages of planning processes the organisations are active, and the types of actors. The results for these aspects are presented below.

Raison d'être

As for raison d'être, governmental policy actors have a formal duty to take care of pedestrians[588]. The other organisations have a duty by their own choice. Client NGO's and the interviewed consultancy agency have formalised their raison d'être in their mission statements; for the other organisations the affiliation to W+S springs from their key tasks.

With regard to W+S in 2016 there were seven key strategic policy sections in the national government[589]. On the local level municipalities put effort in providing and sustaining pedestrian facilities[590], but only seven of them have been found to have developed explicit W+S policies[591]. In 2019 this changed for the better, when the Ministry of Infrastructure and Water Management appointed a quartermaster for pedestrian policies, and a Platform Room for Walking (NL: Ruimte voor Lopen') was established.

With regard to private organisations, key client organisations and knowledge institutes[592] have been interviewed. Two commercial policy actors (one consultant[593] and one public transport (rail) enterprise) were interviewed, both of whom explicitly linked W+S to their raison d'être. Two other public transport enterprises (bus, tram) were approached, but could not be interviewed due to lack of time and priority on their side. These enterprises indicated that regional and local authorities are conceived to be responsible for the reachability and

[587] In Section 6.1.c the research approach is described.

[588] Governmental tasks are captured in legislation; local government owns public space, regulate its use. Central and regional government issues strategic policies and formal planning.

[589] All of them are interviewed.

[590] Municipalities provide, maintain and manage use of the local road network and public spaces.

[591] Nine municipalities have been interviewed, including two without explicit W+S policies.

[592] Central governmental knowledge institutes established to advise central government (i.e. Mobility Knowledge Institute KiM), Central Planning Bureau CPB, Social and Cultural Planning Bureau SCP, and the Knowledge Institute Environment & Health (RIVM)) are not included as they do not directly advise the domain.

[593] The interviewee at the professional education organisation is also a very active town planning and transport consultant focussing on vulnerable road users; furthermore, there are a number of medium and large consultancy firms which when asked advise on walkability.

accessibility of public transport stops; W+S are taken to be outside their span of control. Consequently no direct insight in a relevant perspective, bus- and tram service providers, could be included. Indirectly insights were however acquired through input from local authorities.

Types of actors
Six of the interviewed organisations are classified as strategist, 12 as facilitator on the tactical-operational level, eight of the organisations are classified as client organisations and focus on promoting user interests and seven are typified as catalyst, incidentally promoting W+S interests.

Territory
Three of the interviewed organisations operated on the European level, 22 on the national level, 8 on the provincial level and 25 on the local level. 16 of the organisations operated on multiple territorial levels, whilst 17 operated on one territorial level exclusively; SWOV and Wandelnet operate on all territorial levels. MenS, ANBO, the Police, Public Prosecutor, CROW work on the national, provincial and local levels; Molster Advies, ANWB, NHTV/SOAB[594], NS, VVN, Knowledge Centre Sport, Visio work on national and local territorial levels; municipalities and ministries operate on their own territorial level.

The importance of W+S for the organisation
Three of the organisations were specifically established for looking after the interests of pedestrians (MenS, Wandelnet, Molster Advies); two of the nine included municipalities had special organisational units for walkability matters (Utrecht, Amsterdam). For the other organisations walking and sojourning in public space is bycatch or an extra duty, integrated in regular work of the organisation focussing on e.g. mobility, traffic, traffic safety and town planning, public space management or health care.

b. Leadership

In this paragraph the results of analysis of the policy actors' interviews[595] and dossiers regarding leadership propensity, power and persistence, goals and the distribution of leadership are presented. From these accounts it will become clear what the status quo is with regard to leadership propensity, power and persistence and what goals the policy actors employ and how leadership is distributed across the domain.

b. 1. Leadership propensity
From this thesis' theoretical considerations regarding critical steps towards improvement and the leadership pillar of the institutional framework (Section 6.5.2a, b and c) it can be concluded that in theory W+S Leadership propensity is built on awareness and willingness to improve W+S conditions; awareness starts from knowledge about the status quo and 'critical mass' of the weaknesses and threats in the system. Indications for W+S leadership propensity are found in active policy actor's dossiers containing the organisations' public statements in publications and websites and interviewee accounts about the organisation's access to information about W+S conditions, the applied guiding models, its backgrounds, which persons or organisations are pointed out to be key policy actors and why specific guiding models, objectives, targets and strategies are chosen.

[594] The interviewee is both professor at Breda University (NHTV) and the consultancy firm SOAB. Her statements represent both affiliations.
[595] The list of questions used for the interviews is included in Appendix 3, section 3.2.

With regard to access to knowledge about the status quo of W+S conditions the European Commission, central government and nationally operating organisations have a head-start compared to local government. Data and research about current conditions are more readily available on the national than on the local level: on the national level a variety of statistics are compiled by CBS (Statistics Netherlands) and the many national research and knowledge institutes; research programming takes place mainly on the national level; scientific and specialists publishing and the media are organised on the national and international levels. On the other hand concrete calls about walking conditions to be improved mostly come from citizens via (digital) municipal complaints offices. Six of the local government interviewees mention that such concrete complaints are dealt with directly by the city's neighbourhood teams, meaning that they often do not reach local leadership.

The interviews confirmed that in general the European Commission and national organisations are better informed about walking problems than most local organisations. The European Commission and Dutch ministerial policy departments are indeed aware of mobility and road safety shortcomings and the health advantages of increased walking. Deficits and benefits of sojourning in public space and the vast problem of pedestrian falls however stayed under the radar of the Ministry of Infrastructure and Environment. Sojourning in public space (liveability) is an emerging policy issue at the Ministry of Interior; the Ministry of Welfare, Health and Sports pays attention to the promotion of active modes and the prevention of falls. Both the European Commission and the ministries however indicated not to be interested in taking the lead with regard to the W+S domain. The European Commission feels obliged to limit their initiatives to matters regulated in the Treaty on the European Union, obeying the subsidiarity principle and agreed definitions, dictating that the European Commission will not take up matters that can be dealt with by national states. The central government takes the position that dealing with walking and sojourning in public space is a decentralised issue and thus a local government responsibility[596].

On the local level indications of awareness and willingness to act are present in the dossiers of the municipalities of Utrecht, Amsterdam, Eindhoven, Rotterdam and The Hague. In these municipalities awareness of W+S conditions was fed by dedicated studies showing urgent walkability problems and picked up by aldermen of the cities. In Heerhugowaard civil service has developed policies with regard to street crossing, which are tolerated but not actively supported by the town council. It can be assumed that in most other municipalities walkability and sojourning in public space policy and measures are essentially reactive to concrete signals from citizens and local organisations.

Based on the information from the interviewed policy actors policy culture scores were attributed to the organisations. For the scoring an adapted version was used of Hudson's diagram and explanations ('*The evolution of safety culture – it is a long way to the top'* (Hudson, 2001:30); see also Appendix 9, Section 2 Explorative Policy Pillars study). The meaning of the scores in this thesis is presented in Table 6.4. These scores broadly indicate attitudes towards taking initiatives to improve walking and sojourning conditions. In principle six levels are distinguished and awarded. There were some doubtful cases where professionals score higher than their formal leaders. In those cases halfway scores are awarded. In Figure 6.4 the scoring results are displayed.

[596] In 2019 this position changed as the ministry of Infrastructure and Water Management, together with Wandelnet and CROW, took the initiative to establish a Platform Ruimte voor Lopen (~Room for Walking) and appointing a quartermaster to prepare for a policy department on Walking.

On the lowest level W+S policy culture, denial, there is no intention whatsoever to improve walking and sojourning conditions. None of the interviewed organisations move on this level. There are however several organisations, particularly on the national level, which have a pathological attitude, who did express not feeling responsible for W+S matters. Ten of the 33 organisations are typified as 'reactive', which indicates that they expressed to value walkability, but only take measures when they are called to do so. In two cases the interviewed professionals indicated to have actively tried to do more than just react to complaints, and therefore were scored halfway to the next, calculative, level. Twelve of the 33 interviewed organisations score at a calculative culture level, meaning that they value walkability and that they take measures to remedy reported deficits when they have signals that improvements are cost-effective. In one case the professionals rather wanted to be pro-active, which was not supported by formal leaders, thus qualifying for a halfway up score. Another five organisations are scored at the pro-active policy culture level. These organisations value walkability and actively look for improvement opportunities. None of the interviewed organisations score at the highest level, where walkability is seen as a source of wealth and health, and without question everything possible is done to support walking and sojourning, as this is the proper thing to do. This would have been the case if such an organisation applies quality control systems for W+S policies like quality circles complemented with management procedures, training and resources to optimally support quality improvements[597].

Table 6.4 Policy culture – attitudes towards W+S (adapted from Hudson, 2001)

0	**Denial**	Not my problem, pedestrians can fend for themselves
1	**Pathological**	We do not feel responsible for W+S, it's not our plate. It is unimportant. As long we are not summoned or sued and our public image stays unblemished, we do not feel the need to take action.
2	**Reactive**	W+S is important, but as long as we do not get complaints or clear signals from the outside, we do not concern ourselves with it; we do not have active (written) policies on W+S, but we follow general guidelines.
3	**Calculative**	W+S is important, we have signals that improvement is needed, we develop or have active policies.
4	**Pro-active**	W+S is important, we have improvement policies and we actively look for improvement opportunities.
5	**Generative**	W+S is a source of wealth and health and we treat it like that.
In Appendix 9 of this thesis, Section 2 the scheme is exemplified.		

Figure 6.4 shows that high-scoring organisations are to be found in the health and sports domains rather than the traffic, traffic safety, transport and the physical environment domains, where W+S is 'officially' positioned. Large municipalities score much higher than ministries; it looks like W+S promotion is better off with local authorities than central government. Large municipalities also score better than mid-size and smaller municipalities. Large municipalities have better insight in the domain: issues there are more clear and manifest; they have more reason and opportunity to actively measure and research local conditions; staff is better educated and experienced in acquiring insight and overview; political interest is more focussed and less integrated in larger policies. In smaller municipalities 'small things' get lost in the greater whole because there is too little staff to assign a special section or person to cover this subject.

[597] see http://www.economist.com/node/14301388

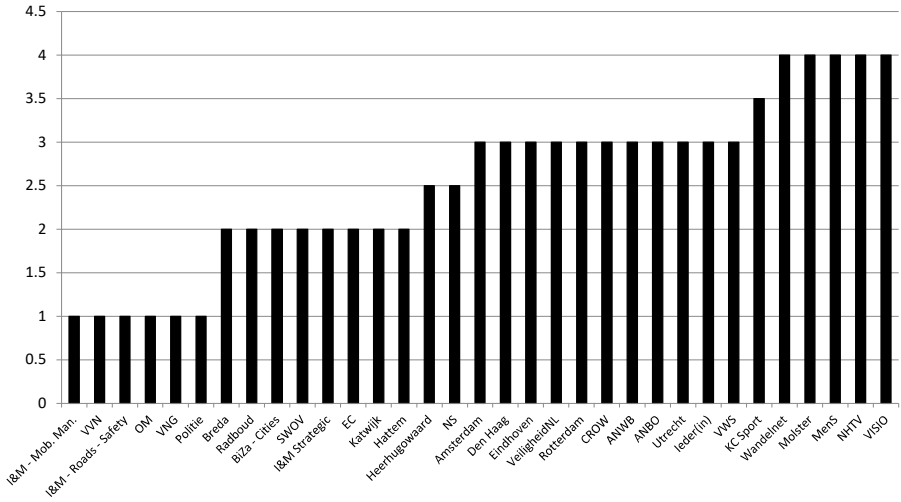

Figure 6.4. Policy attitude towards W+S – scores of interviewed organisations

b.2. Leadership power

Leadership can be associated with a number of powers, such as position in the field, political and legal power, the power of staff and budgetary mass, attributed skills and being informed, personal powers. From the responses in the interviews it showed that with regard to position in the field (as strategists), political and legal power, mass of staff and budgetary mass, the European Commission and the ministries are much esteemed, whilst NGO's have little power in this regard, because they are on the asking (perhaps even 'begging') side, and others have little to fear from them except bad publicity. On the other hand, the NGO's are very well informed, persistent and resourceful, but others don't want them to be in the lead. Also, the European Commission and ministries (and law enforcement organisations) renounce W+S responsibility: they do not want to be in the lead.

With regard to getting things done, municipalities score highest. Front runners amongst them aspire an exemplary role, which is gladly granted by other municipalities, the European Commission and the ministries, but they have no (political) power over others. They can be in the lead within their territory, but not outside.

The NGO's MenS and Wandelnet and some of the interviewed advisers (University of Breda [NHTV/SOAB], Molster Advies, CROW) prudently take initiatives, but none of them has the ambition or power to be in the lead of improving W+S conditions[598].

b.3. Leadership persistence

Leadership persistence can only be a factor if there is a leader and the leader has issued his strategies some time ago. Although not in the lead, only the University of Breda (NHTV/SOAB), Wandelnet and MenS can be considered persistent. Their staff has been active in the domain for decades; as a successor of the Dutch Pedestrians Association MenS volunteers

[598] Ineke Spapé (NHTV/SOAB) summarised leadership positions as follows: "Central government does not take the risk; municipalities do not feel the need; CROW and NHTV prudently take initiatives; client organisations do not have the power …"

are quite active despite the fact that all financial means have been taken away. The most persistent municipality appears to be The Hague, building their walkability activities on the still actual policy note 'De Kern Gezond' (English: 'A Healthy City', The Hague, 1988). Policy activities of Utrecht, Amsterdam and Eindhoven are based on more recent policy choices (respectively 2012, 2012 and 2013). Most of their plans (in 2016) are still in the development and early implementation stages.

b.4. Goals

At the European and national levels goals relate to the policy sector of the Directorate General or ministry. From the interviews it appears that the pecking order is 1) economic affairs, 2) mobility, 3) road safety (limited to crashes involving vehicles), 4) environment (pollution, exhaust gasses, CO_2, NO_X, particles, noise), 5) health (promotion of active modes).

With regard to walking and sojourning ten of the interviewed organisation formulate specific goals. Specific goals were formulated by the municipalities Amsterdam, Breda, Eindhoven, The Hague, Rotterdam, Utrecht and NS (Dutch Railways), Wandelnet, MenS and Molster Advies (see Table 6.5).

Table 6.5 Specific goals formulated by interviewed policy actors

Policy actor	Goal
Amsterdam	Optimal pedestrian facilities; high quality streets and squares
Breda	More space for pedestrians in the inner city
Eindhoven	Balanced approach to all modalities, including pedestrians
The Hague	Crossable streets; less cars on the street; traffic calming in neighbourhoods
Rotterdam	Longer stays of visitors in the inner city; attractiveness of the city centre (for economic reasons)
Molster Advies	The pedestrian central in advise and design
MenS	Increased attention to walking; promotion of Woonerf; safe walking conditions
NS	Client satisfaction; Priority for pedestrian in trips to and from stations
Utrecht	Improvement of walking climate, safe city for pedestrians
Wandelnet	Adequate facilities for people on foot; increased attention to utility walking

The 23 others took W+S as a means to achieve higher order goals or simply something to be taken care of. In this context the health sector (Ministry of Welfare, Health and Sports, Knowledge centre Sports) aims at achieving suitable opportunities for healthy and active living, safety organisations (SWOV, VVN, Ministry of Infrastructure and Environment, VeiligheidNL) aim at less casualties, organisations for the handicapped (Ieder(in), Visio) aim at participation. For others W+S is just something that should be taken care of (ANBO, CROW, Ministry of Infrastructure and Environment [now called Ministry of Infrastructure and Water Management], Ministry of Interior, the Police and the Public Prosecutor).

b.5. Distribution of leadership

In principle leadership can arise from all four kinds of policy actors. The *strategists* European Commission and ministries are not interested in taking the lead. Respondents from local authorities indicated that it would perhaps be good if central government would give some guidance; paradoxically in general local authorities are not keen on being guided by central government.

Amongst *facilitators* leadership initiatives are connected to clear signals regarding impacts of walking and sojourning problems, originating from internal policy studies and numerous complaints from citizens and commercial stakeholders. In this regard the municipalities of Utrecht, Amsterdam and Eindhoven take up a leadership role locally. In most municipalities the Mayor and Aldermen decentralised operational leadership with regard to walkability to the neighbourhood teams. These teams have been allotted a budget to react independently to complaints from citizens and solve maintenance problems.

Client representatives try to get attention for walkability problems whenever they can.

Amongst known potential *catalysts* there is also reserve to take initiative, as (some) walkability problems conflict with internal traditions and competitive key issues in their portfolio.

Another perspective regarding the distribution of leadership is who the various policy actors see as the key player in the domain, including their own organisation. In total the 33 interviewed policy actors casted about three nominations each, in total 94 nominations. National government received most nominations (18 of the 33 respondents), NGO's and the business world each received 11 nominations, municipalities 10, citizens 9, public transport 7, visitors 6, board of directors 7, supervisory boards 5 and commissioning organisations 5.

In sum, there is no clear leadership or 'champion' in the W+S domain. Strategists are nominated as such, but do not accept this leadership, facilitators are not keen to be followers and rather would do things on their own, clients (NGO's), and some catalysts (CROW, VeiligheidNL, Knowledge Centre Sports) and front-running consultants try to set an encouraging stage, but do not see themselves as the leaders.

c. Knowledge & professional skills

In this paragraph the results of analysis of the policy actors' interviews and dossiers regarding knowledge & professional skills are presented. From these accounts it shows what the status quo is with regard to sources of knowledge & professional skills exchange, the status quo of knowledge & professional skills about how W+S works and how it can be improved, and distribution of knowledge & professional skills.

c.1. sources of information & knowledge exchange

In most of the interviews the subject of sources of information for policy making was touched on. In general use of sources, such as those mentioned in Section 6.3.3 on the technical environment, depends on time available and level of knowledge and skills for focussing the search for information[599]. An obstacle in this regard is that knowledge about W+S is limited (see below).

For *strategists* reports and strong cries of distress in the media, eye-catching research reports, statistics ('facts and figures') and strategic consultative structures are considered the most significant sources. Apparently no publications or initiatives have yet scored in this respect[600].

[599] 'one only finds what one is looking for'.

[600] The PQN publications, the WALK21 conference and a VeiligheidNL report on elderly travel casualties (alarming conclusion 100% increase in number of hospitalised pedestrian casualties in 6 years), although initiated and funded by the Ministry of Infrastructure and Environment have not been picked up by internal policy makers and politicians.

As regards *facilitators*, particularly municipalities, complaints from citizens and businesses trigger repair and maintenance activities as well as reconstructions of problem locations, such as dangerous pedestrian crossings and bad or missing links in the network. Local consultative structures[601] and traffic accident databases (VIA-database and software) are also widely used. In some cases internal explorative exercises, student's essays or talks with consultants triggered strategic thinking (Amsterdam, Utrecht, The Hague, Rotterdam, Eindhoven, Heerhugowaard, Breda). The largest municipalities have internal statistical departments who actively collect data on various aspects of behaviour, such as use of space, mobility, safety, producing reports to be used in policy making. For developing plans for countermeasures CROW guideline publications are said to be widely consulted. Occasionally reports in specialist media, publications and presentations by champions (e.g. WALK21 and other conferences[602], symposia, MenS network meetings) help to set the stage for changes.

Client organisations are chiefly informed by their members or other target group representatives, their networks, statistics and the internet, general and specialist media, policy literature and consultative structures.

Catalysts are informed by their own research, experiences, statistics and internet, specialist and scientific literature and their network contacts, often both international and national level.

With regard to findability and accessibility of information about walking and sojourning in public space it has to be mentioned that common definitions and interpretations of key concepts regarding walking and sojourning in public space obstruct adequate insight in major walking and sojourning problems, hiding e.g. sub-modal trips on foot, sojourning activities, injury incidents not involving vehicles (pedestrian falls). A short article raising these matters is published separately in the Journal of Transport and Health (Methorst et al., 2017a).

c.2. knowledge about how W+S works and how it can be improved

The central question in this paragraph is what knowledge and professional skills are available for application in organisations. This question is answered from replies from interviewed persons and not from dedicated knowledge tests, and therefore cannot be more that an mere indication of the status quo.

As there is no dedicated academy or course on walking and sojourning in public space and the subject is subordinately present in curricula for education of future transport and town planning professionals, such knowledge and professional skills need to be acquired by self-education through professional experiences. The best experts in the field are self-educated by years of experience. Apart from those few[603], all practitioners in the domain have less than two or three years full-time equivalent experience (see also below under Resources). Apart from the large municipalities, where W+S is dealt with in multidisciplinary and multi-person project groups and the specialised NGO's where practitioners are (almost) full-time involved in W+S related activities, most practitioners and consultants are not in the position to become an expert in this field; their low 'exposure' is not enough to acquire knowledge and skills and keep them up. It is also not enough to support high level W+S policy cultures and resilience.

[601] committees including the police, local businesses, various NGO's, particularly handicapped persons

[602] Most traffic conferences nowadays have special walkability sessions. Both in 2016 and 2017 special symposia on walkability have been organised in the Netherlands.

[603] Such experts are known to be employed by NHTV/SOAB, CROW, MenS, Molster Advies, The Hague, Amsterdam, Rotterdam, and Wandelnet. Utrecht, Eindhoven, Heerhugowaard, Knowledge Centrum Sports, Ieder(in) come close.

With regard to W+S, organisations chose their own scopes. As far as the author knows there is no Dutch organisation specialised in overview and integration. In Figure 6.5. the distribution of scopes is pictured; 14 organisations limit their scope to one perspective. Municipalities focus on the physical environment and their city centres mostly. Ministerial agents focus their policy domain, e.g. mobility, traffic safety, sports/physical activities, physical environment, enforcement. NGO's also specialise in scopes e.g. walkability, rambling, traffic safety, traffic behaviour, accessibility/handicaps. Knowledge institutes focus on knowledge, policy and advise. The ministries, law enforcement and the association of municipalities more or less renounce responsibility for W+S and do not keep up their knowledge concerning the field.

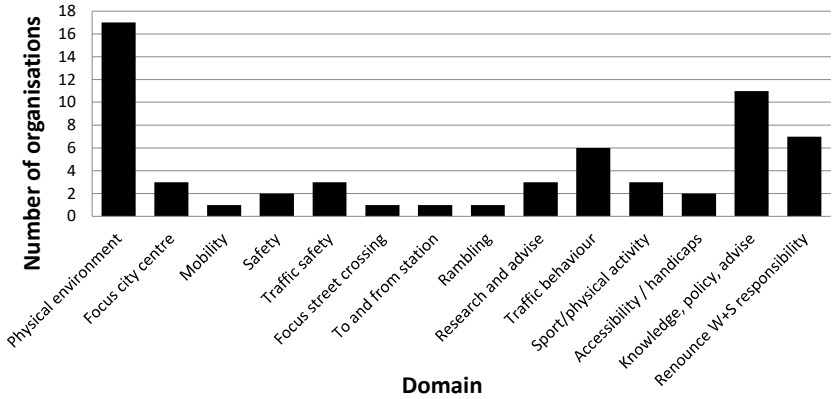

Figure 6.5. Main scopes of the interviewed organisations

c.3. distribution of knowledge & professional skills

Organisations do not actively and professionally communicate on matters outside their domain. From the above it is apparent that even within subdomains knowledge and professional skills are not evenly distributed across the field. Although municipalities are (implicitly) assigned most responsibility regarding walking and sojourning conditions, most of them cannot be expected to have the necessary knowledge and professional skills. A small group of (relatively) large municipalities form an exception. There are a few consultants that can adequately support municipalities; NGO's, who are best equipped with W+S knowledge and professional skills can also stimulate and selectively support municipalities. Apart from CROW and VeiligheidNL, catalysts have not excelled in W+S knowledge. Strategists neglect the domain.

With regard to W+S expertise crude scores were calculated to pinpoint the status quo of this policy pillar. The scores are calculated as follows. First the *number of experiences* per year are categorised into 'hardly any (< 1x)', 'Sometimes (1–5x)', 'Regularly (6-10x)', '(Almost) weekly (11-50x)', '(Almost) daily (51-250x)' and scored 1 – 5 points. *Years of experience* and *domain coverage* were scored likewise. The categorisation of years of experience was 'None, superficial', 'Beginner', 'Advanced' and 'Expert'; the categorisation of coverage was 'single issue', 'single domain', 'multi domain', 'strategic policies'. The scores of the three aspects were summed into a total expertise score per organisation (see Figure 6.6).

The table on knowledge and professional skills scores of the 33 interviewed organisations is put in Appendix 7. It has to be remarked that, because the author has no information on their professional skills, the skills of neighbourhood teams are not included in the scores.

Figure 6.6. shows that the Public Prosecutor and the Police score lowest on W+S expertise with regard to W+S professional skills, whilst the dedicated W+S NGO's score highest. Small municipalities score lower than the large municipalities. Apart from CROW and NHTV/SOAB knowledge institutes score relatively low on W+S knowledge and professional skills.

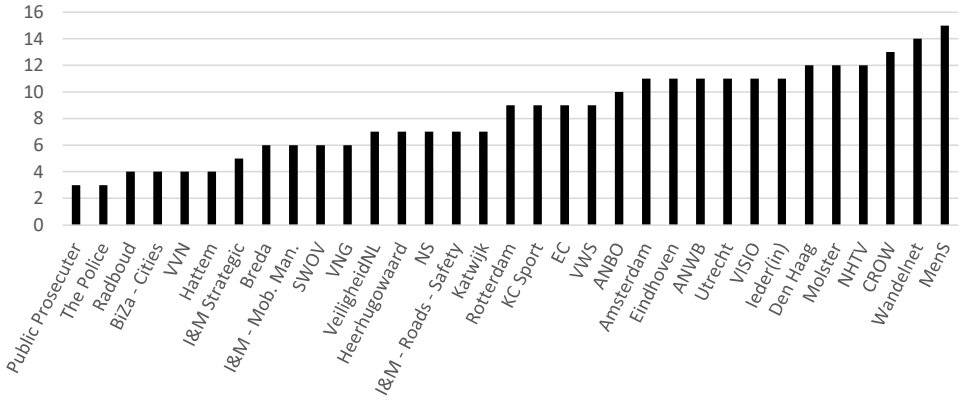

Figure 6.6. Interviewed policy actors – W+S expertise Scores

d. Policies and strategies

In this paragraph a concise overview of visions, strategies and concrete policy activities within the domain, drawn for policy actor interviews and dossiers is presented. These policy activities are then related to how they compare to the proposed System approach (cf. Section 3.2.2.).

d.1. The distribution of W+S policy activities

In principle four levels of activities can be distinguished: visions, long-term strategies, mid and short-term policies and concrete (operational) activities. 13 of the 33 interviewed organisations mentioned leading visions or general guiding principles, 12 are found to have long-term strategies affecting W+S, 24 had short and mid-term policies and all interviewed policy actors but the Public Prosecutor and the Police mentioned activities in relation to W+S. As the sample of respondents is limited to active W+S policy actors, possibly an overly positive image of activities in the domain would be sketched. To put the distribution of W+S in a wider perspective, first an account is given about earlier studies.

Earlier studies regarding distribution of W+S policies in the Netherlands

There are indications that walking and sojourning are not high on the list of important issues of policy makers. In national policy notes and in parliamentary discussions, walking and sojourning in public space hardly ever appear. Gorissen (2011) found that in the Dutch National policy paper on mobility (Nota Mobiliteit) walking and the pedestrian is mentioned only with respect to 'chain mobility' and accident risk from car crashes. In the Strategic Plan Road Safety 2008-2020 however, pedestrian safety is allotted priority, and 3 dedicated measures are specified: improvement of pedestrian crash protection of cars, safety improvement of pedestrian crossings and stimulation of pedestrian detection systems in cars. From the recent draft 'Structure Vision Infrastructure and the Physical Environment (Land Use)' of the Ministry of Infrastructure and the Environment (Ministerie I&M, 2011) it can be concluded that walking and sojourning are seen as predominantly provincial and local matters. Consequently it would be logical to find that local and regional authorities devote ample attention to the issue. In a

sample of provincial and city-region plans Gorissen (2011) did not find any items on walking and pedestrians. In a sample of 20 local municipal traffic and transport plans it turned out that in 25% of the plans walking and the pedestrian and walking was amply dealt with, in 15% the issue was not mentioned at all, and in 60% of the plans the issue is mentioned, but not extensively worked out. De Leeuw & Visser (2012) explored common W+S policy practises of a sample of large, mid-size and small municipalities. In 2012 three of the four large cities had dedicated W+S policies, one out of the eight mid-sized municipalities and none of the two smaller municipalities.

Visions and intervention frameworks

About half of the interviewed organisations said to apply a vision or set of guiding principles to W+S policy making. Some of these principles are quite general. Sustainable Safety, which is promoted by SWOV and also mentioned by the municipalities and CROW, is a leading principle in the road safety domain. Design for All and Reverse Design (start with the pedestrian), explicitly mentioned by the municipality of Eindhoven and Ieder(in), are also common in the domain. Ieder(in) uses the United Nations Convention on the Rights of Persons with Disabilities for testing public and private policies and actual conditions. The above guiding principles are included in the CROW vision 'Walking Pays', the ANWB vision of 'traffic in towns', and MenS perspectives, and play a role in the Utrecht, Amsterdam and Eindhoven visions[604]. Other encouraging visions and guiding principles are 1) the Dutch Railways 'pyramid of consumer needs'[605], 2) the guiding principle of the Knowledge Institute Sports and Ministry of Welfare, Health and Sports 'Movement-friendly environment' as determinant for the use of active modes, generating health, 3) the educational principle adhered to by Visio that abilities to do things independently can be stretched by training, and 4) general principles of deregulation and decentralization given face by the new national Environmental Law regarding land use planning ('Omgevingswet'), which will probably be operational from 2021, shifting planning authority to from central to local government.

With regard to the design, construction and keeping up the quality of public space large municipalities (Amsterdam, The Hague, Rotterdam, Utrecht, Eindhoven) employ municipal design guides, specifying design and application criteria, to be applied by the neighbourhood teams and other staff authorized to improve public space quality.

Long-term strategies

Long-term strategies concern policies with a time horizon of 10-20 years, mainly developed by *strategists*. With regard to pedestrians or walking and sojourning in public space in the Netherlands no dedicated long term plans were found. There are however some national strategy plans ('white papers') that can be expected to structurally affect aspects of walking and sojourning in public space:

- SVIR (=Structure Vision Infrastructure and Land Use) by the Ministry of Infrastructure and Environment
- the Strategic Plan Road Safety 2008-2020 by the same Ministry of Infrastructure and Environment – DG Accessibility - Traffic and Road Safety
- Programma Stad (= Programme for City development) and the connected Agenda Stad (=City Agenda)[606] by the Ministry of Internal Affairs

[604] Respectively (translated into English) "Utrecht, Attractive and Accessible', 'The pedestrian Emperor, the cyclist King' and 'Vision Eindhoven under way'.

[605] In this thesis mentioned earlier as the 'Van Hagen pyramid' of consumer needs.

[606] Boosted in 2015 by the so called Jaar van de Ruimte (= Land Use Year), which included extensive discussion amongst city and land use planning professionals.

- Programma Sport in Bewegen in de Buurt (Program for Sports and Active Living in Neighbourhoods) by the Ministry of Welfare, Health and Sports.

Some municipalities also developed long term, strategic plans as a framework for more concrete year plans. One of the oldest in this respect are the Groningen Sector Plan for the inner city and the The Hague's white paper 'De Kern Gezond' (= A Healthy City Centre, Den Haag, 1988) and their Mobility White Paper (Den Haag, 2011). More recent structure plans are 'Utrecht: Attractive and Accessible', the 'Mobility Approach Amsterdam', 'City Centre – City Lounge 2008-2020' (Rotterdam, 2008), 'Vision Eindhoven under Way' (Eindhoven, 2013) and 'Breda Vision Public Space Breda 2020 – Adequate-Recognisable-Sustainable' (Breda, 2008). Furthermore, a number of (larger) organisations issued mission statement white papers or web pages, which can be understood as long term plans, such as Ieder(in), ANWB, Wandelnet, NHTV/SOAB, SWOV, Knowledge centre Sports and Visio.

Short and mid-term policies

Short and mid-term policies concern policy plans for the coming two to ten years, mainly developed by facilitators, client representatives and catalysts. They may cover a wide range of scopes and plans for activities. Most important in this respect are the municipal implementation plans, such as those in operation in Utrecht (the Pedestrian Plan; 2015) and Amsterdam (Rode Loper (= Red Carpet; 2013).

Concrete activities

Concrete activities, i.e. measures that directly affect pedestrians and/or walking and sojourning in public space are carried out by or under the direction of municipalities, educators and law enforcers.

24 out of 33 of the interviewed organisation carry out policy activities to affect preconditions for pedestrians, mostly in the context of responsibilities regarding the pedestrian's physical context (24), traffic and transportation (19), the pedestrian's social context (23) or information technology (20, including traffic lights).

Seven of the interviewed organisations do not actively affect walking and sojourning in public space; 24 organisations take in such activities in higher order schemes like street reconstructions; 15 organisations mention dedicated pedestrian projects, whilst 10 indicate that such projects are integrated in larger projects for synergy reasons.

A great diversity of domains are covered by the interviewed policy actors. Public space and infrastructure is the main domain for 13 of the organisations; traffic safety comes next with 3 organisations. Other domains covered were geography, planning & the environment; housing and building; safety & health; pedestrians; wanderers; recreation, tourism & mobility; rail transport & access; the elderly; law enforcement; sport and active living; land use planning; handicapped persons; mobility, transport & environment.

Only 5 of the interviewed organisations cover all stages of the plan cycle; 16 of the interviewees are involved in the data & research stage, 23 in knowledge aspects, 7 in the policies and strategies development stage, 12 in planning & design stage, 12 in commissioning and implementation and 10 in management & control of pedestrian facilities.

Although not tested through the policy actors' interviews, it was observed that most municipalities did not have many W+S activities apart from reactive repairs, maintenance,

crossing complaints (what is mostly done by neighbourhood teams and contractors) and pedestrianisation projects in city centres.

d.2. Policy activities compared to proposed system approach criteria
In this paragraph policy activities of the interviewed policy actors are compared with criteria regarding the proposed System approach (cf. Section 3.2.2 of the thesis). The following criteria were considered: 1) systematic process, 2) comprehensive analysis, 3) integral intervention strategy. Below it is assessed to what degree the criteria are met by the interviewed policy actors.

Systematic process
The criterion *systematic process* includes systematic planning, implementation, checking implementation results and acting on conclusions (cf. Deming Circle – Plan-Do-Check-Adjust – see Appendix 9, Section 2.3 Policies and Strategies). Dedicated pedestrian plans in Utrecht, Amsterdam and various public space plans in other cities qualify in this respect, be it that most are so recent that the later stages of Check and Adjust do not yet apply.

Comprehensive analysis
This criterion includes analysis of the status quo and the nature of relations between system components, system effectiveness and system dynamics, i.e. future prospects. Furthermore the status quo and system effectiveness can be assessed on the basis of concrete evidence and perception perspective.
Noteworthy with regard to W+S analysis are a comprehensive recreational walking monitor by Wandelnet (the National Wandering Monitor 2010) and explorative W+S studies in Amsterdam (Memorandum Nice Walking and Cycling in Amsterdam, 2001[607]), Utrecht (pre-study 100 Walk Along interviews, 2013), Eindhoven (student's study about walking routes in Eindhoven; design study Eindhoven Under Way) and Rotterdam (Public Spaces - Public Life, Rotterdam 2007- Gehl Architects, Copenhagen[608]).
Municipal walking and mobility studies are limited to respectively crashes involving vehicles (pedestrian falls excluded) and focus on door-to-door mobility (walking as a sub-mode and sojourning are excluded). Consequently pedestrian falls are not taken up in planning processes; sub-mode walking and sojourning are taken up in some spatial quality studies of inner cities.

Integral intervention strategy
This criterion includes assessment of the degree to which an approach includes 1) all relevant components and interrelations of the system, 2) the application of state-of-the-art knowledge and expertise, 3) improvement of both current and future system functionality, 4) correction or compensation of biased misperceptions and side-effects, 5) co-ordination through some kind of master plan, where all planning levels, planning cycle stages, nested activity levels and spans of control are dealt with.

None of the policy activities meet the above criteria completely. Apart from MenS and NHTV/SOAB, who target the W+S system as a whole, but do not have operational authority, none of the policy activities are targeted at more than one or two of the system components in a coherent way. In some cases plans are based on state-of-the-art knowledge and expertise; up until now plans and projects are mainly reactive, to correct or improve current conditions, but

[607] DRO (2001): Lekker wandelen en fietsen in Amsterdam, over verbetering van het netwerk van recreatieve hoofd wandel- en fietsroutes in en om Amsterdam. Gemeente Amsterdam, Amsterdam.
[608] Source: www.rotterdam.nl, accessed november 2014

not explicitly to correct for expected adverse future conditions and side effects; the author did not come across a pedestrian Masterplan, targeting the W+S system as a whole. Current best practises concern intensively used pedestrian facilities in central city areas (Utrecht, Amsterdam, Eindhoven, The Hague and Rotterdam).
It has to be stressed that in designing new neighbourhoods and streets the pedestrian never was out of the picture, though this has never been captured in formal policies, as has been done for cycling[609].

e. Resources

This paragraph presents a concise overview of deployment of resources in the W+S domain drawn from policy actor interviews and dossiers. Initially the objective was to describe deployment of resources, the distribution of applied resources across the domain and to what degree preconditions are shaped at the national level. The results of the interviews and the compiled dossiers did not allow this. Therefore only a crude indication is given of what resources are actually said to be deployed.

The respondents were asked to indicate what resources they deployed for W+S policy activities. This proved to be a rather difficult question, producing vague and ambiguous answers. From the interviews and organisation dossier it is distilled what financial budgets, manpower, data and information and tools are deployed.

Financial budgets
Apart from budgets for staff, few of the interviewed organisations had specific budgets for W+S policy activities. Most W+S activities are funded from general policy development, planning and reconstruction projects and cannot be specified. A sample of specific budgets for W+S within the interviewed organisations concerns some specific projects regarding W+S policy making: CROW (project regarding development of W+S policy guidance 'Walking Pays' in 2012-2015), Wandelnet (projects regarding their National Wandering Monitors 2010 and 2015), VeiligheidNL (ED casualties database LIS funded by central government; research projects for central government with special attention to pedestrian casualties from walking accidents in 2006, 2012) and Knowledge centre Sports (project on developing and publishing guidance for active living friendly environments in 2014). Furthermore Molster Advies and NHTV/SOAB indicated to having received money for research and consultancy projects, and MenS shared that their volunteers spend their own money on organising meetings and a website. Although officially governmental budgets are nil, both at ministries and municipalities, in fact governments do spend money on W+S policy activities. The Ministry of Infrastructure and Environment supported and funded research activities for the COST 358 Pedestrians' Quality Needs project and paid for the Final Report and the organisation of the WALK21 conference in 2010; the Ministry also subsidises the LIS ED casualties database work by VeiligheidNL and various CROW projects. The Ministry of Welfare, Health and Sports subsidises the Knowledge centre Sports and their activities. The municipalities of Utrecht, Amsterdam and Eindhoven have spent money on development of dedicated walkability plans. More importantly, municipalities finance and own public space, including sidewalks and footpaths. The total monetary value of pedestrian space in the Netherlands is estimated on 20-25 billion Euros in 2015[610]. Most probably all municipalities allot money for public space maintenance and

[609] Mentioned as generality by interviewees in Heerhugowaard, The Hague and Rotterdam.
[610] This is estimated by multiplying the total length in kilometres of municipal roads by 1000 (1000 meters) and 2 (assumed average m2 of pedestrian space per meter road) and average property value

'standard' dealing with complaints by neighbourhood teams in most municipalities; how much is unknown because such work is not specified in their book keeping. The author estimates yearly maintenance cost roughly at 1.4 billion Euros or 84 Euros per capita. Other societal costs are accident costs, which amount about 2 billion Euros (Methorst, 2010), which is about 115 Euros per capita. It is probably needless to say that these values and costs are not considered in common policy decisions.
In sum: with regard to W+S policy activities money does not seem to be a decisive factor.

Manpower
As a resource for W+S policy activities, manpower is said to be much more important than money. If convincingly motivated, one way or the other the needed money becomes available anyway. This seems to be true for manpower as well: staff time spending is far from transparent. It can be argued that by far the most manpower is allocated to management & control activities like the municipal neighbourhood teams regarding keeping up public space, including infrastructure, walking paths and greenery. How much of their time is devoted keeping up W+S facilities is not specified however. In most cases even the number and kinds of citizens' complaints are not systematically reported to policy departments and municipal leadership.
A tip of the iceberg surfaced during the interviews. It was asked how much time staff spends on W+S policy activities. Only indications could be given; none of the organisations had registration data available on this topic. From the indications it became clear that eight of the 33 interviewed organisations spend half an Fte per year or more on W+S policy activities; NGO's are the champions in this regard (see Figure 6.7.).

In total the 33 interviewed organisation invest about 17 Fte's in W+S policy making. For the Netherlands as a whole it is estimated to be approximately 45 Fte's. It has to be noted that policy making is only a fraction of the total effort of organisations for sustaining and improving W+S conditions. In general municipalities have neighbourhood teams, which execute issued policies including public space maintenance and management. It is estimated that on average municipalities deploy about 1 Fte for sustaining and improving W+S conditions. Including the deployment of neighbourhood teams and the total manpower deployed for W+S comes to approximately 430 Fte's, which corresponds to 2.5 Fte per 100,000 inhabitants[611]. At an average monthly salary of 3,000 Euro's (gross) this amounts to national expenditure of 16.7 million Euro (about 1 Euro per inhabitant).

Data, information and (external) knowledge
Data and information on walking and sojourning (mobility, safety, satisfaction, impact) are found to be scarce, and not particularly accommodating for local authorities. About prevalence of sojourning, satisfaction and health impacts hardly any data are available, but there is some (project-related) information on economic impact in relation to retail.

Although mobility and incident data about walking are available on the national level, these do not play a role in W+S policy making by ministries. As for safety of pedestrians, only road traffic safety data concerning crashes involving moving vehicles are applied; data about pedestrian falls are largely neglected by the Ministry of Infrastructure and Environment; the

of 100 Euros per m2 = 118.995 x 1000 x 2 x 100 / 1.000.000.000 = 23,8 Billion Euros. Assumed interest and maintenance costs are 6 Euros per m2, totalling 1.4 billion Euros per year.

[611] This is calculated as follows: (17 Fte [in interviewed organisations, including 8 municipalities] + 382 municipalities x 0,05 Fte (policy staff) + 390 municipalities x 1 Fte (neighbourhood teams) + 2 Fte academic research + 2 Fte students' research + 1 Fte cosultancy/ 17 million inhabitants/100,000 = (rounded) 430 / 170 = 2.5 Fte

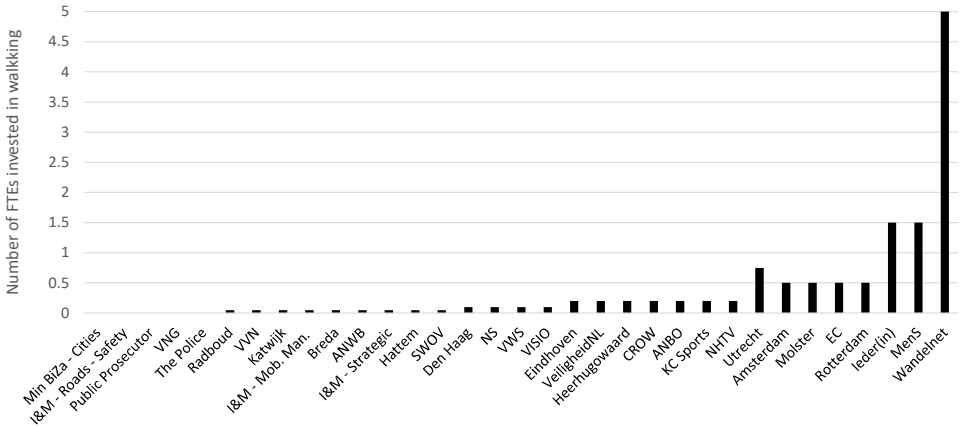

Figure 6.7. Full-time equivalents per year employed for walking and sojourning policy activities (excl. Neighbourhood teams)

Ministry of Welfare, Health and Sports is aware of developments regarding pedestrian falls, but has taken it in as notification. From the nationally operating organisations only MenS and Wandelnet use general mobility and safety data for conceptualisation.

With regard to walking and sojourning local authorities bank on road accident and complaints data exclusively. Mobility data on walking and sojourning are not available on the local level (apart from dedicated research by municipalities themselves) and do not cover the topic adequately (see Chapter 5). Health impact data in relation to walking are not available on, or translated to, the local level. Consequently municipalities are bound to have a limited image of what walking and sojourning conditions are suboptimal and/or in need of improvement and cannot be held result-responsible for the full W+S domain as suggested by national decentralisation policies.

Tools

There are very few W+S policy activity tools available. The only reference found in the interviews was CROW guidance (i.e. the Handbook Urban Transport and Traffic Facilities (ASVV) and to a lesser extent 'Walking Pays'). From literature it is known that there are various micro-simulation models available. None of the respondents however referred to the use of any of them.

f. Co-operation and partnerships

This paragraph explores the status quo of co-operation and partnerships within the W+S domain. Initially the author's objective was to describe the status quo of abilities and willingness to co-operate, what 'carrots and sticks' there are for co-operation and partnerships and finally how co-operation and partnerships are distributed across the domain. From the results of the interviews and the compilation of dossiers it became clear that co-operation and partnerships in practise most often are not feasible because of the little working time available for almost all policy actors in the domain. When an organisation has only a few hours per week for W+S policy activities, involving in co-operation projects costs more than it possibly might deliver.

Within the domain there is an tentative alliance between Wandelnet and MenS, a partnership regarding utilitarian walking matters; the large municipalities, Mens, Wandelnet, ANWB, CROW, VeiligheidNL, Molster Advies and NHTV/SOAB are actively networking. Organisation-internal co-operation is often mentioned. Municipalities consult adjacent municipalities, NGO's and consultants. Apart from these alliances and networking co-operational within the field seems to be scratchy.

6.5.4. Conclusions

This subsection summarises the status quo, i.e. the strengths and weaknesses of the W+S institutional framework. In this context the raisons d'être of organisations, leadership, knowledge and professional skills, policies and strategies, resources and co-operation and partnership are successively dealt with.

a. Raisons d'être of organisations

Distribution of raisons d'être

From the results of the raisons d'être explorations in 2016 it can be concluded that the walking and sojourning domain is dominated by governmental organisations. Client organisations obtained a leading role regarding strategic information towards governmental organisations, partly fed by data and meta knowledge from knowledge institutes.

For the successor of the Dutch Pedestrians Association MenS ('Streets for People') and slightly less Wandelnet (the Wandering Association) walking and sojourning in public space is the central issue. For all other studied W+S policy actors it is a side issue. Regarding the volume of W+S policy activities the municipalities of Utrecht, Amsterdam, Rotterdam, The Hague and Eindhoven stand out positively. Other major players in the domain are CROW, NHTV/SOAB, the Ministry of Welfare, Health and Sports, Visio, Ieder(in), Knowledge centre Sport and ANBO/BVM. The health sector (VeiligheidNL, Kenniscentrum Sport, Ministry of Welfare, Health and Sports) seemed to be stronger motivated than the Transport and Traffic sector (pedestrian appears to be 2nd rate road user), but in 2019 this changed for the better, when the Ministry of Infrastructure and Water Management appointed a quartermaster for pedestrian policies and a Platform Room for Walking was established; Town Planners, both as consultants and as municipal officers, generally take W+S seriously.

Strengths and weaknesses

In sum, there are many potential policy actors in the domain, but in 2016 only a few of them were found to be active policy makers. In 2020 the number of active policy actors, collected in the Platform Room for Walking, grew to 32 partners[612]. Furthermore most probably almost all 388 municipalities are reactive policy actors: there are indications that most of them have neighbourhood teams reacting to citizen's complaints about defective pedestrian facilities.

b. Leadership

Under 6.4.2 Theoretical considerations, regarding leadership it was postulated that in the present study three factors need to be assessed: 1) leadership propensity, power, and persistence, 2) W+S goals, and 3) distribution of leadership.

[612] https://ruimtevoorlopen.nl/partners/, accessed 2-7-2020

Leadership propensity, power and persistence
With regard to W+S domain leadership conditions, three major leadership factors were explored in 2016: propensity, power and persistence. With regard to these factors conditions in the W+S domain could be considered a weakness. Both the European Commission and national government were not interested in taking the lead with regard to the W+S domain, although it is admitted that ministries have system responsibility with regard to legislation, basic statistical data, research, the organisation of the transport system and the citizen's health. The central government took the position that dealing with walking and sojourning in public space is an decentralised issue and thus an exclusive local authority responsibility. In 2019 the Ministry of Infrastructure and Water Management took steps to upgrade its role. With regard to getting things done, indeed, municipalities score highest. Front runners amongst them aspire an exemplary role, but they have no (political) power over others. They can be in the lead within their territory, but not outside. Client organisations and catalysts prudently take initiatives, but none of them has the ambition or power to be in the lead of improving W+S conditions.

W+S goals
With regard to walking and sojourning ten of the interviewed organisations formulated specific goals. Specific goals were formulated by the municipalities Amsterdam, Breda, Eindhoven, The Hague, Rotterdam, Utrecht and NS (Dutch Railways), Wandelnet, MenS and Molster Advies. In 2019 the Platform Room for Walking, endorsed by the partners, set general goals.

Distribution of leadership
From the explorations it is concluded that there is no evident leadership or 'champion' in the W+S domain. Strategists (i.e. the central government and the European Commission) are nominated as such, but do not yet accept this leadership; facilitators like municipalities are not keen to be followers and rather do things on their own; client organisations, catalysts and front-running consultants try to set an encouraging stage, but do not see themselves as leaders. Thus in 2016 there was a vacuum in W+S leadership, since 2019 filled up by the collective Platform Room for Walking. Furthermore, as only recently leadership emerged, and front-runners amongst municipalities have taken up W+S policy activities only recently, leadership persistence as a factor cannot yet be evaluated.

Strengths and weaknesses
Strength in the domain are leadership propensity in the largest municipalities and the dedicated NGO's Mens and Wandelnet, and since 2019 the Platform Room for Walking. A weakness is that collective policy actors are only beginning to be inspired and pushed to greatness by the formal strategists and national level system responsible policy actors in the field, and that the role of an active policy entrepreneur (Platform Room for Walking) still is in the making.

c. Knowledge & professional skills

After leadership, knowledge and professional skills is the second pillar of W+S policy making. Aspects that have been explored in this study are sources of information and knowledge exchange, knowledge about how W+S works and how it can be improved, and the distribution of W+S knowledge and professional skills.

Sources of information & knowledge exchange
Although on the national level some alarming reports have been produced in the W+S domain, as yet none of these could penetrate the strategists' policy makers shell. At the local level some publications and consultants were successful, setting policy making in motion in Amsterdam,

Utrecht, The Hague, Rotterdam, Eindhoven, Heerhugowaard and Breda. In general definitions and interpretations of key concepts still tend to obstruct adequate insight in major walking and sojourning problems. Some progress is made in this regard: discussion on definitions started.

Knowledge about how W+S works and how it can be improved
Knowledge about how W+S works and how it can be improved is only subordinately present in curricula and refresher courses for (future) traffic and public space practitioners. Apart from dedicated NGO's and larger municipalities, where W+S is a priority and significant working units are formed for dedicated policy activities, professionals are not in the position to acquire and keep up W+S expert level professional skills. In law enforcement walking and sojourning in public space as a subject is almost totally neglected, except for walking on a motorway, issued gathering prohibitions and unwanted behaviours in entertainment centres or at large events.

Distribution of knowledge & professional skills
This thesis scored W+S knowledge and professional skills (situation 2016; 2019 is too soon to expect changes) regarding experiences per year, years of experience and domain coverage. It can be concluded that knowledge and professional skills are not evenly distributed across the domain and that the level of knowledge and experience is lacking where it is needed most: in the majority of mid-sized and smaller municipalities. A select group of W+S policy actors, including notably NGO's, the knowledge institutes CROW and VeiligheidNL and two consultants have good sum-scores on W+S knowledge and professional skills. The majority of W+S policy actors have low to very low scores in this regard.
Very few professionals have overview of the domain. Every actor commands only a small part of the domain. The main scope of most organisations concerns the physical environment, i.e. the road and road environment. It is noticed that the majority of relevant knowledge institutes, apart from CROW and NHTV/SOAB, score relatively low.

Strengths and weaknesses
In sum, strengths of the domain are that basic general data and information, generic system knowledge and knowledge about what can be done to improve W+S conditions are available; weaknesses are however that such data, information and knowledge are not available locally in most municipalities and that common walking, sojourning and safety definitions and insights obstruct adequate comprehensive insights.

d. Strategies and policies

The third pillar of policy making is policies and strategies. Under 6.5.2. Theoretical considerations, it was postulated that in the present study three factors need to be assessed: 1) what kinds of visions, strategies, policies and concrete measures are in fact issued and/or implemented, 2) how do these activities compare to the proposed System approach criteria of a systematic process, comprehensive analysis and integral intervention strategies and 3) how can the policy activities be positioned in the policy life cycle?

Kinds of issued and/or implemented visions, strategies and policies
With regard to policy activities visions and intervention frameworks, long term strategies, short and mid-term policies and concrete activities were distinguished. In 2016 13 of the 33 interviewed organisations mentioned leading visions or general guiding principles, 12 are found to have long-term strategies affecting W+S, 24 had short and mid-term policies and all

interviewed policy actors but the Public Prosecutor and the Police mentioned activities in relation to W+S. An update for 2019 is not available.
From earlier studies it was abduced that walking and sojourning were not high on the list of important issues of policy makers. With regard to walking and sojourning in public space, policy makers and politicians, with only a few exceptions, did not seem to be agents of improvement, but rather agents of reinforcement of the status quo, who undervalued the added value of walking and sojourning in public space. It was mentioned that in designing new neighbourhoods and streets the pedestrian never was out of the picture; the interests of the pedestrian however were not captured in formal policies, as was done for cycling. Although there are some signs of improvement, it appears that in some other countries (e.g. Norway, Austria, Switzerland, United Kingdom, Wales) progress in policy research activities regarding walkability and sojourning in public space is stronger than in the Netherlands. This was confirmed by assessment of the various activities of the interviewed organisations, that can be considered front-runners in the domain. Only CROW, MenS, ANWB, the municipalities Utrecht, Amsterdam, The Hague and Eindhoven presented dedicated walking and sojourning visions. None of the organisations had dedicated long-term plans, although there are a number of strategic plans and intervention frameworks affecting walking and sojourning in public space.

Compliance to System approach
Based on the 2016 interviews and the organisation's dossiers the distribution of W+S policy activities were assessed and broadly evaluated against the system approach criteria *systematic approach*, *comprehensive analysis* and *comprehensive intervention strategy*.

The interviewed organisations only partly comply with the proposed W+S system approach criteria. It appears that where a systematic planning process matters most, i.e. in local authority plans, this is quite common. Dedicated pedestrian plans in Utrecht, Amsterdam and various public space plans in other cities qualify regarding a systematic process design.
With regard to comprehensive analysis the results are less positive. The author has found only one study attempting to comprehensively cover the W+S system as a whole: the CROW publication 'Lopen Loont' (=Walking Pays). None of the few available studies carried out for or by municipalities covered all three pedestrian activity aspects (door-to-door walking, sub-mode walking and sojourning), and pedestrian safety studies were limited to road traffic safety, excluding pedestrian falls as the dominant injury cause.
Also, no really comprehensive intervention strategies were identified. None of the mentioned policy activities targeted more than one or two of the system components coherently. In some cases plans were based on state of the art knowledge and expertise within the chosen limitations; up till now plans and projects were mainly reactive, to correct or improve current conditions, but not explicitly tackle expected future detriments and side effects; no Master Plan targeting the system as a whole is found. Developments since 2019 are too early to expect significant changes.

Position in the policy life cycle
It is difficult to position current W+S policies in the Winsemius' Policy Life cycle. As a whole the domain could either qualify for 'management & control stage', but there are indications for being in the early explorative or early political stages as well, particularly because of 2019 developments regarding the Platform Room for Walking. Having concrete policy plans the municipalities Utrecht, Amsterdam and Eindhoven, and MenS, Wandelnet, VeiligheidNL, NHTV/SOAB and CROW, can be said to qualify for the 'explorative' or early 'political' stages. Most other policy actors, including most of the ministries and municipalities, appear to perceive

W+S as something that is well taken care of and not in need of activation, so as qualifying for the 'management & control' stage.

Strengths and weaknesses
In sum, a strength of W+S policy activities is that in planning and design of new neighbourhoods and streets the pedestrian never was out of the picture; weaknesses are however that in plans for keeping neighbourhood, road and path conditions up to date, impacts on walking and sojourning in public space have been neglected and/or forgotten in many ways and that current W+S policy making certainly cannot yet meet system approach criteria.

e. Resources

The fourth pillar of policy making concerns *resources*. Under 6.5.2. Theoretical considerations, it was postulated that in the present study three factors need to be assessed: 1) deployment of resources, 2) distribution of applied resources across the domain, and 3) to what degree preconditions are shaped at the national level.

Deployment of resources
In the study four kinds of resources were distinguished: financial budgets, manpower, data, information and (external) knowledge, and tools. Regarding financial budgets it can be concluded that with regard to W+S policy activities money does not seem to be a decisive factor. Manpower and data, information and (external) knowledge however are crucial factors. The interviewed organisations did not refer to the use of dedicated tools.
Regarding manpower invested in W+S policy making only a tip of the iceberg surfaced. In 2016 Wandelnet scores top regarding about 5 Fte manpower allotted to W+S policy activities. MenS and Ieder(in) score second and third with about 1.5 Fte each. Utrecht allotted 1.5 Fte, Amsterdam, Rotterdam, Molster and the European Commission 0.5 each; all others allotted less than 0.25 Fte per year. With some caution for the Netherlands as a whole it is estimated to be approximately 45 Fte's. In 2019, because of Platform Room for Walking developments, this can be expected to be slightly more (e.g. 50-55 Fte's). It has to be noted that policy making is only a fraction of the total effort of organisations for sustaining and improving W+S conditions. In general municipalities have neighbourhood teams, which execute issued policies including public space maintenance and management. It is estimated that in 2016 on average municipalities deploy about 1 Fte for sustaining and improving W+S conditions. Including the deployment of neighbourhood teams the total manpower deployed for W+S comes to approximately 430 Fte's which corresponds to 2.5 Fte per 100,000 inhabitants. At an average month salary of 4,000 Euro's (gross)[613] this amounts to national expenditure of 22.3 million Euro (about 1.30 Euro per inhabitant).
Insight in application of data, information and (external) knowledge is scratchy. There are indications that full-scope national data[614] on pedestrian mobility and casualties are applied by VeiligheidNL, MenS, NHTV/SOAB, Molster, Wandelnet and CROW, and that these are not actively communicated by the ministries. These data are not suitable for local use. Large municipalities use their own data. Guidance on walkability by CROW is not (yet) popular.

[613] According to CPB in 2017 the modal income of a Dutch employee is 37,000 Euros before taxes. Including overhead costs the total salary costs are estimated to be 48,000 Euros.
[614] Full scope: covering walking as door-to-door, to-and-from other modes and sojourning, as well as covering both pedestrian traffic crashes and pedestrian falls in their considerations.

Distribution of applied resources
Data and information on walking and sojourning (mobility, safety, satisfaction, impact) are found to be scarce. Full scope data are available on the national level but are not particularly accommodating for local authorities, where they are needed most.

Preconditions shaped at the national level?
Although the Ministry of Welfare, Health and Sports promoted active living, in general ministries do not (yet) specifically promote W+S policy activities; Mens, Wandelnet, CROW, VeiligheidNL, NHTV/SOAB, Molster Advies pushed for better pre-conditions. Amsterdam, Utrecht and Eindhoven actively shared progress made.

Strenghts and weaknesses
In sum, a strength is standard availability of the neighbourhood teams for keeping up public space quality. With the exception of the dedicated NGO's, resource deployment is not a strength. Although money does not seem to be a critical factor, manpower deployment for policy making is, with the exception of dedicated NGO's, the municipalities Utrecht, Amsterdam and Rotterdam and one consultant, marginal at best. Rather passive policy actors are the Public Prosecutor, the police, VNG, bus and tram enterprises, VVN and mid-size and small municipalities.

f. Co-operation and partnerships

The fifth pillar of W+S policy making is co-operation an partnerships. Under 6.5.2. Theoretical considerations, it was postulated that in the present study three factors need to be assessed: 1) abilities and willingness to co-operate, 2) 'carrots' and 'sticks' for co-operation, and 3) distribution of co-operation arrangements.

Abilities and willingness to co-operate
As in 2016 most policy actors' allotted working time for W+S matters was too small for allowing for co-operations and partnerships; willingness was not yet a relevant factor. With the introduction of the Platform Room for Walking this gently changed for the better.

'Carrots and sticks' for co-operation
The author did not come across incentives or punishments regarding co-operation and partnerships within the W+S domain.

Distribution of co-operation arrangements
Within the domain there is an tentative alliance between Wandelnet and MenS; the large municipalities, Mens, Wandelnet, ANWB, CROW and VeiligheidNL are actively networking. Municipalities consult adjacent municipalities, NGO's and consultants. Apart from these alliances and networking co-operation within the field seemed to be scratchy in 2016. The introduction of the Platform Room for Walking in 2019 offered new opportunities for co-operation.

Strengths and weaknesses
In practise lack of co-operation and partnerships could and still can be considered a weakness. Because of the very little manpower-time allotted to W+S policy activities, co-operation most of the times is hardly an option. Exceptions and a (strategical) strength are organisation-internal

co-operations and 'light' co-operations between the front-running organisations, improved by the introduction of the Platform Room for Walking.

6.6. Conclusion and discussion: institutional improvement potentials

6.6.1. Introduction

The above sections dealt with methodology and results of this thesis' research into the policy context, the playing field and how policy making is organised in the Netherlands. This section first submits conclusions concerning controls that policy actors can adjust to for supporting walking and sojourning in public space effectively, efficiently and fairly, eventually delivering improved wealth and well-being of the population. The second subsection broadly evaluates the used methodology and opens discussion on improvements. In the third subsection a discussion is opened on application of the identified controls regarding W+S policy activities. The last subsection opens a discussion on system and result responsibility/accountability.

6.6.2. Conclusions concerning W+S policy activity controls

In management and political science literature it is made obvious that almost all effective change processes start with knowledge and awareness of system problems and ways to deal with them. This is also expressed in our model on critical factors in the policy life cycle (see Section 6.5.3., Figure 6.3). From such theoretical considerations as well as evidence from the explorative studies, policy actor interviews and organisation dossiers the author identified a number of controls[615], which policy actors, particularly the ones in the lead, can adjust for triggering, intensifying or decreasing policy activities, improving effectiveness, efficiency and possibly fairness of policy activities and impacts:

- *Fact-finding*
  The state of knowledge and awareness is fed and defined by a number of orientation processes such as orientation on international developments in W+S policy activities, on the status quo, development and impacts of W+S.
- *Competence building*
  Knowledge and professional skills are forged and distributed by knowledge management functionalities, such as the references functionality[616], learning opportunities, information exchange, guidance on solving problems and personnel management.
- *Direction and allotment*
  The domain is organised through *leadership* activities, which are based on the leader's awareness of system problems, their urgency as well as technical, social and political feasibility of ideas to solve the problems (Feitelson & Salomon, 2004). Propensity, power and persistence can be forged and distributed through advocating visions, positioning and prioritizing the W+S domain, promoting visibility and esteem of the domain, managing the playing field, distribution of resources and promoting co-operation and partnerships.

[615] Controls can function as switches, filters or regulators, dosing or filtering inputs systems and subsystems that trigger or effectuate changes in the W+S system and thereby walking and sojourning.
[616] The references functionality concerns a physical or virtual place where valid, reliable and state-of-the-art information is collected, stored and made accessible like a library, knowledge centre, guidance website or a help desk.

- *Communication*
  Communication is the binding agent and lubrication of the policy process. W+S changes require engagement, commitment, participation and movement of many parties[617], which will only come about when the parties concerned effectively communicate. Events need to take place to convey messages and arrange participation in change processes.
- *Operational organisation*
  Factual changes in the W+S system, walking and sojourning in public space and impacts thereof are realised through *packages of measures*, framed by legislation and regulation and long term plans and effectuated by enforcement of legislation and regulations, mid-term and operational plans, management, maintenance and surveillance, and supported by communication, participation and events.

6.6.3. Methodology discussion

This research into the status quo W+S institutional framework follows up on one of the most important gaps in the innovative legacy of the COST 358 Pedestrians' Quality Needs and OECD/ITF Pedestrian Safety, Urban Space and Health projects. Though touched on, the organisation of improvement of walking and sojourning in public space conditions was not thoroughly analysed as a decisive factor regarding the support and improvement of walking and sojourning conditions. The current study is, as far as the author knows, the first of its kind, and necessarily restricted to tentative, explorative research. Studies in adjacent domains like road safety, sustainability and health provided clues of what to expect and helped to structure the research. Much effort was put into advancing the theoretical considerations developed in the PQN project, particularly the ideas on policy pillars. Results of this pre-study is presented in Appendix 9 and summarized in this chapter. From the PQN and OECD/ITF projects it was concluded that the domain still is 'under construction'. It was considered best to interview W+S policy actors about their policy activities and experiences. As their experiences are very diverse in depth and scope, in some tentative discussions with a number of municipalities and other experts it proved to be dysfunctional to develop a closed questions questionnaire. The researcher decided to only prepare a scheme of basic questions on the policy context and policy pillars and to try to document those subjects comprehensively from standard information about the concerned organisation and two-way discussions about the policy actor's assessments and experiences compared to the researchers trial-and-error notions. This approach may have led to bias; while processing the information it is tried to correct this, amongst others by asking expert colleagues to check results, comment and point out possible bias. Still, the results of this study are not entirely objective. Follow-up studies are needed to verify and validate this thesis' tentative conclusions.

6.6.4. Discussion: indication of institutional controls and improvement potentials

As a tentative indication of institutional improvement potentials, this subsection discusses how opportunities to improve W+S conditions can possibly be created or regulated by 'turning' the above identified controls. The subsection answers this chapter's fourth research question. In each of the illustrations impressions can be found regarding a) the content, function and role of the control, b) the status quo, c) under what conditions is it opportune, and d) who is most suited

[617] Strategist-leaders need support form partners for achieving their aims, engaging the facilitators; likewise facilitators need co-operation from their (potential) partners and acceptability, compliance and satisfaction from stakeholders and clients; clients and catalysts need to be heard regarding their needs and abilities.

to steer and take up activities. The bullet-letters correspond with these items. Clearly, this all concerns untested ideas for discussion which hopefully can contribute to setting up better strategies, policies and packages of measures to support walking and sojourning.

Table 6.6. gives an overview of the identified organisational controls, which the joint policy actors can deploy to make desired changes in the W+S system happen. The table displays general proceeds of the control functions and their intended impacts. Subsection 6.5.3. further develops the application of the controls, including conceivable assignments to the different policy actors in the domain.

Table 6.6 Organisational controls which policy actors can adjust to make W+S change happen

nr	Control	Proceeds	Impact
Fact finding			
1	Orientation on international developments in W+S policy activities	Ideas, innovations, strategies, experiences, impacts	Knowledge, leadership support, strategies
2	Orientation on the status quo, developments and impacts of W+S	Facts & figures, relevancy, urgency	Knowledge, leadership support, strategies
3	Evaluation of policy activities	Figures on effectivity, efficiency, fairness	Knowledge, leadership support, strategies
Competence building			
4	References function	Accessibility, dissemination of facts & figures	Knowledge, strategies
5	Learning opportunities	Professional skills	Quality of strategies and policies
6	Information exchange	Relevancy, urgency, acceptance	Distribution of policy activities
7	Guidance on solving problems	Improved plans	Effectivity and efficiency of measures
8	Personnel management	Policy effort, level of education, years of experience, expertise	Volume and quality of policies and measures and results
Direction and allotment			
9	Vision	Definitions, position, direction & aims, cascade of policies	Creation of demand
10	Visibility, position and priority of W+S domain	Acceptability, motivation to perform	Volume of policy activities
11	Playing field management	Policy effort, activation, support, 'carrots & sticks'	Volume and consistency of policy activities
12	Allotment of resources	Policy effort, activation, support, 'carrots & sticks'	Volume and consistency of policy activities
13	Co-operation and partnerships	Improved coverage, synergy	Better results
Communication			
14	Communication	Awareness, Engagement, commitment, movement	Acceptability, social and political feasibility
15	Participation	Acceptability, satisfaction	Social and political feasibility
16	Events	Visibility, awareness, engagement, commitment	Movement, social and political feasibility
Operational organisation			
17	Legislation and regulation	laws, contracts, procedures, operational rules	Motivation, consistent policies, improved effectivity, rigidity
18	Enforcement of legislation and regulation	Compliance to norms and rules	Motivation, consistent policies, improved effectivity, rigidity
19	Long term plans	Framework for measures	Motivation, planning consistency, readiness for changes
20	Mid-term plans	Implementation planning	Motivation, planning consistency, feasibility
21	Operational plans and implementation	Production planning	Changes in system behaviour
22	Management, maintenance & surveillance	Orderly systems behaviour	Keeping up status quo

Control 1 Orientation on international developments in W+S policy activities

a. Content and role of the control

Orientation on international developments in W+S policies includes exploring innovations and structural developments in the domain and adjacent domains which can affect walking and sojourning or affect policy making in one's territory. The role of such orientation is inspiration, to enable to timely react to foreseeable developments, and do that effectively and efficiently.

b. Status quo of the control activities

As very few of the Dutch policy actors have manpower, time and contacts to properly orient internationally, they cannot be expected to be aware of relevant international developments. Within the context of this thesis a tentative exploration has been carried out (see Section 6.3). The exploration was based on signals from other studies, conferences, newsletters and keeping in touch with the professional network. Up till Fall 2020 the report has not been spread in the domain.

c. Timeliness and urgency

Timeliness and urgency of orientation on international developments depends on how advanced policy maturity of joint policy actors is, and how effective and efficient current policies are, and how much they have to rely on 'trial-and-error' and undergo failures and 'reinvent the wheel'. To be effective orientation should be a continuous activity, to be carried out by full experts in the field and reported regularly to leadership and the domain policy actors. International orientation potentially helps to find clues for improving fairness of policies, measures and standards (e.g. forerunners' experience regarding the UN Convention on the Rights of persons with disabilities).

d. Most suited policy actor(s)

Orientation on international developments can best be carried out on the national level, by organisations which have an antenna for it, such as policy departments at ministries, dedicated NGO's and knowledge institutes. The findings can be distributed through an information exchange function (cf. Control 6, and the recently established Platform Room for Walking).

Control 2 Orientation on the status quo, developments and impacts of W+S

a. Content and role of the control

This control concerns orientation on the status quo, developments and impacts of comprehensive research into current conditions, changes therein and how W+S affects mobility, wealth and well-being. Valid orientation studies and performance data and statistics are needed to identify system strengths and weaknesses, and opportunities for and threats to walking and sojourning.

b. Status quo of the control activities

This thesis' research showed that generally available data on the status quo of walking and sojourning in public space are rather flawed, and that there is very little general research into and tacit knowledge about outcomes and impacts of W+S policies. From this thesis' survey amongst Dutch policy actors 'Trial-and-error' policy development seems to be dominant.

This thesis presents a broad comprehensive orientation on the status quo, developments and outcomes (see Chapter 5). As yet, other current studies do not cover mobility and safety comprehensively, neglecting trips to and from other modes, circulation, sojourning, pedestrian falls and security issues. The large, active municipalities monitor traffic safety, mobility and sojourning (city centre) developments within their territory. Wandelnet regularly produces a

Nation Recreational Walking Monitor. VeiligheidNL studied pedestrian travel safety. Other national knowledge institutes and national government do not systematically monitor W+S at the national level.
This way potential benefits are missed, e.g. including sojourning aspects can help to point to profit opportunities. Also, substantial societal costs, to be raised anyway, are unattended, e.g. a cost-benefit analysis regarding primary and secondary costs from pedestrians falls and security issues lacks.

c. Timeliness and urgency
In relation to effectiveness, efficiency and fairness this thesis argued that research needs to be based on functional, dedicated definitions and systematic, comprehensive analysis. Incomplete coverage degrade research utility and policy effectiveness, can result in unneeded societal losses, and tends to be unfair towards vulnerable groups. Coverage needs to be complete with regard to subjects and perspectives taken (i.e. dimensions), also to be able to develop and implement more fair policies.
In this context at least all four key types of walking (access mode, access sub-mode, circulation, and sojourning) need to be included in research; likewise walking safety research needs to include both vehicle-pedestrian collisions, pedestrian falls (Methorst et al., 2017a) and security issues.
Surrounding conditions, influences and forces that are autonomous and unaddressed can be hidden from detection and thus easily missed. Examples from the past are consequences of growing car ownership and car use, promotion of cycling taking up ever more space from pedestrians etc. Structural monitoring of walking and sojourning performances and educated prognoses can possibly counter this threat; the monitoring is usually needed for 'fellow' modalities anyway.
The orientations need to include three dimensions 1) facts and figures, 2) perceptions and 3) insights in developments and dynamics. Subjects included this way are typically W+S population descriptions, complaints and satisfaction, mobility (mono-modal and to and from other modes), sojourning, number and severity of accidents and casualties, their precursors, and social, economic and health impacts. Methods include making use of complaint desks, mobility survey, accident and hospital data analysis, dedicated surveys, neighbourhood surveys, etc.

d. Most suited policy actor(s)
In order to warrant validity, orientation studies into the status quo, developments and impacts are preferably carried out by independent research institutes, commissioned by domain leaders, applying the here proposed dedicated definitions. Who is considered domain leader depends on the span of control of the targeted system: national level, regional, local, neighbourhood, street. A pitfall is that currently comprehensive coverage data for regional and lower level are not (yet?) available. Orientation studies need to be updated regularly and the information needs to be disseminated widely, e.g. by regular newsletters.

Control 3 Evaluation of policy activities
a. Content and role of the control
Policies need to handle uncertainties. Consequently the outcome of the policy activities is also uncertain. Evaluation of the policy input, process, products, outcomes and impacts deliver opportunities to learn from mistakes and be able to correct them.

b. Status quo of the control activities
In practise ex-ante and ex-post policy evaluations are quite rare. This is particularly true for walkability policies, when the dominant perception is 'the matter is already well taken care of' and 'we have been doing it for ages'. Other reasons often put forward are that there is no budget for evaluation and certainly not for adjusting measures when the results are not satisfactory or that the subject is too complex for a firm evaluation.

c. Timeliness and urgency
The evaluation results are needed for improving an active, fully operational and matured policy field, but even more so in a field that is in a decayed 'management and control' stage of the policy life cycle (where curiosity is subdued), or in an infancy stage of a new policy life cycle. Taken it up as the latter, W+S is in the early stages of the diffusion of innovation of W+S policy making, where brave innovators carry the change (see also Appendix 9, Section 5 on Rogers' Diffusion of Innovation theory (Rogers, 1995) and where there still is a lot to learn to produce effective, efficient and fair policies and measures. As evaluation and consequently adaptation costs energy and money, budgets should be allotted for them in advance. Also, it is important that evaluation results are made available to other policy actors in the domain (see also Control 6).

d. Most suited policy actor(s)
Policy evaluations can best be carried out by independent institutes, although such research can also be executed by the policy actors themselves, provided they are willing (and enabled) to follow up the evaluation results.

Control 4 References function
a. Content and role of the control
A references unit can be considered a physical or virtual centre where practitioners (and others) can access relevant information for W+S policy practitioners. In such a references unit state of the art key knowledge and good practises from international as well as national experts are available and accessible for W+S policy makers through the internet. Such state-of-the-art knowledge and information is needed for developing optimal policies for the improvement of conditions for the support of walking and sojourning.

b. Status quo of the control activities
Key knowledge from international experts is available. For cycling there is a centralised digital reference unit at CROW Fietsberaad (http://www.fietsberaad.nl/[618]), publicly accessible, paid for by national government. For walking there is not yet such a reference unit[619], but CROW considers to establish it. First steps have been taken: a basic W+S policy collection is compiled. Furthermore, this thesis' documentation in principle is available for W+S policymakers.
It needs to be mentioned that W+S knowledge and information is more or less in its infancy. Most information and research results are still fragmented and its quality level is generally not comparable to what is present for cycling.

[618] http://www.fietsberaad.nl/?section=kennisbank+home&lang=nl, accessed 22-3-2017
[619] Up until 2000 the Dutch Pedestrians Association had a state of the art library of approximately 3.500 titles accompanied by a searchable literature database. The library was transferred to Rijkswaterstaat AVV, but is not kept up and is now lost; the database in dBase3 format is still available.

c. Timeliness and urgency
To be effective and promote efficiency, information should be easily accessible through the internet as well as comprehensible for Dutch policy practitioners. It should also adequately cover status quo, outcomes and impacts regarding vulnerable pedestrian groups, to evoke and substantiate fair policies. Much of the key information is available in English or other foreign languages only. For use in the Netherlands the research literature and practitioners' information needs to be monitored, collected, rated and translated into Dutch and made accessible and ready for use by practitioners. The information needs to be organised and if possible reviewed and/or rated by top experts in the domain to warrant finding information concerning the state of the art of W+S conditions and approaches.

d. Most suited policy actor(s)
As national level system responsible policy actor it would be most logical if the Ministry of Infrastructure and Water Management took the initiative and fund establishment of a national W+S library. Experts can deliver and spread their knowledge from there (see also Control 6).

Control 5 Learning opportunities
a. Content and role of the control
Learning opportunities for W+S policy practitioners are crucial for being able to cope with complex and changing conditions. In W+S policy making and implementation opportunities for learning are not self-evident. In large organisations working units can be big enough to allow for learning opportunities, but in most of the W+S policy actor organisations the W+S domain is dealt with by a single person, part-time. Learning opportunities can be optimised by working in three-plus person[620] task units, to whom local W+S policy tasks are delegated and/or a boosting function is attributed[621]. Such units can be established through (regional) inter-organisational (e.g. inter-municipal, supplemented by NGO's) agreements. The task units can be linked to an also proposed national information exchange unit ('Pedestrian Assembly' – see Control 6).

b. Status quo of the control activities
W+S learning is an area of interest at large municipalities (particularly Utrecht, Amsterdam and Eindhoven) and dedicated NGO's, and since 2019 the partners of the Platform Room for Walking. It is however not (yet) on the radar and agenda of most knowledge institutes. In fact, in non-front-runner organisations less than one or two man-hours per week is spent on W+S policy matters. Consequently there is hardly any time for orientation on good practises elsewhere; thus solutions-choices are based almost exclusively on personal perceptions and creativity, and not really evidence based. Frequently 'the wheel is reinvented'. There is no time for evaluation; not much will be learned, and progress is absent or minimal.

c. Timeliness and urgency
Knowledge and professional skills are essential for effective, efficient and fair W+S policy making. These need to be acquired, i.e. learned and maintained. Critical conditions for learning and progress are the volume and variety of experiences with policy development and implementation, professional discussions, and support base amongst strategists, clients and catalysts. If time or experience options are scarce, creative solutions for learning need to be organised. It can be argued that discussion, progress and continuity in learning can only be

[620] Not necessarily three-plus full-timers.
[621] Comparable to the Regional Road Safety or former Mobility Regions secretariats (Dutch: Vervoerregio's)

warranted in learning units of three or more persons. This may include upscaling knowledge units to inter-local or inter-organisational units. Such units can be formed through inter-organisational agreement concerning delegation of activities to common knowledge units.

d. Most suited policy actor(s)
W+S task units can probably best be established by a collective of W+S policy actors, particularly municipalities, who are not able to create three-plus person units themselves. Promotion of the idea and support by national government and dedicated NGO's is recommended to help pull municipalities across the line.

Control 6 Information exchange
a. Content and role of the control
Information exchange supports learning to better deal with difficult and changing W+S conditions. Connected to the idea of establishing a 'references unit' (see Control 4) and creating inter-organisational task units is the establishment of an Information Exchange Unit, comparable to the CROW Fietsberaad, but specialised in W+S policy matters, and provisionally called 'Walkability Assembly' (Dutch: 'Voetgangersberaad'). Such an assembly consists of working- and discussion groups of delegated experts from municipalities, central government and client organisations and a professional secretariat. The secretariat supports and manages the expert groups and assembly, the above 'library' and information database, and keeps in touch with experts and developments abroad. Products could be a physical and digital library and dedicated knowledge centre, a website, a newsletter, working group reports, research programming initiatives, presentations and promotion via conferences and workshops, guidance on W+S policy matters. Such a (new) organisation can be expected to both boost attention to W+S and professionalism in the domain. A 'walkability Assembly' is more or less an extended combination of the above controls 4 and 5.

b. Status quo of the control activities
Information exchange on the international and national levels is taking place scantily. One problem is that the domain is on the one hand considered 'taken care of' and on the other hand only just reborn and again in its infancy. The number, volume and the quality of exchange events has increased substantially over the last decennia (2000-2020). Particularly the WALK21, Project for Public spaces, International Cooperation on Theories and Concepts in Traffic Safety (ICTCT) and OECD/ITF deserve compliments. On the Dutch national level over the last years several small conferences and symposia have been organised; within national Transport and Traffic Safety conferences the subject of walkability and pedestrians has become more prominent. Still, a common contact and exchange opportunity and address is not yet operational. During the first Dutch Pedestrian Conference[622] it was agreed that the feasibility of establishing such a pedestrians reference centre ('Voetgangersberaad' = 'Walkability Assembly') would be investigated by the University of Breda (NHTV). In 2019 the wish for a walkability assembly potentially came true by the establishment of the Platform Room for Walking.

c. Timeliness and urgency
Establishment of a 'Walkability Assembly' depends on awareness of the costs and other disadvantages of lack of promotion, channelling and co-ordination of state of the art knowledge. It also dependeds on expected benefits and the willingness of the joint policy actors to co-

[622] The first Dutch Pedestrians Conference 'Lopen Loont' (= 'Walking Pays') was held on 4 July 2017 in Rotterdam.

operate and actively support the idea. Information exchange about experiences and evaluations of policies can be expected to improve its effectiveness, and can also lead to more efficiency and fairness of measures, provided this comes about in the deliberations.

d. Most suited policy actor(s)
Unlike the above W+S task units, the role and function of a 'Walkability Assembly' is beyond usual functional and budgetary competences and interests of local authorities. The organisation and co-ordination of exchange of information can be labelled a systems responsibility on national level, something which is obviously accepted regarding support and funding the CROW Fietsberaad. Promotion of the idea and support by the joint policy actors in the W+S domain, particularly the knowledge institutes and dedicated NGO's is recommended.

Control 7 Guidance on solving problems
a. Content and role of the control
Guidance on solving W+S problems supports creating better W+S conditions. It comprises central (external) directives and arrangements on fundamental questions like adequate data on W+S, adaptation of operational definitions and strategic priorities as well as practical guidance and tools for operational problem solving at the local level.

b. Status quo of the control activities
Data on W+S, as far as these are available, are derived from work in other (mobility) domains and do not optimally match suitable operational definitions for supporting walking and sojourning. Apart from general planning procedures, traffic rules and general guidance for road authorities, little structural guidance is offered by central government for supporting W+S. In 2014, on their own account CROW published 'Lopen Loont' ('Walking Pays') as a state-of-the-art guide for W+S policy making, design and management of (physical) pedestrian facilities. This guidance is available for paying members of CROW only. The publication has been presented in a number of ways: an introduction symposium, presentations at general transport conferences and in a number of newsletters. Furthermore several organisations put a link to the publication on their websites. As a product the publication is not a top seller.
Unfortunately much of current guidance is necessarily based on theories, 'best professional judgement' and assumptions, and lacks attention to fairness of the measures; research into dedicated W+S measures and its consequences for all relevant kinds of users is still lacking.
As there are only a handful of experts on W+S policies, strategies and measures, the multitude of experts is too small to be able to deliver personal just-in-time guidance if demand for guidance and expert support rises.

c. Timeliness and urgency
General guidance on W+S policies, strategies and effective and efficient measures can be delivered through publications and through person-to-person consultancy. Targeted, on-demand guidance for specific conditions requires availability of abundant experts who can deliver targeted expertise just-in-time.
Guidance for effectively, efficiently and fairly solving problems needs to be substantiated, marketed, easily findable and approachable by all policy actors in the domain, evidence based and unambiguous.

d. Most suited policy actor(s)
For some fundamental questions official directives and guidance from national government are essential. CROW, as a knowledge centre, can deliver 'printed' general guidance; specific

guidance needs to come from experts in the field. A 'walkability assembly' can help to advance W+S policy support and guidance and increase the number of experts in the field able to deliver on-demand guidance and support.

Control 8 Personnel management

a. Content and role of the control

Personnel management helps to optimise the effort of manpower in qualitative and quantitative terms. The main aim is to be able to deliver effective and efficient answers and resilience regarding (unexpected) operational problems[623]. Expertise, learning opportunities and continuity are essential ingredients. Most policy actors cannot control for these factors within the margins of their organisation. By delegating the relatively small W+S tasks to a more or less shared task unit (see also Control 3) better opportunities can be created.

b. Status quo of the control activities

Currently domain activities are dominated by on the one hand reactive public space maintenance activities and special projects on the other hand[624]. Reactive public space maintenance is triggered by complaints which typically are not structurally fed back to policy makers. This means that learning opportunities are not fully used. Special projects are typically manned by staff new to W+S policy making, without guarantees for continuity of employment in the special field. Highflyers (there definitively are some) are there by chance. Learning opportunities are not automatically subject to deliberate policy. Nevertheless, in Utrecht and Amsterdam the pedestrian projects explicitly include education of project participants.

Personnel management is usually bound to individuals and groups of persons, and connected to structural tasks. A special option would be to delegate tasks to a common unit, staffed by a group of policy actors (e.g. three-plus person task units as proposed under Control 3).

c. Timeliness and urgency

In a relatively small domain as W+S active and 'out-of-the-box' personnel management is a crucial precondition for improving effectiveness, efficiency and fairness of W+S policies.

d. Most suited policy actor(s)

Most W+S policy actors are not in the position (yet) to structurally allot multiple staff to W+S policy activities, apart from the municipal neighbourhood teams. By far most of them allot less than 1 day per week on W+S policy activities. In such cases personnel management is not obvious. For larger units e.g. within NGO's, some knowledge institutes and possibly a ministry, the meant personnel management is an option.

Control 9 Vision

a. Content and role of the control

A vision sheds light on ways to improve current conditions, gives direction to the joint policy actors and helps to inspire, motivate and focus them on improving performance in policy making and implementation. Thus a vision on pedestrians, walking and sojourning includes an image of an imperfect current state, images of a better future and means to get there. Visions typically lead to a 'Masterplan'.

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[623] e.g. in connection with changing mobility and traffic patterns, health and safety notions, ageing of the population. With ageing of the population the risk of injury incidents while walking increases, most likely at weakest links in the pedestrians network.

[624] e.g. the pedestrian plans in Utrecht, Amsterdam, Eindhoven.

b. Status quo of the control activities
With regard to W+S there are two inspiring models: the 1990s Dutch Masterplan Fiets (= bicycle) and the recent Austrian Masterplan Gehen (= Walking). Both offered a national framework for co-operative policy making and planning. Noteworthy are also the European Charter of Pedestrians' Rights by the European Parliament, the International Charter for Walking by Walk21, and visions presented by front-running cities like Toronto, London, Barcelona, Brussels. Since the economic crises in 2008 in the Netherlands presenting visions was unpopular. This is apparently changing. The large municipalities Amsterdam, Utrecht and Eindhoven issued visions on walking; on the national level there was much discussion around Agenda Stad (Urban Agenda) and there was call for new visions within the context of the new Environmental Law. There was even some attention to walking and sojourning in public space being an essential aspect o city vitality. Political room to move (the political parties, budgetary options, public support, media support) seems to be expanding.

c. Timeliness and urgency
Basic preconditions for developing visions and catching them on are collective awareness of urgency of an issue, political and public (media) support, knowledge about causes and remedies, and a positive, inspiring, active, open minded policy making atmosphere, entrepreneurship and co-operative attitudes within the domain. Visions are not likely to catch on in an indifferent atmosphere, where economizing is the dominant governance attitude. Vision development demands an appropriate sense of urgency, clear definitions, collective status quo assessment, specification of desired image of the future and strategies to get there; it must effectively address major policy actors, dissemination of best/good practises and include carrots and sticks; critical mass of collective support is needed at the start and for continuity; there should be an at least rudimentary staff bureau and a figurehead. A vision can inspire and motivate, but not for eternity. Even successful visions like the Dutch Sustainable Safety did not last more than ten years. Success depends on follow-up and execution. Dishonesty about performances can be killing.

d. Most suited policy actor(s)
History taught that visions are either introduced from the outside by champions of the domain (e.g. WALK21, WHO, OECD/ITF), by policy entrepreneurs (e.g. Jan Gehl and other consultants) or from within by dedicated researchers in the organisation (e.g. Amsterdam, Eindhoven). Initiatives are likely to be taken by dedicated NGO's and catalysts (media, knowledge institutes). Promotion and guidance needs to be taken up by the strategists and facilitators in the field (respectively ministries and municipalities). Nation-wide visions can be expected to have most impact. Next best are connected local authority visions, inspired by large leading municipalities, supported by the association of municipalities and other co-operation bodies.

Control 10 Visibility, position and priority of W+S domain

a. Content and role of the control
Visibility of the walking and sojourning issues as well as their impacts are essential for positioning the field in the policy world. This concerns highlighting walking and sojourning as essential and worthy activities, making costs and benefits visible, connecting to ideas and visions regarding improving walking conditions. Visibility functions as booster for policy attention and priorities both at central and local positions.

b. Status quo of the control activities
One of the main obstacles to spreading and success of promotion of walking and sojourning in public space is that as a theme it is hidden in many ways. The fate of common things like walking is that they are overlooked. Definitions of mobility and safety largely neglect the pedestrian, walking and sojourning in public space; data, statistics and information on walking and sojourning are missing or 'integrated' in other activities and impacts; generally approaches focus on the 'average' pedestrian and not so much on impaired groups; W+S policy measures and budgets are integrated in larger projects; the common perception about walking without a critical look is 'we got it well covered', which might apply to able adult pedestrians, but not to less able (potential) pedestrians.

c. Timeliness and urgency
A prime condition for visibility of the issue and domain is that it is clearly, independently, objectively and convincingly shown that walking and sojourning is not adequately covered, posing real and large problems, and that it is worthy of getting special attention, bringing wealth and health. Best practise examples from abroad can support such message.

d. Most suited policy actor(s)
Visibility heavily depends on media exposure, preferably on the national level. Such exposure leans on perceived urgency and concerns voiced by credible sources, i.e. persons that matter. Independent researchers and popular politicians are more trusted and thereby better spokesmen than interest group representatives.

Control 11 Playing field management
a. Content and role of the control
When a playing field is rather passive, like the W+S playing field, management activities can help to activate the field. Examples are benchmarking, highlighting good practises, publicly rewarding front-running players and promising initiatives, and pushing stragglers. In an active field discussion and learning is more prominent. Active policy actors are likely to infect the less active ones if this helps to improve their public image, helping the domain to reach critical mass for diffusion of innovations.

b. Status quo of the control activities
Currently there are only a few really active policy actors in the domain, specifically dedicated NGO's, large municipalities and a small number of consultants. Around 2000 the then stimulator of the field, the Dutch Pedestrians Association was forced to merge with two other road safety NGO's. Consequently the pedestrian voice was effectively silenced and its activation function stopped. It can be expected that the recently established Platform Room for Walking takes up this role.

c. Timeliness and urgency
Activity of a policy domain depends on visibility of the field and promise of esteem, benefits and other rewards. Below a critical mass of active W+S policy actors communication between actors does not happen by itself, even if in solitary cases reason exists. Activation needs to be organised.

d. Most suited policy actor(s)
Playing field management cannot easily be carried out by peers. National government, policy entrepreneurs and/or the Platform Room for Walking are the most likely candidates.

Control 12 Allotment of resources

a. Content and role of the control

Allotting resources can be considered a good means to highlight the importance of walking and sojourning in public space. Leadership can selectively allot and withhold resources (manpower, expertise, money, time, attention, communication, production materials, tools etc.). Without resources, particularly manpower, W+S policy activities cannot thrive.

b. Status quo of the control activities

National government allots hardly any resources to W+S policy activities; some are spent on subsidizing NGO's and knowledge institutes (e.g. CROW, VVN, SWOV and VeiligheidNL); some relevant data are collected, though under generic titles (e.g. mobility data, accident data, hospital data); municipalities do not receive earmarked budgets for W+S policy activities. Municipalities themselves allot budgets to larger projects, integrating W+S measures; large municipalities allot staff to specific W+S projects. Apart from dedicated NGO's, CROW and VeiligheidNL hardly any personnel time is assigned to W+S policy activities. Dedicated and comprehensively covering data, information and expertise are (very) scarce, causing pedestrian issues to be overlooked.

c. Timeliness and urgency

The collection of data, information and acquiring expertise require financial resources. As most W+S measures can be financed under other titles, money does not seem to be a critical issue for taking measures. Integrative approaches however have the disadvantage of shielding W+S measures from public and political attention, contributing to the low visibility of the W+S domain and consequently a low sense of urgency.

d. Most suited policy actor(s)

The vast majority of (potential) nationally available resources for W+S policy activities are distributed by governmental bodies, i.e. ministries and municipalities.

Control 13 Co-operation an partnerships

a. Content and role of the control

Co-operation and partnerships can help to increase volume, quality and coverage of W+S policy activities. Authorities and competences are joint and are likely to deliver synergy benefits.

b. Status quo of the control activities

Currently co-operation and partnership in the W+S domain is still in the making. Dedicated NGO's co-operate with each other and with knowledge institutes and front-runner municipalities; Wandelnet and MenS have formed an informal partnership. For most other (potential) W+S policy actors applies that as yet they devote little time to W+S activities and that this little time does not enable them to forge co-operation with other W+S policy actors. In practise disadvantages of time investments for forging and sustaining co-operation and lost leeway weigh heavy.

c. Timeliness and urgency

Co-operation and partnership require mutual interests and benefits beyond a certain critical mass of manpower and outlook of added value.

d. Most suited policy actor(s)
W+S is a shared interest within the domain. None of the organisations cover all W+S aspects, so in theory every one of them can be expected to benefit from co-operation and so all of them qualify for entering into co-operation or partnership arrangements. Possibly carrots and sticks issued centrally can help promoting co-operation.

Control 14 Communication

a. Content and role of the control
Dedicated communication can be deployed to build awareness, engagement, commitment and movement regarding W+S issues and solutions. Communication is crucial for acquiring public and political support, i.e. social and political feasibility of proposed solutions. Apart from mass-media, social media and person to group/person communication, communication also comprises the application of information technology for traffic and crowd management, navigation, protection and highlighting points of interest.

b. Status quo of the control activities
All policy actors practise communication in some way; almost all municipalities invest in public participation; large cities frequently organise sojourning activities for city promotion. W+S matters are generally published in low profile media. In journals and newsletters for professionals W+S is regularly a subject, be it less than cycling. Most news about walking and pedestrians however concerns pedestrian traffic accidents (collisions with vehicles) and not much more abstract and at least equally disruptive matters like suppressed mobility, menacing traffic volumes and speeds, pedestrian falls, obstacles and threats on sidewalks etc. Interesting initiatives are shopkeepers teams for place making and maintenance, new playing grounds, hang-out (youth) facilities, school route projects, 'Walking Bus', and street survey groups.

c. Timeliness and urgency
Communication, participations and events can be considered a starting point as well as a final paragraph in W+S policy activities. Support created by these activities are essential for development and continuity of policies.

d. Most suited policy actor(s)
All policy actors can initiate and carry out activities regarding communication, participation and events. Direction can be provided by central government, policy entrepreneurs as well as umbrella associations of municipalities and other policy actor groups.

Control 15 Participation and events

a. Content and role of the control
Acceptability of and satisfaction with solutions can be forged by participation of relevant policy actors in policy making projects. W+S related events can highlight the W+S issue and set the stage for public support by making the issue visible, fostering awareness, engagement and commitment. Events can incite positive side effects like city promotion.

b. Status quo of the control activities
In the Netherlands at the national level there is a tradition of involving stakeholder organisations in the development of strategic plans e.g. for land use planning and road safety. On the local level participation in neighbourhood and public space projects is promoted, though no longer as common as in the 1980s. In some municipalities delegates from specific interest groups (e.g. cyclists, handicapped persons, elderly) are invited to carry out streets and public spaces surveys.

From the 1980s until the turn of the century so called Street Play Days were organised. Each year the European Commission promotes local mobility events. In the context of city promotion many cities, particularly the larger ones (e.g. Rotterdam, Utrecht, Amsterdam) initiate and actively support place making events like green streets, car-free streets and liveable street events.

c. Timeliness and urgency
Participation of non-governmental stakeholders is most opportune when the activities can be followed up by concrete measures. Events can be considered useful for introducing unusual and new solutions and for mustering support for them.

d. Most suited policy actor(s)
The policy responsible authority can set rules of the game and promote and facilitate the participation of stakeholders in change processes. W+S promoting events are most suited to bottom-up 'grass roots' initiatives, but active governmental support can help to make them a success.

Control 16 Legislation and regulation

a. Content and role of the control
Legislation and regulation are deployed for capturing, establishing and command certain behaviours and procedures. Legislation usually follows common perceptions and agreements. It can also be the fundament for realising (new) behavioural objectives, distribution of competences and norms regarding behaviour, products and processes, inciting for example W+S policy activities. Legislating and regulation are particularly useful in the management & control stage of policy life cycle, when motivation to act no longer comes from political and public pressure. Legislation and formal regulation can be useful for achieving a sense of direction and common practises, based on common definitions and references. Legislation, directives and regulations can be enforced.

b. Status quo of the control activities
With regard to pedestrians, walking and sojourning, very little is formally legislated or regulated. A number of ancient national rules have been abolished under deregulation policies, like the general obligation of winter maintenance of sidewalks in front or surrounding one's home or business, the obligation to walk on the left side of a rural road if there is no sidewalk present. On the other hand, although there never was an obligation for local authorities to provide sidewalks and pedestrian crossing facilities, it is common practise to attend to these demands. Under pressure land use exploitation costs however this common practise is compromised in so called VINEX development areas, where for lack of available public space the 'woonerf' solution without separate sidewalks was widely applied, even in relatively busy streets. Thus not regulating may pose a risk[625].
Local authorities can and do issue sufferance taxes for the use of public space. This way the competition for space in intensively used urban areas can be regulated, or at least compensated, be it still at the expense of pedestrians space.

c. Timeliness and urgency
Legislation and regulation requires awareness of risks of problematic conditions, public support and political willingness, and consensus to regulate. In practise only legislation with 85%

[625] As the poet Lucebert said: 'all valuable things are defenceless'.

(expected) compliance is deemed effectively and efficiently enforceable. Lower compliance rates can be reason to abolish regulation. Effectiveness of legislation can often be enhanced by offering a matching behavioural context, e.g. designing a street in such a way that slow speeds and freedom of movement for pedestrians come natural and is publicly considered to be fair and considerate for all: legislation and rules should match perception and experiences including enforcement of the rules. Urgency largely depends on how many people seriously suffer consequences of non-compliance, and actually get their concerns public.

d. Most suited policy actor(s)
Only the national government is authorised to issue generic legislation. Municipalities can issue local by-laws e.g. regarding winter maintenance, limited use of public space (e.g. sufferance tax). Other organisations can regulate behaviours to some extent within their authorities.

Control 17 Enforcement of legislation and regulation
a. Content and role of the control
Enforcement of legislation and regulation helps to make sure that issued and (democratically) accepted regulation is acted upon. Enforcement can imply correction, punishment or rewarding behaviours. Law enforcement is restricted to authorised organisations and depends on the type of legislation or regulation.

b. Status quo of the control activities
Generally a differentiation is made between enforcement (authorisation to punish) and surveillance (authorisation to regulate behaviour). Enforcement activities are restricted to authorised offices. For traffic behaviour law offences the public prosecutor, the police and in serious cases the court deal with enforcement. Surveillance focusses on minor enforcement activities (e.g. car and bicycle parking), which can also be delegated to local governmental or private enforcement surveillance teams. For pedestrians important surveillance organisations are 'verkeersbrigadiers' (especially near schools) and 'verkeersregelaars'. They protect pedestrians and pedestrian groups. Administrative and procedural regulations are usually enforced by inspections or dedicated governmental departments; cases can be brought to court. As a road and public space user, pedestrians are under the radar of the police and other norm enforcers. Pedestrians are seldom punished for not obeying the law. Sometimes pedestrians are fined if they provoke or do not obey the police. Likewise behavioural offences against pedestrians or at the cost of pedestrians, like obstructing sidewalks are not taken seriously. Under pressure of other interests, regulation or guidelines regarding walking and sojourning facilities are easily compromised.

c. Timeliness and urgency
The level of enforcement generally reflects the (political) priority given to a subject and follows political undercurrents. Enforcement units have limited capacity and authority and need to focus their activities on prioritized areas. The pedestrian, walking and sojourning are not considered a priority. With regard to pedestrians, walking and sojourning legislation and regulation is rudimentary. Statistics and complaints do not give strong reasons for prioritization, hence there is little enforcement activity in this regard. Particularly vulnerable groups (children, elderly, impaired persons) suffer the consequences.

d. Most suited policy actor(s)
Traffic rules enforcement is directed centrally by the assembly of public prosecutors-general and decentral by Triangle Consultation between local government (the Major), the public

prosecutor and the police. Dedicated inspections at the ministries[626] and special agencies[627] are directed by their minister and ministerial policy departments. The various policy actors can apply their influence to cause a change in priorities, directly and indirectly through the media and public opinions.

Control 18 Long term plans

a. Content and role of the control

Long term plans offer a framework for mid-term and implementation planning, give direction to public and professional discussions and offer a fundament for multi- and inter-sectoral policy activities. In general long term plans take a broad, integral perspective, mostly on the national level. With regard to walking and sojourning the former Dutch Masterplan Fiets (=bicycle) and its supporting organisation and the recent Austrian Masterplan Gehen (=walking) can serve a model for developing and issuing a Masterplan Pedestrian.

b. Status quo of the control activities

In the Netherlands there are no dedicated long-term W+S plans. There are however White Papers on mobility and land use, and on traffic safety[628]. With regard to physical activity and health there are a number of policy programs in operation. The white papers are somewhat outdated and discussion about preparing new long term policies is on-going, because, after a period of economic problems, economic conditions have become more favourable for such activities.

The Netherlands may be a Mecca for cycling, it is not a Mecca for walking. Conditions of the W+S policy context are however such that the country could easily be, if politicians and professionals want it to be, a Mecca. The question is: are Dutch national organisations able and willing to welcome expertise, support and advise from the outside?

Opportunities for making the Netherlands a Mecca may stem from the identified strengths. There are some obstacles to be conquered:

- International agreements positively affecting walkability conditions, like the Decade of Road safety and the United Nations Convention on the rights of persons with disabilities, are ratified or otherwise supported by the Dutch government. Dutch NGO's are aware of them and can help making use of these agreements. Dutch government's implementation procedures can render the agreements difficult to make use of, as is the case regarding the above UN convention. Lobby by NGO's can help to smooth things up.
- The natural physical environment in the Netherlands is favourable for walkability conditions: the country is flat, the climate moderate, the cities and villages are relatively compact, etc. A problem is that when these advantages are applied to the maximum for cycling this often happens at the expense of room for walking and sojourning facilities (De Bruijne, 2016[629]).
- Recreational walking is increasingly popular, inciting demand for dedicated facilities. This demand is supported by economic interests (tourism, catering industry). The facilities

[626] e.g. Rijksverkeersinspectie, Inspectie Verkeer en Waterstaat

[627] e.g. Rijksinstituut voor Volksgezondheid en Milieuhygiëne

[628] Structuur Visie Infrastructuur en Ruimte (2011) and Strategisch Plan Verkeersveiligheid 2008-2020 (2008).

[629] Ruben de Bruijne investigated for the municipality of Amsterdam what spatial requirements are for pedestrians. He found that the separation of modes has been achieved at the cost of walking space (De Bruijne, R. (2016) Ruimtevraag van de voetganger. Gemeente Amsterdam/NHL Hogeschool Leeuwarden, Amsterdam/Leeuwarden)

destine for recreational walking can support utilitarian walking as well, particularly within urban areas.

- The Netherlands is a wealthy country. It can easily afford super pedestrian facilities. These are cheap compared to facilities for car traffic and even bicycle traffic. Being cheap can also be a disadvantage: such facilities are more likely to be perceived simple and not urgent.

c. Timeliness and urgency
Like for Visions, basic preconditions for developing long term plans are collective awareness of urgency of an issue, political and public (media) support, knowledge about causes and remedies, and a positive, inspiring, active, open minded policy making atmosphere, entrepreneurship and co-operative attitudes within the domain (see also Control 9 Visions).
As long term plans are less free of obligations than visions, political room to move (the political parties, budgetary options), public and media support and co-operation from policy domain are crucial. History has taught that long term plans stand the best chances to be realised if interested, concerned and joint parties actively participate in developing and planning activities.

d. Most suited policy actor(s)
National long term plans are developed under direction and authority of national government, i.e. the Ministry of Infrastructure and Water Management, Ministry of Interior and the Ministry of Well-fare, Health and Sports, with ample support of the policy domain. Commitment and inputs from important W+S policy actors, including decentral government, Justice department and the police and NGO's and knowledge institutes, can be considered a major success factor.

Control 19 Mid-term plans

a. Content and role of the control
Mid-term plans are used for focussing, working out visions and long term plans and are a major reason and context for developing operational plans. On the local level such plans mostly concern mono-sectoral structure planning. The plans offer justification for the development, budgeting of operational planning and implementation.

b. Status quo of the control activities
With regard to W+S mid-term plans concern large city sector plans, particularly about public space in city centres. In the Dutch four largest cities there is explicit attention to W+S in spatial structure plans, and in a number of other larger cities, too. W+S is introduced in these planning contexts only recently, which can best be considered a growing process. It is generally seen as a good way to focus and keep up attention to W+S. Mid-term plans for the city as a whole are not yet an option.

c. Timeliness and urgency
Although probably most effective, dedicated mid-term W+S plans on the local level do not seem to be a very realistic option; W+S issues are usually part of other (spatial, economic, welfare and well-being) planning issues. For efficiency reasons special sections in the plans, however, can serve the cause of improving pedestrian conditions adequately. Preconditions for including W+S as a special section are evidence based reasons, awareness, political and public support. As data on walking and sojourning, particularly on the local level, are scarce it is difficult to produce evidence based arguments. Such data need to be actively collected for the territory of the concerned planning authority (e.g. municipality, joint municipalities) to develop fair (social justice) plans. Because of their information and knowledge richness, exchange of ideas on the contents of mid-term plans is vital for collective learning.

d. Most suited policy actor(s)
Evidently, with regard to mid-term plans local authorities are the main players, but, like for national long term plans, commitment and inputs from important W+S policy actors, including local governance agencies, the police, (local) NGO's, can be considered a major success factor. Motivation can come from national level initiatives and support, e.g. through a national vision and supportive activities, such as benchmarking, competitions, prices. Input from knowledge institutes and for example the Platform Room for Walking (see Action 6) can help to improve the quality of planning significantly. Particularly in smaller municipalities expert consultants are needed for substantiation of the plans.

Control 20 Operational plans and implementation

a. Content and role of the control
Operational plans concern the organisation of implementation of measures and packages of measures on the short term (1–2 years) and limited territory. These plans ideally imply tangible concrete measures and (re-) constructions and also deal with resources employment, communication and public participation, events, co-operation and partnerships, evaluation and room for later adjustments.

b. Status quo of the control activities
This kind of plans appeals most to politicians, because such plans connect best to their term in parliament or council and political need to display performance and settle scores. Operational plans are, because they are so practical, the most common type of plan. (Almost) all active W+S policy actors have short term working plans. There are no operational W+S plans on the national governmental level. In most of the operational plans the subject of evaluation and room for adjustment is however missing. Amongst municipalities most W+S policy activities concern ad-hoc measures as a reaction on complaints.

c. Timeliness and urgency
To be effective and efficient regarding general impacts, operational W+S plans need to be framed in other contexts. Like any other plan, reason, awareness, political and public support are crucial factors. With regard to fairness of the measures the devil is in the details (cf. Design for All and accessibility guidelines). For advancing the state-of-the-art and practitioners' expertise evaluation sections and exchange of experiences on inter-municipality and national levels are dearly needed.

d. Most suited policy actor(s)
The development and implementation of operational plans concerns all implicated W+S policy actors and implies their active involvement. Measures will be more effective if end users (particularly vulnerable groups) are actively involved. The volume and quality of the plans can be boosted by central promotional initiatives (e.g. benchmarking, competitions and prices, experiment projects) and exchange of experiences (see also Action 6).

Control 21 Management, maintenance & surveillance

a. Content and role of the control
Once pedestrian facilities are created, they need to be (actively) managed, maintained and supervised to sustain their optimal functionality.

b. Status quo of the control activities
Management, maintenance and surveillance are usually delegated tasks, e.g. to the municipal neighbourhood teams, other operational units or external services. Politically the subject is not very challenging; delay or postponements do not show immediately, which makes them candidates for budget and personnel cuts. Thus management, maintenance and surveillance plans are often reduced to their minimum: restricted to on-call maintenance and management activities, e.g. based on citizens' complaints through complaints desks. Extreme large events however, because of their public safety risks are actively managed, e.g. the SAIL event in Amsterdam. Officially 'more blue in the streets' (police) is a priority, in reality this priority is continuously under pressure. As stated above, pedestrian behaviour is not systematically supervised, and neither is offensive behaviour towards pedestrians. It has to be said that in the Netherlands there is a rich tradition of neatness, pushing towards adequate management, maintenance and surveillance.

c. Timeliness and urgency
Management, maintenance and surveillance requires having a proper guidance and operational organisation form, adequate budget and working tools.

d. Most suited policy actor(s)
Management, maintenance & surveillance can be considered operational activities and thereby a systems and result responsibility of local authorities. It does not do harm to centrally monitor conditions and reward exemplary local authorities in this regard, e.g. by benchmarking and awarding prices for outstanding performance.

6.6.5. Discussion on System & Result responsibility/accountability

Above the concepts of system and result responsibilities, accountability and delegation have been referred to multiple times. In short the idea may have appeared to be: ministries are system responsible and accountable on that level, whilst local authorities are 'only' result responsible. This representation sells responsibilities and accountabilities short. Municipalities are also systems responsible and accountable, however only with regard to the system within their territory and authorities.

Connected to the concepts of system and result responsibility are the European Commission's subsidiarity principle and central governmental decentralisation goals. Both are often used in a black-and-white manner. Both European Commission and ministries seem to renounce responsibilities with regard to walking. Reality, fortunately is not so black-and-white. Both are involved in legislation, research programming, data acquisition, long-term planning, general norms and values, objectives and targets, affecting walking and sojourning in public space. Both are politically accountable for their decisions and actions on their territorial levels.

It can be argued that the European Commission and national governments are system responsible and accountable for walking and sojourning in public space *on their governmental levels*. After all, in the end they are responsible and up to a point accountable for the status quo of wealth and well-being. Walking and sojourning in public space can be seen as lubricating oil and cement for being outdoors, mobility, health and thereby societal performance. Walking and sojourning in public space impact on the economy, competitive power and public health of the population and population groups. In the end societal cost of offering walking and sojourning facilities and opportunities as well as consequences of pedestrians accidents, fatalities and injuries (hospital costs, time lost) and governance costs (monitoring, research, legislation costs,

enforcement costs etc.) have to be balanced out by benefits on the European and particularly national levels. Governmental activities coupled with system responsibility concern structural facilities (health care, law enforcement, land use policy, the transportation system, infrastructure, the environment etc.) and include strategic land use legislation and planning, strategic traffic and transport legislation and planning, environmental planning, legislation, preservation of European and national knowledge institutes, mobility management, data, knowledge management, including education of practitioners, government structures, availability and distribution of budgets etc. In short: everything that is needed to keep up the country and take care that result responsible policy actors can do their job: taking care that pedestrians can move safely, comfortably and agreeably through public space towards their destinations and sojourn in public space, contributing to wealth and well-being of population and the nations. Major controls in this regards have been identified above.

A common condition is that political accountability rests with the political leader of the lead organisation, e.g. a Minister of Infrastructure and Water Management. This political leader decides on public resources invested in the (W+S) domain. In practise leadership responsibilities and strategic decisions can be delegated to the high level civil servants, who in turn delegate responsibilities and operational decisions to the domain staff within the organisation. In such cases the domain staff exerts leadership on behalf of the organisation, personified by the accountable minister. On the other hand, the same domain staff selectively informs the high level servants about the domain characteristics and urgencies (filtered regarding what the higher level is believed to want to hear, which is probably not about 'futile' W+S problems). For prioritization the accountable minister is heavily dependent on information s/he gets from society, the organisation and partner policy actors, and chances are that important information is filtered out. Within the organisations following the lead organisations similar processes take place. It is assumed that this situation can only be resolved by active leadership, promoting uncensored communication.

6.7. Epilogue

To round off this chapter the author feels the need to position the above findings and present general observations regarding the W+S policy field:

- In the Netherlands, compared to 10 years ago the field is more alive and active than before. Around 2005 none of the municipalities had explicit W+S policies; knowledge institutes and most consultants (except e.g. NHTV/SOAB, Goudappel Coffeng and DTVconsultants) largely neglected W+S. There were no dedicated symposia and conferences and there were hardly any W+S articles and presentations on more general events. The establishment of the Platform Room for Walking is a real sign of the positive developments in this regard.
- Although the Ministry of Infrastructure and Water Management did not take initiatives as long as the ‘outside world’ does not emphatically ask for it, this is only half of the story. Without the consent to work on the subject of walkability policy making and altruistic financial support of this Ministry (in total more than €150,000), the COST 358 Pedestrians’ Quality Needs project would not have been possible. Furthermore, within the context of the Year of Space and the Environmental Law, the subject of Healthy Cities was discussed and expanded in documents. More importantly, in 2019 the ministry appointed a quartermaster to prepare for development of W+S policy and co-initiated the establishment of the Platform Room for Walking, which promises to be the key to improved policy attention to the pedestrian, walking and sojourning in public space.

- Another sign of positive attitudes towards highlighting the need for walkability policy making is that, directly after retiring as an advisor at the Ministry of Infrastructure and Environment (Rijkswaterstaat Water, Traffic and Environment), SWOV Institute for Road Safety Research altruistically offered a working place, support to complete this thesis and a stage to present tentative results.

7. CONCLUSIONS AND DISCUSSION

7.1. Introduction

The main aim of this thesis is to comprehensively cover what is known about pedestrians, walking and sojourning in public space and effective and fair policies to sustain and improve conditions in this regard. The result is meant to become powerful information for policy making to improve pedestrian, walking and sojourning (W+S) conditions as a source of wealth and well-being.

The work on this thesis took an unusual long trip and comprises an unusual broad perspective towards the subject of pedestrian, walking and sojourning in public space policy development. It is based on heartfelt worries about developments in this regard. To warrant credibility and maximal impact the format of thesis is chosen. In this regard it is important to stress that this thesis should be considered a means, but not the ultimate goal. This thesis is the grateful author's contribution to society in return for his exceptional privileged rich and rewarding professional life.

This chapter summarises the thesis and draws conclusions and offers discussion points regarding results of the explorations and analysis to answer this thesis' central research question:

What insights are available and/or needed and how can they be acquired, and what controls can authorities adjust to effectively, efficiently and fairly improve conditions for walking and sojourning in public space as a source of wealth and well-being?

The central research question was split up into four leading research questions:

1. *What conceptual framework can be developed to structure and inspire research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, its interrelations and main determinants?*
2. *What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space supporting them to optimally contribute to the wealth and well-being of communities and the nation?*
3. *How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?*
4. *How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?*

The thesis is made up of seven chapters. The first chapter introduces and defines the subject. In the second chapter taken approaches to answering the four leading research questions is unveiled. The third chapter deals with the first leading research question about developing a conceptual framework to structure and inspire the research into the second, third and fourth leading research question, which are dealt with in respectively Chapter 4, 5 and 6.
The current Summary, Conclusions and Discussion chapter captures to what degree this thesis' approach successful, what conclusions can be drawn from the results of the research, and what consequences the thesis' conclusions should have for future research and policy development.

In the following sections the above questions successively will be answered. Section 7.2. deals with this thesis' approach to the research, i.e. the effectiveness of the applied methodology. Subsequently Section 7.3. draws general conclusions with regard to the results of the researched policy development steps (cf. Figure 1.2), answering the chapter's second main question. In answer to the third main question, Section 7.4 presents general discussion points and/or recommendations regarding future research and policy development.

7.2. Conclusions regarding this thesis' research approach

7.2.1. Introduction

This section covers conclusions with regard to what degree this thesis' approach is successful in covering the realm of pedestrians, walking and sojourning in public space and public policies in this regard. Successively, as return to the question, baseline research conditions and assumptions, scoping review as the main method, redefinition of the domain, substantiation of complexity, and the added value of this thesis' approach (i.e. its success) are established.

7.2.2. Solidity of baseline research conditions and assumptions

Around 2010 experts from precursory international projects (WALCYNG, PROMPT, COST C6, COST358 Pedestrians' Needs project and the OECD/ITF project Pedestrians, Safety, Urban Space and Health) sketched a rather grim picture of baseline research and policy conditions regarding the pedestrian realm. They concluded that pedestrians were neglected in academic research and that pedestrians, walking and sojourning in public space held a subordinate

position and were unfairly treated in traffic, public space, and in policy development and implementation.

Based on these expert opinions beforehand there was reason to assume that there is little dedicated research into pedestrians, walking and sojourning. This thesis' initial explorations however have proved this assumption wrong. There is an increasing amount of (scientific) literature on the subject, be it far less than on bicycling and still somewhat fragmented and incompletely covering the domain; overview on the domain as a whole is extremely rare and not available for the Netherlands.

Unchallenged baseline assumptions are:

- Pedestrians, walking and sojourning are important for wealth and well-being of communities and the nation;
- The idea that there is always room for improvement;
- Pedestrians are unfairly treated in traffic, public space, and neglected in policy making and implementation. A reason for this seems to be that policy makers seldom receive urgent signals that changes are needed, and consequently do not feel the need to take a closer look. Although there now seem to be some (marginal) improvements, initial explorations could not falsify this assumption;
- The research and policy development communities are not negative regarding research and development of walking and sojourning improvements. They support such ideas, but do not (yet) feel the need to come into action. Other matters are more important;
- Whenever attention is given to walking and sojourning conditions, the baseline condition is that it is not done from the perspective of interests of pedestrians, but as part of serving 'other' interests like traffic safety, health, the economy or the environment (where the pedestrian is a target object and not the initial subject);
- Whenever dedicated pedestrian, walking and sojourning policies are initiated, such policies aim at effectively, efficiently and fairly supporting freedom of movement, safety and health of pedestrians while walking and/or sojourning in public space.

The thesis substantiates the above assumptions. Particularly Chapters 5 and 6 account current conditions, which are found not to differ more than marginally from baseline conditions. The general attitude towards improving conditions for pedestrians is not negative, but there appears to be *need for a paradigm shift*. Recent developments like the ageing of the population, the establishment of a national Platform Room for Walking, and the COVID-19 crisis instigating need to keep social distance, even reinforce the starting point.

7.2.3. Scoping review as the main method

This thesis explicitly concerns *exploration* of the pedestrians realm. It targets at covering the totality of pedestrian activities, its determinants, consequences, and ways to optimally support and promote walking and sojourning in public space as complete and comprehensive as possible. The ultimate goal is to inspire dedicated pedestrian, walking and sojourning policies on the national level, based on knowledge about conditions in the Netherlands.

Knowing that traffic safety mishaps and successes are not 'acts of God', Rumar (1999, 2001) indicated that there are many partially and even (almost) totally hidden causes of accidents. He advocated to look more closely at causal chains, and to put much effort into uncovering (partly) hidden system success and failure causes for delivering a rich state-of-the-art account in this

regard as basis for effective measures and policies. This thesis assumed that this applies as well to pedestrian, walking and sojourning in public space problems, weaknesses, treats and opportunities.
As the main aim of this thesis can be expected to expand the scope and uncover beforehand unknown process variables, the application of a classical research design (research question > hypotheses > testing the hypotheses > drawing conclusions thereof) is not suitable. Beforehand it was clear that available empirical data and research results were scarce, incomplete, inconsistent and sometimes biased. This does not offer sufficient hold for proper analysis and drawing solid conclusions. Plan B is to more freely explore the domain, using so called scoping review and attempt to substantiate the findings with the available (restricted) data, research results, proxies and best estimations and triangulation, and so delivering a best fit sketch of requirements, status quo and (institutional) change options. Due to time and information limits the effectiveness of measures was not researched and no concrete best fit proposals for policy plans could be drawn up. Still, a rather comprehensive picture of (potential) cues for improvement of pedestrian, walking and sojourning conditions could be delivered.

7.2.4. Redefinition of the domain

This thesis' approach is knowingly explorative, questioning commonly used definitions and conceptual models for delimiting scopes regarding the domain, fact finding, knowledge and craftmanship, leadership, application of means, operational organisation etc. In this regard the definitions of a pedestrian, the system around the pedestrian, safety, health, the economy and more, are scrutinised and redefined to better cover totality of the pedestrians' interests, insights into processes leading to pedestrian activities ('outputs'), and its direct and indirect consequences ('outcomes' and 'impacts'). This way the pedestrians activities were redefined into four kinds of activities (viz. 1. walking from A to B, 2. walking to and from other modes, 3. circulation (from A to A), and 4. sojourning in public space). The system around the pedestrian in this thesis was upgraded from 'human-road-vehicle' to comprising five main components working on three activity levels (components: pedestrian, other users / social environment, physical environment, transportation environment, and Information and Communication Technology, captured in the so called Pizza model). Pedestrian safety is broadened from restricted to traffic safety to traffic safety plus falls plus public safety/security. Due to practical limitations of this thesis' research there are, of course, limits to the degree of completeness in coverage and substantiation. Anyway this thesis' coverage of the pedestrians' realm is much more complete than any of the other accounts that the author came across. Definitions used are included in the extensive Glossary of terms appendix (see Appendix 1).

7.2.5. Substantiation of complexity of the subject

The thesis covers more than 30 years of learning, and it took about 15 years to develop this (relatively) complete and mature 'handbook' for substantiation of policy development regarding pedestrians and their activities. Like Gemzoe (2001) and Jan Gehl (2011) said: there is (much, much) more to walking than walking. This thesis approach substantiates Gehl's statement, highlighting the vast complexity of the subject, consequences and impacts, clearly transcending the common idea that providing for pedestrians is a simple thing ('everybody walks every day, how difficult can it be?').

7.2.6. Added value of this thesis - facilitation of paradigm shift

Although this thesis yielded many new insights into walking, the added value of this thesis is not so much the provided in-depth knowledge, but the offering of a comprehensive image on the many perspectives regarding pedestrians, walking and sojourning in public space. The main game changer is putting the pedestrian central: what is good for the pedestrian, walking and sojourn in public space, instead of focussing on what is good for achieving goals of a specific policy sector or domain, e.g. transport, traffic, road safety, public space design, mobility, accessibility, health, the economy, the environment. This focus on the interests of the pedestrian is rare; apart from pedestrian advocates, as far as the author knows only Gunnarsson (1995, 2001) and the PQN and OECD/ITF projects put the pedestrian central in their (semi-)academic publications, be it less complete and comprehensive.

This thesis' approach is meant to facilitate a paradigm shift, i.e. to offer an alternative conceptual model for structurally, effectively and fairly improve pedestrian, walking and sojourning in public space conditions. This alternative builds on and combines earlier conceptual models supporting paradigm shifts, such as the McLoughlin systems planning process model (1969), System approach (Heylighten, 1992), Steg & Vlek's NOA model (2008), Gunnarsson's overview of pedestrian problems (1995, 2001), Michon (1979) and Hatakka et al.'s (1999) activity hierarchy, the Pizza model (Methorst, 2000, 2003), Van Hagen's consumer transportation needs model (2006), and Sauter & Tight's assessment model (2010). The results of the deliberations led to the structure of this thesis based on an adjusted policy process model, and transcending common approaches to pedestrian needs, abilities and activities, risks, safety & security, and data and information collection. The author realises that this alternative is not perfect either, but hopefully a step forwards to more effective and fair (pre)conditions for walking and sojourning in public space.

7.3. Conclusions regarding research results

7.3.1. Introduction

This section covers what conclusions can be drawn from the results of the research. Following the process model regarding steps in a generative pedestrian quality policy process (Figure 1.2.) this thesis comprises four blocks of research, viz. Modelling of the W+S system (Chapter 3), System Requirements (Chapter 4), System Status Quo (Chapter 5), and Devising change (Chapter 6). The first block is heavily based on the PQN Final Report on the principles of System approach and was completed in 2013. The block on Devising Change was researched between 2013 and 2017, followed by the block regarding the W+S system requirements (2017 - 2019) and W+S system status quo (2019 - 2020). General conclusions regarding the results of these blocks of research are highlighted successively below, in the order of the process model.

7.3.2. Conclusions regarding Modelling the W+S system

At the end of the COST358 Pedestrians' Quality Needs project the author delivered a theoretical framework for a system approach to improving pedestrian, walking and sojourning conditions (Final Report Part A, Methorst, 2010). This thesis scrutinises and advances that theoretical framework to optimally structure and inspire this thesis' research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, its interrelations and main determinants (= this thesis' first leading research question). This

paragraph successively presents conclusions with regard to this thesis' coverage of the pedestrian realm, the origin of the applied conceptual models, the application and role of the conceptual models, and the relevance of the conceptual models for a paradigm shift in W+S policy development and implementation.

Coverage of the pedestrians realm

In principle a complete theoretical framework for W+S policy making should include process, context, and content regarding walking and sojourning in public space. This thesis attempts to fully cover the domain, and features conceptual models in the Chapters 1, 3, 4 and 6.

Chapter 1 presents the conceptual model for policy development (= *process*, viz. Figure 1.2). This model is used to the structure the chapter of this thesis. The successive chapters follow the policy development up to the moment that decisions on (programs of) interventions are made.

Chapter 3 deals with the main body of the conceptual framework, i.e. factors that affect the volume and qualities of walking and sojourning in public space (= *content* regarding pedestrians, walking and sojourning in public space).

Chapter 4 includes elaborations regarding W+S system requirements and opportunities (= detailing general content models).

Finally, Chapter 6 pictures conceptual models regarding devising change towards improved W+S conditions, i.e. models that concern external influences on factors that directly affect pedestrians, walking and sojourning in public space (= *context*).

The above conceptual models are designed to together cover the total process, context and content of the suggested system approach to sustaining and improving conditions for pedestrians, walking and sojourning in public space.

Origin of the conceptual models

In the course of time the author came across many interesting and useful conceptual models. The models included in this thesis do not come from a solid review of available conceptual models that could possibly be useful, but comprise a selection that aims to cover the subject of improving conditions for pedestrians, walking and sojourning in public space.

By definition models are simplified images of reality. The question is whether the degree of simplification is suitable and accurately picturing the subject. In some cases the original models picture too much detail, in others crucial aspects or elements are lost (over-simplified) or potentially misinterpreted. Most of the conceptual models in this thesis are adaptations from original models, adjusted for or translated to the specific use in the context of W+S policy development. Exceptions are the Need-Opportunities-Abilities (NOA) model (Steg & Vlek, 2009) and the Policy Life Cycle (Winsemius, 1986), which are neither adjusted nor translated to the W+S subject. Because no suitable conceptual models were found for the identification of W+S determinants, for the identification of W+S policy actors, and critical factors in the policy life cycle, the author designed dedicated models, respectively the so called Pizza model (Figure 3.8), the model on policy actors and their relations within the policy process (Figure 6.1), and the model on Policy Life-cycle critical factors (Figure 6.3).

Application and role of key conceptual models

This thesis applies selected conceptual models to inspire systematic exploration of the pedestrians realm, to direct substantiation of general concepts and findings, to check out completeness of results, and to position research results. This resulted in improved (presumably state-of-the-art) insight in, and overview of pedestrians realm, both regarding pedestrian activities and dedicated policy development.

In short the following key conceptual models were applied for this cause. Rumar's (1999, 2001) ideas nourished curiosity leading to systematically explore the pedestrians realm. Sauter &

Tight's model (Figure 3.4.) pointed to what general subjects need to be assessed to be able to adequately address strengths, weaknesses, opportunities and threats regarding pedestrians, walking and sojourning. Systems theory and the System approach models directed the general structure of the thesis by providing cues for this thesis' division into chapters (cf. Figure 1.2 regarding the policy process) and understanding the general mechanisms regarding developments in the status quo of pedestrians, walking and sojourning in public space (cf. Figure 3.3. input-throughput-output-outcome-impacts; the role of the system's direct and more distant environment). The Conceptual Framework Model Pedestrian Behaviour integrates 1) the pedestrian travel & sojourn system model (cf. Figure 3.5) that identifies what elements (and subsystems) interact within the W+S system, 2) Michon's and Hatakka et al.'s activity levels, 3) the Pizza-model and 4) the role of the pedestrian's perception. The Needs-Opportunities-Abilities (NOA)-model (Steg & Vlek, 2009) and Fuller's Task demand model (Wegman et al., 2006) inspired the explorations towards W+S System requirements; Van Hagen's customer transportation needs model directed the classification of impacts of facilities to support walking and sojourning. Explorations into the W+S institutional framework were directed by the policy field model (Figure 6.1), Sauter & Tights's model (Figure 3.4) and the Policy Life-cycle critical factors model (Figure 6.3).

Towards a paradigm shift?
The idea of a paradigm shift concerns attitudes and activities related to W+S policy making. The question is: what kinds of attitudes and doings qualify for improvement, what role is there for conceptual models and how could a desirable shift be triggered. With regard to the policy process and status quo of institutional organisation an answer is pointed out by the model on Policy Life-cycle critical factors (Figure 6.3) and the evaluation of both the status quo of the W+S system (Chapter 5) and Devising Change (Chapter 6). Assuming that W+S policy making is not in the 'management and control' phase (cf Winsemius, 1986), but in the more promising 'Discovery phase', critical factors are awareness and commitment. In that phase fact-finding, knowledge and professional skills, and leadership are most critical. As to the content of policy making, most important shifts concern redefinition of the following key concepts, viz. '*pedestrian activities*' (the four kinds of pedestrian activities), *'pedestrian safety*' (including traffic accidents, falls and security), and '*W+S needs*' requirements' (sequence of impacts of the pedestrians behaviour choices and outcomes, cf. Figure 4.1 Conceptual model pedestrian W+S behaviour choices and outcomes). The redefinitions and impacts (volume of consequences of the pedestrian behaviours) should reflect in policy priorities.

7.3.3. Conclusions regarding System requirements

This conclusions subsection concerns this thesis' second leading research question: *what (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation?* For the research this general question is elaborated into four sub-questions:

1. *In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?*
2. *How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements?*
3. *How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?*
4. *What W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians adequate and tempting W+S opportunities, now and in the next decade?*

Below the main research results with regard to these four sub-questions are presented. Successively general conclusions, based on a combination of modelling and substantiation to position significance, are put forward.

1. Environmental settings
The (international) explorations regarding the first sub-question about environmental setting for walking and sojourning yielded indications that a number of factors affect W+S needs, abilities, decisions and strategic behaviour, i.e. experienced need to travel on foot, structural environmental constraints, potentially leading to W+S issues regarding suppressed mobility, social-economic deprivation, safety and health. With regard to exposure to the environmental factors vulnerable groups can be identified. Thus the found environmental factors can be considered population attributes. In total seven kinds of population attributes were discerned and substantiated to sketch a picture of their scope and weight of impacts. These attributes are 1) the everyday living environment, 2) social economic status, 3) lifecycle and demographics, 4) access to transportation, 5) social psychological characteristics (incl. attitudes), 6) access to information and information technology, and 7) general health.

Analysis of available and easily findable documents per attribute led to the identification of subgroups of (potential) pedestrians and impacts which the attributes had on individuals within the subgroups, such as how free or limited persons are in their mobility and sojourning choices and to go outdoors and walk.

The analysis offers cues for strategic prevention of mobility poverty, improved support and promotion of walking as solution for social-economic, safety and health issues.

With regard to the volume and severity of W+S issues the following pedestrian groups stand out: very urban residents, tourists, holiday makers and visitors, residents of low-SES neighbourhoods, children aged 0-15, retired persons, professional walkers, low-income people, households with young children, transport-poverty stricken persons, recreative walkers, duo or group walkers, dog owners, women, informal care givers, (non-western) immigrants, ICT illiterates, temporarily impaired people, chronically impaired people and latently impaired people. In total more than half of the Dutch population can be expected to need dedicated or better than average facilities or services.

The findings however are far from conclusive as very few studies focus on general walking push or pull factors associated with population attributes. Most attitude studies are limited to specific strategic, tactical or operational W+S choices, e.g. health, obesity, physical activity, traffic safety, security, walking in the dark, street crossing, walking on sidewalks, shared use of sidewalks or streets, pedestrian count-down installations. This way the above observations are not more than indicative for impacts of the discerned population attributes on strategic

walking and sojourning decisions. For a better assessment of the impacts targeted research is needed.

2. Translating human needs into W+S requirements
The second sub-question (about the relation of human needs with reasons and motives for walking and consequences for system requirements) was dealt with in a dedicated workshop. The session yielded that there is no clear picture of what people in general need, want or desire when it comes to walking. People's needs, wants and desires are person/group and context sensitive. It was found that human needs (as discerned by Lapintie, 2010) cannot be translated into W+S system requirements without discerning the four kinds of walking and target group segmentation. Pedestrians as a group are extremely heterogeneous; this is true for W+S needs as well; the needs differ per (group of) persons, place, moment and environmental conditions. Concrete W+S needs only apply after a potential pedestrian has decided to go to some outdoors destination and to do that entirely or partly on foot.

The four kinds of walking connect to the degree of freedom that (potential) pedestrians have to choose to walk as well as the degree to which quality of the environment pulls potential pedestrians over the line to actually walk. Utilitarian walking as *access mode* (door-to-door) and walking as *access sub-mode* are less affected by lack of environmental quality than *free-choice walking* (circulation) and *sojourning*, particularly recreative walking and sojourning. Apparently there is also some kind of hierarchy in W+S requirements in relation to (potential) pedestrian's needs and wants, comparable to the ideas of Van Hagen's presented in his pyramid of consumer transportation needs (Van Hagen, 2006). In conclusions regarding the fourth research sub-question this will be put forward in more detail.

3. Translating abilities and skills into W+S system requirements
Explorations regarding the third sub-question (regarding how abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements) yielded some important insights:

- It is important to realise that relevant pedestrian abilities include much more than just covering serious disabilities as propagated by the United Nations Convention on the Rights of persons with disabilities (UN, 2006);
- With regard to abilities and skills for walking and sojourning in public space the (potential) pedestrians population is heterogeneous. Because being able to walk is essential for functioning socially, the pedestrians' physical, social, transportation and information environments should not exclude anyone to walk and/or sojourn there (cf. Inclusive Design, or Design for All principle). In other words, the environments must allow for persons who have one or more limitations regarding critical walking task abilities;
- Walking and sojourning concerns a multitude of tasks and task abilities. Successively the tasks are 1) orientation, consideration and enabling walking (lifestyle), 2) to go outdoors and walk towards a chosen destination or transport mode, planning and preparation of the trip (strategic choice at home), 3) plotting a route and choosing how to behave (tactical choices while on the way), 4) operational behaviour, i.e. reacting to actual conditions on the way and actually taking steps, accessing the (sub) destination, and sojourning at the destination (doing something there). The concerned task abilities comprise cognitive, mobility and sensory abilities, conditioned by posture (including the very small, large or big) and/or the use of wheels (e.g. wheelchair, rollator, pram, wheeled suitcase), and latent impairments (osteoporosis, sarcopenia);

- For designing inclusive environments suitable for all potential users the concept of *Reference Standard Pedestrian* is introduced. This concept represents a fictive person who is marked a significant lack of all situation relevant abilities and skills, requiring ergonomic measures;
- *Lifestyle conditions* set the stage for walking and sojourning in public space and largely determine captivity and the quantity of walking and sojourning in public space, while operational conditions largely determine their quality and outcomes;
- A person's agenda, actual events and conditions and self-knowledge about one's abilities largely determine *strategic walking and sojourning decisions*; captive pedestrians do not have a choice regarding door-to-door trips and most sub-mode trips; there is a rather general preference for other travel modes (easier, faster, less effort) and society is strongly adapted to and dependent on car use (Jeekel, 2011); for captive pedestrians the quality of W+S is decisive for their easy and safe mobility, for non-captives it plays a role in their decisions whether or not to walk. Strategic decisions largely concern mental processes; children and the cognitive impaired (both chronical and temporary) are disadvantaged in this respect, needing special attention regarding environmental qualities; this comprises 18 - 20% of the population;
- *Tactical W+S behaviour* is prompted by both strategic behaviour and observed operational conditions. Like strategic behaviour, this is about mental processes, disadvantaging children and the cognitive impaired (18 - 20% of the population);
- *Operational W+S behaviour* results from (implicit, mostly 'automatic') strategic and tactical decisions. Those who did not (yet) master walking, and the cognitive impaired and physically impaired, are disadvantaged, i.e. restrained in their mobility and having increased injury risk (collisions and falls), which may induce (some) stress. This comprises about 50% of the population;
- Explorations regarding how abilities and skills translate into W+S system requirements yielded that in total about 9 million (potential) pedestrians (54%) have impairments which in some way can affect their ability to easily, comfortably and safely walk and sojourn in public space. Approximately 20% of the population has long time cognitive impairments[630], 38% has one or more physical impairments, 3% has temporary cognitive impairments and 0.4% has temporary physical impairments. The majority of them have light impairments (5.7 million people, 35% of the population), causing inconveniences and increased risks. A substantial group (3.4 million people, 21% of the population) however has moderate to severe impairments, causing them to subdue going outdoors and participate in social life, and seriously limiting productivity and quality of life. In sum, the majority of walkers and sojourners have impairments requiring W+S system qualities beyond what is needed for 'normal' healthy and fit adults. From a scoring exercise it appears that attending to the following (overlapping) disadvantaged groups seems to be most urgent: children younger than 12 years of age, those who are disadvantaged regarding idea and reasoning (includes children < 12 years), those who are disadvantaged regarding perception abilities (idem), those who are disadvantaged regarding attentiveness abilities (idem), those who are psycho-motor disadvantaged, particularly stamina and manual dexterity impairments, deviant posture, particularly children (< 1.25 m) and obese persons, those who are disadvantaged regarding verbal and communication abilities (incudes children < 12 years of age), those who have severe memory impairments, and those who have low visual acuity;

[630] Not counting distraction and limited spatial abilities.

- The travel motives as discerned in the Dutch national travel survey (respectively OVG, MON, OViN) do not adequately cover the wider range of motives for walking and sojourning in public space;
- Pedestrian safety comprises more than pedestrian *traffic* accidents. This thesis argues and substantiates that it comprises all hazards that a pedestrian may experience, including falls, social safety, fear and exposure to other external causes;
- In theory W+S attitudes and intentions determine W+S behaviour. In practise it is extremely difficult to capture such attitudes. The concept of W+S propensity appears to be a more practical and realistic concept, as it can be expressed by applying statistical data regarding a group's walking and sojourning characteristics;
- The research results regarding walking needs, tasks, task abilities, functional disadvantages and the translation of the disadvantages into what functionalities the W+S system needs to offer, lead to general insights into what the W+S system should be like to enable the *Reference Standard Pedestrian* to participate and contribute to society (do-ability requirement) and lead a life that matters. In principle this means that all (potential) pedestrians should be enabled to complete their journeys and/or sojourn in public space. For persuading non-captives to walk and/or sojourn in public space this may not be sufficient, but meeting do-ability requirements often is pre-conditional for more advanced policies regarding non-captives;
- Environmental requirements supporting the concept of the *Reference Standard Pedestrian* are not universal, but depend on which population it actually concerns, i.e. whose use is targeted. If for example the probability of children being somewhere is very low, requirements regarding children need not to be given priority on that spot.

4. W+S arrangements

The fourth sub-question: w*hat W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians adequate and tempting W+S opportunities, now and in the next decade?* To answer this question three sub-sub-questions were explored: what kinds of conditions are (potential) pedestrians looking for; what factors frame the genesis of W+S opportunities; what kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

What conditions (potential) pedestrians are looking for

From explorations into what kinds of conditions are looking for, this thesis learned that first of all pedestrians need to feel enabled to safely reach and access the destinations that matter to them. This connects to meeting requirements to enable the *Standard Reference Pedestrian* to walk and sojourn in public space. This covers the needs and abilities of both pedestrians who do not have a choice but to walk and those who have a choice (respectively captive and non-captive pedestrians).

Knowing that basic requirements are met is not enough for potential pedestrians who have a choice to walk or use other modes, and like or at least do not dislike walking. For them walking must feel as a fair or even tempting option under the right conditions, i.e. convenient, without expected irritations from inconveniences and discomforts while walking.

In some cases people, even those who do not really like to walk, can be tempted to walk more and more often by offering them appealing and rewarding walking and sojourning experiences. In short: opportunity is only an opportunity if a person or more persons recognise them as such. Anyway W+S arrangements need to be suitable, preferably convenient or even tempting.

Factors that frame genesis of W+S opportunities

W+S arrangements are most likely to be offered by persons, institutions or private organisations that are aware that they have a stake in walking and sojourning in public space, and that appreciate one or more of the many benefits from providing for pedestrians. Institutional obligations (legislation, moral responsibilities) to create and safeguard can help tip the balance. Another factor tipping the balance can be using the pedestrian experience: '*knowing why or why not people walk, what encourages walking and what hinders it'* (New Zealand Land Transport, 2019:1).

What kinds of arrangements are required?

This thesis discerns three kinds, or better: levels, of requirements: *Basic* (need to have) requirements for utilitarian walking, *Convenience* requirements and *Tempting* arrangements. The latter two concern nice to have arrangements for free choice (recreational) walking. Whether or not convenience requirements and tempting arrangements are provided for depends on the provider's aims.

In general W+S arrangements should at least be effective and efficient to achieve the provider's aims.

I. Basic requirements

This thesis also argues that *Basis requirements* should at least be suitable, which is apart from being effective and efficient, also being fair, i.e. treating people without favouritism or discrimination, serving all kinds of potential pedestrians. Basic W+S requirements concern *reachability, accessibility and safety*.

Reachability requires proximity, whereby built environment variables are *density* of users building units and attractions per area, *diversity* in the land use mix, design of the network, *destination accessibility*, distance to public transport (and parking facilities), *demand management* and *demographics*. Important person variables are motives, walking speed, physical endurance, self-reliance and perceived route impedance.

Accessibility concerns do-ability, and needs to match posture, sensory, psycho-motor characteristics of the vast majority of potential pedestrians on sight, including the impaired and disadvantaged, users of wheeled pedestrian carriers, prams, carts and persons carrying goods or dragging suitcases etc. Accessibility design guides (e.g. in CROW ASVV, 2012) offer detailed instructions for appropriate measures. Clear footway width should be at least 1.80 meters wide (space needed for two pedestrians walking in opposite direction, without needing to step into a traffic lane). The route should be stable, smooth and skid resistant and lack sharp edges, discontinuities, slopes and stairs, and should be properly illuminated.

Safety requirements concern measures to prevent pedestrians getting injured or killed or physically threatened. In this thesis safety concerns traffic safety, injuries from falls, and assaults (public safety, security, or threats in these regards). A major problem is that common safety definitions are dis-functional for pedestrians: in practise the definition of pedestrian safety only covers traffic safety and neglects the more important falls (at least four times as many casualties as pedestrian traffic casualties) and equally important public safety (about as many casualties as pedestrian traffic casualties).

Traffic safety is strongly related to the presence and speeds of car traffic and is best served by separating pedestrians from motorised vehicle traffic, offering adequate road crossing facilities, and limiting actual traffic speeds at potential encounters to 30 km/h or less. Sustainable Safety measures (particularly road classification and traffic calming in sojourning areas) are effective measures. Fall safety and security need to be included in the definition of pedestrian safety (Methorst et al., 2017a). Currently there is a lack of data and awareness of the volumes and severity of falls and security incidents. Important measures to prevent falls are taking care that

footways are smooth, clean, non-slippery, free of obstacles, level (preferably no stairs; loose tiles are risky), and fall prevention courses. Security requirements are adequate view on pedestrians, street lighting, absence of isolated and physically shielded spots in walking routes enabling perpetrators to threat and assault pedestrians. Public space maintenance is important for both the prevention of falls and security incidents.

II. Convenience requirements

Assuming that basic requirements are met, *convenience W+S requirements* concern absence of expectable irritations, i.e. the quality of facilities that is experienced as indispensable and /or normally available, directly enabling walking and sojourning in public space. If convenience requirements are met this generally does not lead to (strong) feelings of satisfaction, ease or conviviality. It is just experienced as 'in order' and does not stand out. Comfort, on the other hand concerns a state of physical ease and freedom from pain or constraint. Contrary to convenience it does incite feelings of easiness, satisfaction, conviviality, or even delight. Key reference group for convenience requirements is non-captive healthy and fit adults, who are most likely to draw consequences from their irritations about experienced inconveniences and discomforts.

III. Tempting arrangements

Tempting arrangements in principle concern new or as yet unfamiliar opportunities for walking and sojourning concerning experiences, discoveries or attractions, that are created for the purpose of persuading the (potential) pedestrian to walk and sojourn in public space and to visit an attraction. Tempting arrangements can be derived from general 'likes' expressed by (specific groups of) pedestrians. Some general 'likes' are nice surroundings, easy and uncomplicated walks, being active, having a gratification, cheap compared to the car, and streets with little traffic (Risser, 2002; Kuitert & Maas, 2017). Kuitert & Maas (2017) and various publications by the Project for Public Spaces (https://www.pps.org/) offer useful guidance in this respect.
Tempting W+S arrangements can also be considered a weapon in the competition and friction between cities, attractions, and policy objectives where the number of attracted pedestrians matter. In this regard tempting people to walk more and more often is important for achieving economic, social, health, safety and environmental goals.

Is the leading research question adequately answered?

There is no simple and short answer to the question *'what (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space, supporting them to optimally contribute to the wealth and well-being of themselves, communities and the nation?'*
The author concludes that an important precondition for kicking-off and ensuring effectiveness, efficiency and justice of pedestrian, and walking and sojourning policies is to make the pedestrian more visible in statistics, in narratives and in real life conditions. This will take years. In the meantime this thesis' systematic explorations may help to support a transition to better W+S policy making.

From the explorations it appeared that there are many handbooks, guidelines and documents available on what is required to adequately support pedestrians, walking and sojourning in public space, be it somewhat fragmented and narrowed down to a specific range of perspectives. In principle information about what is required in general is available. What is required in concrete situations however depends on what local pedestrians' characteristics are regarding needs and abilities, the so called Reference Standard Pedestrian. This thesis provides a framework and basic knowledge needed to audit current situations and establish situation

specific program requirements for future W+S improvements. Following this guidance however is no guarantee that (potential) pedestrians indeed recognise and take advantage of the opportunities offered, and thus contribute to the wealth and well-being of themselves, the community and the nation, now and in the near future.

7.3.4. Conclusions regarding the W+S System Status Quo

This conclusions subsection concerns this thesis' third leading research question: *How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?*

For the research this general question is elaborated into two sub-questions:

1. *What is documented and entered up about prominent arrangements established in the Netherlands to offer opportunities for walking and sojourning in public space, their distribution, and roughly how well con these arrangements be expected to serve the needs and abilities of the Dutch population of (potential) pedestrians?*
2. *How do pedestrians interact with their W+S environment, and what are the consequences?*

Below the main research results with regard to these two questions are presented. Successively general conclusions are put forward.

1. What W+S arrangements are documented?

General statistical data indicate that on average Dutch citizens have most destinations that matter within reach. There is however hardly any statistical information and documentation available about concrete reachability, accessibility conditions and the quality and distribution of safety and security arrangements in the Netherlands. Asset-management seems to be absent regarding preconditions for utilitarian walking; in most municipalities citizens can call in abuses and faulty conditions, but the status quo of reachability, accessibility and safety arrangements is not monitored. Asset management regarding recreational walking appears to better organised: e.g. larger events are published in on the internet in event agendas; hiking routes are marked, monitored and managed; Wandelnet regularly publishes a hiking monitor. Recreational walking assets are mostly targeted at special groups of pedestrians, viz. particularly healthy and fit adults. No information is available about the profiles of target groups regarding utility walking (walking for transport), but it is not to be expected that the profile is similar to the so called Reference Standard Pedestrian.

2. Pedestrian activities and their consequences

This thesis' research covered three aspects of behaviour and behavioural consequences, viz. 1) mobility and sojourning, 2) safety and security, and 3) convenience, comfort and attractiveness.

2.1. Mobility and sojourning

This thesis found and substantiated that pedestrian activities comprise more than what is commonly reported in mobility statistics. It comprises main-mode walking (A to B), sub-mode walking (walking to and from other modes), circulation (roundtrips), and sojourning in public space. In mobility statistics mode performance usually is expressed in main-mode total travel-kilometres; this thesis argues that this is not a fair measure for comparing travel mode

performances: as main mode pedestrian cover less kilometres per hour than a car or even a bicycle; additionally pedestrians cover almost as many kilometres to and from other modes, whilst other modes cover less than 10% of their travel kilometres this way. Furthermore, by far the largest share of travel kilometres of walking concerns circulation (roundtrips comprise almost three times more kilometres than main mode or sub-mode walking), which does not apply to other modes, including cycling. Another argument against using travel kilometres as reference measure is that the fourth kind of pedestrian activities is sojourning in public space (waiting, child's play, meeting people, working, exercise etc.), which cannot be expressed in kilometres, but only in time spent this way, or 'exposure time'. This thesis assesses that about 40% of the time spent as pedestrian (90 hours per person per year) concerns sojourning in public space. Main-mode exposure and sub-mode walking comprise 13% of time spent, and circulation 32% of time spent as a pedestrian (see Table 5.31). Travel surveys strongly underreport pedestrian activities (about 40% underreporting) of walking kilometres; main-mode walking is almost fully covered in the Dutch travel survey, for both sub-mode walking and circulation underreport surpasses 40%, whilst sojourning is not covered at all (not even regarding exposure time-wise). According to the Dutch travel survey walking amounts to 18% of all (main mode) trips (OViN, 2017).

2.2. Safety and security

With regard to safety this thesis found and substantiated that pedestrian safety comprises 1) traffic safety, 2) falls and 3) security / public safety. General statistics generally focus on traffic safety, which currently does not do justice to the many more injured and killed pedestrians in (accidental) fall and victims from harm inflicted by others (assaults, murders in public space, crimes like robberies, sexual offences). In 2014-2018 on average 166 pedestrians per year died in public space (9.8 fatalities per million inhabitants). In the period 1998-2018 average number per year decreased substantially (-37%). The number of pedestrian traffic fatalities gradually decreased from 133 (in 1998) to 54 (in 2018). The number of fall fatalities decreased from 1998 to 2000 from 85 to 61, and then increased again to 80 in 2017[631]. The number of crime deaths in public space (security/public safety) dropped from 55 to 35.

For traffic safety the decreases are found in number of injured pedestrians as well (from 4,900 to 4,100), but this does not apply for falls (increase from 52,700 to 76,800 casualties). No casualty data on security/public safety casualties are publicly available.

With regard to falls analysis showed that the total number of casualties increased with age and differs for gender. For males the numbers increase (~300%) from age 70, while for females the numbers increase (~400%) from age 50. When corrected for population numbers however, the differences in risk between males and females almost disappear: the age related increase for males up to age 80 disappears; for females there is an 100% risk increase from age 50 up to age 80, dropping to zero increase at age 90+. The increase in risk correlates to osteoporosis and sarcopenia risks.

2.3. Convenience, comfort and attractiveness of walking and sojourning

Based on theoretical considerations (particularly Van Hagen's consumer transportation needs pyramid, 2006) convenience, comfort and sojourning were expected to matter for persuading non-captive walkers to walk more and more often. This is confirmed by Wandelnet 2014 monitoring data. No data are available on experiences and perceptions of inconveniences, discomforts and lacks of attractiveness. With regard to utilitarian walking and captive walkers no conclusions can be drawn regarding the influence of negative perceptions on (strategic) walking decisions.

[631] the 2018 figure is not made available to the author.

Is the leading research question adequately answered?
No conclusive, dedicated and complete accounts were found to assess to what degree pedestrians are enabled to walk and sojourn in public space, and how pedestrians currently perform regarding their walking and sojourning needs and abilities. Based on the available limited and often inadequate and incomplete statistical data and a variety of specialists' accounts this thesis' compiled and substantiated approximations and 'best guesses'. The picture is not very positive. It appears that the W+S system is reasonably suitable and mostly convenient for fit and healthy adults, but that for some (particularly persons with moderate to serious walking impairments, comprising about 20% of the population) the system is inadequate, unsafe and impeding them to function socially. This cannot but degrade both their individual as well as community and national wealth and well-being. This is not fair towards those who most depend on being enabled to walk and sojourn in public space.

7.3.5. Conclusions regarding Devising change

The leading research question regarding *Devising change* is:

How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?

This part of this thesis' research aims to provide broad insight in the nature and extent of Dutch policy actors' activities regarding W+S, how the institutional framework as a whole performs, and what need and room there is for institutional improvements. The role of this insight in this thesis is to answer this thesis' central research question of what controls authorities can adjust to better support walking and sojourning in public space. This leads to the following research questions to be dealt with in this chapter:

1. *What kinds of factors and processes theoretically set the stage for bringing about improvement of W+S conditions?*
2. *What kinds of policy actors can be discerned regarding their function for sustaining and improving pedestrian, walking and sojourning conditions?*
3. *What kinds of settings outside the Dutch institutional framework can or do affect W+S policy activities in the Netherlands?*
4. *How is management of pedestrian and W+S conditions organised?*
5. *What controls can policy makers adjust to enhance W+S policy activities?*

7.3.5.1. Conclusions regarding theoretical considerations

In order to direct research into the (Dutch) policy playing field, external settings affecting Dutch W+S policy making, and the organisation of change policies, relevant theory was compiled.
With regard to the policy playing field four kinds of interacting actors were discerned: strategists, W+S facilitators, clients, and catalysts (see Figure 6.1).

Regarding external settings a classification of contexts was inspired by the Pizza model, the NOA model, and a Google Scholar search on external influences on public policies. Ultimately seven classes of influences (dimensions) were discerned: the international context, the physical environment context, the transportation context, the social and cultural context, the economic context, the technological (including knowledge) context, and the political context.

Regarding research on the institutional organisation of change a separate background study was carried out (see Appendix 9). This study applied the Policy Life-cycle critical factors model (Methorst, 2003/2010), the Sauter & Tight (2010) model on the assessment for measuring walking, through the Topical Questions (What, Who, Why, Where, When and How; Spencer-Thomas, 2012), for drawing a general picture of mechanisms regarding devising change, inspiring the development of a tentative questionnaire for interviewing a selection of Dutch policy actors, and systematically reporting research results.

7.3.5.2. Conclusions regarding the W+S playing field

The descriptive model on the W+S policy field can be considered a first step towards insight in the size and characteristics of the W+S policy field. It inspired drawing up a crude list of W+S policy actors and potential interviewees for exploring the status quo of policy activities, and particularly how committed policy actors are to improve the pedestrian, walking and sojourning conditions. Potentially the field comprises about 1,300 policy actors, of which 950 can be considered key players because of their competences. From the explorations (in 2015 and 2016) into *raison d'être* through analysis of policy actors' mission statements, strategic policy plans and interviews, it appeared that the domain is dominated by governmental organisations. Client organisations obtained a leading role regarding strategic information towards governmental organisation, partly fed by data and meta knowledge from knowledge institutes. The most active players are pedestrian advocates (Wandelnet, MENSenSTRAAT), and some larger municipalities and dedicated consultants.

In the run-up to the establishment of the Platform Room for Walking the number of interested players increased substantially. The 'new' organisations appear particularly interested in motivating people to walk more and more often, ultimately to support achieving health and economic aims, and are not yet focussed on mitigating pedestrian problems[632]. The 'new' organisations include the Ministries of Infrastructure and Water Management, and Well-being, Public Health and Sports, who upgraded their attention to the field, but also a number of provinces. In 2015 and 2016 the latter did not yet show interest in being involved in this thesis' research and were (mistakenly) considered to have small potentials regarding W+S policies and therefore not included in the initial list of W+S policy actors to be interviewed extensively.
Understandably the starting Platform Room for Walking has not yet achieved demonstrable results.

7.3.5.3. Conclusions regarding external settings affecting policy making

The W+S institutional framework and policy making can be affected by a variety of external conditions. Stimulating conditions (strengths) are a number of foreign organisations that can offer key information to support national policy making, supportive international agreements, favourable physical environmental conditions in the Netherlands, the popularity of recreational walking, the relative wealth of the Netherlands making policy activities affordable, and, not least, the widely available neighbourhood teams for solving W+S problems 'on the go'.
Weaknesses regarding external settings are the lack of insight in the W+S system 'hardware' and 'software', changes in land use policies reducing favourable physical environmental conditions (e.g. abolishing the principle of compactness of cities, and further shift towards

[632] As participant in the preparatory workshops of the establishment of the Platform Room for Walking the vast majority of the participants reckoned that a positive message needs to be disseminated; emphasis on mitigating problems was looked upon as potentially discouraging other stakeholders to join the Platform.

private properties instead of collective ownership), the strong focus on cycling (at the cost of walking), transportation policy that is not linked up to the factual role of walking in mobility and sojourning, the hidden nature of investments in walking, health and welfare budget cuts enlarging stress for persons with mobility limitations, scarce expertise regarding (utilitarian) walking problems and solutions, and decentralisation and low priority of improving pedestrian, walking and sojourning in public space conditions.

7.3.5.4. Conclusions regarding management of W+S conditions

Management of W+S conditions was explored on the basis of questions into the five policy pillars (Sauter & Tight, 2010), viz. leadership, knowledge & professional skills, strategies and policies, resources, and co-operation and partnerships.

With regard to *leadership* three major leadership factors were explored: propensity, power and persistence. A strength of the domain is leadership within the largest municipalities, the dedicated NGO's and since 2019 the Platform Room for Walking. A weakness is that the collective policy actors in the field are only beginning to be inspired and pushed to greatness by the formal strategists and national level system responsible policy actors in the field, and that the role of the platform Room for Walking is still in the making.

A strength regarding *knowledge and professional skills* is that basic general data and information, generic system knowledge and knowledge about what can be done to improve W+S conditions are available externally. It is however not yet a strong competence of strategists and facilitators, whose knowledge and professional skills regarding pedestrian, walking and sojourning problems and real solutions are still in early stages of development. Furthermore, data, information and knowledge are not 'just-in-time' available where needed most (i.e. in most municipalities); common walking sojourning and safety definitions and insights obstruct adequate comprehensive insights.

A strength regarding W+S *strategies and policies* is that in planning and design of new neighbourhoods and streets the pedestrian was never out of the picture. Weaknesses however are that in plans for keeping neighbourhoods, road and path conditions up to date, impacts on walking and sojourning in public space have been neglected and/or forgotten in many ways and that current policy making cannot (yet) meet system approach criteria.

With regard to *resources* a strength is standard availability of the neighbourhood teams for keeping up public space quality. With the exception of dedicated NGO's, resource deployment is not a strength. Although money does not seem to be a critical factor, manpower deployment for policy making (with the exception of dedicated NGO's, the municipalities Utrecht, Amsterdam and Rotterdam and one consultant) is marginal at best. Recently (2019) the Ministry of Infrastructure and Water Management and the provinces Zuid-Holland and Utrecht became more active. Rather passive policy actors are the public Prosecutor, the police, VNG, bus and tram enterprises, VVN and mid-size and small municipalities.

The fifth pillar in W+S policy making is co-operation and partnerships. Three critical factors can be discerned in this regard: abilities and willingness to co-operate, 'carrots' and 'sticks' for co-operation, and the distribution of co-operation arrangements. With regard to abilities and willingness to co-operate this thesis concludes that allotted working time for W+S matters was too small for allowing for real co-operations and partnerships; willingness was not yet a relevant factor. Concerning 'carrots' and 'sticks' as yet no significant incentives or punishments regarding co-operation within the domain were identified. Within the domain there is a tentative alliance between Wandelnet and MenS; the large municipalities, MenS, Wandelnet, ANWB, CROW and VeiligheidNL are actively networking. Municipalities consult adjacent municipalities, NOG's and consultants. Apart from these alliances and networking in 2016 co-operation within the field is scratchy. Within the context of the Platform Room for Walking beginnings are made intensifying co-operation and partnerships.

7.3.5.5. Conclusions / discussion regarding policy actors' controls

This thesis identified five kinds of controls that policy actors can adjust to improve pedestrian, walking and sojourning conditions: fact-finding, competence building, direction and allotment, communication, operational organisation. The five kinds of controls are tentatively substantiated and discussed on the basis of four criteria: content and role of the control, status quo of the control activities, timeliness and urgency, and most suited policy actor(s). To raise plausibility the suggested controls are substantiated with (not always empirical evidence based) results from this thesis' explorations. The suggested controls must be considered mere suggestions for discussion e.g. within the Platform Room for Walking and (potential) W+S policy actor organisations. For starting up effective, efficient and fair W+S policies particularly leadership and knowledge and professional skills matter. This reflects on the urgency of dealing with the content of the identified controls.

7.4. Discussion

Visibility of pedestrians, walking & sojourning in public space

Overseeing the large pile of guides, recommendations and instructions, the increasing number of conferences, and this bulky thesis, it becomes clear that there are ample reasons, possibilities and opportunities to improve pedestrians', walking and sojourning in public space. The main obstacle to improvements appears to be awareness. From the position of administrators and facilitators pedestrians, walking and sojourning in public space are rather invisible and deniable without consequences. The solution can only be a paradigm shift towards more conspicuousness of walkers, walking and sojourning, unveiling them literally and figuratively, and of course actually make improvements happen. Points of attention in this regard can be:

- Take up leadership regarding making the pedestrians (positively) conspicuous;
- Actively support the WALK21 International Charter for Walking;
- Agreement on the roles, relevancy and vast benefits of walking and sojourning in public space, and most importantly, functional definitions towards better coverage of the pedestrians' role (cf. the four kinds of walking and sojourning) and safety (cf. falls, traffic safety, security), health and economic consequences;
- Visibly provide for disadvantaged pedestrians and particularly tackle transport poverty;
- Explicitly put the pedestrian central in walking and sojourning relevant policies (e.g. in spatial, mobility and transportation, recreation, legislation and public ICT plans);
- Clearly allot financial means and manpower to improving walking and sojourning in public space;
- Consistently highlight the role and position of pedestrians, walking and sojourning in public space in data, statistics and communications;
- Tackle neglect, incompleteness and bias in statistical data and research (e.g. by explicitly promoting walkability research);
- Deal with fundamental gaps in knowledge;
- Systematically monitor, evaluate and communicate walkability and sojourning in public space policies, interventions, and good practises;
- Give pedestrians their space and position back: enforce what is rightfully theirs (e.g. get rid of obstacles, overhanging green, parked cars and bicycles on the footway), and return space

and rights vended to shopkeepers, street cafés, cars and bicycles, private and public land use.

Filling gaps in knowledge

Although much effort was put into compiling a comprehensive, complete image of the pedestrians realm, it is clear that there still are some important gaps in knowledge, to be filled by future research. To begin with, in 2005 ambitiously the chapters classification of this thesis (cf. Appendix 2 on the W+S policy literature scan) also included chapters on measures, selection and added value were anticipated. Ultimately this thesis got a more modest scope. The current thesis' position is that the W+S policy making is still (or again) in the explorative phase of the policy cycle (cf. Winsemius, 1989) and therefore it is far too early to discuss effectivity, efficiency and fairness of generative walking and sojourning in public space measures, policies and strategies. On the way it became clear that this thesis would not be able to cover all gaps in knowledge as identified by Shalom Hakkert in his article in the PQN Final Report (Part B.5.13 Policy Process - Gaps in Knowledge, 2010:237-244) and by New Zealand Land Transport (2019). Hakkert identified gaps regarding the lack of data (regarding planning models and tools, planning and land use aspects, infrastructure characteristics, safety, lack of exposure data about pedestrians), perceived safety, needs, economic analysis, tools for decision makers and politicians, and promising interventions. New Zealand Land Transport found three major gaps: consideration of the rural-urban division, full recognition of pedestrian diversity, and consistency in measures used for walking. Additionally (or more specifically) this thesis amongst others identified gaps regarding the utility-recreation division, transport poverty, missing insights in numbers and severity of security casualties amongst pedestrians, perceptions and experiences of the various groups of pedestrian regarding feasibility, accessibility, safety, convenience, comfort and attractiveness of walking and sojourning in public space. In Appendix 8 a more extensive account of found gaps in knowledge is presented.

In conclusion: there still is a lot to be learned about the pedestrians realm!

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Appendix 1 - Glossary of terms

This appendix is a further development of the author's own work as part of the COST358 Pedestrian 'Quality Needs, published at www.walkeurope.org, www.walkeurope.eu, and www.walk21.com/pqn-project as 'PQN Glossary of terms'.

3 P's or Triple P	Triple P stands for: People, Planet and Prosperity. This relates to Sustainable Development and its indicators: Social Justice, Environmental Preservations and Economic Growth (Feitelson, 2002) and the so called Triple Bottom Line Concept (Young, 2012).
5 C's	The 5 C's regarding pedestrian requirements are: Connected, Convivial, Conspicuous, Comfortable, Convenient (Gardner et al. 1996).
Abduction, abduce	Abduction is a form of reasoning and argumentation. Other forms are deduction and induction. Using deduction ensures that the result is 100% true (all humans are mortal + Socrates is a human -> conclusion: Socrates is mortal); results from induction are less certain (I interviewed 10 humans and all were right-handed + John is hum -> conclusion John is right-handed). Abduction is the least accurate form of reasoning. It concerns searching for a conclusion that *best fits* what is being observed. This could be called 'guessing', and is applied often in law, detectives and archaeology: making it plausible that 'he' is the perpetrator (Griffioen, 2011).
Ability	Ability refers to operational quality of a person of being able and having the power to perform, whether physical, moral, intellectual, conventional, or legal. Ability depends on intrinsic competences, task capabilities and concrete task demands. A schematic representation of determinants for abilities, based on ideas of Fuller (2005), is provided by Wegman e.a., 2006.
Access (sub-) mode	Walking can be done as access mode (door-to-door), sub-access mode (to and from other modes) and for sojourning.

Accessibility

Accessibility is a general term used to describe the degree to which a person can reach and enter a public space. It is not to be confused with usability which is used to describe how easily a thing or provision can be used by any type of user.

Accessibility is strongly related to Universal Design or Design for All. This is about making things accessible to as many people as possible, regardless of age, ability or personal situation.

See also: Reachability, which describes whether a destination on adequate accessibility conditions can be reached.

Accident

In general an accident is an unfortunate event which occurs unexpectedly and unintentionally. In the PQN project an accident is an incident where a pedestrian is *injured or killed*, in principle unintentionally; incidents where a pedestrian is injured or killed by a careless or aggressive road user in this thesis are seen as accidents as well. Committed or attempted suicides are not included in accidents. If there is no injury, but only material damage the event will be seen as an incident.

Activity levels

In this thesis four activity levels are discerned: Lifestyle, Strategic, Tactical and Operational. The terms are explained in this glossary: see Lifestyle, Strategic behaviour, Tactical behaviour and Operational Behaviour.

Affects

Affect is the scientific term used to describe a subject's *externally* displayed mood. This external display is not necessarily the same as the actual mood of a person.

In philosophy affect is defined as an empowerment, and not a simple change or modification. Affects are not simple affections, as they are independent from their subject. Artists create affects and percepts, "blocks of space-time", whereas science works with functions and philosophy creates concepts.

Ageing

In this thesis Ageing is defined as the socio-demographic process in which the proportion of the elderly increases. The elderly normally are defined as people of 65 and older. With regard to walking elderly people of 80 years and older is a much more functional definition. Generally speaking the generation between 65 and 80 do not have serious trouble walking, except when they have one or more specific diseases or handicaps. One has to bear in mind that among the 80+ there are many that have an excellent condition, are able to walk quite fast and do not have any serious handicap walking. They are however more fragile than younger generations.

There is some empirical evidence that there is a ‘fear factor’ from speed of cars by people of over 65, that might be explained by uneasiness facing the acceleration of life in general. As a perceived risk it needs to be addressed.

Agoraphobia

Intense fear or anxiety about being in open or public places.

Amenity

Amenities are non-monetary benefits enticing prospective pedestrians to use public space. These amenities may be in the form of tangible benefits e.g. parks, swimming pools, health-club facilities, party rooms, bike paths, community centres, pet-friendly home, etc. Intangible benefits are "pleasant view", "sun-lit living room" etc. which add to the living comforts.

Aneurysm	Abdominal and cerebral aneurysms concern an excessive localized swelling of the wall of an artery, respectively in the abdomen or brain (Oxford Dictionaries, 2019). Such swellings can tear under stress conditions and cause severe internal bleedings and even death.
Anthropophobia	Intense fear of people and human companionship. This is also called Social Anxiety.
Arthritis	A disease causing painful inflammation and stiffness of the joints (Cf. Oxford Dictionaries, accessed June 2019 at https://www.lexico.com/en/definition/arthritis)
Assessment	Assessment is the process of documenting, preferably in measurable terms specific qualities for the pedestrian, with regard to the person himself (including knowledge, skills, attitudes and beliefs), the social and physical environment and/or the transportation system.
Attitude	Attitudes are positive, negative or neutral views of a person or group of persons. People can also be "ambivalent" towards a target, meaning that they have mixed feelings.
Attractiveness	Attractiveness means the capability of giving rise to confluences in most pedestrian users through appeal based on intermediate spaces configuration (form, use and structure of spaces) (definition by Rauhala et al.).
Attribute	A quality or feature regarded as a characteristic or inherent part of someone or something (Oxford dictionaries: accessed 19-3-2018; https://en.oxforddictionaries.com/definition/attribute)
Audit	An audit is an evaluation of an organisation, system, process, project or product. Audits are performed to ascertain the validity of a strategy, policy or policy measure and/or the functionality and safety of a current or future situation.
Awareness	Awareness is defined as the policy agent's concern about and well-informed interest in W+S (pre-) conditions or developments. Thus awareness comprises more than just knowledge about, insight in or being conscious of W+S conditions: it also comprises that the policy agent is being aroused and concerned about it, perceiving the conditions as matters that need attention. It concerns knowledge that incites emotions, like compassion, fear, anger, joy, feeling of belonging.
Barrier	Barrier is used in two meanings: • in the sense of physical obstacle that makes, e.g., walking at a certain place more difficult or impossible • in the more general sense, where a circumstance makes a certain type of behaviour - walking in our case - unattractive, which could be to such a degree that that behaviour - walking - is avoided.
Behaviour	Behaviour refers to the actions or reactions of a person or group of persons in relation to their environment. Behaviour can be conscious or unconscious, overt or covert, and voluntary or involuntary. It can also be common, unusual, acceptable, or unacceptable. People evaluate the acceptability of

behaviour using social norms and regulate behaviour by means of social control.

Behaviour only gets meaning if it is directed at other people or at objects. Social behaviour is behaviour that is specifically directed at other people.

Capable; capability / capabilities — Capable concerns having the ability, fitness or quality necessary to undertake a certain action or achieve a specified goal; a capability is the power or ability to do something or the extent of someone's ability (after Oxford Dictionaries, accessed 20-04-2015 at https://www.lexico.com/en/definition/capability).

Nussbaum listed 10 basic human capabilities which societies should guarantee (Nussbaum, 2000).

Captive walkers — Pedestrians that have no choice but to walk as opposed to persons who have a choice concerning the mode to use.

Cascade principle — The Cascade principle states that it pays to give attention to the context of matters. Macro level interventions set the stage for the functioning of the system on the lower activity levels. It is therefore most sensible to start the intervention programme development with looking at the practical options for intervening at the macro level, then deal with the meso level and finally with the micro level (Methorst, 2000).

Catalysts — The playing field of the W+S domain consists of four kinds of policy actors: catalysts, clients, facilitators and strategists. A catalyst is a policy actor (organisation or person) who is not a direct stakeholder with regard to walking and sojourning, but who is dedicated and knowing about improving W+S conditions, as well as respected in society and in the W+S institutional framework.

CEMT — CEMT stands for Conférence des Ministres de Transport; the English abbreviation is ECMT, European Conference of Ministers of Transport. The CEMT/ECMT is succeeded by the ITF: International Transport Forum, which is one of the OECD organisations.

Certainty — Certainty means the provision of a place to let people know where they are and where to go. It is often used as the third aspect in the triad with safety and security and closely linked to place legibility. See also Place legibility, Safety, Security.

City centre — In general the city centre is the older central area in a city, where shopping and public services are to be found. It generally is the showpiece of the city. Typically city centres are compact and easy to walk.

Clients — The playing field of the W+S domain consists of four kinds of policy actors: catalysts, clients, facilitators and strategists. A client is a policy actor (organisation or person) who is a direct stakeholder with regard to walking and sojourning. Clients can be represented by associations and/or lobby organisations for specific pedestrian groups. In the Netherlands there are two dedicated pedestrian lobby organisations: MenS (English: STREETSforALL) and Wandelnet. Additionally there are a number of client lobby and service organisations dealing with walkers and walkability

	as a spin-off from work for handicapped persons, traffic safety, mobility in general and the elderly.
Comfort / Comfortable	Comfort or Comfortable is one of the 5C's regarding to public space requirements for pedestrian. It relates to the extent to which walking is accommodated to competences and abilities of all types of pedestrians. In 'objective' functional terms comfort refers to observable usability, where pedestrians can use spaces or facilities without the apparent need to strain oneself. Comfort is primarily associated with positive feelings. It can however also be seen as 'no negative feelings'. Therefore, facilities are usually seen as comfortable if one does not notice anything negative (see definition in RAUHALA ET AL.). In 'subjective' terms Comfort is a state of mind, a feeling of usability without stress, uneasiness or pain.
Commitment	Commitment is defined as the state or quality of being dedicated to a cause, activity, etc. (cited from Oxford Dictionaries, accessed 1-10-2020 - https://www.lexico.com/en/definition/commitment), which to my opinion is characterised by taking responsibility with regard to the change processes and a willingness to act. Commitment concerns matters of which the emotional load beats competing matters in that regard, creating a significant level of urgency and a willingness to act. A policy actor is 'committed' when the felt urgency is combined with a feeling of responsibility and accountability, and a willingness to act.
Communication (interpersonal)	Interpersonal Communication is social interaction where at least two interacting agents share a common set of signs (words, thoughts, ideas, other information) and a common set of rules to handle the exchange of those. Communication is ideally – but not necessarily - based on the respect, promises and the want for (social) improvement.
Competences	Competences refer to the ability to perform certain tasks. Competences are intrinsic abilities, which sometimes can be enhanced by training. Oxford Dictionaries define competence as the ability to do something successfully or efficiently[633]. Fuller argues that a person's competences are defined by personal (here: the institutional framework's) characteristics, education and training, and experiences, which together deliver understanding, attitudes and skills (Fuller, 2005; Wegman et al., 2006). In this thesis the institutional framework's (and their individual policy actor's) competences are defined wider: they also comprise legal and informal authority.
Connected / Connectivity	Connected or Connectivity is one of the 5 C's regarding public space requirements for pedestrians. It refers to the property of the infrastructure network that links trip origins to desired destinations, thus making it

[633] http://www.oxforddictionaries.com/definition/english/competence?q=competence [2-1-2014]

possible for persons to get where they want to go, as well as the extent of linkages between different routes and network.

Conspicuous — Conspicuous is one of the 5C's regarding to public space requirements for pedestrians. Conspicuous relates to the measure to which an object or a facility is noticeable or eye-catching in terms of clear and legible routs, signing and information.

Constraints — A constraint is anything that prevents the system and/or the pedestrian from achieving a higher performance relative to its goal.

Context — The context refers to a set of facts or circumstances, settings or backgrounds which determine, specify, or clarify the meaning of an event.

The content of conclusions or recommendations have to be placed in their context and their position in the process which the conclusion refers to (Pettigrew, 1992).

The concept of context is similar to the concept of environment, but not exactly the same. Environment is defined as the totality of surrounding conditions, influences or forces, by which entities (like the institutional framework, the policy actors, the W+S system) *can be* influenced and modified in their growth and development (this definition follows Webster's Dictionary, accessed 2012; the website is removed from the internet). Thus the concept of environment is similar to context, but on the one hand it is wider than context because it also includes factors that do not (yet) influence the alluded entities, and on the other hand more narrow as it does not naturally cover abstract conditions like historical or legal contexts.

Convenient / Convenience — Convenient or Convenience is one of the 5C's regarding to public space requirements for pedestrian. Convenience relates to the measure to which public space or a facility suits the pedestrians' special needs, i.e. that it saves time or reduces frustration.

"Convenience" is a very relative term and its meaning tends to change over time. What was once a convenience (a zebra crossing) is today regarded as a normal part of life. Likewise today's luxuries will probably be perceived in the same way in the future.

Convivial — Convivial is one of the 5C's regarding to public space requirements for pedestrian. Convivial connects two qualities: 'liveable' and 'together'. Convivial public space means that its design and facilities support an agreeable sojourn, that it is liveable, endurable, tolerable. Convivial public space feels safe and inviting for pedestrians, mainly because (most of the times) there are other human beings.

COST — COST is an intergovernmental European framework for international co-operation between nationally funded research activities. COST creates scientific networks and enables scientists to collaborate in a wide spectrum of activities in research and technology. COST activities are administered by the COST Office in Brussels. Website: http://www.cost.esf.org

COST358 — The Pedestrians' Quality Needs project is a so called COST Action. Its number is 358.

Country Report	In the Pedestrians' Quality Needs project a Country Report is a report in which the state of affairs in a country with regard to pedestrian quality and knowledge, data, information and attitudes about it is described.
Danger	Danger refers to being at risk, meaning that events or conditions may occur that have a harmful or negative effect. Danger and Risk are related concepts. The difference is best illustrated by looking at the meaning of 'greater danger' and 'greater risk'. A greater danger implicates a larger chance on greater disaster; a greater risk points to a larger chance on a particular type of disaster.
Design for All = D4A	Design for All (= Universal design = Inclusive Design) is an approach to the design of products, services and environments to be usable by as many people as possible (at least 95% of the population (Kuitert & Maas, 2017) regardless of age, ability or situation. It strives to be a broad-spectrum solution that helps everyone, not just people with disabilities. It also recognizes the importance of how things look and appeal to a wide range of potential users.
Determinants	A determinant factor is a factor that causes a (specified) effect with a certain probability.
Dimension	The word Dimension can have three meanings: 1. size or extent of an (physical) object 2. an aspect, characteristic or quality of a concept, for example the concept of Quality of Life has an number of dimensions (such as economic, social, political, security, comfort dimensions) 3. mathematical concept: one dimensional: a line; 2 dimensional: a square or other matters that have a width and height; 3 dimensional: a cube or other objects that have width, height and depth.
Durability	Durability is not a synonym for Sustainability. Durability relates to the life cycle, the wear & tear and functionality of materials, interventions, policy programmes. Conversely Sustainability refers to the absence of negative consequences for future generations from decisions taken at this moment. See also: Sustainability.
ECMT	ECMT stands for European Conference of Ministers of Transport. The French abbreviation is CEMT: Conférence des Ministres de Transport. The CEMT/ECMT is succeeded by the ITF: International Transport Forum, which is one of the OECD organisations.
ED	ER is abbreviation for Emergency Department of a hospital.
Effectiveness	An effective measure or policy is one that significantly helps to improve the situation, getting things done. Effectiveness of a measure of policy always relates to the goals that were set in advance. If no goals were set, no statement regarding the effectiveness can be given. See also: Efficacy, Efficiency.
Efficacy	Efficacy is about doing the right things to get desired results, regardless of the resources spent. See also: Effectiveness, Efficiency.

Efficiency	An efficient measure or policy is one that helps achieving goals at a minimum of resources spent. It is about doing things right.
Emotions	Emotion is an intense mental state that arises autonomically in the nervous system rather than through conscious effort, and evokes either a positive or negative psychological response. An emotion is often differentiated from a feeling (Wikipedia, 2007). An emotion is usually experienced as a distinctive type of mental state, sometimes accompanied or followed by bodily changes, expressions or actions. An emotion is caused by a person consciously or unconsciously evaluating an object or event as relevant for a personally important concern. The core of an emotion is readiness to act and the prompting of plans (Oatley and Jenkins, 1996). see also Motivation.
Engineer	An Engineer is a professional who, given a problem and a specific set of goals and constraints, finds a technical solution to the problem that satisfies the goals within the constraints.
Environment	Environment is defined as the totality of surrounding conditions, influences or forces, by which entities (like the institutional framework, the policy actors, the W+S system) *can be* influenced and modified in their growth and development (this definition follows Webster's Dictionary, accessed 2012; the website is removed from the internet). Environment is similar to Context, but not exactly the same: on the one hand is wider than context because it also includes factors that do not (yet) influence the alluded entities, and on the other hand it is more narrow as it does not naturally cover abstract conditions like historical or legal contexts. Nowadays it is often used in de the context of ecological quality of the surroundings. In this thesis it is used in a broad sense.
Everyday walking	In this thesis Everyday walking is defined as walking in public space within the urban area, done for common reasons (going to school, to work, leisure, social reasons, shopping).
Existential level decisions	Decisions that precondition strategic decisions with regard to travelling in this thesis are called 'existential'. Examples of such decisions are decisions to go live at a certain place, to accept a job, to marry and have children, to buy a year ticket for railway services, to move to a home near a train station etc.
Exposure (to risk)	Exposure is measured in terms of time spent in traffic, number of trips, total distance covered, the number of streets to cross. Exposure defines risk, which can be expressed in quantitative terms as the ratio between accidents and exposure.
Facilitators	The playing field of the W+S domain consists of four kinds of policy actors: catalysts, clients, facilitators and strategists. A facilitator is an organisation or person who performs tactical and operational tasks with regard to W+S facilities (e.g. planning, providing, construction, management & control).

	As a group of policy actors they are direct stakeholders with regard to walking and sojourning. The group includes local road and public space authorities, the association of municipalities, advisory boards, law enforcement organisations, public housing corporations, public transport corporations, consultants and specialists, and road construction companies.
Facilities	A Facility is a building, a structure, a utility, a usefully designed environment that supports doing something one needs and wants to do (i.e. talking to people, work, crossing the street).
Fair, fairness	According to Oxford Dictionaries fair and fairness concern respectively 'treating people equally without favouritism or discrimination' and 'impartial and just treatment of behaviour without favouritism or discrimination'. See https://www.lexico.com/definition/fair and https://www.lexico.com/definition/fairness (accessed 6-7-2020).
Forecasting	Forecasting is the process of estimation of unknown (future) situations. Prediction is a similar, but more general term. Forecasting usually refers to the estimation of time series (statistical trends) see also: Foresight, Future prospects, Trends.
Forensic principle	The Forensic principle concerns finding out hidden truths. This means that the researcher will not put up with first impressions and accept easy answers, but again and again tries to look behind the symptoms (i.e. 5 times asking why?).
Foresight	Foresight is a form of forecasting, but includes also events that cannot be predicted by time series (statistical trends), like radical changes of attitudes regarding walking, new technologies etc. see also: Forecasting, Future prospects, trends.
Fraternal review	Review of a text by other participants, in this thesis in the PQN and OECD/ITF projects and colleagues in the office.
Future prospects	In this thesis the assessment of Future prospects includes foresight, which includes foreseen radical changes in attitudes or technical, political or organisational innovations. See also: Forecasting, Foresight, Trends.
Gender	Gender refers to the sexual distinction between male and female.
Grey literature	According to Oxford Dictionarie (accessed 1-1-2020 - https://www.lexico.com/en/definition/grey_literature) grey literature is '*documentary material which is not commercially published or publicly available, such as technical reports or internal business documents'*. In this thesis it concerns specialists literature which is not published in scientific (peer reviewed) journals, as a dissertation or a publication that is to be based on scientific methods: gathering measurable empirical evidence subject to specified principles of scientific reasoning and meant to be as objective as possible, to lessen the risk of biased conclusions regarding the research results. In a grey publication proof of the scientific approach and independent external review is missing. Biased interpretation of results is not carefully watched. This does not mean that the results presented in the

publication are biased; it merely means that they are not evaluated by independent peers. This is true for most governmental, institutional and consultancy reports and many specialist books.

Hardware — In this thesis Hardware concerns the static and mobile physical environment, technical devices and technology. These entities are guided by Software (the idea, common visions and objectives regarding the functioning of the system, norms, behaviour rules and computer software).

The conglomerate of intervention arrangements and their pre-conditions, to organise system change is called 'Orgware' (Smits, 2000). The orgware is meant to affect the system hardware and/or software.

also: Software, Orgware.

Health — Health concerns physical and mental fitness and also includes well-being, enabling people to function properly and satisfactorily.

In this thesis it specifically refers to physical fitness and stress management in relation to the tasks a pedestrian needs to perform and the health benefits of transport related physical activity like walking or cycling. See also: Competences.

HOTEL — HOTEL – How to analyse quality of life – is an accompanying measure in the key Action “Improving the socio-economic knowledge base” of the EC Fifth Framework Programme.

ICTCT — International Co-operation on Theories and Concepts in Traffic Safety (the organisation that took the initiative to this project; many of the participants of the PQN project are affiliated with ICTCT); website: http://www.ictct.org.

Impact — In Systems Theory terms Impact concerns secondary effects of policy actions and strategies, such as economic, social, health, and environmental effects (cf. sustainability: PPP or Triple P = Profit/prosperity, People, Planet).

Impact assessment — Impact assessment (IA) is "a process aimed at structuring and supporting the development of policies. It identifies and assesses the problem at stake and the objectives pursued. It identifies the main options for achieving the objective and analyses their likely impacts in the economic, environmental and social fields. It outlines advantages and disadvantages of each option and examines possible synergies and trade-offs" [Source: European commission on:

http://ec.europa.eu/governance/impact/index_en.htm].

Impedance of a route — The effective resistance of a route because of distance to be covered *plus* (expected) inconveniences encountered and/or other limitations (like need for escort, cultural impediments, uncertainties because of lack of information on route conditions).

Indicator — An indicator represents a synthesis of data. It is a way to represent and simplify a more complex system of knowledge. Indicators can be tools:

- to evaluate the existing walking environment and to give suggestions for policy and strategies to apply;
- to guide stakeholders (including planners, designers and policymakers) for making interventions where the requirements for pedestrians are not met.

Every indicator can be described to specify its characteristics, its objectives, how to apply it, transversal relations, the way to measure it, the thresholds, minimum or maximum values etc.

Incident	An incident is an occurrence or event. In this thesis the word Incident will be used as an potentially harmful event i.e. a near-accident or accident with material damage only (conflict without physical damage). Incidents can be have emotional effects.
Injured pedestrian	In this thesis an injured pedestrian is any pedestrian that needs medical attention (at least Emergency Rescue services). Severely injured is defined as an injured person that needs to be hospitalised for at least one day and night (24 hours).
Input	In Systems Theory terms Input concerns autonomic influence and interventions towards the system for managing and changing (improving) the system, e.g. maintenance, change actions, policies, strategies, policy programmes.
Institutional framework	The institutional framework consists of the institutions, i.e. policy actors, which together affect the walking and sojourning in public space system and thereby the walking and sojourning behavioural performance.
Intention	An intention is a course of action a person or organisation intends to follow in the (immediate) future, given enough perceived behavioural control and as soon as the opportunity arises.
Intended state	Intended state, desired or ideal state of the system refers to qualities of the system that people feel are needed or wanted. The intended state is generally not quantifiable.
Intervention	An intervention is a deliberate action that interferes with the course of events. In general an intervention is aimed at changing an undesired process. Intervention is rather similar to Measure; an intervention however can be unplanned, whilst a measure is always planned.
Intrinsic quality	An Intrinsic quality is an essential quality that a product or service has from itself.
Item	An item is a subject in a discussion, an entry in a list, or one object in a collection of objects. For example items in a requirement programme are points that have to show up at a minimum, standard, maximum or optimal level.
Journey	In this thesis a journey concerns travelling door-to-door, or from the point of origin to the destination. (see also: Trip).
Killed pedestrian	A killed pedestrian is a pedestrian who was involved in an accident and died within 30 days of that accident.

Knowledge

Knowledge can be defined as structured, carefully considered information (Bax, 2011). Knowledge concerns information that is consolidated in a person or an organisation. Knowledge and insight are synonyms: information placed in context, related to more generic concepts.

According to Edelenbos (2000, cited in Bax, 2011:19) knowledge can be placed on a continuum with on the one hand 'data' and on the other 'wisdom':

- *Data: loose, unstructured data*
- *Information: data ordered in a way that makes sense*
- *Knowledge: information consolidated in a person or organisation*
- *Wisdom: a combination of knowledge, experience and intuition.*

'Some authors distinguish types of knowledge. Veenman' (2008, cited in Bax, 2011:21) 'differentiates between hard and soft knowledge. *Hard knowledge* refers to more technical knowledge, *soft knowledge* refers to ideas, concepts and discourses'.

There is a difference between scientific knowledge and lay knowledge. *Scientific knowledge* is derived from empirical scientific research, complying to scientific standards (determined by 'falsifiability' and a peer review system, to demarcate the boundary between science and non-science). *Lay knowledge* can be defined as all knowledge that is not scientific, since it does not comply with methodological standards (Bax, 2011:22).

KSI

Killed and Seriously Injured. Seriously Injured is commonly defined as MAIS2+ (Reurings, 2010). This refers to casualties admitted to a hospital after an accident. MAIS2+ excludes MAIS0, 1 and 9. MAIS0 stands for 'not injured', MAIS1 for 'slightly injured' and MAIS9 for 'Not Further Specified'. MAIS0 refers to casualties that were admitted to hospital because of suspected (internal) injury, that could not be determined at the accident location or by the attending physician/ambulance staff.

Life quality

Quality of life is a term that can be defined in many different ways: referred to material supply, to non-material values, in terms of objective living conditions and their determinants (Scandinavian approach), or in subjective terms as an individuals' subjective experience of his/her lives (American Approach).

Lifestyle

A lifestyle refers to the way a person (or a group) lives. This includes patterns of social relations, consumption, entertainment, and dress. A lifestyle typically also reflects an individual's attitudes, values or worldview. Having a specific "lifestyle" implies a conscious or subconscious choice between one set of behaviours and some other sets of behaviours.

LIS

LIS stand for Letsel Informatie Systeem (= Injury Information System) of VeiligheidNL, a dataset on injured persons being treated in an Emergency Department (ED) of a hospital in the Netherlands.

LMR and LMR/LBZ

LMR stands for Landelijke Medische Registratie (= National Medical Registration); LBZ stand for Landelijke Basisregistratie Ziekenhuiszorg (= National Basic Registration Hospital Care). Both are managed by Dutch

Hospital Data and include (almost) all hospital admittances after injury accidents.

Longlist — a longlist is a list of selected names or things from which a shortlist is to be compiled: Smith was on nobody's longlist for chairman (Oxford Dictionaries, accessed 24-11-13).

Maintenance — Maintenance is fixing any sort of device, facility, service or policy should it get out of order, broken or dysfunctional as well as performing the routine actions which keep the device etc. in working order or prevent possible trouble (preventive maintenance).

MAIS — MAIS stand for: Maximum Abreviated Injury Score. This is a score systems that is used internationally. The AIS is a classification system for assessing the impact injury severity. It was developed and published by the Association for the Advancement of Automotive Medicine (AAAM). It is the system of choice for coding single injuries and is the foundation for methods assessing multiple injuries or for assessing cumulative effects of more than one injury. These include Maximum AIS (MAIS), Injury Severity Score (ISS), and Probability of Death Score (PODS) (source: WHO-website: Classification Systems, accessed 1-10-2020 at www.who.int/violence_injury_prevention/surveillance/ classification/en/).

AIS-Code	Injury
0	Not injured
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Maximum
9	Not further specified (NFS)

MAIS0 refers to casualties that were admitted to hospital because of suspected (internal) injury, that could not be determined at the accident location or by the attending physician/ambulance staff.

MAIS1+ — This refers to casualties admitted to a hospital after an accident. MAIS1+ excludes MAIS0 and 9. MAIS0 stands for 'not injured', MAIS1 for 'slightly injured' and MAIS9 for 'Not Further Specified'.

MAIS2+ — This refers to casualties admitted to a hospital after an accident. MAIS2+ excludes MAIS0, 1 and 9. MAIS0 stands for 'not injured', MAIS1 for 'slightly injured' and MAIS9 for 'Not Further Specified'.

Manual dexterity — Skill in performing tasks with the hands (Oxford Dictionaries, 2019).

MASTER — MASTER stands for Managing Speeds of Traffic on European Roads and was a European mobility research project, in which needs and wishes

expressed by pedestrians were compared to the needs and wishes of car drivers.

Measure A measure is a deliberate and planned action that interferes with a course of events.

See also: Intervention.

Mental map A Mental map refers to the image a person has of his world: what his environment looks like, where elements (i.e. homes, shops, parks, friends) are placed, how they can be reached and how the elements are valued.

Mental representation Mental representation refers to how something (external) is represented in one's mind. A mental model is an explanation in someone's thought process for how something works in the real world. It is a kind of internal symbol or representation of external reality, hypothesised to play a major part in cognition.

Mobility Mobility is the ability to move or be moved freely and easily (Oxford Dictionaries).

There exists an even broader definition linked to the concept "mobility of the mind": imagining that you go or are somewhere else than where you actually are, is also mobility. So you don't necessarily have to move physically, and you can travel to imaginary worlds. This is not taken into consideration in this thesis.

Thus mobility is about the ability and willingness to move, travel or change house or work. In this thesis this broad definition is used, contrary to common use in transport sciences and transport policy, where it is mainly seen in terms of distances covered.

For a pedestrian, mobility can depend on motor skills; mobility aids may be needed such as a walking stick, walker, mobile standing frame, power operated vehicle/scooter, wheelchair or white cane for visual impairment.

In relation to disability, mobility refers to safety in movement and the prevention of accidents. People are able to be more mobile with vehicles and uncongested roads, well organised public transport.

Mobility with regard to one's home depends on availability of houses and being bound to an area because of a job or school, etc. Mobility with regard to one's job depends on availability of jobs (depending on the general job market and on one's versatility, quality, etc.), mobility with regard to one's home, etc.

See also: motility.

Model / modelling A model is a simplified representation of a real world system or (chain of) events. Modelling is the activity of simplifying and schematizes reality to a measure that it can be (more) easily understood or used for forecasting.

Motility 'Motile' - simply means exhibiting or *capable* of movement (from an entity that can produce its own movement as opposed to being pushed or lifted etc).

Oxford Dictionaries refers to zoology & botany, and defines motility as (cells, single cell organisms) 'capable of motion'.

Motility is very similar to mobility, but Motility means active movement of an entity, active meaning that it moves itself. Mobility is does not necessarily connote active movement or self propulsion. In medical context this is more useful, e.g. regarding the movement of limbs. In transport terms mobility is useful as it includes being transported as a handicapped person, or passenger, who does not travel, drive, ride on his own.

Motivation Motivation is having the desire and willingness to do something. It refers to the initiation, direction, intensity and persistence of behaviour. Motivation is a temporal and dynamic state that should not be confused with personality or emotion. A motivated person can be reaching for a long-term goal such as becoming a professional writer or a more short-term goal like learning how to spell a particular word. As opposed to motivation, emotion refers to temporal states that do not immediately link to behaviour (e.g., anger, grief, happiness) See also http://en.wikipedia.org/wiki/Motivation.

Motive In this thesis the concept Motive refers to the reason why a person travels, walks or sojourns in public space: to go to work, shopping, visiting family, friends and acquaintances, to recreate etcetera. The word is also used as synonym for motivation.

Multiple sclerosis A chronic, typically progressive disease involving damage to the sheaths of nerve cells in the brain and spinal cord, whose symptoms may include numbness, impairment of speech and of muscular coordination, blurred vision, and severe fatigue (Oxford Dictionaries, accessed 1-10-2020 at https://www.lexico.com/definition/multiple_sclerosis).

Muscular dystrophy A hereditary condition marked by progressive weakening and wasting of the muscles (Oxford dictionaries, accessed November 2019 at https://www.lexico.com/definition/muscular_dystrophy).

Needs For this thesis a need is defined as something that is necessary for humans to live a healthy life and feel well. A Need is a human feature that arouses a human being to action towards a goal and the reason for action, giving purpose and direction to behaviour. There are needs on several 'levels': homeostatic (existence), psychological, social and political spheres.

A need refers to a desired state of the system; it does not matter how that desired state is achieved.

A need exists irrespective of satisfaction of the need.

In this thesis the word Needs will only be used as an individuals' or group of individuals' needs (demand-oriented) and refers to necessary qualities of the system, 'need to have'. Wants refers to qualities, services and objects that are not absolutely necessary, but 'nice to have'. A requirement is the necessity for a product or service to have one or several specified qualities (to fulfil the needs or wants of pedestrians) and is a (scientific) translation.

See also; Requirements.

Nervous system	The network of nerve cells and fibres which transmits nerve impulses between parts of the body (Oxford Dictionaries, accessed November 2019 at https://www.lexico.com/definition/nervous_system).
NOA model	A model on Needs, Opportunities and Abilities presented by Steg & Vlek (see Steg & Vlek, 2009).
Objective quality	Objective quality, which is defined by measurable characteristics of an object or service, which can be observed by instruments like cameras, counters etc. The parameters must not be internal ones (i.e. subject to interpretation, like 'strain'). Subjective quality in turn is an individual's personal assessment and valuation of the objective quality.
Objective risk	Objective risk = (probability of an accident per exposure) x (losses per accident).
Orgware	The conglomerate of intervention arrangements and their pre-conditions, to organise system change is called 'orgware' (Smits, 2000). The orgware is meant to affect the system hardware and/or software. Hardware concerns the static and mobile physical environment, machines and technology. These entities are guided by Software (the idea, common visions and objectives regarding the functioning of the system, norms, behaviour rules and computer software). see also: Hardware, Software.
Operational behaviour	Operational behaviour relates to the pedestrians' walking and sojourning decisions on the operational level (Michon, 1979; Asmussen 1986): taken on the spot and generally highly automated; operational decisions are seldom conscious deliberate decisions. Examples are: place on the road, reaction to traffic and other persons in the environment, pushing the pedestrian light button, step aside. Operational policy concerns execution of policy plans and directives, including management of current conditions.
Opportunity	Opportunities represent a favourable condition to execute a purpose. It is a chance of advancement. To be relevant, the opportunity has to be recognised as such. What is an opportunity is subjective. If a situation offers a favourable circumstance, communication and education can help to recognise such opportunities.
Osteoporosis	A medical condition in which the bones become brittle and fragile from loss of tissue, typically as a result of hormonal changes, or deficiency of calcium or vitamin D (Oxford Dictionaries, accessed 1-11-2019 at https://www.lexico.com/definition/osteoporosis). It concerns an increased risk of breaking bones.
Outcome	In Systems Theory terms Outcome concerns the direct payoffs resulting from actions or strategies, i.e. mobility, safety, sojourning, satisfaction.

Output	In Systems Theory terms Output concerns the products delivered by the system, as a consequence of policy actions and strategies. It refers to the system as it IS, the state of the system.
Paradigm	A Paradigm is a set of theories, laws, models, methods that explain the way a particular subject is understood at a particular time. (Cf. Kuhn). Practises may include methods, theories, concepts and connected activities. The term is mostly used as Paradigm Shift, meaning that the common practises need to be changed to (better) cope with the problems. System approach means a Paradigm Shift from reactive to proactive policy making.
Parameter	In general terms a parameter is a measurable characteristic, variable, constant or quantity of a system. In this thesis **parameter** is used for simple (not composite) characteristics, whilst **indicator** is used for complex characteristics (a measure made up from complex data).
Pavement	See under Sidewalk. In British English it means both sidewalk and surface (asphalt, stones, …) of the street/road.
Pedestrian	A pedestrian is any person who walks or passively sojourns in public space. Consequently this does not only include a country's citizens, but visitors and tourists from abroad as well. Also included are children using toy transportation modes and handicapped persons using walking aids like walking stick, crutches, a wheelchair or 3 or 4 wheeled electric scooters. Persons using scooters, steps, Segways or other 'aids' and transportation tools 'for fun' are excluded. Pedestrians having special demands with regard to facilities because of extra ordinary walking motives, like joggers, marathon walkers and wandering outside the urban area (i.e. the mountains or woods) also count, but in this thesis get attention only when there are special reasons to deal with their needs, abilities and opportunities for walking and sojourning.
Pedestrian quality	Pedestrian (walking & sojourning) quality is defined by the measure to which a pedestrian can fulfil his needs: to be as free as possible in his strategic, tactical and operational decisions regarding mobility, travelling, walking and sojourning in public space.
PEP	PEP is the acronym for the pan-European programme on transport, health and environment (THE PEP). It is a WHO related programme.
Perception	Perception is the end result of an individual interpretation of observations. It includes observation via all senses, processing of this information and the images and impressions. It refers to the personal filtering process (see also Representation: 'unfiltered' visual information).
Peri-urban	Peri-urban areas are areas that are relatively close to the urban area of a city. It involves environments where people to some extent depend on the city, but where non-urban land use like agriculture is dominant. See also: Sub-urban.
Performance	I discern two types of performance: actor performance and design performance. Actor performance is also defined in terms of how successfully the inherent, agreed or assigned tasks are performed.

	Design performance is defined as the extent to which a requirement is met in relation to its use.
Person equivalents	The measure Person Equivalents estimates the number of persons concerned at an average moment. This number is calculated to enable comparison of temporary conditions with continuous conditions, e.g. tourists present at an average moment compared to the total population present.
Pizza-Model	The Pizza model is a descriptive model of clues for options with regard to interventions in transport policy. Essentially the Pizza-model is a checklist for the assessment of the extent to which all options with regard to interventions are covered. It highlights the four main components road user, social environment, physical environment and transportation on three levels: individual level, 'group' level and macroscopic level.
Physical quality	Quality of the physical environment described in functional or material terms.
Place legibility	Place legibility refers to the measure to which public space can be 'read' easily: are there unambiguous, distinctive and recognisable cues for orientation and for assessing what one can find there, how safe it is, which behaviour is expected or to be expected etcetera. See also: Certainty.
Policy (programme)	According to Dunn (1981:46-47) policy, more specifically: public policy, is "*long series of more or less related choices made by governmental bodies and officials*". A policy is a plan or approach (course of action) that is needed to achieve a certain goal. Ideally a policy leads to a coherent set of measures. Policy programme is made up of a number of individual policies and measures, cemented together in an integral plan.
Policy agent or policy actor	A person or organisation that takes an active role or produces a specified effect (derived from Oxford Dictionaries, 2nd definition: '*a person or thing that takes an active role or produces a specified effect'* (https://www.lexico.com/definition/agent],accessed 16-4-2014) (see also: stakeholder).
Policy entrepreneur	A policy entrepreneur is a leading actor in the policy-making process. '*They* [the policy actors] *work hard at developing close ties with people through which they can realise their policy goals and they seek to develop convincing arguments for selling their policy ideas.*' … '*The presence and actions of policy entrepreneurs* […] *can help explain* […] *innovation and policy innovation diffusion.*' (Mintrom, 2000:765).
Policy Life-cycle	Policy issues, like most concepts, generally go through a life cycle, starting with an exploration phase, then a political phase, then an implementation phase and finally a management & control phase. In the last phase policy attention approaches zero, and the issue is no longer a policy issue. Not all policy issues found in the exploration phase, reach the next phase (Winsemius, 1986).

Policy maker	A Policy maker is a person (officer) who develops policies. In principle a policy maker does not decide on the implementation of the policy. That task is reserved for the decision maker; in governmental organisations: a politician.
Policy pillars	The Policy pillars are: • Leadership • Knowledge & Professional Skills • Strategies & policies • Resources • Co-operation and partnerships.
PPP	Triple P stands for: People, Planet and Prosperity. This concept relates to the Sustainability concept.
Procedure	A procedure is a method, mode of operation or a routine that should be used to achieve a specified target. Thus a procedure can include steps to be taken. Procedure is different from **practice**, which is an established way of doing things.
Prognosis	A prognosis is a forecast. The best forecasts use foresight. See also: Forecast.
PROMPT	PROMPT stands for the research project on New means to PROMote Pedestrian Traffic in cities. PROMPT is a joint European research effort funded by the European Commission under the Key Action "The City of Tomorrow and Cultural Heritage" of its Fifth Framework Programme "Energy, Environment and Sustainable Development". The project includes six participating countries: Finland, Italy, Switzerland, Norway, Belgium and France. The duration of the project was 36 months from the beginning of March 2000 to the end of February 2003 (Rauhala et al., 2003).
Propensity	see Walking Propensity.
Public space	Space where public authorities have jurisdiction. In principle this is limited to publicly owned space; privately owned property can be public space if there is no clear boundary like a fence, a wall, a door or a gate. Thus a café is not public space, whilst an outdoor café can be, provided it is not fenced off and everyone is free to use the place, for free. In sum: public can be defined in a legal sense and in a de facto sense. In PQN 'public' is used in the de facto sense. Public space should be designed, constructed and maintained in such a fashion that it is accessible for everyone, where no one is excluded and which can be used for free.
Quality	Quality relates to the nature and characteristics of things. Quality is primarily associated with the (subjective) expectations people have with regard to a product or service. Quality can be defined as the measure to which the reaching of the goal corresponds with the goal. Thus it can be described or defined in objective, measurable terms. Often quality refers to the positive aspects or characteristics of an object, measure, service etc., meaning 'good quality'.

See also: Objective quality, Subjective quality.

Quality control — All measures taken to safeguard the quality of the results of the project, such as fraternal review, external review, judgement by the Management Committee or the Senior management Group.

Quality of life — Quality of life is a term that can be defined in many different ways: referring to material supply, to non-material values, in terms of objective living conditions and their determinants (Scandinavian approach), or in subjective terms as an individuals' subjective experience of their lives (American Approach).

Reachability — Reachability concerns the maximum distance that a person can cover under adequate accessibility and safety conditions.

Reliability — *'Reliability concerns the degree to which the measure is consistent, that is, repeated measurements would give the same result'* (Wiktionary, accessed 4-10-2013); *consistently good in quality or performance; able to be trusted* (Oxford Dictionaries, https://www.lexico.com/definition/reliable, accessed 1-10-2020).

Requirements — In this thesis a requirement is a documented characteristic of what a particular product or service should be or do (supply-oriented). In this thesis the word Need will only be used for needs that individuals or groups of individuals have (demand-oriented). A requirement defines the desired performance of a system, facility or service. Requirements derive from demands from users.

See also: Needs.

Requisites — A requisite is synonymous to **requirement.**

Representation — Representation relates to the visible (photographable) environment, and is not necessarily the same as the perception, since perception is an (individual) interpretation and valuation of what one thinks to see. In the context of Representation 'objective' valuations can be given for certain quality aspects like state of repair, building style, property value.

Resilience, Resilience Engineering — *'Resilience refers to the ability to prepare and plan for, absorb, recover from, or more successfully adapt to actual or potential adverse events, such as encountered problems, system malfunctions and/or potential hazards.'* (cited from http://onlinepubs.trb.org/Onlinepubs/dva/SecurityActivities.pdf, accessed 5-12-16).

Resilience Engineering is a policy and/or engineering approach, which is based on the argument that safety is more than absence of failures. The proponents demonstrated the advantage of going 'behind' the error, malfunction and failure concepts (Holnagel, 2012).

Risk — Risk = (probability of a negative event) x (losses per event). A negative event may be an accident, but also other negatively valued events. In simple terms: risk = chance x consequence.

Danger and Risk are related concepts. The difference is best illustrated by looking at the meaning of 'greater danger' and 'greater risk'. A greater danger

	implicates a larger chance on greater disaster; a greater risk points to a larger chance on a particular type of disaster.
Risk perception & Risk acceptation	In practise, people cannot base their opinions on facts and 'objective' norms, as they have no immediate access to records about the facts and norms. So they rely on their perception of the risks at hand and their intuitive norms about the matters at hand or their experience with related situations.. The urgency of a problem thus relates the degree of acceptation of the risks: the perceived probability of things going wrong times the expected consequences (Wildervanck, 1988, p. 37/38).
Road Danger (reduction)	Road danger refers to the threat posed by road (use) characteristics on a persons' physical well-being and the physical integrity. Road danger reduction should aim to diminish the risk for road users e.g. pedestrians by directing at the source of the problem and not, as often is done, by reducing the mobility and freedom of movement of pedestrians.
Rollator	Wheeled walking frame, used as walking aid.
Role	A role is a set of interconnected behaviours, rights obligations and commitments as conveyed by actors. A role can be defined as expected behaviour in a given situation.
Safety	Safety is generally defined by the absence of risk or - less strict - the absence of accidents and potentially harmful incidents. One has to bear in mind however that absolute safety is not possible. The safety of pedestrians should always be seen within the context of mobility and accessibility. In the past safety was often achieved by excluding pedestrians and/or making places inaccessible for them. Safety comprises effective protection of people against personal harm: against damage of their physical and mental integrity (Flinterman, 2009, p. 8). See also Certainty, Perception, Risk, Road danger reduction, Security, Subjective risk.
Sarcopenia	Sarcopenia is a disorder concerning the loss of skeletal muscle mass and strength as a result of ageing (Oxford Dictionaries, 2019). It results in decreasing muscle power, leading to loss of ballance, which relatively often results in falls.
Satisfaction	Satisfaction is a state of mind related to the fulfilment of one's wishes, expectations, or needs and it reflects the pleasure derived from this. In this sense, factors that are positively related to the satisfaction of needs are rewarding factors and vice versa.
Scope	Scope refers to the extent of the area or subject matter that something deals with or to which it is relevant (Oxford Dictionaries Online, https://www.lexico.com/definition/scope, accessed 1-10-2020).
Scoping review	In this thesis *scoping review* (or *scoping research*) concerns rapidly mapping key concepts underpinning the new research into walking, walkability and sojourning policy development through analysis of

	available documents and experts (cf. Dijkers, 2015). In the initial stages of a domain the necessary scientific research is scarce, or not yet carried out or available. Consequently insights can only be based on 'best fits' found in available documents, from expert assessments and through analogies (cf. abduction; see under abduction).
Scientific literature	Scientific literature comprises articles published in scientific (peer reviewed) journals, and dissertations and other publications that have been shown to be based on scientific methods: based on measuarable, empiralevidence which is gathered according to specific principles of reasoning and meant to be as objective as possible, to lessen biased conclusions regarding research results. See also: Grey literature.
Secondary whereabouts	Most walking trips originate from residences, but it can be observed that additionally a substantial number of the trips start and end at secondary whereabouts like the workplace, school, day-care centres and holiday accommodations like hotels, Bed & Breakfasts, holiday homes, campings and tourist boat harbours. There is very little general and statistical information about walking and sojourning from and towards such secondary whereabouts.
Security	Security is a condition, where one is protected against danger from the outside. The dangers are usually related to criminal activity, harassments, threats. The difference with safety is that safety does not only imply treats from the outside: a person can act unsafe himself. See also: Safety, Certainty, Risk.
Setting	The place or type of surroundings where something is positioned or where an event takes place (cited from Oxford disctionaries, https://en.oxforddictionaries.com/definition/setting, accessed 19-3-2018).
Severely injured	Severely injured is defined as an injured person who needs to be hospitalised for at least one day and night (24 hours). See also: Injured pedestrian.
Shortlist	See longlist: a longlist as a list of selected names or things from which a *shortlist* is to be compiled: Smith was on nobody's longlist for chairman (Oxford Dictionaries, accessed 24-11-13)
Sidewalk	A sidewalk is a footpath alongside a street or road, to be used for walking. In British English a sidewalk is also called *pavement*. 'Pavement' can be a confusing term because it also means 'surface of the street/road': the asphalt or stones used for paving the road.
Social exclusion	Social exclusion concerns the degree to which a person or groups of persons are excluded from social activities.
Social Justice	For this thesis I endorse the definition given by Wikipedia (http://en.wikipedia.org/wiki/Social_justice, accessed November 2012): *" Social justice is justice exercised within a society, particularly as it is exercised by and among the various social classes of that society.*

A socially just society is based on the principles of equality and solidarity, understands and values human rights, and recognizes the dignity of every human being."
" Social justice is based on the concepts of human rights and equality and involves a greater degree of economic egalitarianism through progressive taxation, income redistribution, or even property redistribution. These policies aim to achieve what developmental economists refer to as more equality of opportunity than may currently exist in some societies, and to manufacture equality of outcome in cases where incidental inequalities appear in a procedurally just system. The Constitution of the International Labour Organization affirms that "universal and lasting peace can be established only if it is based upon social justice." "Furthermore, the Vienna Declaration and Programme of Action treats social justice as a purpose of the human rights education."

Social role — A social role is a set of interconnected behaviours, rights obligations and commitments as conveyed by actors in a social situation. A social role can be defined as expected behaviour in a given situation by an individual having a specific social status and social position.

Software — In this thesis Software concerns non-physical elements in the system that guide the functioning of hardware. Software is made up of ideas for interaction and change, common visions and objectives regarding the functioning of the system, norms, behaviour rules and computer software. Hardware concerns the static and mobile physical environment, machines and technology.

The conglomerate of intervention arrangements and their pre-conditions, to organise system change is called 'Orgware' (Smits, 2000). The orgware is meant to affect the system hardware and/or software.

see also: Hardware, Software.

Sojourn(ing) area — A sojourn or sojourning area is any public space where vehicle traffic has no primacy. This can be a residential area, a park, other recreational areas, but also a shopping or an office district.

Sojourning — Sojourning in public space concerns all pedestrian activities in public space that are not purposeful walking from an origin to a destination or a round trip like walking the dog. Together with purposeful walking (including walking as sport and wandering) it defines the total of pedestrian behaviour.

There are many kinds of sojourning: professional activities, recreational activities, playing games, children's play, waiting, hanging out, but public space is also the home of the homeless and sometimes the scene of crime and violence. Sojourning in public space is important because it is an indicator for quality of public space and it encourages all kinds of activities, which humans need for their well-being. The concept of sojourning is well-known in Danish, Dutch, German and French language public space literature (for example: 'verblijven' en 'verblijfsgebied' in Dutch, 'zone de rencontre' in Swiss literature). It was rather unknown in the Anglo Saxon countries; it was introduced through presentations and writings of the COST 358 Pedestrians' Quality Needs project.

Span of Control (SoC)	In this thesis the term Span of Control indicates the degree of freedom a person or organisation has to bring about changes in (part of) the system: to decide on changes, act upon those decisions and be in control of their outputs, outcomes and perhaps even impacts of the changes. Span of Control is similar to *latitude* regarding decisions and manoeuvre space. The term *span of control* was originally used in the context of Human Resources management and refers to the number of subordinates of a supervisor[634]. This freedom can be limited or stretched by[635] external influences (other people, organisations, norms, rules), characteristics of the person or organisation in question (e.g. how powerful they are, how capable and healthy they are, how modest or altruistic they are etc.), self-regulation, and finally, aggressive action.
Stakeholder	A stakeholder is any person or organisation that has an interest or concern in a specified matter or is able to influence the situation either negatively or positively. When active in the field a stakeholder is a policy actor. When (still) inactive, the stakeholder can be considered to be a potential policy actor.
Stamina	*'The ability to sustain prolonged physical or mental effort'* (cited from Oxford Dictionaries, accessed November 2019 at https://www.lexico.com/definition/stamina).
Standard	A standard is a reference norm, a required, agreed level of quality. A technical standard is a norm that defines uniform engineering methods, processes and practices. A standard specification is a set of requirements for an object, material, system or service. A standard procedure (or standard practice) is a set of instructions for carrying out acts, operations or functions.
State of Art	The state of the art is the highest level of development achieved at a certain moment in time.
Status Quo	Status Quo refers to the current state of affairs, i.e. the state of the system at the specified moment. In practice this status quo differs (substantially) from the 'ideal' state of affairs or state of the art conditions. The status quo can be compared or rated against the ideal, desired or state of the art conditions.
Strategic behaviour	Strategic travel behaviour concerns decisions taken before a person goes on route, i.e. travel preparation (Michon, 1979; Asmussen, 1986). There are two types of strategic decisions: initial long term choices like where to live and where to work (in this thesis called lifestyle; see Lifestyle) and day-to-day travel related decisions like to go or not to go, where to go, when and which mode. Travel motives are a key issue on this level; the travel motive determines to a large extent whether the decisions are taken consciously or that they are predominantly habitual.

[634] cited from http://en.wikipedia.org/wiki/Span_of_control

[635] based on discussions within the Ministry of I&M for updating the Dutch National Strategy for Road Safety, October 2011.

	Strategic policy concerns general policy statements, like policy aims, general strategies to approach policy issues (= problems and strivings), and providing the necessary preconditions for realisation of the aims and strategies, such as funding, executive manpower, knowledge (research & development), legislation, adequate distribution of knowledge, competences and responsibilities, and communication.
Strategists	The playing field of the W+S domain consists of four kinds of policy actors: catalysts, clients, facilitators and strategists. A strategist is an organisation or person who develops strategic policies with regard to W+S and as such a direct stakeholder with regard to walking and sojourning. With regard to interventions in principle stategists are in the lead. For many people national political leaders are the obvious strategists and leaders. In reality however such policy makers may not be motivated and active like that, although ultimately they are responsible and accountable for the activities and progress, or the lack of them, in the playing field.
Stress	Stress relates to the degree to which there is disparity between real or imagined personal experiences and personal expectations. Stress is a response that includes both physical (i.e. a ruptured tendon) and mental components (anxiety, duress, withdrawal).
Subjective quality	In principle quality is always subjective, but the term may be used as contrast to Objective quality, which is defined by the measure to which a situation is usable without strain.
Subjective risk	Subjective risk refers to a perceived risk. In general perceived risks are not expressed in mathematical, but relative terms. See also: Risk, Safety, Perception.
Subjective well-being	Subjective well-being refers to the degree in which a person generally feels good considering physical and/or mental conditions of life.
Suburban	Suburbs are populated areas located at the periphery of a town or city, within its formal boundaries. Suburbs have some autonomy. Density of habitation is usually lower than in an inner city area.
Sustainability	Sustainability refers to the absence of negative consequences for future generations from decisions taken at this moment (see also: Durability).
SWOT (SWOT analysis)	Analysis of Strengths, Weaknesses, Opportunities, Threats of an (potential) activity: projects, proposal, intervention, measure, policy programme etcetera.
System approach	A System approach is based on Systems thinking, meaning that the well-being of the system is the principal goal. The aim is to plan and provide an optimal (and possibly flawless) system, where (in this case) the pedestrian can move as freely and safely as possible. Thus the focus is *not* on fighting accidents or incidents, but on influencing risk factors within the process. The work is aimed at optimizing the process and reaching multiple targets: safe, healthy, agreeable mobility for all, 'ageing in place', community development etc. Knowing the potential users' needs is a prerequisite for an effective approach.

Tactical behaviour	Tactical pedestrians' behaviour is typified by decisions taken just before or in traffic and concern the route to be taken, walking speed, level of attention (combination with other tasks, like shopping, listening to the radio or iPod), where to cross the road, where to rest (Michon, 1979; Asmussen, 1986). Many of these decisions are automated and are taken unconsciously. Tactical policy concerns policy plans and planning, including process descriptions and management, education, communication and adequate contracts and agreements on execution of the plans.
Technical mobility	Technical mobility refers to the 'objective' ability to be mobile. A person may be technically mobile, but unable to move because he or she *perceives* it impossible to move.
Traffic accident	A road traffic crash on a public road involving at least one moving vehicle (cf. WHO ICD10; Methorst et al., 2016)[636].
Transport system	The Transport System is made up of three kinds of elements: vehicles, infrastructure and users. The system is presumed to be devised to facilitate travelling and moving goods from A to B.
Transportation	Transportation has two meanings: - the means (i.e. vehicles) to transport persons and/or good from A to B. - the activity of transporting persons and/or goods from A to B.
Transport poverty	Transport poverty concerns the degree to which potential pedestrians are impeded to go outdoors, and walk and sojourn in public space, its causes, societal impacts and remedies (see Martens, 2008; Rantakokko et al. 2010).
Transportation system	The transportation system concerns the mobile part of the transport system and its organisation. It does not include infrastructure (is part of the physical environment), or traffic regulation (e.g. traffic lights are part of the physical environment; traffic rules are part of the [direct] social environment).
Travel accident	A travel accident is any accident that happens during travelling from A to B. This definition is wider than a traffic accident, being an accident in which at least one vehicle is involved.
Travel Time Budget	The theory of Travel Time Budget implies that on '*average people spend between 60 and 75 minutes per day on travel, all over the world, regardless of income levels'* (Mokhtarian & Chen, 2004; Van Wee, 2011:93). Van Wee (2011:93): *'The concept of Travel Time Budgets has been debated for decades (...), but nevertheless seems to be quite a robust concept, especially useful for the long term and at aggregate level (e.g. a country).*'
Travel motive	The travel motive is defined by the activity that one wants to undertake at the destination location or the pleasure of moving itself. If the travel motive is 'residential', than the activity of the origin location applies.
Trends	Trends can mean two things:

[636] Dutch: gebeurtenis op een openbare weg, die verband houdt met het verkeer, ten gevolge waarvan schade ontstaat aan objecten en-of letsel bij personen, en waarbij minstens één rijdend voertuig is betrokken (bron: https://www.woorden.org/woord/verkeersongeval)

- a time series (i.e. mathematical function represented by linear, logarithmical, exponential trend lines)

- a form of fashion, culture, relations, proportions, attitudes or needs for a certain length of time like they are being 'observed' by trend watchers.

Thus not all trends can be expressed in mathematical terms.

see also: Forecasting, Foresight, Future Prospects.

Trip

In this thesis a trip is a part of a door-to-door journey.

In statistics usually the main mode is indicated, which will only be walking if it concerns a door-to-door journey made totally on foot. Whenever a different mode is mentioned, this usually means that walking to and from that mode is not reported. These (sub)trips are quite numerous as almost all vehicular trips are preceded and succeeded by (mostly short) trips on foot (see also: Journey).

Universal Design

Universal Design (= Design for All = Inclusive Design) is an approach to the design of products, services and environments to be usable by as many people as possible, regardless of age, ability or situation. It strives to be a broad-spectrum solution that helps everyone, not just people with disabilities. It also recognizes the importance of how things look and appeals to a wide range of potential users.

Utility Theory; Utilitarism

'Utilitarianism is a theory in normative ethics holding that the proper course of action is the one that maximizes utility, specifically defined as maximizing happiness and reducing suffering". In economics, 'utility is a representation of preferences over some set of goods and services'[637].

Utilitarian walking

Utilitarian walking concerns walking for utilitarian reasons (work, service or shopping related, errands), contrary to recreational walking and walking for health and social reasons.

Validity

The *validity* of a measurement is the degree to which the measurement instrument or process measures the variable that it claims to measure (cited from Gravetter & Forzano, 2012, p. 78).

According to Cronbach & Meehl (1955:281-282) '*there are four types of validity: predictive validity, concurrent validity, content validity and construct validity.'* Later the concept of Face validity has been added.

Face validity is the simplest and least scientific form of validity and concerns the '*extent to which a test is subjectively viewed as covering the concept it* [is meant] *to measure'* (Gravetter & Forzano, 2012:78)

'Predictive validity concerns the degree to which a measurement predicts scores on other similar measures or tests.'

'Concurrent validity can be demonstrated when a test correlates well with a measure that has been previously validated.'

[637] (cited from Wikipedia, accessed on 2-12-13: http://en.wikipedia.org/wiki/Utilitarianism, and http://en.wikipedia.org/wiki/Utility)

'*Content validity* (also called logical validity) refers to the extent to which a measure represents all facets of a given construct, i.e. the degree to which it fits logically in a construct or model.'

'*Construct validity* refers to degree a measurement tool is acceptable to scientific peers'. 'It concerns the validity of inferences that observations or measurement tools actually represent or measure the construct being investigated'. (citations from Cronbach & Meehl, 1955:282).

Victim — In this thesis a victim is an unfairly treated, aggrieved, hindered, injured, or even killed person. When related to road traffic or public safety, a victim is someone who is either injured or killed.

Vision — Vision can mean two things:

- inspirational renderings with regard to reaching a specified goal

- the quality of a person's visual system (visual detection and resulting perceived images).

W+S — W+S concerns pedestrians, and walking and Sojourning in public space; W+S conditions is a synonym for walkability conditions, i.e. whatever is needed to enable, support and/or tempt persons to walk and sojourn in public space, and possibly to do that more or more often (see also: walking).

W+S domain — The walking and sojourning domain is the policy field that studies, supports and manages all matters regarding walking and sojourning in public space.

WALCYNG — Acronym for WALking and CYcliNG, a 4th Framework (1996-1997) Programme research project on How to enhance WALking and CYcliNG instead of shorter car trips and to make these modes safer.

WALK21 — Walk21 exists to champion the development of healthy sustainable and efficient communities where people choose to walk. WALK21 features a website (www.walk21.com) and organises yearly conferences.

Walking — The activity of walking: moving about on foot in public space. There are four kinds of walking: from A to B (main mode walking), from A or B to other modes (sub-mode walking), circulation (walking from A to A, a round trip), and sojourning in public space.

Walking propensity — Walking propensity is an indicator picturing the degree of freedom or lack of alternatives to choose to walk over choosing other travel modes, i.e. the inevitability of walking. The indicator is expressed in stars, where 5 stars means 'high propensity to walk' and 1 star means 'very low propensity to walk'.

In the Theory of Planned Behaviour (Azjen, 1985; Fishbein & Azjen, 1975) attitude, subjective norm and perceived behavioural control together shape a person's behavioural intentions (and planned behaviour). Instead of the concept *intentions* the author favours to use the term *propensity*, as this wider concept also covers non-reasoned and non-planned behaviour, such as habitual, reactive and intuitive behaviour. The concept is also more or less similar to walking attitude, but is more neutral, as it does not reflect a state of mind, but a general (statistical) tendency regarding walking.

Walkability — *'The quality of walking conditions, including safety, comfort, and convenience'* (citation from Litman, 2003/2007:1). Walkability describes overall walking conditions, in the widest sense. Walkability takes into account the pedestrian's abilities and competences, quality of pedestrian facilities and services, roadway conditions, land use patterns, community support, security, comfort of walking and connectivity to the transportation system. Scores of walkability indicate how well the pedestrians' needs regarding walking *and sojourning in public space* are taken into account.

It has to be noted that the term 'walkability' is generally used in a more restricted sense: *'Walkability' and 'walkable' are terms that have become common in the fields of engineering, planning and health, partly because walking is widely recognised as having benefits for the social, health and economic well-being of a society. The term 'walkability' was defined in 2005 as '…the extent to which the built environment is walking friendly' (Abley, 2005), and this definition was incorporated into the NZTA's Pedestrian planning and design guide (NZTA, 2007; 2009). The design guide also noted that walkability is '…a useful way to assess the characteristics of an area or a route, although it can be subjective' (cited from Abley, 2011:11).*

Wants — A Want indicates an existing need, which is not yet satisfied. A want is something desired, distinct from a need. It is said that people have unlimited wants, but limited supplied resources.

Wants refer to qualities of the system, services or objects that are 'nice to have' and are felt to be less necessary than Needs, which are 'need to have'. A Requirement is a documented characteristic (scientific translation) of what a particular product or service should be or do (supply-oriented).

Wealth — Wealth includes physical, perceived and durable affluence: robust economic benefits and well-being. The benefits should be sustainable, meaning that they cannot lay burdens on future generations and should not go at the expense of the liveability of the planet.

WHO — World Health Organisation.

Appendix 2 - W+S Policy literature scan

In this Appendix the Walking and Sojourning in public space policy literature scan, carried out late 2011 and in the beginning of 2012 is presented. The objective of the literature scan was to find out what literature there is on the subject and what information was available to answer the leading research questions of this thesis. In this Appendix I first describe the methodology applied in this literature scan, then I will describe the research results and finally I will evaluate the literature scan results. It is important to note that this study represents the state of affairs at the beginning of 2012, and that the indicated chapter division in this appendix concerns the initial chapter division of this thesis. Later in the research process (in 2016) the division has been changed to the less ambitious chapter division presented in this final version of the thesis.

Walking is the oldest form of transport and there are ample societal reasons to foster walking, walkability and sojourning in public space. As such it would be reasonable to expect that over time walking and walkability received a fair amount of governmental attention and that there is a substantial body of research literature about it[638]. If available, such knowledge could be used as a starting point for policy development activities for sustaining and improving conditions for walking and sojourning in public space.

International experts (in various WALK21 and ICTCT conferences) and dedicated scientific working groups (like COST C6, COST358 Pedestrians' Quality Needs and the OECD Working group Pedestrian Safety, Urban Space and Health), however, pointed out over and over again that walking and sojourning in public space are rather neglected in scientific research and governmental policy. They indicated that there is not much literature and that what there is, is either fragmented and often of questionable quality. In this section I will try to verify this conclusion. I will take a broad, multidisciplinary perspective, and will not restrict the search to one of the 'usual suspects' of traffic, traffic safety, transport, infrastructure, public space and land use planning and health promotion.

[638] as 'sojourning' is a relatively new concept, introduced by the PQN project, it is not logical to expect a vast body of literature about it.

In Chapter 1 of this thesis a first impression is given of the policy maker's perception of the significance of walking, walkability, sojourning in public space and of what they perceive that should be done about it. Implicitly a passive role of the policy maker and researcher was assumed, whereby I mainly looked at insights that might pass by while keeping oneself informed. In this chapter I start from a different perspective, where a policy maker and researcher is assumed to actively quest for information on walking, walkability and sojourning in public space. The aim of research done for this appendix on Walkability policy development in literature, is to acquire a general overview of the content of literature relevant for policy development on walkability and sojourning in public space (W+S). I will picture what researchers and policymakers will probably find, given a certain level of energy put into the quest.

Questions to be answered in this section is:

- What body of (research) literature on pedestrians, walking and sojourning policy development is available and accessible to be used as point of departure?
- What subjects, key topics of the context of the publications (policy aims), perspectives, conceptual levels and special groups are covered?
- What seems to be the State of the Attention to W+S policy development?

In section 1 of this Appendix the methodology used and choices made are revealed. In section 2 the results of the literature review are presented. Section 3 is devoted to the evaluation of review results and conclusions with regard to scientific knowledge as a fundament for W+S policy development.

1. Methodology

This section on methodology will reveal *how* for this thesis a general overview is acquired regarding the available literature relevant for policy development on pedestrians, walking and sojourning in public space. It will successively deal with:
1.1. Exploration of literature sources
1.2. Compilation of a dedicated literature database
1.3. Scoring publications on their potentials for W+S policy development
1.4. Analysis of search results.

1.1. Exploration of literature sources

In this paragraph available sources concerning information potentially relevant for W+S policy development are noted and selected. Furthermore it is reported how the searches for literature were performed.

Before the digital era scientific literature searches were usually carried out through university library card indexes or databases. Nowadays most of these databases have been opened up digitally, but they cannot offer more than overview and access to the publications which the libraries acquired themselves. Within academic circles it is commonly agreed that SCOPUS and Science Direct databases provide a much wider outlook on scientific literature, and are therefore widely used for literature searches[639]. For SCOPUS a username and password is

[639] SCOPUS: http://www.scopus.com/home.url; Science Direct: http://www.sciencedirect.com/

needed; Science Direct is freely accessible (as 'guest'). Both are connected to Elsevier publishers, but open up other major publishing houses as well. A relatively new, freely accessible, and fairly comprehensive general source of scientific information is Google Scholar, which is independent from publishers, but draws from many publications databases and library search systems. This makes Google Scholar particularly suitable for a tentative search to find out how hits in digital literature database search are distributed over the years.

Apart from the above mentioned, additional sources for references to specific scientific literature regarding pedestrians, walking and sojourning in public space are SafetyLit, PubMed and a variety of road safety literature databases[640]. In the Netherlands over 400 libraries are joined in the national library system, accessible through www.picarta.nl (not freely accessible). With regard to traffic and transport, road safety and public space and land use planning in the Netherlands there are a number of information services, which spot new developments and research in their fields of expertise (mostly applied science, not necessarily complying with scientific standards).

The SCOPUS and Science Direct databases together contain an extensive sample of scientific literature on pedestrians, walking and sojourning in public space. With regard to her study on knowledge use in road safety policy, Bax (2011, p 51) concluded that the number of studies on that subject were small and that so called grey literature has to be included to provide a true synthesis. The subject of walkability and sojourning policy development can be considered similar. On the subject of W+S policy development itself there are only a small number of publications that qualify as scientific (peer-reviewed) literature. Like road safety it mainly concerns applied science and a substantial part of the literature is not published in peer-reviewed journals, but as institutional research reports or articles in non-scientific practitioners journals. Therefore it was decided to include grey literature in the search.

In the overview research for this thesis I focussed the search on exploring SCOPUS, Science Direct and Google Scholar. Additionally I searched the internet databases Picarta, Kennisplein (library for internal use of the Ministry of Infrastructure and the Environment), TRANSUMO (public-private partnership of transportation research), the SWOV library (national Road Safety Institute), and SafetyLit, as well as my own bookshelves and digital archives. Furthermore, the results from literature searches for the COST 358 Pedestrians' Quality Needs, carried out by Sombekke and Katteler (2008) and Hof (2010), were included.

Because of the sheer number of publications that include 'pedestrian' or 'walking' in their titles, abstracts or keywords (see below), and time and resources available, a complete review of all available publications on the subject is not an option. The quest for literature sources for this thesis aims to cover the dominant subjects in (scientific) literature on pedestrians, walking, walkability and sojourning in public space, and what elements at least need to be included in the conceptual framework for this thesis, and particularly what literature potentially helps to answer the research questions, identified in Chapter 1. As nowadays English is the *lingua franca* and 91% (44,500 out of 49,000 represented in the outstanding and widely used SCOPUS database) of scientific literature on pedestrians and walking is published in the English language, the search of international literature is limited to literature in English. The search also included national research and policy literature in Dutch.

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[640] Freely accessible sources on safety and health are:
SafetyLit: http://www.safetylit.org/citations/index.php?fuseaction=citations.archivesearch;
PubMed: http://www.ncbi.nlm.nih.gov/pubmed (freely accessible); for a list of road safety literature databases see http://www.swov.nl/UK/Research/bibliotheek/links-vak.htm

As the various databases each have their own ways of opening up their content, dedicated approaches are needed. In the following text I will describe these approaches for each of them: SCOPUS, Science Direct, Scholar and various others. All searches started with a primary search on the words 'pedestrian' or 'walking' and 'policy', 'strategy' or 'plan'.

The **SCOPUS**[641] database opens up article titles, abstracts and keywords. In many cases, depending on subscription to the journals in question, the full texts of the article can be accessed. Although searching on the keywords 'pedestrian' OR 'walking' proved to be more goal-oriented and selective compared to searching in complete texts[642], it still yields about 49,000 hits of articles in English.
The majority of publications concern medicine (more than 31,000); after checking a sample of 50 publications, medical publications could be excluded: the publications do not seem to deal with collective walkability issues, but dominantly concern identification and treatment of medical conditions and diseases, focussed on the health of individuals. Health professions, however, dealing with a more general approach, needed to be included. Other non-relevant subject areas were also excluded[643]. After this pre-selection, about 11,000 hits remained. This selection was narrowed down by a within search on 'strategy' or 'policy' or 'plan', resulting in 2,250 hits. This was deemed still too much to go over properly and not necessary for a acquiring a general overview. By selecting 'articles' only and excluding books, short surveys, conference papers and reviews, about 1,250 were left to go through. By checking the article titles and abstracts on relevance for answering this thesis' domain[644], another 825 could be excluded, leaving 420 relevant articles to be included in a dedicated literature database.

Science Direct[645] is a database of scientific literature published by the Elsevier consortium, including most of the influential journals, and although quite large, covers a smaller fraction of worldwide published articles. If subscribed to Elsevier journals, one can access (most of the) articles in full text form. Like SCOPUS, Science Direct can be searched on keywords, but not as sophisticated as in SCOPUS. Only the two main selective search words ('pedestrian' OR 'walking') could be applied, which resulted in about 2,030 hits[646]. By excluding irrelevant subject areas, conditions and issues (similar to the Scopus search), the numbers were narrowed down to 343 relevant articles.

A search in **Google Scholar** yields titles, some lines from the article text or abstract, the number of citations found in reference lists, a link to related articles and, if available, a link to downloadable PDF's or HTML pages. Google Scholar however does not have the option to search publications on keywords, but can be searched either on 'text in the title' or 'text in the article' as posted on the internet.

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641 see http://www.scopus.com/home.url
642 searching on text produces many times as many non relevant references to publications that where the search word is included, but is not really the subject of (part of) the publication.
643 In my search, after checking the first 25 hits on non-relevancy, the following subject areas were excluded: neuroscience, nursing, pharmacology, toxicology and pharmaceutics, nursing, and dentistry, agriculture and biological sciences, chemical engineering, physics and astronomy, material science, arts and humanities.
644 Articles excluded concerned topics that were highly technical, clearly did not concern public policy, non-Western walking conditions, walking in non-public areas or concerned non-everyday walking (i.e. hiking, jogging) and articles where walking, walkability of the pedestrian was clearly merely an example in a different context, were excluded from the SCOPUS search results yielded on the 17th of February 2012.
645 see http://www.sciencedirect.com/
646 16th of February 2012.

The 'text in title' option yields 104,000 hits on 'pedestrian' OR 'walking', which is more than 5 times the number of SCOPUS search on the same search words[647]. It has to be mentioned that, contrary to SCOPUS and Science Direct, not all hits concern scientific publications; 'grey' literature like institute reports and presentations are also included.
In order to yield manageable numbers of relevant articles, refined searches were carried out on the search words 'walking', 'pedestrian' and 'pedestrians' combined with amongst others 'review', 'history', 'research', 'strategy', 'plan', 'planning', 'policy', 'walkability', 'safety', 'health' and 'accessibility' and on specific periods in order to form a picture of historical developments in treatment of subject and find 'classic' publications on walking, pedestrians and sojourning in public space (see also Section 2.3. on the Policy Context). In many cases the publications or abstracts found could be downloaded. About 700 articles or library abstracts, which seemed to be most relevant, using the same criteria as used for the above literature selections, were downloaded.

The Dutch **Picarta** library service searches the 'Nederlandse Centrale Catalogus' (Dutch Central Catalogue of over 400 libraries in the Netherlands). A search yields titles and sub-titles, author(s), publisher and year published. A search on the content of library cards on the (exact) words 'voetganger' or 'lopen' (concerns 'pedestrian' OR 'walking') draws 34 hits of which 26 are in principle relevant for my thesis. A search on keywords related to walking[648] resulted in a list of 151 hits. Of these 111 can be seen as relevant for this thesis (non-relevant titles mostly concern hiking in rural areas).

Kennisplein (literature database for internal use within the Dutch Ministry of Infrastructure and the Environment) covers 3 types of literature: internal reports and notes, reports published by external entities and position papers. The database was searched on 'voetganger' OR 'lopen' (concerns 'pedestrian' OR 'walking'). Thus filtered, the Kennisplein database contains 45 internal and 450 external titles and 8 position papers, of which respectively 35, approximately 350 and 8 have relevancy for this thesis.

As walking is a sustainable travel mode, it seems logical to include the library of the **TRANSUMO** (TRansition SUstainable MObility) foundation in my literature search. TRANSUMO is a platform of companies, governmental organisations and knowledge institutes that together develop knowledge of sustainable transport. Although the words 'pedestrian' and 'walking' draw 28 hits in the library database, none (!) of these publications more than mentions pedestrian and walking related subjects. The publications are not about walking or pedestrians.

In the Dutch Road Safety Institute **SWOV library** a search on the keywords 'walking' or 'pedestrian' draws 6,442 hits (13-4-2012). When narrowed down by limiting to titles including 'policy', 'strategy' or 'plan', the number of hits goes down to 40, 28 and 44 hits respectively.

The last database explored was **SafetyLit**. This is a well-known dedicated database of scientific publications on safety[649]. The database, containing over 300,000 items, can be searched on

[647] 19,200 hits in SCOPUS, search words 'pedestrian' OR 'walking', on the 6-4-2012.
[648] Picarta search on 18-4-2012, using keywords that connect to 'pedestrians' and 'walking' are 'voetgangers', 'voetgangersfaciliteiten', 'voetgangersgebieden', 'voetgangersoversteekplaatsen' and 'voetpaden' (respectively: pedestrians, pedestrian facilitities, pedestrian areas, pedestrian crossings, footpaths).
[649] see http://www.safetylit.org/about.htm; it is based at San Diego State University and supported by the US Centre for Disease Control (CDC) and World Health Organisation (WHO). The quality of the articles is not screened for quality by SafetyLit, but is assumed to be warranted by the source journals.

author name, text words (exact, or text word + synonym) and journal title. It yields lists of article titles, authors, journal references and abstracts.
On the search 'pedestrian' OR 'walking' AND 'strategy' OR 'policy' OR 'plan' the database yielded 737 articles (on 6-4-2012). After checking the first 100 hits on relevance, it was concluded that less than 5% of the topics were not covered by the above databases, and that, for a general overview, there was little need to invest much time to find additional literature.

Finally, my own bookshelves and digital archives were searched; a selection is included in the thesis literature database. The digital archive includes unique material from the former Dutch Pedestrians Association, vulnerable road users projects archives, PQN archive, as well as Wikipedia articles, various factsheets and some eye-catching articles regarding innovations regarding W+S. It needs to be said that the publications and notes collection is not based on a systematic search of databases and the (professional) media, however, but on over the years accumulation of documents that caught the author's professional attention or were delivered by colleagues.

1.2. Compilation of a dedicated literature database

The search results from the SCOPUS, Science Direct, Google Scholar and own bookshelves and digital files were entered in an EXCEL database. Of each of the selected articles, reports and books author names, year of publication, title of the article, report or book, source journal title and/or publisher and city were entered. As the various source databases use different formats, the records had to be checked and edited to comply with the chosen format. Doubles were erased. Subsequently, based on the title and abstract of the publication, crude codes were given regarding the following items[650]:

- in what database the publication was detected
- the publication's scientific quality (scientific, grey or 'media')
- the relevance of the publication for specific chapter(s) of the thesis
- main subject(s)
- the pedestrian activity level concerned (lifestyle, strategic, tactical, operational)
- underlying general policy aim (i.e. mobility, safety, health)
- whether it concerns a special pedestrian group (i.e. children, elderly)
- whether it concerns a general literature review (what is available, State of the Art)
- the origin and representativeness of the research for policy development in the Netherlands.

After checking a sample of about 100 publications, for each of the items code options and (when necessary) specifications were determined and specified. In the thesis' literature database the following codes were applied:

[650] For workability reasons the item list was restricted to items that seemed most relevant to the thesis.

1. Where the publication was detected (source)

- SC: SCOPUS
- SD: Science Direct
- OS: other Sources including Google Scholar, various library systems and own bookshelves; this code was sub-coded regarding scientific quality (see below) and literature studies carried out for the PQN project
- PQN: articles included in the COST 358 Pedestrians' Quality Needs project Final Report.

2. The publication's scientific quality

- Scientific: peer reviewed journal, dissertation, scientific conference paper
- Grey: institute report, governmental report, conference paper (non-scientific)
- Media: newspaper, news journal, popular practitioners journal or web-news letter.

3. The relevance of the publications for the thesis chapters

- Chapter[651] 2. Background, models and theory: literature overviews, relevant theoretical concepts and models
- Chapter 3. Methodology: relevant and optional research methods
- Chapter 4. Policy context: institutional framework, actors, their positions, latitude and doings
- Chapter 5. Needs and Abilities: normative pedestrian characteristics
- Chapter 6. Requirements: what is required for optimal walkability (supply)
- Chapter 7. Performance: how well the pedestrians function within the provided conditions
- Chapter 8. Policy issues: system deficits, (urgent) problems
- Chapter 9. Precursors: associates, precursors, determinants and contributing factors
- Chapter 10. Measures: optional policy measures supporting walkability and sojourning in public space
- Chapter 11. Ultimate policy strategy packages: selection of strategies and measures that qualify on a higher policy level
- Chapter 12. Added value: Added value of a generative system approach.

4. Main subject(s)

The classification is constructed iteratively and unites approaches to supporting and improving walkability and sojourning in public space. It was developed with the traditional 3 E's model (Engineering, Education and Enforcement) in mind. Some activities that did not fit the 3 E's model (Theory, Research, Policy, Organisation, System ecology, Atmospheric conditions, Social/traffic interactions) were added; some of the E's were expanded and split up (Engineering into Engineering, Site level design, Intelligent Transport Systems, Spatial Aspects and Vehicle technology; Enforcement into Enforcement, and Law and Legislation; Education into Human Factors). The final list is:

[651] NB: This chapter division concerns the initial chapter division of this thesis. Ultimately the division has been changed to a less ambitious one.

- Ar = Architecture: design of build environment (site level)
- CL = Climate: atmospheric conditions affecting pedestrian behaviour.
- Ec = Ecology: ecology of pedestrians system elements: interrelation of the pedestrian's behaviour with his physical and social environment and the transportation system
- Ef = Enforcement: enforcement of laws and formal behavioural rules
- En = Engineering: engineering procedures and measures
- H = Human Factors: human capacities (medicine, psychology, education): human physical and mental characteristics and behavioural aspects, such as abilities, competences, behavioural motives, communication and learning processes
- ITS = Intelligent Transport System, hardware and software
- L = Law and Legislation: law, laws, legislation and formal guidelines
- O = Organisation: procedures, process design
- P = Policy: policy strategies, policy packages, policy output
- R = Research: research inputs for policy development, including methods, models etc. A mark 'R' was given when the work in the article focussed on counting and measuring pedestrian behaviour and performance, such as the pedestrian's mobility or accidents which they were involved in
- So = Social interaction: interaction between pedestrians, others in the environment and traffic
- Sp = Spatial aspects: spatial conditions, arrangements and distributions, land use and network design (development plan and structure plan levels)
- Th = Theory: relevant theoretical concepts and models
- Tr = Transportation policy: traffic and transportation policy
- VT = Vehicle Technology: vehicle design and technology.

5. The pedestrian activity level concerned

The classification is based on the COST358 Pedestrians' Quality Needs project's interpretation of the hierarchy of activity levels (Methorst et al., 2010), as discerned by Michon (1979) and Hatakka (1999, 2001):

- Life style activity: level concerns general preconditions
- Strategic activity: level concerns travel decisions (before traffic participation)
- Tactical activity: levelconcerns navigation and conditional behaviour in traffic
- Operational activity: level concerns reactive traffic decisions in traffic / while sojourning.

6. Key topic of context of the publication

The classification is based on the list presented in the COST358 Pedestrians' Quality Needs project Final Report, Part A Introduction and Conceptual Framework (Methorst et al., 2010, Part A, p 26):

- * : concerns either all aims or aim not specified
- A = Accessibility: Accessibility of places
- He = Health: Physical and mental health
- M = Mobility: Mobility options and support
- L = Liveability/sojourning: Liveability and sojourning conditions and satisfaction

- Sa = Safety: Safety, prevention of accidents and casualties, perceived safety and risk
- Su = Sustainability: People, Planet, Prosperity on the longer run.

7. Whether it concerns a special pedestrian group

- * : not specified or 'all'
- Adults: adults (not children or elderly)
- Car: motor vehicles
- Child: children and youngsters
- Drivers: motor vehicle drivers and cyclists
- Limited mobility: people with limited mobility
- Old: elderly people (= age 65 and older)
- Various: various groups specified in the publication
- Women.

8. Whether it concerns a state of the art or available literature review

- N = No
- Y = Yes, overview of subject relevant to walking and sojourning
- YY = Yes, (relatively) comprehensive overview of pedestrian research or policies.

9. The origin and representativeness of the study.

- NL: the Netherlands
- EU: research results valid for European countries
- W: research results valid for Western world, including USA, Canada, Australia, New Zealand, Japan
- G: research results valid global, including other source countries like China, Korea, Mexico, Brasil, India.

10. Chapter 2 - Conceptual framework - theory and models

The publication is scored with regard to the degree to which it helps to provide a global image of the State of the Art as well as a conceptual framework serving as starting point and frame of reference for the structure of the thesis and as guidance for the research into walkability and sojourning policy development. The scores are:

0 Not relevant

1 Includes potentially useful or dispositional information for the subject

2 Includes essential information for the subject

11. Chapter 3 - Methodology - methods

The publication is scored with regard to the degree to which it helps to provide insight and overview of the methodology that is available to provide answers to the thesis' research questions and helps to support policy developers to programme and/or carry out research tasks within the policy development process. The scores are:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

12. Chapter 4 - Policy context
The publication is scored with regard to the degree to which it helps to provide insight in the policy context, particularly to assess how much leeway actors have regarding policy measures and policy programmes. The chapter is to provide the essential background information needed to understand feasibility of proposals later on in the thesis. The scores are:
0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

13. Chapter 5 - Needs and Abilities
The publication is scored with regard to the degree to which it helps to provide insight in the demands of pedestrians regarding walkability and sojourning facilities. The scores are:
0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

14. Chapter 6 - Requirements (opportunities)
The publication is scored with regard to the degree to which it helps to provide insight in what the system is required to offer (opportunities) to support the walkability and sojourning in public space needs and abilities of pedestrians. The scores are:
0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

15. Chapter 7 - Performance
The publication is scored with regard to the degree to which it helps to provide insight in what the system actually offers and what consequences this offer has for (groups of) pedestrians. The scores are:
0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

16. Chapter 8 - Issues
The publication is scored with regard to the degree to which it helps to provide insight in what issues (SWOTS) regarding the system need policy attention. The scores are:
0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

17. Chapter 9 - Causal factors (precursors)
The publication is scored with regard to the degree to which it helps to provide insight in the clues there are for improving the system. The scores are:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

18. Chapter 10 - Promising walkability measures
The publication is scored with regard to the degree to which it helps to provide insight in what interventions look promising for promoting walking and sojourning. The scores are:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

19. Chapter 11 - Selection of walkability strategies / measures
The publication is scored with regard to the degree to which it helps to provide insight in what measures and packages of measures actually suit the larger system and higher order policy targets. The scores are:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

20. Chapter 12 - Added value of system approach to walkability
The publication is scored with regard to the degree to which it helps to assess the added value of the proposed system approach to walkability and sojourning in public space. The scores are:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

1.3. Analysis of the literature database on potentials for W+S policy development

The coding described above cannot lead to more than just a rough picture of what the crude selection of 1,700 publications deals with. It does not adequately answer the question in what ways the available body of literature supports W+S policy development. For proper insight in the potentials of the available body of literature for W+S policy development, a more precise picture is needed. In order to acquire such insight, the publications were scored on their potential to help substantiate the policy development in question. The database was then analysed to pinpoint potentials for W+S policy development. The process is described below.

The first step in the scoring process was to establish what the publications need to contribute to help answering the research questions dealt with in the Chapters 2 - 12 of this thesis. Subsequently a simple 3 point scale was developed to assess the potentials of the publications for the substantiation of the chapter's topic:

0 Not relevant
1 Includes potentially useful or dispositional information for the chapter
2 Includes essential information for the chapter.

The scores were determined by interpreting the title and abstract of the publications. When it was clear to the author that a publication offers relevant, valid and reliable information concerning the topic of the chapter, the publication scored '2 - includes essential information for the chapter'. When this could not be determined conclusively from the title and/or abstract, or when there were uncertainties regarding relevancy, validity or reliability, the publication was scored '1 - includes potentially useful information for the chapter'.

A publication can score on relevancy in more than one chapter. This can be the case if the topic of a concerned chapter is explicitly addressed or when a specific concept has a significant carry-over effect. In the latter case, true for some of the publications attributing to the conceptual framework, the score is set '1 - includes potentially useful or dispositional information for the chapter'.

Per publication the scores are summed into a total score for the publication, indicating its relative relevance or importance for the thesis and walkability and sojourning policy development in the Netherlands.

The thesis literature database (MS Excel 2007 database) was analysed using the PivotTable option. Cross-tables were produced for all items; for easier interpretation some of the tables were put into graphs. The analysis focussed on:

a. Identification of major developments in the **numbers of publications** regarding pedestrians, walking, walkability and sojourning in public space, in order to roughly assess prospects regarding W+S policy development research
b. Assessment of what **subjects** connected to the pedestrian, walking and sojourning in public space are dealt with in literature or are (recently) highlighted in professional media; this includes identification of disciplines involved, assessment of the activity level and whether the publication is focussed on a special pedestrian group. The aim is to roughly assess the width of coverage of W+S policy development
c. Distribution of the various publications over the thesis **chapters**, to get a first impression of coverage of the research questions (subjects) and needs to look further
d. Identification of publications that offer (partial) **overview** regarding the State of the Art of (segments of) W+S policy development and identification of publications that touch the whole range of the policy development process.
e. Determining the potentials of the available body of literature for adequate policy development for the **Dutch case**.

In all of these analyses the content quality of publications in the database (i.e. scientific, 'grey' and 'media') is explicitly taken into account. Scientific publications are dissertations, scientific articles mentioned in SCOPUS or Science Direct, and other peer reviewed publications such as articles in scientific journals. When not explicitly peer reviewed, multi-author books, and research and advisory reports, conference papers and articles in non-scientific journals were classified 'grey'. Short articles in the (professional) media were classified 'media'.

As the literature scan aims for a first impression, and, in this stage, the individual publications were not thoroughly studied, it is clear that the scoring is 'quick and dirty' and thus superficial, not entirely objective, and sometimes possibly erroneous. To tackle erroneous and imprecise

scoring, during the analysis process, the scores were checked on accuracy and consistency, and faulty scores and omissions were adjusted.

2. Literature scan results

In this section the results of the literature review are presented[652]. Following the analysis focus revealed in paragraph 2.1.1.c, attention will be given to the following subjects:

a. Volume of attention to W+S policy development
b. Subjects dealt with in the publications in the database
c. Distribution of publications over the thesis chapters
d. Identified overview publications
e. Relevance of publications for Dutch case
f. Evaluation of the literature review.

2.1. Number of publications regarding W+S policy development

As the Google Scholar literature database draws from a large number of primary literature databases from libraries all over the world, it is particularly suitable for a tentative search to find out how much attention is given to pedestrians and walking in literature. This tentative search was carried out on the search words 'pedestrian' and 'walking' in the title. The results revealed that the number of hits increased exponentially from the 1970s (see Figure II.1). On one hand this relates to the fact that a substantial part of the pre-1970 literature is not (yet?) digitally accessible via the internet, on the other hand it may also connect to a change in attention to the pedestrian and walking, linked to the political priority given to road safety, taking off at that moment in many Western European countries. Furthermore, since the beginning of the digital era, for almost any subject the total number of publications has increased exponentially, but also searching the mountain of publications has been improved and refined by better search tools, making it easier to find what one is looking for. Still, the exponential increase in volume makes it increasingly difficult to sift the wheat from the chaff. Another consequence can be that historical awareness degrades, because the older key publications get lost in the abundance.

Although the Google Scholar scan produces a first impression of the volume of literature and the trend in numbers of publications on pedestrians and walking, it does not answer the question of how much attention is given to *policy development* on the matter, particularly in scientific publications. Regarding scientific publications, in my literature scan, SCOPUS was the main source, delivering 420 relevant publications. The second main source was Science Direct, producing a substantial number of publication references, which were already found in SCOPUS. Science Direct yielded 287 unique relevant publications. Other sources for relevant scientific and 'grey' publications were Google Scholar, the Sombekke/Katteler literature review for the PQN project, the PQN project and 'Other sources' including various libraries and my

[652] It has to be noted that other researchers might come to different selections of publications, both regarding in/exclusion of publications and distribution of features of the publications. The selection was carried out by the author only, using personal, possibly biased and inconsistent, judgements. Although using more reviewers would have been a better solution, because of the work effort involved in this project, this was not an option.

own bookshelves and digital archives. Of the found articles 56% was classified as 'scientific', 40% as 'grey' and 4% originated from the media, which were mainly articles from practitioners journals or newsletters (see Table II.1).

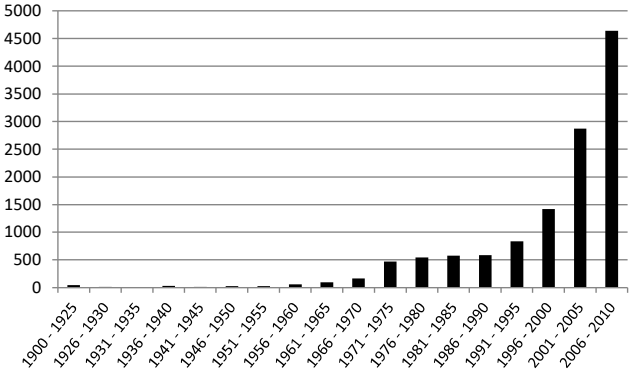

Figure II.1 Number of hits in Google Scholar search on 'pedestrian' in the title of the publication (accessed on 26-1-2012)

Table II.1 Sources and quality of found articles

	Scientific	Grey	Media	Total
SCOPUS	420			420
Science Direct (excl. doubles SCOPUS)	287			287
Other Sources - Scientific	242			242
OS-Sombekke/Katteler	24	4		28
PQN		59		59
Other sources - Grey		622		622
Media			67	67
Total	685	973	67	1725

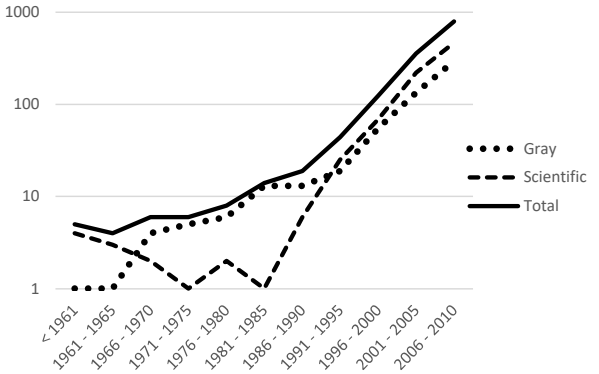

Figure II.2 Number of scientific and 'grey' publications in the thesis literature database

In Figure II.2 the development in numbers of scientific and grey publications, as included in the database, is captured. Compared to the results of the Google Scholar scan graph in Figure II.1, the graph shows similar developments in numbers of publications concerning walking and sojourning in public space. The trends in number of scientific and grey publications are alike. By now the numbers are so large that no professional will be able to detect, read and make use of the full body of literature on the subject. It seems that the statement, that there is very little literature available on pedestrians, walking and sojourning in public space, true until about 2005, is no longer valid. Even if one's only source is the internet, one will not be able to digest it all and lack of information can no longer be an excuse to refrain from developing W+S policy.

It has to be remarked that the graph does not fully represent the true distribution of publications over the years. Pre-2005 publications, not digitally available publications are underrepresented, as even their references are not comprehensively available. Also, because of the applied selections, medical and health related publications, publications in other languages than English and Dutch, publications from non-European sources, and from regional and local authorities will be underrepresented. It is to be expected that, besides the exploited resources, other relevant sources might exist. An exhaustive search in academic and public libraries will reveal additional references to relevant publications. Based on the 80-20 principle, however, the author expects that a more exhaustive search will not deliver a fundamentally different picture. Furthermore, in practice most of the times professionals do not have the time nor the resources to dig deeper than the author did. Consequently, they will probably generally acquire a less comprehensive image regarding literature relevant for W+S policy development.

2.2. Subjects dealt with in the publications in the database

In order to determine what subjects are dealt with in the collected literature 4 different items were distinguished and scored. In this paragraph the found distributions within the collected literature database are presented, first regarding the distinguished items and the quality of the content of the publication, and next the interrelations between the items. The item score distributions are presented in the tables 9 - 15. Remarkable scores are typed in bold. As the numbers within specified Special groups are small, I refrained from presenting distributions concerning publications focussing on these groups with regard to the items Main Subjects and Key topics of context of the publications. Below the following distributions are presented:

1. Main subjects dealt with in the collected literature (item 1)
2. Key topics of context of the collected publications (item 2)
3. Activity levels of the pedestrians' behaviour dealt with in the collected literature (item 3)
4. Special groups dealt with in the collected literature (item 4)
5. Relation Main subjects and Key topics of context of the publications within the literature collection
6. Relation Main subjects and Activity level of pedestrian behaviour
7. Relation Key topic of context of the publications and Activity level of pedestrians behaviour.

1. Main subjects

Regarding 'Main subjects dealt with in the publication' a 16 items list (see table II.2 and this Appendix - above, under 1.2) was constructed iteratively, applying subject listings found using SCOPUS and combining smaller interconnected categories. The classification recapitulates approaches to supporting and improving walkability and sojourning in public space and includes Site level design, Atmospheric conditions, System ecology, Enforcement, Engineering, Human Factors, Intelligent Transport Systems, Law and legislation, Organisation,

Policy, Research, Social / traffic interaction, Spatial aspects, Theory, Transport policy, and Vehicle technology.

With regard to the item 'main subject dealt with in the publication' from 6 of the 16 distinguished subjects (see Table II.2) the numbers of publications stand out: Research, System ecology, Policy, Human Factors, Engineering and Enforcement.

When only scientific publications are considered, a slightly different picture emerges. The subjects that are written about most are respectively System ecology (Health dominated, 232 out 979 publications), Human Factors (191 out of 979 publications), Research (146 out of 979 publications) and Engineering (102 out of 979 publications).

An article's main subject was coded 'Research' when the work in the article focussed on acquiring knowledge, without a specific application or solution strategy in mind. The work mainly concerned counting, measuring and modelling pedestrian behaviour or performance, such as the pedestrian's mobility or accidents which they were involved in. 317 (18.4%, the largest group of publications) of the publications focussed on such research. It is remarkable that half of the found publications on pedestrians, walking and sojourning in public space research are grey literature, and not scientific literature. This can be explained by the practical nature of most of these publications: the studies were carried out within the context of policy development, and were not focussed on addressing the scientific community.

Table II.2 Main subject dealt with in the publication x quality of content

Main subject dealt with in the publication	Quality of the content of the publication							
	Grey		Media		Scientific		Total	
Site level design	0.9%	6			1.1%	11	1.0%	17
Atmospheric conditions	0.3%	2	1.5%	1	1.9%	19	1.3%	22
System ecology	10.9%	74	7.5%	5	23.7%	232	18.0%	311
Enforcement	0.3%	2	1.5%	1	0.2%	2	0.3%	5
Engineering	14.1%	96	26.9%	18	10.4%	102	12.5%	216
Human Factors	8.1%	55	14.9%	10	19.5%	191	14.8%	256
Intelligent Transport Systems	0.3%	2			0.2%	2	0.2%	4
Law and legislation	1.2%	8	1.5%	1	1.1%	11	1.2%	20
Organisation	0.1%	1			0.2%	2	0.2%	3
Policy	22.7%	154	13.4%	9	10.2%	100	15.2%	263
Research	23.1%	157	20.9%	14	14.9%	146	18.4%	317
Social / traffic interaction	2.8%	19	3.0%	2	3.5%	34	3.2%	55
Spatial aspects	7.8%	53	4.5%	3	7.4%	72	7.4%	128
Theory	4.0%	27	1.5%	1	1.4%	14	2.4%	42
Transport policy	1.9%	13	1.5%	1	1.8%	18	1.9%	32
Vehicle technology	1.5%	10	1.5%	1	2.3%	23	2.0%	34
Total	100%	679	100%	67	100%	979	100%	1725

Another subject of which the number of publications stood out, ranking second, was System Ecology. A publication was coded as such when it focussed on the interrelation of the pedestrian's behaviour with his physical and social environments. The main subject of 311

publications (18%) concerned 'System ecology', of which more than average (75% compared to 57%) were scientific articles.

As a main subject Policy ranked third; 263 (15.2%) of the articles were coded as such. In most cases the publication concerned practical commissioned research, focussing on concrete policy recommendations. The vast majority of these publications is grey literature; in most of the cases, scientific publications on public policy concern evaluations of past policies and the act of policy development.

A publication's main subject was coded 'Human factors' when the focus of the publication was on human physical and mental characteristics and behavioural aspects, such as abilities, competences, behavioural motives, communication and learning processes, and 216 (14.8%, ranking fourth) of the publications had this focus. The majority of these publications were scientific publications.

'Engineering' and 'Site level design' together score in 233 (13.5%, ranking fifth) of the publications. These highly practical subjects appears relatively often in grey literature (44% compared to 39% for all subjects). The majority of these publications (including the scientific ones) are directed at road and public space authorities.

Of the low scoring main subjects, the scores of Enforcement and Law are remarkable. Concerning motorised traffic 'law and order' are political priorities. Regarding W+S policy development, as main subjects, Enforcement and Law together scored in only 16 (0.9%) of the found publications. Within the subject of W+S policy development, pedestrian rights, his law abiding behaviour and other road user's behaviour against pedestrians clearly are not issues that appear high on the legislation, law enforcement and research agendas.

2. Key topics of context of the publications

The second score item concerning subjects dealt with in the publications in the database is 'Key topic of context of the publication'. The classification is based on the list presented by Methorst et al. (2010, Part A, p 26). The optional scores were 'not indicated', 'Accessibility', 'Health', 'Liveability', 'Mobility' and 'Safety'. In 30% of the cases the aim behind the publication could not be specified, either because it was meant to support many or all of the discerned general policy aims, or because it was not clear from the title and abstract which of them applied (see Table II.3).

With regard to pedestrians the dominant general policy aim behind a publication seems to be Safety. This is a somewhat biased conclusion as medical publications, comprising the vast majority of publications on walking and sojourning in the SCOPUS, Science Direct, Google Scholar and SafetyLit databases, were mostly left out of the selection as they generally did not concentrate on *public* policy, but on policy towards individuals as patients. The publications with health as the key topic of context of the publication are dominantly scientific publications. The ones that are not, mostly concern policy research and recommendations from foundations like the WHO, consultants and health policy institutes.

Accessibility, Liveability and Mobility appear to be less prominent general policy aims, but from the titles and abstracts it appeared that city economics (attracting customers and tourists) are an important drive. The importance and relevance of these subjects/general aims need to be checked and probably better documented in the literature database.

When only scientific publications are considered, the sequence of key topics of context of the publications is the same, although it has to be mentioned that of 208 out of 979 publications the key topic of context of the publication could not be specified from the title or abstract of the publication. When the key topic of context of the publication could be specified, 45% of the publications concerned safety, 27% concerned health and 22% concerned mobility.

Table II.3 Key topic of context of the publication x quality of the content

Key topic of context of the publication	Quality of the content of the publication							
	Grey		Media		Scientific		Total	
not specified	**42.9%**	291	28.4%	19	21.2%	208	**30.0%**	**518**
Accessibility	0.1%	1			0.4%	4	0.3%	**5**
Health	3.7%	25	6.0%	4	21.2%	208	13.7%	237
Liveability	4.4%	30	1.5%	1	4.6%	45	4.4%	76
Mobility	14.4%	98	20.9%	14	17.1%	167	16.2%	279
Safety	34.5%	234	43.3%	29	35.4%	347	35.4%	610
Total	100%	679	100%	67	100%	979	100%	1725

3. Activity level of the pedestrians' behaviour

In the database all publications were scored regarding the pedestrians activity level that was treated in its content. The classification is based on the PQN (Methorst et al., 2010) interpretation of Michon (1979) and Hatakka (1999, 2001) ideas on human activity levels. The pedestrians' activity level connects to policy level (i.e. long term national plans, short term local implementation plans) and thus to the relevance for policy development on the various governmental levels.

In Table II.4 the distribution of publications dealing with the different activity levels is pictured. In the selected body of literature all of the discerned activity levels are dealt with. In 32.6% of the cases (562 publications) the publication covered more than one activity level. A relative large share of the publications concerned the Lifestyle level (384 publications = 22.1%). In many cases it is difficult to distinguish between the Lifestyle and Strategic activity levels. This is also true for the Tactical and Operational levels.
Whenever the publication dealt with the relation of the pedestrian's environment and his mobility decisions, the publication was classified 'Lifestyle', even when the starting point of the publication was the pedestrian's concrete mobility decision, which is by definition a strategic decision.

As regards the distinction between the Tactical and Operational levels, in many cases it proved difficult to actually pinpoint the activity level. For example, when a publication deals with road crossing, this may concern the tactical decision 'where to cross' as well as the actual crossing manoeuvre, which is an operational activity. In the cases where the level was not clear or where (probably) both levels applied, the item was coded 'Tactical level'.

The distribution of the publication records over this item were as follows: in 164 (9.5%) of the cases the publication focussed on the Strategic activity level, in 384 (22.1%) on the Tactical level, and in 234 (13.6%) on the Operational level.

If the Lifestyle and Strategic levels, and Tactical and Operational levels are both seen as one class, the numbers of publications concerning the various activity levels are distributed evenly.

Of the total batch, 31.6% (545) concern the Lifestyle/Strategic level of activity (decisions taken before participating being in public space) and 35.8% (618) concern the Tactical/Operational activity level (decision taken while moving or sojourning in public space).

The quality of the content of the publications varies for the different focuses of the publications. Publications that deal with more than one activity level are dominantly grey literature (343 = 61.0%). Of the grey literature publications 50.1% of the publications concern a multi-level focus. This can be seen as an indication that connections and coherency between activities on the different activity levels are mostly dealt with in grey literature. On the other hand, a lifestyle activity level focus is dominantly dealt with in scientific publications.

Table II.4 Activity level of the pedestrians' behaviour x Quality of the content

Activity level of the pedestrians' behaviour	Quality of the content of the publication							
	Grey		Media		Scientific		Total	
Lifestyle	14.0%	96	17.9%	12	28.1%	273	22.1%	381
Multi-level	50.1%	343	16.4%	11	21.4%	208	32.6%	562
Strategic	10.7%	51	17.9%	11	15.3%	102	13.6%	164
Tactical	7.4%	122	16.4%	21	10.5%	241	9.5%	384
Operational	17.8%	73	31.3%	12	24.8%	149	22.3%	234
Total	100%	685	100%	67	100%	973	100%	1725

When only scientific publications are considered, the lifestyle level receives most attention (28% of 973 publications), followed by tactical level (24.8% of 973 publications), multi-level (21.4% of 973 publications), operational (15.3% of 973), and lastly strategic level (10.5 of 973 publications).
Contrary to scientific publications, where only one in five of the publications consider more than one activity level, in half of the grey publications this is the case.

4. Special groups
As some pedestrians have specific or limited abilities, which need to be taken into account in policy development, under 'Subjects' the item 'Special groups' was included.
In the vast majority of publications (1391 = 80.6%) the target group is not specified or all pedestrians are the target group. When a target group is specified, children (94 = 5.4%) and the elderly (40 = 2.3%) are most often highlighted (together 7.8% (134) of the cases). In the literature selection the share of publications on persons with limited mobility is underrepresented (25 = 1.4%). This is a consequence of the pre-selection regarding medical publications. Other aggregated groups are 'car' and 'driver', 'adults', 'ages' (two or more age groups compared), 'various ages' and 'young people' and 'women', all of which score less than 2% of the publications.

When the selection of scientific publications are compared to the selection of grey publications, it is notable that a larger share of the publications (25.4% compared to 10.8% in grey literature) are focussed on a specific target group. Out of the scientific publications 9.7% deal with children, 4.1% with elderly persons and 11.6% with other target groups. In grey literature, when the publication focuses on a special group, most of them deal with elderly pedestrians, and children come second.

Table II.5 Special (target) group x quality of the content

Special (target) group	Quality of the content of the publication							
	Grey		Media		Scientific		Total	
Not specified	89.2%	611	80.6%	54	74.6%	726	80.6%	1391
Adults	0.1%	1			1.2%	12	0.8%	13
Ages					0.8%	8	0.5%	8
Car	0.7%	5	3.0%	2	2.3%	22	1.7%	29
Child	3.2%	22	11.9%	8	9.7%	94	7.2%	124
Driver	1.0%	7			1.1%	11	1.0%	18
Persons with limited mobility	0.9%	6			2.0%	19	1.4%	25
Elderly people	4.1%	28	4.5%	3	4.1%	40	4.1%	71
Various ages	0.6%	4			2.9%	28	1.9%	32
Women	0.1%	1			0.5%	5	0.3%	6
Young people					0.8%	8	0.5%	8
Total	100%	685	100%	67	100%	973	100%	1725

5. Relation Main Subjects and Key topic of context of the publications within the literature collection

Additional insight in how subjects are dealt with in literature can be acquired by cross-tabling item scores regarding 'Main subjects' and 'Key topic of context of the publications'. From Table II.6 some dominant literature clusters appear:

- 'Engineering' and 'Safety': 136 (63.0%) of the Engineering focussed publications concern safety; this number concerns 22.3% of safety-related publications
- 'Safety': dominant main subjects are Engineering, Human Factors and Research (respectively 22.3, 17.7 and 22.3% of the safety-related publications)
- 'Human Factors' and 'Safety': 108 (42.2%) of the Human Factors focussed publications concern safety improvements (17.7% of the safety related publications)
- "Research' and 'Safety': 22.3% (136) of the safety-related publications focus on acquiring insight; thus 42.9% of the publications that concentrate on acquiring insight only concern safety issues
- 'System ecology' and 'Health': 50.2% (119) of the Health promotion related publications deal with 'System ecology'; 38.3% of the System ecology focussed publications target health improvement
- Publications dealing with health promotion dominantly focus on System ecology, Human Factors and Policy (respectively 50.2%, 25.7% and 11.4% of the health related publications)
- Of the publications dealing mainly with mobility questions, 28.7% (80) concern acquiring mobility facts only (Research), 18.2% (51) System ecology, 16.8% (47) Human Factors
- Regarding 'Liveability', the dominant focus is on 'spatial aspects' (20 out of 76 = 26.3%), and surprisingly, not on 'Human Factors' (4 out of 76 = 5.3%).

6. Relation Main subjects and Activity level of pedestrian behaviour

In order to get some idea of the distribution of 'Main subjects' regarding 'Activity level', the scores were cross-tabled. The following dominant literature clusters appear (see Table II.6):

- 'Policy' and 'Research' focussed publications dominantly deal with more than one activity level (respectively 198 out of 262 [75%] and 119 out of 316 [38%] of the publications). This is true for Theory focussed publications as well (39 out of 42 publications [93%]).
- A majority of the 'System ecology' publications concern the Lifestyle activity level and vice versa.
- Publications focussing on Engineering mainly concern the tactical and operational activity level.

Table II.6 Main subjects x Key topic of context of the publications dealt with in selected literature

Main subject dealt with in the publication	Key topics of context of the publications						
	not specified	Accessibility	Health	Livea-bility	Mobility	Safety	Total
Site level design	2	1		7	4	3	17
Atmospheric conditions	3		6	10	1	2	22
System ecology	75	1	**119**	14	51	51	311
Enforcement						5	5
Engineering	38	2		5	35	**136**	216
Human Factors	36		61	**4**	47	**108**	256
Intelligent Transport Systems	2				1	1	4
Law					2	18	20
Organisation			1			2	3
Policy	151	1	27	8	18	58	263
Research	86		9	6	**80**	**136**	317
Social / traffic interaction	17		1		4	33	55
Spatial aspects	59		10	**20**	23	16	128
Theory	36			1	1	4	42
Transport policy	12		3	1	11	5	32
Vehicle technology	1				1	32	34
Total	518	5	237	76	279	610	1725

7. Relation Key topic of context of the publications and Activity level of pedestrians behaviour
By cross tabling scores on 'Key topic of context of the publications' and 'Activity level of pedestrians behaviour' an impression can be given about the main focus of approaches in literature regarding the key topics of context of the publications behind W+S policy development (see Table II.8). From the literature database it appears that publications that are written for health promotion aims dominantly deal with lifestyle level decisions regarding walking, i.e. preconditions for walking, like attractive and inviting walking environments. Publications that are written to support and improve safety, on the other hand, dominantly focus on the tactical and operational levels of walking, i.e. where to cross the street and reacting to traffic and vehicles. For the other key topics of context of the publications focus is not so clear; in both Liveability and Mobility related publications, the operational activity level received relatively little attention.

Table II.7 Activity level of pedestrian behaviour x Key topic of context of the publication subject dealt with in the publication

Key topics of context of the publication	Activity level of pedestrian behaviour					
	Lifestyle	Multi-level	Strategic	Tactical	Operational	Total
Site level design		2	1	12	2	17
Atmospheric conditions	1	2	2	13	4	22
System ecology	163	61	34	33	20	311
Enforcement				1	4	5
Engineering	2	22	3	129	60	216
Human Factors	94	37	32	50	43	256
Intelligent Transport Systems		2		2		4
Law	3	1		13	3	20
Organisation		3				3
Policy	36	198	17	8	3	262
Research	25	119	54	62	56	316
Social / traffic interaction	17	7	4	13	14	55
Spatial aspects	31	54	9	33	3	130
Theory	2	39	1			42
Transport policy	7	15	7	3		32
Vehicle technology				12	22	34
Total	381	562	164	384	234	1725

Table II.8 Activity level of pedestrian behaviour x aims dealt with in selected literature

Activity level of pedestrian behaviour	Key topics of context of the publications						
	not indicated	Accessibility	Health	Liveability	Mobility	Safety	Total
Lifestyle	92		178	24	45	42	381
Multi-level	335	1	23	24	36	142	561
Strategic	37		27	2	77	21	164
Tactical	44	3	5	25	91	216	384
Operational	10	1	4	1	30	189	235
Total	518	5	237	76	279	610	1725

2.3. Distribution of publications over the thesis chapters

The literature scan offered a chance to discover whether there is a substantial body of literature available to help providing the necessary background information and answering the leading research questions. In connection with this question, as mentioned in Section 2.1.1.c., all publications were scored regarding their relevance for each of the subjects of the current and following chapters, i.e. the necessary background sketch (Chapters 2, 3 and 4 on the Conceptual framework, Methodology and the Context of W+S policy development) and the leading research questions as identified in Chapter 1 (Chapters 5 - 12 on Needs and Abilities, Requirements, Performance, Issues, Precursors, Measures, Selection and Added Value of the proposed approach). In this section the results of the scoring are presented. It has to be kept in mind that a publication can score on more than one chapter.

In figure II.3 the number of publications relevant for the subsequent chapters are pictured. The Figure displays both the 'relevant' and 'probably relevant' scores. The latter refer to publications of which in a global scan based on the information in the title and/or abstract, could not be determined with some certainty that the publication would be relevant for the subject of the chapter. This also includes publications that are relevant for the background chapters having a carry-over effect regarding the subjects of the leading research questions.

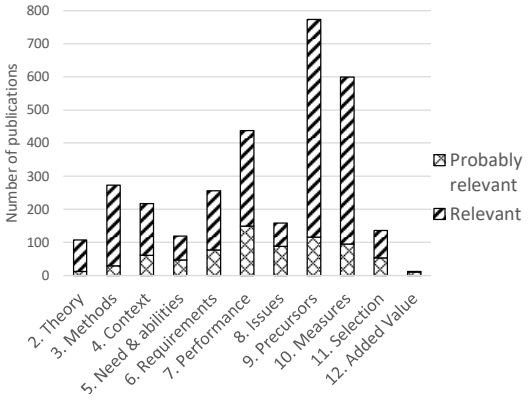

Figure II.3 Number of publications in the literature database concerning the thesis' chapters and relevancy score

I found that the subjects of each of the thesis' chapters were touched by publications in the literature database. The numbers of relevant publications varied per chapter.
From the analysis of the score on chapter subject relevancy it appears that a very large body of literature deals with precursors or determinants to issues that need to be dealt with, and with promising measures to be included in W+S policy (respectively 773 and 599 publications out of 1725). Relatively few, but still substantial bodies of literature, deal with Theory, Needs and Abilities of pedestrians, Issues, Selection of measures and strategies, and Added Value of the proposed system approach (respectively 107, 119, 158, 136 and 12 publications out of 1725). In other words, it looks like there is ample material for answering the research questions.

The question also is, of course, whether the quality of the content of the publications indicates a good chance to proper (valid, reliable) answers to the research questions. In Figure II.4 this matter is addressed. Apart from the Methods, Needs and Abilities, and Precursors subjects, grey literature is dominant. As the numbers of scientific publications are substantial, is seems that quantitatively there is a fair scientific fundament, but that the quality of the answer to many detailed questions probably also depends on information from grey literature.
When only scientific publications are considered the distribution of the literature across the thesis' chapters follows the general pattern, although a larger share of the theory (Chapter 2) relevant papers are grey literature and found literature on precursors (Chapter 9) is dominantly scientific.

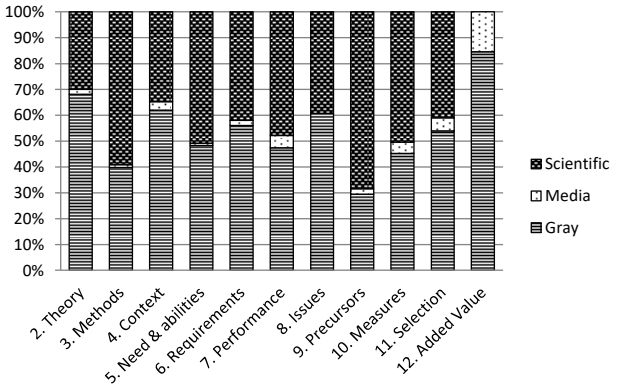

Figure II.4 Quality of the content (percentage of publications in the literature database per chapter)

Another indication of relevance to the thesis is formed by the number of thesis' chapters' that a publication touches. In Figure II.5 this aspect is thrown light on. The y-axis is pictured in a logarithmic scale, to subdue the effect of large numbers. The graph shows that there are only a relatively small number of publications that touch more than three chapters (128 out of 1725, of which 52 are scientific publications and 76 grey publications). Only 4 publications touch the complete policy process (Chapters 2 - 11), all of them are grey publications. One of them concerns a glossary of safety-terms, and the other 3 all come from the PQN project. Other high scoring publications are a number literature reviews that try to cover the whole policy process, mostly from a specific perspective, like safety, health or town planning. Apart from the PQN project publications, no publications were found that aims to cover the complete range of W+S policy issues.

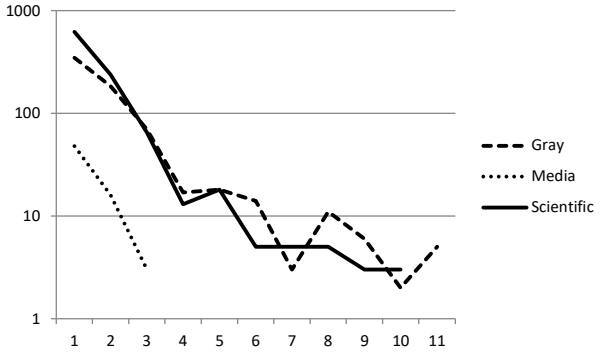

Figure II.5 Number of publications and the number of chapters relevant

2.4. Identified overview publications

As this thesis particularly aims to provide overview and global insight in what options there are for effective, efficient and integral W+S policy development, special attention is given to trace overview publications that comprehensively cover the whole area. It was assumed that publications on past experiences with W+S policy development can provide powerful

information for the development of new policy plans. In this context the publications in the literature database were screened on 'review' or 'overview' in the title or text of the abstract.

From the literature scan it appears that there is a quite lot of literature about pedestrians and walking related topics, but there is very little overview literature (see Table II.9). In total 104 out of the 1,725 publications entered in the literature database complied as 'review' or 'overview' publication.

Of these 104 overview publications 74 covered a specific subject within W+S policy development, like infrastructural pedestrian facilities, pedestrians movement models, child injuries, moving walkways, safety strategies or pedestrian measures. I found 30 publications that displayed a more or less general W+S policy review, of which only two are scientific publications: a study by J. Moran on crossing the road in Britain (Moran, 2006) and a dissertation by P. Olszewksi on walking as a mode of transport - a planning and policy perspective (Olszewksi, 2007).

Among the 30 general reviews were classical publications connecting to walking or pedestrians, like Buchanan's 'Traffic in towns' (Buchanan, 1964), Plowden's 'The motorcar and politics' (Plowden, 1971), C. Hass-Klau's 'The pedestrian and city traffic' (Hass-Klau, 1990), and H. Knoflacher's 'Pedestrian- and bicycle traffic. Planning principles' (Knoflacher, 1995). The list also includes some literature reviews and literature listings on W+S policy.

Even in the selected 30 W+S policy development overview publications the authors dominantly focus on policy advise from a certain (external) perspective like safety, health, mobility, transportation policy, traffic calming and public space design, infrastructure, road design, public, accessibility of shops. Publications starting from pedestrian needs are quite rare. I cannot avoid the impression that knowledge on walking, walkability, sojourning in public space is mostly a by-product from studies that have other goals.

Table II.9 Review publications regarding W+S policy development

	Not a review	Review of specific topics	General W+S policy review	Total
Grey	614	43	28	685
Media	67			67
Scientific	940	31	2	973
Total	1621	74	30	1725

From the scan results with regard to the number of chapters that a publication touches and the scarcity of review and overview publications I conclude the vast majority of publications on the thesis literature database are rather one-dimensional and focussed on a specific issue, not on overview or placing the item researched in a wider context. Attention to walking and sojourning appears to be rather fragmented, and it is far from common to interconnect the great variety of topics that are dealt with. Finding such publications is like looking for a needle in a hay-stack.

2.5. Relevance of publications for the Dutch case

This thesis aims to deliver, as an example of a system approach to W+S policy development, a viable policy proposal for the Dutch situation. The quality of the proposal will depend on the

degree to which the proposal fits in the Dutch context. With regard to this it can be hypothesized that the more the proposal can be based on publications originating from the Netherlands, the better the fit will be. In order to assess this aspect, the distribution of the origins of the publications was made an item in the literature database.
In Figure II.6 the relative distribution of the origins of the publications per subject of the thesis' chapters is revealed. Of the total of 1725 publications in the database, 339 (19.7%) of the publications were Dutch[653], 941 (54.6%, including the Dutch publications) European, 1,657 (96.1%) Western and 68 (3.9%) non-Western. The latter comprised theoretical accounts mostly. Per chapter the distributions varied from 14.6% (113 publications, on Precursors) of the publications Dutch origin, to 36.4% (39 publications, on Theory), not counting publications on Added Value (because of the small numbers: 5 publications). The best fit is found with regard to the policy development context (82 out of 216 publications), performance (130 out of 440 publications), requirements (70 out of 255) and theory 39 out of 107 publications). For policy effectiveness the number of publications regarding context sensitive subjects of 'policy context', 'requirements' and 'performance' are particularly encouraging, as accurate information on these three subjects can be the key to success.

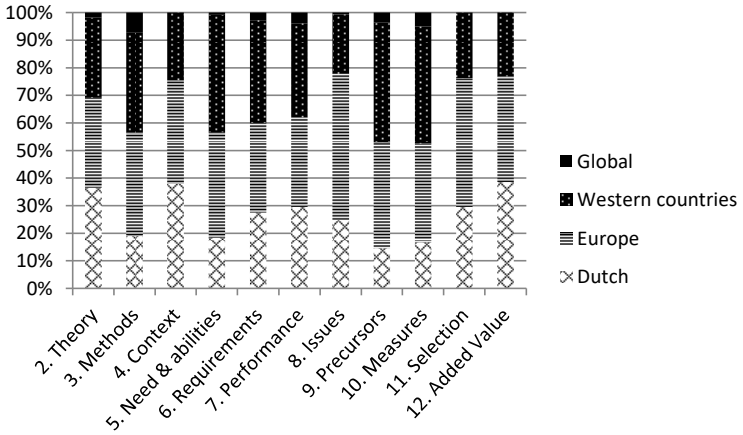

Figure II.6 Origin of the publications (percentage of publications in the literature database per chapter)

The number of publications on the discerned main subjects dealt with in Dutch publications included in the thesis literature database are rendered in Table II.10.

Almost 70% (231 out of 339) of the Dutch publications are grey publications, compared to 32.8% of the publications of other origins. The share of scientific publications is lower than average for the total database. This is partly due to the comparatively good accessibility of grey publications on W+S, particularly institutional publications (within the then Ministry of Infrastructure and the Environment, from the former Pedestrians Association and reports from research institutes and consultants). On the other hand it also shows that W+S is low on the university research agenda's (54 out of 339, 15.9% of Dutch publications in the literature database). The exceptions particularly concern pedestrian movement modelling at the Delft and Eindhoven universities and the rise in walking perception research at Utrecht university. In the 70s and early 80s of the last century child pedestrian research was important at Groningen

[653] Most, but not all Dutch publications concern Dutch situations.

university. As there are few high quality publications from Dutch origin, policy development needs to be based on international (scientific) literature.
It is remarkable that W+S policy development publications with Research as main subject (mostly on mobility and safety data) are dominantly grey literature.

Table II.10 Number of publications of Dutch origin in the literature database per Main Subject

	Dutch origin				All origins			
	Grey	Media	Scientific	NL total	Grey	Media	Scientific	Total
Site level design					6		11	17
Atmospheric conditions		1	4	5	2	1	19	22
System ecology	13	2	11	26	74	5	232	311
Enforcement		1		1	2	1	2	5
Engineering	30	14	2	46	97	18	101	216
Human Factors	13	10	5	28	55	10	191	256
Intelligent Transport Systems					2		2	4
Law	6			6	8	1	11	20
Organisation					1		2	3
Policy	**54**	7	7	68	156	9	97	262
Research	**70**	13	**16**	**99**	158	14	144	316
Social / traffic interaction	6	1		7	19	2	34	55
Spatial aspects	24	2	1	27	55	3	72	130
Theory	10	1	4	15	27	1	14	42
Transport policy	3	1	3	7	13	1	18	32
Vehicle technology	2	1	1	4	10	1	23	34
Total	**231**	54	54	339	685	67	973	1725

Table II.11 shows the percentages of number of publications on the discerned key topics of context of the publications. In Dutch publications mobility, safety and liveability are fairly well covered, but health receives less attention than elsewhere in Western countries. Closer analysis learned that many of the publications concerned modelling pedestrian behaviour in relation to city economics (attracting customers, tourists) and crowd movements (evacuation). No recent publications on accessibility were found. The available publications in Dutch on this subject date back to the 70s and 80s, and focus on facilities for the people with mobility handicaps. The content of these publications is assimilated in general infrastructure and public transport guidelines, and therefore there was no need to include them in the literature database separately.

Regarding the distribution of publications over the thesis' chapters (see Table II.12) it can be concluded that a remarkable large number of the Dutch publications concern the pedestrians' performance (dominantly grey publications).
A relative large part of the Dutch scientific publications deals with theory and methods (pedestrian movement models!) and precursors (Groningen and Utrecht publications). For other subjects policy development depends primarily on grey literature.

Table II.11 Percentage of number of publications on Key topics of context of the publication and Quality of content in the literature database of Dutch origin

	Dutch origin						Total Dutch origin	% of total number of publi-cations
	Grey		Media		Scientific			
	abs.	%	abs	%	abs	%	abs	%
not specified	76	14.6	14	2.7	22	4.2	112	21.6
Accessibility		0.0		0.0		0.0	0	0.0
Health	6	2.5	4	1.7	4	1.7	14	**5.9**
Liveability	11	14.5	1	1.3	3	3.9	15	19.7
Mobility	47	**16.9**	10	3.6	12	4.3	69	**24.8**
Safety	**91**	14.9	25	4.1	13	2.1	129	21.1
Total	231	**13.4**	54	3.1	54	3.1	339	19.7

Table II.12 Number of publications of Dutch origin in the literature database per main subject (thesis chapter)

	NL - Grey	NL - Media	NL - Scientific	Total
2. Theory	29	1	9	39
3. Methods	12	2	9	23
4. Context	26	5	2	33
5. Need & abilities	2			2
6. Requirements	32	1	4	37
7. Performance	**62**	15	9	86
8. Issues	5			5
9. Precursors	32	9	**14**	55
10. Measures	27	17	2	46
11. Selection	3	4	6	13
Total	230	54	55	339

3. Evaluation of literature scan results

At the end of the introduction in Section 2.1. I formulated the questions to be answered by my literature scan: how much (research) literature is available and accessible regarding pedestrian, walking and sojourning policy development? What subjects, general policy aims, perspectives, conceptual levels and special groups are covered? What seems to be the State of the Art? In the following sections I will summarise my findings and give my conclusions with regard to these questions. Additionally I will present my conclusions at this stage regarding the value of available literature for effective and efficient W+S policy development.

3.1. How much research literature is available?

To answer the literature scan questions I first established what sources are available for finding publications on walking and sojourning policy development. I found that SCOPUS, Science Direct, Google Scholar, various library databases and specialised literature databases together

contained references to a large number of publications on pedestrians and walking (more than 100,000 publications), but that only a relatively small part of the literature deals with pedestrian, walking and sojourning public policy development. At the end of my literature scan I was able to select a sample of about 1,700 publications[654] relevant for W+S policy development in the thesis literature database.

With regard to representativeness it has to be noted that there are limitations. As the numbers of references in the source databases were far too big to process all references and abstracts, a 'quick and dirty' selection had to be made. In order to have the best possible coverage of W+S policy development, I decided to select publication references and abstracts on relevance for W+S policy development. There is always a subjective element in such a selection process, the more so as I included my own archives in the scan.

In my quest I found that the majority of publications on pedestrians and walking are produced in the field of medicine. In SCOPUS 31,000 of the 49,000 publications assigned either the keyword 'pedestrians' or 'walking' are medical publications. Because of the difficulty of handling the large quantity of references, the limited relevance for *public* W+S policy development, and because including the adjacent field of health would cover public policy matters, in principle medical publications were not included in the thesis literature database.

The number of publications on W+S policy development is increasing rapidly, making it increasingly difficult to sift the wheat from the chaff. Another consequence can be that historical awareness degrades, because the older key publications get lost in the abundance.

Through the literature scan I identified 979 scientific, 685 grey and additionally 67 media publications mentioning aspects of W+S policy development. Thus almost 56% of the references in the thesis literature database concerned scientific publications, almost 40% grey literature and 4% references in (professional) media and newsletters.

3.2. What subjects are covered?

With regard to subjects covered by W+S policy related literature, I coded the references on eight different items: main subjects, key topics of context of the publications, activity level of the pedestrians' behaviour, special groups, distribution over the thesis' chapters, overview publications, and relevancy for the Dutch situation. Below conclusions with regard to these items are summarised.

Main subjects
Main subjects in my definition concern approaches to supporting and improving walkability and sojourning in public space. Subjects that are most frequently dealt with are Research, System ecology, Policy, Human Factors and Engineering. Research focussed publications mainly deal with safety and mobility data, counting, modelling; System ecology focussed publications are dominantly Health inspired, and Policy and Human Factors focussed publications, mainly deal with safety or health issues. When a publication is about engineering, the dominant aim is to deal with safety issues. Remarkably Law and Enforcement appear to be rather neglected subjects.

[654] 1,725 publications on the 25th of May 2012, of which the full texts of some 1,200 have been acquired digitally; abstracts of the rest of the references have been collected via the literature reference sources.

When only scientific publications are considered, the subjects that are written about most are respectively System ecology (Health dominated), Human Factors, Research and Engineering.

Key topics of context of the publications

For the coding of 'Key topic of context of the publications' the COST 358 PQN list was used, producing the options 'not indicated', 'Accessibility', 'Health', 'Liveability', 'Mobility' and 'Safety'. Analysis on this item showed that Safety, Health and Mobility are the most prominent general aims behind the production of a publication on W+S. In the selected publications the safety aim is mainly supported by dealing with research, engineering and human factors; in health aim publications the importance of System ecology is stressed, whilst in publications on mobility, achieving the aim is chiefly supported by Research, System ecology, Human Factors and Engineering.

When only scientific publications are considered, the distribution of the publications regarding the key topics of context of the publications does not differ significantly from the distribution within grey literature; from 208 out of the 979 scientific publications the main policy aim behind the publication could not be specified from the title and abstract content, either because the publication aimed to cover all or most of the aims, or because it was unclear what the aims behind the publications were.

Activity level of the pedestrians' behaviour

With regard to Activity level of pedestrians' behaviour, five options were offered for scoring: Lifestyle, Strategic, Tactical, Operational and Multi-level. Almost one-third of the publications covered more than one activity level and were scored 'Multi-level'.

Policy, and to a lesser extent Research focussed publications dominantly deal with more than one activity level; Health inspired publications, typically focussing on System ecology, generally focus on Lifestyle and Strategic activity levels, whilst Engineering, typically aiming to improve safety conditions, mainly concern the Tactical and Operational activity levels.

When only scientific publications are considered the sequence in volume of attention is slightly different: Lifestyle receives most scientific attention, followed by respectively Tactical, Multi-level, Operational and lastly Strategic level focus. Contrary to scientific publications where only fifth of the publications consider more than one activity level, in half of the grey publications this is the case.

Special groups

In the vast majority of the publications the target group is not specified. In the selection of scientific publications a larger share of the publications deal with a special target group than in grey publications. Out of the scientific publications one in 10 deal with children, one in 25 with elderly persons and 11.6% with other target groups. In grey literature, when the publication focuses on a special group, most of them deal with elderly pedestrians, and children come second.

Distribution over the thesis' chapters

With regard to each of the thesis' chapters it was assessed whether a publication contained information that could help provide background information and answers to the leading research questions formulated in the first chapter. The publications could be scored 'not relevant', 'probably relevant' and 'relevant'.

I found that, logically apart from Chapter 12 on the Added value of the system approach proposed in this thesis, the subjects of all of the thesis' chapters were touched by substantial numbers of publications in the literature database. The numbers of relevant publications varied per chapter. On the low end I found only 12 publications for the chapter on Added Value and

107 (probably) relevant publications for the Conceptual Framework chapter ('Theory'). On the high end I found 599 (probably) relevant publications regarding W+S policy measures and 773 for the chapter on precursors and determinants of walking and sojourning in public space.
When only scientific publications are considered, the distribution of the literature across the thesis' chapters follows the general pattern, although a larger share of the theory (Chapter 2) relevant publications are grey literature and found literature on precursors (Chapter 9) is dominantly scientific.
Another indication of relevance to the thesis is formed by the number of thesis' chapters that a publication touches. It appeared that only a relatively small number of publications touch a larger part or the policy process (Chapters 2 -11), dominantly grey publications.

Overview publications
As this thesis particularly aims to provide overview and global insight in what options there are for effective, efficient and integral W+S policy development, special attention is given to trace overview publications that cover the whole area comprehensively. It appeared that finding such publications is like looking for a needle in a hay-stack.
There is a lot of literature about pedestrians and walking related topics, but there is very little overview literature. Literature seems rather fragmented, and it is apparently hard to interconnect the great variety of topics that are dealt with. The vast majority of publications on the thesis literature database are rather one-dimensional and focussed on a specific issue, and not on overview or placing the item researched in a wider context.
In this literature scan I found only 30 publications that displayed a general W+S policy review, of which only two are scientific publications. Even in these publications the authors dominantly focus on policy advise from a certain (external) perspective like safety, health, mobility, transportation policy, traffic calming and public space design, infrastructure, road design, public, accessibility of shops. Publications starting from pedestrian needs are quite rare. I cannot avoid the impression that knowledge on walking, walkability, sojourning in public space is mostly a by-product from studies that have other goals.

Relevancy for the Dutch situation
This thesis aims to deliver, as an example of a system approach to W+S policy development, a viable proposal for the Dutch situation. In this context publications in the literature database were assessed regarding their origin. About one fifth of the publications were of Dutch origin. Almost 70% of the Dutch publications are grey publications, compared to 32.8% of the publications of other origins. This large share of grey publications can be partly explained by the comparatively large share of Dutch policy and advisory reports, and publications on walking mobility and safety data, which are mostly grey literature. The small number of scientific publications (54 out of 339, 15.9% of Dutch publications in the literature database) confirms earlier statements that in the Netherlands walking and sojourning is low on the university research agendas.

3.3. What seems to be the State of Attention?

The literature scan results do not permit far-reaching conclusions with regard to the State of the Art of W+S policy development in general and in the Netherlands in particular. A more precise picture will arise from deeper analysis of available publications.

At this point it can be concluded that scientific literature offers many bits and pieces of information about problem causes, needs, abilities and requirements. It is unknown however to what degree accumulated scientific knowledge comprehensively covers the W+S policy

development domain. The author assesses that available overview publications are either quite old and probably somewhat outdated (i.e. Buchanan, 1964; Plowden, 1971; Hass-Klau, 1990; Knoflacher, 1995; Hydén et al. [WALCYNG], 1998), covering only part of the domain (i.e. Fleury et al. [COST C6], 2002; Rauhalla et al. [PROMPT], 2003; Provincie Friesland [Shared Space], 2005; CIVITAS, 2011; Project for Public Space, 2012), or still tentative and likely to be immature (i.e. Methorst et al. [COST 358], 2010). Even key players in the W+S knowledge domain only cover only one or two aspects of the field; they seldom start from the interests of the walker, but rather from a specific discipline, policy field or even a measure type.

Furthermore, a major part of available knowledge is captured in grey literature produced outside the scientific world, initiated and produced for the support of concrete policy measures, and much less for the increase of scientific knowledge on the W+S policy domain. With regard to road safety research Bax (2011) finds that the scientific and policy worlds are different and that they have divergent definitions, focus and ambitions regarding the State of the Art. The scientific world finds satisfaction in acquired in-depth knowledge about problems and determinants and wants to be able to explain phenomena, whilst on the other hand the policy world aims to find integrated solutions for perceived problems in some domain in relation with other problems, and finds satisfaction successes associated with 'doing'. Grey, policy initiated research therefore is somewhat more focussed on integration and consistency.

What appears from my analysis is that in current W+S policy development safety and health, and to a lesser extent city centre economics, are major drivers. The health, safety and city economics domains however have different focuses. The safety domain seems to favour a technical, single discipline and 'implementation orientation' approach, dominated by traffic engineering, site level design, education, communication and law enforcement. The health domain adheres to system ecology associated with 'crossing domain borders' and 'policy orientation', particularly the connection between human behaviour and the physical and social environments in general. The with regard to W+S policy smaller city economics domain is particularly focussed on attracting customers and tourists. Here the focus is on research (modelling), architecture and communication.

In summary: because of fundamental shortcomings regarding insight in interacting phenomena and processes affecting walking and sojourning in public space, the question is whether currently discussed and 'promising' measures deal with true (the most important) problems.

3.4. Value of the available body of literature for W+S policy development.

At this point it can be concluded that my literature scan produced a rich database of publications regarding the W+S policy development domain. Because of the variety of subjects, aims and situations and behavioural contexts, there seems to be great potential to identify what controls authorities can adjust to support and promote walking and sojourning as a source of wealth and well-being.

Although my selection underreports health aspects and documentation from other languages than English and Dutch, and may suffer from scoring errors, the author feels that the literature scan provides a useful bird's-eye view on W+S policy development knowledge. The aim here was merely to acquire a first impression of what is available on W+S policy development, not to do an in-depth literature study. The usefulness of *content* of the found publications will be touched on in this thesis under Chapter 6 on Devising change.

In the past international experts stated that pedestrians, walking and sojourning in public space is a rather neglected field in literature and what there is, is either fragmented and often of questionable quality. From my literature research I found that this statement might have been true up until 2000, but that from that moment on the number of publications on pedestrians and walking has increased enormously. Scientific literature now offers ample information on problem causes, needs, abilities and requirements, but much less on promising and proven measures. I did not find many publications on sojourning or staying in public space, however. What, according to my literature search, still is true, is that there are not many publications providing a comprehensive perspective on walking and sojourning in public space as a subject and information regarding all steps of the policy process.

So, the expert's conclusion, that there was very little useful scientific literature, was true until 2005, but needs to be revised now. On the other hand, there is indication that the part of their assessment that academic attention is fragmented, still applies. The increase in number logically points to 'going more deep' and not necessarily to increase overview. Indeed, the sheer number of scientific publications makes it more difficult to gain overview.

Generally policy initiated grey literature is more oriented to integration and policy developers have greater need for overview than researchers. As grey literature research quality is usually not ensured by peer review, validity and reliability on average are inferior to scientific literature. An important condition for policy development that the discussed measures deal with true (the most important) problems. Because of undetermined reference data quality and lacking overview regarding W+S policy this condition is not assured in grey literature; scientific literature will score better on reference data quality, but worse on ambition to acquire overview.

With regard to W+S policy development scientific literature does not appear to be the dominant source for policy development. It rather functions as 'icing on the cake', dealing with selected topics, 'nice to have', but also 'potentially serious trouble'; scientific literature does not evenly and comprehensively cover the W+S domain; for policy developers there is ground to concentrate on 'grey literature' and to fill the gaps with whatever help one can get. Wikipedia and Google Scholar offer such practical help, more than SCOPUS, Science Direct and the various library databases, as these sources are not accessible for 'common' policy developers.

An additional practical problem is that, because in the current situation there is little overview and the science world appears not to aspire acquiring overview, policymakers will need to 'connect the dots' themselves. For 'common' policy makers, finding their way through the large number of publications dealing with a fragmented message, will make this an extremely difficult job, which therefore is unlikely to happen. Firstly because 'common' researchers, policy developers and their advisers do not have the time nor energy to surmount this barrier and acquire a general overview. Secondly, falling back on key players in the knowledge domain does not offer much help either: even they only cover only one or two aspects of the field; they seldom start from the interests of the walker, but rather from a specific discipline, policy field or even a measure type. Thirdly, the available overview publications generally are quite old, therefore usually perceived as outdated, but are also outside the policy developers 'natural' search reach.

With regard to using the Netherlands as an example, there appear to be limitations. There are few high quality publications from Dutch origin[655]. Together these publications do not at all

[655] It has to be remarked that there is one field within the W+S policy domain where Dutch academics, like Hoogendoorn, Timmermans and Daamen, excel: modelling pedestrian behaviour.

cover the W+S policy development domain. Consequently policy development in the Netherlands (and other countries as well) needs to be based on accumulated international (scientific) literature.

In sum, there currently is a large number of publications relevant for W+S policy development, but overview is lacking. The experts' opinion that what there is, is of questionable quality, is no longer plausible. The latter statement could not be tested via my literature scan.

Appendix 3 - List of detailed research questions

1. Central research question:

What insights are available and/or needed and how can they be acquired, and what controls can authorities adjust to effectively, efficiently and fairly improve conditions for walking and sojourning in public space (W+S) as a source of wealth and well-being?

Leading research question in this thesis are:

1. *What conceptual framework can be developed to structure and inspire research for the support of W+S policy development, instigating basic understanding of walking and sojourning in public space, its interrelations and main determinants?*

2. *What (pre)conditions are required to present (potential) pedestrians with an adequate and tempting range of opportunities for walking and sojourning in public space supporting them to optimally contribute to the wealth and well-being of communities and the nation?*

   2a. In what ways do environmental settings for (potential) pedestrians underlie W+S needs, abilities, decisions and behaviour?

   2b. How do general human needs relate to reasons and motives for walking and/or sojourning in public space, and what does this mean for W+S system requirements
   - How do general and abstract human needs (as classified by Lapintie, 2010) relate to concrete motives and reasons for walking?
   - Which motives and reasons do (potential) pedestrians have for walking and sojourning in public space? How should they be sorted?
   - What trip types and groups can be distinguished regarding W+S needs, motives and reasons?
   - What kinds of conditions, facilities and/or services can (potential) pedestrians be expected to feel necessary or most suitable for achieving their general targets?

2d. How do abilities to meet the reasons and motives for walking, or the lack thereof, translate into W+S system requirements?
- What W+S tasks are (potential) pedestrians to perform?
- What kinds of abilities and skills are involved in W+S tasks?
- How do W+S abilities and skills translate into W+S system requirements consistent with Design for All?

2e. What kinds of W+S arrangements are required to offer a heterogeneous population of (potential) pedestrians a suitable variety of W+S opportunities, now and in the next decade?
- What kinds of conditions are (potential) pedestrians looking for?
- What factors frame the genesis of W+S opportunities?
- What kinds of W+S arrangements are required to enable and/or motivate people to walk and enjoy W+S?

3. *How well are pedestrians enabled to walk and sojourn in public space, and how do pedestrians currently perform regarding their walking and sojourning needs and abilities, and what changes in performance can be foreseen?*

3a. What is documented and entered up about prominent arrangements established in the Netherlands to offer opportunities for walking and sojourning in public space, their distribution, and roughly how well can these arrangements be expected to serve the needs and abilities of the Dutch (potential) pedestrians?

3b. How do pedestrians interact with their W+S environment, and what are the consequences?

4. *How can conditions for pedestrians, walking and sojourning in public space be effectively, efficiently and fairly managed and improved?*

4abc Conceptual model regarding devising changes:
- What kinds of factors and processes theoretically set the stage for bringing about improvement of W+S conditions?

4a. The Dutch W+S policy playing field:
- What kinds of policy actors can be discerned regarding their function for sustaining and improving pedestrian, walking and sojourning conditions?

4b. External settings:
- What kinds of settings outside the Dutch W+S institutional framework can or do affect W+S policy activities in the Netherlands?

4c. The organisation of change (W+S institutional framework):
- How is management of pedestrian and W+S conditions organised?
- What controls can policy makers adjust to enhance W+S policy activities?

Appendix 4 - Contributors

Chapter 1, 2 & 3 reviewers

- Willem Vermeulen - Rijkswaterstaat WVL
- Paul Schepers - Rijkswaterstaat WVL, SWOV Road Safety Research Institute
- Derk van der Laan - Independent expert author

Chapter 4 - workshop attendants and reviewers

Workshop Needs

- Annemiek Molster - Molster Stedenbouw
- Annemiek Waterborg - ANBO
- Berry den Brinker - VU Amsterdam
- Hans Godefrooij - DTV-Consultants
- Janneke Zomervrucht - VVN and MENSenSTRAAT
- Olinde de Smit-Andringa - Rijkswaterstaat WVL
- Paul Schepers - Rijkswaterstaat WVL
- Paul van Beek - Goudappel Coffeng
- Tobias Wolderdorp - DSP-Groep
- Willem Vermeulen - Rijkswaterstaat WVL

Reviewers Needs & Abilities (Sections 4.1, 4.2. and 4.3)

- Annemieke Molster - Molster Stedenbouw
- Christine Chaloupka - Factum OG
- Derk van der Laan - Independent expert author
- Emile Oostenbrink - CROW
- Filip van As - Ministry of Infrastructure and Water Management
- Gert-Jan Wijlhuizen - SWOV Road Safety Research Institute
- Janneke Zomervrucht - MENSenSTRAAT

- Paul Schepers - Rijkswaterstaat WVL
- Ralf Risser - Factum OG
- Willem Vermeulen - Rijkswaterstaat WVL
- Wim van den Boogaard - Wandelnet

Chapter 5 - reviewers

- Derk van der Laan
- Paul Schepers
- Willem Vermeulen

Chapter 6 - respondents and reviewers

Institutional respondents - policy actors

- ANBO/BVM (~ Association of the elderly)
- ANWB (Dutch Tourists' Association)
- European Commission
- Jaar van de Ruimte (~project on future land use affairs)
- MENSenSTRAAT (~ Pedestrians Association)
- Ministry of Infrastructure and the Environment (in 2018 the name changed to Ministry of Infrastructure and Water Management)
- Ministry of Internal Affairs
- Ministry of Wellfare, Health and Sports
- Molster Advies (Consultant)
- Municipalities of Amsterdam, The Hague, Rotterdam, Utrecht, Hattem, Katwijk, Heerhugowaard, Eindhoven, Breda
- NHTV/SOAB (Consultant, teacher of future practitioners)
- NS (Dutch Rail)
- Openbaar Ministerie (Public Prosecutioner)
- Police Academy
- Radboud University (Institute Geography)
- SWOV Institute for Road Safety Research
- Veilig Verkeer Nederland (~ Traffic Safety Association)
- VeiligheidNL (~Consumer Safety Institute)
- Visio (Knowledge institute regarding visual impairments)
- VNG (Association of Dutch Municipalities)
- Wandelnet (~Association of Hikers)

Reviewers:

- Charlotte Bax
- Derk van der Laan
- Paul Schepers
- Willem Vermeulen

Appendix 5. Exposure estimation calculations

Chapter 1

Average distance covered on foot to and from other modes

Source:

- Knippenbergh, L.M.G. et al. (1993) Voetgangers tellen mee, De Voetgangersvereniging, Den Haag
- Methorst, R. (2005) Voetenwerk, Rijkwaterstaat AVV, Rotterdam.
- Sauter, D. (2010) Swiss Country Report for COST358, Zurich.
- Berge, G. (2010) Notes on pedestrian mobility (not published), Ministry of Transport, Oslo.

Facts:

- Number of trips to and from other modes per year = 1,600 per person per year = 4.4 per person per day;
- concerns 40% of total distance covered on foot; total distance covered on foot per person per year = 325 kilometres = 0.9 kilometre per person per day in 2007; Estimations 2010-2017 = 328 kilometre per person per year.

Calculation:
- 0.4 * 0.9 = 0.36 kilometres ~ 400 meters

Chapter 4

Table 4.8. Estimated pedestrian group volumes (x1000) based on health characteristics, 2016 and 2025 in the Nethetlands. Sources facts and calculations are as follows:

Healthy population

Source:
CBS Statline = Statistics Netherlands open data website - Gezondheid, aandoeningen, beperkingen; leeftijd en geslacht, 2010-2013
https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81174ned/table?ts=1527161727581
accessed: 16-10-2018

Facts:

- 80.3% of the total population aged 16 or older perceive their health as very good / good
- 53.2% of the population does not have long time disorders
- 12.9% of the population aged 12 and older have at least one disability
- 11.8% of the population aged 55 and older have at least one disability regarding general daily activities
- 4.0% of the population aged 4 years and older have hearing aids
- 60.9% of the population aged 12 and older have visual aids
- 4.6% of the population aged 12 and older have mobility aids
- 5.7% of the population 12 years and older have anatomical aids (orthopaedical shoes, limb prothesis or brace (not tooth brace))
- total population in 2012 = 16,730, 348 (source: CBS bevolkingsstatistiek)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

calculations:

- 80.3% of total population stated to be (very) heathy
- assumption: health of population is stable **on 80.3%** of the population
- estimation of total number of healthy people in the Netherlands 2010-2013: total population in 2012 * 80.3%, rounded figure = 16,730,348 * 0.803 = 13,434,469 = **13,434** * 1000
- estimation total number of healthy people in 2025: total population in 2025 * 80.3 = 17,539,636 * 0.803 = 14,084,327 = **14,084** * 1000

Person with long time disorders

Source:

- https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81174ned/table?ts=1527161727581
- Concerns statistics title 'Gezondheid, aandoeningen, beperkingen; leeftijd en geslacht, 2010-2013'

Facts:

- 53.2% of the population does not have long time disorders in 2010-2013

Calculations:

- estimation of total number of people with long time disorders 2012 = 100 - 53.2% = **46.8%** of the population has long time disorders; total number = total population * 0.468 = 16,730,348 * 0.468 = 7,829,803 = **7,829** * 1000
- idem in 2025: 17,539* 0.468 = 8,208,550 = **8,208 *** 1000

Temporary physical-impaired people (person equivalents)

Source:

- Panneman & Blatter (2016) Letsel Informatie Systeem: Representatief voor alle SEH's in Nederland? Rapport 627, VeiligheidNL, Amsterdam.
- https://www.veiligheid.nl/organisatie/wat-we-doen/onderzoek/letsel-informatie-systeem

Facts:

- The report indicates that each year about 2 million people visit an ER department of a hospital for injury treatment. Reference year = 2015
- total population NL in 2015 = 16,900,726 (source CBS Statline - bevolkingsstatistiek)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- For the calculations it is assumed that they on average are somewhat incapicitated for about twee weeks
- calculation: in 2015 2/52*2,000,000 = 76,923 person equivalents; rounded: **77** * 1000
- in 2025: assumption: risk per person is stable; population 2025/population 2015 * 76,923 person equivalents = 79,830,974 = **80** * 1000 person equivalents

Chronically impaired people

Source:

- https://www.allesoversport.nl/artikel/feiten-en-cijfers-over-het-aantal-mensen-met-een-beperking/
- Data based on Heijden, A. von, Dool, R. van den, Lindert, C. van & Breedveld, K. (2013) (On)beperkt Sportief 2013 - Monitor sport- en beweegdeelname van mensen met een handicap. This report is based on the national health survey 2008-2011 (CBS Statline)

Facts:

- in 2010 roughly 1.7 million inhabitants in the Netherlands had a moderate or serious impairment
- the NL population total in 2010 is 16,574,989 (source CBS Statline, bevolkingsstatistiek)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- in 2010 the total number of chronically impaired is estimated on 1,700 * 1000 persons
- the percentage is 1700000/16574989 = 10.3%
- assumption: the percentage of chronically impaired is stable
- in 2025 the total number of chronically impaired is estimated on 17,539,636/16,574,989 * 1,700 = 1,799 *1000

Obesity

Source:

- CBS Statline - Leefstijl en (preventief) gezondheidsonderzoek; persoonskenmerken Data regarding 2017
- https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83021NED/table?ts=1522312658353

- CBS Statline Lengte en gewicht van personen, ondergewicht en overgewicht; vanaf 1981 https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81565NED/table?dl=1BB3A
- https://www.volksgezondheidenzorg.info/onderwerp/overgewicht/cijfers-context/huidige-situatie#node-overgewicht-volwassenen

Facts:

- In 2017 in the Netherlands 54.7% of the population aged 4 and older had a normal weight, 43,1% had overweight, and 12.1% had severe overweight (obesity). 2.3% of the population had underweight.
- in 2014 in the Netherlands 54.9% of the population aged 4 had a normal weight; 43.1% had overweight; 11.7% had severe overweight.
- the NL population in 2017 was 17,081,507 (CBS Statline)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- In 2017 0.121 * 17,081,507 persons were obese = **2,067** * 1000
- assumption: the obesity increases from 12.1% to 14% (cf. increase from 2016 - 2018: 11.3 to 13%)
- it is estimated that in 2025 0.14 * 17,539,636 will be obese = 2.456 *1000

Sarcopenia

Source:

- Shafiee et al. (2017) Prevalence of sarcopenia in the world: a systematic review and meta-analysis of general population studies, Journal of Diabetes & Metabolic Disorders (2017) 16:21 DOI 10.1186/s40200-017-0302-x.
- Lauretani et al. (2003) Age-associated changes in skeletal muscles and their effect on mobility: an operational diagnosis of sarcopenia. J Appl Physiol 95: 1851–1860, 2003.

Facts:

- Meta-analysis yielded that about 10% of the general population suffer sarcopenia; diagnosis is still difficult, and new and better tools are needed
- Consequences are different for gender. a (much) larger proportion of females have difficulties to walk 1 kilometre (about 45% of females aged 75+; about 28% of males aged 75+)
- the NL population in 2017 was 17,081,507 (CBS Statline)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- 10% of the population in 2017 is 1,700 *1000; 10% of the population in 2025 = 1,750 *1000

Cardio-vascular diseases

Source:

- Hartstichting: https://www.hartstichting.nl/hart-en-vaatziekten/feiten-en-cijfers-hart-en-vaatziekten

Facts:

- In 2015 in the Netherlands there were about 1.4 million patients suffering hart- and vascular diseases
- total population in 2015 = 16,900,726
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- Assumption: the incidence rate is stable
- In 2025 the number of hart and vascular patients is estimated to be 17,539,636/16,900,726*1,400,000 = **1,453** * 1000 = **8.0**% of the population

Diabetes

Source:
https://www.volksgezondheidenzorg.info/onderwerp/diabetes-mellitus/cijfers-context/huidige-situatie#node-prevalentie-diabetes-naar-leeftijd-en-geslacht
https://www.diabetesfonds.nl/over-diabetes/diabetes-in-het-algemeen/diabetes-in-cijfers
https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83005NED/table?dl=E196

Facts:
- an estimation based of general practitioners data in 2017 was that in that year 1,135,000 persons suffered diabetes
- In 2017 4.6% of the population stated to suffer diabetes, which is lower than known from the medical world
- the NL population in 2017 was 17,081,507 (CBS Statline)
- total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:
- in 2017 the number of patients is 1,135 * 1000 patients; 1,135/17,082 = 6.64% of the population
- assumption: the rate is stable
- In 2025 the number of patients is 0.0664 * 17,539,636 = **1,165** * 1000

Eye disorders

Source:

- Heijden, A. von, Dool, R. van den, Lindert, C. van & Breedveld, K. (2013) (On)beperkt Sportief 2013 - Monitor sport- en beweegdeelname van mensen met een handicap
- VISION 2020 Netherlands2005Vision 2020 - The right to sight - vermijdbare blindheid en slechtziendheid in nederland - samen werken aan het voorkomen van vermijdbare blindheid en slechtziendheid.VISION 2020 Netherlands, Leiden
- Limburg, H., Boon, J.M. den, Hogeweg, M., Gevers, R.J., Hove, T.G.Th. ten & Keunen, J.E.E. (2005) Vermijdbare slechtziendheid in Nederland: het project Vision 2020 Netherlands van de Wereldgezondheidsorganisatie. Ned Tijdschr Geneeskd 2005;149:577-82
- CBS Statline - Gezondheidsmonitor, bevolking 19 jaar en ouder, regio, 2016

Facts (translated from Dutch):

- Von Heijden et al. (2013), based on the national health survey 2008-2011:

  Visually impaired (numbers 2011 x 1000)

total	19%	2.611.000
Light	14%	1.911.000
Moderate	2%	280,000
Severe	3%	446.000

- Limburg et al., 2005:
  'Between 33.300 to 45.000 people (0,21%-0,28% of the total Dutch population) in the year **2000** were blind, and 115.000 - 175.000 (0,72%-1,09%) partially sighted according to WHO-criteria. The ratio male : female is about 1:2. More than 82% of all blindness concerns people aged 50 and older.'
- Vision 2020 data 2010:
  It is estimated that in 2010 320.000 Dutch inhabitants had a visual impairment in both eyes (a vision of less than 0.3 with available sight corrections). About 76.000 of them are blind (visus less than 0.05) and 223.000 pasrtially sighted (visus 0.3 - 0.05). The most important causes of visual impairments in the Netherlands are cataract (83.000 persons), refraction deviations (69.000), age related macula degeneration (LMD) (68.000), diabetie retinopaty (19.000) en glaucome (13.000).
- Bartimeus (https://www.bartimeus.nl/visuele-beperkingen/blindheid):
  'People with a visual impairment can be blind or partially sighted. In the Netherlands, more than 75,000 people are blind and this number will probably only increase in the coming years because we are getting older.'
  Distinguished eye diseases (https://www.bartimeus.nl/visuele-beperkingen/ ophthalmic disorders): Albinism, Cataract (cataract), Congenital stationary night blindness, Diabetic retinopathy, Glaucoma, Juvenile macular degeneration, Cone dystrophy and cone rod dystrophy, Keratoconus, Reticulate dystrophy macular degeneration, Retinitis pigmentosa, Toxoplasmosis.'
- CBS Statline, Gezondheidsmonitor, population age 19 jaar and older, regio, 2016:

age	Visual impairment
Total	5.5%
19-65	4.7%
65 and older	8.2%

- Population

	data 2016	prognose 2025
total	16,979,120	17,539,636 (100%)
total 19+ =	13,235,165	13,901,534 (79.3%)
0-18	3,616,582 (21.5%)	3,638,102 (20.7%)
19-65	10,478,611 (61.2%)	10,151,235 (57.9%)
65+	2,756,553 (16.4%)	3,750,299 (21.4%)

Calculations:

- The data do not match well
- Assumption: the number of visual impaired equals the number of persons with eye-disorders
- Assumption: the percentage of persons with visual impairments in the group 0-18 is minimal

- The total number of persons with eye (serious) disorders is 0.055*(10,478,611+2,756,553) = 727,934. Rounded to include visual impairments amongst 0-18: **750***1000
- The share of persons with visual impairment / eye disorders = 750,000/16,979,120*100% = 4.4%
- As the group 65+ will grow substantially and a much larger part of the elderly suffer eye disorders, the population share will increase. The estimated numbers (x 1000) of impaired persons are:

Age group	2016	2025
0-18	32 (0.9% of total)	32 (= 0.009 * 3,638,102)
19-65	492 (4.7% of 19-65)	477 (= 0.047 * 10,151,235)
65+	226 (8.2% of 65+)	307 (= 0.082 * 3,750,299)
total	**750 (4.4% of total)**	**816 (4.7%)**

Hearing disorders

Source:

- Heijden, A. von, Dool, R. van den, Lindert, C. van & Breedveld, K. (2013) (On)beperkt Sportief 2013 - Monitor sport- en beweegdeelname van mensen met een handicap
- CBS Statline, Gezondheidsmonitor, bevolking 19 jaar en ouder, regio, 2016:

Facts:

- Von Heijden et al. (2013), based on the national health survey 2008-2011:

Auditief

Total	14%	1.924
Light	12%	1.600
Moderate	2%	232
Severe	1%	119

Visual impairment (numbers = '2011' x 1000)

totaal	14%	1,924,000
Light	12%	1,600,000
Moderate	2%	232,000
Severe	1%	119,000

- CBS Statline - Gezondheidsmonitor, bevolking 19 jaar en ouder, regio, 2016

age	Hearing impairment
Total	4.5%
19-65	3.3%
65 and older	8.6%

- Population

data 2016 (CBS)		*prognose 2025 (US Bureau of Sensus)*
total	16,979,120	17,539,636 (100%)
total 19+ =	13,235,165	13,901,534 (79.3%)
0-18	3,616,582 (21.5%)	3,638,102 (20.7%)
19-65	10,478,611 (61.2%)	10,151,235 (57.9%)
65+	2,756,553 (16.4%)	3,750,299 (21.4%)

Calculations:

- Assumption: the number of hearing impaired equals the number of persons with hearing-disorders
- Assumption: the percentage of persons with hearing impairments in the group 0-18 is minimal
- The total number of persons with eye (serious) disorders is 0.045*(10,478,611+2,756,553) = 595,582. Rounded to include visual impairments amongst 0-18: **600***1000
- The share of persons with visual impairment / eye disorders = 750,000/16,979,120*100% = 4.4%
- As the group 65+ will grow substantially and a much larger part of the elderly suffer eye disorders, the population share will increase. The estimated numbers (x 1000) of impaired persons are:

Age group	2016	2025
0-18	17 (0.5% of total)	18 (= 0.005 * 3,638,102)
19-65	346 (3.3% of 19-65)	335 (= 0.033 * 10,151,235)
65+	237 (8.6% of 65+)	322 (= 0.086 * 3,750,299)
Total	600 (3.5% of total population)	675 (3.8% of total population)

Arthroses (disabled)

Source:

- http://www.reumafonds.nl/informatie-voor-doelgroepen/pers/feiten-en-cijfers
- A.M.J. Chorus & D.F. Schokker (2011) Nationale Peiling van het Bewegingsapparaat 2010, TNO Leiden

Facts:

- In 2010 almost 2 million adults in the Netherlands suffered Rheumatism
- Arthroses: 1 million patients
- Inflammatory rheumatism: 420,000 patients (rheumatoid arthritis: 210,000)
- Soft body parts rheumatism: 240,000 patients
- 60% of the Rheumatism patients are younger than age 65
- 280,000 patients are unable to work. This is 16% of all patients with severe Rheumatism
- Total population in Netherlands 2010 16,574,989
- Total population in the Netherlands 2025 is 17,539,636

Calculations:

- in 2010 280,000 people were unable to work; this is 1.7% of the population
- assuming that the population share is stable, in 2025 the expected number of arthroses impaired is 0.017* 17,539,636 = **298** *1000

Neurological diseases

Source:

- Schepman, S.M., Hansen, J. & Velden, L.F.J. van der (2010) Behoefteraming neurologen 2009 - 2027 https://www.nivel.nl/sites/default/files/bestanden/Rapport-behoefteraming-neurologen-2009-2027.pdf (pp 26, table 3.4)

- https://www.hartstichting.nl/hart-en-vaatziekten/feiten-en-cijfers-hart-en-vaatziekten/feiten-en-cijfers-over-beroerte
- https://www.alzheimer-nederland.nl/sites/default/files/directupload/factsheet-dementie-algemeen.pdf
- https://www.volksgezondheidenzorg.info/onderwerp/epilepsie/cijfers-context/huidige-situatie
- https://herseninstituut.nl/onderzoek/onderzoeksgroepen/huitinga-groep/multiple-sclerosis/

Facts:

- Stroke (beroerte): 43,000 per year; 80% of which concern a cerebral infarction (herseninfarct), 20% cerebral/brain haemorrhage (hersenbloeding) Source: https://www.hartstichting.nl/hart-en-vaatziekten/feiten-en-cijfers-hart-en-vaatziekten/feiten-en-cijfers-over-beroerte
- Dementia: ruim 270,000 patients, of which 100,000 no diagnosis; Expected in in 2014 500,000 patients.

  (source: https://www.alzheimer-nederland.nl/sites/default/files/directupload/factsheet-dementie-algemeen.pdf)
- Parkinson's disease: number of patients in 2010 = estimated 26,300
- Epilepsy: 182,000 persons suffer epilepsy (2017),

  (source: https://www.volksgezondheidenzorg.info/onderwerp/epilepsie/cijfers-context/huidige-situatie)
- Multiple Sclerosis: prevalence is 1 in 1,000 inhabitants; Belgium ~12,000 patients; Netherlands:~17,000

  (source: https://herseninstituut.nl/onderzoek/onderzoeksgroepen/huitinga-groep/multiple-sclerosis/)
- Rough estimation including early Dementia, Parkinson's disease and epilepsies is 200,000 patients that latently have W+S impairments. Patients with early dementia and Parkinson's disease can walk and sojourn in public space independently; advanced illness patients however do not come into public space very often and need to be excluded. Most epilepsy patients can function as a normal pedestrian, but they are in danger of having a fit sometimes. likewise advanced MS patients have serious problems walking, but in the early stages they can function as a pedestrian
- The NL population in 2017 was 17,081,507 (CBS Statline)
- Total population in 2025 = 17,539,636 (source: US Bureau of Census)

Calculations:

- Rough estimations for neurological diseases in the Netherlands in 2017 is:

  early stage dementia (100,000) + early Parkinson's (26,000) + epilepsy (untreated: ~25,000) + early multiple Sclerosis (17,000) = ~200,000 patients
- - assumption: the incidence rate is stable over the years
- - in 2025 the total number is 200,000*17,539,636 / 17,081,507 = **205** * 1000

Cancer (effects on W+S only)

Source:

- https://www.cijfersoverkanker.nl/selecties/incidentie_kanker_totaal/img568b9ade13f90 57174
- https://www.cijfersoverkanker.nl/selecties/Dataset_3/img5b0566e45eba1
- Maheu, C., Cashman , R., Johnson, K. & Parkinson, M.(2018) Mobility impairments. In: Cancer and Work-newsletter, McGill University , Montreal.

  https://www.cancerandwork.ca/healthcare-providers/cancers-impact-on-work/effects-mobility/

Facts:

	Year	Number	survival rate (%)
All tumors	1995	64798	n.a.
All tumors	2000	70642	n.a.
All tumors	2005	82795	64
All tumors	2010	98311	66
All tumors	2014	105399	69
All tumors	2015	106914	73
All tumors	2016	108450	80
All tumors	2017	109663	100

Calculations:

- Assumption: cancer affects W+S abilities and propensity for three years
- The number of cancer patients being inhibited by cancer then is in 2017: 109,663 + .8*108,450 + .73*106,914 = 109,663 + 86,760 + 78,047 = 247,470
- This is 1.456% of the NL population
- Of which 25-35% suffers effects on walking abilities (Maheu, 2018) -> about 30% --> 247,470 * 0.3 = 74241 ~75,000
- Number of new cancer cases levels at about 110,000 per year; in 25-35% of patients effects on walking abilities (Maheu, 2018) --> take 30% into account = 0.3 * 247,470 = ~**75** * 1000

Latently impaired people
Osteoporosis

Source:

- Blokstra, A. & Verschuren, W.M.M. (red.), Baan, C.A., Boshuizen, H.C., Feenstra, T.L. , Hoogenveen, R.T., Picavet, H.S.J., Smit, H.A. & Wijga, A.H. (2007:44) Vergrijzing en toekomstige ziektelast - Prognose chronische ziektenprevalentie 2005-2025, RIVM rapport 260401004/2007; https://www.rivm.nl/dsresource?objectid=6bd0ef9e-fa28-49ff-9732-63cb77404a77&type=org&disposition=inline

Facts:

- RIVM rapport pp 44
- Prevalence figures for osteoporosis are only available for the population aged 55 years and older (see also Appendix 2 RIVM report, which describes the data sources). The projection therefore only applies to men and women from the age of 55 (see Appendix 4 of the RIVM report, Table 4.18). Based solely on demographic developments, the total number of women with osteoporosis is expected to increase from 640,000 in 2005 to almost 880,000 in 2025,

an increase of 37% (Figure 31). Among men, the number rose from over 210,000 to over 325,000, an increase of over 50%.Total NL population in 2005 is 16,334,210

- Total population in the Netherlands 2025 is 17,539,636

Calculations:

- Assuming that population younger than age 55 does not suffer (severe) osteoporosis
- The total number of osteoporosis patients in 2005 is 640,000 + 210,000 = 1,090,000. This corresponds with 1,090,000/16,334,210 = 6.7% of the population
- The prognosed number for 2025 is 880,000 + 325,000 = 1,205,000 patients (6.8 % of the total population)

Other 'hidden' disorders

Source:
p.m.

Facts:
p.m.

Calculations:
p.m.

Table 4.11 Calculations of the urgency scores:
Urgency scores are based on propensity of risk scores, assigned as a duo exercise (the author and the reviewer Wim van den Boogaard) in May 2019, by weighing two kinds of risks (moderate to severe mobility [M] and safety [S] disadvantages) which members of the group are expected to suffer, and the volume of the group concerned. Impacts on behavioural functionality from mobility deficiencies are more fundamental and unavoidable than safety deficiencies. Through his or her behaviour a person has influence on (some) travel safety, and conditions are not unsafe all the time. For this reason the weight for mobility is set on '1' and for safety at '0.75'.

The scores for [M] and [S] severity propensity were assigned as follows:

maximum severity	5 points	= (nearly) all trips are affected
severe	4 points	= most of the trips are affected
moderate	3 points	= about half of the trips are affected
slight	2 points	= about a quarter of the trips are affected
minimal	1 point	= some of the trips are affected

First scores were calculated: ([M] + 0.75 x [S]) x % of the population that is affected.

The 32 scores varied from 62 (highest) to 1 (lowest). The scores were ranked and sorted into 5 (about equal; if in the lower part equal ranks exist, these were allotted to the highest score group) groups, which were allotted stars:

*****	=	more than score = 25 n = 6
****	=	score 11 to 25n = 8
***	=	score 4 to 10n = 7
**	=	scores 3 and 2n = 6
*	=	score = 1 (rounded)n = 6

Table 4.12 Calculations of expected benefits from fully meeting the requirements
The scores are based on **Group Benefit Scores** assigned as a duo exercise (the author and the reviewer Wim van den Boogaard) in May 2019, by weighing the two kinds of risks (moderate to severe mobility [M] and safety [S] disadvantages which the members of the groups are expected to suffer, and the volume of the groups concerned. The scores for [M] and [S] benefits were assigned as follows:

totally compensated disadvantage	= 5 points
about 75% of the disadvantage remedied	= 4 points
about half of the disadvantage remedied	= 3 points
about 25% of the disadvantage remedied	= 2 points
less than 25% of the disadvantage remedied	= 1 point

Societal Benefits scores were calculated through the formula:
score = ([{A-1} x 0.25] + [0.75 x {B-1} x 0.25]) x C

whereas:
A = allotted score for Mobility benefits
B = allotted score for Safety benefits (having a lowered weight of 0.75)
C = **estimated volume of the group of people who benefit** from the intervention more than average.

The estimated volumes (%) of the groups of people who benefit were calculated as follows:

Lifestyle activity level interventions:

- Pedestrian friendly and compassionate culture: = summed disadvantaged groups (rounded) = 60
- Compact cities and villages: = national population minus people who hate walking = 80
- Mixed land use: = national population minus people who hate walking = 80
- Walkable neighbourhoods: = national population minus people who hate walking = 80
- Conveniently connected: = national population minus people who hate walking = 80
- Follow-on transport: = estimated (max.) potential PT and taxi users = 30
- Safe walking networks: = children + cognitive impaired (rounded) = 50
- Walking shielded from traffic: = children + cognitive impaired (rounded) = 50
- Guardianship, support, escort: = severely disadvantaged persons plus children <12 years = 20

Strategic activity level interventions:

- all intervention: = children + cognitive impaired (rounded) = 20

Tactical activity level interventions:

- Self explaining roads/space: = children + cognitive impaired (rounded) = 20
- Self explaining rules: = children + cognitive impaired (rounded) = 20
- Safe mobility education: = children + cognitive impaired (rounded) = 25
- Training: = children + cognitive impaired + slowly decreasing abilities (rounded) = 25
- Convenient land use: = children + cognitive impaired + first time visitors (rounded) = 25

- Clear boundaries: = children + cognitive impaired + first time visitors (rounded) = 25
- Navigation cues / devices: = children + cognitive impaired + first time visitors (rounded) = 25
- Pedestrian safety legislation & information: = children + new immigrants/foreigners (rounded) = 25

Operational activity level interventions:

Memory

- Conveniently connected safe walking networks: = children + cognitive impaired (rounded) = 20
- Clear orientation cues: = children + cognitive impaired (rounded) = 20
- Lifelong traffic education: = children + cognitive impaired (rounded) = 20
- Dedicated advise and training: = children + cognitive impaired (rounded) = 20

Concentration

- Unambiguity of routes: = children + cognitive impaired (rounded) = 20
- Traffic calming: = children + cognitive impaired (rounded) = 20

Orientation, observation and detection (sensory abilities)

- Readable environments: = (severely) sensory impaired = 5
- Clear environments identities: = (severely) sensory impaired = 5
- Obstacle-free walkways: = (severely) sensory impaired = 5
- Flat, even and clean surfaces: = (severely) sensory impaired = 5
- Obstacle-free walkways: = (severely) sensory impaired = 5
- Traffic calming: = children + (severely) sensory impaired = 5
- Crossing: footpath extensions: = children + (severely) sensory impaired = 20
- Safe mobility education & training: = children + (severely) sensory impaired = 20

Walking skills

- Convenient paving: children + physically impaired + revalidation patients (rounded) = 20
- Support (handrails etc): children + physically impaired + revalidation patients (rounded) = 20
- Forgiving environment: children + physically impaired + revalidation patients (rounded) = 20
- Obstacle free sidewalk of > 1.8 m wide: = Wheeled pedestrians + Duo or group walkers + Persons carrying bags, goods = 10
- Channelling pedestrian space: = Young children + Visually impaired + Balance impaired persons = 15
- Forgiving verges/boundaries: = Young children + Visually impaired + Balance impaired persons = 15
- Pedestrian detection: = Young children + Walking aid users / the very old + Wheelchair users = 15

- Extended crossing time: = Young children + Walking aid users / the very old + Wheelchair users = 15
- Flat, even & sturdy walkway surfaces: = Balance-impaired + Elderly (females ~70+, males ~80+) = 15
- Fall prevention training: = Balance-impaired + Elderly (females ~70+, males ~80+) = 15
- Forgiving verges/boundaries: = Balance-impaired + Elderly (females ~70+, males ~80+) = 15
- Level crossings: = psycho-motor impaired = 20
- Easy (curb ramp) slopes: = psycho-motor impaired = 20
- Forgiving verges: = psycho-motor impaired = 20
- Handrails: = psycho-motor impaired = 20
- Automatic pedestrian detection and permission: = Manual dexterity-impaired = 2
- Seating every 200 m: = Reduced stamina persons = 10
- Sanitary facilities every 500 m: = Reduced stamina persons = 10
- Crossings: sidewalk extensions: = Children + Walkers wearing dark clothes = 65
- Rich contrast background: = = Children + Walkers wearing dark clothes = 65

<u>Adapt to actual conditions</u>

- Sun, wind and rain shielding: at most 25% of the time strong sun, wind or rain affect walking = 25
- Clearing snow and ice: concerns exposure to either snow or ice on walking routes (< 2% of time) = 2
- Anti-slip footwear: concerns exposure to slippery conditions that can arise during ice and snow period and wet pavements (< 3% of time) = 3
- Fall prevention training: = visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Escort: = visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Rich in contrast backgrounds: = visually + psychomotor + cognitive impaired + children + 'strangers' = 45
- (Selective) warning signs: = visually + psychomotor + cognitive impaired + children + 'strangers' = 45
- Detection aids: = visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Escort= visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Warning/direction signs= visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Escort= visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Self explaining conditions= visually + psycho-motor + cognitive impaired + children + 'strangers' = 45
- Escort: children + cognitive impaired = 20
- Safe mobility education: children + cognitive impaired = 20
- Escort: children + cognitive impaired + elderly 80+ = 20
- Detection aids: children + cognitive impaired + elderly 80+ = 20

- Emergency services: children + cognitive impaired + elderly 80+ = 20
- Adapted traffic speeds: children + cognitive impaired + elderly 80+ = 20
- Adapt sight lined: children + cognitive impaired + elderly 80+ = 20
- Safe mobility education: children + cognitive impaired + elderly 80+ = 20
- Emergency rescue services: children + cognitive impaired + elderly 80+ = 20

Special abilities

- Simplify walking tasks: =almost everybody = 80
- (In critical conditions) restrain second task and enforce: = almost everybody = 80
- Rollator: = elderly 80+ = 5
- Wheeled bags: = elderly 80+ = 5
- Delivery services: = elderly 80+ = 5
- Guardianship: = children + cognitive impaired + blind people = 15
- Escort services: = children + cognitive impaired + blind people = 15
- Dog walking services: = some of the dog owners (~1%) = 1
- Guide dog use training: = persons eligible for getting a guide dog = 1
- Uniform tactile guiding: = blind and severely visually impaired persons = 2
- Accessible transport: = handicapped persons = 12
- Ergonomic design: = (part of) psycho-motor impaired = 4
- Social pressure, education and training: = (part of) psycho-motor impaired = 4
- Ergonomic design: = wheeled pedestrians = 2
- Training: = wheeled pedestrians = 2
- Ergonomic design: = young children + cognitive impaired + computer illiterates = 10
- Training: = young children + cognitive impaired + computer illiterates = 10.

For **Table 4.12a** the 34 (rounded) scores varied from 140 (highest) to 13 (lowest). The scores were ranked and sorted into 5 groups (of about 6 scores), which were allotted stars:

*****	= more than score = 80 incl. (6 scores)	n = 6
****	= score 33 to 80 incl. (6 scores)	n = 6
***	= score 28 to 32 incl. (6 scores)	n = 6
**	= scores 26 to 27 incl. (8 scores)	n = 8
*	= scores below 26 (8 scores)	n = 8

For **Table 4.12b and c** the 70 (rounded) scores varied from 65 (highest) to 0 (lowest). The scores were ranked and sorted into 5 groups (of about 14 scores; equal scores were allotted to the highest), which were allotted stars:

*****	= more than score = 26 incl.	n = 14
****	= score 18 to 25 incl.	n = 14
***	= score 13 to 17 incl.	n = 12
**	= scores 8 to 11 incl.	n = 14
*	= scores below 8	n = 15

Table 4.13 Calculations of expected benefits from fully meeting system requirements per system component

Calculations similar as calculations and scoring for Table 4.12; data on group volumes (as above) are applied (see Table 4.13); a check on consistency regarding group volume estimations was carried out.

For **Table 4.13** the 68 (rounded) scores varied from 81 (highest) to 0 (lowest). The scores were ranked and sorted into 5 groups (of about 14 scores), which were allotted stars:

*****	= more than score = 38 incl.	n = 18
****	= score 26 to 37 incl.	n = 13
***	= score 16 to 25 incl.	n = 18
**	= scores 6 to 15 incl.	n = 12
*	= scores 0 to 5 incl.	n = 9

Appendix 6 - Questions to policy actors

General context and raison d'être of the organisation

a. What is the added value of taking care of pedestrians for your organisation? and for society?
b. Is providing preconditions for safe mobility on foot and sojourning in public space a government task?
c. To what degree does W+S policy touch your organisation?
d. How did (general) objectives, tasks, powers and responsibilities come about?

Steering model regarding walking and sojourning in public space

a. What is the steering model with regard to walking and sojourning in public space? (what attitude should be adopted if there is a pedestrian problem? What is the first response? Are certain principles, e.g. the market, unless applied (who is next to move?)? What should the approach yield? Who are the key players? Who are the players in the field?
b. Why does your organization choose your approach to walking and sojourning? What should the approach yield? What does the organization have (support) for this?
c. At what times and under what preconditions is management aimed at (making possible) improvements walking and staying? What time frame and what procedures apply?
d. Where does the motivation and direction come from? How have objectives, tasks, powers and responsibilities regarding walking and accommodation come about? Where are the various steering activities carried out?
e. How (which way) are the tasks, powers and responsibilities carried out (policy culture)? How well is it done? How do choices come about? What is needed for that (methods, methods, tools)? What does the use of the management model yield? How well does the management model work? What control and settlement mechanisms are there?

Objectives regarding walking and sojourning in public space

a. What objectives are used (themes, ambition)?
b. Who set the objectives and who play a role in the realization?
c. Why does your organization choose these objectives?
d. When must the target be achieved? Are there intermediate steps and benchmarks?
e. Where do the goals come from? Where should the objectives be achieved?
f. How are the objectives to be achieved? (process, methods, approach, organization, preconditions, tools, priorities)

Vision, strategy and policy with regard to walking and sojourning in public space

a. What vision does the organization adopt with regard to walking and staying in public space? What rules and policies have been established on the subject or in procedure?
b. In that view, who are the players (decision-makers, implementers, target groups)?
c. Why was this vision and approach chosen precisely? What should the approach yield?
d. When (policy process, planning process, preconditions) will the vision / approach be implemented?
e. Where does the vision come from and where (spatial, organizational context) is the strategy implemented?
f. Which methodologies, approaches, perspectives are used (sectoral / integral, stratification, solution-oriented, decisiveness, innovation, ...)?

Knowledge and professional skills with regard to walking and sojourning policies

a. What types of knowledge and expertise with regard to walking and staying does the organization have within its ranks (analysis, theory, problems, policy space, disciplines, management & maintenance, ...)?
b. Who has what knowledge and expertise (role, experience, how many FTE's)
c. Why is such knowledge acquired, available, needed? What should the bet yield?
d. When (and under what conditions) is that knowledge acquired, available, applied?
e. Where within the organization are the different types of knowledge and expertise available and where can external knowledge be found (FTEs per unit, internal - external)?
f. In what ways are knowledge and craftsmanship acquired and brought in to support and improve walking and living? How is knowledge acquisition, exchange and securing organized? What does the use of knowledge and craftsmanship yield? How well is the situation with regard to knowledge and expertise (focus, impact, policy quality, ...)?

Resources with regard to walking and sojourning in public space policies

a. What resources / tools does the organization have at its disposal to support walking and staying (space in terms of money, manpower, time, knowledge, instruments, tools, communication, hardware / software / orgware, ...)? Which resources are actually used?
b. Who decides how the resources are used (operationally)?
c. Why are those tools used and not others? What should the bet yield?
d. When are which tools / resources used (policy cycle, policy process, timeline, preconditions, ...)?
e. Where can resources be found and are they used (spatial, in which departments / sections and external parties, ...)?

f. How are the aids used (choices, distribution, package, synergy, ...)? What are the returns? How well does the deployment meet criteria regarding validity, coverage, effectiveness, efficiency, reliability, support, impact…?

Co-operation and partnerships with regard to walking and sojourning in public space policies

a. Which partnerships (themes, domain, sub-goal) has the organization entered into? What form does this cooperation take (dialogue, cooperation, coordinated action, coalition, integration, outsourcing,…)?
b. Who works with whom? Does it concern specific organizational units and / or external parties?
c. Why were the different partnerships entered into? What should it deliver to the participants and / or stakeholders? Can you manage that?
d. When does collaboration take place (history of origin, place in a policy cycle, policy process, moment, context)?
e. Where can (potential) collaborators be found and where does the collaboration take place (spatial context, organizational context)?
f. How is cooperation organised (forms of cooperation, critical factors, how obstacles are overcome, trust, solidarity, added value, validity, volume, coverage, effectiveness, efficiency, synergy, reliability, support, impact, ...)?

Voorschoten, RM 2-7-2015

Appendix 7 - W+S policy actor analysis tables

Table 1 W+S policy actors and their features

Key		
Group type	**Motivation**	**Means**
Ass-lob = Association-Lobby	Com = Commerce	Ass = Association
C.G. = Central Government	Com. = Commercial	Beh = Behaviour
C.R. = City Regions	EdProf = Education of professionals	Com = Communication
Con. = Consultants	Entre = Policy Entrepreneurship	Con = connectivity
E.S. = External Specialists	Info = Information	Des = Design
Eng = Engineering	K.M. = Knowledge management	Ed = Education
K.I. = Knowledge Institute	Leg-Cli = Legal task – Client needs	Gui = Guidance
L.A. = Law Enforcement	Opin = News, opiniating	Imp = Implementation
L.A. = Local Authorities	P.sup = Policy support	In = Initiative
Media = Media	R.D. = Research, dissemination	Inf = Information
P.I = Parallel Interests		Kn = Knowledge management
P.S. = Public Services		Man = Managegement
P.T. = Public Transport		Med = Media
Ped. = Pedestrians		P.sup = Policy support
R.A. = Road Authority		Re = Research
Spec = Specialists		Res = Rescue
		Strat = Strategy
Quality		StratDev = Strategy development
Evidence based (scientific)		Sur = Surveillance
Knowledge-based (includes experience, professional judgement)		
Info based (what is offered)		
Strategy based (what is targeted)		

Methodology	
Group type	Grouping on similarity of role in W+S policy captured in actor dossiers
Motivation	Grouping on dossier information motivation captured in actor dossiers
Quality	Grouping on average information quality used in activities captured in actor dossiers
Means	Grouping on similarity of key methods applied in activities, captured in actor dossiers
Contact	Grouping on frequency of experiences with W+S captured in actor dossiers
Impact Quality	Grouping on thoroughness of policy development by author
Key Player	Grouping on expected impact by author, assessment by author
Main targets	Grouping on primary policy target institution by author captured in actor dossiers

Type	Name	#	Group type	Moti-vation	Quality	Means	Contact with W+S matters	Impact quality	Key players	main targets
Cat.	Radboud University - Geography	1	K.I.	R.D.	Evidence based	Re, Ed, Med	incidental	professional	No	national government
Cat.	Utrecht University - Geography	1	K.I.	R.D.	Evidence based	Re, Ed, Med	incidental	professional	No	national government
Cat.	Groningen University - Psychology	1	K.I.	R.D.	Evidence based	Re, Ed, Med	incidental	professional	No	national government
Cat.	CROW	1	K.I.	K.M.	Knowledge based	Kn, Gui, Comm	structural	professional	Yes	L.A.
Cat.	NHTV (Breda University of applied sciences)	1	K.I.	EdProf	Knowledge based	Kn, Gui, Ed	structural	professional	Yes	future professionals
Cat.	SWOV	1	K.I.	R.D.	Evidence based	Re, Gui, Comm	structural	professional	Yes	Min I&M - WV. L.A.
Cat.	Kennis-centrum Sport	1	K.I.	R.D.	Evidence based	Re, Gui, Comm	structural	professional	Yes	national government, L.A.
Cat.	Health Boards (GGD)	25	E.S.	P.I.	Evidence based	Re, Gui, Comm	incidental	professional	Yes	L.A.
Cat.	Insurance (health; property damage; liability)	243	P.I.	P.I.	Knowledge based	Kn, Gui, Comm	incidental	professional	No	L.A.
Cat.	Platform31	1	E.S.	P.I.	Knowledge based	Kn, Gui, Comm	incidental	professional	Yes	Min I&M - L.A.
Cat.	Windesheim University of applied Sciences	1	K.I.	EdProf	Knowledge based	Kn, Gui, Ed	professional skills	professional	Yes	future professionals
Cat.	TU Delft - TBM	1	K.I.	R.D.	Evidence based	Re, Gui, Ed	incidental	professional	No	national government
Cat.	Med	65	Med	Opin	Info based based	Info based, In, Comm	structural	experiences, observations, opinions	Yes	all players
Cat.	KiM	1	K.I.	P.sup	Evidence based	Re, Gui, Comm	strategy related	professional	Yes	national government
Cat.	Planbureau Leefbaarheid	1	K.I.	P.sup	Evidence based	Re, Gui, Comm	strategy related	professional	Yes	national government
Cat.	Centraal Planbureau	1	K.I.	P.sup	Evidence based	Re, Gui, Comm	strategy related	professional	No	national government
Cat.	Sociaal en Cultureel Planbureau	1	K.I.	P.sup	Evidence based	Re, Gui, Comm	strategy related	professional	Yes	national government
Cat.	Guru's (Jan Gehl, Beasly, …)	10	P.I.	Entre	Knowledge based	Kn, In, Gui, Comm	incidental	professional	Yes	L.A.
Cat.	VeiligheidNL	1	K.I.	R.D.	Evidence based	Re, Gui, Comm, Ed	structural	professional	Yes	national government, citizens
Cat.	Rijksbouwmeester	1	E.S.	P.sup	Knowledge based	Kn, Re, Gui, arbitrage	incidental	professional	No	national government, citizens

Cat.	TNO Institute for Applied Sciences	1	K.I.	R.D., Com	Evidence based	Re, Gui, Comm	incidental	professional	No	national government
Cat.	RIVM (National Institute for Health and Environmental issues)	1	K.I.	R.D., P.sup	Evidence based	Re, P.sup	incidental	professional	No	national government
Cli.	Ped.	0	Ped.	Cli. needs	Info based based	Comm, Ass, Beh	continuous	experiences, observations, opinions	Yes	L.A.
Cli.	Shop keeper	0	E.I.	Com.	Info based based	Comm, Ass	continuous	experiences, observations, opinions	Yes	L.A.
Cli.	Hotel owner	0	E.I.	Com.	Info based based	Comm, Ass	incidental	experiences, observations, opinions	No	L.A.
Cli.	Mens en Straat	1	Ass-lob	Cli. needs	Knowledge based	Kn, Gui, Comm, lobby, Med	continuous	professional	Yes	L.A., national government
Cli.	Ieder(in)	1	Ass-lob	Cli. needs	Knowledge based	Kn, Gui, lobby, Med	structural	professional	Yes	national government
Cli.	Wandelnet	1	Ass-lob	Cli. needs	Knowledge based	Kn, Gui, lobby, Med, RM	continuous	professional	Yes	national government, Cli.s
Cli.	ANWB	1	Ass-lob	Cli. needs	Knowledge based	Kn, Gui, lobby, Med	structural	professional	Yes	national government, L.A., Cli.s
Cli.	VVN	1	Ass-lob	Cli. needs	Knowledge based	Med, Comm, Ed	incidental	experiences, observations, opinions	No	national government, L.A., Cli.s
Cli.	ANBO	1	Ass-lob	Cli. needs	Knowledge based	Kn, lobby, Med	structural	experiences, observations, opinions	Yes	national government, L.A., Cli.s
Cli.	PCBO	1	Ass-lob	Cli. needs	Knowledge based	Kn, lobby, Med	structural	experiences, observations, opinions	No	national government, L.A., Cli.s
Cli.	Visio	1	Ass-lob	Cli. needs	Evidence based	Re, Gui, training	continuous	professional	Yes	Cli.s, L.A.
Cli.	Shoppers	0	Ped.	Cli. needs	Info based based	Comm, evation	incidental	experiences, observations, opinions	No	L.A.
Cli.	Tourism Bureaus	85	E.I.	Com.	Info based based	lobby, Med	incidental	experiences, observations, opinions	Yes	L.A.
Cli.	Employees	0	Ped.	Cli. needs	Info based based	Comm	incidental	experiences, observations, opinions	No	?
Cli.	Culture sector	0	E.I.	Com.	Info based based	Comm, Med	incidental	experiences, observations, opinions	No	L.A.
Cli.	Sport Asss	76	Ass-lob	Cli. needs	Info based based	Comm, lobby	incidental	experiences, observations, opinions	No	L.A.
Cli.	Business world	0	Ass-lob	Com.	Info based based	Comm, lobby	incidental	experiences, observations, opinions	No	L.A., national government
Cli.	Fietsersbond	1	Ass-lob	Cli. needs	Knowledge based	Kn, Gui, lobby, Comm, Med	structural	professional	No	L.A., national government
Cli.	EVO	1	Ass-lob	Com.	Info based based	Comm, lobby	incidental	experiences, observations, opinions	No	national government

Cli.	Chamber of Com	1	E.I.	Com.	Info based based	Comm, lobby	incidental	experiences, observations, opinions	Yes	L.A.
Cli.	Citizens	0	Ped.	Cli. needs	Info based based	Comm, Ass, Beh	incidental	experiences, observations, opinions	Yes	L.A.
Cli.	Residents	0	Ped.	Cli. needs	Info based based	Comm, Ass, Beh	incidental	experiences, observations, opinions	No	L.A.
Cli.	Tourists	0	Ped.	Cli. needs	Info based based	Beh	incidental	experiences, observations, opinions	No	?
Cli.	KBO	1	Ass-lob	Cli. needs	Knowledge based	Kn, lobby, Med	structural	experiences, observations, opinions	No	national government, local government, Cli.s
Cli.	Jantje Beton	1	Ped.	Cli. needs	Info based based	Kn, lobby, Med	incidental	experiences, observations, opinions	No	L.A., national government
Cli.	Local consultative bodies	0	Ped.	Cli. needs	Info based based	Comm, lobby	incidental	experiences, observations, opinions	No	L.A.
Fac.	Amsterdam	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Den Haag	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Breda	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Eindhoven	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Rotterdam	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Molster	1	Con.	Com.	Evidence based	Re, Des, Gui, Comm	incidental	professional	Yes	L.A.
Fac.	Heerhugowaard	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	NS	1	P.T.	Com.	Knowledge based	Con, Gui	incidental	professional	Yes	L.A.
Fac.	CVOM	1	L.E.	Leg/Cli	Strategy based	L.E.	structural	professional	No	Cli.s
Fac.	Utrecht	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Vereniging Nederlandse Gemeenten	1	Ass-lob	L.A. needs	Knowledge based	Kn, harmonisation, P.sup	structural	professional	No	L.A.
Fac.	Politie	1	L.E.	Leg/Cli	Strategy based	L.E., Res, Sur, traffic Man	structural	experiences, observations, opinions	No	Cli.s
Fac.	Katwijk	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Hattem	0	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Experts	80	Con.	Com.	Knowledge based	Re, Des, Gui, Comm	incidental	professional	Yes	L.A.
Fac.	Triangle	11	L.E.	Leg/Cli	Strategy based	Co-ordination, L.E.	structural	professional	Yes	the police, Cli.s
Fac.	Municipal Council	0	L.A.	Leg/Cli	Strategy based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	ProRail	1	P.T.	Com.	Strategy based	Strat, Des, Impl, Man	incidental	professional	Yes	L.A.
Fac.	Prosecuter-General	1	L.E.	Leg/Cli	Strategy based	L.E.	structural	professional	No	the police, Cli.s

Fac.	Road authorities	388	L.A.	Leg/Cli	Knowledge based	Strat, Des, Impl, Man	continuous	professional	Yes	Cli.s
Fac.	Connexxion	1	P.T.	Com.	Strategy based	Con, Gui	structural	professional	Yes	L.A.
Fac.	HTM	1	P.T.	Com.	Strategy based	Con, Gui	structural	professional	Yes	L.A.
Fac.	RET	1	P.T.	Com.	Strategy based	Con, Gui	structural	professional	Yes	L.A.
Fac.	Goudappel	0	Con.	Com.	Knowledge based	Re, Des, Gui, Comm	incidental	professional	Yes	L.A.
Fac.	BOA's	0	L.E.	Leg/Cli	Info based based	L.E., traffic Man	incidental	experiences, observations, opinions	No	Cli.s
Fac.	Fire brigade	0	P.S.	Leg/Cli	Info based based	Res, Gui	incidental	experiences, observations, opinions	No	L.A.
Fac.	Traffic experts	0	Spec.	P.sup	Knowledge based	Re, Des, Gui, Comm	structural	professional	Yes	L.A.
Fac.	Town planners	0	Spec.	P.sup	Knowledge based	Re, Des, Gui, Comm	structural	professional	Yes	L.A.
Fac.	Housing corporations	40	P.S.	P.sup	Strategy based	Comm, P.sup	incidental	experiences, observations, opinions	No	L.A.
Fac.	ITS Spec.	0	Spec.	Com.	Knowledge based	Des, Gui, Impl, Comm	strategy related	professional	No	L.A.
Fac.	(road) building contractors	250	Eng.	Com.	Strategy based	Des, construction/building	structural	professional	Yes	L.A.
Fac.	Regional Traffic Safety Boards	5	Advisory Board	P.sup	Knowledge based	Kn, Gui, P.sup, Med	incidental	professional	Yes	L.A.
Fac.	Complaint desks	400	Complaint desks	Cli. needs	Info based based	Comm	structural	experiences, observations, opinions	Yes	L.A.
Fac.	Rijkswaterstaat (National Road and Waterway Aurhority)	1	R.A.	Leg/Cli	Knowledge based	Des, Impl, Man	structural	professional	No	Cli.s
Fac.	C.R.s	3	C.R.s	Leg/Cli	Strategy based	Comm, P.sup, P.T.	structural	professional	No	L.A.
Strat.	W+S Policy entrepeneurs	0	P.I.	P.I.	Knowledge based	Kn, In, Gui, Comm	incidental	professional	Yes	L.A.
Strat.	Ministry Internal Affairs –DG Governance & Housing (Bestuur en Wonen)	1	C.G.	Leg/Cli	Strategy based	Str-SE-Fin	strategy related	professional	Yes	L.A.
Strat.	Ministry of Infrastructure & Environment DGB - Better Use	1	C.G.	Leg/Cli	Strategy based	Str-SE-Fin	strategy related	professional	Yes	L.A.
Strat.	Ministry of Infrastructure and Environment - DG B (Accessibility) - Roads and Traffic Safety	1	C.G.	Leg/Cli	Strategy based	Str-SE-Fin	strategy related	professional	Yes	L.A.
Strat.	Ministry of Infrastructure and Environment - DG R&W (Space & Water) - Strat	1	C.G.	Leg/Cli	Strategy based	Str-SE-Fin	strategy related	professional	No	L.A.
Strat.	Ministry WVS (Welfare, Health	1	C.G.	Leg/Cli	Strategy based	Str-SE-Fin	strategy related	professional	Yes	L.A.

	and Sports) - Dir. Sports									
Strat.	European Commission	1	E.C.	Leg/Cli	Strategy based	StratDev, Gui, P.sup	strategy related	professional	Yes	national government

Table 2 Policy Actor Dossiers

nr	Type	Name organisation	Interview date
01	Facilitator	Amsterdam	11-4-2014
02	Facilitator	Den Haag	15-1-2015
03	Facilitator	Breda	15-1-2015
04	Catalyst	Radboud University	20-1-2015
05	Strategist	Ministry of Interior affairs	21-1-2015
06	Strategist	Ministry of Infrastructure and Environment - Mobility	30-1-2015
07	Facilitator	Eindhoven	6-2-2015
08	Catalyst	VeiligheidNL	9-4-2015
09	Client	Wandelnet	21-1-2016
10	Facilitator	Rotterdam	26-8-2015
11	Facilitator	Molster Advies	18-9-2015
12	Client	MenS (Streets for All)	15-10-2015
13	Facilitator	Heerhugowaard	6-11-2105
14	Catalyst	CROW	10-11-2015
15	Client	ANWB	15-11-2015
16	Catalyst	NHTV/SOAB	3-2-12-2015
17	Facilitator	National Railways (NS)	9-12-2015
18	Client	VVN	15-12-2015
19	Catalyst	SWOV	14-12-2015
20	Strategist	Ministry of Infrastructure and Environment - Traffic and Traffic Safety	5-1-2016
21	Client	ANBO	7-1-2016
22	Facilitator	Public Prosecutor	12-1-2016
23	Facilitator	Utrecht	13-1-2016
24	Catalyst	NISB	18-1-2016
25	Facilitator	VNG	21-1-2016
26	Client	VISIO	28-1-2016
27	Facilitator	Police	3-2-2016
28	Strategist	Ministry of Infrastructure and Environment - Strategic Policy	3-2-2016
29	Client	Ieder(in)	4-2-2016
30	Strategist	European Commission DG MOVE	17-3-2016
31	Strategist	Ministry of Health, Welfare and Sports	1-3-2016
32	Facilitator	HTM	n.a.
33	Facilitator	Katwijk	27-1-2015
34	Facilitator	Hattem	27-1-2015
35	Facilitator	Alphen aan de Rijn	n.a.

Table 3 Interviewed policy actors – Professional Skills Scores

Frequency of experiences	**	Amsterdam	Den Haag	Breda	Radboud	BiZa - MarK	I&M - Zinn	Eindhoven	VeiligheidNL	Wandelnet	Rotterdam	Molster	MenS	Heerhugowaard	CROW	ANWB	NHTV	NS	VVN	SWOV	I&M - WV	ANBO	Public prosecutor	Utrecht	KC Sport	VNG	VISIO	Police	I&M Strategy	leder(in)	EC	VWS	Katwijk	Hattem	
subject	**class - per year**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**33**	**34**	**total**
Hardly any	< 1x				1	1	1												1		1		1			1		1	1					1	10
Sometimes	1-5x			1														1		1											1	1	1		6
Regulary	6-10x								1							1									1					1					4
(Almost) weekly	11-50x		1					1			1			1	1							1													6
(Almost) daily	51-250x	1								1		1	1				1							1			1								7
Score		5	4	2	1	1	1	4	3	5	4	5	5	4	4	3	5	2	1	2	1	4	1	5	3	1	5	1	1	3	2	2	2	1	93
Years experience (Fte's)																																			
subject	**ass - Fte**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**33**	**34**	**total**
None, superficual					1	1																	1			1		1						1	6
Beginner	<0,2 fte			1															1		1								1						4
Advanced	0,2 - 1fte						1		1		1			1				1		1											1	1	1		9
Experienced	1-5 fte	1														1						1		1	1					1					6
Expert	> 5 fte		1					1		1		1	1		1		1										1								8
Score		4	5	2	1	1	3	5	3	5	3	5	5	3	5	4	5	3	2	3	2	4	1	4	4	1	5	1	2	4	3	3	3	1	105
Coverage																																			
subject	**class**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**33**	**34**	**total**
single issue									1										1	1			1				1	1							6
single domain		1		1	1	1	1	1			1	1					1	1				1		1	1				1				1	1	16
multi domain			1																																1
strategic policies										1					1	1					1					1				1	1	1			8
W+S sys. + Inst. Framew.													1																						1
Score		2	3	2	2	2	2	2	1	4	2	2	5	0	4	4	2	2	1	1	4	2	1	2	2	4	1	1	2	4	4	4	2	2	78
subject	**class**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**33**	**34**	**totaal**
Prof Skills score total		11	12	6	4	4	6	11	7	14	9	12	15	7	13	11	12	7	4	6	7	10	3	11	9	6	11	3	5	11	9	9	7	4	276

** The scores are based on indications given by the interviewed policy actors;

Indications per class (e.g. 'hardly any') are weighed into the score. The lowest class is allotted weight = 1, the highest class has weight = 5; the total score = frequency + experience + coverage

Appendix 8 - Gaps in knowledge

1. Introduction

In the past Hakkert (2010[656]) and New Zealand Land Transport (2019[657]) presented accounts about gaps in knowledge regarding W+S research and policy making. The appendix aims to put in order what gaps in knowledge were detected in the thesis, and examines to what extent the indicated gaps in knowledge still apply after this thesis and which still may hold back improvements of pedestrian, walking and sojourning conditions.

Hakkert (2010) identified gaps in knowledge regarding the following subjects:
1. Lack of data:
    - for application in planning models and tools;
    - for planning and land-use aspects;
    - regarding infrastructure characteristics;
    - safety, i.e. underreporting, and lack of exposure data about pedestrians;
2. Perceived safety;
3. Needs;
4. Economic analysis;
5. Tools for decision makers and politicians;
6. Promising interventions.

Throughout this thesis Hakkert's points 1, 2 and 3 were touched on and substantiated, but economic analysis, tools for decision makers and politicians, and promising interventions could receive only marginal attention. Development, design, consideration and choice of (programs

[656]Hakkert, S. (2010) *Gaps in knowledge* In: Methorst et al., 2010, Part B5, p. 237-244
[657] New Zealand Land Transport (2019) *The Pedestrian Experience.* New Zealand Land Transport, Wellington.

of) interventions fall outside the scope of the thesis (cf. Figure 1.2., the stages of 5. Decision on interventions, 6. Implementation, and 7. Evaluation and re-adjustment).

New Zealand Land Transport (2019) identified three major kinds of gaps in knowledge:
1. Consideration of the rural-urban division;
2. Full recognition of pedestrians diversity;
3. Consistency in measures used for walking.

Contrary to Hakkert's points of attention, New Zealand Land Transport's perspectives on gaps fully concern pre-decisions steps in the policy process on interventions survey and analysis. In the thesis the *rural-urban division* is mentioned, but could not be adequately substantiated; Chapter 4 and 5 substantiated the issue of *pedestrian diversity* with available data, which are as yet far for conclusive; *consistency in measures used for walking* was touched on in Chapter 4 and 5, but still leaves some questions unanswered.

This thesis introduced (relatively) new definitions regarding walking activities and pedestrian safety, which both Hakkert and New Zealand Land Transport implicitly aplied, too, but did not point out. With regard to pedestrian activities this concerns circulation and sojourning in public space; with regard to safety it concerns knowledge about contexts, causes and consequences of falls and assaults in public space. It is no surprise that knowledge on aspects, that are not yet covered by commonly used less comprehensive definitions, is limited.

This appendix puts still existing gaps in knowledge in the perspective of the Measuring Walking Assessment Model (Sauter & Tight, 2010 - cf. Figure 3.4 of this thesis), and elaborations and theoretical consideration taken up in this thesis. Following Sauter & Tight the appendix successively deals with Input, Output, Outcome and Impact aspects of the pedestrian system and changes therein (cf. Figure 3.3. and 3.5).

2. Input aspects (the institutional framework)

As far as the author knows there are no general overview studies on the impacts of institutional organisation ('input') on the improvement of W+S conditions. This thesis' research broadly explored the status quo of the W+S institutional framework, but only covered institutions that were found to be active regarding improving pedestrian, walking and sojourning conditions. It concerns Dutch and some international organisations that presented their activities in documents and on the internet. A much larger group of potentially involved institutions, but did not stand out, is not covered.

Most of the information about W+S activities concerns plans, and strategies and policies for future activities. Very little operational information about what policy actors actually do is captured 'in house' and/or made available. There is also very little information about what room the organisations have to invest and to actually perform. It is often unclear what preconditions they established for concrete, effective, efficient and fair measures to improve W+S conditions, i.e. the five policy pillars *leadership*, *knowledge & professional skills*, *resources*, and *co-operation & partnerships*. For better support of policy development and implementation, this thesis' explorative account needs to be advanced to test, validate and substantiate its findings and conclusions.

3. Output aspect (institutional products & activities)

3.1. Needs and abilities of (potential) pedestrians

Very little is known about the degree to which policy actors facilitate the heterogeneous pedestrian W+S needs and desires. This thesis explored (potential) pedestrians needs and abilities, as well as what is required to comply and enable walking and sojourning. It was mentioned that many (potential) pedestrians, and particularly vulnerable groups, do not structurally voice complaints. The degree to which facilitators in general and locally meet requirements regarding the full range of needs and abilities is unclear. Such insights are needed to determine in what cases additional measures should be developed and taken.

3.2. Physical environment

This thesis concluded that in most cases facilitators do not structurally and systematically capture and manage walking and sojourning facilities: asset management is scarce. Consequently the distribution and qualities of such facilities are unknown, and cannot be used for determine the degree to which (vulnerable groups of) pedestrians are exposed, facilitated and run risks. The insights could function as (new) starting point for policy development.

3.3. Transportation environment

An important aspect of walking concerns walking to and from other modes. In many cases Knowledge is acquired about transfer site conditions (e.g. public transport stops, parking facilities), schedules and routing, but not about the quality of walking routes towards and from the transfer points, as a necessary precondition for the use of the follow-up modes. Insight in the degree to which qualities of such routes do and do not match requirements, lacks.

3.4. Social-normative environment

The social-normative environment includes both formal (coded) and informal behavioural rules (including culture, group- and personal attitudes towards walking and co-existence in public space). Although formal behavioural rules are laid down in legislation and instructions, many people are not adequately informed about them. This is even more true for informal rules; these are based on social perspectives and agreements about attitudes, observed behaviour, education and various forms of communication. There is very little research about the pedestrians' awareness of behavioural rules and agreements, and what the consequences of lack of awareness are.

3.5. Communication and Information and Communication technology

Whereas much research and industry attention is given to communication and Information and Communication Technology for vehicle drivers/riders and vehicle traffic, knowledge about the utility of and opportunities delivered by ICT applications for the support of pedestrians, is sketchy.

4. Outcome (Performance, behaviour & perceptions)

4.1. Walking and sojourning activities

In most countries travel surveys are carried out on a regular basis. In general these travel surveys do not cover the full spectrum of walking activities; whereas main-mode walking usually is more or less completely captured, this is not true for sub-mode walking, circulation, and particularly sojourning in public space. Furthermore gaps in knowledge concern the relatively large groups of professional walkers, tourists and impaired and disadvantaged walkers. Adequate statistical exposure data about vulnerable and disadvantaged groups (cf. Reference

Standard Pedestrian) are lacking. This forestalls correct utility assessment for use in planning and for prioritising fair improvements of pedestrian facilities. Data should also address differences between urban, semi-urban and rural conditions (cf. urban-rural division, urban density), and between utilitarian and recreational W+S.
In the Netherlands (and probably most other countries as well) the methodology of travel surveys has changed several times over the past decades, causing trend breaks in the data. Because of these trend breaks valid time series cannot be derived. This way little can be said about developments in walking (and sojourning in public space) over time and the urgency of interventions to better support pedestrian activities.

Knowing that responses to travel survey questions regarding walking are often biased (the respondents forget to mention walking trips, and particularly those to and from other modes; estimations of distances and time walked are often inaccurate), special validation studies are needed. These validations can yield indicators for average sub-mode walking trips towards/from car, bus, tram, train etc. for correcting exposure data and the use in planning instruments.

Data with regard to the relation between the volumes of disadvantaged W+S groups and actual qualities (cf. basic, convenience and tempting arrangements; consequences of shared space or detours; perceptions of qualities; evaluation of interventions) are not available.

4.2. Accidents, casualties and damages
This thesis identified a number of lacks in safety data and knowledge:

- On the national level in many cases triangulation of data can yield a reasonable valid picture of safety conditions, but on the local level this is not an option (Death Causes data, hospital admittance and Emergency Department data do not include specification of location). Police and insurance data (which specify location) do not adequately cover casualties from accidents and assaults amongst pedestrians. Consequently local authorities are in the dark about this;
- Because of methodological changes and societal developments trend breaks and/or changes in coverage of medical treatment cases occur. Research is needed to pinpoint the (external) influences on data acquisition and correct time series and overview statistics. With regard to falls and assaults no location specific casualties data are available for use in local safety assessments;
- Research results on assaults on pedestrians in public space are not available;
- Knowledge on long term effects of injuries and impairments lacks. Na data are available on economic and social consequences, transport poverty etc. Evidence on the national level is rare and not available on the local level;
- Safety evaluations of interventions are rare. This way it is difficult to determine whether planned interventions (e.g. relative safety of crossing facilities, law enforcement, shared space etc.) is promising or not.

4.3. Atmosphere, experiences and culture
In design studies often address the relevance of atmosphere, experiences and culture. There is however very little academic research on its effects on the volume, safety and experiences of W+S; the few available studies generally are location specific and cannot validly be generalised.

4.4. Perceptions, satisfaction, motivations, attitudes & wishes

There is a surprisingly small number of studies on perception, satisfaction, motivations and attitudes of (potential) pedestrians, and the ones that are available are restricted to a specific W+S aspect, e.g. the safety of road crossing, reasons to walk towards certain facilities, satisfaction of hiking routes, attitudes towards safety, or local conditions. The results of such studies cannot be validly generalised to walking in general (i.e. kinds of walking, relation with pedestrian needs and abilities, utilitarian versus recreational walking, relation to the degree to which facilities meet quality requirements regarding relevant user groups, urban rural division, social exclusion, media role in perceived mobility and safety, the effects of rewards and punishments, etc.). Results from studies on likes and dislikes are not consistent, and rarely put the results in a context of pedestrian needs, motives, abilities, disadvantages etc. In sum, very little is known about actual perceptions, satisfaction, attitudes a& wishes.

5. Impact aspects (Bottom-line effects; benefits)

Decisio, Molster & CROW-KPVV (Lelieveld et al., 2018) explored the effects of investments in walking. They identified divers cost-benefit ratios compared to other modes, costs of infrastructure and use of space, different impacts regarding mobility and transport, safety, the environment (ecological impacts), the economy, and health consequences. Their main conclusions were:

1. Investments in walking yield demonstrable and very diverse benefits;
2. Information is available about many kinds of benefits, but the information is not always comprehensive or usable;
3. Knowledge about the effects of interventions on the number of pedestrians is especially scarce.

This thesis identified, amongst others, lacks of knowledge regarding:

- Economic, social ecological and health impacts of the four kinds of walking;
- Social impacts of transport poverty, of injuries, age, gender and ability related mobility restrictions, Social Economic Status groups on walking;
- Costs of pedestrian accidents and assaults, including secondary costs (e.g. informal care, loss of income, loneliness)
- Costs of (not) complying with basic W+S requirements, such as (micro and macro) economic effects of not complying to reachability requirements for destinations that matter, social exclusion effects of transport poverty, costs and social effects of needing accompaniment (support) for W+S.

Appendix 9 - Background: thesis' sub-studies[658]

In this Appendix background information of some important knowledge issues is presented.

The Background: thesis' sub-studies comprises the following sub-studies:

1. Deduction study Policy Life Cycle – Critical Factors. → p 659
2. Explorative study Policy Pillars – points of interest for analysis → p 669
3. Impacts of Risk Awareness and Risk Acceptation on policy → p 721
4. Policy justifications → p 725
5. Diffusion of Innovation Theory → p 734
6. The role of perception in walking and sojourning in public space policy → p 736
7. System and Result responsibilities → p 740

1. Policy Life Cycle – critical factors model

1.1. Introduction

In Chapter 6 Status Quo Institutional Framework Winsemius' Policy Life Cycle model (6.5.2) is summarized. From this model critical factors regarding effectiveness of policy making are deduced. In the main text of the thesis a summary of the deduction study is entered. This Appendix presents the full text of the deduction study.
In the deduction study it is indicated that risk awareness can trigger policy development, and that risk acceptation and policy justification factors will affect the outcome of the W+S policy

[658] This appendix partly is a further development of the author's own work as part of the COST358 Pedestrian 'Quality Needs, published at www.walkeurope.org, www.walkeurope.eu, and www.walk21.com/pqn-project.

process. In the current Subsection these aspects will be dealt with in more detail. First current insights regarding risk awareness and risk acceptation will be highlighted; next some modern views concerning policy justifications, potentially affecting W+S policy development and implementation, will be presented. In both cases also consequential research question for this thesis will formulated.

1.2. Winsemius' Policy Life-cycle model

Winsemius' Policy Life-cycle model (see Figure XI-1) explains along what lines policy processes regarding acknowledged policy issues develop. The model forms a good start for deductions regarding the identification of general requirements for policy initiatives to support and promote walking and sojourning in public space.

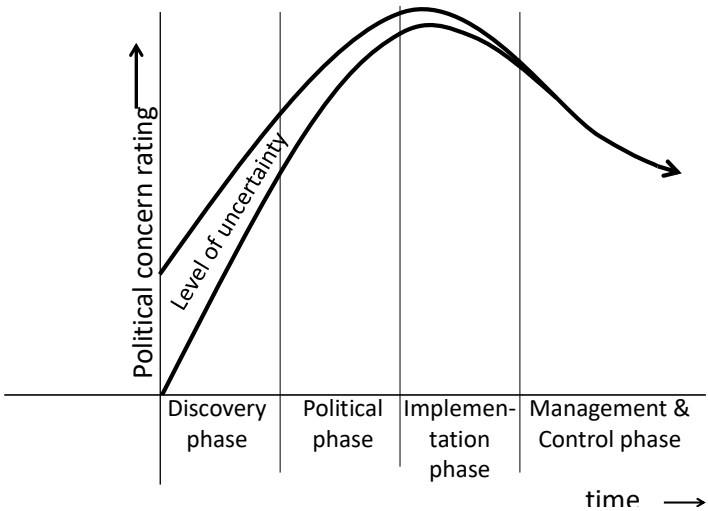

Figure IX-1 Winsemius' Policy Life Cycle model

For the Vulnerable Road Users report (Methorst, 2003) and the Final Report of COST 358 Pedestrians' Quality Needs (Methorst et al., 2010) I freely translated Winsemius' linear model into a cyclical model (see Figure XI-2). Winsemius' account about the main steps in the policy life cycle makes clear that consecutively awareness, willingness to act, abilities and implementation, co-ordination and evaluation are preconditions for W+S policy development, implementation and impact on society. The adapted model discerns the following sequence of phases which the policy agent is likely to go through for achieving improvement of W+S conditions[659]:

[659] In the Vulnerable Road Users report the phases were called 'Know', 'Want', 'Can' and 'Do'. In the PQN report the headings were amended to 'Awareness', 'Willingness to act', 'Opportunities, competences and skills' and 'Implementation'. For this thesis again new headings were decreed.

I. Awareness
II. Commitment
III. Competence
IV. Performance.

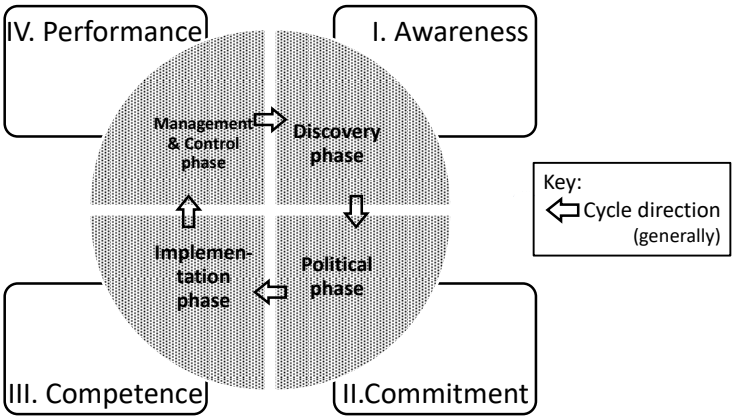

Figure IX-2 Policy Life-cycle - critical factors (adapted from Methorst, 2010)

1.3. Policy Life-cycle - critical factors

In this thesis the earlier 'translations' are used for an advanced assessment of the critical factors for effectiveness of policy development and implementation implication (see Figure IX-2 and Table IX-1 Conversion Winsemius model into Policy life-cycle circular model). Through literature study, working group discussions, and feedback on notes and articles, I identified and substantiated critical preconditions, opportunities, triggers, obstacles for, and counterforces against W+S policy development. In this part of the Policy Life Cycle – Critical Factors study report the results of this work are presented, and conclusions and research questions about requirements for W+S policy development are formulated. In each of the pieces below with regard to the phases, I first define the phase, then go into the role of the activities in W+S policy making and implementation and finally discuss what factors predetermine the outcome and impact of the activities.

Table IX-1 Conversion Winsemius model into Policy life-cycle circular model

Winsemius - Policy Life-cycle phase		**Policy Life-cycle critical factors**
Phase	***Activity***	***Keywords***
Discovery phase	Identifying the issue	I. Awareness [Knowing, insight, conscious of, being concerned]
Political phase	Formulating (new) policy	II. Commitment [Willingness to act]
Implementation phase	Implementing (new) solutions	III. Competence [Opportunities, abilities, competences and skills]
Management & Control phase	Management & Control	IV. Performance [Doing, co-ordination, monitoring Plan-Do-Check-Act cycle]

I. Awareness

In this thesis awareness is *defined* as the policy agent's concern or dissatisfaction[660] about and well-informed interest in W+S (pre-) conditions or developments. Thus awareness comprises more than just knowledge about, insight in or being conscious of W+S conditions: it also comprises that the policy agent is being aroused and concerned about it, perceiving the conditions as matters that need attention. It concerns knowledge that incites emotions, like compassion, fear, anger, joy, feeling of belonging.

The *role* of awareness in the W+S policy process is that it stipulates W+S policy development. It is true that, even without awareness of a condition, unwittingly and haphazardly a change agent can bring about change in the W+S system. In some cases problems are accidentally solved that way, but one could argue that this is rather 'autonomous' than (conscious) policy driven. Thus a critical factor for the improvement of walking and sojourning conditions is awareness of the need for improvement at the stakeholder level (OECD/ITF, 2012, p 85). When there is no awareness of a (potential) problem, there is no chance that tackling the problem will even be considered. Authorities and providers must know and feel that there is something wrong and, for starting an effective policy process, they also must have an *accurate* image of what kinds of undesirable events might happen (Lyons, 2003, p 3), for which in the end the community gets the bill. In this context Vlakveld (2001) discerns 'knowing', including facts, procedures and insight, and 'feeling', including disposition, emotions and attention.

Awareness is *predetermined* by a number of factors. In literature I found references to the following factors: detection, perception and prioritization, cognitive processes, a person's or institution's interest, risk awareness and risk acceptation, and perception bias. These factors are dealt with successively.

From psychology it is known that in general not all phenomena are equally well *detected, perceived and prioritised* in the same way (Atkinson et al., 1990; Steffen, 1975). As remarked before, some problems are quite visible and obvious (first order problems), others are only detected when studied more closely (second order problems) and some basic problems are only detected if carefully looked for (third order problems; Rumar, 1999).

Knowledge acquisition involves complex *cognitive processes*: perception, communication, association and reasoning; while knowledge is also said to be related to the capacity of acknowledgment in human beings (Cavell, 2002:238-266). Important factors are perceptibility of an issue, the differences in scope of individuals and of providers on the collective level, perception mechanisms and the policy maturity (presented later in this section) regarding the issue in question. There are many subjects competing for attention. If something stands out and it causes some kind of emotion, like arousal, surprise, amazement, curiosity, greed, discontent, fear and anger, chances are that reason is felt to take a closer look, and record or even study the matter (Atkinson et al., 1990). In the Preamble in Chapter 1 it was mentioned that humans generally tend to overlook common things and focus their attention on special conditions (Steffen, 1975). This is also true for mainstream research and policy development. Special conditions get researched, common conditions tend to be neglected.

[660] Dissatisfaction is "*the lack of satisfaction"; Satisfaction is 'fulfilment of one's wishes, expectations, or needs, or the pleasure derived from this*" (https://www.lexico.com/definition/satisfaction, = Oxford Dictionaries, accessed 2013;). This has to do with the appreciation of one's current position, system shortcomings, and (increasing) negative balance in perceived gains and losses.

A third factor influencing detection of a phenomenon is a person's or institution's *interest* in matters. Jacobs (2009) observes that universities (in the Netherlands) focus on 'curiosity driven' pioneering research, and enterprises and public bodies focus on 'usefulness driven, problem solving research' and that it concerns two rather separate worlds. He also observes that university education of researchers is almost uniquely directed at curiosity driven - discipline directed research. On the other hand, university researchers are obliged to acquire credits related to the quality and number of articles published in scientific journals. Consequently (young) university researchers with a view on adjacent fields and experience in multidisciplinary applied science are quite rare. In general university institutes' choices of research subjects are more and more determined by large companies and financial opportunities, i.e. instantly applicable knowledge. The researchers themselves appear to be more idealistic and many state that they are triggered by a subject because it is interesting or socially relevant, or because they want to help others to advance (Jacobs, 2009).

The fourth factor concerns risk awareness and risk acceptation. From several studies (i.e. Wildervanck, 1988; Hollander & Hanemeijer, 2003; Derriks, 2011)[661] on risk awareness and risk acceptation, it is clear that the degree to which some kind of impact is perceived to be a risk also matters a great deal. In most cases people do not have factual insight in the 'objective' danger and risk of a situation. Furthermore, some risks are feared more than others. These psychological mechanisms will bias the perceived urgency of problems compared to evidence based urgency ranking. On the one hand much feared risks can trigger policy development ('the government should do something about it...'). On the other hand, in political discussions it will take great effort and courage to overcome the effects of unwarranted low personal valuations on priority discussions regarding walking and sojourning in public space in relation to other issues, as walking scores low in almost all of these personal valuations.
Fresco (2011) argues that the perceived urgency of an issue can differ very much from priorities that are science based. With regard to the measurable effectiveness of an approach, in the end policies based on facts, if directly available and valid and reliable, will be more productive than policies based on perceptions that are inherently somewhat biased. A system approach to walkability policy development requires a combination of pioneering and multidisciplinary usefulness driven research, which apparently is beyond the separate curiosity and usefulness driven worlds, and can hardly be expected to arise spontaneously within those circles. The effects of these biases need to be taken into account. The greater the bias, the more effort has to be taken to detect the factor and to communicate about its policy relevance.

From the above it can be concluded:

- A basic precondition for improved support of walking and sojourning is awareness of deficits in the system that really matter. This awareness is based on perception, which in turn can be based on knowledge (bits and pieces of information placed in an expertise context);
- Not all phenomena are equally well recognised, acknowledged and/or researched. Many factors potentially affect the detection and awareness of W+S system strengths, weaknesses, opportunities and threats. It is important to know what relevant W+S determinants and conditions are not 'automatically' detected or neglected in research, and why they are not detected or researched;
- When factual knowledge on the functioning of the system is lacking, policy actors are not likely to become aware of a need for improvement. It is critical that researchers, policy

[661] See also Section 3 of this Appendix where I provide some background information on this subject.

makers and providers at the right place and time know and understand what the real issues and options are; the policy actors' perception should match the facts;

- Many subjects are competing for attention. This prompts researchers and policy developers to be selective. W+S determinants and conditions have proven to be rather susceptible to be marginalised[662].

II. Commitment

Following Oxford Dictionaries, in this thesis 'commitment' is *defined* as the state or quality of being dedicated to a cause, activity, etc., which to my mind is characterised by taking responsibility with regard to the change processes and a willingness to act. Commitment concerns matters of interest of which the emotional load beats competing matters in that regard, creating a significant level of urgency. A policy actor is 'committed' when the felt urgency is combined with a feeling of responsibility and accountability, and a willingness to act.

Regarding the *role* of 'commitment' in W+S policy development and implementation, it turns out that 'awareness' in itself is not enough to produce change. Once a problem is recognised and roughly rated, the responsible authority must be willing to take action (OECD/ITF, 2012, p85). This will only come about when this authority somehow owns the problem and is stimulated to feel responsible for taking care of the issue. If the policy agent is content with the current situation, no movement, including research into the matter, can be expected. Movement will only come about when the policy agent has aspirations with regard to changes, usually captured in policy aims and targets.

Commitment is *predetermined* by a number of factors. In literature references were given to the following factors: influence of external parties, sacrifices and rewards, and responsibilities, accountabilities and leadership.

Regarding, the first factor, influence of external parties[663]: from psychology it is known that external parties need to keep on asking questions and 'stir in the pain', give temptation to act, flatter, intensify urgency and reassure that change indeed is an attractive and viable option (Atkinson et al, 1990). Feitelson and Salomon (2004:14) argue that '*innovations are not developed in response to problem awareness or need, but rather as a result of* [political] *entrepreneurship'*. In their opinion there are two kinds of transportation (read: W+S) innovations: originating from industry interests (profit driven) and policy innovations, originating from experts and professionals (policy suggestions, which the promotors, termed policy entrepreneurs[664], believe in). '*Ideas are promoted constantly, but they can become concrete proposals at specific points of time'*, when it is opportune to put these ideas on the political agenda[665]. Kingdom (cited in Feitelson and Salomon, 2004:15) calls these moments 'policy windows'.

Policy suggestions can run into resistance. Knowles and Linn argue that resistance can be overcome by persuasion (Knowles et al., 2004). Two important revelations about persuasion are that acknowledging resistance, scepticism and inertia helps to reduce it, and raising reactance makes a strong message more persuasive.

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662 Braman (2003): 'We have been on our feet too long to study the art of walking'.

663 With regard to politicians and decision makers experts and advisors within the organisation can also be considered to be external parties.

664 as such termed by Kingdom (1984, cited by Feitelson & Salomon, 2004, p14).

665 Below, under section 2.3 of the Appendix, when the author deals with the question 'How are W+S strategies and policies developed and applied and what factors drive it?' a more complete citation of Feitelson and Salomon's model on the adoption of innovations is given.

With regard to the adoption of innovations Feitelson and Salomon (2004) distinguish three kinds of (external) active agents: experts, industry interests and non-business interests. Experts influence the perception of problems (crises), suggest innovations and point to technical requirements and technical feasibility. Industry interests also influence the perception of problems and suggest innovations, but also influence sanctioned discourses (e.g. parliamentary or council discussions about the problem) and social and political feasibility. Like industry interests, non-business interests groups influence the perception of problems, sanctioned discourses and social and political feasibility. The actual adoption of innovations depends on technical and political feasibility. Political feasibility itself depends on social feasibility (e.g. support of the majority of voters), sanctioned discourses and decision making procedures (Feitelson & Salomon, 2004).

The second factor is identified by Risser (2009), who states that the dominant mechanism regarding the willingness to act concerns costs (monetary costs, effort, sacrifice, 'sticks') and benefits (rewards, or 'carrots'). In the field of economics this is referred to as Utility Theory. Commitment decisions generally depend on the expected rewards compared to the expected risks and disadvantages. The benefits will always be weighed against what is expected to happen if no action is taken. If the expected rewards adequately exceeds the 'sacrifices' to be made, those who have a choice may take the initiative. If the 'sacrifices' outbalance the expected rewards, the initiative will most certainly not be taken.
According to Risser (2009) the reward can be highly practical and materialistic, but also idealistic or ethical, like 'doing the good thing' (see also Subsection d. on policy justifications). Walking and sojourning fits the current political atmosphere that favours a sustainable future. In such a context failing to support the issue might be perceived unwise because of possible negative effects. Depending on the policy agent's role and aspirations, supporting walking can possibly help delivering a green image and thereby re-election or it yields grants from high level authorities like the European Commission or from central government like in the UK, where central government actively rewards local authority initiatives within the road safety policy framework.

This leads to the third factor: responsibilities, accountabilities and leadership (Geller, 2001). From the OECD report on Pedestrian Safety, Urban Space and Health I conclude that it is important to prevent and tackle confusion about who is in charge and who should take the lead (OECD, 2011, p 11-22). With regard to the walking and sojourning issue in most countries there appears to be no compelling legal or cultural reasons for national or regional governments to take responsibility for W+S conditions and W+S policy preconditions. Although almost everyone agrees that walking and sojourning conditions are important, there seems to be a general confusion about who is in charge and who should take the lead. This leads to shunning responsibility, like national government assuming that local authorities take care of the issue; local authorities can hide behind lack of guidance from central government and on the other hand assume that planners and designers take care of the pedestrian's interest; planners and designers assume that, since it is not explicitly asked, it is not a priority; the police refer to the citizen's own responsibility; pedestrians blame car drivers; car drivers blame careless pedestrians and negligent authorities; the elderly are afraid to ask for protection; children are unaware of their responsibilities and just play; the handicapped suffer but rarely voice their suffering or claim their right for support; courts treat pedestrian's claims as minor cases or 'acts of God'.

With regard to mechanisms regarding willingness to act it can be concluded:

- Commitment does not automatically follow up awareness. It does not happen when a passive reaction seems to suffice; only when taking action is felt imperative relative to tackling other urgent matters, commitment to (innovative) changes will happen;
- Innovations are not developed in response to problem awareness or need, but rather as a result of political entrepreneurship. There are two kinds of W+S innovations: originating from industry interests (profit driven) and policy innovations (expertise driven). Although ideas are promoted constantly, they can become concrete proposals at so called policy windows, when it is opportune to put these ideas on the political agenda;
- Commitment decisions generally depend on the expected reward compared to the expected effort, risks and disadvantages. Rewards can be financial benefits, but can also be enhanced image, esteem, self-esteem, desired leadership, contentment, ease of mind or feeling good, i.e. by fulfilling one's duties or achieving settled targets;
- Commitment is connected to feeling responsible and accountable for the improvement of conditions. Responsibility and accountability are driving forces ('drives');
- Commitment does not manifest in isolation. It takes place in a playing field, and the subject can choose to take up the roles of leader or follower;
- In many cases obstacles to commitment probably can be overcome. Expected rewards need to balance out expected sacrifices and punishments.

III. Competence

Oxford Dictionaries *define* competence as the ability to do something successfully or efficiently[666]. Fuller argues that a person's competences are defined by personal (here: the institutional framework's) characteristics, education and training, and experiences, which together deliver understanding, attitudes and skills (Fuller, 2005; Wegman et al., 2006; see Figure 3.10). In this thesis the institutional framework's (and their individual policy actor's) competences are defined wider: they also comprise legal and informal authority.

Given political or institutional willingness to take action to improve walking and sojourning, the institutional framework has to be able to successfully implement the plans. The *role* of 'competences' regarding W+S policy development and implementation is to assure that the policy actor is capable to make use of available windows of opportunity to improve W+S conditions and hence to support walking and sojourning in public space.

For developing adequate W+S improvement plans, the policy actors within the institutional framework (and a policy actor's organisation) need the authority and windows of opportunities, the tools, the skills and the necessary support (OECD/ITF, 2012, p 85). In the next subsection I will go into policy opportunities in relation to the distribution of powers, and the latitude and span of control of policy developers and decision makers. In the current subsection I will first touch on the main factors that, apart from the individual player's latitude and span of control, determine opportunities and competences for successfully implementing policies: 1) authority, 2) tools ('production factors'), and 3) abilities and skills.

Regarding the first factor 'authority': without the proper legal authority an organisation is not allowed to implement their planned actions. On the other hand dedicated legislation, clear and accepted responsibilities supported by financial and organisational arrangements, like a national

[666] http://www.oxforddictionaries.com/definition/english/competence?q=competence [2-1-2014]

plan, are believed to provide ample opportunities for interventions to support walking and sojourning (Sauter, 2003, p 39-52). Lack of informal authority, i.e. implicit or explicit consent and/or support of affected external stakeholders, can also be a powerful stumbling block, because the struggle against objections sometimes takes years and costs a lot in terms of energy, money and image damage. In this context it is essential that the plans are justified and that the justifications are properly substantiated and documented, particularly if the plans affect the interests of powerful stakeholders.

The second factor concerns implementation and management & control tools. Depending on the content of the plan in most cases tools are needed for the implementation of the plans: money, manpower, information, a proper organisational structure and strategies, hardware, software, monitoring instruments etc. When the plans involve participation of external parties 'sticks' and 'carrots' will be needed to motivate them to do what is expected (OECD/ITF, 2012).

Regarding the third factor, abilities and skills, the following decisive aspects were found: the education of practitioners (e.g. Meessen, 2007; Weggeman, 1997); craftsmanship and knowledge (Baart, 2012); planning, organisation and management of implementation (e.g. McLoughlin, 1969; Johannessen & Olsen, 2011); communication skills (e.g. Johannessen & Olsen, 2011). Lack of necessary skills can degrade the effectiveness of implementation substantially (Baart, 2012). The interventions need to be developed, designed and managed. Windows of opportunities present themselves if they are looked for and are recognised[667]; the desired improvements ('needs') can only be achieved if abilities match the aspirations.

The quality of policy development, substantiation and elaboration of interventions and the design and construction of concrete measures depends on *education of practitioners*. Currently there is little attention to walking and sojourning issues in curricula for practitioners. Apart from some specialised institutions like the American Pedestrian and Bicycle Information Centre the status and level of expertise on the walking issue in professional educational is basic at most. Professional W+S education appears to be hampered by limited awareness and commitment, but also by disdain amongst the teachers (like "designing walking facilities is 'girly architecture'"[668]).

The *craftsmanship and knowledge* needed for developing functional interventions for walking and sojourning is all too often underestimated. A common deficit is that the design is not tuned to important user groups (Baart, 2012), i.e. those that have special needs, like children, persons with mobility handicaps or mothers with baby buggies and shopping bags. In practise it proves to be very difficult to find showcases without serious design or construction deficits.

Another important needed skill concerns the *planning, organisation and management of the implementation of the plans*. Administrative support and implementation procedures need to be skilfully devised, timed, communicated and later, monitored. Flexibility is an asset as adjustments and fine tuning will be necessary most of the time.

With regard to factors affecting competences for improving W+S conditions it is concluded:

- The institutional framework needs to have proper authority, windows of opportunities, tools, skills and the necessary support to be able to improve W+S conditions;

[667] Cf. Steg & Vlek's NOA model: Needs and Abilities together underlie a person's Opportunity Search.
[668] Statement made by Ineke Spapé, lecturer Traffic and Urban Planning at Breda University.

- Legal and informal authority are basic preconditions for being able to improve W+S conditions;
- In theory windows of opportunities present themselves when the agency has justification, proper authority, tools and skills, and the moment is right to take action. This right moment appears when plans are supported by the stakeholders and real rewards compensate (actual) efforts, risks and punishments;
- Adequate communication is another precondition for effectiveness. Stakeholders must be persuaded to support plans for improvement of W+S conditions.

IV. Performance
In this thesis performance is *defined* in terms of how successfully the inherent, agreed or assigned tasks are executed.

The *role* of 'performance' regarding W+S policy development and implementation is to condition W+S policy outcome and impact. Without performance, i.e. factual implementation and management & control, true W+S improvements cannot happen.

Performance regarding W+S improvements is *predetermined* by the following factors 1) effort, 2) quality control and 3) obstacles to effective and efficient implementation of (fair) plans. I elucidate the factors successively in the following pieces.

Regarding the factor *'effort'*, I found that the effort made to meet change preconditions determines the output, outcome and impact of institutional framework's performance. In the next subsection on the institutional framework as a white box, this issue is dealt with in more detail.

With regard to the factor *'management & control'* it is found that measures have to be truly and adequately implemented and ultimately evaluated or audited (OECD/ITF, 2012, p85). A relevant account in this regard is Drucker's (1990) article on the emerging theory of manufacturing, where so called quality circles (such as the Deming circle) are highlighted. In the Netherlands the national road and waterways authority Rijkswaterstaat, as the main policy implementation agent within the then Ministry of Infrastructure and the Environment, adopted the Deming Circle and translated it into their Plan-Do-Check-Act (PDCA) cycle (Kruisbergen, 2007). The PDCA comprises:

- **Plan**: make a plan for the realization of a project, and take care that all preconditions for the execution of the plan are met, including co-ordination of activities;
- **Do**: execute the plan and manage co-ordination of activities;
- **Check**: monitor the execution of the plan and evaluate its results with respect to the project targets and plan specifications and requirements;
- **Act/Adjust**: act on the findings: report on the findings to management, suggest improvements and take care that preconditions for follow-up plans and action are in place.

In practise there are many *obstacles* to be conquered before the actual implementation of plans ('Plan' and 'Do') takes place. In the Plan stage duplications and gaps in coverage of the various activities and approaches must be prevented, particularly when there is more than one implementer. The collaborating stakeholders need to gear their activities to one another. Bad organisation and un-coordinated activities can undermine effectiveness and efficiency of policy interventions and can even be counterproductive. In order to learn from experiences and

improve interventions and processes, it is has been proven opportune to monitor the policy implementation process, its effects and side-effects (Wijnen et al., 1984). A low status of walking and sojourning in the research and policy worlds, fostered by statistics which neglect W+S conditions and performance (OECD, 2011, p 19-22), and common practises do not encourage in depth audits into implementation quality. The European Directive on road safety, for example, makes road safety audits focus on car traffic. In this context at most dangerous pedestrian crossings will be noticed. Although recently some W+S audit instruments have been developed (Gerlach, 2010/2013; New Zealand Transport Agency, 2008; Eady, 2013), these instruments, as far as I know, have not penetrated on the work floor. Furthermore, in high status locations like shopping centres and tourist attractions there is no real danger of sloppy construction, use of inferior materials and little attention to quality control procedures, but it can be argued that in common residential neighbourhoods and particularly industrial districts there is all the more danger of low standards.

With regard to mechanisms affecting performance regarding improvement of W+S conditions it is concluded:

- Impact from improvement of W+S conditions will only happen when policies are actually and effectively implemented. This requires planning, realization of projects, monitoring and evaluation of the execution of the plans and acting upon the findings.
- There are contextual obstacles to be overcome before W+S improvement plans are actually implemented. This is even more true for quality control of the implementation.

2. Policy Pillars – points of interest for analysis

2.1. Introduction

Section 6.5.2 referred to an explorative study into the to identify key features to be considered in research on the Dutch W+S institutional framework. The complete version is presented below. To substantiate the Policy Pillars Model, available literature on the pillars was scanned with regard to a variation of the Topical Questions (Spencer-Thomas, 2012; 5 W's + H):

a. What happens, what is the nature of such a pillar?
b. Who is it about?
c. Why does it happen, why is the pillar is important for policy making?
d. Where does it take place and does the pillar matters most?
e. When does it take place or does it matter most?
f. How does it happen, how are the pillars formed and optimised?

Section 6.3.2 referred to an explorative study to identify key features to be considered in research on the Dutch W+S institutional framework. The full version is presented below.

2.2. Sauter & Tight's assessment model

Although there may be other useful classifications, I choose to use the Sauter and Tight (2010) list of system input[669] components, because it comprehensively covers the institutional framework as a system, and discerns components which are evidently crucial for the

[669] In this case 'input' refers to input towards the W+S system, as pictured in the Figure 3.3.

effectiveness, efficiency and fairness of interventions in the W+S system[670]. The model was extensively contemplated, amended and finally accepted in the PQN project. However, following the policy life cycle presented in the above black box section and the policy process steps presented in this Subsection 4.1.2, I will use slightly different headings and sequence. The following institutional framework *policy pillars* are discerned:

1. Leadership
2. Knowledge & Professional Skills[671]
3. Strategies & policies
4. Resources
5. Co-operation and partnerships.

Regarding W+S policy development as a system approach, it is important to know:

- What the inputs, such as knowledge about the current state, perceived problems and expected changes in W+S conditions, towards the institutional framework are
- How the institutional framework receives and processes this input into interventions in the W+S system
- How implementation of the interventions is organised
- How the implementation of the interventions and their effects are monitored, evaluated and fed back as input to the institutional framework.

The first aspect is dealt with in Chapter 5 Status Quo of the W+S system and Section 6.2.1. about the Dutch W+S policy context. In the current subsection this is taken for granted. This subsection focuses on how information is picked up from external sources and processed into concrete actions to improve and manage W+S conditions.

The research on preconditions for adequate W+S policy development, implementation and management & control, was carried out in three stages, respectively *divergence*, *translation* into research questions, and *convergence* leading to a concise list of tested W+S policy preconditions research questions.

In the *first* stage the focus was on what aspects, processes, conditions etc. need to be covered to acquire comprehensive insight regarding the discerned policy preconditions to be met (divergence). In this stage of the research snowballing principles were used to find literature on theories, empirical evidence and experiences regarding the precondition items. A variety of sources was tapped, such as management literature, social psychological literature, policy evaluation studies and safety management literature. The results were captured in an (internal) discussion note for the Rijkswaterstaat working group for the 2012 assessment of the State of Safety Management within the organisation (Methorst, 2012).

The *second* stage concerned the *translation* of the insights found in the first stage into a list of provisional policy preconditions research questions. From the acquired insights, together with the deliberations of the Rijkswaterstaat State of Safety Management working group, a wide range of questions regarding policy preconditions could be collected, deduced, formulated and finally structured in a questionnaire. The questions are not domain (Safety Management or

[670] For example the McKinsey 7S model, identifying seven performance factors: Staff, Style, Systems, Structure, Strategy, Skills and Shared Values. See website 7smodel.nl

[671] Sauter and Tight (2010) labelled this 'Research & Training'. Following Baart (2012) I find that 'Knowledge & Professional Skills' captures the role of this pillar in the institutional framework better.

W+S) specific. They are directed at generic organisational aspects and meant to lead to a sketch of how the W+S policy system in principle works and what the W+S policy landscape entails, and particularly what roles and functions are or can be attributed to the various policy actors on the national level.

The *third* stage of the research regarding the State of Safety Management (and thereby W+S) policy preconditions, concerned testing of the research questions and concentration into a concise set of research questions (*convergence*). This aimed for the (qualitative and where possible quantitative) assessment of the status quo regarding W+S policy on the national level. To test the provisional research questions, within the Rijkswaterstaat organisation dedicated survey research was initiated (Van der Meer, 2013)[672]. SWOT[673] analysis of the validity and functionality of the answers to the questions was carried out. Based on this evaluation the questionnaire was adjusted. It was found that the ancient Topical Questions (5W + H)[674] based on Aristotle's Nicomachean Ethics[675], which are commonly used in journalism to check completeness of information (Spencer-Thomas, 2012), formed a practical model for organising questions regarding policy preconditions and their substantiation (convergence).

In this subsection each of the discerned institutional framework components will pass in review. The components will be defined and elucidated by the answers to the Topical Questions. This way the carry-over effects of the components and interactions, their position and role within the institutional framework and W+S system interventions, and major contextual processes and drivers will be identified on a theoretical level. Based on this assessment per component, conclusions are drawn and research questions regarding W+S policy preconditions formulated.

To substantiate the Policy Pillars Model, available literature on the pillars was scanned with regard to a variation of the Topical Questions:

a. What happens, or what is the nature of the pillar?
b. Who is it about?
c. Why does it happen, why is the pillar is important for policy making?
d. Where does it take place and does the pillar matters most?
e. When does it take place or does it matter most?
f. How does it happen, how are the pillars formed and optimised?

Each of the subsections concludes with a shortlist of key factors to be empirically assessed in the context of this thesis' research.

2.3. Leadership

With regard to *leadership* my research findings are captured under the headings of the 6 Topical questions[676] tuned to the subject, conclusions and research topics ('in short') for the assessment of the status quo.

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[672] Rijkswaterstaat trainee Mirjam van der Meer performed a study of current policy practises on road safety within Rijkswaterstaat.
[673] SWOT stand for: Strenghts, Weaknesses, Opportunities and Threats.
[674] The Topical Questions are Who is it about, What happened, When did it take place, Where did it take place, Why did it happen, and How did it happen (Spencer-Thomas, 2012; 5 W's +H)
[675] see https://en.wikipedia.org/wiki/Five_Ws#cite_note-:0-6
[676] The When and Where questions are combined in one question about the time-place context

a. What is the nature of leadership in a W+S institutional framework?
In order to describe the nature of leadership in an imaginable W+S institutional framework, first it is necessary to define 'leadership' and then determine what key leadership characteristics regarding the W+S institutional framework context are. The results are based on a literature scan and snowballing. Literature is searched in my dedicated library, Science Direct (search words 'leadership', AND 'policy', 'strategy', 'pedestrian' and more specific search words), and Google Scholar (same search words as Science Direct).

In line with Chemers (1997) and Northouse (2013) I define leadership as "*a process whereby an individual influences a group of individuals to achieve a common goal*" (Northouse, 2013:5). Leadership can be a person or a lead agency, whereas a leader is a person. The leader is a pacemaker and the life and soul of walkability improvements[677]. It can be said that the main challenges of leaders are 1) setting goals and 2) putting a policy process in motion towards achieving the goals, i.e. making sure that the right things are done. The latter comprises controlling the performance factors organisation (influencing and organising followers), time, money, quality and information (Wijnen et al., 1984). In this regard leadership is mainly about *encouraging and managing people* and *making choices*, and choices inevitably concern both benefits (achieving the aims) and costs (loss of freedom, money, investments, using up resources). As such leading includes morality and ethics (Van Wee, 2011). Leadership is usually associated with system responsibility and accountability for the current state of affairs regarding the system.

Harrigan & Newman (1990) found that inter-organisational co-operation and partnership is based on a) propensity, b) power and c) persistence. Leadership is about leader-follower partnership; the content of found publications on leadership can be attributed to one or more of these features, it can therefore be assumed that these features are characteristic drivers for leadership as well. In the following I will concisely consider these characteristics.

Propensity relates to why and how much the leader is interested in leadership and to the leader's awareness of W+S matters. A leader can have personal or organisational *reasons to be interested* to lead. Following Bradshaw (1972) and my own reasoning regarding his taxonomy of needs, these reasons can follow from formal and informal rules (normative interest), or from personal motives (felt interests), or because similar organisations take the lead and leadership wants to follow the example (comparative interests), or is simply assigned to someone, or because it is a logical consequence of the distribution of interests regarding walking and sojourning in public space, e.g. policy responsibility and accountability because of ownership of public space (systemic interests).

Leadership is an aspect of *power*, and it is inseparable from follower's needs and goals (Burns, 1978). Leadership is based on interaction. With regard to achieving W+S conditions change, a leader's power is associated with on the one hand responsibility for W+S conditions and related policy activities, and on the other hand accountability. If leadership is deemed responsible for (some of the) W+S conditions and related policy activities, the contraposition of this responsibility is that a leader can be held accountable for not achieving the issued and/or agreed goals (Rhodes, 1997).
In policy practise the position of leadership and the leader within the institutional framework matters a great deal. Psychology reveals that both leadership traits and the leader's environment

[677] In special cases the leader can be the champion, the frontline strategist (see above under 6.2. regarding the playing field).

shape leadership. '*Researchers on leadership have produced theories involving traits*[678], *situational interaction, function, behaviour, power, vision and values, charisma, and intelligence*, *among others'* (https://en.wikipedia.org/wiki/Leadership). Leadership action can also be shaped by the leader's situation or environment (Atkinson et al., 1990). Consequently, different situations and organisational cultures will call for different leadership characteristics.

Persistence, finally, relates to the leader's enduring commitment to change conditions, in our case W+S conditions. In order to achieve aims, leadership needs to convince other policy actors, and needs to be *persistent*, even when the political decision to implement interventions has been passed long ago and achieving the aims is mainly a matter of management and control. In the following I substantiate these statements.

b. Who is leadership about?

In this paragraph the leadership's playing field is broadly considered. First the 'who' is specified. Next the playing field is considered and the players' roles are defined.

Regarding leadership *'who'* it is necessary to specify what is meant: a person, a legal persona, an organisation, or a role. For politically new W+S issues (cf. Discovery stage of the Winsemius policy life cycle) a W+S *champion*[679] or a W+S policy entrepreneur, functioning as catalyst and leader, most probably emerges from outside the institutional framework (Methorst & Kuiken, 2014). For politically agreed issues leadership can be less personal, more institution related. In this study the focus is on such institutional leadership, i.e. the organisation which leads other policy agents and legal personae. Ideally it concerns someone who personifies the lead organisation[680], who is dedicated to the improvement of W+S conditions, and who on the one hand leads the policy process and on the other hand can be held accountable for the process, product and primary and/or secondary consequences of policy decisions, or the lack of them.

In this thesis the W+S policy *playing field* is understood to comprise all (groups) of persons who have a stake or interest in W+S conditions and W+S behaviour, the so called stakeholders. Most stakeholders have some degree of influence on the system, either negatively or positively. I call the ones that actively aim to influence the W+S system and/or W+S behaviour *policy actors*. The policy actors can enter into a cooperation or partnerships with other (groups) of policy actors.

With respect to their role in the policy process on the community and higher levels,
the questions to be answered are who are the stakeholders with regard to walkability policy making, what are their roles and globally what powers do they have to achieve walkability improvements. A scan of literature on walkability policy literature and discussions within the PQN and OECD/ITF Pedestrian Safety, Urban Space and Health projects did not yield a

[678] Regarding leadership traits, Maxwell (1999:contents) for example identifies 21 indispensable qualities of a leader: '*character, charisma, commitment, communication, competence, discernment, focus, generosity, initiative, listening, passion, positive attitude, problem solving, relationships, responsibility, security, self-discipline, servanthood, teachability and vision'.*

[679] someone who is dedicated and knowing about improving W+S conditions, as well as respected in society and the institutional framework can function as a catalyst (see also Figure IX-3).

[680] like a minister of Transport or of Health, a secretary-general, a CEO etc.

systematic study into the walkability playing field. In order to organise a structured search into the W+S playing field, a theoretical model of the field was developed[681].

In principle four kinds of stakeholders can be distinguished: the strategic policy makers ('strategists'), the tactical and operational policy makers and performers ('facilitators'), pedestrians, their representatives and economic stakeholders ('clients'), and active and concerned parties ('catalysts'). The four kinds of stakeholders communicate and thereby try to influence each other's activities to suit their needs. The institutional strategists, W+S facilitators and clients interact within their normal W+S policy framework. Catalyst interact as outsiders, without formal stakes in the W+S system, and focus on stimulating the formally responsible leaders/strategists and W+S facilitators. They generally do not focus on operational change decisions, as these lie outside their span of control (see Figure IX-3).

With regard to interventions in principle *strategists* are in the lead. For many people national political leaders are the obvious strategists and leaders. In reality however such political leaders may not be motivated and active like that, although ultimately they are responsible and accountable for the activities and progress, or lack of them, in their playing field. Relief can be found if there is a W+S policy entrepreneur, being a highly motivated individual or a small team who does '*much to draw attention to policy problems,* [stimulate] *innovative solutions, build coalitions of supporters and secure legislative action'* (Mintrom & Norman, 2009:649). Such a policy entrepreneur can be a politician, decision maker or policy maker. He can also be an outsider, a dedicated researcher or a regional or local stakeholder, one who looks beyond his normal span of control. Thus the strategist-leaders can be self-appointed or (directly or indirectly) appointed by the other stakeholders. Such an authority cannot successfully implement policies without being recognised by and having interaction with the other stakeholders, the W+S facilitators like planners and managers of the physical environment, the police, property owners, and the *clients*, i.e. citizens, public space users, other affected persons.

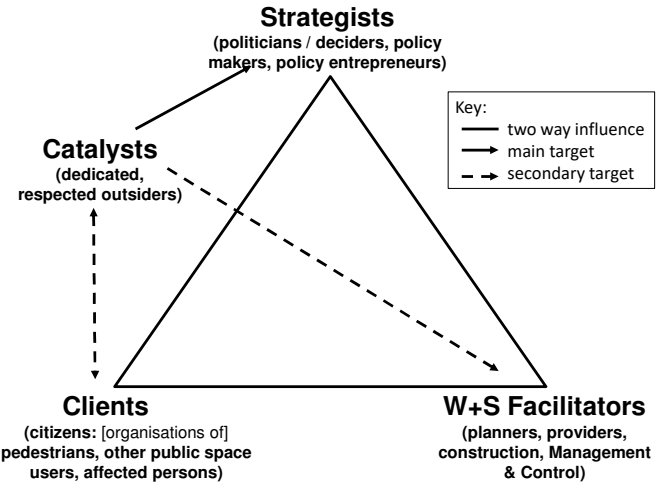

Figure IX-3 Stakeholders and their relations within the policy process (macro level)

681 In the PQN Final Report, Part A Introduction and theoretical framework (Methorst, 2010, p 39, fig. 7) an earlier version of the model on stakeholders and their interrelations was presented. Based on discussions with various experts the terms were changed and the model was extended.

The *W+S facilitators* include tactical and operational leaders such as office directors, strategic planners and the sector managers who take care of the W+S conditions (transportation and public space managers, law enforcement agents). These are mostly professionals who in principle follow the political leader's lead. Depending on the leadership model, the followers have more or less freedom of interpretation and responsibilities. The followers are the organisations or sections within the organisations that provide facilities, that implement the guiders' plans and that take care of management and maintenance of the system. For this they get the necessary resources from or through the leadership organisation. They are included in my definition of the W+S system.

The *clients* of the system are the walkers, sojourners, but also other stakeholders that have an interest in a functioning system, like shopkeepers, schools, offices, pubs, bicyclists, car drivers who parked their car, public transport companies, etc. As citizens they are the claimant, payer, receiver and consumer of W+S facilities. Walkers and sojourners as clients are anonymous (everyone is a pedestrian, hardly anyone feels pedestrian), and in practise do not truly have a voice or bargaining power for claiming W+S facilities. The walkers' and sojourners' interests are represented by the other stakeholders who have an interest in a functional system, including the facilitators and strategists themselves.

A c*atalyst* is someone who is dedicated and knowing about improving W+S conditions, as well as respected in society and the institutional framework. He or she can function as a catalyst regarding public agenda setting, shaking up, sensitizing and mobilizing policy actors and setting the machine in motion for the improvement of W+S conditions. A catalyst is generally not part of the institutional framework establishment and can for example be a known researcher, TV personality, actor, famous medical doctor etc. The catalyst generally addresses the general public for support and aims to mobilize institutional leadership and practitioners through publicity.

c. Why is leadership important in a W+S institutional framework?

In this paragraph I consider why leadership matters in the W+S policy process. In this context I will indicate importance of key leadership tasks. I will close this piece by pointing to the fact that perfection is rarely achieved.

There is a vast body of literature on organisational leadership and why it is important. From this literature it becomes clear that the main reason why leadership matters is that leadership, when policy change is indicated, can be considered essential for starting up and achieving improvements in W+S conditions. In this regard Selznick (1957, p 62) states:

> *'When an organisation lacks leadership, these tasks are inadequately fulfilled, however expert the flow of paper and however smooth the channels of communication and command' (Selznick, 1957:62).*

Selznick (and many others) substantiate the above statement by referring to the key tasks leaders are called on to perform. I adapted Sleznick's account to the improvement of W+S conditions (cf. Selznick, 1957:62-64):

1. *The definition of institutional mission and role*
   The failure to define aims is a major source of irresponsibility in leadership. It comprises self-assessment to discover the true commitments of the W+S institutional framework, as they are incited by internal and external demands. Explicit and clear aims provide justification and guidance for the policy actors' activities.

2. *The institutional embodiment of purpose*
   The failure of embodiment of purpose tends to result in unreliable elaboration and execution of policy, not being in harmony with the spirit and letter of the aims. This includes monitoring progress and keeping alive focus on essential operational tasks. The playing field needs to be sensitive and responding to the leader's way of thinking. For effective and efficient collaboration the playing field 'character' needs to be moulded into a purposeful harmonious 'machine'.
3. *The defence of institutional integrity*
   The failure of defence of institutional integrity may lead to disintegration of the institutional framework and tends to result in the absence of means and tools to achieve the aims. Institutional survival is a matter of maintaining values and a distinctive identity. Institutional integrity cannot be assured by adequate administrative alone. A distinctive identity provides the motivation tools which administrative adequacy lacks. The failure of assembling (internal) stakeholders on the basis of 'logical' association of their strengths, weaknesses, opportunities and threats is a characteristic result of not looking after institutional integrity.
4. *The ordering of internal conflict*
   The failure to ordering internal conflicts tends to seriously affect the institutional framework's performance towards achieving the aims. In an extensive and complex (W+S) institutional frameworks different interest groups form naturally. It can be expected that there are many competing interests, inciting a struggle for power. On the one hand the leader must win commitment of the various policy actors for maximising collaboration, and on the other hand maintain a balance of power appropriate to realise key commitments.

d. Where and when does leadership matter?

In this paragraph of text I specify when and where leadership matters most and what kind of information is needed to determine when and where leadership determines the state of affairs of W+S policy development and implementation.

In Oxford Dictionaries[682] 'where' is defined as 'in what place or position' whereas 'when' is defined as 'at what time'. Both concepts can refer to a specific place or position (e.g. address, institution) respectively moment (clock time, day, week, month, year), or to circumstances, situations or wider contexts (e.g. where or when certain people, things or events come together, a stage in a process).

The question 'Where and when does leadership matter' can be interpreted in specific place/time and in contextual terms. In this thesis the question refers mainly to contextual situations, like performing on internal or external stages, on stages with only peers or dominantly subordinates. On external stages and stages with only peers, to influence people, leadership generally cannot apply command power or punishment as 'weapons'. In such cases rewarding and convincing through credible arguments, emotions (happiness, joy, fear), respect, incentives etc. are the dominant persuasion tools.
Under Subsection '*a. What is the nature of leadership in a W+S institutional framework?'* it was already mentioned that the affiliation of the leader and the leadership scope tend to change during the transition from the discovery phase into the political phase of the policy life cycle.

It is also important to discern ad-hoc reactions and planned interventions. *Ad-hoc reactions and initiatives* are provoked when urgent problems, that have not been foreseen, arise. Leadership

[682] accessed 19-5-2015

may feel forced to decide to take action immediately. In those cases time to properly prepare and select optimal solutions, usually lacks, particularly when knowledge about the problem causes and professional skills regarding the development and implementation of solutions are limited, missing, or expert recommendations are not asked. Such policy decisions tend to produce suboptimal solutions, and in many cases the (real) problem will not be solved. This increases the risk of 'backfiring'.

Planned interventions, provided well prepared and implemented, stand a better chance of solving problems and achieving targets. Obviously, lack of clear choices at the start of a policy process later on result in ineffective or inefficient policies. To be effective regarding the improvement of W+S conditions, leadership must first be sensitive to and aware of the need of improvement of pedestrian conditions. From the assessment of critical factors in the policy life cycle it turned out that risk perception mechanisms can pose a formidable obstacle to understanding the true W+S conditions and state of affairs.

e. How is leadership fleshed out?

This paragraph considers what the driving forces of leadership are and how leadership is fleshed out, i.e. how leadership strategies and activities come about. Under the first paragraph, on the nature of leadership, I referred to Harrigan & Newman's proposition that co-operation and partnership are based on a mix of propensity, power and persistence. In the current paragraph I develop this idea further regarding how leadership can make objectives operational through strategies and policies: how is the process designed and what tools are used to effectuate the strategies, what conditions does leadership have to take into account and how does the process work, what are the success and failure factors.

In practise perfection with regard to leadership is rarely achieved. Meindl et al. (1985) adequately voice this. They find that the romantic images about the vast difference that leadership makes are not backed up by scientific evidence. On the contrary: although leadership is an important change factor, leadership is never fully 'in control' of the group's achievements. Group dynamics block such complete control, and resolve on accountability. Apart from this, the *span and level of control* depends on many other factors, e.g. the leadership's competition, the amount and power of opposition that leadership endures[683], restrictive legislation, the leadership's agreements with other persons and organisations regarding the participants' strategic, tactical and operational latitude (see below, under 'co-operation & partnerships'), the policy process in question, etc.

As described above, leadership over others is characterised by propensity, power and persistence. After describing these important forces behind leadership activities, I discuss how leadership tasks are fleshed out. I close this subsection with some sentences about measuring leadership performance.

Leadership propensity: Policy Maturity Theory

Major preconditions for leadership activities are awareness and the followers' competences to prepare and carry out the changes. Without awareness of the need for change, willingness to act is unlikely. The leader must first recognise (in our case) W+S as *her or his* problem, must feel a need to be informed and be willing to initiate and enforce change of conditions. On top of it the organisation s/he leads must be made and kept able and competent to prepare and carry

[683] The British television series 'Yes, Minister' provides anecdotic examples of office politics subtly undermining the political leaders' lead.

out the changes. Policy objectives, and the effectiveness and efficiency of policy development, implementation and achievements, can be assumed to depend for a large part on the experience and skills which the policy agent has accumulated over the years. Ultimately the changes must in fact be implemented under his/her leadership.

The *policy life-cycle theory* (see also this thesis main text, Subsection 6.5.2) shows that the institutional framework's (leadership's) sensitivity regarding signals from the outside (read: the W+S system and its impacts) depends on what stage the policy life-cycle is in. Particularly during the political phase political interest is building up, and intrinsic motivation to improve conditions can be expected. When transferring to the management & control phase, political interest fades, and there is bound to be less political drive to perform, and competing political issues tend to attract more policy energy.

From Safety Management it is known that the *Safety Culture* is an important driver for improving safety. The maturity of a policy culture amongst others shows itself by the how much leaders and managers trust their staff, personnel and partners doing the right things. With regard to Safety Culture, Flemming (1999) and Hudson (2001) made some interesting observations that are relevant for the pedestrian issue as well. They identify a number of levels of maturity in Safety Culture and they conclude that it is still a long way to the top. Based on Hudson's typology (Hudson, 2001; Gordon & Kirwan, 2004; Flemming, 1999), the stakeholders' pedestrian policy quality can be distinguished along a line from pathological to generative. In Figure IX-4 Hudson's and Flemming's ideas on the evolution of safety culture are combined and adapted to the W+S policy domain.

Based on Hudson's typology (Hudson, 2001; Gordon & Kirwan, 2004; Flemming, 1999), the stakeholders' pedestrian policy quality can be distinguished along a line from denial to to generative[684]:

- **Denial**: with regard to W+S policy culture the worst case is *denial* (Sauter & Tight, 2010).
- **Pathological:** the organisation cares less about pedestrian quality than about being caught or sued for malpractice (Hudson, 2001). At best, staff, management and politicians see the pedestrian issue as an *emerging* problem. At this maturity level the organisation is not interested what others (the media) think about the organisation's attitude and does not feel the need for acquiring information and information management. The general attitude to safety and quality is characterised by: 'Of course there are accidents and other problems. Using public space can be dangerous and we live in an imperfect world. Fine the idiot who had an accident.' (Hudson, 2006). In general a junior employee will be assigned to solve the problem at hand with minimal resources. Available handbooks, like in the Netherlands the CROW Recommendations for Urban Traffic Facilities (CROW, 2004) and 'best professional judgement' are used to tackle problems that the organisation is confronted with.
- **Reactive:** the organisation looks for fixes to problems that were reported by citizens or in the media after they happened (Hudson, 2001). Administrators pay lip service to the importance of the issue but do not formulate targets: 'We are serious about pedestrian safe mobility, but why don't *they* obey the rules?' Staff and management focus on *managing* the

[684] The following typification is based on Hudson's article 'Safety culture, the ultimate goal', Flemming's article 'Safety culture maturity model' and PowerPoint presentations by Hudson, Parker and Rijkswaterstaat, as well as the Shell Hearts and Minds programme publication 'HSE - Understanding your Culture'. In all cases 'Safety Culture' is substituted by 'walking and sojourning policy culture' or synonym.

problem and think that there is nothing better and anyone who claims better performance probably is lying. They do what they feel is as good as can be done (Hudson, 2001). Quality for pedestrians *'is solely defined in terms of adherence to rules and procedures and engineering controls'* (Flemming, 1999:5). At this maturity level the organisation is sensitive to outside signals that something is wrong and files those signals, but no action is taken to acquire additional knowledge. Up to a point staff is educated on methods for solving reported problems within the confinement of the office. 'Best professional knowledge', available handbooks, and sometimes colleagues and the internet are used for solving problems. Management is sensitive to benchmarking by highly influential and media connected research institutes. There are limited resources available for basic analysis and 'fire- fighting' measures; in special cases there is some additional money for more structural interventions, provided the investment suits other objectives as well.

- **Calculative:** the stakeholder has systems in place to manage hazards, which are supported by the administrators and politicians: 'we have the solution'. However, the system is applied mechanically. Staff and management follow the procedures and instructions, but do not necessarily believe that those procedures and instructions are critically important to their jobs or the operation (Hudson, 2001). Staff and management focus on *involving* stakeholders and try to get them to take their responsibility and help solving the problem. Staff and management take care that they are educated and informed on the current state of affairs and common methods for tackling problems that arise. A lot of audits are carried out (Hudson, 2006). The organisation is sensitive to monitoring and benchmarking of any kind (Flemming, 1999). There are adequate resources available for interventions that are affordable and cost-effective in the short and medium terms. Long term efficiency is not taken into account. There is no systematic looking back: evaluation of interventions is only undertaken when there apparently was something wrong. There is also no intention to prospect for hidden problems, so hidden problem stay hidden. Calculative organisations are hard to move because they are comfortable, even if they know that improvement is possible.
- **Proactive:** the organisation has systems in place, including procedures, resources, technical means and staff, to manage hazards, vigorously supported by administrators and politicians (Hudson, 2001). In this stage attention is still focussed on problems and potential problems that are observed, where a problem is only a problem if the observer perceives it as a problem. '*Performance is actively monitored using all data available'* (Flemming, 1999:9). Hidden problems, however, stay hidden if they are obstructed by common definitions and agreed organisational frameworks[685]. Pedestrian quality targets and strategies are laid down in a dedicated policy plan. Staff and management have begun to acquire beliefs that pedestrian quality is genuinely worthwhile and are obsessed by obtaining data (Hudson, 2006). They concentrate on *co-operation*, both within the organisation in integrated teams, including stakeholders from outside the organisation. Staff and management are well informed and educated on the issue and are motivated to gain insight in the functioning of the system and to look for options for improvement. There is no doubt about the potential benefits of pedestrian quality and initiatives are taken to compare the organisations' effectiveness with sister organisations and other trend setters, both nationally and internationally. The aim is to learn and deal with the issue on a State-of-the-Art level. Outcome of current scientific research is applied. There are adequate resources available for a programme of interventions that are cost-effective in the short, medium and long term. Policy robustness is a serious consideration and management and maintenance are fully integrated in the policy programme. The policy programme's results are monitored and

[685] i.e. road safety is defined by accidents involving at least one moving vehicle. Single pedestrian accidents are not prospected, as they fall outside the definition. What is not looked for, is not found.

evaluated on a regular basis. Communication with the outside world comes natural and is not restricted to successes.

- **Generative:** There is a chronic anxiousness regarding quality deficits Flemming, 1999). At this stage the aim is not so much to solve or prevent (perceived) problems, but to improve the quality of the pedestrian's environment so that he feels more at ease and can perform optimally, stimulating the pedestrian to bring prosperity to the community. Quality thinking is fully integrated into everything the organisation does. The value system associated with pedestrian quality is fully internalised as beliefs, almost to the point of invisibility (Hudson, 2001). The organisations' activities are directed at continuous improvement of pedestrian quality. For this they initiate or undertake scientific research and development. New ideas are welcomed (Hudson, 2006). There is a tendency to take an increasingly wider perspective.

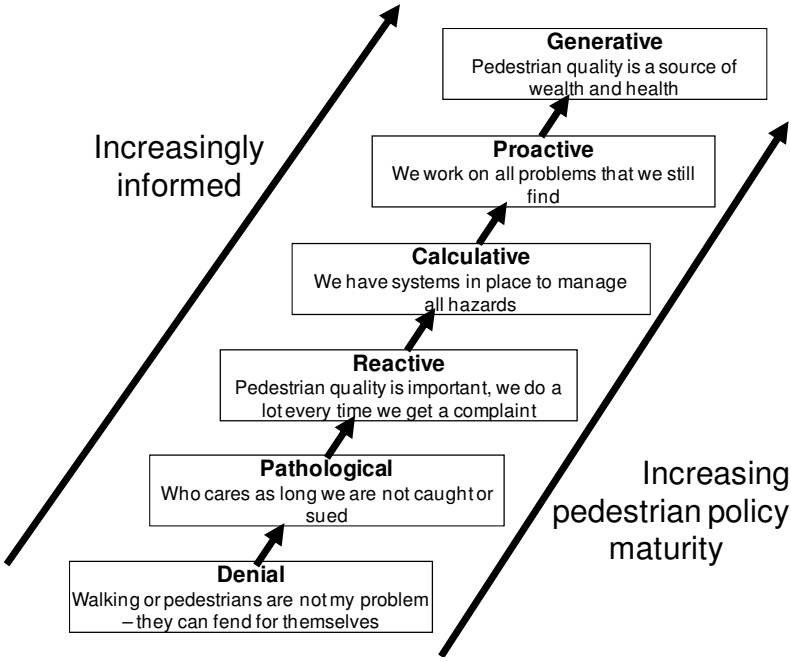

Figure IX-4 W+S policy maturity (adapted from Hudson, 2001 and Flemming, 1999)

Regarding cultural change process in policy cultures in the real world Hudson (2001) states:

> *'Cultural change is drastic and never takes place overnight. If a safety culture (read: pedestrian quality) champion leaves, there is often no-one to take up the fight and the crucial top-down impetus is lost. But even without a personal change there are two threats to successful transition to a higher level of safety culture (read: pedestrian quality). One is success, the other one failure. In the case of success, effective processes, tools and systems may be dropped, because the problem is perceived to have gone away. In the case of failure, old-fashioned approaches may be retrieved on the grounds that they worked before. But in both of these cases, the new, and often fragile, beliefs and practices may not have become sufficiently internalised to survive changes at the top.'*

In the course of time stakeholders have discovered ways to tackle concrete problems regarding walking, public health, liveability and sojourning in public space. Interested scientists, policy makers and practitioners have put effort into learning how to promote walking. In literature and some policy plans a general idea about what the ideal situation with regard to pedestrians would look like, is voiced. It becomes more and more clear however that we do not have adequate insight in the processes that lead to problems and processes that inhibit their solutions. The more general causal factors behind the undesirable events rarely get touched. Every once in a while unexpectedly new undesirable events 'pop up' and additional measures have to be taken. Policymakers will get the feeling that they are always behind the time[686]. Decision makers find it difficult and unrewarding to react to an issue when they thought that they had already dealt with it. They feel they have other urgent matters to attend to.

In theory, a pro-active and quality oriented system approach offers a more structural solution. Here the point of departure is insight in the functioning of the system and fair image of what is required for walking and sojourning in public space, based on insight in pedestrians' needs and abilities. In such an approach problems are dealt with implicitly, and in an integrated way. Although the approach focuses on benefits for the pedestrian, evidently the provision of favourable conditions for pedestrians can only be supported if they do not go against the interests of the facilitators.

Anyway, a science based systematic (generative) approach to pedestrian quality can be expected to make a big difference to the citizen's quality of life as a pedestrian. In the leading groups within the safety sector the benefits of such a systematic approach is obvious; with regard to pedestrian quality however, the added value is not yet obvious to most stakeholders. They can have several reasons for not adopting a system approach: they are not aware of its existence, the approach is not considered relevant for the issue or the approach is not adopted because of its perceived complexity. In this context this thesis contributes by documenting and substantiating what a fully matured pedestrian quality policy approach can look like and by pointing out its benefits, which in general are presumed to be[687]:

- in principle such an approach covers all options and prevents a one-sided approach and promotes synergy between the policy content, process and context (Pettigrew, 1992);
- it can be expected to offer best value for money;
- it can be expected to help improve the image of the pedestrian issue by taking a 'professional' rather than an intuitive approach that is often associated with 'minor' issues. This in turn will make it more likely that the issue reaches the political and research programming agendas.

Very few policy agents can be expected to function on the highest, generative, W+S policy maturity level. Every once in a while unexpectedly new undesirable events will 'pop up' and leadership is challenged to take measures. Leaders may get the feeling that they are always behind the time[688] and find it difficult and unrewarding to react to an issue which they thought

[686] For example: the notions that there is as much multi-modal walking as there is mono modal walking and that the number of injury accidents without involvement of motor vehicles is neglected in road accident statistics, but nevertheless quite substantial.
[687] The arguments originate from an internal brainstorm session at DVS Centre for Transport and Navigation in October 2008.
[688] For example: the notions that there is as much multi-modal walking as there is mono modal walking and that the number of injury accidents without involvement of motor vehicles is neglected in road accident statistics, but nevertheless quite substantial.

that they had already dealt with. They may also feel they have other urgent matters to attend to. However, to be effective on the long run, leaders must keep an open mind to new developments.

A word of caution has to be expressed. A challenging and productive W+S culture will not be not built overnight. In most cases the policy maturity ladder has to be climbed from the bottom. Starting somewhere in the middle or beginning right at the top is no real option. Organisations will have to go through all the stages and learn how to deal with inherent problems. Here the lessons from Piaget (1968) regarding proximal learning apply. To be effective, learning should link up with what the subjects already know and are able to do, and therefore has to be dosed cautiously. Also, leadership cannot move too fast before the troops. When the organisation is predominantly equipped to be pathological (which still is more productive and helpful for advancing an issue than 'denial'), transferring it into a reactive organisation will be quite an achievement. It is like making fire from a spark.

Up to this point it is discussed how a W+S culture affects a single uniform and 'omnipotent' organisation. In a large organisation, like the Dutch ministry of Infrastructure and Water Management, there will not be a uniform policy culture with regard to any of the policy domains but the smallest ones. Furthermore, both the Policy Life-cycle theory and the Policy Maturity theory show that W+S policy culture does not operate in a vacuum and that contextual aspects matter.
With regard to W+S policy on the national level, leadership will need to exceed the individual (lead) organisation and aim to affect a larger domain and to take into account what happens on the 'outside'.
Therefore, in any case leadership has to deal with a multitude of W+S cultures and maturity levels in the domain and beyond. Transformational leadership, where the policy actors help each other to improve their organisational quality will be hampered by complexity. Transactional leadership will be more opportune. For the lead organisation the trick will be to acquire the power to perform leadership tasks, particularly the power to '*evaluate, correct, train the followers when productivity is not up to the desired level*' (https://psychology.wikia.org/wiki/Leadership_style). When on the other hand the expected outcome is reached, the leader should be enabled to reward the followers. An important competence in this regard concerns communication and communication management, and organising the internal and external chain of command and delegation of decisions (how is leadership fleshed out), allocation of available resources, and coordination and partnerships.

Leadership power
French et al. (1962:10) '*distinguish five bases of power: 1) Referent power which concerns identification and liking, 2) Expert power is based on the leader's competence, 3) Legitimate power, which is based on the leader's status and job authority, 4) Reward power, which is derived from having the capacity to provide rewards to others, and finally 5) Coercive power which comes from the capacity to punish or penalize the followers'* (French et al., 1962, cited in Northouse, 2013:10). The Referent and Expert power types are personal powers; Legitimate, Reward and Coercive powers come from the position of the leader and his organisation (Kotler, 1990, cited in Northouse, 2013, p 11).

In nearly all cases leadership will have a combination of power bases. Clearly a well-liked leader, being an expert and having legitimate, reward and coercive power will be more successful than the ones who do not have such power bases. It can be argued that on the long run organisation-related power bases will be most predictive, constant and effective. Expert power will help to warrant the quality (effectiveness, efficiency and justice) of policy decisions.

Assuming that the intervention plans were properly prepared, i.e. the recommended interventions are evidence based or based on dedicated research, leadership needs to decide on their implementation. With regard to the quality of decision making Van Wee (2011) offers practical rules of thumb. He argues:

> *"... that the quality of public decision making is higher if the decision makers make the choice they would have made:*
>
> *(1) if they had all (from their perspective) potentially relevant choice options available;*
>
> *(2) if they were fully informed; and*
>
> *(3) if they were able to evaluate different choice options.*
>
> *This would be a valid rule of thumb under conditions of a high level of democracy."* (Van Wee, 2011:20).

As the public's and public representatives' knowledge about W+S generally is far from perfect, a high level of democracy by itself does not ensure high quality decision making on the improvement of W+S conditions. Support and influence of dedicated and informed external parties (stakeholders, partners) contribute to the quality of decision making.

Leadership persistence

From the discussion of my cyclic model of the policy life-cycle (this Appendix, Section 1.2 and 1.3) it was concluded that change leadership is driven by commitment to a cause. It was noted at that point that commitment is based on awareness of matters of interest of which the emotional load beats competing matters in that regard. Leadership is 'committed' when the felt urgency results in a feeling of responsibility and accountability, and willingness to act. Leadership will become effective by interacting with (potential) followers, i.e. policy actors within his/her organisation (internal leadership) and/or outside his/her own organisation (external leadership); when leadership stops interacting, its power will fade, and the involved policy actors will 'do their own thing'.

With regard to the interaction of leadership characteristics it can be assumed that willingness to act differs from person to person, that it heavily depends on emotions, and that emotions do not last and change over time. Furthermore, potential leaders differ in knowledge and awareness, capabilities and competences, how trigger signals are perceived, awareness, and what for them acceptable choices and sacrifices are.

According to Selznick a key factor to persistence is creativity in finding solutions to institutional conflicts. He writes: '*… creative men are needed (…) who know how to transform a neutral body of men into committed policy*' (Selznick, 1957:63). Also required are some obstinacy, rowing against the flow, patience and focus. To warrant continuity of activities legislation, organisational structure, mission statements, handbooks have proven to be helpful tools.

Measuring leadership performance

Leadership performance relates to what it brings, irrespective of the goal and target decreed and policy process guidance and deployment of resources. Such performance can be measured and evaluated in absolute and relative terms.

f. Conclusions

The author concludes that the following matters regarding leadership are likely to set the stage for effective and efficient policy making and implementation:

- Leadership is necessary for 1) setting goals and 2) putting a policy process in motion towards achieving the goals. This means that the existence of leadership and its distribution is a key factor for policy activities;
- W+S Leadership is about choices and power to make W+S improvements happen. This power is based on awareness and commitment, i.e. an emotional load regarding the W+S subject, and felt responsibility and accountability. If not properly informed by his advisors, stakeholders and partners about true W+S conditions, improvement options and their consequences, W+S improvements will probably not take place;
- Key characteristics of leadership are a) propensity, b) power, and c) persistence;
- With regard to W+S system interventions the leader is taken to be responsible and accountable for deciding what is important and setting objectives and targets, deciding on intervention strategies, taking care that preconditions for achieving the targets are met, including the allocation of resources to policy development, implementation and monitoring, and co-operation and partnerships;
- Leadership is most needed in the early and late stages of the policy process, when decisions need to be made. Such decisions will be most effective if they are evidence based;
- The success of leadership depends largely on the maturity of a W+S policy culture which the leader happens to achieve through persistence, and on how well leadership involves and makes use of external parties;
- Important tasks of the leader are to assure that the right preconditions are shaped and to outweigh and correct W+S improvement counterforces. New, unexpected problems can 'pop up' any time, and leadership will then be challenged to take measures. In many cases personal and organisational barriers need to be conquered to actually tackle such problems adequately;
- The degree to which leadership is in control of W+S conditions and performance depends largely on the organisation's W+S policy maturity level.

g. Research topics for assessment of the status quo

From the above the author deduces that this thesis' research needs to deal with the status quo with regard to leadership in the W+S institutional framework deserve to be assessed on the following aspects: 1) leadership propensity[689], power, and persistence, 2) what W+S goals are formulated and decreed, and 3) how leadership is distributed[690].

2.4. Knowledge & professional skills

With regard to *knowledge and professional skills* my research findings are captured under the headings of the 6 Topical questions tuned to the subject, conclusions and research topic ('in short') for the assessment of the status quo. The matters are dealt with below.

[689] An image of propensity answers the questions asked in the introduction of section 6.4.2. Theoretical considerations, of how concerned policy actors are about current W+S conditions and (partly) to what degree the critical stages in the change process are passed through.

[690] It is perhaps unnecessary to say that there can be different leaders on different W+S areas, like the safety of children, handicapped persons, comfort, network planning etc.

a. What is the nature of W+S knowledge & professional skills?

In this paragraph concerning W+S knowledge and professional skills I first consider definitions, and subsequently properties and dimensions.

Weggeman (1997) defines knowledge as K = I * ESA[691]. The K in the formula stands for Knowledge. The I stands for Information, i.e. explicit, encyclopaedic or codified knowledge, whilst the ESA part stands for implicit or tacit knowledge, made up by Experiences, abilities and Skills, and Attitudes, values and norms. Simply put, knowledge is information put into context.

From the results of a rough scan of literature database, library, Google Scholar and Wikipedia, using the search words 'knowledge' and 'professional skills', supplemented by snowballing, I identified properties and dimensions of knowledge and professional skills which potentially affect W+S policy development and implementation. These properties and dimensions concern what relevant W+S knowledge and skills are, acquisition and ownership of knowledge and professional skills, professionalism as an ideology, finiteness and decay of knowledge, context sensitivity, uniqueness of organisational knowledge and skills, and dispersion of knowledge over policy actors.

In this thesis the question *what relevant W+S knowledge and skills are* can only be answered in general terms. W+S policy professionals need to have adequate understanding of the W+S context, policy process and W+S behaviour. This should include their precursors, performance and consequences (strengths, weaknesses, opportunities and threats), and how improvements can be made. As a whole this thesis aims to outline the scope of what matters regarding W+S policy development; knowledge and skills requirements are dependent on the professional's position in the institutional framework, the true impact of W+S performance[692], and his organisation's scope and responsibilities (i.e. span of control).

With regard to knowledge *acquisition and ownership*, a property of knowledge, understanding and professional skills is that these are products of learning, and that only living beings can learn. Thus knowledge and understanding are personal attributes, which cannot exist outside an individual, and cannot be passed on. It can 'merely' be stored as information, in systems, machines or on paper. Consequently, as an entity an organisation cannot learn (Weggeman, 1997; Caluwé en Vermaak, 2006). It can however offer opportunities to its staff to learn. Furthermore, as a collection of people aiming at the same targets, people can learn individually and collectively. Accumulated professional skills are an implicit product of what the individuals know about their (W+S) domain, their experiences, learning and education and training. It refers to how familiar the collective staff, as an entity, is with the (W+S) domain. This can be considered an organisational asset. The understanding and skills can be more or less formal or systematic (Meessen, 2007; Weggeman, 1997).

Contrary to what is stated in the Oxford Dictionary definition, in my view there is a difference between 'knowledge' and 'professional skills'. The latter can be taken as a specific type of knowledge which is connected to the application, interpretation and association modes of knowledge (cf. the four modes discerned by Broudy, 1980, cited in Eraut, 1994). For

[691] Knowledge is more than just adding context to information; in knowledge information is also rated and positioned in a large whole. Therefore the formula K = I + ESA does not do justice to what knowledge encompasses.

[692] The question is, however, who assesses what the true impacts are, and to what degree this understanding must be matched by the professional's knowledge and skills.

replication, without putting the knowledge in some context, interpretation or association, professional skills generally are less important. I refer to professional skills when specific knowledge and abilities matter. Professional skills connect to professionalism, which according to Eraut (1994) can be taken as an *ideology*. Like all ideologies it embodies appealing values: '*service, trustworthiness, integrity, autonomy and reliable standards. Professionalism works in the interest of certain groups while winning the consent of others whose interests are served by it'* (McIntyre, 1994).

Other important properties of knowledge and professional skills are that their supply is *not endless*, that they *decay* over time and must be kept to the required standard, that they are *context-sensitive* (De Vries et al., 1993, cited in Meessen, 2007)[693], and that each organisation has its own, *unique characteristic*s (Auée et al., 2001, cited in Meessen, 2007). With regard to W+S policy development and implementation tasks, it has to be remarked that W+S relevant knowledge is *dispersed* over many disciplines, persons and organisations. There is no dedicated discipline which covers the complete W+S domain and knowledge needs throughout the policy process. For effective, efficient and fair W+S interventions, at all policy process stages input from a variety of knowledge and professional skills bearers is needed, and this input needs to be organised and supported by leadership decisions.

b. Who gathers and delivers W+S knowledge & professional skills, to whom?

The question about who gathers and delivers W+S knowledge & professional skill concerns W+S knowledge dispositions and arrangements. In this context I will consider general W+S knowledge dispositions and arrangements, knowledge exchange platforms, W+S knowledge presence, quality and effectiveness, knowledge management and local level knowledge tasks.

Regarding W+S policy relevant knowledge *dispositions and arrangements,* from professional observations and working group discussions I found that, although W+S impact wealth and well-being in many ways and although the domain touches on many disciplines and other domains, there is only a (very) limited group of professionals that dedicated sufficient time and effort to W+S aspects to become experts. It takes years to become an expert (Ericsson et al., 2007). Consequently, sound W+S knowledge and professional skills are quite scarce. Furthermore, based on knowledge management discussions, I hypothesize that, to be viable on the longer term, (W+S) expertise requires nuclei of at least three experts. Only then experts will be challenged enough to grow in their field and continuity of knowledge building will be secured.

Only since the turning of the 21st century an international *platform* for professionals is established (WALK21), but for academic researchers such a platform is not (yet) available. On the national level in some countries pedestrians associations or discussion forums unite and disseminate practical information. The question is what knowledge arrangements there are on the national (strategic) and regional and local (tactical and operational) levels to support the improvement of W+S conditions.

In relation to the question about knowledge arrangements, I hypothesize that W+S knowledge *presence, quality and effectiveness* will roughly depend on the demand for W+S knowledge. This can be assumed to depend on a number of factors, such as 1) the number and volume of initiatives and projects concerning the W+S domain, 2) the existing W+S policy culture within

[693] Under the 'When do W+S knowledge and professional skills come about?' question I discuss process-time-contextual aspects of W+S knowledge and professional skills.

the policy framework, policy interventions that obviously affect W+S conditions, and 3) signals from the outside, such as complaints from citizens, academic and practitioners' research results, reports from the media.

With regard to W+S I observe that a critical mass for *advancing* W+S knowledge is not prone to be present, as most relevant policy actors are not yet thoroughly aware and committed to improving W+S conditions. From 2000 to 2013 there was no pedestrian lobby group for promoting W+S knowledge building; the new volunteer pedestrian lobby group 'Mens en Straat' (Streets for All) is only beginning to build the necessary networks. Most relevant knowledge institutes for the support of government do not have walkability experts; W+S is not an explicit subject in curricula for professional education. Research bears on the very limited own budgets of universities and from the public health sector mainly, with themes like active mobility and prevention of falls). Another important factor is how much time potential experts can invest in knowledge building. When such persons with regard to W+S policy making are alone in an organisation and involved part-time there is no time to thoroughly search for available knowledge, talk to expert colleagues, let alone properly evaluate effectiveness of interventions and learn from it. Consequently, in order to be able to advance W+S policy development and implementation, *leadership* needs to actively *manage building of W+S knowledge and professional skills*. Leadership's task herein is also to organise timely availability of the needed resources (time, money, facilities) and dissemination of new insights.

Concrete change in W+S conditions needs to be delivered on and to the local level, where the focus of policy activities lies. The role of local policy actors with regard to W+S knowledge and professional skills is to benefit from national leadership initiatives and opportunities offered to advance W+S knowledge and professional skills, and to take up responsibilities. In this context professionals need to be educated properly, to take effort to acquire state of the art knowledge and professional skills, exchange experiences with other policy actors in the domain, and draw attention to gaps in knowledge that cannot be effectively and efficiently rectified locally.

c. Why are knowledge & professional skills applied in W+S policy?

In this paragraph I discuss the reasons for, and the function of acquiring and managing W+S knowledge and professional skills. In this context the following aspects will pass: the function and role of W+S knowledge and professional skills in W+S policy, and advancing policy maturity and resilience.

The general *function* of knowledge and professional skills is to select information from the vast offer and attribute the right meaning to that information. This depends on the staff's loyalty to process the acquired information into real-time action to make a valuable contribution to the realization of the organisation's objectives (Weggeman, 2000, cited in Meessen, 2007). As such adequate knowledge and professional skills form a safety net for leadership to timely notice what needs to be dealt with, how this can be done, and effectively and efficiently handled.

The *role* of knowledge and professional skills within the institutional framework is to help to position, advance and underpin W+S policy decisions, implementation and monitoring (Sauter & Tight, 2010). Knowledge and professional skills are needed for a great variety of tasks throughout the policy process. At the start of the policy cycle they are needed for processing and advancing external input information on W+S conditions, delivering early warnings

regarding (potential) problems[694] and reacting to incidents and system failures. Further on they are needed for submitting adequate policy development project proposals to the leaders. As input for W+S policy development, situational knowledge is indispensable. Without situational and behaviour knowledge and professional skills it is not feasible to develop adequate policy proposals, prepare decision making by evaluating policy proposals regarding their expected effectiveness, efficiency and fairness of distribution of impacts, and prepare policy implementation and monitoring tasks. Below, under Subsections d, e and f more details about the relation between knowledge and when, where these are needed and how that can be achieved will be given.

Knowledge, expertise and professional skills demarcate the scope and quality of policy development, implementation, management & control, and monitoring, i.e. *W+S policy maturity*. Advanced knowledge and professional skills support higher levels of policy maturity and the effectiveness and efficiency of regular policy activities. Furthermore, when under pressure, professional skills enable professional improvisation, which in most of such cases provides more effective reactions to incidents (*resilience*) than sticking to the fixed procedures (De Bruijne et al., 2012). Particularly in policy conditions connected to a policy life-cycle stage of management & control, when W+S conditions are managed within the context of other 'higher order' policies, and activities concerned are not closely controlled by leadership, the quality of W+S policy heavily depends on the policy actor's staff's W+S knowledge and professional skills.

f. How are W+S knowledge & professional skills acquired and delivered?

In this paragraph I consider how knowledge and professional skills are acquired, managed and delivered. In this context this includes learning processes, coverage of W+S conditions and options, knowledge related tasks, knowledge management and W+S knowledge & professional skills performance.

From psychology it is known that most *learning* is a creation or construction process. In this regard knowledge is both input for and output of the process. There are basically two ways of learning: learning by doing (tacit knowledge) and learning from codified information (codified knowledge) (Meessen, 2007). Nonaka & Takeuchi (1995, cited in Meessen, 2007; Weggeman, 2000) identify four ways of learning:

1. Socialising: empirical learning by copying, imitating, trial and error and exchanging the acquired knowledge;
2. Externalising: codifying implicit knowledge, i.e. expressing tacit knowledge in language, signs, figures;
3. Combining: relational learning by exchanging explicit (codified) information;
4. Internalising: individual internalisation of codified information.

W+S knowledge needs to comprehensively *cover W+S conditions and options*. In this regard various disciplines[695] and sections or work fields within the policy agent[696] need to be able to deliver bits and pieces of useful information and insights concerning W+S conditions, performance, impacts and improvement options. These bits and pieces need to be combined to

[694] From leadership's perspective staff needs to help minimize the chance of being taken by surprise.
[695] I.e. social sciences, economics, engineering.
[696] I.e. general policy staff, or specialised domains: land use planning, traffic and transport, road safety, public works, economic affairs, tourism, law enforcement etc.

a comprehensive picture, which is a demanding task that needs to be assigned to someone in the organisation.

Knowledge related tasks are research, dissemination, communication, and application. I assume that the first three tasks are duly familiar to the reader; the latter needs some explanation. Broudy (1980, cited in Eraut, 1994) distinguishes four modes of delivering knowledge: replication, application, interpretation, and association. In other words: bits and pieces of knowledge can be simply replicated in communications ('communication'), skilfully (or not) applied together with other bits and pieces of tacit and codified knowledge ('doing'), put into a specific context and given new meaning ('Research & Development', including policy development), and used to come up with new ideas ('learning'). With regard to application of knowledge in the W+S domain the following general tasks can be discerned: 1) Research & Development (including policy development), 2) implementation (connected to types of measures, like delivering physical W+S conditions ['engineering'], Education, Legislation & Enforcement, tuning measures to each other, communication, management of the implementation [inspection], 3) management & control (including monitoring and taking care of adjustments).

Knowledge management is a means to increase the efficiency and pleasure from the production factor knowledge (Weggeman, 1997, cited in: Meessen, 2007). It can be seen as the discipline that deals with the organisation of optimal preconditions for developing required knowledge, keeping it functional and up to date and promoting and managing that it is available when needed. According to Weggeman knowledge management aims to affect operational processes in the knowledge value chain (Weggeman, 1997, see Figure). He identifies a number of processes in the chain: the Mission-Vision-Aims-Strategy stage, knowledge development, knowledge sharing, application of knowledge and the evaluation of knowledge. The latter process concerns knowledge quality control, monitoring context, process and content of knowledge, i.e. the functionality of the available knowledge, the quality of professional skills etc. in such a way that wrong conclusions, advise and design can be averted. Another role is to identify gaps in knowledge and learning processes.

Knowledge management stipulates, first of all, that professionals are adequately educated and skilled. As mentioned before, it takes many years to become an expert (Ericsson et al., 2007). Learning from codified information involves discussion, for which fellow learners are needed. Learning (and knowledge delivery) is usually organised in disciplines and task groups. Opportunities to learn can first of all be associated with the prevailing organisational W+S policy culture, particularly in the way capacity building is valued, organised and knowledge quality is managed. Learning about W+S calls for dedicated W+S chapters in practitioners' advanced education and academic curricula, post graduate and refresher courses. Professionals are only inclined to follow such educational offers if attractive and actively promoted. Other knowledge management tasks are exploring gaps in knowledge and knowledge needs, research programming, initiating research projects, experiments and demonstration projects and dissemination of research results, involving civil servants, consultants or managers etc. to do research and actively exchange ideas and experiences.

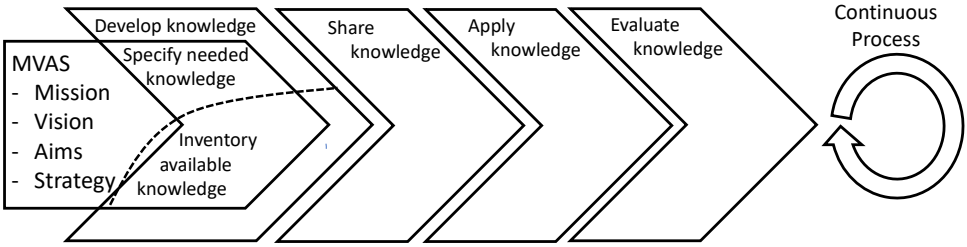

Figure IX-5 Operational processes in the Knowledge Value Chain (after Weggeman, 1997)

The last subject to be dealt with in this paragraph is *W+S knowledge & professional skills performance.* In principle this can be assessed in several ways, but as far as I know, there are no examples in this regard. Similar to performance assessment regarding leadership, I propose the following indicators: *input* volume and quality of staff deployed in the W+S domain[697], *product* volume and quality number of W+S innovations in the year, number of W+S publications, *impact* volume and quality benchmark for the quality of W+S skills within the policy agency compared to other similar agencies nationally or internationally.

d. When do W+S knowledge and professional skills come about?

In this paragraph I first assess the scope of the 'when' question, and then discuss process/time context sensitivity of W+S knowledge & professional skills.

The answer to the question when W+S knowledge and professional skills come about, largely depends on what kinds of knowledge and skills are required and available at the situation in question. At all stages of policy development, curiosity and understanding of the W+S context, true W+S performance and impacts are needed to create awareness and willingness to act. When there is commitment to improve W+S conditions, knowledge about improvement options becomes paramount. When then the decision is taken to develop and carry out improvement, skills to do so are required. With regard to the stages after 'awareness', leadership can decide to employ external experts 'just-in-time'. For management & control, outsourcing the needed knowledge and skills seems less attractive, as it creates the risk of not being in control.

With regard to *context sensitivity*, it is found that the value of knowledge can change over time, regarding a policy issue and regarding the kind of knowledge needed during the various phases of the policy process.

With respect to the value of knowledge *regarding a policy issue* Spek et al. (1996, cited in Meessen, 2007) developed a Knowledge Life-cycle model, which connects nicely to the Winsemius' Policy Life-cycle model (see Figure IX-1 and Figure IX-6). New knowledge emerges in High knowledge growth - Discovery phase, and becomes key knowledge a little later in the still High growth Political phase. In the Implementation phase knowledge growth slackens, and the knowledge becomes Basic knowledge. In the Performance phase, where management & control prevail, knowledge development is lowest, and knowledge has a tendency to become obsolete.

[697] I.e. quantity in terms of Full Time Equivalents, quality in terms of years of W+S professional experience

With regard to the *kind of knowledge needed during the various phases* of the policy process I developed a diagram, picturing how W+S system can be improved through policy activities and what kinds of knowledge and professional skills are needed for the successive policy steps, of which the knowledge & professional skills leads are marked by number (in bold-italic type) in the following description (see Figure IX-7).

Contribution to key processes / Growth Potential	Large contribution	Small contribution
High growth	Key knowledge *Political phase*	Emerging knowledge *Discovery phase*
Low growth	Basic knowledge *Implementation phase*	Obsolete knowledge *Management & Control phase*

Figure IX-6 Knowledge and Policy life-cycles (after Spek et al., 1996)

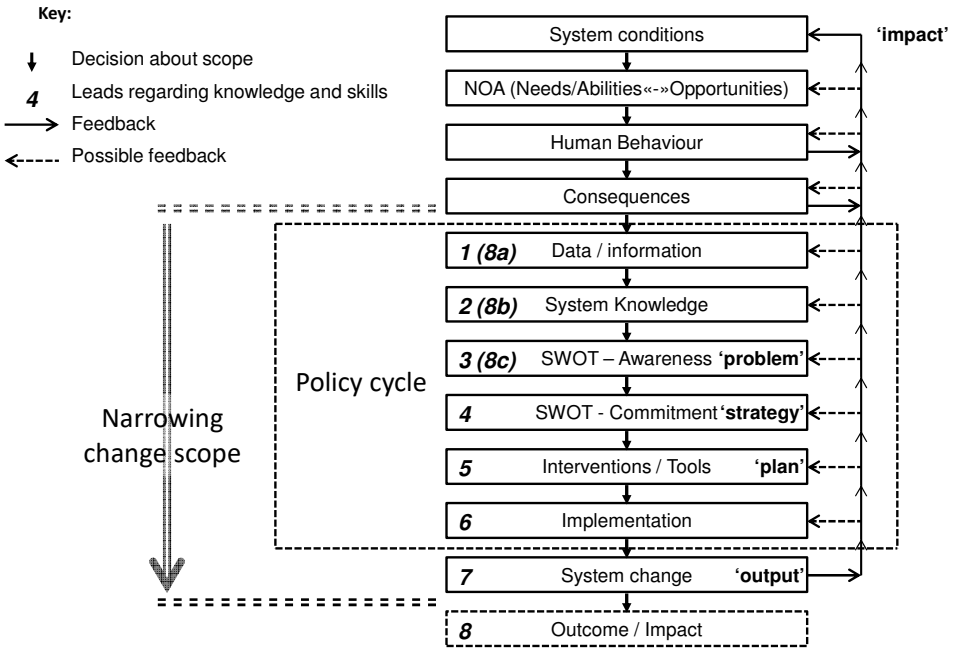

Figure IX-7 The W+S system change cycle - knowledge & professional skills leads

At the top of the diagram current system conditions are positioned. Following the NOA model (see main text of the thesis, Section 3.3.3), some of those conditions offer opportunities to

satisfy human W+S needs within the limits of their abilities. This brings about W+S behaviour, which impacts on the system.

The policy process starts at the point where data and qualitative information about W+S come about and are brought to the attention of the policy agent (1). These data and bits and pieces of information are put into the frames of mind of persons within the policy agency and moulded into knowledge. Knowledge functions as a perception filter: one only finds what one is looking for. The quality of the knowledge particularly depends on the policy actor's depth and scope of W+S knowledge, his research skills, his capabilities regarding putting this knowledge into a wider context, and his communication skills (2). The knowledge about W+S and its precursors then needs to be valued, and awareness of strengths, weaknesses, opportunities and threats regarding W+S and consequences for wealth and well-being of individuals, communities and/or the nation needs to be built (3). This involves knowledge about W+S, its precursors, impacts, and contextual knowledge of political preferences and actual and potentially political opportunities and risks. When choices regarding subjects to be dealt with are made, improvement strategies can be developed (4). This involves knowledge about the W+S SWOTS, their precursors, as well as knowledge and professional skills concerning suitable improvement measures and strategies, and solutions design skills. The various ideas regarding improvement measures must then be selected and made operational in improvement plans (5). This particularly concerns feasibility and added value of the proposals, entailing 'technical', administrative and management knowledge and skills. When the plans are completed and set down, the organisation of the implementation can be carried out (6). The quality of the implementation depends on project management skills, including knowledge about effects and consequences of adjustments made while realizing the plan. Here conceptual flexibility and resilience are important professional skills. Next, the output of the implementation, i.e. the plan products, needs to be captured administratively and evaluated regarding their product qualities (7). This entails administrative and 'technical' knowledge regarding product requirements. Following the system approach principles, after implementation the 'products', their consequences need to be monitored and evaluated (8). This requires knowledge and professional skills similar to (1) and (2).

An important observation regarding the change scope is that with each of the policy steps the change scope narrows down. With regard to W+S system improvement potentials it is important to know how much the change scope narrows down because of knowledge and professional skills limitations.

e. Where do W+S knowledge & professional skills come about?

Consistent with the use of 'when' under the leadership paragraph, I consider 'where does W+S knowledge and professional skills come about' in place and contextual terms. Like with 'when' the answer to the 'where' question depends on what kinds of knowledge are required and available at the context in question. With regard to the leader's and professional's position, the following dimensions are discerned: governance authority, leadership - follower, scope of expertise, and solicited - unsolicited.

With regard to the *governance authority* dimension I discern three levels of governance: national, regional and local. Knowledge and skills requirements associated with governance authority mainly depend on the policy agent's formal responsibilities and accountability. On the national level this in principle concerns national aims and guidance, legislation, universal knowledge management (assessment of gaps in essential knowledge, research programming, formal education requirements, strategic research), management of national (infra)structures,

funding, and law enforcement. On the regional and larger city level authorities concern situational knowledge, principles regarding W+S conditions and general design principles, guidance and general programming for local projects. On the local level authorities are in (relatively) direct contact with the clients as potential pedestrians, and have to answer to their concrete demands. The condition, design and management of physical W+S environment and behavioural guidance (e.g. mobility management, signage, traffic management, public space management) are local responsibilities.

The *leadership - follower* (or strategist – facilitator) dimension can be typified regarding the policy actor's position in the W+S policy domain as lead organisation, partner or facilitator/performer. The different positions come with different knowledge & professional skills requirement profiles. It can be assumed that, for effectiveness and efficiency of leadership, first of all, for both groups people skills[698] are important; with regard to the W+S subject particularly important features are a holistic overview of actual W+S conditions, W+S behaviour and potential improvements, whilst also insight in what potential partners can contribute to the cause, and how critical gaps in knowledge coverage can be filled, are necessary. Partner policy actors' profiles will typically be characterised by in-depth knowledge and professional skills on a specific subject, discipline or responsibility concerning the W+S domain. Facilitators/performers carry out specific parts of policy development. Their most desirable W+S knowledge and professional skills profile will depend on the stage of the policy process and the executive tasks at hand.

The *scope of expertise* dimension concerns the perspective taken with regard to W+S conditions and behaviour. The scope can vary from holistic and/or integrative, to specialised on a specific subject like pedestrian crossing facilities, or discipline like traffic engineering. Holistic scopes are ideally associated with central leadership and master planning. A holistic and integrative scope presumes extensive experience with the subject. As already was stated that there are not many experts, finding such leaders will not be self-evident. Academic knowledge and professional skills, although sometimes holistic and directed at meta knowledge (cf. W+S determinants researchers in the health sector), are typically focussed on a demarcated subject, delivering highly specialised knowledge. In professional education W+S still plays a marginal role. The scope and quality of practitioners' knowledge and professional skills therefore mainly depend on how much they have been engaged in the field. I assume that level of engagement is subject to the existing W+S culture. Inspired by Rasmussen (1983) and Reason (1990) For the assessment and evaluation of knowledge & professional skills applied in policy making I discern the following levels of expertise:

- *knowledge-based application*, which is based on a lay person's[699] implicit knowledge of facts, experiences, perceptions and beliefs, without further attempts to acquire external knowledge. The level of knowledge can range from hap-hazard amateurish ('how difficult can it be?'), experienced trial-and-error, to science based. This type of application can be associated with the pathological and reactive policy maturity levels;
- *rule-based application* by professionals, which relates to application of available instructions, guidelines and recommendations, and which highly depends on the quality of the instructions, guidelines and recommendations. This type of application can be associated with the reactive and calculative policy maturity levels;

[698] People skills concern how well one can communicate and manage other persons.
[699] A person not explicitly educated or trained regarding the improvement of W+S conditions or any of the policy tasks involved.

- *(high level) skill-based application*, which is based on the person's own knowledge and skills as well as the organisation's efforts concerning capacity building and regular prospecting available facts and options. The organisation strongly supports capacity building. Depending on the quality of the orientation, this can result in fair to State of the Art policy development, implementation and monitoring. This type of application can be associated with proactive and generative policy maturity levels.

The last dimension I discern is *solicited - unsolicited*. Solicited W+S knowledge and professional skills can be expected to be welcomed by the receiving policy agent. Such knowledge can come from both external and internal sources. Although unsolicited information can come from within the policy agent organisation, it is more likely that it comes from the outside. Such unsolicited information will only be welcomed if the message and tone suits the policy agent. From general literature on lobby organisations (e.g. Mitchel et al., 1991; Richardson, 2000; Hooker et al., 2007; Hout, 2015) and contacts with walkability lobby groups it is clear that the sender, with regard to W+S probably a walking, safety or health advocate or academic, must be credible, extremely well documented, well respected and patient, and have excellent communication skills.

g. Conclusions

The author concludes that the following matters regarding knowledge and professional skills are likely to precondition effective and efficient policy making and implementation:

- Knowledge is information put into context; knowledge consists of bits and pieces of information that are connected to each other by understanding;
- The role of knowledge and professional skills is to position, advance and underpin decisions, implementation and monitoring;
- Knowledge and skills are a product of learning, i.e. personal attributes. When a person leaves the organisation, his knowledge and skills are lost. An organisation itself cannot learn, but it can codify what individuals learned;
- W+S knowledge and skills are scarce and do not expand easily. It takes years to become an expert;
- Knowledge exchange is crucial. On the international level there is now an exchange platform, but nationally it lacks;
- Knowledge is not endless, it can decay over time, and it must be kept to the required standard. Each organisation has its own unique knowledge characteristics;
- W+S knowledge and professional skills are needed throughout the policy process, but the content varies with the stage of the process. Knowledge and skills demand depend on the number and volumes of projects in the domain, existing W+S policy culture, and the urgency of signals from the outside;
- The availability and quality of knowledge and professional skills relate to the maturity of W+S policy culture within an organisation. Demand for knowledge and skills also connects to the policy life-cycle stage, the W+S subdomain, and/or a specific issue in the domain. In the discovery- and political phases there usually is strong growth in what is learned, in the management & control phase the amount of learning fades out. There is a risk of under-attention and decay of knowledge and skills, and thereby effectiveness of the agency;
- Along the policy process the scope of knowledge and skills demand inevitably narrows. With respect to achieving the set aims, there is need to take care that this is kept within acceptable limits;

- The development and care of knowledge and professional skills will be most served by concentration of at least three staff members; scattering staff across the agency or country will decrease learning opportunities and propensity;
- Preconditions for effective and efficient interventions are (1) adequate knowledge on both how the system works and how the system can be improved, (2) adequately educated, trained and skilled staff, and (3) an inviting, mature policy culture which promotes the use of state of the art knowledge.

h. Research topics for assessment of the status quo

From the above the author deduces that in this thesis' research the following features with regard to knowledge & professional skills in the W+S institutional framework deserve to be assessed: 1) what sources of information & knowledge exchange W+S policy actors apply, 2) what and how much knowledge the policy actors acquired about how the W+S works and how the system can be improved, 3) how knowledge & professional skills are distributed across the policy domain (positioning, levels of knowledge).

2.5. Strategies & policies

With regard to *strategies & policies* my research findings are captured under the headings of 6 Topical questions tuned to the subject, conclusions and research topics ('in short') for the assessment of the status quo. The matters are dealt with below.

a. What is the nature of W+S strategies and policies?

In this paragraph I first define and contextualise the concepts of strategy, policy and programme. After that W+S strategies and policies are typified, what form they can take and some important requirements. The results are based on snowballing literature scan starting from Oxford Dictionaries and Wikipedia articles on 'strategy' and 'policy'. Keywords mentioned in these articles were used for a literature search in Google Scholar, Science Direct and my dedicated library (search words 'policy', 'strategy', and 'pedestrian' and more specific search words like 'definition', 'patterns', 'concept', 'application'). The search was limited to the public policy domain and relevance for W+S policy making and implementation.

Oxford Dictionaries[700] defines *strategy* as "*a plan of action designed to achieve a long-term or overall aim*", *policy* as "*a course or principle of action adopted or proposed by an organization or individual*", and *programme* as "a planned series of future events or performances", or "*a set of related measures or activities with a particular long-term aim*". Both policy programmes or strategies are made up of a number of individual policies and measures, cemented together in an integral plan. In my view a strategy distinguishes itself by aiming to gain a position of advantage over competing issues with the objective of best exploiting emerging possibilities. Mintzberg (1978:934) defines '*strategy as a pattern in a stream of decisions'*. McKeown (2015) typifies strategy as a method for shaping the future, achieve goals with available means.

Oxford Dictionaries definition of policy can imply that it concerns a '*principle or rule to guide decisions and achieve rational outcomes. A policy is an intent, and is implemented as a procedure or protocol'* (Anderson, 2005, 2011 at http://www.bizmanualz.com/)[701]. According

[700] https://www.lexico.com/definition/strategy; https://www.lexico.com/definition/policy; https://www.lexico.com/definition/programme, accessed 29-1-2014

[701] A policy sets a direction or rule; a procedure outlines the steps one takes to realize the policy or move in the direction of the policy (Anderson, 2011 at http://www.bizmanualz.com/).

to Dunn (1981:46-47) *public policy* is "*long series of more or less related choices made by governmental bodies and officials*". Strategies and policies both concern plans or approaches (courses of action) that are needed to achieve certain goals, but a policy concerns more 'traditional' or 'fixed' measures. Ideally both will lead to a coherent set of measures. The term 'strategy' will be used for strategic, long term plans; the term 'policy' refers to mid and short term 'fixed' structure plans and implementation plans.

In short, policies and strategies describe what executive bodies do, codify[702] or plan or are supposed to do.

Above I found that W+S conditions and behaviour are typically dealt with within other 'higher order' policies and projects, i.e. integrated in 'standard' policy activities and management & control activities of the policy agent's assets. In special cases, when policy changes are indicated, dedicated policies and strategies will come about. The quality, i.e. effectiveness, efficiency and fairness, of integrated aspects of policy can be expected to heavily depend on the quality of legislation and enforcement criteria, policy and work procedures, requirement specifications, resources available, external influences, and particularly the policy actor's staff's knowledge and professional skills and the volume of their efforts.

Dedicated W+S strategies and policies, like all policies and strategies, generally are a reaction to disturbing developments in society. Dissatisfaction with current conditions and manifest aspirations regarding W+S conditions, set the stage for the policy reactions. In policy making it matters what position the decision maker chooses. S/he can either take his/her own position as a reference, or take a more general position as a stakeholder organisation, community, nation, continent, or the world. The perceived volume of the imbalance and degree of urgency position the W+S issue in the policy field. As measures based on misperception cannot be expected to produce the desired outcome or impact, perception should match the facts. Research can help to close gaps between actual and perceived shortcomings and (changes in) gains (benefits) and losses (costs).

Strategies and policies are about the hope or ambition to achieve something. With regard to W+S this relates to the cumulated W+S policy culture, and is based on earlier experiences with, and expectations about the improvement of W+S conditions and introduction of innovations. In reactive, calculative and proactive W+S policy cultures, the acknowledged impacts of system malfunctions, deficits, damages, and losses, in terms of money, grieve, nuisance, mal-distribution of harm, set the stage for decisions on commitment and the energy put into subsequent policy development. In pathological W+S policy cultures only the fear of being punished for not acting on indicated problems will persuade the organisation to commit to developing interventions. In (rare) generative W+S policy cultures perceived opportunities for quality improvement of W+S conditions will be sufficient for far reaching aims.

From the above and from a quick scan of literature it can be concluded that in principle strategies and policies relate to domains, domain SWOTs, lead organisations, aims, dimensions, aspirations, solutions, and consequences (outcome and impact). This great variety makes it very difficult to find conclusive *typologies of strategies and policies*. In his classic article, Lowi (1968) discerned four main types of policies: distributive, redistributive, regulatory and constituent policies. In practise however no fruitful classifications of policies came about

[702] For example the national road authority Rijkswaterstaat which works on the basis of 'Kaders' (= framework of rules regarding design and implementation)

(Steinberger, 1981; Smith, 2005). With regard to W+S I conclude that the most important features of policies and strategies are:

- *Origin of the action idea*: external or internal; knowledge institutes, advocates, technical and societal developments, new partners, political desires; legislation and official (European, national) regulations;
- *Subject of the strategy and its demarcation*: pedestrian behaviour, system preconditions, physical conditions, social conditions, travel and transport conditions, environmental conditions, legal conditions, etc;
- *Whose strategy or policy it is*: which of the policy actors issued the strategy or policy (what is his/her span of control?);
- *Scope of the strategy or policy*: European, national, regional, municipality, city, district, neighbourhood, street, site; strategic, structure, implementation planning;
- *Target group and impact*: Dutch population, public space users, road users, pedestrians, providers (other policy actors), the media, etc.;
- *Political impact*: does the policy aim to adapt or control developments; problem solving or walking as a solution?;
- *Intervention target*: physical space, legal system, public opinion, other public space user's behaviour, transportation, traffic, etc.;
- *Intervention method*: engineering (i.e. making and providing 'things'), communication, education, legislation, regulation, enforcement, integral
- *Tangibility*: symbolic, tangible;
- *Activities*: research & development, design, carrots, sticks and sermons (e.g. appeals to one's responsibilities), communication, pilot projects.

Strategies and policies can take several *forms*: legislation, white paper, framework (master) plans, structure plans (including long- and mid-term research projects programming), development plans, production plans, implementation plans, management & control plans, adjustment plans etc.
In legislation norms with regard to a subject are generic and imperative, and laid down in laws, jurisprudence and formal directives, including norms and procedures. '*A white paper is an authoritative report or guide helping readers to understand an issue, solve a problem, or make a decision'* (Stelzer, 2008[703]). A framework (or master) plan lays down the structure of the organisation and kinds of projects with regard to the policy issue in question (in our case W+S). Structure plans go a step further and specify what projects and actions will be carried out on the long, mid and short terms. Development plans focus on specific functional changes to be made. In production and/or implementation plans these changes are made concrete (e.g. design of the site, use of materials, use of tools etc.), in management & control plans day to day management (e.g. traffic management, cleaning, maintenance) is laid down, and in adjustment plans, based on evaluation of a project or situation, measures are taken to make the situation function properly (again).

With regard to W+S strategy and policies the *most important requirements* are considered to be justification, SMART scope and formulation of the strategy or policy (Specific, Measurable, Attainable, Relevant and Time-bound (Doran, 1981)), coherent and consistent interventions, embedding in the legal and organisational structures, flexibility, and attention to potential

[703] Source: http://www.writingwhitepapers.com/resources.html

undesirable distribution and side effects. The concept of justification is worked out in Section 4 of this appendix.

Regarding *embedding* in legal and organisational structures, in the context of the PQN project, it was noted that W+S policy strategies and plans need to comply with the existing legal and policy framework concerning the W+S domain. Important features are how the rules and norms are effectuated, and how supportive the rules and norms are for implementation (Sauter & Tight, 2010)[704]. This can be taken further by arguing that synergy with policies and strategies in adjacent domains and consistency of interventions in a wider context are also requisite.

Another important requirement of strategies and policies is *flexibility*. In most cases the outcome and impact of strategies and policies is not totally predictable, mainly because knowledge and professional skills, and implementation are not perfect, and unforeseen developments and mistakes happen. These need to be identified and remedied. Apart from that, undesirable distribution effects of current conditions, and change strategies and policies, can sometimes be mitigated by involving (all groups of) stakeholders and by applying redistribution policy principles for compensating negative effects of losers. In this regard Sauter and Tight (2010) point to optional policy principles supporting walking, e.g. Polluter Pays, 'True Costs' approaches, 'Complete Streets', 'Vision Zero' and 'Design for All'.

b. Who are involved in developing and applying W+S strategies and policies?

In this paragraph I consider who are involved in developing and applying W+S strategies and policies. Under 'Leadership' the playing field and extensively considered leadership's involvement was already described. In this paragraph I therefore focus on the leaders' followers and clients (pedestrians) as far as they are involved in the policy process. Who is actually involved in the policy process depends on many factors, such as the policy subject, aims, scope and stage of the policy project. Below, under f. How are W+S strategies and policies developed and applied and what factors drive it?, the policy activities and associated tasks will be pictured. Here I will touch on some generalities regarding the policy actor characteristics: policy arrangements and actor roles, origin, position and involvement, numbers, qualities and interests, availability, and how they are affected.

A policy arrangement concerns cooperation of policy actors. It can consist of internal and external policy actors as organisations or as individual persons. Usually the arrangement refers to a part of the strategy or policy, particularly projects such as assessing societal demands, policy development, project implementation. External policy actors in a policy arrangement can be informers, consultants, partners, contractors, participating clients, external suppliers and providers of related services etc. Internal policy actors in the policy arrangement can for example be the initiator and responsible unit within the organisation, public space management, health and welfare, economic affairs, traffic management, the financial department etc. From practise I know that, with regard to W+S policy, it can prove difficult to arrive at the required coverage of interests. In many cases the required knowledge, engagement and commitment to deliver input and contribute to the success of the project is not available in state of the art knowledge and professional skills quality and volume. Regarding experts, practitioners, facilitators and clients it is generally easier to find learned representatives of opposing parties than advocates of pedestrian interests.

[704] An important aspect is how responsibilities and accountabilities with regard to 'my' W+S domain are distributed and effectuated. Who is responsible for what? Are there any gaps in coverage of the domain, e.g. regarding sojourning and casualties from falls in public space.

c. Why are W+S strategies and policies requisite and applied?

In this paragraph I consider why W+S strategies and policies are requisite and applied. First I go into what the *function and role* of strategies and policies is with regard to improving W+S conditions. Next I go into justifications for W+S policy making in general. In Section 4 of this appendix I work out the theme of justifications more extensively.

With regard to improving walking and sojourning conditions, the *function and role* of strategies and policies is being the 'manual' and 'reference' for policy implementation. The policy or strategy describes a process aiming to control disturbances of the system (Ashby, 1956; Van den Top, 2012). It describes what actions will be carried out to regulate the system. Such actions can be delivered by persons, machines and/or organisations. My process design (see Figure 1.2) is an example.

From policy development justification in literature and looking at various institutional policy statements I conclude that justifications for W+S policy making can be *content* related, *process* related, a *legal obligation* or an *emotional* choice.

Content related justifications for W+S policy making can be found on several abstraction levels: macro, domain, organisation and personal levels. Macro level justifications are for example Sustainability (People, Planet and Prosperity (Profit)), Quality of Life and Social Justice[705]; on the domain level it for instance concerns warranting safe mobility, promotion of health, supporting vulnerable groups, transportation, safety, health, economic, touristic or recreational interests; on the organisation level examples are visions on functionality of walking and sojourning, economics or social reasons; on the personal level examples are mobility, safety, health, recreational reasons.

Process related justifications can be particularly important on the organisation and personal levels: demands from the outside such as complaints or advise or management requests; W+S as a niche for profits; raisons d'être, mission statements.

Legal justifications follow from international, national legislation and local legislation and contracts. International legislation concerns for example the environment (CO2, climate agreements), civil rights (such as rights of handicapped persons). Example of relevant national legislation are Land Use legislation, transport and traffic management regulation, traffic rules, administrative rules for traffic and transport facilities, public transport tender rules and preconditions and civil rights. Local legislation can for example concern road and public space use, maintenance of public goods of traffic management. Examples regarding contracts are consultancy, building and maintenance contracts.

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[705] With regard to Social Justice and W+S strategies and policies, in the PQN project Steenberghen (2010, Part B5, pp. 221-236) argued, based on ideas from Nussbaum (2001), that the W+S system can help to achieve higher order goals (i.e. fairness), by complying with 10 capabilities (see this appendix, section 4), inspired by the Universal Declaration of Human Rights (United Nations, 1948).
In his book on Transport and Ethics, Van Wee (2011) confirms this, but also offers a variety of alternative ideas on criteria as well, like Rawls' Theory of Justice , Sen's ideas (introduced the concept of capabilities), Deontology, Contractarianism, 'Values Matter', 'Not Only Humans Matter', 'Rich People Versus Poor People', 'Choices and Reason', 'Absolute Levels Are Ignored' and 'The Process Matters'.
Although Risser (2003) uses a somewhat different approach to the policy subject, he covers the same dimensions and teaches that regarding Quality of Life not only objective parameters count, but subjective parameters as well.

Emotional justification in principle are person-related. Emotional load (compassion for wrong doings, suffering by children or the elderly, the poor, unfortunate family members, fear of losing money) can amplify content related justifications. Emotional involvement can be a powerful drive for change. The loss of family, spouse, children for example has driven many politicians to take traffic safety measures (e.g. traffic safety initiatives by Al Gore, Jacques Chirac, Tjerk Westersterp).

d. When can W+S strategies and policies be developed and applied?
With regard to the moment of W+S policy development and application, in this paragraph I first position policy development and application in the policy process, and then point to important preconditions for policy development.

As mentioned before W+S management & control activities are typically integrated in other 'higher order' policies and the policy actor's standard duties. When leaders decided that there is reason to develop and implement dedicated W+S policies, these activities will come about.

The decision to develop dedicated W+S strategies and policies marks the beginning of the policy development process. Such a decision follows from leadership's perception that there is sufficient reason to invest into improving W+S conditions. This will, apart from true W+S conditions or behaviours, depend on the leader's personal experiences and how convincingly his sources sketch the causes. Urgency needs to rise above 'background noise'. With regard to walking and sojourning this will only come about when something noticeable happens which turns walking and/or sojourning into a new policy issue. Leadership's and the institutional framework's sensitivity to such signals will be subject to the prevailing W+S policy culture.

As we have seen in Figure 1.2 in the first chapter of the thesis, policy development takes place in a number of steps. Only in the instrumentation step (step 5 in my policy process design), when optional measures are identified and program variants are sketched, W+S policy will take concrete form. Application (implementation) takes place after decisions on interventions are made.

e. Where can W+S strategies and policies be developed and applied?
With regard to where W+S strategies and policies are developed and applied a common adage is: do local what can be done local, and do central what needs to be done centrally. Some policy activities are necessarily national activities, like issuing legislation. Others are more effectively and efficiently taken up centrally, like law enforcement, research programming, nationwide knowledge management, proceeding against fragmentation (reinventing the wheel, inconsistent policies / activities).

f. How are W+S strategies and policies developed and applied and what factors drive it?
Although walking and sojourning is done since the beginning of the history of mankind, it seems that W+S strategy and policy development are either obsolete or still in their infancy. Consequently I do not have much information on experiences in this regard. However, from other domains I can learn how to carry out such tasks professionally. In this paragraph I will present ideas about how to adequately set up W+S policy development, inspired on state of the art policy development and implementation approaches from safety sciences and theory on the diffusion of innovations: start from well organised administrative machinery, the Plan-Do-Check-Adjust policy circle (see Figure IX-8, below), a generic cascade model describing the full policy process including realisation and evaluation. These ideas can be used as reference for assessing the quality of current policies and as guiding principles for suggestions for

institutional improvements. In this context I present two cascade models, a model on the adoption of innovations and touch on performance of the W+S strategies and policies: ex-ante and ex-post evaluation of policy plans, ex-ante cost benefit analysis, assessment of fairness and the need for flexible plans.

Foundation: well organised administrative machinery
A precondition for successful policy making and implementation is well organised administrative machinery, where necessary systems are in place to support achievement of planned activities: leadership, knowledge and professional skills, orgware (legislations, working rules, contextual arrangements), resources and basic co-operation and partnership agreements.

Plan-do-check-adjust policy circle (Deming Circle)
Van den Top (2012) argues that ideally change processes are designed as regulation loops, like the Deming circle (Plan - Do - Check - Adjust, see Figure IX-8 Deming Circle (after Van den Top, 2012:Fig 2.5.)). Large organisations, e.g. the Dutch road and waterway authority Rijkswaterstaat use this principle for their work organisation, specifically safety management (Rijkswaterstaat, 2013).

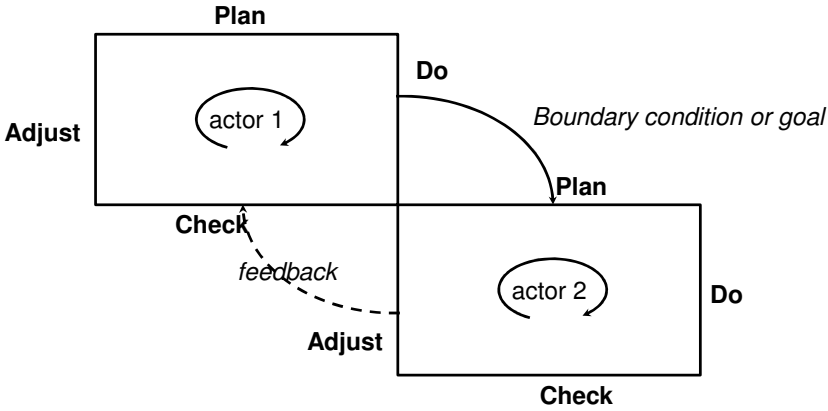

Figure IX-8 Deming Circle (after Van den Top, 2012:Fig 2.5.)

Generic Cascade Model
Van den Top (2012) distinguishes a number of regulation loop types, positioned in a Cascade (see Figure IX-9).

The highest stage of the cascade concerns societal (= contextual, life style level) values, norms and goal, such as legislation. In this stage general goals are stipulated. The fifth stage concerns setting generic goals for the policy plan, the strategic level. In the fourth stage the process concerns determining the degree to which the system can be changed, i.e. the design process. The third level the production planning or structure (e.g. network plan, street plan, timetable, traffic routing) of the system is set: the tactical policy level. In maintenance processes this step is about maintenance planning. The second stage is about realising the system targets, i.e. building process, education, communication, enforcement, being the operational (execution) policy level, which in maintenance processes concerns the actual maintenance activities. The lowest level in the cascade deals with evaluation.

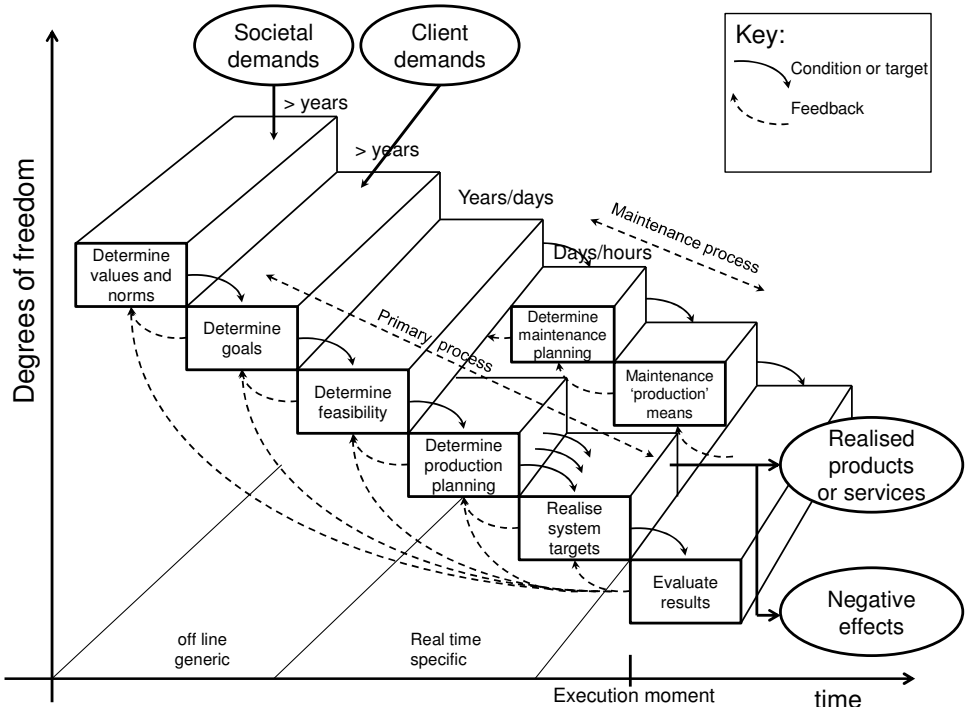

Figure IX-9 Generic Cascade model (after Van den Top, 2012:Fig 2.4.)

Cascade of interventions model

About a decade before Van den Top introduced his cascade model, Hendriks et al. (1998) introduced a simple version of a similar cascade model, which is not so much focussed on organisational processes, but on policy *scope* in relation to the road user's (read pedestrian's) activity levels and plan hierarchy. The premise here is that all activities happen within a context; conditions at the macro level, concerning the land use distributions, jobs, access to transport, vehicle ownership, mobility management etc. set the stage for mobility decisions on the lifestyle and strategic levels. Network level conditions set the stage for tactical activity levels, and site level and 'here and now' conditions set the stage for operational activity level decisions. Basically, planning levels connect to these decision levels. It therefore pays to give attention to the context of matters (see Figure IX-10).

Macro level interventions set the stage for the functioning of the system on the lower activity levels. It is therefore most sensible to start the intervention programme development with providing the best possible contextual conditions at the macro level, e.g. system management and change preconditions (i.e. policy input factors), distribution of functions, generic legislation, generic mobility options. When everything possible has been done to create optimal conditions on the lifestyle and strategic activity levels, within that framework it becomes opportune to look at options to improve conditions on the tactical activity level. At this level attention should be paid to route characteristics, road design, road environment, speed management, vehicles, communication & campaigns, urban space management, network design and traffic regulation & enforcement. Then, according to this cascade principle, when more or less everything possible has been done at the lifestyle, strategic and tactical levels, 'as

a last resort' it becomes most practical to look at the micro level: pedestrian and other public space users' behaviour, and deal with occurring mishaps (Hendriks et al, 1998; Methorst, 2000; see Figure IX-10 Cascade of interventions principle (after Hendriks et al., 1998)). It has to be mentioned that the above procedural description is a principle, and not a regularity or existential law. For example, although not based on a cascade principle related policy process, in most cases streets have paved sidewalks, which of course is a merit. Furthermore, this cascade model and Van Hagen's pyramid model have similar tenor.

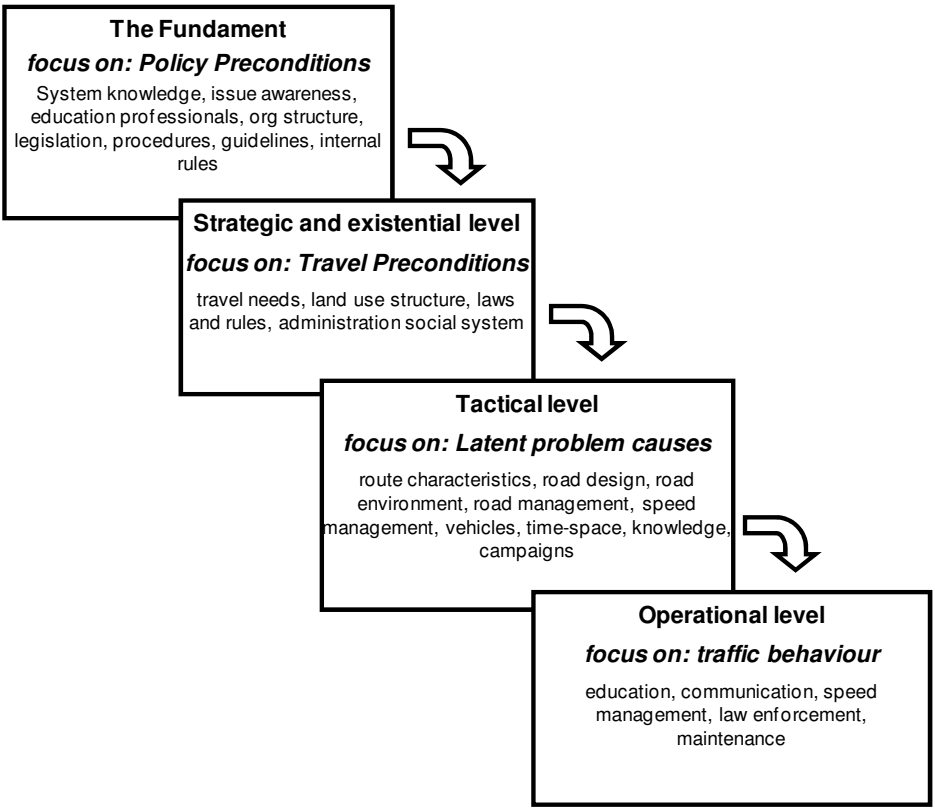

Figure IX-10 Cascade of interventions principle (after Hendriks et al., 1998)

Adoption of innovations model

In the above models it is more or less assumed that technical feasibility of the implementation of evidence based measures in the public domain preconditions or should precondition their implementation. This is probably true for simple operational measures where authority regarding financial decision is delegated to civil services, but for more fundamental changes and innovations political decisions are needed. With regard to transport innovations Feitelson and Salomon (2004:15) argued and showed that in such cases[706]:

[706] The author assumes that Feitelson and Salomon's ideas also apply for walking and sojourning in public space strategies, policies and specific measures.

"an innovation will be adopted only if it is seen as technically, economically, socially and politically feasible. Unless an innovation meets this minimal (essentially satisficing) criteria, it will not be adopted.

Techno-economic feasibility is composed of two elements. One, the innovation needs to be technically feasible (i.e. it can work technically). However, an innovation is not likely to be seen feasible unless it also can pass a benefit-cost analysis (i.e. that it is also economically viable). […]

From the social feasibility perspective, a project can be seen as feasible if a majority of voters are likely to support it. […] social feasibility is […] a function of the public perception of problems and the perception of effectiveness of the proposed innovation in addressing these problems. These perceptions are affected by experiences with similar policies or systems elsewhere. Policy entrepreneurs can affect these perceptions by publications and media appearances that support or criticize the proposed innovations. Environmental interests or transport lobbies can do likewise. […] they try, essentially, to affect the 'sanctioned discourse'.

[…] some innovations will seem as politically acceptable. These will be the ones that are supported by a wide coalition of specific interests and whose costs will be borne by the wider public, but still low enough not to generate opposition and that can be rationalised as meeting the public good and addressing an urgent problem. […] not all politically acceptable innovations will ultimately be adopted…" (Feitelson and Salomon, 2004, p 15, see Figure IX-).

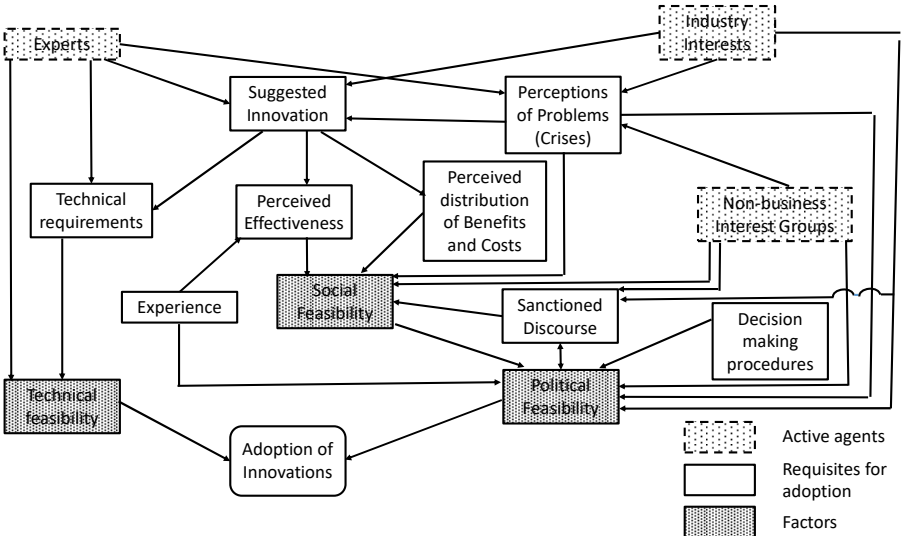

Figure IX-11 Institutional model of W+S innovations (adapted from Feitelson & Salomon, 2004)

Performance evaluation

This paragraph is closed with consideration of W+S performance of policy strategies. In this context I touch on ex-ante evaluation, Multi Criteria Analysis, Social Cost-Benefit Analysis, assessment of fairness, and the need for flexibility.

The quality of the decision on the implementation of strategies or policies depends on the quality of the *ex-ante* evaluation of proposals. Regarding what is the 'best' policy Van Wee describes the essence of modern policy approaches:

> *"It is important to recognize the three generally accepted criteria required to answer the question: effectiveness, efficiency and equity. Effectiveness relates to the question of whether the policy leads to an improvement. [....] efficiency relates to the question of at which costs the improvements are made. [....] The third criterion, equity, is related to the question of whether the policy is 'fair'."* (Van Wee, 2011, p. 56)

In *ex-post* evaluations effectiveness of strategies and policies can amongst others be assessed by multi criteria analysis (MCA) and Social Cost Benefit Analysis (SCBA).
MCA '*explicitly evaluates multiple conflicting criteria in decision making (both in daily life or in professional settings). Conflicting criteria are typical in evaluating options: cost or price is usually one of the main criteria, and some measure of quality is typically another criterion, easily in conflict with the cost criterion'* (Wikipedia, 2017)[707]. Van Wee mentions that MCA has some severe drawbacks because of the difficulty of setting weights (Van Wee, 2011, p 19).
SCBA works by comparing information about the actual state of conditions with information about the targeted state of conditions. It needs to be ascertained whether differences can be attributed to the interventions taken or to autonomous factors. In *ex-ante* evaluations, obviously, this is not an option and the effectiveness of the interventions needs to be estimated, i.e. by applying experiences and evidence from similar cases, by using forecasting techniques, or by making 'educated guesses'. *Ex-post* evaluations can be used as input for *ex- ante* evaluations, if the interventions build on previous experiences. Anyway, such experiences and evidence need to be based on insight in the performance of the W+S system: what its components are, how they interact, how interaction and performance are affected by internal and external stimuli etc.

Efficiency of strategies or polices can be *ex ante* assessed by *Social Cost-Benefit Analysis (SCBA)*. For good comparison of proposals the evaluation results need to be expressed in a common denominator, which usually means expressing consequences in monetary terms. Litman (2007, 2009:1) warns that '*decision making can be biased by the tendency to focus on easy-to-measure user impacts'* ('if you can't count it, it does not count'). Indeed, some costs or benefits, i.e. the loss of nature, aesthetics, suffering from noise, pollution, perceived danger, disadvantages for future generations, or social cohesion cannot be (easily) expressed in monetary terms. Some people even find it unethical to express such values in monetary terms. As decisions on proposals have to be made anyway, it seems better to have debatable monetary valuations than none at all (Van Wee, 2011).

Another question is what costs and benefits are to be included in the evaluation. For enterprises it may suffice to only include 'out of pocket' costs and direct (financial and market position) benefits. Governmental policy agents, however, are supposed to take into account all costs and benefits to society: Social Cost Benefit Analysis. This however is not self-evident, as governments, much like enterprises, themselves have to take care of (financial) continuity. Expenses for W+S strategies have to compete with other expenses, and many times it will be difficult to sell that specific other organisations get a better (market) position without having to bear the costs. Another problem is that the benefits and costs can picked up by different policy actors, e.g. the costs of pedestrian facilities rest with the road authorities, whilst the mobility and health benefits fall to other policy agents.

[707] https://en.wikipedia.org/wiki/Multiple-criteria_decision_analysis, accessed 19-2-2017

Whilst assessment of effectiveness and efficiency of policies can and should be based primarily on factual information, the *assessment of fairness* of a policy is a different matter. Fairness concerns ethical issues such as distribution effects of policies. Fairness cannot be based on 'objective' criteria, but stems from perceptions, norms and values. These are not easily 'countable', 'black or white', or easily expressed in monetary terms. An important ethical discussion concerns winners and losers because of introduced policies, making it indispensable to involve stakeholders in the assessment and subsequent choice between alternatives.

The future is uncertain, and consequences of W+S policies and strategies can be unpredictable. *Flexible and adaptable plans* will have better potentials for ultimate success than blueprint plans (Kwakkel et al., 2013). Shortcomings in the quality of the implementation and undesirable developments from the W+S plans and external influences can be detected by monitoring the policy input, output, and outcomes and impacts of system changes. By following up on monitoring conclusions, effectiveness and fairness of the system changes can be improved.

g. Conclusions

The author concludes that the following matters are likely to set the stage for effective and efficient W+S strategies and policies:

- The function and role of W+S strategies and policies are being a frame, i.e. guidance and reference, for policy implementation;
- W+S strategies and policies are developed within a W+S policy culture and related to the position of W+S as a policy issue in the Policy Life-cycle. W+S strategies and policies are typically seen as a ‘management & control’ stage issue and are integrated in ‘umbrella’ policies. In special cases, when policy changes are indicated, dedicated W+S policies and strategies will come about;
- All decisions are made within a context. This feature determines opportunities for effective and efficient policy interventions. First of all it streamlines the policy process towards system improvements into a cascade of actions from setting goals to implementation and evaluation of interventions. This is pictured in Van den Top's generic cascade model. Secondly contexts mould practical options by funnelling degrees of freedom regarding mobility and safety decisions. Thus many fundamental problems cannot be solved on the operational (site, reactive behaviour) level. Consequently it is more effective and efficient to improve conditions 'upstream'. This is pictured in the Hendriks Cascade principle;
- There is great variety in policies and strategies. Main distinguishing features are: origin of action idea, subject of the strategy or policy, whose strategy or policy it is, scope, target group and impact, political impact, intervention target, intervention method, tangibility of expected impact, activities;
- The most important policy requirements are: the policy is justified; SMART formulation and scope; it is coherent and consistent; embedded in the legal framework and organisational structures; flexible enough to enable coping with unexpected developments and policy consequences;
- For achieving W+S aims, the lead agency needs co-operation and support of other policy actors’ to develop, instrument and implement W+S interventions;
- A common adage is: do local what can be done local, and do central what needs to be done central. Some policy activities, like legislation, law enforcement policy, research programming, nationwide knowledge management, proceeding against fragmentation are necessarily central tasks;

- The success of W+S policy implementation depends on the degree to which preconditions for achieving the decreed targets are met, purposeful measures are taken, and implementation adapts to unforeseen and changed conditions and effects. Quality control of the W+S strategies and policies is helped by ex-ante evaluation of proposals. Evaluation should cover effectiveness regarding the aims, efficiency of the policies and fairness of the interventions and their impacts.

h. Research topics for assessment of the status quo

From the above the author deduces that in this thesis' research the following matters with regard to strategies and policies in the W+S institutional framework deserve to be assessed: 1) what kinds of visions, strategies, policies and concrete measures are in fact issued and/or implemented, 2) how do these activities compare to the proposed System approach criteria of a systematic process, comprehensive analysis and integral intervention strategies and 3) how can the policy activities be positioned in the policy life cycle?

2.6 Resources

With regard to *resources* findings are captured under the headings of the 6 Topical questions tuned to the subject, conclusions and research topic ('in short') for the assessment of the status quo. The matters are dealt with below.

a. What is the nature of W+S policy resources?

In this subsection I define the concept of resources, and relate to kinds of resources, their field of application, and availability of resources for W+S policy development and implementation. The results are based on a literature scan and snowballing. Literature is searched in my dedicated library, Science Direct (search words 'resources', AND 'policy', 'strategy', and additionally 'pedestrian'), Google Scholar (same search words as Science Direct).

In Oxford Dictionaries[708] the concept of resources is defined as "*a stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organization in order to function effectively*". It can also mean "*a country's collective means of supporting itself or becoming wealthier, as represented by its reserves of minerals, land, and other natural assets*", or "*personal attributes and capabilities regarded as able to help or sustain one in adverse circumstances*". In this respect resources concern the means, help and tools to support leadership, policy decisions and achieving the goals laid down in the policies and strategies. With regard to improving W+S conditions, the function of resources is to help provide building blocks for the creation of opportunities for policy development, implementation and evaluation.

In this thesis I discern three *kinds of resources*: resources of the hardware, software and orgware kinds.

Resources of the *hardware* kind include space, building materials, physical tools and machinery.

Examples of resources of the *software* type are data, policy independent 'universal' modern information technology, and knowledge and information. The availability of this type of resources often tends to be taken for granted, but can considerably impede success of W+S policy development, implementation and evaluation if staff within the policy agents cannot

[708] https://www.lexico.com/definition/resource, accessed 29-1-2014

have them at their disposal. For example outdated software or other tools[709] impedes work effectiveness and efficiency; bad and missing data[710], such as missing and incomplete inventories of W+S assets (i.e. usability, appeal), mobility and accident data, can cause researchers and staff to draw the wrong conclusions.

Orgware type resources comprise: 1) funding, 2) staff, 3) the normative environment (legislation, rules, protocols, procedures, guidelines), 4) dedicated tools for policy development, implementation, management and enforcement, evaluation, 5) communication, education and voice, and 6) educational facilities.

Sauter and Tight (2010:25) list the orgware type resources 'funding' and 'staff' as key performance indicators. Regarding 'funding' they indicate that this includes infrastructure investments, promotion, maintenance, research etc. They suggest to assess the '*levels and continuity of funding for modes or projects a) with adverse effects on walking; b) for rectifying poor walking situations, and c) to genuinely improve walking conditions and public spaces'*. Concerning 'staff' as key performance indicator, Sauter and Tight suggest to look at '*a) the number and qualifications of staff involved, and their seniority and training, and b) the position and power of the walking unit within administration'*. I think that the amount and quality of time[711] that staff can devote and the organisational attitude towards W+S (W+S policy culture) also matter, because these can be expected 1) to strongly contribute to effectiveness and efficiency of the measures, and 2) to support keeping up and building of W+S knowledge and professional skills. The latter is extremely important, as was concluded before, because sound W+S knowledge and professional skills are quite scarce.

Regarding the field of *application of resources,* it was found that what resources are de facto needed depends on the characteristics of the strategy or policy: its domain or domains, the scope of the plan, the volume, type and complexity of the activities, available alternative resources, synergy with other projects etc. At this point no general resources requirement specification can be given.

With regard to policy activities integrated in 'umbrella' policy programs[712], the question of what resources are needed is less relevant, as their application is subject of consideration beyond the W+S domain. To assure that W+S interests are properly included, however, attention is needed to the availability of current W+S knowledge and professional skills, and room (particularly time and financial budget) for necessary adjustments of the plans and implementation.

Resources availability for the application in W+S policies and strategies depends on their relative priority, particularly in relation to similar strategies and policies, like bicycle facilities improvement plans or landscaping plans. Pedestrian needs are, compared to other modes, relatively modest and though complex and wide-ranging, not particularly urgent politically. In

[709] E.g. what tools are available to the W+S authority for policy development, implementation, and management & control? What is the quality of these tools (i.e. scope and application design envelope, usability, life span)?
[710] E.g. what data are available for acquiring insight in the W+S state of affairs, policy development, evaluation? What is the quality of the data (i.e. coverage and representativeness, validity, reliability)?
[711] How much time is available for performing relevant activities (i.e. total time, person-time, phasing)? How is time distributed and how suitable are the moments?
[712] Such as land use projects, infrastructure projects, safety programs, health promotion programs.

most cases W+S quality can be improved with a relative small budget; however, fitting in the projects within larger schemes can still be a great challenge.

While most resources are used up by deployment, the contrary is true for knowledge and professional skills. No deployment means no experiences and skills gathered, but with increasing deployment of knowledge, knowledge grows more or less exponentially.

b. Who are involved in deploying W+S policy resources?
With regard to W+S policies and their implementation, it is essential who deploys which of the discerned kinds of resources depends particularly on the distribution of responsibilities, policy objective and kind of activity. In this paragraph I concisely consider national and local level activities.

At the *national level* the main responsibility generally is to deliver a functional normative (legal) and organisational framework for the provision of adequate W+S conditions at the local level, i.e. software and orgware type resources. In this regard the most important resources deployed are software type resources, staff and budget. At the *central level* software and orgware resources are used, but also created and managed. Examples are compilation of statistical data, meta-information, normative environment for other policy actors, dedicated generic tools for policy development, implementation, management and enforcement, and evaluation. Furthermore, much of the prioritizing concerning generic policy issues, communication about it, professional education and voice, educational facilities, are organised and managed directly or indirectly by central government.

In most cases *local authorities* are responsible for policy implementation, i.e. taking care of public space facilities (including infrastructure) for pedestrians. In this context they deploy funding and staff of their own, and make use of software and orgware made available nationally, and use budget for hiring in consultants, contractors, deploying hardware type resources. As mentioned before, much of the work regarding providing W+S is integrated in 'higher order' policies and projects, such as land use development, traffic and transport projects, public space projects, economic policy. In practise it will be difficult to identify how much of the budget is spent on the management and improvement of W+S conditions. To a lesser extent this is true for the deployment of staff as well, but it is highly likely that the staff's W+S knowledge and professional skills determine the quality, distribution and volume of the measures taken to improve W+S conditions within the context of the integrated projects.

For other policy agents, resources of the hardware kind, apart from e.g. computers, surveillance equipment for research and the police, will only be indirectly important for supporting their W+S strategies and policies. Budget and staff are the most important resources for them, too.

Relevant question with regard to the relationship between policy actors and resources are: who controls the various resources (ownership, distribution, go-betweens), how scarce and accessible are the various resources, and what options are there regarding substitution of certain resources with other resources?

c. Why are the W+S policy resources deployed?
In this paragraph I concisely consider why W+S policy resources are deployed. In this regard I will touch on justification, responsibilities and accountability.

The deployment of resources for management and improvement of W+S conditions needs to *be justified*. W+S policy resources deployment can be justified if this deployment apparently serves the realisation of objectives issued by leadership, and the ensued and agreed policies, strategies and projects. The role of resources in W+S policy is to enable the management and improvement of W+S conditions, which can be needed for a variety of reasons. Compared to other modes and public space uses, like commerce, traffic flow, parking, public services, W+S demands are modest, and can, in most cases, easily be integrated in management and improvement projects set up for 'umbrella' policy issues. In practise, paradoxically however, because of the modest demands, pedestrian policies do not have an overly favourable position in the competition for available resources[713]. Acquiring more resources, particularly budget and deployment of staff for supporting W+S improvements, is probably not on top of the policy agent's To Do list. It would be interesting to know what conditions boost commitment to employ more resources than usual.

From the lack of national policy papers and plans regarding W+S it can be concluded that, at the national level, logically existing *responsibilities and accountability* regarding these matters are not obvious and urgent. It appears that they are often seen as settled: legislation is issued, norms for pedestrian facilities are taken care of by the official technology platforms, the tasks are delegated to municipalities, and they have been given appropriate budgets. This corresponds with conditions regarding Winsemius' policy life-cycle phase of 'management & control'. Indeed, for public space and local transportation issues including walking space and pedestrian facilities, local authorities, and not central government, are responsible and accountable. The territorial delimitation, however, obscures the more abstract strategic responsibilities and accountability regarding the legal framework, enforcement, guidance, knowledge management etc. For matters that surpass local significance, like general mobility and safety conditions for pedestrians, it can be argued that national government is responsible and accountable, controlling generic data and information and governing local authorities, and thereby availability and allocation of resources at the local level.

d. Where and when are the W+S policy resources deployed?

In this paragraph I concisely consider where and when deployment of W+S policy resources comes about. In this context I focus on the initial decision regarding W+S sources deployment and its carry-over.

As has been established above, preconditions for deployment of W+S policy resources are shaped at the national level. It can be expected that the central lead agent's (read: ministerial) explicit decisions on W+S policy strategies affect resources deployment decisions at the local level (see below, under 'how...').

Decisions regarding the deployment resources for the improvement of W+S conditions are made at the start of policy development and implementation processes, and are based on the available data and information of the cause in question (software type resources). At such moments and places it is decided what and how much is available or will be made available for W+S causes. Above I already concluded that, with exception of high profile strategic questions, decisions on deployment of resources for W+S improvements are often made within the context of integrated projects. In such cases W+S interventions join in with other, larger scale projects. When decisions are made within integrated projects, the W+S investments will be relatively

[713] If one is not asking much, popular reasoning is: 'it can't be important or urgent'

implicit, hidden and untraceable. In relation to quality control of the interventions[714] there is (see above) reason to separately consider the deployment of staff and professional skills. This way it can be assured that staff time is allotted for consideration of the W+S matters at hand, that can be learned from the experiences for future projects and that the quality of the measures in terms of effectiveness, efficiency and fairness is seriously considered.

In principle W+S policy implementation, and thereby resources deployment, is handled at the local level, in a *project context*. At the local level there is usually little manoeuvring space: deployment should fit in (mostly integrated) project plans and the project organisation context; when not suitable, it can be expected that resources will not be made available. Pedestrian facilities are dominantly included in the plans for plain reasons: handbooks and professional practises incite them, the facilities are affordable, opportunities are available, tradition, culture, fairness etc. In this regard new policies differ from existing ones. Changes generally are more difficult to achieve than sticking to traditions. In rare cases a resource may be not applied because there is a taboo on its deployment: political or social reasons. As the provision of W+S generally is integrated in public space and infrastructural projects, resources deployment will be decided within the project organisation. Only in special (high profile) cases leadership decides on budgets and staff for W+S conditions improvement.

e. How are the W+S policy resources deployed and what drives the deployment?
In this paragraph I consider how W+S policy resources deployment can come about. In this context I look at resources deployment in new policy initiatives at the national and local levels, and then in more standard procedures for W+S conditions management and improvement. This paragraph is closed by touching on assessment of policy performance due to W+S policy resources deployment.

New W+S policy initiatives at the national level can start from availability of (statistical) data on walking and sojourning in public space, urgent calls from the general public or W+S domain, and/or monitoring of W+S conditions on the meta level and (political) recognition of significance of W+S developments and trends. To be effectuated, staff and current W+S knowledge must be deployed to develop national level W+S policy strategy recommendations. It can be expected that the central lead agent's (read: ministerial) explicit decisions on W+S policy strategies, such as national targets or special promotion budgets, rewards or penalties, affect resources deployment decisions at the local level. On the *local level* new dedicated W+S policy activities can be expected to be either driven by urgent calls from the public or media or 'functional opportunism'.

In practise most effort and energy can be expected to be spent on *standard procedures*, i.e. keeping up, repairing and integrating W+S facilities and services, as laid down in formal responsibilities. As said before, the quality of such policy activities and effectiveness of deployment of depletable resources dominantly depends on the quantity and quality of the staff mobilized for the tasks. I found that sound W+S knowledge and professional skills are quite scarce. In this regard it seems wisest to cluster W+S staff in a taskforce. This will enable the members to learn from each other by properly discussing their experiences and knowledge of facts, methods and procedures. Working together helps them to internalise and accumulate knowledge and professional skills, and become experts, who deliver effective, efficient and fair proposals and who are resilient when confronted with unexpected setbacks. Decentralisation or scattering of niche domain staff can be expected to be counterproductive, as knowledge and

[714] Particularly the risk of neglect of important W+S interests.

professional skills will then degrade and 'reinventing the wheel' will be common practise. Co-operation arrangements can be expected to be most effective.

I close this paragraph by touching on assessment of policy performance due to W+S policy resources deployment. As far as I know there is no tradition of evaluation studies on this subject, and I did not find examples of such studies. I propose the following indicators: 1) estimated *input volume of budgets* for the totality expenses on resources for W+S interventions[715], 2) estimated *net value of the W+S interventions*, 3) estimated *net value of the outcomes* of the W+S interventions, 4) *concrete and conceivable impacts* of the interventions in terms of pedestrian mobility, safety and comfort, wealth and well-being of individuals, communities and the nation. Performance can be expressed as a ratio 1) and 2), 1) and 3), and 1) and 3) + 4).

f. Conclusions and Research questions

The author concludes that the following matters regarding the deployment of resources are likely to precondition effective and efficient policy making and implementation:

- With regard to sustaining and improving W+S conditions, the function of resources is to help provide building blocks for the creation of opportunities for policy development, implementation and evaluation;
- In principle there are three kinds of resources: hardware, software and orgware kinds;
- What resources are de factor needed, depends on the characteristics of the strategy or policy: its domain, scope of the plan, the volume, type and complexity, alternatives, synergy demands etc.;
- New W+S policy initiatives at the national level can start from the availability of (statistical) data on W+S, urgent calls from the general public or W+S domain and monitoring. In this way software kind resources can be of vital importance;
- For national level W+S policy level and W+S improvement integrated in 'umbrella' policies and projects, resources of the orgware kind, particularly funding and staff, are generally most suitable. Most effort and energy can be expected to be spent on standard procedures, i.e. keeping up, repairing and integrating W+S facilities and services;
- In most cases W+S quality can be improved substantially with only small (additional) budgets. Fitting in the measures can be a great challenge. W+S Knowledge and professional skills, however are critical for the quality of the action;
- Contrary to other resources, knowledge and professional skills grow more or less exponentially with the volume of deployment. Decentralisation or scattering of staff can be expected to be counterproductive, inciting 'reinventing the wheel' and ineffective and inefficient 'trial and error' actions;
- In practise it is proven difficult to identify how much of the budget is (to be) spent on management and improvement of W+S conditions. This weakens the argument for such actions;
- Preconditions for deployment of W+S policy resources are shaped at the national level. On the national level feeling responsible and accountable is not obvious, weakening the urgency and grounds for justification of investments at the local level. Deployment of resources is subject to perceived responsibilities and accountability.

[715] I.e. the total of preparation costs, direct expenses regard staff costs, costs of dedicated W+S projects, estimated shares in integrated project costs, costs of invested hardware types resources etc.

g. Research topics for assessment of the status quo

From the above the author deduces that in this thesis' research the following matters with regard to deployment of resources in the W+S institutional framework deserve to be assessed: 1) deployment of resources, 2) distribution of applied resources across the domain, and 3) to what degree preconditions are shaped at the national level.

2.7. Co-operation and partnerships

With regard to *resources* findings are captured under the headings of the 6 Topical questions tuned to the subject, conclusions and research topics ('in short') for the assessment of the status quo. The matters are dealt with below.

a. What is the nature of cooperation and partnerships?

In this paragraph on the nature of cooperation and partnership I start with defining the concepts of cooperation and partnership. Subsequently I establish what the main dimensions of co-operation and partnership are, position the cooperation and partnership with regard to their level of endeavour and types of activities, and consider the main function of cooperation and partnerships. The results are based on a literature scan and snowballing. Literature is searched in my dedicated library, Science Direct (search words 'cooperation', 'partnership', AND 'policy', 'strategy', and 'pedestrian'), Google Scholar (same search words as Science Direct).

According to Oxford Dictionary[716] *cooperation* "is the action or process of working together to the same end". Cooperation can grow to *partnership* by agreement, when the co-workers agree to work closely together in an undertaking (e.g. a project or an organisation) and share risks and profits. Based on a literature review Brinkerhoff defines partnership as follows:

> *"Partnership is a dynamic relationship among diverse actors, based on mutually agreed objectives, pursued through a shared understanding of the most rational division of labour based on the respective comparative advantages of each partner. Partnership encompasses mutual influence, with a careful balance between synergy and respective autonomy, which incorporates mutual respect, equal participation in decision making, mutual accountability, and transparency."* (Brinkerhoff, 2002:216)

In practise partnerships will not totally comply with the ideal type as formulated by Brinkerhoff. Furthermore, the justification for entering a partnership is subjective and value based; this can change in the course of time.

With regard to W+S, co-operation and partnership take place in a policy network, and can be seen as a special kind of functioning in such a network. Van Waarden (1992) discerned seven dimensions describing policy networks, which may also be presumed to *typify* co-operation and partnerships. The seven dimensions are: '*1) number and types of actors, 2) function of networks [read: co-operation & partnerships], 3) structure, 4) institutionalisation, 5) rules of conduct, 6) power relations, and 7) actor strategies'* (Van Waarden, 1992:29).

Both co-operation and partnership can be *positioned* regarding their level of endeavour of collaboration. Based on literature, Horwath et al. (2007:56) discerned five levels:

1. *'Communication*: individuals from different disciplines talking together.
2. ***Co-operation***: low key joint working on a case-by-case basis.

[716] Accessed 29-1-2014

3. ***Co-ordination***: more formalized joint working, but no sanctions for non-compliance.
4. ***Coalition***: joint structures sacrificing some autonomy.
5. *Integration*: organizations merge to create new joint identity'.

The levels 2, 3, and 4 (typed in bold) within our definition of co-operation and partnerships (typed in bold).
The lowest level of collaboration concerns *communication,* which I see as a pre-stage for co-operation and partnerships. Within the W+S domain a variety of policy actors communicate with each other and form a policy network.

The second level of collaboration, according to Horwath et al. (2007) concerns *co-operation,* i.e. low key case-by-case working together. This coincides with my definition of co-operation. In such cases the collaboration is not formalised in agreements. In this thesis partnerships concern forms of collaboration, where collaboration is formalised, but the partners can also agree to form a *coalition*, where consequences of non-compliance are mutually decreed. Sanctions cannot be issued by any of the partners, only by an agreed independent facilitator or mediator; apart from refusing to further co-operate, there is no formal hierarchy amongst the partners. In partnership there can be '*voluntary pooling of resources between two or more partners, in order to accomplish collaborative goals'.* Gulati typifies this as a mutual self-help group (Gulati, 1998, cited in Augustyn, 2000:341). Characteristic for co-operation is co-ordination of activities. Johannessen et al. (2011) scale the degree of co-ordination to the degree of change and innovation (see Figure IX-12). They find that, when the degree of co-ordination and the degree of innovation are small, the culture within the policy arrangement is counter-productive, whilst with little innovation and a large degree of co-ordination a management and control culture, where the status quo is kept, exists. When however the degree of innovation is large, and the degree of co-ordination is (still) low, there is a culture of innovation, but the innovation does not spread much beyond its origin. This can change, when both the degree of innovation and the degree of co-ordination are large. Under such condition vast improvements can come about.

The highest level of collaboration concerns integration, i.e. merging of organisations of W+S policy actors. Although integration of policy responsibilities theoretically can be a promising development for improving W+S conditions, as control over activities becomes simpler, this goes beyond the scope of this thesis. Furthermore, in times of decentralisation of policies towards local authorities, integration of W+S policy responsibilities on the national level is unlikely.

One of the main *functions* of co-operation and partnering up in the W+S domain is combining the individual spans of control to a greater whole, with better chances of achieving the aim of improving W+S conditions. As was shown in Chapter 3, the latitude (Span of Control) or room to play connects to the stakeholders abilities, competences and skills; on theoretical grounds it can be concluded that the actual span of control can differ substantially from the perceived span of control. The freedom depends both on external influences and perspective taken regarding the assessment of the stakeholders span of control (cf. Bradshaw: normative, subjective, comparative, expressed, or systemic span of control).

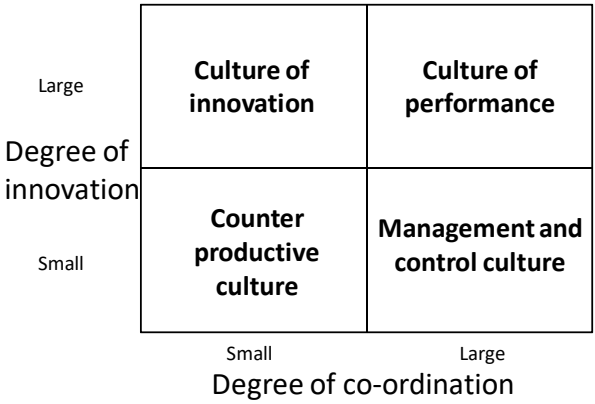

Figure IX-12 A culture of innovation and performance (after Johannessen & Olsen, 2011)

b. Who establishes cooperation and/or partnerships in the W+S playing field?

In this paragraph, about who establishes cooperation and/or partnerships in the W+S playing field, I first define the concept of stakeholder and subsequently roughly assess the players' potentials to enter in a co-operation or partnership regarding the improvement of W+S conditions.

With regard to aim of improvement of W+S conditions, stakeholders can form partnerships. Stakeholder can be *defined* as any person or organisation that has an interest or concern in a specified matter or is able to influence the situation either negatively or positively (after Oxford Dictionaries[717]). Most of the stakeholders have some degree of influence on the system, either negatively or positively. Different individuals, interacting public space users and organisations can also have different perspectives and interests or stakes in the functioning of the W+S system.

Above three main groups of stakeholders were discerned: strategists, facilitators and clients (cf. Figure IX-3). I assume that, with regard to W+S policy development on the national level, individual persons, in whatever role, do not enter in national level co-operations or partnerships in the W+S domain, and that only organisations can qualify. Following Johannesson et al. (2011), I discern two main levels of (potential) collaborating policy agents: management (leadership) and operative (staff). In table IX-2 a tentative list of candidates for entering W+S policy activities collaboration is presented. Not that not all of these actors have a direct interest in W+S; some of them can or will influence walkability and walking without having a W+S interests. The list shows that in principle there are many candidates. However, the list of candidates concerning clients organisations, although relatively long, represents rather unlikely collaboration candidates, as clients are rarely unionized and adequately equipped for collaboration with powerful lead and followers organisations. Clients Associations, including pedestrians' representatives, if at all existing, have severe difficulties to survive and/or deliver the needed input; they do not have much to offer to other players in the field and a lot to ask.

With regard to pedestrian needs, stakeholder interests and responsibilities are to a large extent determined by organisation characteristics, like position, bargaining power, (sector) leadership,

[717] A person with an interest or concern in something, especially a business (2nd meaning https://en.oxforddictionaries.com/definition/stakeholder, accessed 20-2-2017).

core tasks, scope of activities, mutual agreement on task division etc. In this regard National government can be expected to not interfere with what they see as local matters and confine their policy to generic measures like legislation, funding of pilot projects, research programming and facilitating dissemination of knowledge. Local authorities on the other hand can be expected to be responsible for integration of interests in spatial plans on the executive level, and will have to consider both the interests of walkers and other road and space users. They will, however, not be able to influence road user competences, hardware characteristics of transportation, behavioural rules, norms and values, and public transport connectivity on the regional or national scale.

Table IX-2 Tentative list of W+S policy activities collaboration candidates

	Organisation	**Management**	**Staff**
Strategists	Ministry	Minister Politicians	Policy makers
facilitators	Road authority Land Use authority Province Municipality Police Consultants	Director (-General) Politicians	Policy makers Planners Project leaders Advisors Researchers
Clients organisations	Pedestrians Association Elderly's Association Child protection Road Safety Association Chamber of commerce Tourist agencies Road Users Association Political parties Lawyers	Chairman Director	Policy makers Lobbyists Researchers Consultants Helpdesk staff Client representatives

c. Why do cooperation and/or partnerships come about?

In this paragraph I assess what arguments may apply for entering into co-operation or partnership arrangements. The assessment is based on a Wikipedia orientation and a cursory Google Scholar literature scan using the following search terms: 'determinants cooperation or collaboration' separately and in combination with 'reasons' or 'review'. The search yielded about 20 relevant publications. The publications were analysed; the identified determinants can be roughly grouped into a consistent collection of reasons for entering into a co-operation or partnership: 1) there are one or more shared reasons for a policy activity, plus 2) the policy actors do not themselves have full control over the matter, plus 3) the policy actors expect to achieve their aims at tolerable effort[718]. In this paragraph I will successively consider the factors 'shared reasons', 'control' and 'tolerable effort'.

[718] Robert Axelrod (1985) concluded '*Cooperation […] is explained to a considerable extent by the three factors […]: mutuality of interest, the shadow of the future, and the number of players'* (World politics Volume 38, Issue 1 October 1985, pp. 226). With the found variety of rather specific determinants as background, the author translated this conclusion into the above composition of reasons.

Having a motive and justification to act is, by itself, not sufficient reason to consider collaborating with other parties. First of all, there must be perceived potential synergy from *shared interests* and aims of other potential policy actors within reach. Under the next heading concerning where and when co-operation and/or partnerships will come about, I will consider precursors for reasons and other prerequisites for entering in co-operation and partnerships.

A policy agent cannot be expected to enter into co-operation when he (thinks he) has *full control* over the matter in question, unless the co-operation is entered for different reasons, like popularity, coercion, kindness among friends. For simple matters like where a municipality, because of potential claims from fall victims, needs to repair broken tiles in sidewalks, co-operation is not indicated[719]. For solving more complex manifest problems, surpassing the policy agent's authority and span of control, there can be reason to collaborate with other policy actors. Choices are: not doing anything about it, doing only what is within one's span of control, or considering asking help from others. In most cases a policy agent cannot achieve W+S improvement aims without consultation, support and co-operation of partners and other stakeholders, the followers, like planners, managers of the physical environment, the police, property owners, and not in the least the clients, i.e. citizens, public space users, other affected persons. Therefore policy development and implementation in fact is dominantly based on co-operation and partnerships, because many hands make working easy, synergy improves efficiency and effectiveness of each other's activities, and by combining experiences and ideas critically and creatively, the cooperation can lead to innovations improving W+S conditions.

The third successive reason for entering into co-operation or even a partnership is that the effort needed for such collaboration is compensated somehow, making the *effort* at least *tolerable*. Apart from the energy and effort needed for dealing with the matter, co-operation and partnerships also use up energy and effort. The expected reward, which can be almost anything from not being punished to huge benefits, should, in the eyes of the partners, fairly balance out the effort, expenses, discomfort etc.

Additionally, successful co-operations can be an *example* for other policy actors. In this regard it would be interesting to know what the subjects are, what forms of co-operation there are, who the participants are, their levels of involvement, and particularly what the experiences, outcomes and impacts are.

In many domains there was and probably still is a tendency to encourage the private sector to enter into traditionally public operations, through Public-Private Partnerships. Such linkages are politically promoted, because they promise efficiency of the (e.g. W+S) domain, as well as the creation of new job opportunities. On the other hand, such partnerships can affect the lives of vulnerable and marginalised groups. Collaboration interests are mutual:

" ... a public sector with less than satisfactory efficiency and capacity, a private sector willing to undertake some parts of the activity, and the general public willing to pay the private sector for the extra service..." (Ahmed & Ali, 2004:476).

In such cases the public sector may be helped with considerable savings and solving budget deficits and sometimes corruption. The private sector can jump into demands that cannot be met by the public sector, whilst the general public can be helped by appropriate, demand responsive and low-cost solutions.

[719] Still, sometimes such a local authority takes measures, simply to show that they care.

d. When are co-operation and/or partnerships in the W+S domain established?

In this paragraph I consider when co-operation and/or partnerships in the W+S domain are (potentially) established. I will first focus on the moment or period of involvement, and subsequently under what conditions this involvement happens, where will be dealt with prerequisites for co-operation and partnerships, and some success determinants.

With regard to the *moment or period*, I think that co-operation can come about at almost any moment and situation in the policy process. It however depends on the subject in question, interests, focus and aims and intentions of the co-operation candidates which moment or period is most suitable. It generally will not be throughout the complete policy process, although for commitment reasons this may be attractive. Because of shared competences it can be expected that walkability advocates, and mobility, health and safety experts will be most interested to be involved at the early stages of the policy process (analysis, development objectives and strategies) and local authorities, consultants and contractors, who are most interested in getting things done, to be involved in the later stages of the policy process.

With regard to *prerequisites* for co-operation and partnerships Harrigan & Newman (1990) found that the basis of inter-organisational co-operation is that the co-operating partners must have an unusual mix of a) propensity, b) power and c) persistence. Before entering into the matter of critical factors for collaborations, in the following lines I concisely elaborate Newman's prerequisite factors.

Propensity of the policy actors to collaborate is, as was shown before, incited by manifest causes, proper insight in the matters, the existence of a supporting institutional framework, a sense of urgency incited by an, in the eyes of a policy agent, significant infliction of his interests, political commitment. Main ingredients are thus: a problem or cause; information, knowledge and professional skill; W+S policy culture or atmosphere (e.g. when times are hard, there is more reason for joining forces); mutual trust; communication; collective aims, and their precursors (= drawbacks) versus expected rewards.

Brinkerhoff (2002), based on an extensive literature study, identified the following prerequisites for partnerships: tolerance for sharing power, willingness to adapt to meet partnership's needs, and the existence of champions. The first prerequisite includes receptivity to new solutions, flexibility in taking corrective action, accommodation of special request, and responsiveness to unforeseen situations. With regard to championship, important factors appeared to be location and focus of their advocacy.

The second prerequisite Harrigan & Newman (1990) identified was existence of the *power* to solve problems and support causes. Many forms of power can be raised: hierarchical power, formal authority, volume of staff, knowledge and skills, budget, authority.

The third prerequisite Harrigan & Newman mention is *persistence,* concerning capacity to persevere activities with regard to the collective aims, long term planning and long term agreements.

With regard to *success determinants* for co-operation and partnerships, there proves to be a relatively large body of literature. Brinkerhoff (2002) did a literature review and identified as main success factors: trust (character and competence), confidence, senior management support, ability to meet expectations, clear goals, partner compatibility, and conflict management.

e. Where are co-operation and/or partnerships in the W+S domain established?
In this paragraph I concisely consider where co-operations and or partnerships in the W+S domain may establish.

W+S policy development on the national level can have its roots in international connections, like international platforms dealing with (aspects of) walking and sojourning in public space. Examples are WALK21, the OECD/ITF, the European Commission research framework programs, International Road Traffic Accident Database IRTAD, European Transport Safety Council, WHO Decade of Road Safety platform.

Horizontal co-operation of the lead agency with adjacent policy fields like health, land use, transport, child care, welfare, law enforcement seems most natural, although in practice the fences between ministries prove to be difficult hurdles. Co-operation and partnerships between local authorities can come about through service agreements between groups of municipalities. Sharing knowledge or shared regional knowledge centres would seem to be a logical and potentially effective and efficient option.

With regard to the W+S domain, vertical co-operation and partnerships are also conceivable, e.g. between the Ministry of Infrastructure and Water Managenment and nationally organised representatives of local authorities, consumer and transportation representatives and knowledge institutes in project or issue platforms like Blijf Veilig Mobiel (Stay Safely Mobile).

f. How are cooperation and partnerships established in the W+S policy field and what factors drive them?
In this paragraph I consider how co-operation and partnerships are developed and maintained. In this context I deal with precursory tasks, critical and enabling factors, and hurdles and risks. This paragraph is closed by touching on assessment of policy performance due to co-operation and partnerships.

Above it was established that in general co-operation and partnerships only come about when the proper propensity exists. This can be the case when one or more of the stakeholders takes the initiative to muster potentially interested policy actors. A precursory task is to find out what policy actors there are in the W+S domain. A practical move is to carry out actor analysis regarding the seven dimensions Van Waarden (1992) discerned, specifically 1) the number and types of actors involved in the W+S domain, 2) function and scope of the networks, 3) the structure of the networks, 4) to what degree institutionalisation has taken place, 5) what the rules of conduct are within the networks, 6) what the power relations within the networks are, e.g. the policy actor's focus and span of control, and 7) what strategies the policy actors currently apply and what strategies they can be expected to be persuaded to change to.

Augustyn (2000) researched what factors influence the success of tourism partnerships. She reviewed available literature on this subject, and validated and substantiated conclusions in a case study in York. I assume that the findings are also valid for W+S domain. She found that *critical factors* regarding setting up and maintaining partnerships are (Augustyn, 2000:344-351 summarised):

1. Expert preparation: sound reasons; simple, conforms legal provisions, based on formally established links; organised along horizontal lines (equality); official body responsible for joint efforts established; time needed for arranging a partnership scheme;

2. Right underlying objectives: long term, based on extensive research and forecasting; strike balance between the diverse interests; respect mutual identities; competition in other areas must be explicitly excluded: limit activities to areas that are not under competition;
3. Development structure of the partnership: reciprocal: pooling, sharing of control and decision making, clear roles and co-ordination to link activities, effective information system therefore needed;
4. Effective and efficient actions of the partnership: appropriate actions undertaken, efficiency not only in economic terms, but also in social network terms; limit uncertainty through information;
5. Sustainable nature of partnerships: sustain partnership through constant feedback; if necessary reshape objectives before they lose importance; monitoring systems need to be developed, changes in the internal and external environment are to be reflected in modified objectives, structures and actions.

Ahmed & Ali (2004) researched the main *enabling factors* and potentials of Public-Private-Partnerships. They found the following conditions to be most compelling: 1) partnerships should be formed naturally, 2) by existing pressures, the involved sectors need to adapt their ways of doing (Public bodies - change from role of provider to partner and regulator; private: new way of doing business), 3) capacity building to address the new challenges, 4) careful construction of the partnership (facilitation of new roles – independent facilitator needed), 5) there must be incentives for both public and private agencies to enter it, 6) strong structural, financial and legal framework (transparency, fairness, accountability), and 7) partnership must be dynamic, adjusting to new situations (scope and nature evolve over time).

From road safety practise I know that potential partners outside central government (such as local authorities, the police, public transport entities etc.) can be enticed to join and invest in policy making and implementation. If central government wants something done, ‘carrots’ and 'sticks' are needed. A proven solution is that central government takes initiative to approach potential partners and offers to take up a role as coordinator and provider of preconditions like legislation, research programming, knowledge management and policy guidance based on some rewarding system. The Dutch Sustainable Safety Starting-up action is a good example of this (Wegman & Aarts, 2006).

Apart from critical and enabling factors, in literature also a great variety in *hurdles and risks* to achieving and maintaining co-operation and partnerships can be found. It seems best to assess chances case by case.

g. Conclusions and Research questions

With regard to co-operation and partnerships to support improvement of W+S conditions it can be concluded:

- Co-operation and partnerships are specific forms of collaboration, where policy actors join forces, but do not give up way identity and independence. The difference between co-operation and partnership arrangements is that the first is limited to case-by-case working together, and in partnership co-ordination is characteristic;
- The function of co-operation and partnerships is combining individual spans of control to a greater whole, with better chances of achieving the aim of improving W+S conditions;
- The main reasons for entering in a co-operation of partnership are: 1) there is one or more shared reason for W+S policy activity, plus 2) the policy actors do not themselves have full control over the matter, plus 3) the policy actors expect to achieve their aims at

tolerable effort. Furthermore, the co-operating agents must have an unusual mix or propensity, power and persistence;

- Success factors for co-operation and partnerships are trust, confidence, senior management support, ability to meet expectations, clear goals, partner compatibility and conflict management;
- There are two main levels of collaborating policy agents: management (leadership) and operative (staff);
- Co-operation between the lead organisation and facilitator organisations are more obvious than co-operation between the lead and/or facilitator organisations with client organisations. This is particularly due to the low degree of organisation of client groups;
- Horizontal co-operation is primarily based on expected synergy of aims, whilst vertical co-operation is dominantly based on synergy in effort (where leadership support really matters);
- The playing field regarding W+S policy development consists of clients, strategists and facilitators. Strategists can make use of signals from various types of users and facilitators to develop W+S policies;
- What interventions a stakeholder can initiate or implement, depends on his span of control, which is not a fixed power. The latitude which a policy agent takes primarily depends on what he perceives to be his span of control. What is exercised will usually be less than what is potentially available;
- For establishing co-operation or partnerships a precursory task is to find out what policy actors there are in the W+S domain. A practical move is to carry out actor analysis;
- Critical factors for setting up and maintaining partnerships are expert preparation, right underlying objectives, development structure, effective and efficient actions, and sustainable nature of the partnerships;
- ‘Carrots’ and ‘Sticks’ are needed, when the lead organisation wants something done by his followers. In many cases there are hurdles to be taken.

h. Research topics for assessment of the status quo

From the above I deduce that the following factors with regard to co-operation and partnerships in the W+S institutional framework deserve to be assessed: 1) distribution of co-operation arrangements, 2) abilities and willingness to co-operate 3) ‘carrots’ and ‘sticks’ for co-operation.

3. Impacts of Risk Awareness and Risk Acceptation on policy

3.1. Introduction

In this thesis walkability and sojourning policy aims to improve conditions for walking and sojourning and tackle mobility, health and safety risks, and inconveniences and nuisances. In negative terms this can be phrased dealing with fears and actual and potential risks. Risk is usually defined as the probability of an unwanted event times the expected loss in case that something goes wrong. A risk becomes a problem when the risk is not acceptable, and a problem is only a problem if people (read: the policy world) say that it is a problem. In practise, people cannot base their opinions on facts and 'objective' norms, as they have no immediate access to records about the facts and norms, so they rely on their perception of the risks at hand

and their intuitive norms or their experience with related situations about the matters at hand. The urgency of a problem thus relates the degree of acceptation of the risks: the perceived probability of things going wrong times the expected consequences (Wildervanck, 1988).

3.2. Wildervanck's findings

This is true also in scientific research programming, policy development and in politics. Based on social sciences research, Wildervanck (1988) finds that perception of risk is not random, but based on a number of systematic psychological factors. He identified and illustrated the following factors:

- *Voluntariness*
  People accept more risk from activities that they voluntarily chose themselves than from risks that they involuntarily were exposed to. When they participate in risky activities like hunting, skiing, motor riding, they accept more risk than when, for example, walking in a pedestrian area or watching a child play.
- *Chronic/catastrophic*
  Risks related to events that often happen are generally more acceptable than risks from rare events. Thus small traffic accidents and falling accidents are perceived as less threatening than for example plane crashes, that are relatively very rare, but still frighten many people when boarding a plane. Wildervanck (1988) compares the annual road traffic death toll (1953: 1,390 killed) to the storm disaster in the Netherlands in 1953 (1,795 killed). The storm disaster led to extensive societal and political attention and investments in prevention measures. Compared to that, the attention to road safety is very meagre (Wildervanck, 1988).
- *Own influence*
  The more a person thinks he is able to influence risk, the more risk he accepts. Again a reason why common road users are more hesitant to board a plane (Wildervank, 1988) and there is so much support for 'the war against terror'.
- *Familiarity with the risk*
  Unknown, unloved. When it is unclear what can go wrong and what the consequences are for a certain course of action, the risks are less acceptable. The causes of such risks are complex, rather abstract and hard to understand. This explains why many people fear nuclear energy more than road traffic accidents and walking accidents in particular.

3.3. Additional factors from Hollander & Hanemeijer

In their report about coping rationally with environmental risks, 2003 Hollander and Hanemeijer (2003) added 4 other factors to Wildervanck's list, pictured in Figure IX-13:

- *The distribution of costs and benefits*
  Wilfully taken risks generally are related to the expected benefits of the activity in question. People will accept more risk if the benefits show instantly while the possible costs are postponed or spread in time, like somatic complaints that can occur after exposure to magnetic fields from high voltage cables (Kessels, 2005), or using a car for a short trip instead of walking (benefit of time saved comes first, the costs come later and are often not noticed at all);
- *The degree to which a person benefits from a risky behaviour*
  The costs and benefits can be of individual or collective nature. The individually perceived risk will be lower when there are collective benefits from the risky situation or activity.

This is why some risk from nuclear energy plants can be accepted (Kessels, 2005) and speeding traffic is unacceptable for pedestrians;

- *The number of exposed persons*
  The larger number of people are exposed to a risk, the higher the risk is perceived. Examples are the risk of anti-biotics resistant bacteria on chicken flesh, and external safety risks from accidents with dangerous goods transport;
- *Origin of the risk: human or natural.*
  Natural causes of disasters and accidents are more acceptable than man-made risks. This mainly has to do with the impotence people experience in natural disasters, like Tsunami wave flooding and earthquakes, compared to cancer risks of smoking, fatality risks due to construction failures, or climate change due to irresponsible use of fossil fuels.

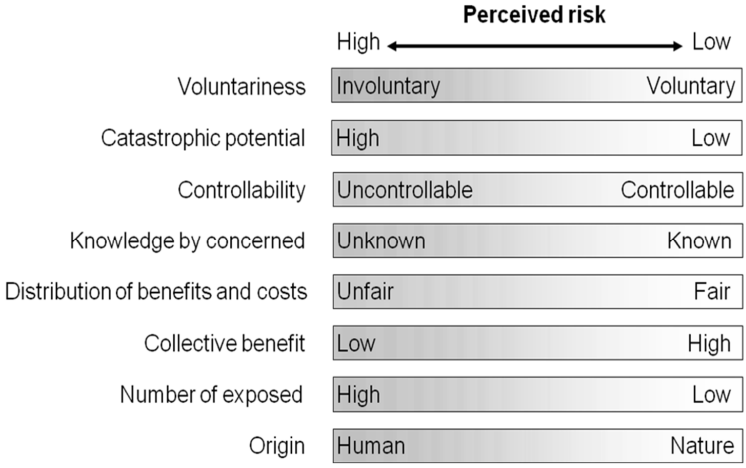

Figure IX-13 Directing factors of perceived risk (adapted from Hollander et al., 2003; Kessels, 2005)

The way walking and sojourning issues are treated in the media and in 'public opinion', and consequently in political discussions, will be guided by these basic psychological mechanisms.

3.4. Update by Derriks

Recently, Derriks (2012) updated insights on risk perception and awareness. He clustered risk factors into 5 categories: background of the danger, effects of the danger, individual factors, environment, and other factors (see Table IX-3). These conclusions are primarily related to accident, injury and fatality risk, I assume however that they are also valid for other system failures, inconveniences, nuisances and injustices[720].

[720] For example: waiting for a delayed train is much more accepted when the train is delayed because of extreme winter weather (origin = nature) compared to delays because of 'logistic' (no train driver available) reasons (origin = human). Likewise, waiting for a pedestrian traffic light with count-down figures is more acceptable (less red light negation) than common pedestrian lights (knowledge/predictability of waiting time by the concerned).

Table IX-3 Risk factors and their perceived severity or urgency

Risk factors		Increase in perceived severity/urgency if:
Background of the danger		
1	Origin of the danger	caused by mistakes / human failures
2	Threat	reported threats (i.e. terrorism)
Effect of the danger		
3	Catastrophic potential	many fatalities, injured persons and damage at the same time
4	Repairability	not repairable
5	Effect on children	larger involvement of children
6	Effect on later generations	risk for future generations
Individual factors		
7	Knowledge	- experimental knowledge: many (direct or indirect) experiences with dangerous situations - cognitieve knowledge: mechanisms or process unknown or diffuse and uncertain
8	Confidence	lacking trust in responsible authorities
9	Voluntariness	Not of one's own free will
10	Controllability	not controllable or manageable
11	Attributes	the failure can be attributed to someone else / low own contribution
12	Asymmetry between profit and loss	the danger is captured in negative terms (focus on loss)
13	Imaginability	easy to imagine the incident
14	Unrealistic optimism or pessimism	unrealistic pessimism
15	gender and age	- in general women rate risk higher - in general young persons rate risk higher
Environment		
16	Media attention	much media attention to risk/accidents
Other factors		
17	Collective and personal utility	danger caused by a socially unimportant phenomena
18	Distribution of gains and losses	uneven distribution of gains and losses (influencing one's own position)
19	Cultural differences / context	more public openness
20	Context	higher life expectancy
Source: Derriks, 2011.		

Although the indicated factors mostly concern individual perceptions and evaluations, the conditions also apply on a more collective or institutional level, as key policy makers and deciders will be affected by the indicated psychological mechanisms. In many cases, politically, perceptions form more weighty arguments than figures, as the data are not available or disputed (Fresco, 2011). This affects decisions on the urgency of dealing with issues, including collection of basic data[721]. In this thesis on W+S policy development it is therefore important to gain insight in the public's and policy maker's risk perception and risk acceptation. Such knowledge is relevant in the discovery stage (What problems need attention?) and in the selection/decision/implementation stages of a policy process (What measures need to be taken? What support can be expected for measures to be implemented?).

[721] This seems to be particularly true for collection of data on pedestrians risks, nuisances and injustices. Falls, being common and quite frequent and familiar matters are perceived to be not very serious. The severity of risks of car occupants are (wrongly) perceived to be much more important, and the transportation community does not seriously support collecting insight in pedestrian falls. Likewise congestions costs, despite amounting to only a fraction of road accidents costs, are politically perceived to be more disruptive and instigate more policy attention.

4. Policy justifications

Once a problem is recognised and roughly rated, justifications for policy actions, including additional research, must be explored and chosen. The question is what justifications help to tip the balance towards policy actions. This question concerns both morality and ethics. It concerns morality, *'defined as 'society's most general standards*' (Beach, 1996, cited in Van Wee, 2011) in the sense that ultimately policy actions must be accepted and supported by society. It concerns ethics, defined as 'the discipline related to what is good and bad or right or wrong behaviour, including moral duty and obligation, values and beliefs and the use of critical thinking about human problems' (Beach, 1996, cited in Van Wee, 2011), in the sense that the answer to the justification question will primarily depend on the politically agreed role and core tasks of the policy agent, and thus on the ethics applied by that policy agent.

In this thesis I assume that a government's core tasks are to take up societal change leadership, and ownership and management of public goods (including public space) to support society to function to the standards of the time. This should be achieved within available moral, financial and budgetary mandate.

Furthermore, I assume that it is generally accepted that the use of natural resources, human input and technology for the benefit of any governmental policy should not compromise the ability of future generations to meet their needs. In other words: the results should be sustainable (World Commission on Environment and Development, 1987 [Brundtland report]; Risser, 2003).

With regard to sustainable policies, Van Wee finds that often distinction is made between three categories of indicators (often labelled as 'dimensions'): economic, environmental and equity (social justice) indicators (Van Wee, 2011, p. 16). John Elkerton (1997), translated the three kinds of consequences into business practise, into the so called Triple P [722]:

- *People*
  Social consequences: what are the consequences of corporate activities for humanity, groups of humans?
- *Planet*
  Ecological and environmental consequences: what are the consequences of corporate activities for sustaining flora, fauna and other natural resources on the planet?
- *Profit (Prosperity)*
  Economical return (growth): what are the consequences or corporate activities for sustaining corporative functionality on a collective level? During the World Bank World Top of 2002 in Johannesburg the P for Profit was changed into Prosperity.

Feitelson (2002) submits that there are trade-offs between the three dimensions. Maximising Economic Growth and Social Justice, without regard to Environmental Preservation will lead to environmental degradation. Likewise maximising Social Justice and Environmental Preservation, without regard to Economic Growth will lead to economic stagnation, and maximising Economic Growth and Environmental Preservation, without regard to Social Justice will lead to mal-distribution of social consequences (Feitelson, 2002, cited in Van Wee,

[722] 'Cannibals with Forks – the Triple bottom line of 21st century business' by John Elkerton, Oxford 1997. Although Elkerton's story is directed at commercial enterprises, in my view the arguments should apply for governments and Non Governmental Organisations as well. Thus 'corporate activities' include both business, governmental and non-governmental activities.

2011:16-17). In other words, sustainable development is only feasible if some economic growth, environmental preservation and social equity is sacrificed for the greater good of sustainability (see Figure IX-14).

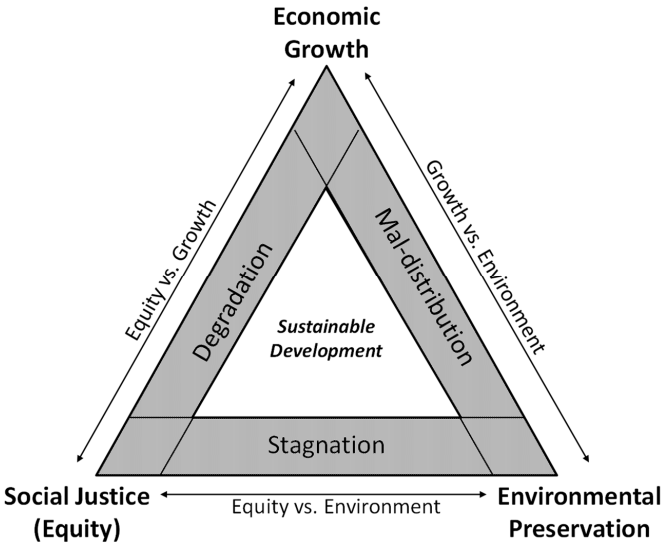

Figure IX-14 A trade-off approach to sustainable development (Feitelson, 2002, cited in Van Wee, 2011)

In order to value and evaluate current conditions and the potential options for future policy measures, a common denominator is needed. Expressing current conditions as well as pros and cons of policies in monetary terms to some extent can be such a common denominator. Regarding evaluation of policy measures Van Wee concludes that, in many countries, '*Cost-Benefit Analysis (CBA) is nowadays a very popular ex ante evaluation method*' (Van Wee, 2011:17). The downside is that not all matters can be adequately, acceptably and ethically '*expressed in monetary terms*', and that that matters that cannot very well be expressed tend to be neglected. In this context Van Wee proposes to use hybrid [assessment and] evaluation methods, taking advantage of the benefits of CBA as well as offering some (be it an imperfect) platform for assessing current conditions and potentials of (selected) policy measures.

Whilst the Triple P and similar concepts cover a planet wide spectrum of consequences, including consequences for wild life and earth's resources, it can be argued that regarding walking and sojourning in public space, the evaluation of policy measures to support walking and sojourning in public space can be limited to social and prosperity consequences. After all, the negative impacts from walking and sojourning in public space to the general environment are minimal: what could be more sustainable than walking? It appears that especially sojourning can have negative effects, like graffiti, disturbance of breeding grounds (cf. below, statements under 'The role of perception...'), waste in public space, noise, and the like. Furthermore, negative environmental impacts from external causes (cf. car and industrial emissions, barriers raised by motor traffic infrastructure) however need to be identified, assessed and evaluated, in order to develop strategies to remedy such unfavourable environmental conditions for walking and sojourning.

In the context of this thesis it is not possible to give a full overview of policy development justifications and concerned theories and concepts. I will limit myself to considering theories and concepts identified in the PQN project (Methorst et al, 2010) and by Van Wee (2011), aiming at building a practical scheme for assessing justification of W+S policy development practices. This scheme needs to cover Triple P as well as other norms and values that are used for identifying policy issues, researching them, delivering and choosing policy options.

In the following I will first cover fruits from Van Wee's study of Transport and Ethics, next I will summarise Risser's conclusions regarding Quality of Life indicators. After that, to complete the picture regarding W+S relations to Triple P, I will deal with W+S and economic growth. I conclude this subsection with conclusions regarding the formulation of research questions for this thesis regarding the policy context.

W+S and Ethics

In his book 'Transport and Ethics - Ethics and the evaluation of Transport Policies and Projects' Bert van Wee pictures an inspiring (broad) selection of ethical issues of transport, in order to give his readers 'food for thought' (Van Wee, 2011, p 3). Although he focuses his exposé to *ex ante* evaluation of transport projects, I find that many of his observations and conclusions are also valid for assessing W+S current conditions, the identification of subjects that need policy attention and ex-ante evaluation of, and decision on W+S policies. Van Wee states:

> *" A practical rule of thumb could be that the quality of public decision making is higher if the decision makers make the choice they would have made: (1) if they had all (from their perspective) potentially relevant choice options available; (2) if they were fully informed; and (3) if they were able to evaluate different choice options. This would be a valid rule of thumb under conditions of a high level of democracy. [...]*
>
> *I assume [...] that the decision maker at least wants to have insights into:*
>
> - *Effects in real terms, both pros and cons [...]*
> - *Effects expressed in monetary terms if appropriate (in the eyes of the decision makers), and if generally acceptable methods to do so exist.*
> - *Insights into who are the winners and losers, and how much these gain or lose (distribution effects).*
> - *Insights into any values, in addition to those evaluated as a result of the bullets above, that might be relevant for the choice to be made.*
>
> *[...] Decision making implies trading-off pros and cons."* (Van Wee, 2011:20-21).

Van Wee uses *ex-ante* Cost-Benefit Analysis (CBA) methodology as a starting point for discussing what is good or bad, and right or wrong with evaluation methodology and practices. CBA is based on Utility Theory. '*Utilitarianism is a theory in normative ethics holding that the proper course of action is the one that maximizes utility, specifically defined as maximizing happiness and reducing suffering. In economics', 'utility is a representation of preferences over some set of goods and services'*[723]. In other words, CBA, if properly executed, can help the policy maker to find out how advantageous the studied policy proposals are, what they are expected to yield. Just as importantly, if an adequate set of indicators is chosen, the assessment can provide insight in the actual level of utility of facilities and services.

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http://en.wikipedia.org/wiki/Utilitarianism, and http://en.wikipedia.org/wiki/Utility), accessed 2-12-2013

In his book Van Wee summarises the reasons to challenge Cost-Benefit Analysis (CBA) methodology and its utilitarian foundation (see Van Wee, 2011, p 27) and discusses a variety of relevant (alternative) ethics theories and critiques of CBA. In this way he uncovers what kinds of aspects qualify to be included in the ethically well-founded assessments.

According to Van Wee the most important ethics theories concern Rawls' Theory of Justice (1971) and Sen's (2009) ideas on capabilities. Both theories concern social justice aspects. Furthermore, Distribution Effects and Equity, the difficulty to monetize some of the effects, and some other theories matter[724].

Rawls' theory of justice differs from 'standard' utilitarianism in two ways: (1) justice should not focus on welfare, but on the provision of primary social goods, (2) it should not strive for the maximum of the sum of some index, but provide at least for a minimum of a set of welfare levels. According to Rawls primary social goods are:

- Basic liberties, including freedom of association, liberty, and so on;
- Freedom of movement and choice of occupation;
- Powers and prerogatives of offices and positions of responsibility;
- Income and wealth;
- The social bases of self-respect.

Sen disagrees with Rawls: not welfare or the provision of some kinds of primary goods should be equalised, but what he calls 'capabilities', which lie between goods and welfare, and focus on the actual opportunities that a person may have. Sen does not provide a list of capabilities, but indicates that several factors influence the conversion of income to the lives that people can lead:

- Personal heterogeneities
- Diversities in the physical environment
- Variations in social climate
- Differences in relational perspectives (people belong to communities).

Following up on Sen, Nussbaum (2003:41; not dealt with in Van Wee, 2011) provides a, according to her, provisional list of central human capabilities to be catered for:

1. Life (to live to the end of a human life of normal length);
2. Bodily health;
3. Bodily integrity;
4. Senses, imagination and thought;
5. Emotions;
6. Practical reason;
7. Affiliation;
8. Other species;
9. Play;
10. Control over one's environment.

[724] The following highlights of theories, critiques or CBA and other theories heavily leans on Van Wee's texts (2011, p 29 - 48). It reflects my summary of Van Wee's story, in many cases using his words. In some cases I introduces some additional thoughts and comments, and marked them clearly.

Nussbaum (2003), like Sen, points to the need for respecting pluralism regarding capabilities (cf. Sen: personal heterogeneities): individuals differ in their ability to effectuate their needs and desires and to make use of opportunities offered. A substantial part of the population is physically or mentally dependent on others and needs to be cared for: children, the disabled and the elderly. Furthermore, Downs (cited in Beauchamp, 1976) observed that our most intractable public problems have two significant characteristics:

> *" First, they occur to a relative minority of our population (even though that minority may number millions of people). Second, they result in significant part from arrangements that are providing substantial benefits or advantages to a majority or to a powerful minority of citizens."* (Beauchamp, 1976:101).

Although, at least in the Western world, the need to do something about social injustices can be presumed to be fairly well accepted (cf. features in the public media about societal wrongs, campaigns to collect money for needy people), the majority of individual citizens (and listening to their voice: politicians) are somewhat reluctant to pay the consequences on a structural base. Most of the times tackling social injustices requires redistribution of resources and responsibilities, and will involve painful sacrifices and the acceptance of new burdens by the most powerful and the most numerous on behalf of the least powerful or the least numerous (Beauchamp, 1976, p 101). On the other hand, Veldheer et al. (2012) find that the individual's life is very much intertwined with collective services and facilities. In Europe there is general support for collective provisions like health care, care for the elderly, education, services that are open for everyone. This also seems to be true for basic pedestrian and bicycle facilities, and public transport. Citizens can be altruistic, up to a point.

Although some political parties do not endorse social justice principles, it can be argued that a skewed distribution of capabilities is socially, economically and politically harmful for society, and that therefore there is justification for considering them in policy development and policy justification discussions. So, for this thesis the question is to what extent social justice and capabilities are actually supported by policy agents.

In harmony with the above, Van Wee presents criticizes CBA and utilitarianism that distribution effects and equity are often ignored. Van Wee argues that this can be easily remedied, by including subjective valuations into the equations, by distinguishing between intended and unintended effects of equity, by explicitly choosing a level of aggregation, by reporting on who benefits, and to what extent, together with who loses and to what extent, and by distinguishing between income classes and regions.

Furthermore, although CBA aims to express (preferably) all effects in monetary terms, some effects are difficult to monetize, such as nature, aesthetics or social cohesion. As a result, '*decision making may be biased by the tendency to focus on easy-to-measure user impacts'* ('if you can't count it, it does not count') (Litman, 2007, 2009:1). A special case of monetization relates to so called 'irreplaceable things', such as irreversible effects on nature. Van Wee, based on Hanson (2007), remarks that the real problem is that in case of decision making the incomparable outcomes of interest need to be compared anyway.

Other theories in ethical literature, cited and discussed by Van Wee are Deontology, Contractarianism, 'Values Matter', 'Not Only Humans Matter', 'Rich People Versus Poor People', 'Choices and Reason' , 'Absolute Levels are Ignored', 'The Process Matters'. Besides he identified and described methodological critiques, such as: the list of indicators may not be

complete; difficulties to estimate the quantitative changes; some price tags are not available or highly debatable; the quality of cost estimates is often poor or manipulated.
Despite an extensive list of critiques, Van Wee maintains that CBA can be an adequate [assessment and] evaluation tool, provided ethical issues are dealt with properly.

To conclude this subsection on W+S and ethics, I agree with Van Wee regarding what the 'best' policy would be:

> *"... It is important to recognise the three generally accepted criteria required to answer this question: effectiveness, efficiency and equity. Effectiveness relates to the question of whether the policy leads to an improvement. [...] ... efficiency relates to the question of at which costs the improvement is made. [...] ...equity is related to the question of whether the policy is 'fair'."* (Van Wee, 2011:56).

The concept of Quality of Life (QoL)
In this thesis I assume that Quality of Life is defined by the measure to which a (group of) person's needs are realised. Whilst pedestrians' quality needs relate to human needs as the personae *pedestrian* (a person in the temporary role of a pedestrian), Quality of Life refers to a wider, more abstract quality, which is less limited in space and role, and will be of a more constant nature.

Within the context of the HOTEL[725] study, a State of the Art report was published on assessment of Quality of Life. Risser (2003, quote of the Summary of the report) concluded:

> *" Quality of Life is a term defined in many different ways. There is no single definition, which covers the widespread field. In the state-of-the art report some Quality of Life definitions and models are summarised. In addition the interrelation between sustainability and quality of life and between traffic & mobility and quality of life is considered.*
>
> *Looking back into history at the beginning Quality of Life mainly referred to material supply. The main indicator for quality of life was the Gross National Product. At the end of the 1950s quality of life was linked to non-material values, too. The idea of a "Quality of Life" with a strong qualitative ingredient was spread out over the world in the late 1960s and early 1970s, when first doubts were raised in the highly developed western societies about economic growth as the major goal of societal process.*
>
> *Two distinct traditions of applied quality of life research emerged in different parts of the world: The Scandinavian Quality of Life approach and the American Quality of Life approach. The Scandinavian approach focuses on objective living conditions and their determinants. The American approach analyses the individuals' subjective experience of their lives. Nowadays, the Quality of Life research is in most cases based on both objective and subjective indicators."*

Risser continues to discuss the assessment of Quality of Life. He concludes that the assessment of Quality of Life not only varies from discipline to discipline, but also within disciplines. Looking at it from a more abstract level, however, he concludes that (2003, quote of the Summary of the report):

[725] HOTEL is an acronym for HOw To analysE Life quality. This study was done in the context of the Keys Action of the EU Fifth Framework Programme "Improving the Socio Economic Knowledge Base".

" All indicators defined in the different disciplines refer quite consistently to four dimensions:

- ***Social dimension***[726]***:*** *The social dimension covers all aspects from health, social relations, mobility, social status, etc.;*
- ***Political dimension:*** *Under political dimension all aspects are summarised that belong to a political system e.g. political stability, possibility of participation, quality of social services, tax systems;*
- ***Economic dimension:*** *To the economic dimension belong for instance the use of resources, economic stability and competitiveness, employment;*
- ***Environmental dimension:*** *The environmental dimension covers aspects like the prudent use of resources, sustainable transportation, waste minimisation, etc.".*

Risser goes on to conclude that Quality of Life is closely linked to sustainability. With regard to traffic, mobility, city planning and Quality of Life it is concluded that there are more or less seven quality dimensions relevant (Risser, 2003):

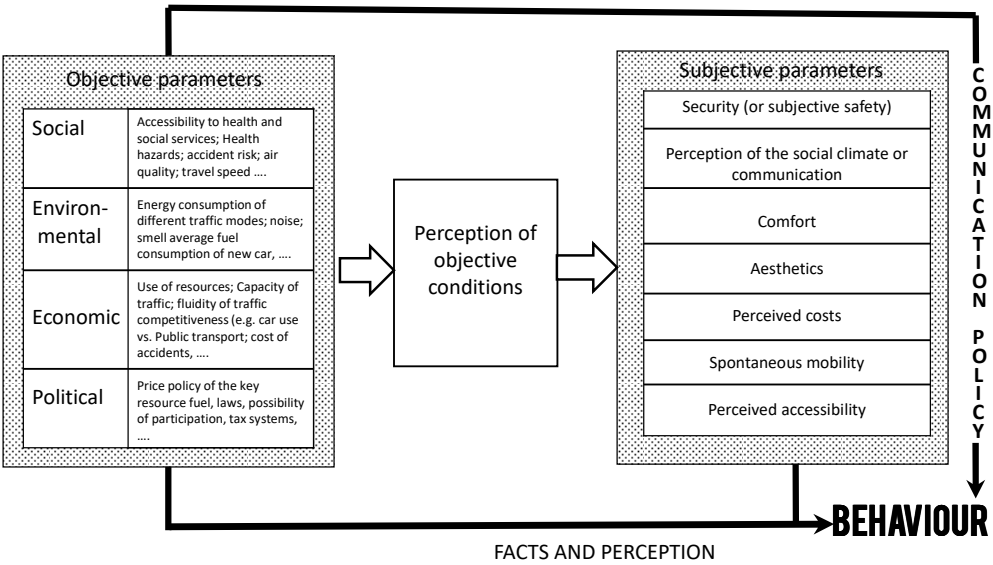

Figure IX-15 Parameters for Quality of Life (Risser, 2003)

" More or less seven quality dimensions are relevant for the subjective well-being of road users and for the choice of mode: social climate/equity, objective safety, security, mobility, comfort, aesthetic/environmental quality, cost aspects."

Risser's ideas are summarised in Figure IX-15 It has to be noted that the listed indicators are abstractions of the concrete indicators, which Risser found in his literature review. For practical use the indicators need to be made operational. Furthermore, it can be argued that the listed

[726] RM: This dimension should also include emotional aspects.

'objective parameters' also have a subjective side; what is meant here is that the objective parameters follow from observed features and that subjective parameters depend on indirect measurement of intentions, feelings etc.

Environmental preservation

The above ideas give useful insights into social consequences of policy activities (the People P of Triple P). Next it is needed to look into basic insights in ecological and environmental consequences. It is clear that from the travel modes available, walking is the most environmentally friendly form of transportation, as it uses no non-renewable resources like oil, gas and other raw materials. It has a very small ecological footprint. On the other hand, there is no clear relation between walking and sojourning as an activity and environmental preservation. In fact, in natural reservations persons are prohibited to go outside the indicated pathways, to prevent damage to natural conditions.

As this thesis focuses on walking and sojourning in public space and urban and sub- and peri-urban areas, there is no significant reason to pay much attention to this relation. When selecting policies, strategies and concrete measures, however, interventions that support W+S more or instead of other modalities, W+S can be rated as most advantageous regarding environmental preservation.

Economic Growth

Lastly, I consider (potential) economic consequences of W+S policies. The key word Prosperity (originally Profit) concerns the practical argument that, in order to support sustainable life on the planet, the citizen's Quality of Life and Social Justice, in general corporate activities must be economically viable, businesses must be profitable and people must be prosperous enough to be able not to overuse natural and human resources.

Whilst passenger and goods transport are clearly associated with the economy, for walking and sojourning in public space this is less obvious. Walking is not associated with 'big business'. Apart from human energy and footwear, walking does not cost money and most of the times does not directly generate money. Indirectly, however it does, although this is not generally recognized.

As walking is part of (nearly) all travel chains, and economy sectors like retail, recreation and tourism, heavily depend on the number of walkers towards their establishments, W+S policy has undeniably economic consequences. Furthermore, to underscore the economic value of walking in relation to health, in 2011 the World Health Organisation published the HEAT (Health Economic Assessment Tool) to calculate the economic consequences of the health impact of walking (WHO, 2012[727]; Olabarria, 2012).
Another example of the positive Cost-Benefit ratio of walking (and cycling) can be gathered from American statistical sources: whilst funding for walking and cycling does not cover more than 2.1% of the Federal transportation budget, walking and cycling are good for 11.4% of trips made, but unfortunately walkers and cyclists are also 14.9% of the traffic fatalities (which, of course, would be almost zero percent if there would be no motorised traffic)[728](Alliance for Biking and Walking, 2014).

[727] WHO Regional Office for Europe. Health Economic Assessment Tool for Cycling, (HEAT for cycling) Available at: http://www.euro.who.int/__data/assets/pdf_file/ 0011/87482/E90948.pdf (16 August 2011, date last accessed).
[728] Comparable Dutch or European statistics are not available.

Regarding contributions to the local economy already in 1974 the OECD concluded that 'no parking, no business' is a much heard myth, which in practice does appear not to be true, especially for locations that are accessible by various modalities (OECD, 1974). Furthermore, from customer research amongst supermarket shoppers it became clear that, in the Netherlands, most of them come walking or cycling. About 40% of the supermarket turnover comes from pedestrians (CROW, 2014); in 6 French cities it is true that car users spend 50% more per visit, but pedestrians visit more often *and* spend twice as much per shop than car users; in London a similar pattern was detected: 55% of the customers of local supermarkets on foot visit more than 5 times per week, whilst for car drivers this is only 15%. More visits generally also means more impulse purchases. The mindmap of shopkeepers differs from reality: they structurally and massively underestimate the share of walkers amongst their clients. In Lille (Grand Place) the share appeared to be 10 times larger than estimated by the shopkeepers. In the Netherlands 22 of 24 interviewed supermarket managers overestimated the share of car users (CROW, 2014). It can be expected that for the recreation and tourism industries similar pictures can be drawn.

From the above indicative figures it follows that it would be worthwhile to assess what investments supporting W+S are made and what these actually deliver. Very little is known about actual cost-benefit ratios, cost-effectiveness ratios, willingness to pay (WTP) for pedestrian facilities and willingness to accept (WTA) risks, inconveniences and nuisances while walking and sojourning in public space. It would be interesting to compare the factual scores to those of car and public transport users and even more interesting, to the perceived scores given by governmental decision makers. What would appear to be the most effective Carrots, Sticks and Sermons for W+S?

Conclusions and research questions

In this subsection about policy triggers and justifications for action cues for policy development and evaluation are discussed.

Risk awareness mechanisms can pose an obstacle to understanding the true W+S conditions and state of affairs. There probably is great potential for improvement of W+S conditions in strategies achieving a better match between perception of the W+S state of affairs and their true values.

Van Wee's study learned us that applying ethics to policy development and implementation makes a difference. A common rating of current conditions, and Cost-Benefit Analysis (CBA) of policy strategies and projects, in mere financial terms does not do justice to social (equity), ecological and environmental consequences. Exploration and analysis of W+S system deficits and *ex ante* evaluation of policy strategies and projects needs to include elements of the CBA, social justice and some other relevant theories and values. Furthermore, methodological issues concerning CBA need to be remedied. With regard to coverage particularly attention is needed for distribution effects and equity (winners and losers, primary social goods, capabilities, trade-offs). According to Van Wee the 'best' policy meets the following three criteria: effectiveness, efficiency and equity.

Although Risser uses a somewhat different approach to the policy subject, he covers the same dimensions and learns us that regarding Quality of Life not only objective parameters count, but subjective parameters as well. Risser's concept of Quality of Life strongly relates to Sustainability and covers the dimensions of People, Planet and Prosperity as well as the contextual political dimension.

These conclusions lead to the following research questions with regard to the policy context:

- What data and information on W+S conditions and effectiveness, efficiency and fairness of policies are known and available?
- How are risks and inconveniences rated by policy agents and to what degree does this perception mismatch the true situation?
- Are walking and sojourning interests explicitly vouched for in the selection, definition, and/or design of options regarding public space and transport plans, projects and/or measures?
- What signals triggered and justified W+S policy (project) developments? What signals are neglected and what justifications (if any) were given? To what extent are Van Wee's 'rules of thumb' applied?
- To what degree are the social, environmental, economic and political dimensions, as well as subjective parameters like safety & security, perception of social climate, comfort, aesthetics, costs & benefits, spontaneous mobility and accessibility covered in W+S conditions research programming and analysis?
- What sacrifices (loss of freedom, money, investments) are stakeholders and policy agents willing to make in order to sustain or improve W+S conditions?
- What societal obstacles are there regarding improvement of W+S conditions, particularly for those who are physically or mentally dependent on others: children, the disabled and the elderly? To what extent are the authorities inclined to support redistribution of resources and responsibilities?
- What W+S policies and projects are developed and implemented, what do they target and how effective, efficient and fair are these interventions? To what degree do financial, budgetary or cost-benefit arguments apply regarding W+S policy development? What investments are made and what do these investments deliver?

5. Diffusion of Innovation theory[729]

Usually policy interventions aim to change current conditions for the better, and most of the times these interventions will mean that things are to be done in new probably innovative ways. In this regard it is useful to know it takes some time to effectuate the changes and that usually the change has to pass through a number of stages to actually produce the targeted effects.

When mentioning *innovation,* people generally think about successful spectacular innovations. Recent examples are the success of the iPod, iPhone and iPad from Apple. The sale and the use of these innovative products has expanded enormously. However, most innovation processes are far less spectacular, visible and quick. Rogers (1995) has done a lot of research into the Diffusion of Innovations in the 1970s and developed and published a well-known theory about it, which can be relevant for walkability and sojourning policy development as well. After all, innovation does not only apply to products but also to ideas, concepts and strategies. Rogers has drawn a number of important conclusions:

1. Potential users of a new technology or procedure must complete a process of five stages (Innovation Decision Theory: see Figure IX-16): they must first get to know the

[729] This section is based on the report 'To a new approach of fatigue in traffic', R. Methorst (2006)

innovation (**knowledge**), secondly they must be convinced of the worth of the innovation (**conviction**), thirdly they must decide to accept the innovation (**decision**), fourthly the innovation must be implemented (**implementation**), finally the decision must be confirmed anew or rejected (**confirmation**). Note the similarity with Winsemius conclusions!;

2. Individuals, who take risks or are otherwise innovative, will sooner accept an innovation than others in the continuing adoption/diffusion process (Individual Innovativeness theory);
3. In the beginning the diffusion happens very slowly and then steadily begins to grow, followed by quick growth, a gradual stabilization and then reduction (Rate of adoption theory)[730];
4. There are five essential characteristics (attributes) on which an innovation is judged: that it can be tried (**triable**), that results can be observed, that they are visible (**observability**), that it has a benefit above other innovations or the present situation (**relative advantage**), that it is not too difficult to learn to use or apply the innovation (**complexity**), that it fits within the circumstances in which it shall be fitted (**compatibility**).

In the innovation process the following groups may be discerned:

1. **Innovators** (2,5%): brave people that carry change. These people take risks, or are innovative in other ways and will accept innovations sooner than others in the continuing adoption and diffusion process. They are very important for communication;
2. **Early adopters** (13,5%): respectable people, opinion leaders, who try out new ideas, but in a careful way;
3. **Early majority** (34%): thoughtful people, careful but taking over changes quicker than average;
4. **Late majority** (34%): sceptic people who only use new ideas and products when the majority uses them;
5. **Laggards** (16%): traditional people, who like the "old way" and who use new ideas and products only when the new idea has become mainstream or even tradition.

Change processes start with 'new' knowledge and insight. This can be absolutely new knowledge, but also 'old' knowledge that is new to the stakeholders in a specific situation. In this respect researchers, politicians, policy makers and practitioners can be seen as potential target groups for the dispersion of innovative ideas and concepts on walkability and sojourning issues. The new knowledge needs to be carefully marketed and the lessons learned from Rogers' research seem to be potentially helpful in this regard.

Conclusions and research questions

Rogers' ideas on the diffusion of innovations makes one realise that innovation takes time and that it is unreasonable to expect that innovative policies immediately produce the desired effects. Furthermore, innovations need to be carefully introduced and marketed to the right segments of stakeholders. If, for example, a national government wants local authorities to take up certain tasks, it seems wisest to prospect for innovative local authorities and convince them

[730] Concerning this the course of the diffusion process of the behaviour of driving under influence of alcohol (ROI). It took decennia before driving under influence ROI was ‘not done’.

to try the innovation, and if successful, help spread the message to a larger group of sensitive opinion leaders, and try to cause a snowball effect.

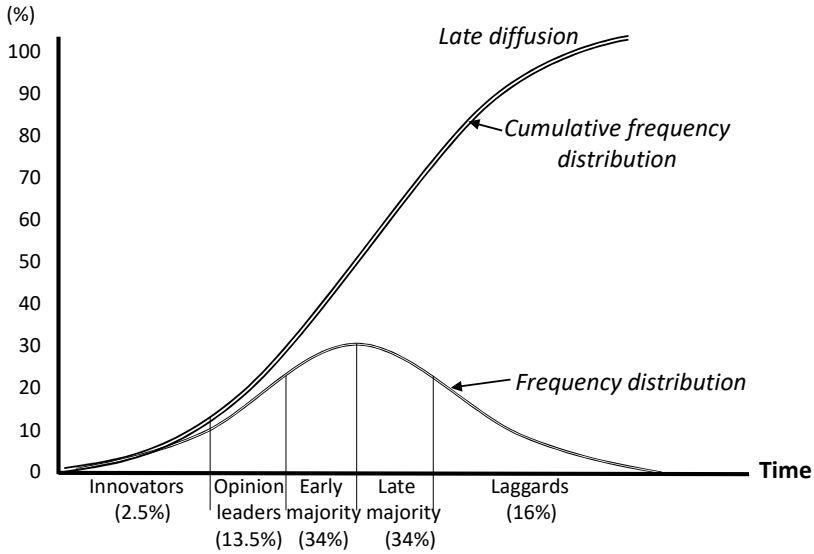

Figure IX-16 Diffusion of innovation according to Rogers (1995)[731]

Relevant questions in this research regard are:

- In recent history, what (promising) innovations regarding W+S were introduced?
- How did these innovations diffuse, and what were the success and failure factors?
- What W+S policy agents seem to be innovators and opinion leaders?
- What 'market' potential is there for the introduction of new W+S policies?

6. The role of perception in walking and sojourning in public space policy

6.1. Introduction

Additional to the significance of walking documented through facts and figures, for policy development the perception of policy makers and politicians is a relevant perspective. Policy decisions are largely based on their perception of policy makers of an issue. In a thesis about the options regarding walking and sojourning in public space policies, it is therefore relevant to investigate the public's, politician's and policy maker's perceptions on the issue.

To indicate the relative level of significance of walking and sojourning in public space, in this section the policy makers' and decision makers' perception of the issue is captured. Indications for perceptions regarding the significance of walking and sojourning in public space can be found in policy statements and communications, budget plans and general developments

[731] picture source: http://www.mitsue.co.jp/english/case/concept/02.html

regarding walkability and sojourning facilities in public space. In the next paragraph first a general overview will be given of policy attention to the issue on the national and local levels, as an expression of the politicians' perception. Next attention given to the issue by the media will be presented. For politicians, apart from official documents, the media are their main source of information, particularly regarding the opinions of their constituency, as well as thermometer of significance of topical matters (Graber, 2007). As in the Netherlands, apart from limited mobility and hiking advocacy groups, there is no longer a pedestrian lobbying agent to inform politicians, this type of influence can be neglected.

6.2. Perception of the significance of W+S internationally

The Dutch case on policy attention regarding walking and sojourning may not be representative for Europe. With respect to cycling the Netherlands is often seen as a model country (i.e. Zegeer, 1994; Rietveld, 2004); it is often assumed that this is also the case for walking. From the PQN Country Reports and experiences in the PQN and OECD/ITF projects it appears that in at least Switzerland, Spain and the United Kingdom the issue is higher on the political and research agenda, both on the national and local levels. The Swiss Country Report (Sauter et al., 2010) pictures a State-of-the Art in walking policy, communication and research, that documents the relative high priority walking is given in the country. Spain has put much effort in contributing to both the PQN and OECD/ITF projects by delegating more experts than any other country in the research groups[732]. The United Kingdom is the home of the leading NGO and conference organiser on walking (WALK21), and The Department for Transport in the United Kingdom has many publications on walking for empowering local authorities[733]. In the first decade of this century a dedicated policy programme was executed on pedestrian road safety (DETR, 2000a). As a local authority, London is exemplary. Its transport provider Transport for London has a special department for accessibility, which explicitly looks after walking routes in the city. Transport for London decided that in 2012 the city should have a consistent walking and cycling network for the Olympics (Transport for London, 2010). In Belgium the city of Brussels issued a strategic plan for pedestrian facilities (2013), which is also a good example.

6.3. Walking and sojourning in Dutch policy documents and plans

There are indications that walking and sojourning are not high on the list of important issues of policy makers. In national policy notes and in parliamentary discussions, walking and sojourning in public space hardly ever appear. Gorissen (2011) found that in the Dutch National policy paper on mobility (Nota Mobiliteit) walking and the pedestrian is mentioned only with respect to 'chain mobility' and accident risk from car crashes. In the Strategic Plan Road Safety 2008-2020 however, the pedestrian safety is allotted priority, and 3 dedicated measures are specified: improvement of pedestrian crash protection of cars, safety improvement of pedestrian crossings and stimulation of pedestrian detection systems in cars (Gorissen, 2011). From the recent draft 'Structure Vision Infrastructure and the Physical Environment (Land Use)' of the Ministry of Infrastructure and the Environment (Ministerie I&M, 2011) it can be concluded that walking and sojourning are now seen as predominantly provincial and local matters. Consequently it would be logical to find that local and regional authorities devote ample

[732] The participants list of the OECD/ITF working group featured 4 experts; the PQN participants list 9 contributers.

[733] The most recent 3 are: 'Proportion of urban trips under 5 miles taken by: (i) walking or cycling (ii) public transport' (2011), ' The Effects of Smarter Choice Programmes in the Sustainable Travel Towns: Full Report' (2010) and ' Active travel choices' (2010).

attention to the issue. In a sample of provincial and city-region plans Gorissen did not find any items on walking and pedestrians. In a sample of 20 local municipal traffic and transport plans 25% of the plans amply dealt with walking and the pedestrian and walking, 15% the issue did not mention it at all, and 60% of the plans mentioned the issue, but it was not extensively worked out.

6.4. Major sources influencing walking and sojourning development

When an issue is not high on the policy agenda, it seems logical that politicians and policy developers do not specifically look for information, but simply rely on what is presented to them by their 'natural' sources: the public media, specialist newsletters and journals, and consultants, and their own experiences as a pedestrian. It can be expected that these sources, for susceptibility reasons, prefer to highlight matters that are obviously interesting to their target groups (Klapper, 1960[734]). Braman (2003) offers an additional explanation of the selectiveness by saying: 'We have been on our feet too long to study the art of walking'.

In an internet search (Google Scholar) no literature was found on the influence of communications on walkability policy development[735]. In order to get an indication of the importance of walking and the pedestrian in the media a tentative search on the websites of two nationwide newspapers (www.volkskrant.nl, www.telegraaf.nl) and two influential web-based traffic and transport newsletters (www.verkeerskunde.nl, www.verkeersnet.nl) was executed.

The websites search included the Dutch words for pedestrian and walker (respectively 'voetganger' and 'wandelaar') and for comparison the words 'bicycle', 'bicycling' and 'bicyclist' (respectively 'fiets', 'fietsen' en 'fietser') and 'non-motorised traffic' (in Dutch 'langzaam verkeer', which literally means 'slow traffic'). In the public newspapers bicycling scored more than 7 times as many hits as walking. In the specialists webbased newletters walking scored even worse: only 1 in every 25 articles on non-motorised traffic concerned walking or the pedestrian, whilst in public newspapers this is about 1 in every 7 articles. These results confirm that walking and the pedestrian is not in the centre of attention in the media, and that the issue has low news value.

With regard to sojourning in public space the American movement Project for Public Spaces, concerning 'place making' can be seen as an influential source, focussing on high profile public spaces (city centres, squares, meeting places). In the Netherlands CROW developed a line of publications on the subject, as well as on designing public space for children. There are a number of NGO's active on this subject on the national level: Childstreet, VVN (Traffic Safety Netherlands), NUSO (national organisation for playgrounds and youth recreation), Jantje Beton, and the platform 'Ruimte voor de jeugd'[736]. On the local level most municipalities have one or more playground associations. These NGO's inform and lobby for play spaces for children.

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[734] Klapper (1960) concluded: *'mass communication functions far more frequently as an agent of reinforcement than as an agent of change*' (cited in Lyengar & Kinder [News that Matters], 1987)

[735] Internet search http://scholar.google.nl/ on 11/12 January 2012 using phrases 'influence of communication on walking policy development', 'policy determinants walking communication', 'evaluation of policy development role of communication', 'walking policy strategies - media - communication - press', 'knowledge management policy walking', 'press, media as political resource walking' produced long lists. Of each list 10 pages were scanned for relevance. Many items dealt with the use of media for policy strategies; only a few dealt with the influence of media on politics or policy development, of which none with walkability and/or sojourning in public space policy development.

[736] 'Ruimte voor de jeugd' is Dutch for 'Space for youngsters'

Table IX-4 Number of hits in websites search

Search word	Volkskrant	Telegraaf	Verkeerskunde	Verkeersnet
Voetganger (= pedestrian)	69	7,880	148	62
Wandelaar (= walker, hiker)	18	991	8	1
Fiets (= bicycle)	~ 600 (>100 in 2 months)	24,300	416	2,970
Fietsen (= bicycling)	38	30,700	294	1,330
Fietser (= bicyclist)	~ 9,000 (>100 in 4 days)	13,500	344	182
Langzaam verkeer (= non-motorised traffic)	71	3,790	52	1,270
Verkeer / auto	20 / ~ 3,500 (>100 in 10 days)	155,000 / 290,000	352 / 469	2,000 / 2,300
Search on 18-12-2011				
Sites: www.volkskrant.nl, www.telegraaf.nl, www.verkeerskunde.nl, www.verkeernet.nl. In the Volkskrant website a maximum number of 100 hits is presented for most search words; the search was set at a period of 1 year (from 18-12-2010 to 18-12-2011).				

I do not have information on what consultants write and advise about walking and pedestrians. It is the authors experience that, whenever consultants advise on slow traffic matters, they focus on bicycling, and do not really include the pedestrian. Even in dedicated publications on recommendations[737] by CROW (the Dutch national knowledge platform on infrastructure, traffic, transport and public space) that in the title refer to walking, the interests of pedestrians are overlooked in most of the cases. In recent (national) conferences[738] on traffic and public space however the number of presentations on walking is significantly higher than in earlier years. In 2011 CROW started a special working group on pedestrian facilities, featuring delegates from a wide range of disciplines.

6.5. Conclusion

There are indications that perception plays a delimiting role in walkability policy development. The rating of the significance of walking in the perception of policy makers and politicians does not always match its significance in functional terms (facts and figures). At the national level walkability is perceived as an issue to be dealt with by local authorities. At the local level the issue is generally 'integrated' in standard policies, but it is unclear to what degree consequences for pedestrians are considered. With regard to walking and sojourning in public space, policy makers and politicians do not seem to be agents of improvement, but rather agents of reinforcement of the status quo, that undervalue its functional significance. Although there are some signs of improvement, it appears that in some other countries progress in policy research activities regarding walkability and sojourning in public space, is stronger than in the Netherlands.

[737] I.e. 'Maatregelen op fietspaden en voetpaden' [= Measures on cycle paths and foot paths]
[738] I.e. Traffic Behaviour Day 2011 and the National Traffic Sciences Conference 2011.

7. System- and Result-responsibilities

Article in 'Verkeerskunde' by Rob Methorst, translated into English.
http://www.verkeerskunde.nl/rob-methorst-zonder-lopen-geen-mobiliteit-dus-een.43967.lynkx, accessed 12-3-17

Rob Methorst: **'No mobility without walking, so it is a government interest'**
Rob Methorst, emeritus researcher, formerly senior advisor Rijkswaterstaat:

'The national importance of walking and sojourning in public space'
Pedestrians, walking and sojourning in public space as a subject is often seen as something of local importance. But shouldn't even the empire get involved? What is happening in other countries?

In short, the answer is: yes, it is also a matter for the state, especially because walking is lubricating oil and cement for mobility and social life, but also because the national government has tasks and powers that local governments do not have with regard to knowledge management. and dissemination, direction and stimulation of local governments and laws and regulations. There is now an explicit pedestrian policy in Norway, Austria and Wales. Scotland and Switzerland are also investing in it. There is every reason to develop an explicit pedestrian policy in the Netherlands as well. The pedestrian has long been forgotten in policy, and improvements for car traffic and bicycles have often been at the expense of pedestrian space, literally and figuratively. Fortunately, the subject is "bubbling" internationally and there are now "white ravens" among municipalities who give walking and lodging the place it deserves.

When answering the questions, it is first of all important to distinguish between "system responsibility" and "result responsibility".

In general, the central government is responsible for the system, which ultimately involves walking and sojourning in public spaces, such as lubricating oil and cement, making an optimal contribution to the well-being and prosperity of the BV Netherlands. This concerns the impact of walking and sojourning on the economy and competitiveness of the country and the health, skills, safety and well-being of the population and population groups. The social costs of making walking and sojourning possible must outweigh the benefits of facilitating walking and sojourning. The costs include facilities, accidents and damage, health care, loss of time, monitoring and research, legislation and regulations, administration and management of knowledge and craftsmanship with regard to maintaining and improving pedestrian friendliness, administrative costs, etc. Activities related to system responsibility knowledge about the operation of the system and the impact on the functioning of the BV Netherlands (such as organizing information availability, knowledge and craftsmanship), developing and setting frameworks (such as objectives, availability of resources, standards and guidelines, legislation and regulations), enforcement of the frameworks (monitoring, action in the event of undesirable developments) and the broad facilitation of the maintenance and improvement of the operation of the system. In other words: ensure that the operational managers (municipalities) (can) do their work.

Responsibility for results is about pedestrians actually being able to move and relax without problems and even pleasantly in the public space, at least in that part that is open to them. To this end, it is primarily about efficient (suitable, safe and pleasant) facilities for all people, regardless of age, skills and skills. Effective facilities mean: connecting, usable for the pedestrians concerned, comfortable, liveable, as such clearly arranged and recognizable, and

safe. Of course, this does not only concern the physical facilities, but also the services and organization surrounding them: management and maintenance, surveillance and enforcement, public lighting, 'eyes' on the street, traffic management, etc. In general, responsibility for results seems to be a local affair. The pedestrian's radius of action is largely limited to short distances (less than a few kilometres), is concentrated within built-up areas of towns and villages, and takes place within public spaces, which in most cases are legally owned and managed by the local government. The local government can delegate or transfer (part of) its formal powers to third parties, such as residents, adjacent companies, housing corporations, contractors.

We have now outlined the responsibilities of central government and local authorities. It is not yet clear what the central government and local authorities should pay attention to, what choices would be obvious and how this could be marketed. In principle, this is a political question: what is efficient, is it right, or should it be better? Do we only look at the existing situation or also at the future? So who should do what? Based on facts, it can be stated that there is still a lot to improve.

From recent research we know, for example, that it is not crossing accidents (approximately 1,200 hospitalized injuries) that are nationally dominant, but falling accidents. This last group of victims (approximately 6,000 hospitalized injuries) is approximately 5 times as large. Local figures are not available; most municipalities are also not aware of the extent and severity of falls. The same story can be told about mobility on foot and accommodation. Local figures are scarce; the national mobility statistics provide a reasonably reliable picture of door-to-door journeys by foot, but not of pre and post transport on foot (is just as extensive) and to the size and impact of sojourning in public space (including tourism!) we can only guess. Where municipalities pursue a pedestrian policy (Rotterdam, Utrecht, The Hague, Amsterdam, Eindhoven, Nijmegen, Groningen, etc.), the focus is mainly on the walking and residential quality of areas where there are many pedestrians, in this case the central area, and an approach to obvious crossing problems.

In general, the facilities in the Netherlands are sufficient for healthy adults. However, the circumstances are far from efficient for children, the elderly and people with reduced mobility, certainly in the light of recent goals such as living independently for as long as possible, reducing obesity, sustainability, more personal responsibility, Agenda City.

With regard to problems with walking and sojourning in public space, a number of major developments play: aging, urbanization and increasing car dependence and the influence of technology. Aging is causing a dramatically increasing number of pedestrian injuries and associated accident and care costs and social consequences; urbanization is causing increasing differences between urban and rural areas; car dependence causes transport poverty and inaccessibility of many facilities; technology has a blind spot for non-mechanical mobility and accommodation, which can further marginalize walking and accommodation.

The question is whether one can expect municipalities to be involved in long-term major developments. Their result-oriented task is mainly to solve problems here and now. From the perspective of system responsibility, it would be obvious that the central government would transfer knowledge about major developments, help to find solutions for them and actively stimulate and support municipalities to tackle these problems. However, under the pressure of the current political situation, the national government rarely conducts its own explorations of the state of the world anymore. What is not explicitly placed on the agenda of the central government via the media is doomed to be neglected. It cannot therefore seep into local policy

and play a role in municipal policy. This means that opportunities are missed to perpetuate and improve the impact of walking and sojourning. Who blows the whistle?

The question is also: what is happening in other countries? In most countries, the situation does not really differ from that in the Netherlands, but under the influence of WALK21 and "prophets" such as the OECD / ITF and Jan Gehl in particular, tings are going to move. Norway presented their concise national pedestrian policy in 2012 and Austria did so in October 2015, with an impressive Masterplan Gehen. Wales has enacted a real law on it. Major cities such as London, Barcelona, Copenhagen, Stockholm, Brussels, Munich and Vienna have made extensive pedestrian plans. Utrecht recently had the scoop in the Netherlands.

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Appendix 10 - Curriculum Vitae Rob Methorst

CURRICULUM VITAE
Born in 1950

Qualifications
Masters-degree Human Geography - Planning Sciences in 1978

Professional activities

- (Emeritus) Senior researcher pedestrians safety at SWOV Institute for Road Safety Research (2015 – 2020)
- Board member Streets for People (MENSenSTRAAT) (2016 - present)
- Senior Advisor Road Road Safety at Rijkswaterstaat Centre for Transport and Navigation (1999 - 2015)
- External advisor / member scientific boards of international research projects, e.g. GOAL, TRACY, VRUITS, ICTCT, ECTRI
- Reviewer of articles on pedestrians and road safety for AAP, Transportation Research–Part F, Journal for Transport and Health
- Chair of COST 358 Pedestrians' Quality Needs project (2006 - 2010)
- PhD research on Walking as a source of wealth and health - a system approach to walkability and sojourning in public space policy development (final title: Exploring the pedestrians realm) at the Technical University Delft (2005 - 2020)
- Dutch delegate in OECD working groups on Ageing and Transport (1999 - 2001), Achieving Ambitious Roads Safety Targets (2004 - 2005) and Pedestrian Safety, Urban Space and Health (2007 - 2010)
- Dutch delegate in ERANET ENT15 Sleepiness behind the wheel (2005 - 2010)

- Head of policy/research section of the Dutch Pedestrians Association (1990 - 1999)
- Researcher for EU project on Transport demand of modes not covered by international transport statistics (delegated from Dutch Pedestrians Association)
- Secretary Regional Road Safety Board at province of Drenthe (1981 - 1990)
- Project leader Traffic Safety and liveability at Municipality of Winschoten (1978 - 1982)

Main areas of interest

- Vulnerable Road Users, particularly pedestrians and older road users
- Human Factors in Road Safety policy development
- Strategic research and policy consultancy (Future prospects of mobility and safety; strategic planning road safety, mobility of vulnerable road users, external costs road safety)

Recent publications

- Methorst, R., Schepers, P., Christie, N., de Geus, B. (2017) *How to define and measure pedestrian traffic deaths?* In: Journal of Transport & Health 7 (2017) 10–12
- Methorst, R., Schepers, P., Christie, N., Dijst, M., Risser, R., Sauter, D. & van Wee, G.P. (2017) *Pedestrian falls' as necessary addition to the current definition of traffic crashes for improved public health policies*. In: Journal of Transport & Health 6 (2017) 10–12
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- Methorst, R., van Essen, M., Ormel, W. & Schepers, P. (2010) *Pedestrian and bicyclist injury and fatal accidents - a surprising image* - Rijkswaterstaat Centre for Transport and Navigation, Delft
- Gerlach, J., Boenke, D, Leven, J. & Methorst, R. (2008) *Sense and nonsense about Shared Space - For an objective view of a popular planning concept*, Straβen-verkehrstechnik, 2008-2:61-65 (Teil 1), 2008-3:140-149
- Methorst, R. (2006) *To a new approach to fatigue* - Rijkswaterstaat Centre for Transport and Navigation, Delft, 2006
- Methorst, R. (2003) *Vulnerable Road Users* – Rijkswaterstaat Adviesdienst Verkeer en Vervoer, Rotterdam

Appendix 11 - 'Pedestrian falls' as addition to the current definition of traffic crashes

'Pedestrian falls' as necessary addition to the current definition of traffic crashes for improved public health policies.

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1. Introduction

Key to the development of public health policies and strategies is the accurate definition of the problem(s) under review. Accurate problem definition fences off undesirable circumstances, highlighting some aspects and throwing others in the shadow (Weiss, 1989). Widely accepted definitions of traffic crashes focus on vehicle crashes (sometimes further restricted to *motor* vehicle crashes) occurring on public roads. These definitions exclude incidents such as

pedestrians slipping, tripping or colliding with objects resulting in falls in public spaces leading to injury or death. Such incidents are hereafter denoted in short as Pedestrian Falls (PFs)

The current definition is understandable from a historical perspective, but it may no longer be accurate or justifiable. The exclusion of PFs by definition and, subsequently, in statistics is likely to lead to biased conclusions in transport and safety policies, which do not serve public health interests. This paper focuses on the problem regarding definition only and not on reporting issues even though these are important as evidenced from frequently missing single-bicycle crashes (which, unlike PFs, are defined as traffic crashes in most countries) (Veisten et al., 2007).

The current definition of traffic crashes emerged in the early 20th century when motorisation led to increasing numbers of people losing their lives in motor vehicle crashes (Norman, 1962). As a consequence, traffic crashes were defined and measured as (motor) vehicle crashes. Indeed, Norman (1962) described that in the United States in 1957, deaths following motor vehicle crashes exceeded the combined deaths from all infectious and communicable diseases at all ages. The risk of pedestrian-motor vehicle crashes was particularly high, with pedestrian deaths following motor vehicle crashes in New York City in 1959 amounting to 70% of all officially recorded traffic crash deaths (Norman, 1962). It is likely that, compared to the number of official traffic crash deaths, the number of deaths following PFs was negligible. Nowadays, PFs no longer appear to be a negligible problem, especially in developed countries with their ageing populations as older people have a high risk of serious PFs. Currently in the Netherlands more elderly people are fatally injured from a pedestrian fall in public space than from pedestrian-vehicle collisions (Den Hertog et al., 2013).

2. Recent research on pedestrian falls

Although there have been very few, if any, official statistics of PFs until recent times, first studies show the size of the problem. According to Den Hertog et al. (2013) a little more than half of all pedestrian deaths and the vast majority of non-fatal pedestrian casualties in the Netherlands are now as a result of a PF. Table 1, which also includes data from Switzerland and Austria, shows that in the present-day road system, figures based on the current definition of traffic crashes do not provide a comprehensive overview of crash victims on public roads. Also, Mindell et al. (2015) found that of all pedestrian casualties hospitalised in England (2007-2009) with a specified International Classification of Diseases (ICD) coding 23,528 were involved in a road traffic accident and 76,087 were injured in falls on the public highway, therefore the number of PF casualties were, similar to Dutch figures (Den Hertog et al., 2013), over three times greater than those involving a motorised vehicle. Both Den Hertog et al. and Furian et al. (2011) found that about three quarters of the PFs were related to bad or slippery pavement conditions, i.e. lack of 'walkability' as defined by how conducive, friendly and safe the urban environment is for walking (Abley, 2005). It is however beyond the aims of this paper to discuss the literature on walkability and factors having an impact on the level of walkability and related PFs.

Probably owing to definitional bias and lack of accessible data, only a few researchers with a transport and walkability focus (Den Hertog et al., 2013; Furian et al., 2011; Methorst & Schepers, 2010; Öberg, 2011; Mindell et al., 2015, Oxley et al. 2016) have started to estimate the size of the PF problem; however, most research into pedestrian injury/death incidents, is still restricted to pedestrian-motor vehicle crashes (Elvik et al., 2009). By contrast, the problem of falls is well recognized among researchers in the field of epidemiology. The World Health Organisation estimates that globally approximately 37.3 million falls occur each year that are severe enough to require medical attention, with an estimated 424,000 falls occurring that result

in fatal injuries (WHO 2014). This is the second leading cause of unintentional injury death (WHO 2014).

Unfortunately for transport- and public space related researchers, these figures also include falls indoors and in private gardens. As most studies on falls and interventions by epidemiologists combine all falls regardless of location, the outcomes are of limited use for road and public space authorities. It is, however, positive that some researchers recently have started to at least distinguish between indoor and outdoor falls (Kelsey et al. 2010).

Table 1 The Proportion of SP casualties on public roads in the Netherlands, Switzerland, and Austria.

	the Netherlands 2011(Den Hertog et al., 2013)		Switzerland 2011(BFU, 2014)		Austria 2009 Furian et al., 2011)	
	numbers	%	numbers	%	numbers	%
total number of injured road users	180,000	100	138,000	100	104,000	100
Injured pedestrians	48,000	27	56,700	41	36,500	35
of which traffic crash	5,000	3	2,400	2	4,000	4
of which PFs	43,000	24	55,300	40	32,500	31
total number of hospitalised road users	41,000	100	n.a.	n.a.	n.a.	n.a.
hospitalised pedestrians	11,000	27	n.a.	n.a.	n.a.	n.a.
of which traffic crash	2,000	5	n.a.	n.a.	n.a.	n.a.
of which PFs	8,600	21	n.a.	n.a.	n.a.	n.a.
Total number of fatalities	747	100	n.a.	n.a.	n.a.	n.a.
pedestrian fatalities	160	21	n.a.	n.a.	n.a.	n.a.
of which traffic crash	74	10	n.a.	n.a.	n.a.	n.a.
of which PFs	86	12	n.a.	n.a.	n.a.	n.a.

3. Consequences of excluding pedestrian falls

The exclusion of PFs from transport research is likely to lead to biased conclusions about the link between road safety and the design of our road transport system. Elvik et al. (2009) described an interesting example based on Norwegian research. The risk of injuries (injuries per kilometre travelled) for car occupants is two times higher than that for bus passengers. This suggests that the number of injuries decreases when people shift from driving to using buses or trains. However, this conclusion only appears to apply to injuries falling within the official definition of road traffic crashes (excluding PFs). According to Elvik et al. (2009: 1064), "The unrecorded injuries from falls will, however, increase so much that no overall gain in safety can be expected if car users start using buses or trains."

Similarly, it is difficult to rule out the possibility that results from studies on pedestrian crossings are biased by the restriction of research to motor vehicle crashes (Elvik et al., 2009). Nyman et al. (2013) recently found that PFs occurred most frequently while pedestrians were crossing a road. As Den Hertog et al. (2013) suggested, the large majority of non-fatal pedestrian casualties are PF victims. This may also be applicable to pedestrian crossings. This

means that walkability factors such as differing kerb heights may have a similar or greater significance on overall safety outcomes than factors relevant to pedestrian-motor vehicle crashes.

We expect that the number of severe pedestrian injuries in motor vehicle crashes in developed countries will further decrease in the future. More speed-reducing measures and new mechanical systems such as automated braking and pedestrian airbags on car bonnets have the potential to reduce the risk of fatalities and the severity of pedestrian-motor vehicle crashes. However, our ageing population means that without the introduction of new public health and road safety policies severe injuries from PFs are likely to increase. This increase and related mobility and reduced physical activity problems among the elderly are unacceptable from the perspective of public health. If we are to address the problem of PFs, the first thing we have to do is agree on a comprehensive definition of incidents that include PFs on an equal basis besides traffic crashes.

4. Discussion

We recommend to consider changing the definition (for instance in the International Classification of Diseases) to the following: "any vehicle crash and pedestrian fall occurring ~~on~~ in ~~the~~ public ~~road~~ spaces." For the same reasons of usability by authorities we recommend to broaden public roads to public spaces. The inclusion of PFs in the definition would lay the basis for the collection of more comprehensive data on injuries on public roads and in public spaces. This would inform more accurate research and analysis of traffic risks and lead to better input and guidance for road authorities, urban planners, and public health authorities, to enable them to design inclusive and safe public spaces, improve walkability and thereby helping the elderly to stay mobile, independent and (physically) active.

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Appendix 12 - How to define and measure pedestrian traffic deaths?

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In this brief communication we integrate and expand on two papers on pedestrian travel deaths recently published in the Journal of Transport & Health, the Noland et al. (2017) paper on pedestrian fatality data and the importance of definitions for gathering data, and the Methorst et al. (2017) paper on the definition of 'traffic crashes'. Methorst et al. (2017) have argued to include pedestrian falls in the public realm or space in the definition of traffic crashes. Even if we use the current definition, which excludes pedestrian injuries without motor vehicle involvement, pedestrian fatalities account for 22% of all traffic deaths worldwide, ranging from 13% in South-East Asia to 22% in the Americas, 26% in Europe and 39% in Africa (WHO, 2015). Policies to improve pedestrian safety are important to reduce the burden of deaths and injuries, but also to encourage people to participate in active transport and enjoy the sizable health benefits of physical activity (Kelly et al., 2014). This starts with gathering data to understand the problem of pedestrian safety and to inform policies (Noland et al., 2017).

Definitions are important to frame problems under study and as a basis for gathering data, throwing excluded aspects in the shadow and outside of official statistics (Noland et al., 2017; Weiss, 1989). With regard to pedestrian deaths, three concepts need to be defined adequately: 'Pedestrian', 'Public Space' and 'Traffic crash'. An important requirement is that the definition provides a way of operationally measuring a phenomenon in a specific context. Moreover, we need to understand pedestrian falls in the public space to develop transport policy and to be able to evaluate interventions.

There are a variety of ways to define the concept of being a pedestrian, for instance the National Highway Traffic Safety Administration (NHTSA) and United States Department of Transport (USDOT) definitions (Noland et al., 2017). In the NHTSA definition, a pedestrian is any person on foot, walking, running, hiking, sitting or lying down (National Highway Traffic Safety Administration, 2014). By applying this definition on collisions with motor vehicles, NHTSA centred its definition on the collision between a pedestrian and a motor vehicle and not on the overall pedestrian risks. In the USDOT definition, a pedestrian is any person who is not an occupant of a motor vehicle or pedal cyclist, regardless of their actions (USDOT, 2012). The latter definition includes persons using wheelchairs, skates and a variety of personal movers like mobility scooters and Segways, which generally use pedestrian facilities and of which users have to obey the same traffic rules as other persons on foot. We suggest adopting the most simple and clear definition: 'all persons on foot, walking, hiking, sitting or lying down'. As mobility and safety characteristics and requirements of personal movers may differ substantially from actual pedestrians, it would be better to treat them as a separate mode.

In their paper, Noland et al. (2017), restrict the definition to pedestrian safety on public highways, excluding parks, special foot paths and privately owned parking areas. The latter indeed falls outside public jurisdiction, but public parks and footpaths are public spaces and therefore should be included in public policy making, planning, management and control. In our article (Methorst et al., 2017a) we pleaded for widening the perspective to public space, i.e. all publicly owned and managed space.

Pedestrian falls are currently excluded from the definition of traffic crashes (a vehicle is required to classify as traffic crash) and are a growing problem for western societies where about half of all pedestrian deaths and the large majority of non-fatal injuries are due to pedestrian falls in public spaces (Methorst et al., 2017a). Road factors such as kerb heights and road surface friction contribute to a substantial share of pedestrian falls (Lai et al., 2011; Nyman et al., 2013). Road safety visions such as Vision Zero ascribe 'forward-looking responsibility' to system designers such as public space authorities (Fahlquist, 2006). Methorst et al. (2017) argue that they can only carry this responsibility for pedestrians if pedestrian falls are added to the definition of traffic crashes and maybe also call these incidents 'travel injuries' or 'traffic crashes and falls'.

It is important to bear in mind that definitions are a necessary but insufficient condition to achieve reliable and comprehensive data collection (Noland et al., 2017). This is also shown by the experiences with cyclist falls, also called single-bicycle crashes. It is well known that the police hardly record non-fatal bicycle crashes without motor vehicles being involved (see e.g. Langley et al., 2003). One important reason is that in many cases the police are not drawn in to record such single crashes. Only recently, it appeared from comparing police statistics with causes of deaths statistics that a similar problem seems to apply to fatal bicycle

crashes (Schepers et al., 2017). Table 1 shows causes of death statistics in the Netherlands contained three times as many deaths following crashes without motor vehicles compared with police statistics. “Statistics Netherlands” estimates numbers of road crash deaths by linking (incomplete) police statistics, court files and cause of death forms filled out by a coroner to exclude suicides and crashes occurring outside public roads (SWOV, 2015), yielding an estimate of 186 cyclist deaths in 2010–2014, almost exactly matching the 187 cyclist deaths recorded in causes of death statistics. This suggests that the quality of causes of death statistics is fairly good. Comparisons between recorded deaths between alternative sources are rare, but a similar difference between police and causes of death statistics is present in Flanders (Agentschap Zorg en Gezondheid, 2017; Statistics Belgium, 2017). More detailed studies of cyclists admitted to hospital following crashes without motor vehicles and recorded through 9th version of the International Classification of Diseases (ICD-9) in the Netherlands and Flanders suggest that between 3% and 8% did not occur on public roads (Nuyttens, 2013). This is corroborated by questionnaire (e.g. for the Netherlands Schepers, 2008), but the percentage may be somewhat higher in other countries such as Australia with more recreational cycling where for instance off-road mountain biking injuries may be more frequent (Heesch et al., 2011).

Table 1 Cyclist deaths per year in Causes of Death Statistics (CS) and police statistics (PS) in 2010-2014 in The Netherlands (Statistics Netherlands, 2015; SWOV, 2017)

Crash type	ICD-10 codes causes of death statistics	Netherlands		
		CDS	CDS*	PS
With motor vehicles	V12-V16	112	116	111
Without motor vehicles	V10, V11, V16–V18	69	**71**	23
Unspecified	V19	6		
Total		187	187	134

* Unspecified assigned to with or without motor vehicles

Noland et al. (2017) examined police reported pedestrian deaths assuming the current definition, i.e. pedestrian-motor vehicle crashes. They found several issues, e.g. 14% of fatal crashes did not involve a traveling pedestrian, e.g. a motorist who was killed standing outside a disabled vehicle. The database also included a few intentional homicides and casualties who were actually in wheelchairs. Notwithstanding the importance of reliable crash reporting by the police (e.g. to correctly report travel mode and exclude homicides and suicides), police reported data are still an excellent source to understand pedestrian-motor vehicle crashes compared with the complete lack of data for public space authorities on pedestrian falls.

Notwithstanding possible differences between countries, the aforementioned experiences with the recording of cyclist falls demonstrate that, even fatal falls may not be included in police statistics, and are even strongly underreported in some countries. This is worrying, as data are needed for this emerging problem and most (local) authorities only have access to police statistics. At least in western societies, it is to be expected that the problem of pedestrian-motor vehicle crashes will further decrease thanks to safer vehicles (for instance new systems such as automated braking and pedestrian airbags on car bonnets), while an ageing society is likely to contribute to a continuing trend of increasing number of serious and fatal pedestrian falls. To increase insight into these falls, not only do we have to include this issue in the definition of ‘traffic crashes’, we also need to seek other data sources, e.g. insurance companies, ambulance services.

Experiences with cyclist falls suggest that hospital data (including data from both Emergency Departments and hospital admissions and discharges) and causes of death statistics (based on

death certificates and post-mortems by medical examiners) are promising. An advantage of these sources is that generally the International Classification of Diseases (ICD) is used to record data (WHO, 2016). Unfortunately, the three-digit ICD codes in version 10 are insufficient for pedestrian falls. Pedestrian falls occur both indoors and outdoors. The location is likely to be sufficiently described by four-digit ICD-10 codes (codes W00-W05, W10, W17-W19 and ×59 with the fourth digit code 'Place of occurrence' is '4' for 'Street and highway' (Mindell et al. 2012). Unfortunately, other types of public spaces, like public parks and footpaths, are not specified). Research into the accuracy of this data is needed and it may be a challenge to identify crashes in public spaces and to distinguish these from other outdoor falls such as in gardens.

To summarize, we recommend considering changing the definition of 'traffic crashes' in the following ways: "any vehicle crash or pedestrian fall occurring in public spaces." We suggest that such a definition will inform public space authorities and help them take their responsibility to take all reasonable preventive measures. Police statistics have advantages such as detailed crash locations and disadvantages such as insufficient reliability for some crash characteristics. Nevertheless, this source is still by far the most useful and complete for severe and fatal pedestrian-motor vehicle crashes. We therefore recommend investment in collection of data on pedestrian falls using hospital data and causes of deaths statistics. ICD seems an adequate and internally available starting point.

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Summary

Walking is an essential form of human mobility. In policy making, however, pedestrians are largely neglected. This dissertation explores how the system for pedestrians works and what steps authorities can take to improve conditions for pedestrians, walking and sojourning in public space. It outlines an effective and fair approach by redefining the domain. Methorst combines, triangulates and advances available information, data and statistics.

About the Author

Rob Methorst obtained a Master degree (equivalent) in Human Geography and Planning Sciences in 1978. He spent his professional life on traffic safety and related domains. He worked for the Dutch Pedestrians Association, Rijkswaterstaat and SWOV Institute for Road Safety Research, amongst others.

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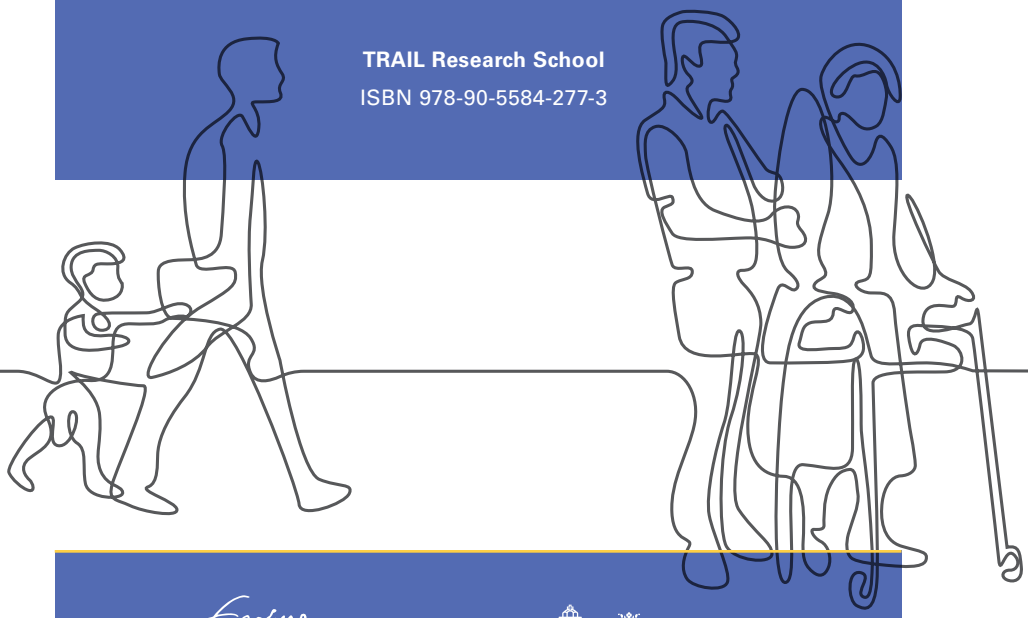

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