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HUMAN WELL-BEING AND TRAFFIC MANAGEMENT

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Within the area of mobility much discussion is going on about human well-being and how mobility can contribute to that. Human well-being is about everything what influences the well-being of people, in the broadest sense. It is about welfare beyond the Gross Domestic Product (GDP). Mobility makes a valuable contribution to the welfare and well-being of people. It provides means for them so that they can reach important destinations and participate in activities, like jobs, all kinds of facilities (cultural, shopping, recreation, etc.) and social contacts. In this way mobility has a positive effect on physical and mental health. However, mobility can also decrease well-being, for example due to traffic unsafety, noise and environmental pollution and climate change. Also, the pros and cons of mobility could be unevenly distributed among certain groups of people, regions or even generations.

In this paper we look at the current contributions of traffic management to human well-being and we search for opportunities that could increase these contributions. The research consisted of a literature scan and two workshops. In the first workshop traffic management experts were connected with experts with a focus on human well-being. Together they discussed the possibilities of traffic management in relation to human well-being. In the second workshop the findings from literature and the first workshop were discussed with experts from the Dutch national road authority Rijkswaterstaat to test how these findings are aligned with practical experience.

The literature scan showed that not many studies make a clear link between traffic management and human well-being. The current focus of traffic management is mainly on accessibility (travel times and delays) and traffic safety. Widening this perspective to the dimensions of health and the living environment is desirable and advisable. There is also a gap between traffic management, that is mainly focussing on the short-term solution of specific problems, and the more umbrella approach of well-being. The opportunities of (operational) traffic management to directly contribute to human well-being are currently limited, due to the way that traffic management is organised. Policy should make clear choices and give directions with respect to the goals that should be achieved with traffic management. Then traffic management can apply those directions in practice, using a network perspective and the experience with multimodal approaches and distribution of the scarce capacity in all kinds of networks, to find the desired balance between the various societal goals.

1. INTRODUCTION

Currently, within the field of mobility, there is much discussion about human well-being and how the mobility sector can contribute to it. Human well-being encompasses everything that influences not only people's prosperity, but also their overall well-being. It goes beyond just the economic aspect and includes aspects contributing to a good and healthy life, such as health, safety, education, social connections, purpose, care, personal development, leisure activities, and the quality of the living environment (Dietz *et al.*, 2017). Mobility plays a significant role in enhancing people's well-being. It enables individuals to reach important destinations and engage in activities there. These destinations could be workplaces, as well as facilities like stores, medical or recreational facilities, or simply where family and friends reside. All of this contributes to their physical health and well-being. This applies not only to personal mobility, but also to the transportation of goods, which significantly impacts people's well-being. However, mobility and transportation can also decrease human well-being through aspects such as traffic accidents, noise pollution, environmental degradation, and climate change (Snellen *et al.*, 2022).

Traditionally, mobility policies have primarily focused on improving accessibility. In addressing infrastructure bottlenecks, traffic management has played a crucial role. Starting from the 1990s, traffic management systems have been developed and implemented on the Dutch road network. Every road user in the Netherlands is familiar with variable speed limits, ramp metering, variable message signs, hard shoulder usage and of course, traffic lights. These measures were often taken from the perspective of the car and accessibility, mainly aimed at resolving traffic congestion. Safety was certainly an important consideration, but the primary objective of these measures often revolved around efficiently managing car traffic.

Over time, there has been a shift in the focus on accessibility. The report 'Outline Mobility towards 2040: Safe, Robust, Sustainable' (MinlenW, 2019) emphasizes that investment decisions will now involve a broader assessment. Traditional aspects such as vehicle hours lost (VHL) and economic value are not the sole considerations anymore. Attention is also given to the impact of mobility measures on traffic safety, robustness, sustainability, liveability, and a healthy environment. Additionally, other policy objectives, such as housing, are taken into account. Furthermore, the document prioritizes traffic safety as the primary focus, followed by creating a robust network, promoting sustainable mobility, and improving liveability. Only then does it address the concept of accessible and liveable urban areas.

The 'Integrated Mobility Analysis 2021' (MinlenW, 2021) describes the long-term development of mobility and accessibility for both passenger and freight transportation. Unlike its predecessor, which mainly identified potential transportation

bottlenecks by examining mobility demand and network capacity, the new analysis takes a broader view of mobility effects and environmental factors. It includes considerations like job and facility accessibility, climate robustness, emissions, and traffic safety. This trend is continued in the 'Infrastructure and Water Management Policy Program' (MinlenW, 2022), which is an elaboration of the coalition agreement. This document explicitly states that "possible measures will be evaluated from the perspective of the citizen and human well-being."

The discussion around human well-being occurs in various domains. It also addresses indicators that effectively capture the aspects of human well-being. Even within the decision process around infrastructural projects, decision-making can change if more aspects of human well-being are considered beyond just accessibility. This question also applies to traffic management. How does traffic management contribute to human well-being? Are there necessary changes to increase and improve this contribution? This paper tries to answer these questions, providing an overview of the current contribution of traffic management to human well-being and exploring opportunities to amplify this contribution.

It's important to note that our definition of traffic management is relatively narrow: it involves managing traffic that is already en route. Individuals have already decided to travel and the road conditions are as they currently exist. We do not consider measures more aligned with mobility management (such as congestion pricing) or infrastructure-based solutions. Regarding human well-being, we adhere to the CBS Statistics Netherlands definition (CBS, 2022a): "Human well-being concerns the quality of life here and now and the extent to which this affects welfare and well-being of future generations or of people elsewhere in the world. Thus, human well-being involves three groups of people: those living in the Netherlands now ('here and now'), the next generations—our children and grandchildren ('later'), and people in other countries ('elsewhere')."

2. LITERATURE

In 2021 and 2022, several Dutch reports were published that study the concept of human well-being in the domain of mobility. Alongside the annual 'Monitor of Well-being & Sustainable Development Goals' (CBS, 2022b), some of these reports included:

- The publication 'Human well-being and Mobility' (Snellen *et al.*, 2022) explores the implications of considering mobility and mobility policy from a human well-being perspective. This report breaks down human well-being in the context of mobility into four dimensions: Environment, Safety, Accessibility, and Health.

- A quick-scan study that built upon the four dimensions outlined in the previous study resulted in a set of 42 indicators across these dimensions (Vonk Noordegraaf *et al.*, 2021; Wilmink *et al.*, 2021). The dimensions and sub-dimensions are illustrated in Figure 1.
- A short report which discusses whether mobility indicators can be incorporated into monitoring human well-being and how the concept of human well-being should be applied in ex-ante evaluations of mobility measures (Visser and Wortelboer, 2021).

More detailed descriptions of the content of these reports can be found in the report 'Human well-being and Traffic Management' (Ashari *et al.*, 2022).

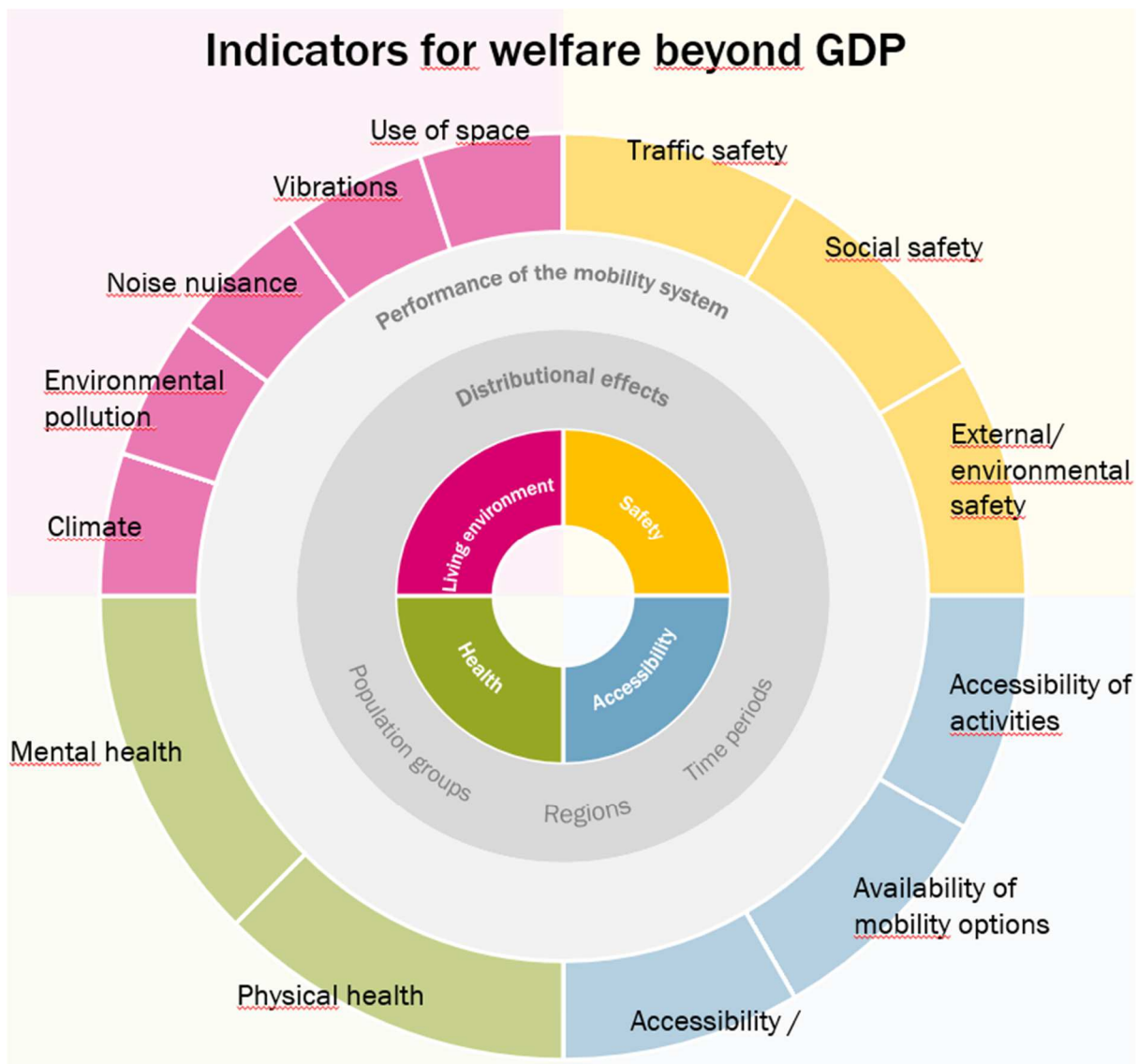


Figure 1: Dimensions and sub-dimensions of human well-being and mobility

Considering the dimensions and indicators as described in the aforementioned reports, what does the literature on traffic management reveal about these different (sub)dimensions and associated indicators? Several findings can be identified.

For each of the distinct dimensions, traffic management measures aligned with those dimensions can be found, but often, one dimension is emphasized while the assessment of the other three dimensions is limited or absent. For nearly half of the 42 mentioned indicators, particularly from the Environmental and Health dimensions, we were unable to identify examples of their use within traffic management. Most traffic management measures are generally applied from improving accessibility or traffic safety.

Various (international) scientific publications highlight how motorized traffic unintentionally generates negative effects on the human well-being dimension of Health, affecting both travellers and non-travellers. This is due to harmful emissions, traffic noise, reduced physical activity, and traffic accidents. In the Netherlands, the introduction of 80 km/h zones on highways near major cities serves as an example of a traffic management measure taken to address air quality and noise issues and their associated health problems. However, when the implementation of these 80 km/h zones, coupled with strict enforcement through speed cameras (section control), led to increased congestion on certain stretches, the speed limit became dynamic: 100 km/h during peak hours and 80 km/h the rest of the day. This dynamic change underscores the challenges of balancing the dimensions of Accessibility and Health.

Furthermore, the literature addresses the distribution of effects in the Health and Accessibility dimensions. Traffic management can play a role by determining where and when traffic is facilitated or restricted. This can influence traffic flows, the mentioned indirect consequences, and the population groups or groups of travellers disproportionately affected by these consequences.

3. CURRENT CONTRIBUTION OF TRAFFIC MANAGEMENT

Based on several case studies, we looked, together with experts in both fields, at the dimensions of human well-being that current traffic management measures focus on, and which dimensions you could add from a 'human well-being perspective'.

3.1 Narrow Focus of Human Well-being in Traffic Management Practice

The historical roots of traffic management lie in optimising existing road infrastructure and facilitating (car) traffic flow, which explains the strong emphasis on accessibility and safety. Over time, the policy orientation towards mobility favoured accommodating car traffic, leading to two key outcomes:

- Visibility of congestion or bottlenecks: With traffic management measures like managed lanes and dynamic message signs (DRIPs), congestion is mitigated or delayed, making congestion points less apparent. This means road users may not be prompted to change their behaviour due to acceptable traffic flow, adversely impacting mobility management's effectiveness.
- Limited use of 'control measures': Prioritising traffic flow meant that mostly advisory and guiding measures were used within traffic management. Direct control measures, involving decisions on who can or cannot drive somewhere, or when, were less commonly employed.

Although traffic management does consider aspects of liveability and health, these dimensions aren't as consistently integrated as accessibility and safety are. Measures to enhance the living environment are not always favoured, sometimes driven by economic considerations. The adoption of a broader view, in which health is also an important dimension to consider, has gained traction. This is linked to mode shifts toward active modes like cycling and walking (from a traffic management perspective mainly to relieve bottlenecks) and is facilitated by the emerging popularity of e-bikes and steps scooters and concepts like the 15-minute city. However, this shift stems more from individual motivations such as health and well-being rather than solely addressing collective accessibility. Traffic management can contribute by prioritizing pedestrians and cyclists at traffic signals, but infrastructure design also plays a vital role.

3.2 Traffic Management and Policy

Most traffic management measures are concrete and operational, reflecting existing policy frameworks. There's an implicit assumption that various dimensions of human well-being are considered during policy formulation before traffic management comes into play. This positions traffic management as responsive rather than proactive. Experts anticipate a broader well-being impact when car traffic is reduced, aligning with a modal shift from cars to other modes. However, this realm is the domain of mobility management, which falls outside the scope of traffic management as studied here.

Integrating broader well-being dimensions into decision-making for implementing and deploying traffic management could yield different outcomes. For instance, the environmental impact of hard shoulder running hasn't been evaluated in the same way as traditional road expansions.

3.3 Geographic Scale Matters

The nature of traffic management varies across geographical scales. On a national level, the focus lies on passenger and freight traffic due to the road network's character, predominantly comprising motorways and highways. In urban areas, traffic

management becomes more multimodal, accommodating various networks such as cars, bicycles, pedestrians, buses, and trams. In cities, the focus is not only on managing existing traffic, but also on reducing car traffic for the sake of liveability. The traffic manager can then have good input in integrating the management of different modes and the distribution of scarce space.

Currently, there are many advisory and guiding traffic management measures, especially on the main road network. In urban areas, traffic lights are the most guiding, generally focusing mainly on the handling of car traffic, with priority also given to public transport and nowadays increasing attention and priority to cyclists.

3.4 Widening the Scope to Human Well-being is Challenging

Transitioning from a focus on accessibility and safety to encompass all four dimensions of human well-being isn't straightforward. The workshops highlighted the challenges of shifting perspectives and adopting new mindsets. However, experts find value in this broader approach, as it could lead to different considerations. This process might require redefining what constitutes a bottleneck and talk about "buffering" instead of "traffic jams." Such a narrative shift could contribute to a new paradigm.

4. FUTURE CONTRIBUTION OF TRAFFIC MANAGEMENT

Traffic management could certainly contribute (even more) to human wellbeing in the following ways:

- By applying more guiding/control measures and strengthening the interaction between traffic and mobility management
- By expanding monitoring and evaluation for broad prosperity.
- By affecting a change in thinking to arrive at a broader way of thinking and working.

4.1 Interaction between Traffic and Mobility Management

Efforts to enhance human well-being often centre around reducing car traffic, which falls within the domain of mobility management. Effective execution of mobility management can make traffic management more manageable, as decreased traffic results in fewer bottlenecks and more flexibility in distributing traffic within existing infrastructure. However, if traffic management continues to facilitate car traffic, it might impede or slow down mobility management because problems remain hidden (e.g. large car traffic flows leading to congestion and other adverse effects). Restricting (car) traffic and prioritising specific groups and modes of transport could be essential for traffic management to significantly contribute to human well-being. This could involve strategically placing queues where you want to have them in the network. This does, however, require effective monitoring and detection.

4.2 Expanding Monitoring and Evaluation Expertise

Traffic management's monitoring function is adept at detecting (car) traffic, and in urban areas, it also includes data on cycling, pedestrians, and public transport. These data can yield indicators such as travel times, speeds, and traffic volumes, which primarily focus on the accessibility and safety dimensions within the human well-being perspective. To include the other dimensions (health and the living environment) equally, the monitoring function needs expansion. It's advisable to include indicators from each dimension of welfare and well-being, when implementing traffic management measures. Leveraging traffic management's existing expertise in monitoring and evaluation could assist in developing, monitoring, and evaluating new indicators. This approach would allow for a holistic view across dimensions and even signal potential concerns across specific groups or regions. The first step in making impact on different dimensions visible is to select or develop a good set of indicators related to traffic management on the different dimensions.

A new challenge, in both monitoring and designing new indicators, is to distinguish between different groups in society and the aspects that contribute to human well-being for them. For example, some groups want to be allowed to drive faster on the motorway, while this may have adverse effects for other groups. The benefits and burdens are not always fairly distributed. To make good trade-offs, this should be better understood.

4.3 Shifting in Thinking for a Broader Approach

Current traffic management practices often stem from a narrow perspective, emphasizing accessibility and safety based on policy frameworks. However, human well-being encompasses various dimensions, demanding a more comprehensive approach. Steps have been taken toward a broader perspective, such as the development of the multimodal network framework (Taale *et al.*, 2023) and Rijkswaterstaat's management scenarios for specific situations. These could potentially evolve into tools that can be used in the context of human well-being.

This shift needs to happen across strategic, tactical, and operational levels of traffic management. It's recommended to instil 'human well-being thinking' within the traffic management organisation, ensuring that all four dimensions are valued at all levels. Exploring ways to prioritise underrepresented dimensions through traffic management is also crucial. For instance, the dimension health could be given a more prominent role. This might involve actions such as prioritising cleaner vehicles, reducing traffic and favouring active modes of transportation in cities. It could also entail focusing on residents' well-being. The question is whether additional measures would be needed, such as adjusting parking norms, narrowing of roads, changes in the lay-out, or creating pedestrian-friendly zones. However, deliberations are also needed regarding the question whether the dominance of cars or consistently improving accessibility

should be challenged from a well-being perspective. Political choices determine such decisions, but when choices are made, traffic management does possess tools to steer traffic based on the chosen priorities.

5. CONCLUSIONS

There exists a gap between traffic management, mainly focused on short-term and specific congestion issues, and human well-being, which is a more overarching and abstract concept. The possibilities of the (operational) traffic manager to contribute to human well-being are relatively limited. Policy needs to establish clear choices and provide guidance for the human well-being goals that need to be pursued. The traffic manager can then operationalize and translate these goals into short-term actions and utilization of existing infrastructure. Their contribution can indeed be crucial, as the traffic manager is uniquely positioned to view mobility from a network perspective. Additionally, they possess extensive experience in handling road traffic, especially in terms of integrating the flow of various modes of transport and managing scarce resources over the years.

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