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A TOOL TO MEASURE OPPORTUNITIES AND RISKS OF CONVERTING EMPTY OFFICES INTO DWELLINGS

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Abstract
In the Netherlands, both the office market and housing market show a mismatch between supply and demand, quantitatively and qualitatively. In 2007 almost 14% of all offices are vacant, i.e. 5.9 million square meters. Experts judge at least 1 million m2 as having no chance at all to be let again as an office. At the same time we see a shortage of about 1 million dwellings. This paper discusses opportunities and risks of converting empty offices into houses. A checklist will be presented that can be used to support the decision whether or not starting a transformation process and a number of go/no go decisions later on. This checklist is partly based on a literature survey on user requirements and preferences with respect to office accommodation and housing, and partly on interviews with parties involved in transformation processes in the Netherlands. The interviewees were asked which features of locations and buildings they considered to be most relevant. An earlier draft of the method has been tested in practice by market players and students of architecture. The five steps method - from quick and dirty to a more thorough, detailed study - include an analysis of the local market and critical characteristics of the location and the building(s), an economic feasibility study and a check on a number of risk factors from a functional, architectonical, juridical and technical point of view. Using veto criteria and gradual criteria, the method shows which features of the location and the building favour successful transformation, and which hinder it.

The transformation prospects of unoccupied office buildings

According to experts in the field of real estate, the transformation prospects of the current supply of office buildings depend primarily on three factors:

1. *Duration of vacancy.* The longer an office building is unoccupied, the readier the current owner will be to convert it so that it can be used for another purpose.
2. *Reason for vacancy: market, location or building.* When an office building is unoccupied because of market factors, transformation would not seem to be an attractive option from the owner's viewpoint if the market is strengthening. If the location is unsuitable for office purposes and/or the building does not meet (or no longer meets) the requirements for office use, transformation may be a good idea. If

the vacancy is due to building-related factors, the transformation potential is highly dependent on the extent to which the building can be converted into an attractive residential property meeting the requirements and wishes of local target groups. Financial feasibility and permission to modify the zoning plan are critical factors for success in this context.

3. *Municipal policy.* When the office building in question lies in an area that has been prioritised for residential use by the municipal authorities, transformation into residential housing would seem to be an obvious solution since this is in line with municipal policy. If on the other hand the building is in an area earmarked for (re)development for office use, renovation and reuse for office purposes would seem to be more appropriate.

In addition, transformation of unoccupied offices into housing only makes sense if the dwelling units produced meet a need. The supply must be in line with the demand of prospective tenants, as regards both the location – which should be a residential environment – and the features of the building.

Demand for housing

Since nearly a quarter of people looking for housing are under 25 (including many students), transformation into low-cost accommodation may be a good choice. Where high-rise office buildings are concerned, transformation into accommodation for families with young children is less appropriate. Conversion into flats for senior citizens might be a good choice here. In case of a high quality of the location and highly attractive building characteristics, young urban professionals and other people from “the creative class” and empty nesters may be an interesting target group, too. The desires and preferences of these different potential target groups can be found in studies into the factors determining the choice of dwelling (see e.g. Ministerie van VROM, 2003, 2005, 2006). The type and size of the housing, an attractive, safe residential environment and affordability are important criteria for all target groups. The main differences between various target groups concern such matters as price and quality level, preference for a family house or a flat, and the desire to live in a lively environment with plenty of facilities or in a more peaceful environment (Table 1).

The studies of housing preferences reveal a wide range of importance in the various aspects of the demand for housing.

a. Residential environment

The choice of residential environment depends much more on the overall impression – e.g. some people like a busy inner-city environment with lots of facilities while others prefer a more peaceful suburban environment with plenty of green space – than on the presence or absence of specific amenities. Nevertheless, easy access to shops for daily shopping, nearby green spaces and parking space near the home are important factors for many people.

Table 1: Factors determining demand for residential accommodation

Location (dwelling environment)	**Building (residential)**
1. Tone a. Nature of built environment b. Social image c. Liveliness d. Amount of green space	1. Dwelling type 2. Access 3. Dwelling size a. Number of rooms b. Living room c. Kitchen d. Bedrooms e. Sanitary facilities f. Storage space
2. Amenities a. Shops b. Restaurants, bars etc. c. Schools d. Bank/Post Office e. Medical facilities f. Recreation facilities	4. Arrangement of dwelling 5. Level of facilities 6. Outside space (garden etc.) 7. View from dwelling + privacy 8. Environmental aspects a. Heating b. Ventilation c. Noise d. Exposure to sun and daylight e. Energy consumption f. Materials used
3. Accessibility public transport a. Distance to bus stop b. Frequency and times c. Distance to tram or underground d. Frequency and times e. Distance to railway station f. Frequency and times	9. General conditions a. Accessibility b. Safety c. Flexibility d. Adequate management
4. Accessibility by car a. Distance to motorway b. Congestion level c. Parking facilities	10.Costs a. Purchase price/rent b. Other costs

b. Public transport

While a high frequency of public transport and availability over long periods during the day contribute to satisfaction with the residential situation, these factors play little or no part in determining the choice of where to live. So the distance to public transport to a tram or bus stop or to a railway or underground station are relevant variables in the supply profile, but the frequency and departure times of public transport are not.

c. Housing characteristics

Dwelling type, accessibility and dwelling size (in particular the size of the living room and the number of rooms) are key factors for many people in the decision as to whether or not to buy or rent a particular dwelling. The costs involved, the quality-price ratio, the choice between renting and buying and the tone of the neighbourhood are also important considerations. The residential preferences based on these variables and the priorities people set vary from one target group to another, depending on age, ability to pay and the stage in life one has reached. The arrangement of the dwelling, the amenities it provides, environmental aspects and general terms and conditions appear to come in second place.

If one wishes to use a Quick Scan to determine whether an unoccupied (office) building is suitable for transformation to residential accommodation for one or more specific target groups, a demand profile must first be created for each target group. This is also necessary when looking for a suitable building for a specific target group. The five target-group profiles shown in Table 2 have been defined on the basis of the dwelling preferences of the persons concerned.

Table 2:
Target-group profiles with dwelling preferences for inner-city transformation projects

Target group 1: Starters	**Target group 2: Starters**	**Target group 3: Young, two-income**
Young, low-income singles	Young, low-income singles	Young couples with two incomes
Shared accommodation	Semi-independent accommodation	
Location (dwelling environment)	**Location (dwelling environment)**	**Location (dwelling environment)**
1. Urban environment	1. Urban environment	1. Urban environment
2. Plenty of amenities	2. Plenty of amenities	2. Plenty of amenities
		3. Suburban (more space, green)
		4. Easily accessible by car
		5. Good parking facilities
Building (features of dwelling)	**Building (features of dwelling)**	**Building (features of dwelling)**
3. Unit in group of 3-7 occupants	3. Semi-independent unit with	6. Big luxury flat
4. Bedsit, average 22 m2	shared facilities	7. Own outside space (garden, etc.)
5. Shared sanitary facilities	4. Bedsit, average 22 m2	
1 shower/toilet per 4 units	5. Sanitary facilities for 2 persons	
6. Shared kitchen with table for meals	6. Kitchen for 2 persons	
7. Shared outside space (garden, etc.)	7. Shared outside space (garden, etc.)	
1.5 m2/unit	1.5 m2/unit	
8. Shared cycle storage	8. Shared cycle storage	
9. Shared washroom	9. Shared washroom	
10. Total 50 m2; useful floor area 35 m2	10. Total 50 m2; useful floor area 35 m2	
Costs	**Costs**	**Costs**
11. Max. rent 160 - 220 Euro	11. Max. rent 220 - 320 Euro	8. Max. rent 550 - 750 Euro
		9. ditto 750 - 1000 Euro for top flat
		10. Purchase 100,000 - 200,000 Euro
Target group 4: Senior citizens 55+	**Target group 5: Senior citizens 55+**	
Low to modal income	Above-modal income	
Location (dwelling environment)	**Location (dwelling environment)**	
1. Safe dwelling environment (social safety)	1. Safe dwelling environment (social safety)	
2. Shops, daily amenities and public trans-	2. Shops, daily amenities and public trans-	
port within walking distance (<500 m)	port within walking distance (<500 m)	
3. Urban environment	3. Easily accessible by car	
4. Suburban (more space, green)	4. Good parking facilities	
	5. Some like urban, some like suburban	
Building (features of dwelling)	**Building (features of dwelling)**	
5. Preferably not on ground floor	6. Preferably not on ground floor	
6. With lift in building	7. With lift in building	
8. Preferably not with internal staircase	8. Preferably not with internal staircase	
8. At least 3 rooms	9. Access via entrance hall, not via gallery	
9. Living room 25 - 30 m2; bedroom > 11.5 m	10. 4 - 5 rooms	
10. Direct link living room, bedroom, bathroom	11.Living room 30 - 40 m2; big kitchen	
11. Extra attention to acoustic insulation	12. Direct link living room, bedroom, bathroom	
12. Adaptable for disabled occupants	13. Amply sized bathroom	
	14. Balcony or roof garden 10 - 15 m2	
	15. Extra attention to acoustic insulation	
	16. Adaptable for disabled occupants	
Costs	**Costs**	
13. Max. rent 400 Euro	17. Rent 550 - 1100 Euro	
14. Purchase 75,000 - 110,000 Euro	18. ditto > 1100 Euro for top flat	
	19. Purchase 110,000 - 500,000 Euro	

Assessment of whether supply meets demand

It is fairly easy to compare the supply situation with the demand requirements as regards the location: all that has to be done is to assess the presence of amenities in the neighbourhood, the distance to public transport and the overall impression as regards tranquillity or liveliness and social safety. The evaluation is more difficult at building level. Some of the features of the supply here may be primarily considered as conditions that either facilitate transformation to certain dwelling types or actually make such transformation more difficult and expensive. These features may be related to such matters as the supporting structure and the installations, which do not occur as such in the demand profile of potential occupants. The extent to which the supply meets the demand in connection with these points cannot thus be determined until at least they have been incorporated in an initial sketch of a transformation plan covering the number of dwellings planned, the type of dwellings envisaged and their size, and allowing a rough estimate of the sale or rental price to be obtained. On this basis, a rough impression can be gained of whether the costs of transformation and acquisition of the building can be recouped by the subsequent sale or rental of the property.

The transformation potential meter

In order to be able to measure the transformation potential both at location and at building level, we have developed a so-called 'transformation potential meter' (Geraedts and Van der Voordt, 2000, 2003). This instrument includes two "layers"; first a quick, superficial appraisal (a 'quick scan') and secondly a more thorough, detailed study (a 'feasibility scan'). To this end, a number of checklists have been developed, containing both veto and gradual criteria, which can be used to determine which features of the location and the building favour successful transformation, and which hinder it. The meter has been tested in practice by a number of market players, and has also been widely used by students of architecture who are nearing the end of their degree course. On the basis of these tests, the transformation potential meter has been refined in 2006 (Geraedts and Van der Voordt, 2007). Two new steps - a financial feasibility scan and a risk assessment checklist – have been added to permit further investigation of the feasibility of a transformation project. The present tool may be used in a GO/NO GO decision-making process in five steps (Table 3), from "quick and dirty" (step 1-3) to a sound feasibility study (step 4-5) in the initial phase of a transformation project.

Step 0 is an inventory of the unoccupied office space. Step 1 is a Quick Scan of the transformation potential of this stock, using a limited number of veto criteria with respect to Market, Location, Building and Organisation. When a project meets one or more of these criteria it does not have sufficient transformation potential, resulting in a NO GO decision. Step 2 is a feasibility scan with a number of appropriate criteria, showing the features of the location and the building that lend themselves to transformation and which do not. This leads in step 3 to the assignment of an overall score expressing the transformation potential of the building(s) in question, varying from non-transformable to highly suitable for transformation. Depending on the results, step 3 leads either to a NO GO decision or to further refinement of the feasibility study in two subsequent phases: step 4 (a financial feasibility scan) and step 5 (a risk assessment checklist). Depending on the nature of the project involved, step 5 may come before step 4.

Table 3: The five steps of the transformation potential meter

Transformation potential meter			
Step	**Action**	**Level**	**Outcome**
Step 0	Inventory market supply of unoccupied offices	Stock	Location of unoccupied offices
Step 1	Quick Scan: initial appraisal	Location	Selection or rejection of offices for further
	of unoccupied offices using veto criteria	Building	study; GO / NO GO decision
Step 2	Feasibility scan: further appraisal	Location	Judgement about transformation potential
	using gradual criteria	Building	of office building
Step 3	Determination of transformation class	Location	Indicates transformation potential on 5-point
		Building	scale from very good to NO GO
Further analysis (optional, and may be performed in reverse order if so desired):			
Step 4	Financial feasibility scan using design	Building	Indicates financial/economic feasibility
	sketch and cost-benefit analysis		
Step 5	Risk assessment checklist	Location	Highlights areas of concern in
		Building	transformation plan

Step 0: Inventory of supply at district level

Before starting to use the transformation potential meter properly, an inventory should first be taken of the market supply of office buildings in a given municipality that have been unoccupied in the long term or may be expected to become unoccupied in the near future. Information for this purpose may be obtained from literature surveys, data from estate agents or the investigator's own observations. If adequate information is already available about a given unoccupied building, this step can be skipped.

Step 1: Quick Scan based on veto criteria

The instrument offers the user the possibility of performing a quick initial appraisal of the transformation potential, which is not very labour-intensive and does not require much data. This quick scan makes use of eight veto criteria (Table 4). A veto criterion is a criterion which if satisfied (if the answer to the relevant question is 'Yes') leads to immediate rejection of the idea of transforming the office premises in question into residential accommodation. Further detailed study is then no longer necessary. This is thus an effective means of picking out promising candidates for transformation quickly from the overall potential market.

The veto criteria apply to all target groups. Veto criteria 2 and 3 at location level concern the situation of the building within the urban fabric. If for example the office building is located on an industrial site where serious public-health hazards have been discovered, or if the municipal authorities do not allow any modification of the zoning plan at this location, there is little point in taking the investigation of the transformation potential any further. Veto criterion 5, under the heading Organisation, concerns the presence or absence of a key player to champion the transformation project. Without an influential and enthusiastic backer, a project of this kind is doomed to failure. The column 'Data source' indicates where the information required for appraisal of the feature in question can be found. The final column provides space for noting whether the veto criterion in question is met.

Table 4: Step 1 – A Quick Scan which office buildings may be suitable for transformation to residential accommodation

TRANSFORMATION POTENTIAL METER FOR OFFICE MARKET						
STEP 1 QUICK SCAN: INITIAL ASSESSMENT USING VETO CRITERIA						
General target-group-independent criteria						
If one of the criteria is met (appraisal = Yes), the office building in question does not come into consideration for transformation to residential housing.						
Step 2 (Feasibility scan) and further stages of assessment are then no longer necessary.						
ASPECT			**VETO CRITERION**		**DATA SOURCE**	**Appraisal**
MARKET						**Yes** **No**
1	Demand for housing	1	There is no demand for housing from local target groups		Estate agent/municipality	
LOCATION						
2	Urban location	2	Zoning plan does not permit modification		Zoning plan/munic. policy	
		3	Serious public health risk (pollution, noise, odour)		Estate agent or on-site inspection	
BUILDING						
3	Dimensions of skeleton	4	Free ceiling height < 2.60 m		Estate agent or on-site inspection	
ORGANISATION						
4	Backer for transformation plan	5	There is no enthusiastic, influential backer		Local investigation	
5	Internal veto criteria	6	Does not meet criteria for region/location/accessibility		Property developer	
	of property developer	7	Does not meet criteria on size and character of building		Property developer	
6	Owner/investor	8	Not willing to sell office building		Owner	

Step 2: Feasibility scan based on gradual criteria

If the results of the Quick Scan indicate that there is no immediate objection to transformation (no single question is answered 'Yes'), the feasibility of transformation can be studied in greater detail with reference to a number of 'gradual' criteria, i.e. criteria that do not lead to a GO / NO GO decision but that express the transformation potential of the building in question in terms of a numerical score. Taken together, these criteria allow a more rounded picture to be built up of the feasibility of the transformation project under consideration.

The feasibility scan at location level (Table 5) comprises 7 main criteria, subdivided into functional, cultural and legal aspects, and 23 sub-criteria. The feasibility scan at building level (Table 6) comprises 13 main criteria, subdivided into functional, technical, cultural and legal aspects, and 13 sub-criteria. An answer 'Yes' to any question indicates somewhat lower suitability for transformation – though not severe enough for out-and-out rejection. At the end of the scan, the Yes's are added up to obtain the overall transformation potential score – the lower the better i.e. the lest risky. This is described under step 3 below. It may be noted that the criteria vary somewhat, depending on the target group under consideration. For example, students will prefer to live in the city centre where there is more night life, while young families with children will tend to opt for a peaceful suburban environment.

Table 5: Step 2a – Appraisal of suitability of an office building for transformation to residential housing with reference to features of its location

STEP 2 FEASIBILITY SCAN USING GRADUAL CRITERIA							
The total number of criteria met is a measure of the unsuitability of the building for transformation to residential accommodation.							
If users of the meter regard one of the criteria as a veto it is moved to the Quick Scan of step 1, and vice versa.							
LOCATION							
ASPECT			**GRADUAL CRITERION**		**DATA SOURCE**	**Appraisal**	
FUNCTIONAL						**Yes**	**No**
1	Urban location	1	Building in industrial estate or office park far from town cer		Town map		
		2	Building gets little or no sun		On-site inspection		
		3	View limited by other buildings on > 75% of floor area		On-site inspection		
2	Distance and quality of amenities	4	Shops for daily necessities > 1 km.		On-the-spot investigation		
	NB:	5	Neighbourhood meeting-place (square, park) > 500 m.		ditto		
	The quality of amenities can be described	6	Hotel/restaurant/snackbar > 500 m.		ditto		
	in terms of number, variety and level	7	Bank/Post Office > 2 km.		ditto		
	of services provided.	8	Basic medical facilities (group practice, health centre) > 5		ditto		
		9	Sports facilities (fitness club, swimming pool, sports park)		ditto		
		10	Education (from kindergarten to university) > 2 km.		ditto		
3	Public transport	11	Distance to railway station > 2 km.		Town map		
		12	Distance to bus/underground/tram > 1 km.		Map or transport services		
4	Accessibility by car and parking	13	Many obstacles; traffic congestion		On-the-spot investigation		
	Obstacles: narrowing of road, speed bumps,	14	Distance to parking sites > 250 m.		Inspection/new design		
	Congestion: 1-way traffic, no parking, tailback	15	<1 parking space/100 m2 road surface		Inspection/new design		
CULTURAL							
5	Tone of neighbourhood	16	Situated on or near edge of town (e.g. near motorway)		Map or estate agent		
	NB:	17	No other buildings in immediate vicinity		Map or estate agent		
	Assessment depends on target group, e.g.:	18	Dull environment		On-the-spot investigation		
	young people not in monofunctional neighbou	19	No green space in neighbourhood		On-the-spot investigation		
	55+ not on edge of town	20	Area has poor reputation/image; vandalism		Inspection and local press		
		21	Dangerous, noise or odour pollution (factories, trains, cars		On-the-spot investigation		
LEGAL							
6	Urban location	22	Noise load on façade > 50 dB (limit for offices 60dB)		Municipal authorities		
7	Ownership of ground	23	Leasehold		Estate agent		
	Maximum possible (weighted) Location score = 23 x 5 = 115				Totaal number of Yes's for Location :		x
					Default weighting:	5	=
					Location Score :		A
					Maximum possible Location score (23x5):	115	

Table 6: Step 2b - Appraisal of suitability of an office building for transformation to residential housing with reference to features of the building itself

BUILDING						
ASPECT		GRADUAL CRITERION		DATA SOURCE	Appraisal	
FUNCTIONAL					Yes	No
1	Year of construction or renovation	1	Office building recently built (< 3 years)	Year of construction		
		2	Recently renovated as offices (< 3 years)	Year of renovation		
2	Vacancy	3	Some office space still in use	e.g. NEPROM		
		4	Building unoccupied < 3 years	ditto		
3	Features of new dwelling units	5	≤ 20 -person units (50 m2 each) can be made	≤ 1000 m2 useful area		
		6	Layouts suitable for local target groups cannot be impleme	Design sketch		
4	Extendability	7	Not horizontally extendable (neighbouring buildings)	On-the-spot investigation		
		8	No extra storeys (pitched roof or insufficient load-bearing c	On-the-spot investigation		
		9	Basement cannot be built under building	Inspection and/or estate agent		
TECHNICAL						
5	Maintenance	10	Building poorly maintained/looks in poor condition	External visual inspection		
6	Dimensions of skeleton	11	Office depth < 10 m	Estate agent or inspection		
	Module of façade determines placing of walls	12	Module of support structure < 3.60 m	On-site or estate agent		
		13	Distance between floors > 6.00 m	On-site or estate agent		
7	Support structure (walls, pillars, floors)	14	Support structure is in poor/hazardous condition	On-site inspection		
8	Façade	15	Cannot be made to blend with surroundings or module > 5	On-site or estate agent		
	External spaces dependent on target group	16	Façade (or openings in façade) not adaptable	On-site inspection		
	Protected monuments: limits on adaptation	17	Windows cannot be reused/opened	Inspection/new design		
9	Installations	18	Impossible to install (sufficient) service ducts	Inspection/new design		
CULTURAL						
10	Character	19	No character in relation to surrounding buildings	On-site inspection		
	cf. Location, 'Tone of neighbourhood'	20	Impossible to create dwellings with an identity of their own	Inspection/new design		
11	Access (entrance hall/lifts/stairs)	21	Unsafe entrance, no clear overview of situation	Inspection/new design		
LEGAL						
12	Environment	22	Presence of large amounts of hazardous materials	On-site or municipality		
	Exposure to sunlight, air and noise	23	Acoustic insulation of floors < 4 dB	Inspection/new design		
	pollution, hazardous materials	24	Very poor thermal insulation of outer walls and/or roof	On-site or municipality		
		25	< 10% of floor area of new units gets incident daylight	On-site inspection		
13	*Requirements of Bouwbesluit (Dutch official re*	26	No lifts in building (> 4 storeys), no lifts can be installed	On-site or estate agent		
	and standards for the building industry)	27	No (emergency) stairways	Inspection/new design		
	concerning access and escape route	28	Distance of new unit from stairs and/or lift ≥ 50 m	Inspection/new design		
	Maximum possible (weighted) Building score = 28 x 3 = 84			Total number of Yes's for Building:		x
				Default weighting:	3	=
				Building score:		B
				Maximum possible Building score (28x3):	84	

Step 3: Determination of the transformation class

The results of the feasibility scan can be used to calculate a transformation-potential score for the building in question, on the basis of which the building can be assigned to one of five transformation classes ranging from 'ideal for transformation' to 'not suitable for transformation'.

Table 7: Step 3. The total transformation-potential scores at Location and Building level are determined by multiplying the number of Yes's in the Appraisal column by the default weighting factor (5 for location and 3 for building); in the present example, score for location (A) + score for building (B) = 40 + 33 = 77

Total No. of Yes's (Location)	8 x	Total No. of Yes's (Building)	11 x
Default weighting	5	Default weighting	3
Score (Location)	40 (A)	Score (Building)	33 (B)
Max. possible score (23x5)	115	Max. possible score (28x3)	84

The total scores for the location and the building are determined by multiplying the number of Yes's in the respective tables by a weighting factor, which has provisionally been chosen as 5 for the location and 3 for the building to reflect the greater relative importance of the location in these considerations. The maximum possible score for the location is thus 23 x 5 = 115, and that for the building 28 x 3 = 84, to give a grand total of 115 + 84 = 199. The minimum score is zero, which would indicate that no single feature of the location or the building is considered unsuitable for transformation. On the basis of the transformation-potential score, the building can be assigned to one of five Transformation classes. Buildings in Transformation class 1 (score lower than 40), are highly suitable for transformation to residential accommodation, while those in class 5 (score higher than 161) are totally unsuitable for transformation. All five Transformation classes are given in Table 8.

Table 8:Transformation classes for office buildings; in the example shown, a total score of 77 corresponds to Transformation class 2 (transformable*)*

STEP 3: DETERMINATION OF TRANSFORMATION CLASS OF OFFICE BUILDING			
Transformation score Location + Building = 0 - 40	Transformation class 1: Excellent transformability	← **Total Score A + B:**	
Transformation score Location + Building = 41 - 80	Transformation class 2: Transformable	laximum Score Location + Building	
Transformation score Location + Building = 81 - 120	Transformation class 3: Limited transformability	= 115 + 84 =	199
Transformation score Location + Building = 121-160	Transformation class 4: Very poor transformability		
Transformation score Location + Building = 161-199	Transformation class 5: Not transformable	→ **RANSFORMATION CLASS:**	

Determination of the transformation class of a building completes the first three steps of the transformation potential measurement. If the results indicate that the building lends itself to transformation (i.e. that it falls into transformation class 1 or 2), the analysis can continue in two additional steps, aimed at studying the financial feasibility of the transformation project and carrying out a risk assessment for use in further planning.

Step 4: Financial feasibility scan

The financial feasibility depends on the acquisition costs, the current condition of the building, the required amount of renovation or modification work, the number of dwelling units that could be created in the building and the project yield in the form of rental income and/or sales prices. In order to determine the financial feasibility, answers must be obtained to a number of questions concerning both the project costs and the expected revenue. On the revenue side, we need to know how many dwelling units can be created and for what target groups they are intended. These questions can only be answered if a sketch has been made of the intended layout of the building after transformation. The financial feasibility can be raised by increasing the size of the building, e.g. by adding extra storeys on top, or by the inclusion of commercial functions alongside the residential ones. On the expenses side, it is necessary to know the acquisition costs for the premises, including the cost of the ground. Building and installation costs are also an important factor. What is the current condition of the building? Which parts can be reused, and which will have to be demolished? The façade plays a particularly important role in this connection. What is the ratio of façade surface area to gross floor area (GFA)? To what level should the building be finished? To what extent can the existing stairways, lifts and other means of access, modular dimensions and façade proportions be maintained?

Table 9 shows the estimated range of total investment costs (acquisition and building costs) for the transformation of existing (office) buildings to student accommodation, per dwelling unit and per m2 of GFA, compared with the costs of comparable new buildings. The data are based on a large number of projects carried out by the housing association Stadswonen in Rotterdam, collected by De Vrij (2004) and indexed by us to 2006. All sums of money are in Euros.

Table 9: Expected investment costs per dwelling unit and per m2 GFA for student accommodation.

Type of construction project		Type of budget	Costs per unit	Costs per m^2 GFA
Transformation	Much demolition and modification	Acquisition budget for student unit	10,000 - 15,000	
		Residual budget for renovation costs	27,000 - 33,000	540 - 660
	Much reuse (including façade)	Acquisition budget for student unit	20,000 - 25,000	
		Residual budget for renovation costs	21,000 - 26,000	420 - 540
New construction		Student unit	36,000 - 39,000	720 - 780
		Social housing		890 - 970
		Luxury flat		1.100

Table 10 gives the estimated ranges of feasible yields and investments for various target groups and types of accommodation, per dwelling unit, per m2 useful floor area (UFA) and per m2 gross floor area (GFA). An appropriate range of the ratio of UFA to GFA is also given. This is taken as 1.3 – 1.55 in all cases, since experience has shown that higher values of this ratio make it more difficult to achieve financial feasibility for the project.

Table 10: Expected financial yields and investments incl. VAT for various dwelling types handled by housing association Stadswonen, Rotterdam.

Dwelling type and occupant	Monthly rent	Feasible investment per unit	Feasible investment per m^2 UFA	GFA / UFA ratio	Feasible investment per m2 GFA
Student's room	160 - 220	30,000 - 45,000	930 - 1,230	1.3 - 1.55	650 - 850
Studio	220 - 320	45,000 - 65,000	1,230 - 1,830	1.3 - 1.55	850 - 1,300
2 - 3-room unit for young couple	550 - 750	110,000 - 150,000	1,620 - 1,940	1.3 - 1.55	1,100 - 1,450
4-room unit for young couple	750 - 1000	150,000 - 200,000	1,620 - 2,150	1.3 - 1.55	1,100 - 1,600
3-room unit for senior citizens	400	75.000	790 - 1,010	1.3 - 1.55	500 - 800
4 - 5-room unit for senior citizens	550 - 1,100	110,000 - 220,000	1,100 - 2,150	1.3 - 1.55	700 - 1,600

Table 11 gives estimated ranges of the construction and acquisition costs incl. VAT per m2 GFA for various target groups and types of accommodation, depending on the amount of modification required. The data refer to various dwelling types handled by housing association Stadswonen, Rotterdam, in cases where relatively little and relatively much modification work is required. Reference date April 2006; source De Vrij (2004), processed by authors. The data indicate that the ratio of acquisition costs to construction costs is roughly 1:2 in projects where a relatively level of modification work is needed, and about 1:4 when a large amount of modification is expected.

Table 11: Expected construction and acquisition costs

Dwelling type and occupant	Little modification		Much modification	
	Construction costs	Acquisition costs	Construction costs	Acquisition costs
Student's room	390 - 520	190 - 260	460 - 620	120 - 160
Studio	520 - 780	260 - 390	620 - 940	160 - 230
2 - 3-room unit for young couple	650 - 870	320 - 440	780 - 1040	190 - 260
4-room unit for young couple	650 - 970	320 - 480	780 - 1160	190 - 290
3-room unit for senior citizens	310 - 470	150 - 230	380 - 560	90 - 140
4 - 5-room unit for senior citizens	420 - 970	210 - 480	510 - 1160	120 - 290

After a rough cost-benefit analysis on the basis of a sketch of how various dwelling types and lay-outs can be fitted into the existing office building, these data can be used as input for the development plans of the property developer. If desired, further demands may be made concerning the profitability of the project at this stage, or the possibility of changes in ground prices during the exploitation period can be taken into account. The project appraisal can be improved by assigning a residual value to the property undergoing transformation. This means that instead of writing off the value of the office building to zero over the exploitation period, it is assumed to have a finite value at the end of that period. This may make it possible to make use of other sources of funding, e.g. from the general company reserves. The residual value can be improved by the use of flexible infill packages, allowing the building to be adapted for other purposes in the future.

Step 5: Risk assessment checklist

When the Quick Scan indicates that the office building in question has transformation potential at both the location and the building level and the results of the initial financial feasibility analysis are also encouraging, work may proceed on the subsequent development phases. It is of great importance to be aware of the possible bottlenecks and risks that can occur during this process. Based on experience gained in a large number of projects, two checklists have been developed that can be useful in this context. Table 12 shows the checklist for market and location risks, and Table 13 that for building-related risks. Neither of these lists is exhaustive. Both list the possible risks under the same headings as those used in the feasibility scan, viz. functional, technical, cultural, financial and legal.

Table 12: Checklist of risks at market and location level. Source De Vrij (2004), modified by authors

MARKET & LOCATION		Risk	Suggested solutions
1. Functional	1	Insufficient parking space	Depends on target group; discuss statutory parking provisions, consider underground parking
	2	No amenities	Provide small-scale amenities in building in cooperation with other parties
	3	No public transport	Consult public transport provider; work together with other parties
	4	Routing to dwelling is unclear	Analyse situation; if necessary, move main entrance or provide additional entrance
2. Technical	5	Odour pollution	Special insulation of façade(s) affected
	6	Noise pollution	Explore possibilities of exemption; extra façade insulation or create double-skin façade
3. Cultural	7	Neighbourhood has poor reputation or is unsafe	Neighbourhood improvement plan with other parties, with specific objectives to attract target group
4. Financial	8	Purchase price of dwelling units is too high	Boost financial yield by combining with (commercial) functions; revise design; aim at other target group
	9	Dwelling units are difficult to rent	Improve quality/price ratio; aim at other target group
	10	Extra facilities needed	Improve financial feasibility by incorporating commercial functions
5. Legal	11	Project may require changes in zoning plan or zoning procedure	Consult local authorities; check compliance with municipal policy
	12	Ownership of ground: leasehold	Bad for ground value appreciation; try to buy off leasehold
	13	Soil pollution	Get owner to obtain clean ground declaration; negotiate lower sales price in connection with soil improvement costs
	14	Limits on max. height of building (e.g. protected monument or air-traffic legislation)	Investigate possibilities of horizontal expansion

Table 13: Checklist of risks at building level. Source: De Vrij (2004), modified by authors

BUILDING	Risk		Suggested solutions
1. Functional	1	Incorrect assessment of possibilities of building	Analyse design factors and key data incl. gross/net ratios; consider expansion possibilities (adding extra storeys)
	2	Office building too shallow	Modify layout of dwelling units; increase depth by adding new façade or foundation; external gallery
	3	Office building too deep	Modify layout of dwelling units; create interior courtyard to let in more daylight; centralise access
	4	No basement (e.g. for parking or storage)	Add basement (if foundation and access requirements allow this)
	5	Distance between floors too great	Create light mezzanine floors with light partition walls
	6	Windows cannot be opened	Replace (some of) the windows that cannot be opened, up to complete façade renovation
	7	Little scope for connecting walls to façade	Connect walls to (glass) panels, up to complete façade renovation
	8	No external space	Target-group-dependent; prefab (French) balconies; recess (part of) façade; roof gardens; inner courtyard with garden
	9	Not enough lifts/stairs (e.g. to meet statutory emergency evacuation requirements)	New lifts and/or stairs in building (e.g. in protected monument) or on outside wall
	10	Inadequate access	Analyse different access possibilities (entrance hall, gallery, central corridor, central access)
	11	Too few internal walls, poor quality internal walls	Modify existing internal walls or add new ones (bearing need for future flexibility in mind)
	12	Inadequate waterproofing in sanitary rooms	Give concrete or tiled floors waterproof finish; use prefab (plastic) sanitary units
2. Technical	13	Incorrect assessment of possibilities of structural situation	Analyse condition of building on site (with reference e.g. to design and condition of structure, finish, maintenance)
	14	Air-conditioning system inadequate	Replace or renew with requirements of dwelling units in mind; system should have individual controls for each dwelling, but possibly central supply
	15	Not enough piping and ducts	Add more (but remember to ensure fire separation between dwellings; may be possible to lay under existing floors)
	16	Inadequate water supply (residential accommodation needs more water than offices)	Expand supply (remember, must have individual controls and individual meters)
	17	Inadequate electrification	Expand (remember, must have individual controls and meters, central antenna system or cable, phone)
	18	Inadequate acoustic insulation between floors	Increase isolation by adding extra floor (concrete or floating) and/or insulating ceilings
	19	Inadequate thermal insulation of façade	Extra insulation on outside of façade or inside (in protected monuments); (remember, openings in
	20	Inadequate thermal insulation of openings in façades	Replace by double glazing; double window frame; double-skin façade (inside and outside)
	21	Inadequate thermal insulation of roof	Insulate existing roof (inside or outside); replace by new roof; combine with adding extra storeys
	22	Damp in building fabric	Analyse causes (structural damp, leakage, rising damp, condensation)
	23	Pointing in poor condition	Clear façade and repoint in part or completely
	24	Daylight/sunlight reaches < 10% of floor area	Use central corridors, extra internal spaces, oriel windows or bigger new windows to give more
	26	Support structure in poor/hazardous condition	Renovation (may need extra reinforcement, shotcrete, adhesive reinforcement, auxiliary
	27	Limited load-bearing capacity or poor foundations	Renovation (may need additional piles - steel piles, jack piles or pulse-driven piles, posssibly
	28	Load-bearing capacity not good enough for addition of extra storeys	Use light steel and/or wooden frame constructions for extra storeys

Table 13: Checklist of risks at building level. Continued.

3. Cultural	29	Limitations due to protected monument status	Timely consultation with *Monumentenzorg* (Historic Buildings Council)
	30	Poor recognisability of building	Install new, more striking façade (or parts of façade); add balconies, new, more striking
	31	Poor recognisability of (main) entrance	Add e.g. canopy to increase impact, or move to other position
4. Financial	32	Difficult or impossible to acquire property	Purchase in steps: first leasehold, then freehold; joint purchase with others
	33	Big investments in initial phase (e.g. because of feasibility studies, extra	Financial feasibility study
	34	Poor financial feasibility (e.g. because project is too small)	Analyse expansion possibilities; combine with other (commercial) functions; apply for subsidies
	35	Risk of prolonged vacancy; dilapidation (e.g. due to long development	Limit time building stands empty by short-term rental; take measures to deter squatters
5. Legal	36	Presence of asbestos; removal in accordance with statutory	Negotiate lower sales price or demand asbestos-free declaration from seller before purchase goes
	37	Restrictions imposed by *Bouwbesluit* (Dutch official regulations and	Exemptions from requirements on outside space, ceiling height, access, incidence of daylight,
	38	Position about building permit is unclear	Timely consultation with local authorities about requirements and information to be provided
	39	Fire safety requirements not fully met	Timely consultation about requirements and information to be provided (access, escape routes

Example of risk at location level: noise pollution

Risk: Excessive noise level at façade. According to the *Wet Geluidshinder* (Dutch Noise Pollution Act), this value should not exceed 60 dB for offices and 50 dB for dwellings.

Solution: Many inner-city locations are situated near major roads, railways or industrial premises. If the properties in question are rezoned for residential use, they will have to meet much more stringent requirements and quite extensive measures may be needed to ensure compliance. The maximum permitted noise level at the façade of residential units is 50 dB, which is 10 dB lower than for offices. Exemption may sometimes be granted for residential property situated near major roads or railways, i.e. the maximum permitted noise level at the façade may be raised in such cases, but extra measures will still have to be taken to keep the sound level within the buildings at acceptable levels. Some of these measures will involve modification of the building, but noise screens placed round the source of the noise may also prove effective. Another option is to locate rooms where less stringent noise standards apply, such as workshops or bathrooms, behind the façades where the noise load is highest.

Example of risk at building level: poor financial feasibility

Risk: Concerns about financial feasibility. There may be various reasons for this: for example, the acquisition price of the office building may be high, the renovation costs may be higher than expected or the building may be too small to allow the development budget to be balanced.

Solution: In projects involving the transformation of office buildings to residential accommodation, it may be stated in general that the larger the complex to be transformed, the better the financial feasibility. The investments needed to make the existing building suitable for residential purposes can be partially recouped by extending the size of the building, horizontally and/or vertically (by adding new storeys on top of the building). One advantage of this type of new construction is that the marginal ground costs are basically zero. If new storeys are added, the building's supporting structure must be

strong enough to bear the load they represent, or must be reinforced to this end. It goes without saying that horizontal extensions to the building must fit in with the location, and that the necessary permits must be obtained from the municipal authorities (town planning, building control, fire safety).
Another possible way of improving the financial feasibility is to rent out retail, business or office space on the ground floor or to rent out parking space. Agreement can be reached with the municipal authorities about possible subsidies in this connection, and possible exemptions from the provisions of the *Bouwbesluit* (Dutch official regulations and standards for the building industry) concerning such matters as levels of incident daylight, the lifts and other means of access, and soundproofing materials. If the stringent provisions of the *Bouwbesluit* in these matters do not have to be complied with, the construction costs can be appreciably reduced.

Application and testing in practice

Practical application of an earlier version of the Transformation potential meter in a number of case studies have revealed its utility for mapping the potential of given office buildings for transformation into residential accommodation in a number of steps, from global to more detailed. It was found, however, that a number of veto criteria included in the original version of the meter were too stringent (De Vrij, 2004; Pang, 2006; Jongeling, 2006). Some buildings that failed to pass these criteria on paper were found in practice to lend themselves well to transformation to residential accommodation. For example, a project size of less than 20 dwelling units (2000 m2), a building that was still partially occupied, a duration of vacancy of less than three years were not necessarily reasons for rejecting the idea of transformation. It was moreover found to be highly desirable to combine the first three stages of the Transformation potential meter (Quick Scan, feasibility scan and determination of transformation class) with a financial feasibility scan and a risk assessment.

Figure 1: Raad van Arbeid (Labour Council) building, Rotterdam
Example of a building that would have been rejected for transformation to residential housing according to the original Quick Scan because of the veto criterion "not unoccupied for long enough". In the new version of the instrument, this criterion has been changed to a gradual criterion and moved to the feasibility scan.

CBS Building, Voorburg
This 60.000 m2 large building turned out to have a high potential to transform the building into dwellings in the towers and care and leisure facilities in the lower part of the building. No single negative veto criterion applies. With respect to gradual criteria, a number of characteristics are positive to transformation. The location is near a train station, greenery and a residential neighbourhood with a number of facilities available. Sufficient parking places, no severe technical defects, a high energy and sound insulation and the availability of a number of stairs and elevators are positive charact4eristics as well. Negative issues are the office like image of the building and the fact that windows can not be opened. Its total transformation score is 26, resulting in transformation class 1: very well convertible.

Concluding remarks

Analysis of the *supply on the market for office accommodation* shows a location with good parking facilities that looks prosperous, well cared for and a typical work-oriented environment is one where buildings that have so far been rented out as office accommodation can appropriately continue to be rented out as such. The presence of dilapidated properties in the neighbourhood, an unfavourable UFA/GFA ratio, low energy efficiency and structural aging, on the other hand, are features of office buildings that do not support a decision to continue renting them out for this purpose. It would seem to be more appropriate to transform them into residential accommodation. Municipal policy is an important factor in this connection. Offices in zones earmarked for residential use can better be converted into dwellings. If on the other hand they are

situated in zones intended for office use, it would be better to keep them in the office market by appropriate quality and/or price changes.

As regards the *demand for residential accommodation*, the dwelling type, accessibility and dwelling size are found to be decisive factors in determining the decision as to whether or not to rent or buy a given property. The price, the quality-price ratio, the choice between renting and buying and the tone of the neighbourhood are also important factors. Priorities vary from one target group to another. The layout of the dwelling and the level of facilities offered appear to be of secondary significance. The choice of dwelling environment tends to be based on the overall impression (e.g. a city-centre environment with many facilities as compared with a peaceful suburban environment with plenty of green space) rather than on the presence or absence of specific amenities. People looking for a place to live will inquire about the distance to a tram or bus stop or to an underground or railway station, but will be less interested in the frequency and times of availability of public transport.

The new meter will be tested again in a number of case studies. A first test of step 1-3 at the CBS-office building in Voorburg showed that it took about two days to analyse a few documents about this building, to visit the building, and to fill in the checklists of these three steps. A test of step 4-5 is in progress. More case studies are needed both to test the reliability and validity of the transformation potential meter and to know if the present tool is appreciated by different stakeholders in transformation processes. Apart form such tests, the meter could be made more effective by illustrating the criteria with the aid of photos or sketches, and digitisation of the analysis and documentation of the results obtained with its aid in professional practice, thus allowing a body of reference material to be built up and made available.

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Note: Abbreviations used in references
CBS: Central Statistical Office
DTZ Zadelhoff is a large commercial real estate company with branches throughout the Netherlands
Ministerie VROM or MVROM: Ministry of Housing, Physical Planning and Environment
NEPROM: Association of Dutch Property Developers
NVB: Association of Dutch Building Contractors
OTB: Research Institute for Housing, Urban and Mobility Studies, Delft University of Technology

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