IS THERE A PLACE FOR BUS RAPID TRANSIT (BRT) IN THE SWEDISH TOWNS AND CITIES? - APPLYING MULTI-CRITERIA EVALUATION (MCE) TO EVALUATE THE POTENTIAL FOR URBAN DEVELOPMENT AND TRANSFORMATION ALONG THE NEWLY PROPOSED BRT LINE IN KARLSTAD, SWEDEN

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ABSTRACT
Karlstad as many smaller towns and cities in Sweden developed rapidly in the 20th century, in years of rapid motorization and decentralization. As a consequence it sprawled into archipelago of urban areas along motorway E18. Karlstad was designed for the private car and today it dominated by individual mobility. The change from a city for a private car to multimodal public transport cities demands major urban transformation and adaptation efforts and Karlstadsbuss, the public transportation authority in the city of Karlstad, proposed a new BRT line named Karstadsstråk or Karlstad’s Corridor to improve the bus transportation and achieve better integration with the city. In this project I explore the possibility for urban development and transformation along the newly proposed BRT line in the city of Karlstad by using multi-criteria evaluation (MCE) that consider analysis not only the physical constrains, but also the preferences of the different actors in the urban development. The questions are: What is the development potential of the neighborhoods along the new BRT line? How and which neighborhoods can develop stimulated by the introduction of BRT?

If we look at the neighborhood scale and on urban development through neighborhood typologies and typological processes, the development potential along the new BRT line in Karlstad is rather limited. But the urban development can happen on small scale. The small scale can be very important in smaller cities where there is a new urban attractor like BRT. If the city of Karlstad wants to have successful implementation of the newly proposed BRT line it is maybe important to rethink urban integration as urban transformation of the city small scale. One solution involves “BRT free development zones” where small businesses and residents, architects and builders from the city can coordinate and develop their own visions of the future city.
INTRODUCTION
Karlstad is a city with around 60000 inhabitants. It is the capital and largest city in Värmland, a county in Sweden on a border with Norway, a vibrant business hub of its region with over 40000 work places. Over 32% of the workers commute from other and 17% commute to other municipalities achieving staggering mobilities. Karlstad as many smaller cities in Sweden developed rapidly in the 20th century, in years of rapid motorization and decentralization. It was designed for the private car and today it dominated by individual mobility (FIGURE 1). A person in the city of Karlstad travelled 49km per day in 2004 or 29% more than the Swedish average by the official statistics, whereas a person in the countryside travelled 62km per day or 62% more than the average of 38km per day (Trivector, 2005a, pp. 42-7).

FIGURE 1: The differences in public mobility in Karlstad and Stockholm as well as in Stockholm and Värmland region. The chart on the left shows the change in annual number of journeys by public transportation from 2003 to 2011 (Source: www.trafa.se), whereas the charts on the left show the share of public transportation for different lengths of journeys for year 2005 (Trivector, 2005a; 2005b).

Karlstadsbuss, the public transport authority in Karlstad, in recent years has been recognized in Sweden for their successful advertisements and marketing campaigns, reorganization of the bus network, reimaging of the orange buses and introduction of the “boat buses” which traverse the delta of Klarälv that cuts through the city. The buses are organized in fewer lines, in easily
comprehensive map that looks like a subway map. When Färjestad BK, the local hockey team, plays the bus network completely changes and hockey buses come out to bring Karlstadborna, the inhabitants of Karlstad, to and from the Färjestad Arena. Their guerrilla marketing increased the use of public transport by 50% from 2005 to 2010 and the satisfaction of the customers is among the highest in Sweden. In 2009 as part of their effort to double the share of public transportation the manager of Karlstadsbuss, Sören Bergerland, and Robert Sahlberg, who is responsible for marketing started to promote an experiment with future bus transportation system. Together with Karl Kottenhoff, we took part in the discussions as academic representatives from KTH Royal institute of technology. The meetings in Karlstad resulted in a Bus Rapid Transit (BRT) vision named *Karstadsstråk* or *Karlstad’s Corridor* (FIGURE 2) It is newly proposed BRT line which connects the most important nodes in Karlstad. The idea was that BRT revolves around inflexible busways that add permanent value and it triggers urban development around the stations. This is known as Transit-Directed Development (TOD) in the USA and defined as design or development of moderate and high density mixed-use walkable urban areas, or pedestrian pockets, at strategic points along the regional public transport system (Calthorpe, 1993, pp. 41-45). In this project I explore the possibility for urban development and triggering TOD along the newly proposed BRT line in the city of Karlstad. What is the development potential of the neighborhoods along the new BRT line? How and which neighborhoods can develop stimulated by the introduction of BRT?

![FIGURE 2: Karstadsstråk or Karlstad’s Corridor with the important nodes in the city of Karlstad](image-url)
METHOD

Urban development and transformation as “planning and development system”

It is very hard, almost impossible, to predict precisely and in detail how a neighborhood or city will develop, even if they are carefully planned and controlled. The neighborhoods are entangling complex and changes happen randomly. Joel Garreau in the book “Edge City” writes: “No matter what you plan, the result will always be a surprise”. There are social and physical aspects of the neighborhoods that can influence urban development and transformation. Gans (1968, pp. 5-11) in his essay “The potential environment and the effective environment” describes the clash and difference between human and natural factors that affect the urban environments. I transcribe his title in potential and effect for urban development and transformation. The potential for urban development is determined by the physical characteristics or consistencies in politics and social life, whereas the effect is determined by social and political conditions in the neighborhoods, the city or the country. I analyze the potential for urban development and transformation through physical parameters of the urban form and their frictions, but also as process of actors in a system of planning and development.

The urban development and transformation is driven by profits, societal endeavors and utopias, urges for monumentality and extravagance, but also by the need to solve everyday problem, by the mundane and ordinary. There is a clash of interests, public or private, individual or collective, veiled or transparent. There are tendencies neatly expressed through Lefebvre’s prism of tendencies in planning. The “scientific planning” tendency neglects the so-called human factor and focuses on cities and neighborhoods as systems. The “people of good will”, architects, artists and writers, want to build neighborhoods and cities to the human scale or to its measure, even though the human scale has grown beyond their grasp. The “developers” do it without hiding for the profits (Lefebvre, 2000, pp. 83-85).

There are many definitions of the city. The urban morphologists look at the city as a mosaic of areas or spaces. Every city has “unique individuality, own life and physiognomy” and it is a “complex individual” of different urban quarters or neighborhoods (Reclus, 1905, pp. 385) or “a mosaic of little worlds that touch, but do not interpenetrate” (Park, 1925, pp. 40). But others look at the city as artwork of political struggle. The cities are artworks accomplished by clearly defined people and groups in historical conditions (Lefebvre, 1996, pp. 101), products of political struggle, or struggle of the control over the right of the city (Soja, 1989, pp. 49). The city is stage where different individuals, social groups or classes and their interests struggle for the right to develop the city today. In a same time it is an artifact, a monument of political clashes in the past. The conflict is not only between the actors today, but also with the fossilized successful endeavors from the past and the future expectations too. Lefebvre (1996, pp. 83-85) writes about tendencies in urbanism instead of actors, whereas Hall (1980) extracts bureaucrats, politicians and the community as a “concert of actors” that shapes the city.

I illustrated a development and planning system that revolves around urban form and describes the sphere of play and domain (extended with dashed lines) of the different actors (FIGURE 3).
FIGURE 3: Development and planning system and its actors

The development and planning system starts with the city as problems, interests and urban forms and ends in the city as urban forms. The negotiations are the core of the system. There are negotiations firstly between ideas, goals and visions versus legislation which results in urban plans. Secondly there are negotiations between the administration and the developers as control over the urban development. The system is inspired partially by Henri Lefebvre, John Turner, Carlo Ratti and Peter Hall, and partially by the wish to connect urban morphology with urban planning, development and transformation. David Harvey argues that urban planning and development is partly reflecting the prevailing ideology of the ruling groups and institutions in society and partly is fashioned by capitalism and the dynamics of market forces. Urbanization has always been a class phenomenon where the control typically lies in a few hands and increasingly, we see the right to the city falling into the hands of private or quasi-private interests (Harvey, 2009, pp. 310-29). But if we look historically the power can lay in the hands of the bureaucrats too. Robert Moses managed to serve under many mayors and worked with many developers and still pursued his own agenda of urban renewal and transformation of New York.

Development and transformation of the urban form in the neighborhoods through urban morphology and Swedish typologies of neighborhoods

Urban morphology revolves around urban form and the processes of formation and transformation of urban areas. It is a multidiscipline between architecture and urban design, geography and history, economics and politics. In its narrower definition within architecture and geography, urban morphology puts emphasis on studying physical form and processes of its emergence and transformation. This definition historically dominated urban and regional planning, architecture and geography and there are many traditions, methods and representations within. The British or Conzenian school originates from the work of geographer Michael R.P.G Conzen. Even though theoretically the urban form is framed as a process, a temporal change of streets, plots and buildings (Conzen and Conzen, 2004), the scholars primarily focus on the two-dimensional extend and representation of urban areas through historical changes in planning.
practice and architectural styles. In contrast to the British school, the Italian school has strong architectural background inherited from the work of the Italian architect Saverio Muratori and his followers. The Italian cities changed architecturally throughout the history and the Muratorian school focuses on three-dimensional transformation, design, representation and interpretation of the architectural detail of the urban form (Caniggia & Maffei, 2001). The representations of an urban mosaic of physical spaces and structure of cities vary from symbolical fuzzy diagrams to accurate drawings and maps: for example as a pattern of streets, plots and buildings that are shaped by the society and its economy (Conzen & Conzen, 2004). In another conceptualization the urban space is defined by a pattern of buildings, streets and squares (Krier, 1979, Krier, 1984).

Urban development and transformation is a process of emergence of urban form or change from one urban form to another. The urban transformation actions or processes are morphologically typological operators defined as “process typologies” or “typological processes” (Kropf, 2001). Urban transformation from one neighborhood type to another is simultaneously predictive to changes in urban density (Rådberg, 1997; 2000; Stojanovski, 2012).

In Sweden the neighborhood was and still is the common or dominant scale of development. Many Swedish as many other Northern and Western European cities, somewhere earlier, somewhere later, experienced a similar history of urbanization, architectural styles and planning paradigms. Transmissions and convergences of European urban images happened continuously throughout the history, but stronger from the middle of the 19th century. For example, Paris with its lavish cityscapes inspired urban reflections throughout Europe in the end of the 19th. The international style in the second half of the 20th century was the culmination when the urban reflections became literally replications appearing instantly in many European cities. These consistencies can be followed by typologies. In Sweden there is a long tradition of making typologies of neighborhoods. A neighborhood type fuses urban form with time and space, with history and society, with ages, styles and paradigms. The latter of Swedish neighborhoods and cities, from wooden to stone and brick and concrete and steel prefabricated city, from traditional, industrial, modern to postmodern is described by many authors. The morphologies or urban typologies in Sweden were method firstly used by geographers and later by architects and urban planners. The city was defined geographically as “agglomeration with clearly differentiated areas” (Ahlmann at al., 1934:7) and the Geographical Institute at Stockholm’s University under Hans Ahlmann, made extensive and detailed geographic studies of Stockholm’s morphology from 1929. They linked urban geography and morphology with history, economy and sociology and drew inspiration from French, German, British and American schools of geography and sociology.

Johan Rådberg made the deepest and most comprehensive insight in Swedish urban morphology throughout the 1980s and 1990s. He developed detailed and chronological Swedish neighborhood types (Rådberg 1988, pp. 435-40; 1996) drawing both from the Conzenian and Muratorian schools in urban morphology (Rådberg, 1995, pp.6). In his consecutive studies he explored the relationship between urban types, attractiveness, quality and housing preferences in the city of Västerås (Rådberg and Johansson, 1998) and south Stockholm (Rådberg, 2000). Arken Architects and Ekologigruppen Ekoplan, together with Jerker Söderlind and Håkan Jersenius, inspired by Rådberg’s research developed an operational urban morphology as a planning method called STEP in the 2000s with a matrix of neighborhood types. Another Swedish typology was illustrated in two books of the “Så byggdes” or “That is how it was built” trilogy (Björk et al, 2003; 2009). The trilogy looks in detail at urban form, architectural styles and materials from 1880 until today. The first book described the development of multifamily housing and the second building single family houses and villas.
**Data**

The GIS maps were downloaded from Lantmäteriet’s (National Land Survey of Sweden) digital library. The data is from 2009 and it includes polygon maps of buildings, real properties and land uses. I used two statistical packages (AMPAK and FASTPAK) from Statistiska centralbyrån (SCB, Statistics Sweden). AMPAK is a package about the labor market, work places and commuting, whereas FASTPAK includes statistics about buildings and real properties. I also received a GIS layer from the NYKO4 areas done by SCB, but there were large differences between the NYKO4 areas layer and the layer of real properties of Lantmäteriet and it was impossible to use it. Instead I merged the real properties in NYKO4 according a table that was sent to me by Karlstad’s municipality.

**Analysis**

Different factors and constrains are explored with a use of multi-criteria evaluation (MCE) and map algebra in geographic information systems (GIS). MCE in GIS is a powerful analysis tool to when “multiple and conflicting criteria, interests and objectives are concerned” (Carver, 1991). The factors are captured by MCE. The factors or criteria interact therefore they are weighted according the assumed or systematized strength of effect. I consider land use, neighborhood type and impedance (which corresponds to the willingness of friction of the people to develop certain neighbourhood types), open spaces and FAR in the urban blocks (which is conceived as factor posed by the administrators), existing buildings, as well as distance from the new BRT stations as factor.

In the end I use a “developer cut” agreeing with David Harvey that the right to the city is into the hands of private interests and developers. The developers in Sweden prefer large projects and prefer to build on empty land and sizable plots. It is a multiplier and focal model in map algebra. Developers tend to find empty field, a large empty piece of land, and build new. They prefer to be left alone with the bureaucrats in the urban development and transformation phase of the planning and development system.

I used both ArcGIS and Idrisi. I used Idrisi to do the MCE and to make the “developer cut” and I used ArchGIS’s tool “block” for focal analysis and look for large areas with high development potential. The background layers for the MCE were prepared by my experience and judgment, where 0 means no desire for development, while 255 means top desirability (TABLE 1).

<table>
<thead>
<tr>
<th>Value</th>
<th>Land use</th>
<th>Distance to stations</th>
<th>Building coverage</th>
<th>Neighborhood type</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>Open land</td>
<td>400m</td>
<td>0-1%</td>
<td>Obebbygd</td>
</tr>
<tr>
<td>250</td>
<td>Industrial areas</td>
<td>600m</td>
<td>1-20%</td>
<td>Other</td>
</tr>
<tr>
<td>200</td>
<td>Low density areas, agricultural land</td>
<td>600m</td>
<td>20-30%</td>
<td>Storskalig funktionalistisk stad, småhusområde</td>
</tr>
<tr>
<td>150</td>
<td>High density areas, agricultural land</td>
<td>800m</td>
<td>30-40%</td>
<td>Småhusområde, villastad, småstadskvarter</td>
</tr>
<tr>
<td>50</td>
<td></td>
<td>800m</td>
<td>40-50%</td>
<td>Institutionspark</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>1000m</td>
<td>50-70%</td>
<td>Churches</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>1200m</td>
<td>above 70%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Urban cores, squares</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Water</td>
<td>over 1200m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 1:** Assumed desirability values of the factors land use, distance to stations, building coverage and neighborhood type
The FAR is considered as regulatory factor set by administrators or planners. I made three weightings of the FAR factor depicting three visions that will be discusses in the scenarios (TABLE 2).

<table>
<thead>
<tr>
<th>Value</th>
<th>FAR=0.25</th>
<th>Value</th>
<th>FAR=1.5</th>
<th>Value</th>
<th>FAR=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>255</td>
<td>&lt;= 0.1</td>
<td>255</td>
<td>&lt;= 0.1</td>
<td>255</td>
<td>&lt;= 0.1</td>
</tr>
<tr>
<td>150</td>
<td>&gt; 0.1</td>
<td>200</td>
<td>&gt; 0.1</td>
<td>200</td>
<td>&gt; 0.1</td>
</tr>
<tr>
<td>100</td>
<td>&gt; 0.25</td>
<td>150</td>
<td>&gt; 0.5</td>
<td>150</td>
<td>&gt; 1</td>
</tr>
<tr>
<td>10</td>
<td>&gt; 0.5</td>
<td>50</td>
<td>&gt; 1</td>
<td>50</td>
<td>&gt; 1.5</td>
</tr>
<tr>
<td>1</td>
<td>&gt; 1</td>
<td>1</td>
<td>&gt; 1.5</td>
<td>1</td>
<td>&gt; 4</td>
</tr>
</tbody>
</table>

TABLE 2: Assumed desirability values of the factors FAR

The weighting of the factors in Idrisi showed acceptable consistency ratio of 0.06. The weights of the different factors are shown blow (TABLE 3).

<table>
<thead>
<tr>
<th>Land use</th>
<th>Distance to stations</th>
<th>Buildings</th>
<th>Open spaces</th>
<th>FAR</th>
<th>Neighborhood impedances</th>
</tr>
</thead>
<tbody>
<tr>
<td>No neighborhood impedances</td>
<td>0.055</td>
<td>0.273</td>
<td>0.101</td>
<td>0.206</td>
<td>0.337</td>
</tr>
<tr>
<td>Neighborhood impedances</td>
<td>0.032</td>
<td>0.161</td>
<td>0.059</td>
<td>0.122</td>
<td>0.199</td>
</tr>
</tbody>
</table>

TABLE 3: Results of MCE weighting in Idrisi with and without neighborhood impedances

**Scenarios**

There are nine scenarios which are multiplication of three basic scenarios which revolve around FAR. The visions of the administrators or planners are usually described by FAR. There are three administrative visions or goals, a city of villas with FAR of 0.25, small city with FAR=1.5 and big city with FAR=4. Each vision is refined through neighborhood impedances showing what happens in the neighborhoods that are preferred and give friction to development. In the end the developers make the cut, looking for large pieces of empty land for development. They completely ignore small plots or any neighborhoods.

**RESULTS**

The maps below show the areas with high desirability for development in regard to the design of the new BRT line. The greener the area is it is more desirable. The first collage shows the desirability in detail and the second blocks of minimum desirability. The horizontal axis shows the different FARs, where the vertical shows the refinement by urban form and actors.
FIGURE 4: Detailed desirability maps of the urban development potential
FIGURE 5: Desirability maps of the urban development potential as 100m x 100m blocks
The analysis display different desirability patterns through the refinements. The neighborhood impedances lower the desirability and the potential for development and the focal tool block really cuts off the areas undesirable for developers. The areas on the west of the line are currently discussed for development in the city of Karlstad. Another interesting result of the analysis is high desirability of the empty areas on the fringes of the neighborhoods. The develop cut shows tendency for urban sprawl and it is what it usually happens in reality.

DISCUSSION

The analysis of the potential for urban development and transformation needs to be further developed, but it is promising method. It needs improved and more specialized data. It needs better conceptualization of the desirability of the geography, the forests, lakes and landscapes. The analysis can be even simplified by using fewer factors. My recent analysis of neighborhood types in Karlstad (Stojanovski, 2012) and Rådberg’s previous research in Västerås and south Stockholm showed consistencies between neighborhood type, FAR and building coverage. FAR and building coverage can be excluded and replaced with other economical factors. The profitability of development was not well captured by the FAR factor. There was no difference in desirability when the MCE was pursuing small or large Swedish city. In reality there is big difference in transformation from single house neighborhoods to small Swedish city is on edge of profitability. The development from 1-2 stories to 3-4 stories is at least half as less profitable than developing to 4-6 stories. Additional aspect that would be interesting to include is the market values of the apartments and houses in the areas, since they play are the one that play essential role in the development. The analysis can be even more simplified.

A very important technical aspect of MCE or any other GIS analysis is the data quality. I had access to both data from SCB and Lantmäteriet. When I compared the data for example for total areas of real properties or NYKO4 areas there were errors. The mean error between the SCB and Lantmäteriet datasets was 21% where around 50% of the areas were in an interval of ±5%. That is the reason why I did not made direct join between the datasets, but I used one as background for the MCE and I used the data from SCB to estimate and assume. For example I estimated the total floor area and FAR by the population and number of work places in the SCB dataset.

The approximations, weighting and estimations are also an issue. The analysis is largely heuristic, done by my judgment, but the results of the MCE are as expected. The zones with high development potential in the developer cut even coincide with the development zones planned in the municipality of Karlstad.

The margins of error for this analysis are ±20%. But the purpose is not predict where the development will occur, but to discuss what will happen around the new BRT line if there are different development tendencies.

The powerful developer cut

The analysis shows that if there is a developer tendency the BRT line will trigger limited development around two stations before the last on the both sides of the line. It seems that is more likely that the main focus of the developers will be the areas far from the new BRT line. In reality that is what is going on in Karlstad. There are no discussions about transformation, but about building new neighborhoods along the BRT line. David Harvey argues that the development of the city is in the hands of private interests and developers and he is right. They have freedom to move their investment in Orebro or other smaller city which offers them large empty plot.
**Linking urban morphology, neighborhoods and urban transformation**

The cities in Sweden developed and transformed partially and the neighborhood is usually the dominant scale in urban development. The knowledge neighborhood types can be very useful for urban development and transformation and MCE and GIS are excellent tools for analyses. The neighborhood types can be mapped, analyzed and discussed. The advantage with neighborhood types is that they are easily identified and recognized by the general public. They can be experiences and illustrated and there is usually a public opinion about the urban quality of the neighborhood types which can be easily followed by preference surveys. We can not only develop neighborhood typologies, but also typological transformations from one neighborhood type to another.

I made a table to describe the different scale of urban development and transformation through morphological and functional actions. The development or transformation actions and their scales are displayed on figure 8 where X designates usual and (X) possible actions. Similar table with transformation from one urban form or neighborhood type to another can be made too (Table 8). In Sweden the neighborhood was and still is the common or dominant scale of development and the usual actions include new development and redevelopments like demolish the old and develop new, infill or adjust new development and occasionally superpose new over the old. The pattern of new developments and continuously extending outward is ongoing even today on the modern periphery of Stockholm despite the compact city policies.

There are different scales of development and transformation.

<table>
<thead>
<tr>
<th>Morphological actions</th>
<th>Building</th>
<th>Block</th>
<th>Neighborhood</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserve (do not develop)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Renovate (keep the old)</td>
<td>X</td>
<td>(X)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renovate (change the old without transformation)</td>
<td>X</td>
<td>(X)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformation (change into new form)</td>
<td>X</td>
<td>(X)</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Redevelopment (infill or adjust new development)</td>
<td>(X)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Redevelopment (vertically extend)</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
<td>(X)</td>
</tr>
<tr>
<td>Redevelopment (superpose new over the old)</td>
<td>(X)</td>
<td>(X)</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Redevelopment (demolish the old and develop new)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>New development</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional changes</th>
<th>Building</th>
<th>Block</th>
<th>Neighborhood</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preserve (do not develop)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Change function</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>Add new functions</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**TABLE 4: Morphological and functional transformations and their scales**

Similar table with transformation from one urban form or neighborhood type to another can be designed too. But there are disadvantages in replicating transformations or forms. The typologies have systematic retrograde disposition and nostalgic attachment to traditional neighborhood types can result in repetitiveness and stereotypes. Many Swedish and European cities today are terribly stereotypical. It started with the Parisian transmission of urban images in the 19th century and Haussmann's regulation and renewal of medieval Paris and continued with Le Corbusian visions and modern surgery of the urban cores and wide replications of same neighborhood types on the
urban fringes of the European cities. Urban development can happen on any scale and when it happens on small scale it usually escapes urban typologies. These atypical places in cities are especially respected and cherished.

CONCLUSIONS AND RECOMMENDATIONS

MCE as tool to analyze urban development and transformation

Overall the MCE showed to be a valuable tool in assessing the potential for transformation and development. With certain modification of the analysis and including market values and possible profits it will be more complete. Another technical recommendation is a suggestion for improving the data quality and decreasing the error between the various datasets by SCB and Lantmäteriet for the NYKO area. It will be also very useful to include building heights as well as the number of stories for the buildings. It will make the calculation and analysis much easier.

Urban transformation, “BRT free development zones” and the smaller scale of urban development

If we look at the neighborhood scale, the development potential along the new BRT line in Karlstad is rather limited. There is very low probability that there will be large scale renewal of the neighborhoods. In the developer eye there is too much complexity and uncertainty to take that risk. The urban development can be seen systematically through neighborhood typologies and “typological processes”, but there is also the small scale with its uniqueness of the detail. The unique and small scale urban development produces special situational values. Every city has “unique individuality, own life and physiognomy” and it is a “complex individual” of different urban quarters or neighborhoods (Reclus, 1905, pp. 385). Each neighborhood is complex individual too of blocks and real properties. The urban development and transformation can happen on small scale and that is very important for smaller cities. The developers always think large and sometimes there are small solutions. It is especially important when there is an attractor for urban development like future public transport system that can link large part of a small city. If the city of Karlstad wants to have successful implementation of the newly proposed BRT line it is important to consider small scale transformation of the city. It should involve “BRT free development zones” where small businesses and architects and builders from the city can develop their own visions of the future city. Similar successful low scale development is for example Borneo in Amsterdam (FIGURE 6). Same system of unique urban design or transformation plot by plot can be applied everywhere around the station of the BRT line.

FIGURE 6: Plot by plot urban development in Borneo in Amsterdam
REFERENCES


