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Densification and urban transformation with space syntax

A feasibility study for the Slettebakken neighbourhood in Bergen, Norway

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ABSTRACT

The post-war neighbourhood Slettebakken neighbourhood in Bergen, Norway, consisting mainly of apartment buildings and a variety of different amenities and services. Due to city growth, the area location has become a part of the central areas of Bergen. The municipality is now planning for the future development of Slettebakken.

This study reveals how to secure quality and sustainability when developing existing urban areas. What methods are available to ensure quality are also stated. In addition, it is discussed whether the methods are used largely within urban planning practice. Relevant literature is described in order to depict conditions that create attractive, safe and lively urban areas, and thus show what qualities future densification can and should focus on. The study shows that an integrated and well-connected street network is important for creating movement, and thus the potential for attraction (e.g. shops) and economic activity. At the same time, attraction is needed to secure human movement. Function mix and high-density buildings also require spatial integration in the street network. Lively and attractive urban areas therefore depend on a fine-mesh grid structure and short urban blocks, pedestrian friendly streets, attractive urban spaces, high entrance density, inter-visibility, low topological depth, psychological understanding, small-scale elements, and medium building heights.

Slettebakken is compared with downtown Bergen, which serves as the reference area for attractive urban areas. It is then proposed how Slettebakken should be densified through the description of some recommendations for further development, and how the municipal zoning plan to a greater extend should be anchored in the scientific, objective and verifiable methods of analysis described in this study.

KEYWORDS

Space Syntax, Street network, Micro-scale analyses, Densification, Zoning plan

1 INTRODUCTION

The post-war neighbourhood Slettebakken neighbourhood in Bergen, Norway, consisting mainly of apartment buildings and a variety of different amenities and services. Due to city growth, the area location has become a part of the central areas of Bergen. The municipality is now planning for the future development of Slettebakken.

This project was done as a test project for revealing the possibilities to densify and to transform Slettebakken to a lively pedestrian friendly urban area. Here we apply the space syntax method (Hillier et al 2012), spacematrix (Rådberg 1996), the degree of function mixture (MXI) (van der Hoek 2009), street profiles (Eldijk 2014), and the urban micro scale tools (van Nes and López 2010). As research has shown, the application of these various methods together can make a spatial diagnosis of the urban areas on various levels (van Nes and Yamu 2021). In addition, it is discussed whether the methods are used largely within urban planning practice. Relevant literature is described in order to depict conditions that create attractive, safe and lively urban areas, and thus show what qualities future densification can and should focus on.

2 INDICATORS FOR DENSE AND LIVELY COMPACT CITIES

There are a number of conditions that create quality in urban areas, and which are essential for compact cities and sustainable densification. When revealing the existing literature on sustainable and compact cities, the following features are identified: Pedestrian friendly streets (Jacobs 2000), activities in streets (Gehl 1971), mobility equality (Hidayati et al 2020a, 2020b, 2021), mixture of activities in buildings at different times of the day (Jacobs 1961), high degree of inter-visibility between streets and buildings (van Nes 2021a), a balanced densification between floor-space index (FSI) and ground-space index (GSI) (Rådberg 1996) and a fine-grained inter-accessible street network (van Nes 2021a). The latter one seems to be the underlying driver for a natural development for all the other parameters. (van Nes et.al 2012, Ye and van Nes 2014).

For making vital urban centres, research has shown that an integrated street network on various scale levels creates lively urban centres (Hillier et al 1993, 1998, van Nes 2021b). Therefore, the theory of the natural movement economic process gives some kind of predictability for setting the spatial framework for enhancing micro economic businesses (van Nes and Yamu 2020). Likewise, the theory of the natural urban transformation process (Ye and van Nes 2014) gives some predictability for how urban areas can transform naturally dependent on the spatial structure of the street and road network (van Nes and Yamu 2021).

2.1 Space Syntax

Space Syntax has made it possible to measure the connection of different streets to all other streets in an urban area, and thus explain the connection between the street network layout and conditions such as pedestrian traffic. At the same time, it emerges how traffic flows are important for social and economic conditions, as shops are mainly located on streets with significant pedestrian traffic. While the flow of people attracts shops and other services, such attractors in turn tend to attract human movement (Hillier et al., 1993, pp. 30-32). Space Syntax thus explains the importance of a well-integrated street network, which encourages human movement, and thus the establishment of so-called attractors. If the street network contributes to little human movement, the opposite effect occurs.

Lively pedestrian-based city centre areas thus require both local integration, as Space Syntax measures, and attractors. Such areas are usually characterized by a fine-meshed street network structure around central shopping streets. This is because both movement and establishment of attractors presuppose such a structure (Hillier 2001).

For a segregated area to be transformed into a vibrant and attractive area, there must be high integration in the street network, but both high building density and a high degree of functional mix must also be developed. Research shows that building density and functional mix are naturally established where the integration in the street network is high, which in turn contributes to a bustling street life with lots of movement and activity (van Nes et.al 2012, van Nes and Ye, 2014, p. 2).

2.2 Street network structures

Urban areas with a grid pattern street network usually have short and fine-meshed quarters, with many directional opportunities for pedestrians (Carmona et al., 2010, p. 93). With good pedestrian accessibility, the grid structure provides short distances and simplified traffic systems. In addition, the structure is better suited for public transport, and creates more lines of sight for orientation in the cityscape (Asplan Viak 2016, p. 132-135). In the researched literature, grid patterns are thus considered a better suited alternative than other street grid structures to crate attractive urban areas.

2.3 Urban block size

Small and short quarters are often recommended in modern literature, due to the potential for liveliness, ease of walking and easy orientation for pedestrians in urban areas (Carmona et al., 2010, p. 99). The research by Siksna (1998) concluded that short, small and fine-meshed quarters are formed in the most lively and attractive trading areas. This also applies where the buildings

were previously characterized by large and extensive quarters. The study concluded that the ideal quarter length in urban areas is 80-110 meters.

The positive aspects of short and relatively small quarters are also highlighted in e.g. Jacobs (1961), Krier (1984) and Van Eldijk (2014). In a project on applying space syntax on densification strategies in Bergen, shows that areas where the street grid has short urban blocks has the most attractive dwelling areas with a large variation of functions within short walking distances (de Koning et al 2020).

2.4 Building – street relationship

According to Montgomery, active facades adjoining public spaces are important for attractive urban areas (Montgomery, 1998), and for serving a bustling street life (Salingaros, 2005, p. 268). Therefore, facades must be constructed so that they create interest and life. The number of doors and windows with activity directly visible from street level is an indicator of the potential for liveliness and attractiveness. (van Nes and López 2010). The higher the input density, the greater the potential (Carmona et al., 2010, p. 215).

Previous research not only shows that high entrance density is important for creating attractiveness and liveliness at street level. Low topological depths between private and public space, high degree of constitudedness and significant inter-visibility is also important. This is the case because a strong correlation between liveliness and conditions at micro-scale level has been shown in urban areas (van Nes and López, 2010). Research shows that if there is a low topological depth and a high degree of constitudedness, more people choose to cycle or walk instead of using private vehicles (de Koning and van Nes, 2017). It is usually the traditional and most central urban areas that have the greatest potential for liveliness through conditions on a micro-scale level (van Nes and López, 2010).

As Jacobs (1961b), Calthorpe (1993) and van Eldijk et al. (2014) among others suggests, one of the most important goals in the development of urban areas is to create a safe environment where the street is free of crime and perceived insecurity. Studies have shown how spatial conditions can affect the possibilities for crime. First, areas with segregated streets, few connections to the surrounding environment and a low number of entrances to street level are often affected by crime (Hillier and Shu, 2000, p. 232). This indicates that integration, high entrance density and constitudedness are conditions that contribute to security in urban areas.

3 APPROACH

In order to identify the spatial parameters for a lively well-working urban centre, a set of spatial analyses methods are applied on Slettebakken as it is today and on an attractive and lively urban area in Bergen centre. As it turns out from the comparison, Slettebakken has very low local

integration, the street profiles are car dominated, buildings are turning themselves away from streets, the area is mostly mono-functional, and the building density is low. Most of the types of buildings in the area consist of mid-rise strip buildings.

Applying space syntax in strategic urban planning requires to solve the path work first (Seamon 1994, van Nes and Yamu 2021). Several alternatives were tested out. The alternative that increased local integration most on a local level was chosen. In this way, the spatial framework was settled for making proposals on land use, street profiles, and the degree of building density.

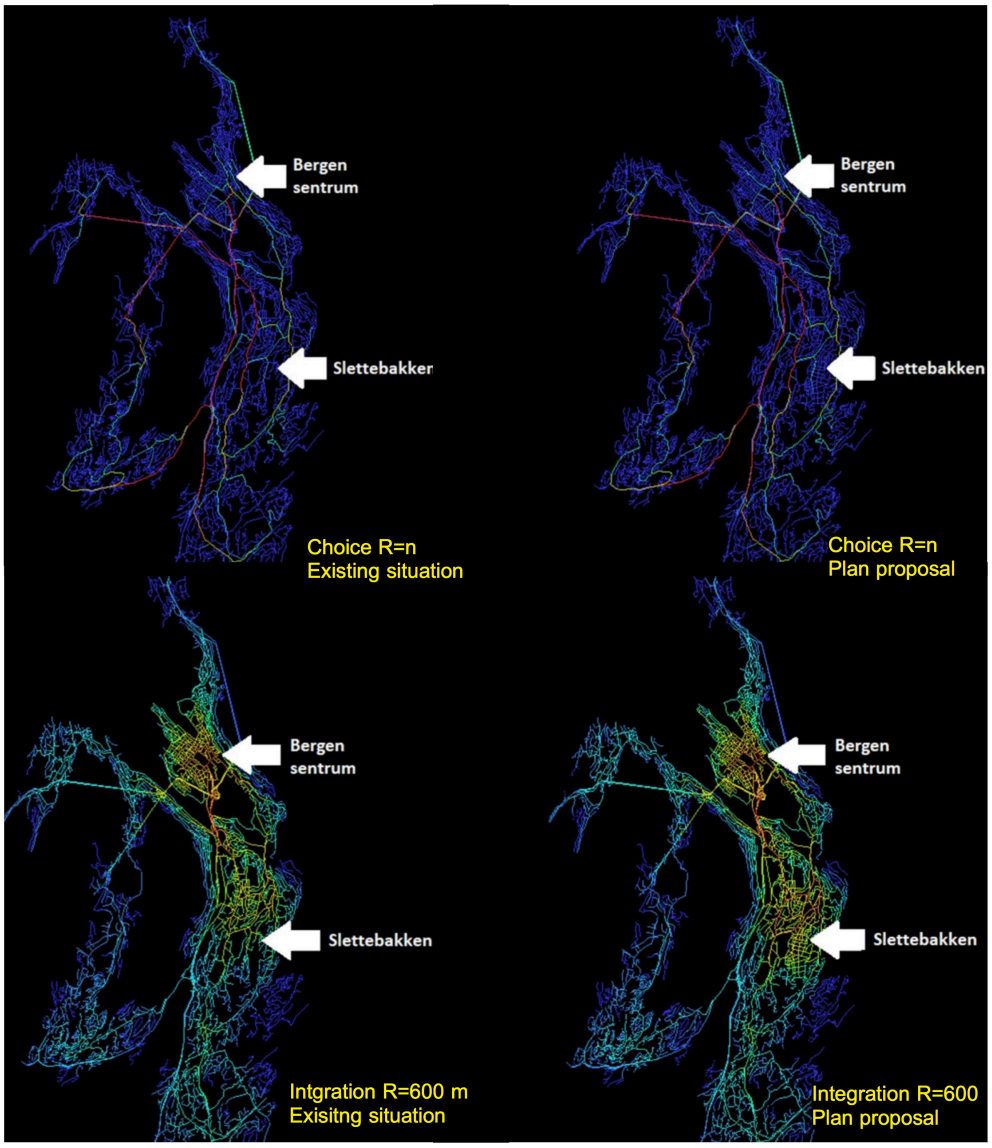

Figure 1. Space syntax analyses of Bergen's central areas with Bergen sentrum and Slettebakken.

As the space syntax analyses show, Slettebakken has a street network that is less integrated than the analysed downtown area (Bergen sentrum). The Choice Rn metric-analysis (fig. 1 top left) shows possible through-movement routes on a city level. When revealing the segment integration

analyses with a metrical radius of 600 meters (bottom left), the downtown area has a lot of potential, in contrast to Slettebakken. Although Slettebakken is less integrated, the analysis still shows some potential of pedestrian based through-traffic. At the same time, it also highlights the lack of a fine-mesh grid street network to promote the ease of walking and pedestrian mobility. Slettebakken is thus lesser integrated than downtown, although it still has a considerable potential for to-movement.

The images on the right side in figure 1 shows the choice and segment integration analyses with the new street network proposal. As it turns out from the local segment integration analyses (fig. 1, bottom right), the local to-movement potentials are now increased in the plan proposal.

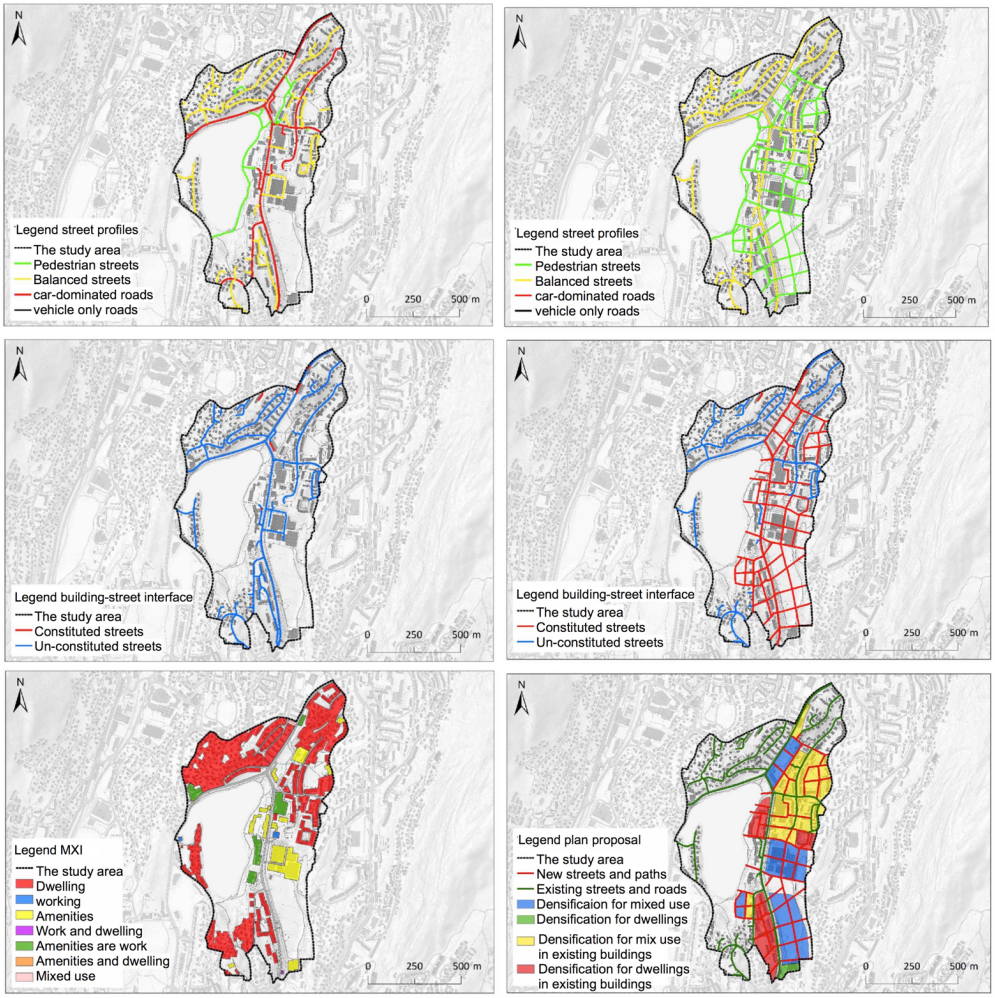

Figure 2. Street profile analyses, street-building interface analyses, and MXI analyses of the existing situation (left) and the plan proposal (right) of Slettebakken.

Figure 2 shows analyses of street profiles, the street-building interface, and the degree of function mixture (MXI). The existing situation is shown on the left side, and the plan proposal is shown on the right side. Regards the street profiles, the main routes are car-dominated. It is not enough to have a well-integrated street network. The street profiles need to be balanced to

enhance transport on foot. At present, most people in the area tend to use the car for short distances, even though the shop is in walkable distance. Therefore, in the planning proposal is to enhance a street network structure, consisting of balanced street (where car-accessibility is needed) and with pedestrian only streets.

Regards the building-street interface, most of the streets are un-constituted in the existing situation. Therefore, in the planning proposal all new buildings must have active frontages with doors and windows oriented towards the streets on ground-floor level.

Below in figure 2, a MXI analyses of the existing situation is shown (left). The new land use plan proposal (right) shows where and how to enhance new types of functions. The mix use areas are enhanced along the light rail stops and along the routes with high values on the choice and local segment integration analyses.

Figure 3. Spacematrix analyses of the existing situation (left) and strategies for densification in the planning proposal (right).

In Norway, the property right is very strong. So, therefore it is difficult to make a detailed building plan inside the dwelling areas. Figure 3 shows a spacematrix analysis of the existing situation (left). The area consists of single-family dwellings and mid-rise strip buildings. In the open area there are some sport fields close to the light rail stop. The plan is to use some of these open fields to densify.

4 CONCLUSIONS

Based on Space syntax, the study of other spatial conditions, and the urban quality shortcomings the study has uncovered, it is concluded that future development of the area must emphasize the following conditions:

- Establish a street structure with a fine-mesh grid pattern, with short urban blocks.
- Street network characterized by pedestrian friendliness and mobility.
- Attractive urban spaces characterized by activity and liveliness.
- Active facades and various other conditions at micro-scale level, such as creates safety.
- Readability and potential of a psychological understanding of the study area.
- High functional mix and high density in new buildings.

It is pointed out that although Slettebakken does not completely lack spatial integration and well-connected street networks, it is possible to create better connections in the street network when developing and densifying the area, like that seen in the lively and attractive downtown area of Bergen. Future land use planning and development must be based on Slettebakkens highlighted shortcomings. As it turns out, regulations and guidelines in the municipal zoning plan must a greater extend be anchored in the scientific, objective and verifiable methods of analysis described in this study.

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