



Delft University of Technology

## A second chance for old buildings

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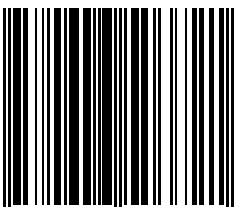
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## A SECOND CHANCE FOR OLD BUILDINGS

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### Summary

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. At the same time we see a shortage of about 1 million dwellings. A building must be able to be changed over its life cycle to adapt to the inevitable evolving needs of its end users. The first real challenge is how to make adaptable buildings without creating unnecessary redundancy. The second challenge is the re-use of old vacant buildings because the available area for erecting new ones is very scarce in the Netherlands. In this matter, old buildings deserve a second chance in their life cycle. We need to be able to measure the transformation potential of office buildings both at location and at building level. To this end, we have developed what we call a 'transformation potential meter' (Geraedts, Van der Voordt, 2003, 2004). The meter has been tested since 2004 in practice by a number of market players, and by students of architecture. This has allowed the transformation potential meter to be evaluated and refined in 2006. Two new steps - the financial feasibility scan and the risk assessment checklist - have also been added. In this paper, we describe the principle of the new transformation potential meter.

### 1. Prospects of vacant office buildings

According to experts from the world of professional practice, the transformation prospects of the current offering of office buildings depend primarily on the following 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 by design interventions 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.

### 2. Demand for housing

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, as regards both the location - which should be a residential environment - and the features of the building (an office building will in general be converted into a block of flats comprising individual dwelling units). 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. Tests of the ability of a transformed building to meet the desires and preferences of potential target groups may be based on the results of various studies of the factors determining the choice of dwelling (see e.g. De Jong,

1997; Priemus, Wassenberg and Van Rosmalen, 1995). Where possible and appropriate, such studies differentiate between the various target groups concerned. The type and size of the housing, an attractive, safe dwelling environment and affordability are important criteria for all target groups. The main differences 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 Relevant aspects on demand side residential accommodation

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

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.

### 3. Transformation Potential Meter

The information collected about the transformation prospects, the housing requirements of potential occupants and the target-group profiles has been used as a basis for a number of checklists that can be used to appraise the potential of the stock of unoccupied office buildings for transformation into residential housing. This appraisal takes place in a number of steps, from more superficial to more detailed and specific. Step 0 is the inventory of the unoccupied office space. Step 1 is a Quick Scan of the transformation potential of this stock, with reference to a limited number of veto criteria which fall under the headings Market, Location, Building and Organisation. Failure of a building to meet these criteria means that it does not have sufficient transformation potential and thus leads to a NO GO decision. Step 2 is a more detailed feasibility scan, which shows with reference to appropriate criteria which features of the location and the building lend themselves to transformation and which do not. This then leads in step 3 to the assignment of an overall score expressing the transformation potential of the building(s) in question on a scale varying from non-transformable to highly suitable for transformation. Depending on the results, this leads either to a NO GO decision or to further refinement of the feasibility study in two subsequent phases: step 4 (financial feasibility scan) and step 5 (risk assessment checklist). Depending on the nature of the project involved, step 5 may come before step 4. The transformation potential meter is particularly intended for use in the initial phase of the plan development process, from the first quick scan to the taking of a well-based decision as to whether or not to proceed with the project.

Table 2 Five target-group profiles with preferences for inner-city transformations

| Target group 1: Starters  | Target group 2: Starters   |
|---|--|
| <p>Young, low-income singles<br/>Shared accommodation</p> <p><b>Location (dwelling environment)</b></p> <ol style="list-style-type: none"> <li>1. Urban environment</li> <li>2. Plenty of amenities</li> </ol> <p><b>Building (features of dwelling)</b></p> <ol style="list-style-type: none"> <li>3. Unit in group of 3-7 occupants</li> <li>4. Bedsit, average 22 m<sup>2</sup></li> <li>5. Shared sanitary facilities<br/>1 shower/toilet per 4 units</li> <li>6. Shared kitchen with table for meals</li> <li>7. Shared outside space (garden, etc, 1.5 m<sup>2</sup>/unit)</li> <li>8. Shared cycle storage</li> <li>9. Shared washroom</li> <li>10. Total 50 m<sup>2</sup>; useful floor area 35 m<sup>2</sup></li> </ol> <p><b>Costs</b></p> <ol style="list-style-type: none"> <li>11. Max. rent 160 - 220 Euro</li> </ol> | <p>Young, low-income singles<br/>Semi-independent accommodation</p> <p><b>Location (dwelling environment)</b></p> <ol style="list-style-type: none"> <li>1. Urban environment</li> <li>2. Plenty of amenities</li> </ol> <p><b>Building (features of dwelling)</b></p> <ol style="list-style-type: none"> <li>3. Semi-independent unit with shared facilities</li> <li>4. Bedsit, average 22 m<sup>2</sup></li> <li>5. Sanitary facilities for 2 persons</li> <li>6. Kitchen for 2 persons</li> <li>7. Shared outside space (garden, etc, 1.5 m<sup>2</sup>/unit)</li> <li>8. Shared cycle storage</li> <li>9. Shared washroom</li> <li>10. Total 50 m<sup>2</sup>; useful floor area 35 m<sup>2</sup></li> </ol> <p><b>Costs</b></p> <ol style="list-style-type: none"> <li>11. Max. rent 220 - 320 Euro</li> </ol>   |
| Target group 3: Young, two-income   | Target group 4: Senior citizens 55+  |
| <p>Young couples with two incomes</p> <p><b>Location (dwelling environment)</b></p> <ol style="list-style-type: none"> <li>1. Urban environment</li> <li>2. Plenty of amenities</li> <li>3. Suburban (more space, green)</li> <li>4. Easily accessible by car</li> <li>5. Good parking facilities</li> </ol> <p><b>Building (features of dwelling)</b></p> <ol style="list-style-type: none"> <li>6. Big luxury flat</li> <li>7. Own outside space (garden, etc.)</li> </ol> <p><b>Costs</b></p> <ol style="list-style-type: none"> <li>8. Max. rent 550 - 750 Euro</li> <li>9. ditto 750 - 1000 Euro for top flat</li> <li>10. Purchase 100,000 - 200,000 Euro</li> </ol>  | <p>Low to modal income</p> <p><b>Location (dwelling environment)</b></p> <ol style="list-style-type: none"> <li>1. Safe dwelling environment (social safety)</li> <li>2. Shops, daily amenities and public transport within walking distance (&lt;500 m)</li> <li>3. Urban environment</li> <li>4. Suburban (more space, green)</li> </ol> <p><b>Building (features of dwelling)</b></p> <ol style="list-style-type: none"> <li>5. Preferably not on ground floor</li> <li>6. With lift in building</li> <li>7. Preferably not with internal staircase</li> <li>8. At least 3 rooms</li> <li>9. Living room 25 - 30 m<sup>2</sup>; bedroom &gt; 11.5 m<sup>2</sup></li> <li>10. Direct link living room, bedroom, bathroom</li> <li>11. Extra attention to acoustic insulation</li> <li>12. Adaptable for disabled occupants</li> </ol> <p><b>Costs</b></p> <ol style="list-style-type: none"> <li>13. Max. rent 400 Euro</li> <li>14. Purchase 75,000 - 110,000 Euro</li> </ol> |
| Target group 5: Senior citizens 55+   |  |
| <p>Above-modal income</p> <p><b>Location (dwelling environment)</b></p> <ol style="list-style-type: none"> <li>1. Safe dwelling environment (social safety)</li> <li>2. Shops, daily amenities and public transport within walking distance (&lt;500 m)</li> <li>3. Easily accessible by car</li> <li>4. Good parking facilities</li> <li>5. Some like urban, some like suburban</li> </ol> <p><b>Costs</b></p> <ol style="list-style-type: none"> <li>17. Rent 550 - 1100 Euro</li> <li>18. ditto &gt; 1100 Euro for top flat</li> <li>19. Purchase 110,000 - 500,000 Euro</li> </ol>  | <p><b>Building (features of dwelling)</b></p> <ol style="list-style-type: none"> <li>6. Preferably not on ground floor</li> <li>7. With lift in building</li> <li>8. Preferably not with internal staircase</li> <li>9. Access via entrance hall, not via gallery</li> <li>10. 4 - 5 rooms</li> <li>11. Living room 30 - 40 m<sup>2</sup>; big kitchen</li> <li>12. Direct link living room, bedroom, bathroom</li> <li>13. Amply sized bathroom</li> <li>14. Balcony or roof garden 10 - 15 m<sup>2</sup></li> <li>15. Extra attention to acoustic insulation</li> <li>16. Adaptable for disabled occupants</li> </ol>  |

### Step 0: Inventory of market supply at district level

Before starting to use the transformation potential meter proper, 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; first impression, assessment with 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 that fall under the headings Market, Location, Building and Organisation.

Table 3 The various steps of the 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 of unoccupied offices using veto criteria | Location<br>Building | Selection or rejection of offices for further study; GO / NO GO decision     |
| Step 2   | Feasibility scan: further appraisal using gradual criteria              | Location<br>Building | Judgement about transformation potential of office building                  |
| Step 3   | Determination of transformation class                                   | Location<br>Building | Indicates transformation potential on 5-point scale from very good to NO GO  |
| <b>Further analysis (optional, and may be performed in reverse order if so desired):</b> |   |                      |  |
| Step 4   | Financial feasibility scan using design                                 | Building             | Indicates financial/economic feasibility<br>Sketch and cost-benefit analysis |
| Step 5   | Risk assessment checklist   | Location<br>Building | Highlights areas of concern in transformation plan; GO / NO GO decision      |

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.

Table 4 Step 1 – the Quick Scan with veto criteria

| ASPECT   | VETO CRITERION   | DATA SOURCE                        | App rais. |
|--|--|------------------------------------|-----------|
| <b>MARKET</b>                                  |  |                                    |           |
| 1 Demand for housing                           | 1 There is no demand for housing from local target groups      | Estate agent or municipality       |           |
| <b>LOCATION</b>                                |  |                                    |           |
| 2 Urban location                               | 2 Zoning plan does not permit modification                     | Zoning plan/municip. policy        |           |
|  | 3 Serious public health risk (pollution, noise, odour)         | Estate agent or on site inspection |           |
| <b>BUILDING</b>                                |  |                                    |           |
| 3 Dimensions of skeleton                       | 4 Free ceiling height < 2.60 m                                 | Estate agent or on site            |           |
| <b>ORGANISATION</b>                            |  |                                    |           |
| 4 Backer for transformation plan               | 5 There is no enthusiastic, influential backer                 | Local investigation                |           |
| 5 Internal veto criteria of property developer | 6 Does not meet criteria for region, location or accessibility | Property developer                 |           |
| <i>Not able to meet specific criteria</i>      | 7 Does not meet criteria on size and character of building     | Property developer                 |           |
| 6 Owner/investor                               | 8 Not willing to sell office building                          | Owner                              |           |

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.

### 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.

Table 5 Step 2a – Feasibility scan on location level using gradual criteria

| LOCATION   |  |   |                           |  |
|--|--|---|---------------------------|--|
| ASPECT   | GRADUAL CRITERION  | DATA SOURCE   | Apprais.                  |  |
| <b>FUNCTIONAL</b>  |  |   |                           |  |
| 1 Urban location   | 1 Building in industrial estate or office park far from town centre  | 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<br>NB:<br><i>The quality of amenities can be described in terms of number, variety and level of services provided.</i> | 4 Shops for daily necessities > 1 km.                             | On-the-spot investigation |  |
|  |  | 5 Neighbourhood meeting-place (square, park) > 500 m.             | Ditto                     |  |
|  |  | 6 Hotel/restaurant/snackbar > 500 m.                              | Ditto                     |  |
|  |  | 7 Bank/Post Office > 2 km.  | Ditto                     |  |
|  |  | 8 Basic medical facilities (practice, health centre) > 5 km.      | Ditto                     |  |
|  |  | 9 Sports facilities (fitness, swimming pool, sports park) > 2 km. | 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/undergr. > 1 km.  | Map/transport services  |                           |  |
| 4 Accessibility by car and parking<br><i>Obstacles<br/>Congestion: 1-way traffic, no parking, tailbacks<br/>Accessibility by car/parking</i>                         | 13 Many obstacles; traffic congestion  | On-the-spot investigation   |                           |  |
|  | 14 Distance to parking sites > 250 m.  | Inspection/new design   |                           |  |
|  | 15 <1 parking space/100 m2 dwelling surface  | Inspection/new design   |                           |  |
| <b>CULTURAL</b>  |  |   |                           |  |
| 5 Tone of neighbourhood<br>NB:<br><i>Assessment depends on target group, e.g.:<br/>young people not in monofunctional neighbourhood.<br/>55+ not on edge of town</i> | 16 Situated on or near edge of town (e.g. near motorway)   | Map or estate agent   |                           |  |
|  | 17 No other buildings in immediate vicinity  | Map or estate agent   |                           |  |
|  | 18 Dull environment  | On-the-spot   |                           |  |
|  | 19 No green space in neighbourhood   | On-the-spot   |                           |  |
|  | 20 Area has poor reputation/image; vandalism   | On-the-spot and local press                                       |                           |  |
|  | 21 Dangerous, noise or odour pollution (factories, trains, cars)   | On-the-spot   |                           |  |
| <b>LEGAL</b>   |  |   |                           |  |
| 6 Urban location   | 22 Noise load on façade > 50 dB (limit for offices 60dB)   | Municipal authorities   |                           |  |
| 7 Ownership of ground  | 23 Leasehold   | Estate agent  |                           |  |

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. 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 6 Step 2b – Feasibility scan on building level using gradual criteria

| <b>BUILDING</b>  |   |                                   |                  |
|--|---|-----------------------------------|------------------|
| <b>ASPECT</b>  | <b>GRADUAL CRITERION</b>  | <b>DATA SOURCE</b>                | <b>App rais.</b> |
| <b>FUNCTIONAL</b>  |   |                                   |                  |
| 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                                      | Representative body               |                  |
|  | 4 Building unoccupied < 3 years                                       | Ditto                             |                  |
| 3 New dwelling units   | 5 ≤ 20 -person units (50 m <sup>2</sup> each) can be made             | ≤ 1000 m <sup>2</sup> useful area |                  |
|  | 6 Layouts suitable for local target groups can't be implemented       | Design sketch                     |                  |
| 4 Extendability  | 7 Not horizontally extendable (neighbouring buildings)                | On-the-spot investigation         |                  |
|  | 8 No extra storeys (pitched roof; insufficient load-bearing capacity) | On-the-spot investigation         |                  |
|  | 9 Basement cannot be built under building                             | On-the-spot or Estate agent       |                  |
| <b>TECHNICAL</b>   |   |                                   |                  |
| 5 Maintenance  | 10 Building poorly maintained/looks in poor condition                 | External visual inspection        |                  |
| 6 Dimensions of skeleton<br><i>Module of façade determines placing of walls</i>                                  | 11 Depth of office building < 10 m                                    | Estate agent/inspection           |                  |
|  | 12 Module of support structure < 3.60                                 | On-site or estate agent           |                  |
| 7 Support structure  | 13 Distance between floors > 6.00 m                                   | On-site or estate agent           |                  |
| 8 Façade<br><i>External spaces dependent on target group</i><br><i>Protected monuments: limits on adaptation</i> | 14 In poor/hazardous condition  | On-site inspection                |                  |
|  | 15 Can't be made to blend with surroundings or module > 5.40 m        | On-site or estate agent           |                  |
| 9 Installations/services   | 16 Façade/openings not adaptable                                      | On-site inspection                |                  |
|  | 17 Windows cannot be reused or opened                                 | On-site inspection or new design  |                  |
|  | 18 Impossible to install (sufficient) service ducts                   | On-site inspection or new design  |                  |
| <b>CULTURAL</b>  |   |                                   |                  |
| 10 Character<br><i>cf. Location, 'Tone of neighbourhood'</i>   | 19 No character in relation to surrounding buildings                  | On-site inspection                |                  |
|  | 20 Impossible to create dwellings with an identity of their own       | On-site inspection or new design  |                  |
| 11 Access (entrance hall, lifts, stairs)   | 21 Unsafe entrance, no clear overview of situation                    | On-site inspection or new design  |                  |
| <b>LEGAL</b>   |   |                                   |                  |
| 12 Environment<br><i>Exposure to sunlight, air and noise pollution, hazardous materials</i>                      | 22 Presence of large amounts of hazardous materials                   | On-site or municipality           |                  |
|  | 23 Acoustic insulation of floors < 4 dB                               | On-site or new design             |                  |
|  | 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 Bouwbesluit(e)isen; bereikbaarheid; vluchtwegen   | 26 No lifts in building (> 4 storeys), no lifts can be installed      | On-site or estate agent           |                  |
|  | 27 No (emergency) stairways   | On-site or new design             |                  |
|  | 28 Distance of new unit from stairs and/or lift ≥ 50 m                | On-site or new design             |                  |

### 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'. 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 (see Fig. 1).

|                                  |           |          |                                  |           |          |
|----------------------------------|-----------|----------|----------------------------------|-----------|----------|
| Total Location (= nr. of Yes's): | <b>8</b>  | x        | Total Building (= nr. of Yes's): | <b>11</b> | x        |
| Default weighting:               | 5         | =        | Default weighting:               | 3         | =        |
| Score Location:                  | <b>40</b> | <b>A</b> | Score Building                   | <b>33</b> | <b>B</b> |
| Maximum Location (23x5):         | 115       |          | Maximum Building (28x3):         | 84        |          |

Figure 1 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

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 7.

Table 7 Transformation classes for office buildings; in the example shown, a total score of 40 + 33 = 77 corresponds to Transformation class 2 (transformable)

| Transformation score            | Transformation class           |  |
|---------------------------------|--------------------------------|--|
| Location + Building = 0 - 40    | 1 = Excellent transformability | <p><b>Total Score A + B: 77</b></p> <p>Min. score Loc. + Build. = 0</p> <p>Max. score = 115 + 84 = 199</p> <p><b>TRANSFORMATION CLASS: 2</b></p> |
| Location + Building = 41 - 80   | 2 = Transformable              |  |
| Location + Building = 81 - 120  | 3 = Limited transformability   |  |
| Location + Building = 121 - 160 | 4 = Very poor transformability |  |
| Location + Building = 161 - 199 | 5 = Not transformable          |  |

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**

If the transformation project is not financially feasible, there is no point in taking the plans any further. The financial feasibility depends among other things on the acquisition costs, the current condition of the building, the amount of renovation or modification work required, 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? 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 and façade proportions be maintained? Caused by limitations of the length of this paper the financial feasibility scan will not be presented in detail.

**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. Two checklists, based on experience gained in a large number of projects, that can prove useful in this context have been developed.

**4. Conclusions**

Practical trials of the Transformation potential meter in practice 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. 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 or an age of less than three years for the building in question 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 (the readiness of the municipal authorities to approve any changes in the zoning plan required for success of the project is one of the points that needs to be thoroughly explored in advance in this context). Additional literature review is required to cover the international state of the art of the topic discussed in this paper.

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