HARBORING DENSITY

EXPLORING DENSITY AND PUBLIC SPACES AS A TOOL FOR DESIGNING MELLERSTA HAMNEN IN MALMÖ

MASTER THESIS
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SUSTAINABLE URBAN DESIGN | LUND UNIVERSITY

TITLE:
Harboring Density: Exploring density and public spaces as a tool for designing Mellersta Hamnen in Malmö

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SUDes
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SUMMARY

Density is often used as a strategy to achieve a sustainable development in contemporary urban planning. A higher concentration in the urban environment of functions and people are argued to be essential to handle the climate change as well as achieving social equity. While a desire for higher density is often formulated in urban development plans by regions or municipalities, there lies a confusion in the many variations the term density can mean. What does it mean to develop a higher density in an urban Environment?

In this thesis, I have explored the physical and perceived density in selected areas in Malmö to better understand how density can be defined. By using a multivariable approach in defining the physical density, the Spacemate method, there has been possible to calculate some of the existing densities in Malmö. While the Spacemate method is a tool measure the physical density, there exist another perspective on how we perceive density. For instance, an urban area can be experienced as dense, even if the physical density is not and vice versa. Additionally, I have also conducted visual studies in selected areas to grasp the perceived density to further nuance the concept of density.

The issue of public spaces in the dense and compact city is also a dilemma. With a higher density in buildings, there exist the risk for less open space being available for inhabitants, impacting the amount of space for greenery and public functions. This thesis also involves the exploration on how public spaces can take form in denser urban settings.

The findings from the exploration of the density in Malmö has then been the basis for formulating density values and qualities for use in designing a future harbor area transformation in Malmö, namely Mellersta Hamnen, into a mixed-use district.

HARBORING | to keep in one's mind or heart

DENSITY | the degree of compactness in an area

TABLE OF CONTENTS

ACKNOWLEDGMENTS

I would like to express my thanks to the SUDes team who made this two years of master studies a blast. The master in sustainable urban design has challenged me in my way of thinking when planning and designing and given me experiences that I will bring with me through my whole life. Additionally, I would like to give my sincere appreciation to my supervisor, Andreas Olsson, who has guided and steered me into the right direction with both the research and the design processes in this thesis project.

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Aerial photo of Mellersta Hamnen and Nyhamnen

BACKGROUND AND PURPOSE

Ratio of population (worldwide)

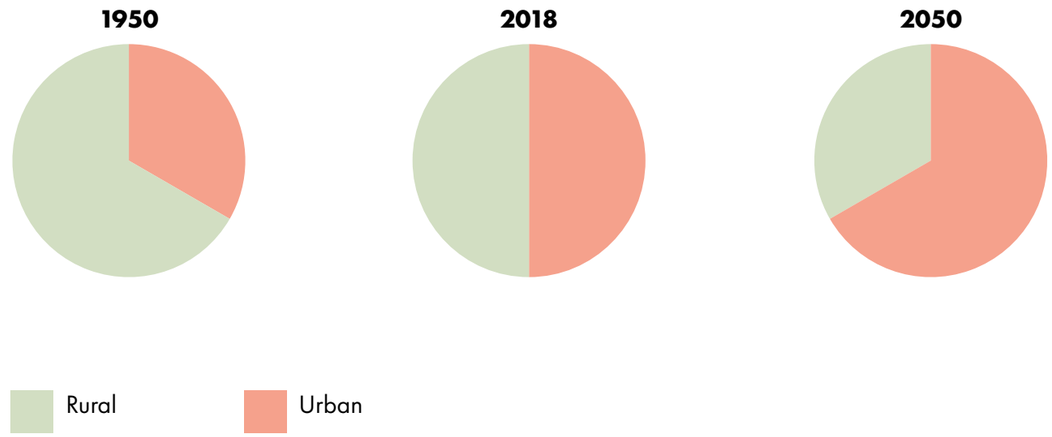


Diagram of the ratio between rural and urban population and predicted ratio by the year of 2050 (United Nations, 2021)

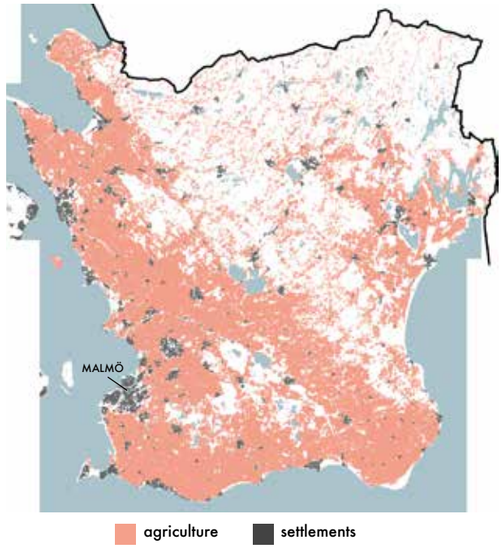
BACKGROUND

More than one half of the world's population in current times lives in urban areas and almost all countries over the globe are facing rapid urbanization. According to predictions by the UN urban population will be increased to two thirds by the year of 2050 and can be compared with urban areas being a third of the share in 1950 (United Nations, 2021). Densification of our cities have been an ongoing trend in the 21st century to handle the development of urban areas and achieve a sustainable development. With a denser and compact city, a more efficient use of the city can be utilized in aspects such as infrastructure and land. Despite the ongoing densification there is no clear consensus on how to achieve an optimal density of our urban areas and to what form it may adhere to. There are also factors in density and densification that can be very specific to a particular area or region such as history, climate change, culture, education and work, further influencing how the density can take form.

Boverket (the Swedish National Board of Housing, Building and Planning) has identified some challenges with densification in a Swedish context that includes lack of green spaces and daylight, land for community functions and noise pollution (Boverket, 2016a). Meanwhile, WHO (World Health Organization) has highlighted that people in Europe spend approximately 90% of their time indoors, adding on to the challenge in designing higher density urban areas (WHO, 2013). The previous mentioned challenges can thus stress the use and form of public spaces in the dense city, becoming more and more important in order to facilitate outdoor activity amongst the population to promote the general health. But there lies a dilemma when factoring in a higher density and public spaces. With a higher concentration of buildings in an area, the pressure on open spaces increases, complicating the development of green structure and public spaces (Berghauser Pont & Haupt, 2009). While the modernistic movement often proposed taller monolith buildings with a rational amount of space between them to facilitate access to sun, greenery and open spaces, this urban form is often criticized for the lack of spaces for social integration and the long distance between functions (Jacobs, 1961). According to the urban researcher Næss, contemporary urban development needs to minimize the unhealthy consequences of the dense city but avoid the design principles of the modernistic era. The author highlights that the compact city needs to be both dense as well as green (Næss, 2013). Thus, a challenge prevails in how public spaces and greenery can take form in the dense and compact city.

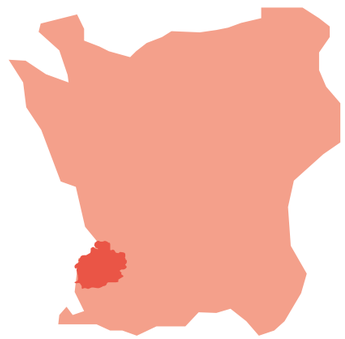
The Skåne region is one of the fastest growing areas in Sweden and both municipal and regional policymakers have approved of strategies that intend to develop the area with densification in mind. While the aim is a higher density in the region, there is exist a vagueness in how the density can be expanded in the development. Thus, one can question what kind of density that can be seen as optimal for a development in the region's different urban areas and, as the case for this thesis, the city of Malmö.

Strategy diagram for a polycentric Skåne (Region Skåne, 2013)



Agricultural lands and settlements in the region of Skåne

Location of Skåne and Malmö in Sweden



Location of Malmö in the Skåne region

SKÅNE, MALMÖ & URBANIZATION

The soil of Skåne is of the greatest quality in Sweden for agriculture, a factor the regional planning office sees as values that must be preserved and protected for future food production. A growing population, urbanization and resilience for uncertain crisis are further arguments for not encroaching on agriculture lands in urban developments in order to sustain the population in future scenarios. It is therefore of importance for the current and next generations in Skåne to develop on other types of land from a sustainable perspective.

Regarding the development of the region of Skåne, the regional planning office (Region Skåne) proposes a polycentric development of cities and settlements. By seeing the cities and settlements as decentralized entities that can grow and expand with attention to their own characteristics, densities and identities, there exist opportunities to create diverse living conditions for the inhabitants in the region. Further on, Region Skåne argues that the polycentric development will offer a shared and diverse job market that will stimulate growth as well as making the region more accessible for the inhabitants. One of the key strategies for the polycentric development in Skåne is to densify or transform existing urban areas, especially areas close to public transportation (Region Skåne, 2013) The city of Malmö is one of the major development areas from a polycentric regional perspective, being part of an intricate network that spans beyond region and country.

There can be arguments made that the land for urban development is scarce in a region like Skåne, with its high-quality soil, and that development needs to be concentrated and dense in areas that are most suited for a built environment. The municipality of Malmö proposes to develop the city trough densification of existing residential areas or through transformation of areas that are under-utilized such as brownfield, industry and/or harbor areas. In the search for a design site, I have been investigating the comprehensive plans by Malmö municipality and found one area that would be a suitable testbed for an urban design based on density as a tool, being the harbor area.

MALMÖ: A BRIEF BACKGROUND

POPULATION

347 949

in December 2020

A YOUNG POPULATION

48%

of the population 35 or younger

HOUSING NEEDS

2000

new dwellings per year

EXPECTATION OF

50 000

new inhabitants by the year of 2030

(Malmö Stad, 2021; SCB, 2021)

THE DESIGN SITE OF MELLERSTA HAMNEN IN MALMÖ

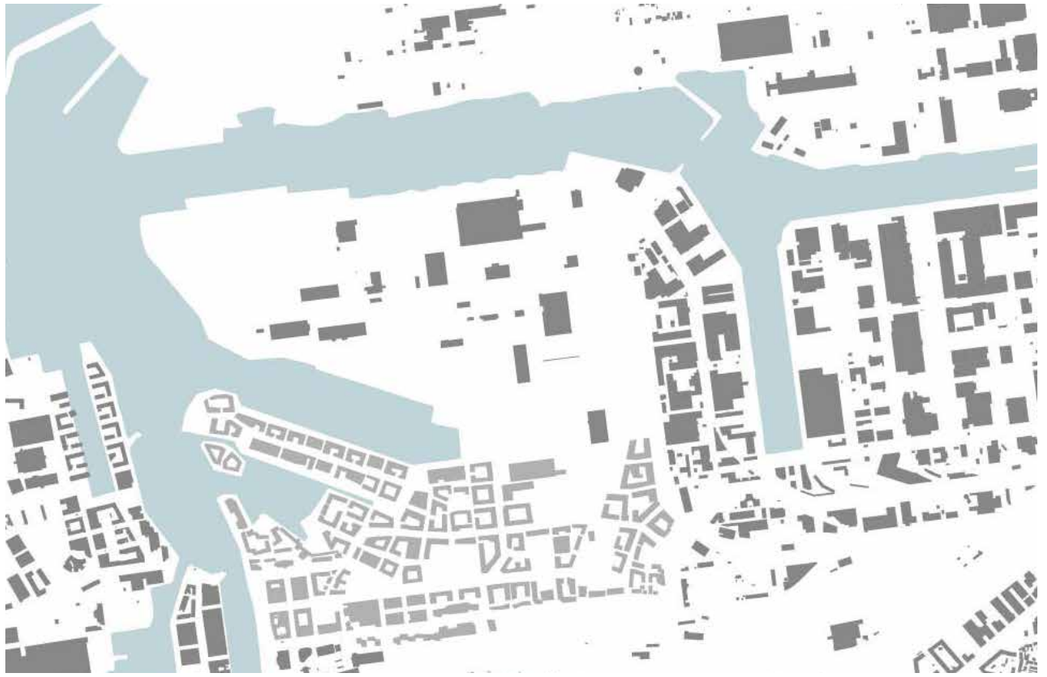
The harbor area in Malmö

MALMÖ HARBOR AREA

The initiative to build a harbor in Malmö was started 1775 by Frans Suell. Being a trader, he saw a demand for spaces where larger ships could load and discharge goods directly without the use for smaller transport ships, a topic that was shared by the rulers in Malmö. The proposed harbor areas were established through landfilling the waters in the northern parts of the old town. The new harbor in combination with the industrialization in the mid-1800s made Malmö one of the forerunners in production and manufacturing in Scandinavia during these times. In 1864, the railway came to Malmö and was interwoven with the harbor activities, developing an intermodular transportation network that spanned sea and land.

During the recession in 1970s, the activities in the harbor started to stagnate and several of the major businesses closed. The former caused a major negative impact on the economy in the city, causing declining rates of jobs as well as a decline in the population. The financial crisis in the start of 1900s made the situation even worse, with the city facing additional decrease. Thus, leading to many areas of the harbor being devoid of activities and functions.

In the early years of the 2000s, the municipality of Malmö identified parts of the harbor as areas for urban renewal. With the housing fair Bo01, the western harbor became an exhibition spot to showcase a mixed-use district with focus on sustainability. The former, in combination with the development of a new university in the city, became a catalysator for the transformation of the harbor areas closest to the inner city in Malmö from industry to mixed-use. In 2019, the comprehensive plan for Nyhamnen, a harbor area north of the central station, was approved and in the concluding chapters of the plan, future areas for development in the harbor has been proposed by the municipality. Mellersta Hamnen is one of those areas.



The harbor area in Malmö with the building footprint of proposed building structure in Nyhamnen by Malmö municipality

MELLERSTA HAMNEN

Mellersta Hamnen is located in the northern part of Malmö in a harbor area undergoing a transformation from industry to mixed housing. The current uses of Mellersta Hamnen are mainly for industry, logistics and storage where the latter appropriate the majority of spaces with vehicles from the car manufacture industry awaiting further transportation. As the inner parts of Malmö grows further into the harbor area, the municipality sees possibilities for a more efficient land use in the harbor that incorporates a mixed urbanity. The opportunities to connect the city with the waterfront as well as creating district close to regional public transportation are further arguments for transformation the harbor area. The planning and development of Nyhamnen, a harbor area south of Mellersta hamnen and northeast of the central station is already in motion by the municipality of Malmö. In the comprehensive plan for Nyhamnen, the municipality highlights the direction for future developments and propose the parts of Mellersta Hamnen closest to the inner city as a future area for urban renewal (Malmö Stad, 2019).

The proximity to regional transportation and the water as well as a more efficient land use is being highlighted by the municipality as qualities and opportunities for a mixed-use area in Mellersta Hamnen.

PURPOSE

The purpose of this thesis is to explore various ways to analyze, achieve, formulate and/or calculate density in urban areas. I also intend to explore and use density as a design tool in a Swedish context on a proposal in Mellersta Hamnen, Malmö. Further on, I also want to explore how density impacts public spaces and how the public spaces can take form in denser urban areas based on current and future challenges as well as site-specific challenges, in my case, rising sea levels and a disconnected waterfront area.

RESEARCH QUESTIONS

- How can density be used as an urban design tool?
- How can public spaces be designed in dense urban areas?

THESIS FRAMEWORK

The first part of the thesis is to explore various ways to achieve, formulate and/or calculate density. I intend to explore the Spacemate theory and conduct studies to several existing urban areas in Malmö, observing the density and urban form. I will also do an overview of ongoing research and best-practice in the field of urban development with focus on density and sustainability.

The second part is to formulate the strategies and design principles that will be a synthesis of the overview and density site studies and will influence how density can be used as a design tool as well as how publics spaces can be designed in ways that contribute to sustainability in a denser city.

The design part of the thesis is the application of the strategies and design principles on the chosen site, Mellersta Hamnen in Malmö, in combination with site-specific challenges and opportunities.

The thesis will be concluded with discussions related to the research questions and final design.

METHOD

PHYSICAL DENSITY STUDIES
Analyzing the physical density in selected urban areas in Malmö to explore and define the density of the city by the use of spacemate. The density values from the spacemate analysis will be used to define a preferred density for the design of Mellersta Hamnen

PERCEIVED DENSITY STUDIES
Analyzing the percieved density in selected urban areas in Malmö to explore and find qualities in the different density of the city by the use of visual studies. The qualities from the analysis will be used to formulate design principles and solutions for the design of Mellersta Hamnen

GENERIC MODELING
The density values and the qualities from the spacemate study and the visual study will be tested in a generic 3d-model to explore and visualize the findings from the analyses.

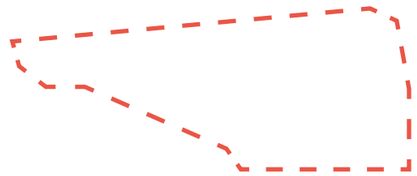
THE DESIGN OF MELLERSTA HAMNEN

STRUCTURAL PLAN
The structural plan will be used to show the relations between Mellersta Hamnen and the surroundings as well as the overall structural order of the design site. The scope of the structural plan is around 50 hectares

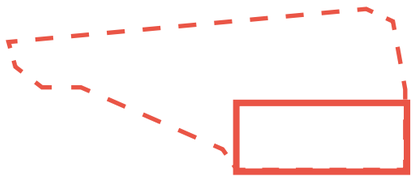
The structural plan will highlight the following topics:

- Network
- Connections
- Public spaces
- Nodes
- Block structure

FOCUS PLAN
The focus plan will be more detailed than the structural plan and show the first steps of the proposed development. The focus plan is also the scale where the findings from the studies will be further explored in terms of detail and depth.
The scope of the focus plan is 20 hectares



Boundary of the structural plan in dotted lines



Boundary of the structural plan with the focus plan area

DENSITY: THEORY & PRACTICE

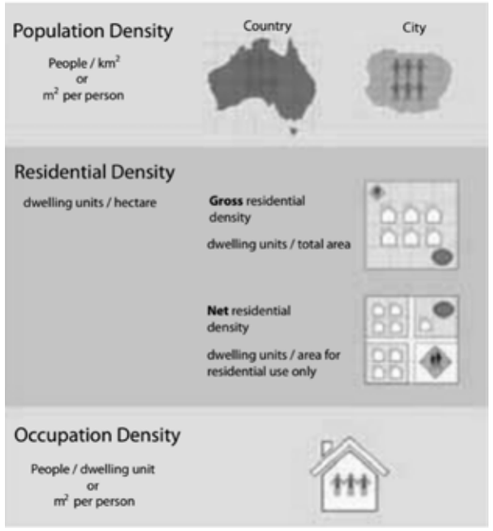
Streetscape in Vallastaden, Sweden, that can be perceived differently depending on cultural background.

AN INTRODUCTION TO DENSITY

In the field of urban planning and design the term density can be broad, with many different definitions depending on the use of the word. In some contexts, density can mean the number of inhabitants that populate an area, causing a higher density to be associated with a higher number of people. Population density can thus tell us how many people that inhabit a certain area, but it tells very little about the physical form. The former is however a good telling of how dense an area is between the people when measuring amount of inhabitants per square meter (Cheng, 2010). Another aspect of the term density relates to the extent of buildings in an area, such as calculating the amount of habitable floor available as seen in the use of floor space index (FSI). The use of building density tells us a different story than the population density by describing the urban form, but nothing about the people living there. Further on, other urban components such as the amount of green spaces in a given area, can tell us how about the density of the greenery (Cheng, 2010). What this way of seeing density has in common, is the measurement of something in relation to a place. Thus, density can tell us about the intensity or concentration of a particular subject in a given area. By defining the physical density with numerical measurements of subjects such as buildings, dwellings or people, the usage of the term can be objective and quantifiable (Cheng, 2010).

It is also relevant to consider that the term density has geographical and cultural differences, a topic that Churchman discusses in her unraveling of the term. Different ways of measuring, such as the use of metric or imperial systems as well as different standards for subjects such as average dwelling sizes makes the concept of density fuzzy. Thus, countries all over the world can have contrasting views and uses of density and the likewise applies to how different people perceive density (Churchman, 1999). What is deemed a high-density development or urban area in an Asian or American context can differ from a European viewpoint. A similar case can be made based on what culture one is accustomed to. For example, an individual that has lived their whole life on the countryside would surely have a different view of the density in Malmö, than an individual acquainted by the city. Another example is a quick reflection of an assumed experience of the streetscape in Vallastaden, Sweden (See picture above). An individual accustomed to a Nordic climate can perceive the shaded street as something negative due to lack of sun hours while a person from an area with warmer climate could get a positive perception of a shaded and chilly space. As Chang discuss, it is not about the factual density per se in the perceived density but about the interplay between the individual and the physical density (2010). Thus, how we perceive density in our urban environments can differ quite a lot depending on the individuals cultural background and experience.

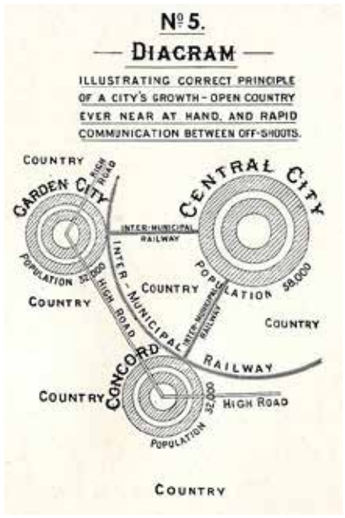
As stated in the beginning of this introduction, the term density can be attributed to a myriad of subjects and while densities concerning themes such as population, dwelling or buildings can be interesting at an overall glance, urban



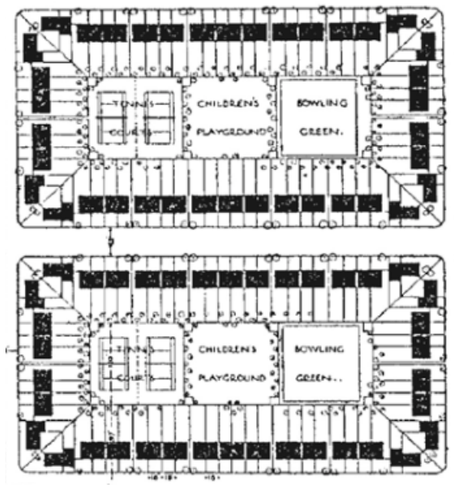
Different ways of measuring densities around the world (Blake, 2012)

researchers, such as Cheng (2010) and Berghauser Pont & Haupt (2009) argues that the use of density is highly dependent on what kind of task one wants to communicate. For example, if a goal would be to secure sufficient space for public spaces in an area, the density and amount of open space would be an appropriate subject to measure. However, one can also calculate the amount of people and how much public space that is deemed suitable per person in the same area. Further on, the amount of what is presumed suitable space per person can differ drastically based on cultural or geographical conditions. Thus, it is of importance to know what the aim and context is when measuring and discussing density in the urban environment to prevent misunderstanding or misuse of the term (Berghauser Pont & Haupt, 2009).

With the various discussions and definitions handled above, the physical density can be reduced to the compactness of a particular subject in a given area while the perceived density can be defined as the interaction between an individual and the physical environment.



The Garden City growth diagram (Howard, 1902)

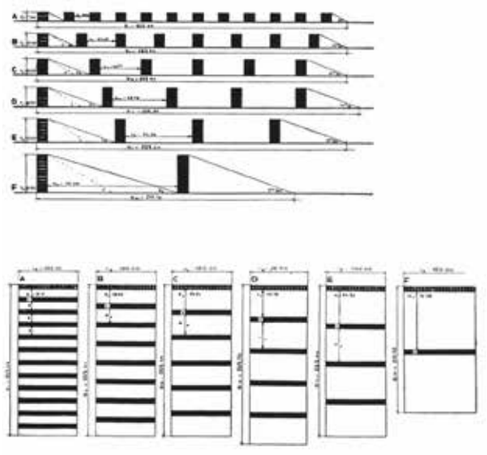


Unwins Scheme II (Unwin, 1912)

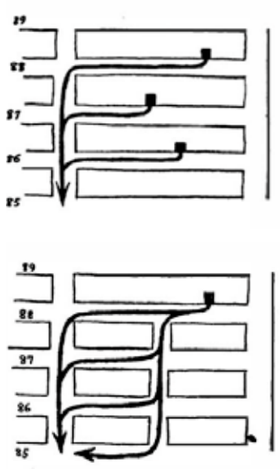
DENSITY THROUGH THE TIMES

Density, or dense urban settings, have through the times been tackled and ascertained by a plethora of architects, urban planners, critics or similar. The urban planner Ebenezer Howards (1902) contribution to the topic of density in urban areas is the garden city, a reaction that originated from the unhealthy and crowded industrial cities in the beginning of the 20th century, envisioned to be a place where people and nature could harmoniously live together without the consequences of a dense city (overcrowding, air and noise pollution) and countryside (sparce population, lack of jobs and functions). By combining city and country, a symbiosis of the strengths in both urban and rural spectrums could be reached to achieve an ideal balance. Howard argued that a town could only hold a set amount of people to maintain the equilibrium and proposed development of new satellite towns when an area had reached its limit. The forms of the garden cities were to be clusters of towns surrounded by greenbelt around a main city hub, all connected by a railway (Howard, 1902). Unwin (1912), similar to Howard, argued that an area could only be populated by a set number of people in his work "Nothing gained by overcrowding" and proposed of an ideal density of 12 dwellings per acre in order to circumvent the overcrowding of both people and structures. A common notion between the previous authors is that the city as they knew it, with overcrowding and unhealthy environments, was too dense. The latter a subject they handled by setting limits on the density in the form of population, plot size or dwellings as a way to achieve healthier urban setting with sufficient capacity for green open spaces and infrastructure.

During the period of 1920-1960, the ideas of CIAM movement, with Walter Gropius and Le Corbusier amongst its members, proposed urban forms based on rational and logical solutions to accomplish healthy environments for the people. According to the modernistic movement, the functions of the cities should be separated, be it in car traffic and pedestrian paths to foster safety or in industry and dwelling areas to facilitate healthy living conditions (Mumford, 2019). Gropius (1962) argued that there were rational economic benefits in the proportions between buildings and open space. Taller buildings would put less pressure on non-built ground, while still providing the same or more dwellings than denser but lower height buildings, thus freeing up space for greenery as well as greater access to sunlight and air. A vital part in the ideas of Gropius was that the height of the building structure had a relation to the width between adjacent ones, alas the taller the buildings were, the wider distance of open space was needed to facilitate sufficient qualities such as sunlight (Gropius, 1931). This modernistic approach to city planning, with spread out functions, monolith buildings and extensive open spaces,



Economic Comparison of building heights and open space distance (Walter Gropius, 1930)



The social benefit of short blocks (Jacobs, 1961)

was opposed by the urban critic Jane Jacobs (1961) in her work The Death and Life of Great American Cities. Jacobs argued that the modernistic urban planning had depleted the public spaces in the city of life and vibrancy and sought a planning that prioritized the social aspects in the city. Contrasting to previous mentioned authors that had a maximum restriction of density (Howard, 1902; Unwin, 1912), Jacobs argued for a minimum limit of 250 dwellings per hectare to achieve sufficient urban vitality, and in extension a basis for a livid streetlife where social interactions between people could prosper. Additionally, the author proposed a dense and diverse city with mixed use of functions such as dwellings, commerce and meeting spots as an integral urban form to further foster social values such as safety, community and equity (Jacobs, 1961). Pafka suggests that the limit of a minimum value of dwellings was adopted by Jacobs to specify density, in lack of other methods at that time. Alternatively, the use of dwellings per hectare functioned more as a descriptor to ensure an adequate density of inhabitants, workers and attractions in a given area to promote lively neighborhoods (Pafka, 2013).

In contemporary times, higher urban densities have been argued as an essential approach to benefit sustainable development and economic growth (Jenks et al.,1996). The compact city, with a higher share of concentration in urban components, is argued to handle the threat of global warming by shorten the distances between the functions in the city and decreasing the reliance on motor traffic for mobility and transport. Further arguments are the preserving of peripherical agricultural lands or green fields by developing on already built land in order to maintain important biodiversity areas and food resources (Hillman, 1996). While the density and the absolute numbers it should have in terms of population or built components was set in ideas by Howard, Unwin and Jacobs, there is little consensus about it in contemporary dense developments. Willam, Burton & Jenks claim that the compact city is more of an idea than a model, having no clear or completed form that can be placed in any urban area. They argue that the process of densifying or intensifying the city with a higher share of people or functions as a direction to reach a compact city and reliant on site-specific circumstances, such as existing city structure and demographics (Willams, Burton & Jenks, 1996). The density in a compact city can thus be something that is very reliant on the context and the use of the term is dynamic.

SUSTAINABILITY	**ADVANTAGES**	**DISADVANTAGES**
SOCIAL	• Active and vibrant public spaces • Developing a sense of community	• Overcrowding • Safety
ENVIRONMENTAL	• Reducing need for development on existing agriculture and green areas • Reducing energy consumption • Promoting use of sustainable mobility such as walking, cycling and public transport • Reducing greenhouse gases emissions	• Increase in traffic in city centers • Risk of heat island effect in high dense urban areas • Higher density puts pressure on open and green spaces
ECONOMIC	• Fostering social equity in reducing cost of transport and need for private cars • Viability of investment on public transport • Viability of new jobs	• Increase of density without consideration for jobs and housing market • Appropriate ratio of facilities and services can be hard to reach for a larger concentration of population in an area

Advantages and disadvantages of higher density from a sustainability perspective (Nikeghabli, 2017; Berghauser Pont & Haupt, 2005)

DENSITY AND SUSTAINABILITY

As mentioned earlier, the ideas of a dense compact city in contemporary times are often seen as a necessary strategy to foster sustainable development. There are however conflicting arguments how the compact city can be sustainable. Some common concerns are that a higher density brings forth unhealthy living conditions with overcrowding, noise, and air pollution. However, a dense area can also be beneficial to the population's health by having higher share of functions in close proximity, making walking attractive among the inhabitants and lessen the reliance on the car (Hillman, 1996).

One of the main benefits by a higher density is claimed to lie in the environmental sustainability. The increased growth in population in combination with a rapid urbanization put pressure on areas in the city to be developed to offer sufficient housing. By building more concentrated and with higher intensity of buildings and functions in areas already developed, there lies possibilities to avoid encroachment on agricultural land and green spaces (Nikeghabli, 2017).

There are also arguments to be made about how higher urban density can benefit the social sustainability. Jacobs was an advocator of cities with medium or high density and highlighted the beneficial aspect in terms of activity and vibrancy that the former mentioned densities bring in comparison to American suburbs with low density. With a greater vibrancy, comes greater possibilities for social interactions between the locals that in extension can foster the community and social cohesion in an area (Jacobs, 1961). The improvement of social equity among inhabitants in higher density areas has also been shown in studies by Burton (2005). The author concludes that areas with higher density makes it possible for equal accessibility in services amongst inhabitants of different social and economic classes in a city. Meanwhile, Neuman brings forth the dilemma that a dense city has in in relation to sustainability and quality of life. According to the author, the presence of green areas and the perception of safety is regarded as factors that contribute to a higher quality of life, qualities found in lower density areas (Neumann, 2005).

The urban researcher Næss suggests that a sustainable type of urban planning must try to minimize the health-threatening effects that increasingly dense cities entail in new densification projects and try to correct the already built environment for the better. The author emphasizes that urban planning should instead take advantage of the benefits that the dense city brings but avoid the most negative consequences. The densely built environment should be adapted where possible and future planning should, according to Næss, consist of something between dense and green where both qualities should be co-existing (Næss, 2013).

In the chart above, some of the common advantages and disadvantages of a higher density have been compiled. As seen in the chart, higher density developments are not fully devoid of unfavorable outcomes, but considering the alternatives in our contemporary climate, the positive aspects is often argued to outweigh the negatives.

Variation and concentration of social values in public spaces (Ståhle et al., 2016)

DENSITY, GREENERY & PUBLIC SPACES

Jenks (2012) articulates that the size of green spaces influences the quality of biodiversity. Fragmented green spaces of smaller sizes, often utilized in denser developments, are less likely to favor biodiversity than larger scale parks. Berghauser Pont & Haupt highlights that an increased density often also raises the strain on green spaces as a consequence (2010). In other words, a denser development can hinder biodiversity and accessibility to green spaces due there being less space for a cohesive greenery.

Ståhle et al. has in their extensive studies about measuring components in the urban city, landed in recommended values regarding distances for and to greenery and public spaces. According to the authors, there should be a minimum walking distance, from the home of the inhabitants, of 200 m and 500 m to green areas larger than 0,2 ha and park areas larger than 1 ha, respectively. The authors also conclude that the amount of built ground should not exceed 40% in order to facilitate enough room for streets, public spaces and private spaces (Ståhle et al., 2016).

The streets also play an important mediator between public spaces in the dense and compact city. Streets that connect or involve public spaces in a given area with the surrounding ones have the opportunities to offer a familiarity and facilitate integration. By having a variation between intimate and more open streetscapes, there exists greater possibilities to offer spaces for different uses and preferences (Ståhle et al., 2016). Akin to the former authors, Wen et al. (2020) argues for a new perspective of streets as public open spaces, when planning and designing, by seeing the streets as part of a green gridlock system instead of only communication ways for traffic. Comparable, Malmö municipality proposes shared use of parks with functions such as schools as well as green paths that connects greenery, points of interests and/or recreational areas a strategy to foster both biodiversity and social interactions as a strategy in a higher density development (Malmö Stad, 2019). The greenery and the streets can thus be a quality in higher density developments that can be incorporated and interplay with the spaces and functions between and in the buildings.

Ståhle et al. also highlights a higher concentration and variation of functions and uses in regard to public spaces as a way to reach synergy and diversity in the urban environment. Just as a biotope describes what kind of ecological values a place can have, the likewise logic can be applied to social values. The authors use sociotope as a term that describes the social values in a place, where the latter can be urban qualities such as walking paths, spaces for play or vibrancy. They also suggest that different social values can be combined and cooperate with each other in an area, such as a café in close proximity to a playground creating possibilities and activities for both parents and kids to visit a place (Ståhle et al., 2016). Thus, Public spaces or paths in the urban environment can involve multiple uses and activities, see social values, as a way to offer a diversity in denser cities.

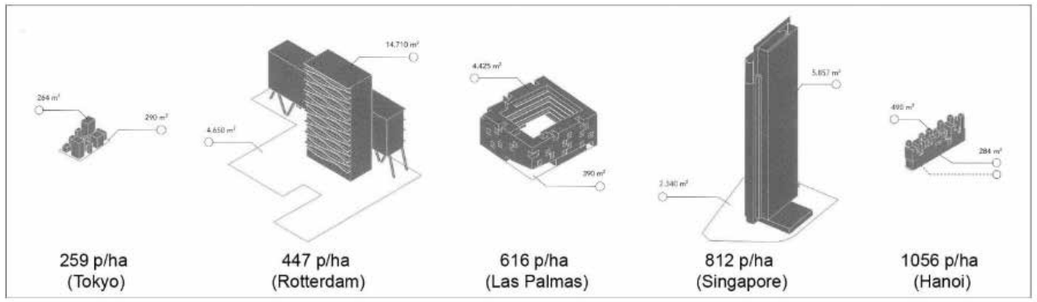
Above: Example on how greenery and seating can be incorporated with other functions in the streetscape. Street in Frankfurt am Main, Germany

Below: Example on how the spaces between buildings can be part of a green network. Arabella Park in Munich (Wen et al., 2020)

Floor Space Index (FSI)=

GROSS FLOOR AREA

PLAN AREA

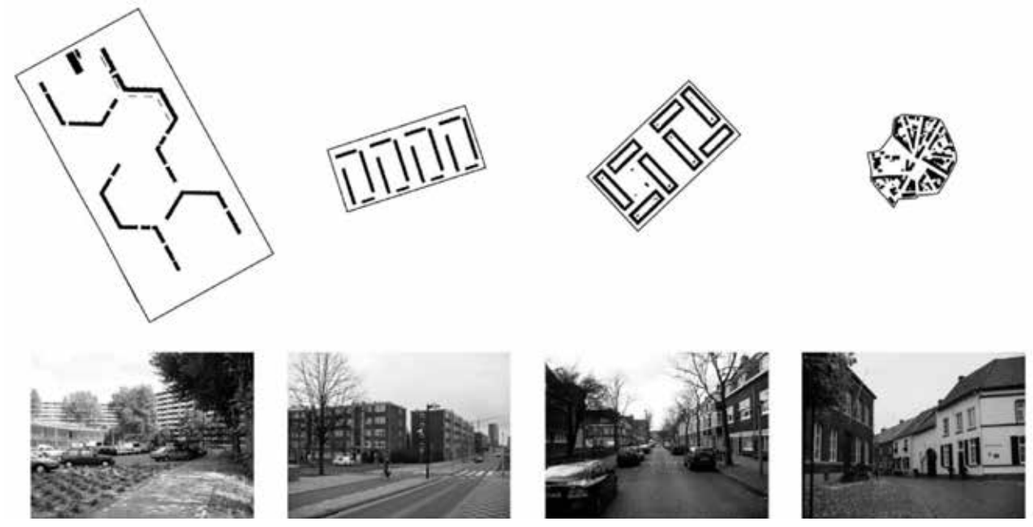


Examples of apartment buildings with a density of 210-230 dw/h (Pafka, 2013)

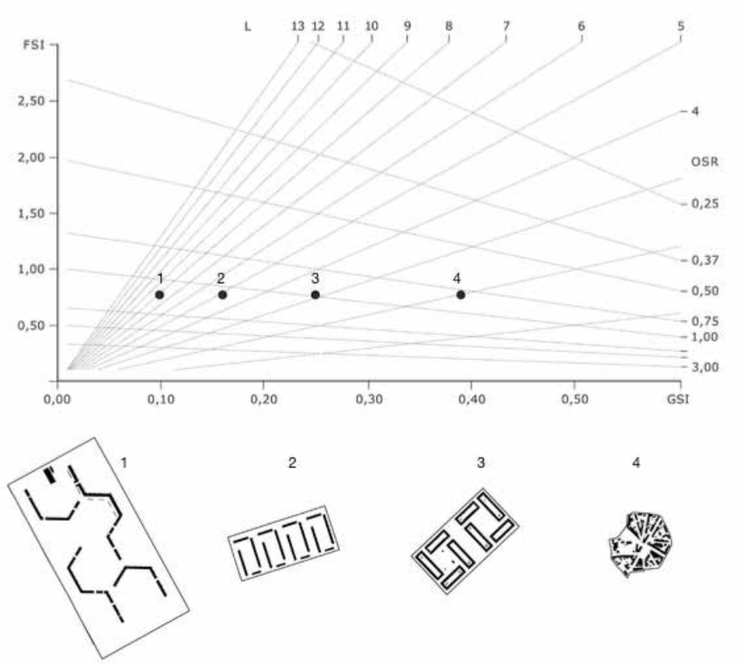
MEASURING PHYSICAL DENSITY

As problematized in the introduction chapter of the term density, the definition is broad and the likewise applies to the measurement of density. Urban theorists, such as Ng (2010) and Jenks (1996), argue that the measurement of density is a topic with none or little consensus regarding a unified method. The former due to different kind of units in use in different parts of the world such as acres, hectares and square meters as well as different measurement methods. The use of dwellings per hectare, plot ratio or habitable room per hectare are common measurements of density in the United Kingdoms (Nikeghabli, 2017). In a Swedish context, the regulation of building heights, plot size and street widths has been a way to control density (and in some manner measure it) as seen in building codes through the late 19th century and the early 20th century (Rådberg & Friberg, 1996; Boverket, 2016). Another prevalent way of measuring density in contemporary Swedish planning is the use of floor space index and population density (Malmö Stad, 2018). The former can be exemplified with the amount of habitable floor space in an area and the latter with the number of inhabitants in an area. In order to achieve sufficient outdoor spaces for schoolchildren or recreation, the calculation of amount of non-built ground in an area is another method to define the density of open spaces in planning (Malmö Stad, 2018). What the aforementioned methods have in common is that they use a single variable to measure the density of a particular topic.

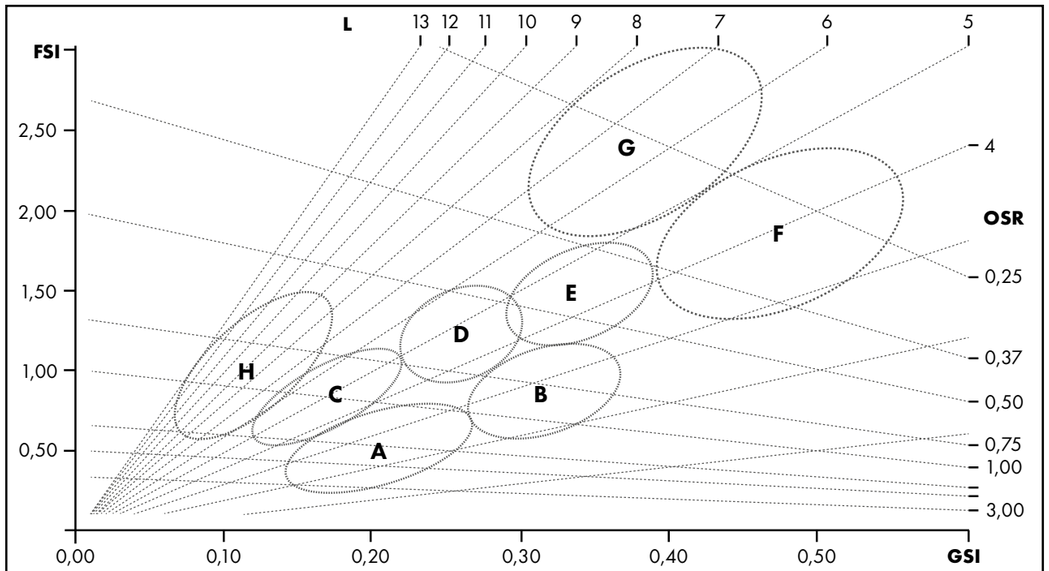
However, single variable measurements of urban density, such as only measuring floor space index in an area or the population density, have been demonstrated to be limited in studies by Dovey and Pafka (2013). The authors conclude that our urban environments are complex and possesses multiple layers of dimensions, factors that are tricky to condense to measurement of a single variable in order to fully reflect the densities of our urban areas. Berghauser Pont & Haupt (2005) exemplifies the problematic use of single variable measurements in their comparison of density in four neighborhoods in the Netherlands. While the studied areas possess the same floor space index, the urban form differ between them. Further on, Pafka (2013) problematize the measurement of dwellings per hectare (dw/h) by highlighting that different countries around the world have different average sizes for dwellings, thus areas with a density of 210-230 dw/h, as exemplified by the author, can have very contrasting urban forms depending on socio-political contexts. Alas, the measurement of a single variable in urban densities aren't specific enough to adhere to defined urban forms. Both Pafka (2013) and Berghauser Pont & Haupt (2005;2009) argue for a multivariable approach in order to better reflect the densities of our urban environment, where the latter mentioned authors have developed the Spacemate method to measure density.



Examples of urban forms with FSI of app. 0.7 (Berghauser Pont & Haupt, 2005)



Spacemate digram with four examples of areas with the same FSI but different GSI, OSR and L (Berghauser Pont & Haupt, 2005)



A. Low-rise spacious strip development blocks
B. Low-rise compact strip developments blocks
C. Mid-rise open building blocks
D. Mid-rise spacious building blocks
E. Mid-rise compact building
F. Mid-rise closed building
G. Mid-rise super blocks
H. High-rise developments

Spacemate chart showing the FSI, GSI, OSR and L variables and a classification of defined urban forms (Berghauser Pont & Haupt, 2005)

THE SPACEMATE

The basis for the Spacemate method is the use of four variables to measure and define physical density in a determined area, by including the Floor space index (FSI) in combination with the Ground Space Index (GSI), the Open Space Ratio (OSR) and the Layers (L). The FSI measures the intensity in an area by calculating the amount of gross floor area through the plan area. The GSI indicates the compactness of an area by calculating the amount of built-up ground. The pressure of on open space, OSR, is accounted by the amount of non-built area per gross floor area and can be explained by how much room there would be in open spaces if every people would leave the buildings at the same time in an area. Lastly, the average numbers of floors in an area concludes the L variable and aims to assess the heights among the buildings. Berghauser Pont & Haupt exemplifies, in their study of urban areas in the Netherlands (See example chart above), that the Spacemate method is specific enough to describe density with a distinct urban form and thus reflect the densities in our urban environments to a greater degree (2005;2009).

By using the four variables when calculating the density of a given area, every area can be adhered to a particular spatial footprint or urban form. Further on, the calculated density values can be inserted into the Spacemate chart, opening up the possibility to compare the densities of the different investigated areas. Thus, areas with the same FSI, but different GSI, OSR and L values, can be distinguished from each other. Berghauser Pont & Haupt contend that the use of Spacemate can aid the process of defining density for an urban development project, both for policymakers and urban planners/designers, by presenting a transparent relationship between measurement units and visual representation. The use of numerical numbers, originated from existing measurement of the variables, facilitate an objective character of the density when used in processes such as decision-making or design (Berghauser Pont & Haupt, 2005).

Berghauser Pont & Haupt (2009) argues that it is of the essence to distinguish where the outer boundaries for measurement are drawn in order to achieve comparable results between areas when calculating density. The former is apparent in situations when the calculation of density includes more than the building blocks, as in a district with a lot of additional open spaces such as parks or water bodies. While a building block can have a clear boundary of adjacent streets, there can be much confusion about where to draw the lines in a district. Depending on the amount of adjacent open space to the buildings, calculations of density can differ a lot. A district where open spaces such as parks or parking is included in the measurements will be less dense than an area without, despite both having the same amount of buildings. The method of drawing an areas borders should in other words be consistent between investigated areas and follow the same set rules. This is in line with Rådberg and Fribergs reasoning in their studies of urban forms and densities of Swedish cities (1996). While the authors included the single variable use of FSI in their calculations of Swedish neighborhoods, the measurements followed a criteria of set rules in order to make comparisons manageable such as placing the outer measurement lines in an investigated area in the middle of adjacent streets of the building blocks or by a set distance into green areas.

However, as there has been different set of criteria in the aforementioned methods and studies regarding the way to measure variables such as FSI and its border area, this thesis will formulate the rules for which the Spacemate studies will adhere to. As long as all the investigated areas follows the same criteria as each other, it will be possible to reach comparable results.

To conclude, the use of Spacemate would be favorable to achieve a greater comprehension of the physical density in an area. By having more variables in the calculation, a greater understanding can be made of the densities in an investigated area.

Diagrams of how the density variables can calculated in the Spacemate method

The Intensity: Floor Space Index (FSI)
the amount of gross floor area in an area

The Compactness: Ground Space Index (GSI)
the amount of built-up ground in an area

The Pressure on Open Space: Open Space Ratio (OSR)
the amount of non-built area per gross floor area

The Height: Layer (L)
the average number of floors in an area.

Floor Space Index (FSI)=

$$\frac{\text{GROSS FLOOR AREA}}{\text{PLAN AREA}}$$

Ground Space Index (GSI)=

$$\frac{\text{BUILT AREA}}{\text{PLAN AREA}}$$

Open Space Ratio (GSI)=

$$\frac{\text{PLAN AREA} - \text{BUILT AREA}}{\text{GROSS FLOOR AREA}}$$

MEASURING PERCEIVED DENSITY

Cheng, in her effort to unravel the perceived density concept, highlights several factors that can influence the individual's perception of the density in the urban environment. Building heights, the openness and complexity in spaces, the amount of people, activity, the street layout, the diversity in building facades and the green spaces being components proposed and shown in research to make an impact on an individual's perception of density (Cheng, 2010). Likewise, in a literature review by Emo, Treyer & Schmitt, the authors identified 6 parameters, that they suggest have an influence on the individual's perception in urban density, being: visibility, amount of buildings, street widths, amount of visible sky, amount of green spaces and amount of vehicles (Emo, Treyer & Schmitt, 2017). Further on, in a questionnaire conducted by the authors, they conclude that a higher amount of visible sky and greenery as prominent factors that gave the impression of a lower density among the participants, while a higher presence of visible buildings and vehicles was experienced as higher density (Emo, Treyer & Schmitt, 2017). The urban researcher Nasar has identified variation, spaciousness, greenery, historical connection, order and maintenance as aesthetic parameters that contributes to a person's perception of the urban environment. A higher amount or stronger relation to the aforementioned parameters tend to contribute to a positive perception and the opposite for negative perceptions (Nasar, 1998).

As stated in earlier chapters, the perceived density is more about the interaction between an individual and the density in an area than the de facto physical density. Therefore, there lies a great complexity in understanding the perceived density in an area. The measurement of perceived density is also a fuzzy matter, with no consensus in the academics about an optimal or unified method. Thus, a decision needs to be made in this thesis about how the perceived density will be studied in the investigated areas. Since this thesis is focused on the urban form aspect of density (and not other density aspects such as population density) the perceived density studies will evaluate the impact of buildings (heights and footprint), open spaces (Streets and public spaces) and greenery. Based on the literature review above, the identified aesthetic parameters of variation, spaciousness and greenery will be used when evaluating the areas to be investigated in Malmö.

Variation: A greater variation in the urban environment has been shown in studies by Nasar to contribute to a positive perception of a place. According to the author people tend to appreciate urban environments with a high variety in building structure and streetscape. The essence of the variation lies in the complexity in our urban environment and involves urban components such as forms, colors, sizes and materiality. But a higher complexity does not always equal a positive perception, and a moderate and organized complexity is suggested by the author to avoid a chaotic urban environment, the latter a factor that can contribute to a negative experience. Likewise can be said for areas that are too monotonous in their urban form, such as areas with high-rises and generous open spaces or low-rise but little open spaces (Nasar, 1998).

Greenery: The presence of greenery in an area is a major factor when experiencing a place. The components in the greenery parameter also includes water bodies, mountains and natural height differences. Nasar highlights that places with a prevailing amount of greenery were appreciated by the respondents while areas with no or little greenery was perceived as negative (Nasar, 1998).

Spaciousness: The amount of spaciousness in a place also contributes to the perception of the urban environment. Areas with higher possibilities for openness and views was perceived as having a positive impact on the respondents, while crowding and narrow streets was being perceived in a negative matter (Nasar, 1998).

To conclude, the 3 parameters above, being variation, greenery and spaciousness, will be used when investigating the perceived density in Malmö.

EXPLORING DENSITY IN MALMÖ

EXPLORING THE PHYSICAL DENSITY

With the knowledge of how to calculate and evaluate density, the time has come to explore areas in Malmö. But before we can do that, I need to set some criteria for the areas to be investigated as well as describing the process.

DATA
Geodata from Svergies Geologiska Undersökning (Geological Survey of Sweden), in short SGU, will be used to get measurable information about the study areas and its urban components such as a building's footprint, open areas and streets. The accuracy of the data is regarded by the author to be legitimate due to being sourced to the Swedish expert agency regarding geological information. Furthermore, the data from SGU is being used in national, regional and municipal planning by organizations, offices and municipalities. In areas with insufficient or no height data of buildings, the digital atlas service from Malmö Stad will be used to study aerial photos to determine the building levels.

PROCESS
The use of the geographical information system qgis was used to extract the numerical values from the geodata regarding the plan area, the ground floor area and the building heights in the investigated areas. With the former mentioned information, it was possible to calculate the gross floor area of the buildings by multiplying the ground floor area with the height value of the building footprints (FSI) as well as the ground coverage (GSI) and pressure on open spaces (OSR). The average height (L) in the investigated areas was calculated by inputting all of the building entities individual height into a chart to extract the mean value.

Certain areas have building with slanted roofs where the attics has been transformed into dwellings. In this study the former has been measured as a half (0,5) floor to facilitate the measurement of gross floor area.

When all of the variables were calculated, they could be inserted into the Spacemate chart. On the following pages, the result from the physical density studies will be presented with a brief description of the investigated areas.

CRITERA FOR AREAS TO BE EXPLORED

In order to select areas in Malmö for analysis, certain criteria need to be formulated

- The area needs to be located centrally in Malmö. A radius of 4 km from the Central Station have been used in order to localize central areas for this study
- The areas selected need to be of similar size as the focus plan area (around 20 ha).
- The areas selected should have a variety regarding the years it was constructed and developed to show the changes in density over time
- The borders of the study areas will include the whole street due to the influence they have on the character as well as the public space in a neighborhood. When an area borders to an open space such as green park or water body, the border will be set to the edge of the green area and water body respectively.

SELECTED AREAS TO EXPLORE FOR SPACEMATE STUDY

mellersta hamnen
(design site)

bo01

central station

slussen

gamla staden

ribersborg

håkanstorp

sorgenfri

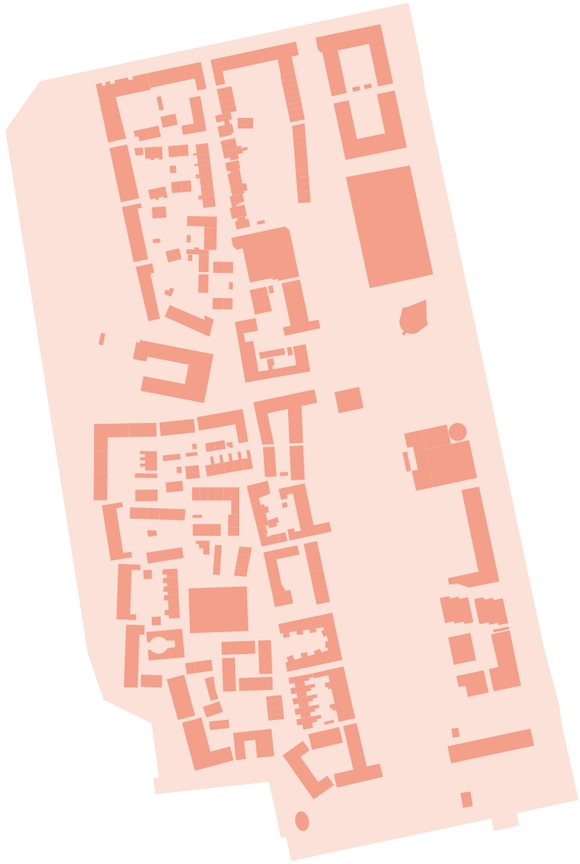
davidshall

möllevången

rosengård

augustenborg

Bo01 (Malmö Stad, 2021)



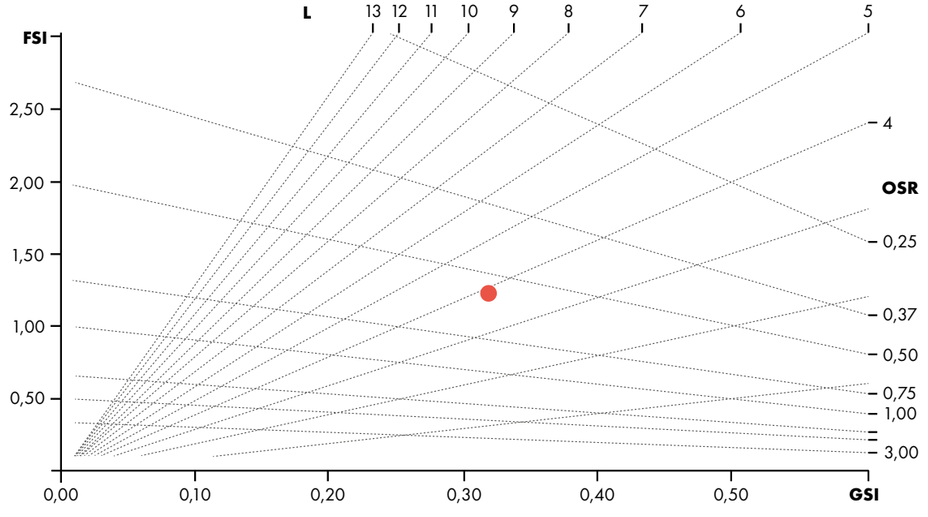
BO01

Bo01 was developed in the start of the 21st century. The housing area is characterized by irregular street patterns with variations in scale in the open spaces. The buildings show a diversity in terms of height, scale and typologies with mid-rise apartments blocks, rowhouses and single-family houses. The public spaces range in scale from large-scale green and blue spaces to pocket parks interwoven between the buildings, offering a positive perception of the density by giving a variation of open spaces. There is sparce of visible greenery in the streetscape that contributes to a negative perception of the density, however the closeness to public spaces with an abundance of green spaces eases the mentioned perception.

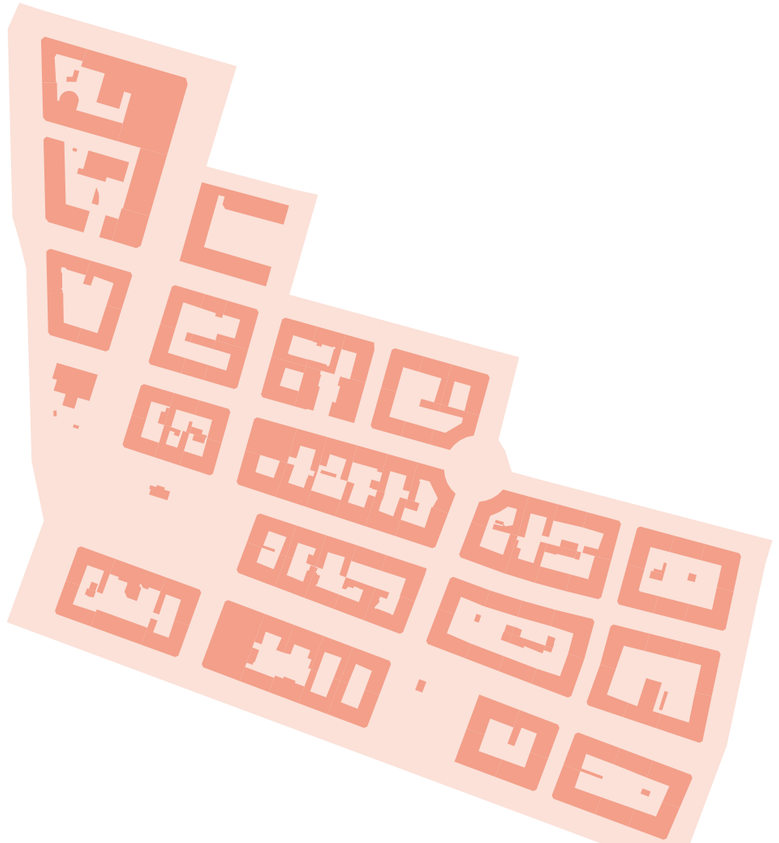
The Turning Torso tower building acts as a landmark and a navigation guide, being visible from almost every urban room in the area. The active-bottom floor is mainly located alongside public spaces or main paths leading through the area, offering a sense of hierarchy to the urban spaces, which in extension gives a positive perception of the density.

Urban form & quality

- North-south & west-east axis urban paths
- Disjointed street network
- Higher density facing larger scale open space
- Diverse building structures
- Active-bottom floors facing public open spaces



Möllevången (Malmö Stad, 2021)



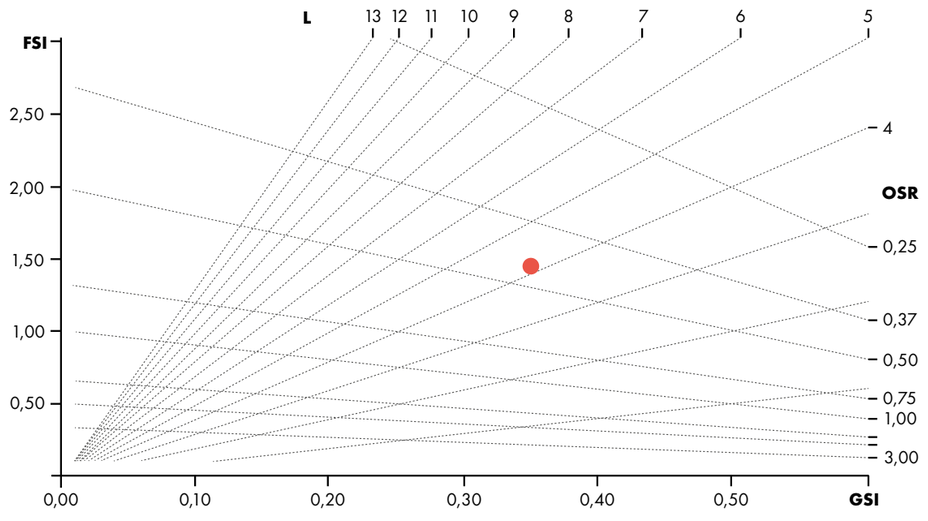
MÖLLEVÅNGEN

The urban form of Möllevången, consisting of mid-rise closed blocks in a grid structure, has its roots from 1903. The materiality of the buildings is mainly brick or stone. The Möllevången Square is one of the main public spaces, located in an open space between three blocks and the main traffic road, and has uses such as being a marketplace as well as a meeting place. Several of the streets have buildings with an active-bottom floor that brings life to the spaces and attention from traffic.

The streets with non-active bottom floors offers a negative perception on density by giving attention to the height of the buildings and vehicles, although in some places the still standing vehicles offers a sense of urbanity to the otherwise empty streetscapes. The streets with greenery, in form of trees, gives a positive influence on the density by breaking the scales and monotony of the otherwise hard surface characterized urban rooms.

Urban form & quality

- Grid plan
- Closed block structure
- Streets with both active- and non-active bottom floors
- Mostly uniform height in buildings



(Malmö Stad, 2021)

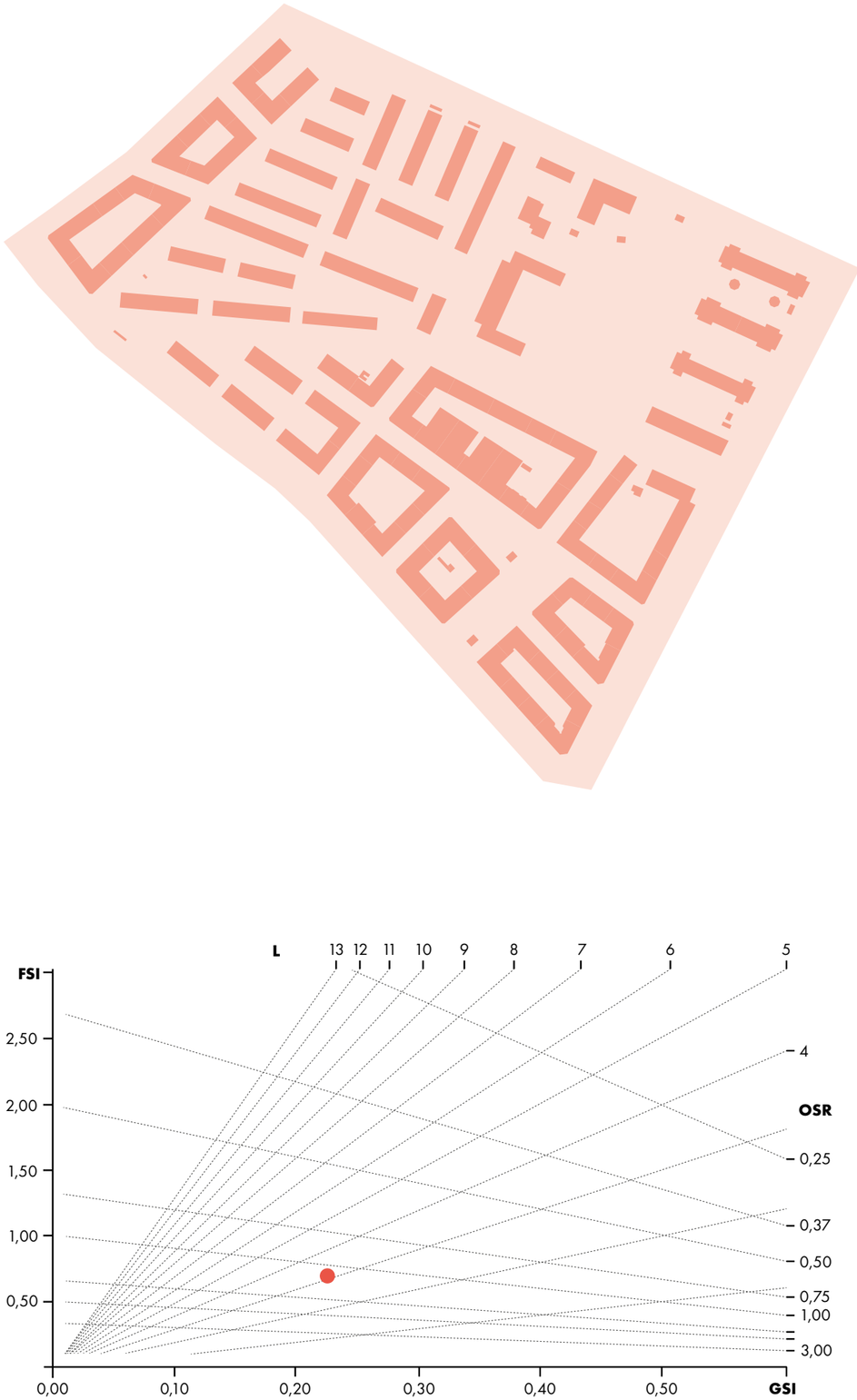
VÄSTRA SORGENFRI

The studied area is constituted of buildings established in the first half of the 20th century with strips houses, rowhouses and closed blocks as typologies. The variation in typologies gives a positive influence on the perceived density in making the area diverse and in extension breaking up the scales. The street network is somewhat disjointed, but the location and concentration of the different typologies serves as a guide in the neighborhood.

The public spaces are made up of several small-scale open areas with different characteristics and uses such as a graveled field surrounded by trees, a dog park, a pocket square at a crossing. The variation and spread of the open spaces contribute to a positive perception of the density. However, nearly all of the streets have spaces for parking and the still-standing vehicles makes the spaces feel dense in a negative way in terms of hindering accessibility and visibility.

Urban form & quality

- Variation of open spaces at several crossings
- Variation of typologies in plan area but clustered on block scale
- Active-bottom floors at crossings and main streets



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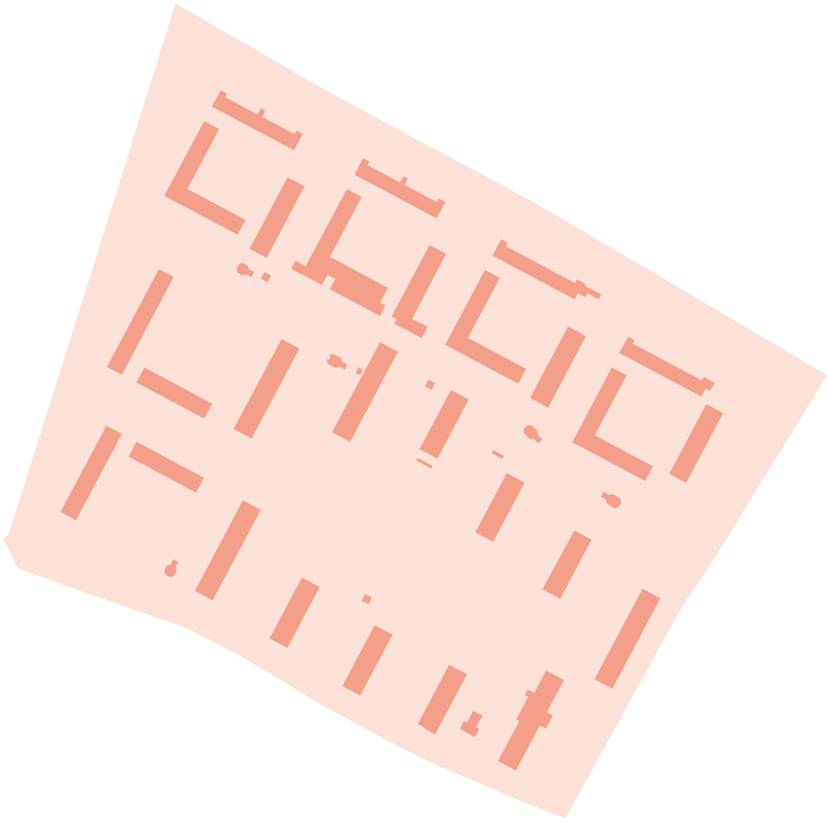


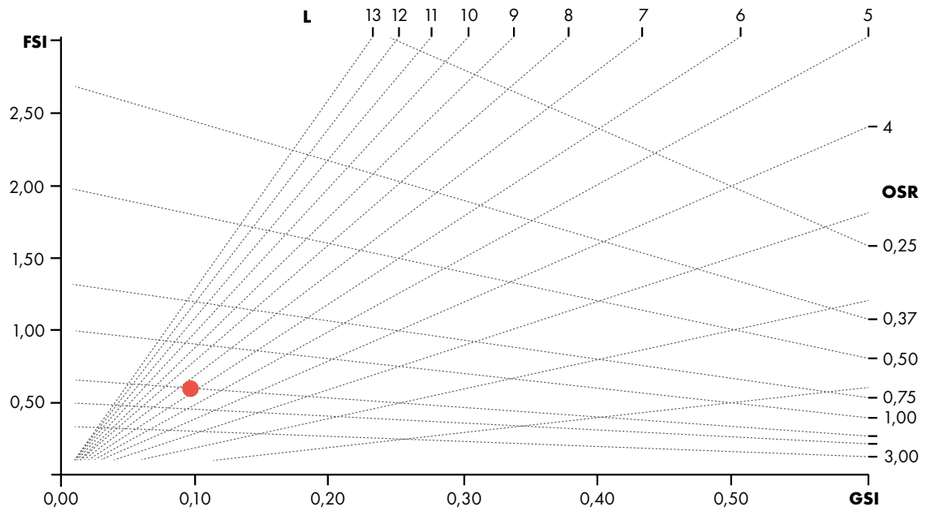
ROSENGÅRD

The area studied was constructed by the year of 1967 and consists of panel housing in either 3 or 8 floors. The vastness of open space and distance between buildings gives the impression of a low density despite several buildings being 8 floors high. The vertical greenery helps breaking up the scale, by giving an element to the area that enhances the perception of higher density. However, the separated pedestrian and motor traffic roads makes the distances and routes around and in the area confusing, giving the impression of a larger area than what may be there.

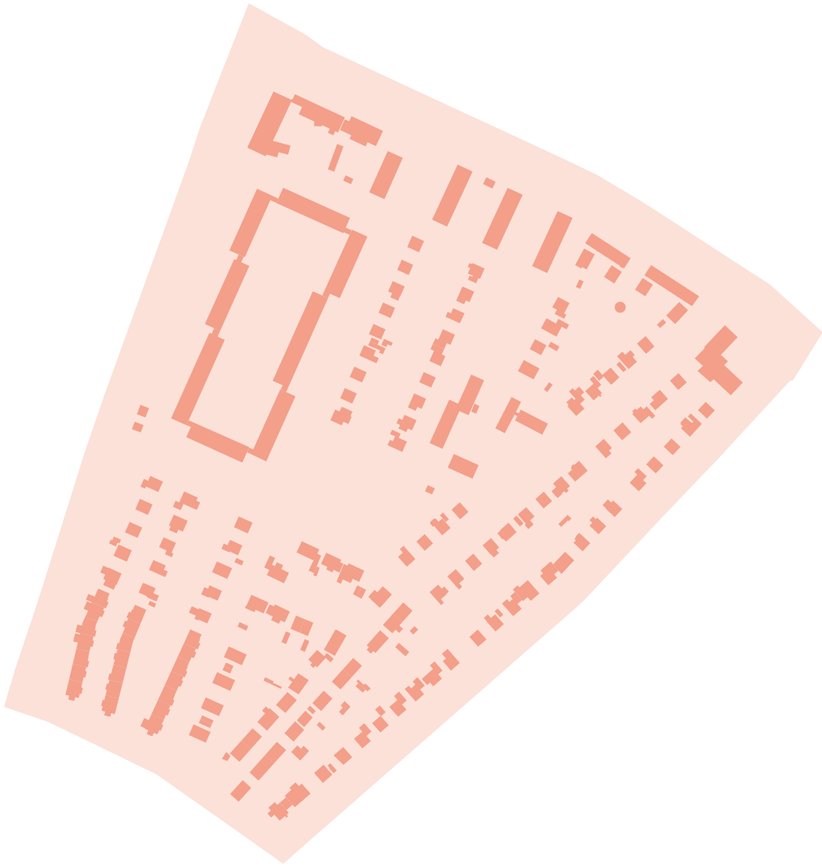
The lack of variation in terms of appearance and form in majority of the buildings makes it hard to navigate in the area, although the area has been densified with lower scale structures (functioning as premises) attached to buildings by the square. The latter helps to bring town the scale in the area as well as giving a different visible structure as a focal point in the urban form, enhancing the positive perception of the density in the area.

Urban form & quality

- Detached buildings from street
- Traffic separated roads and paths
- Lower structures amongst taller ones defines square as a public open space
- High amount of open spaces



(Malmö Stad, 2021)



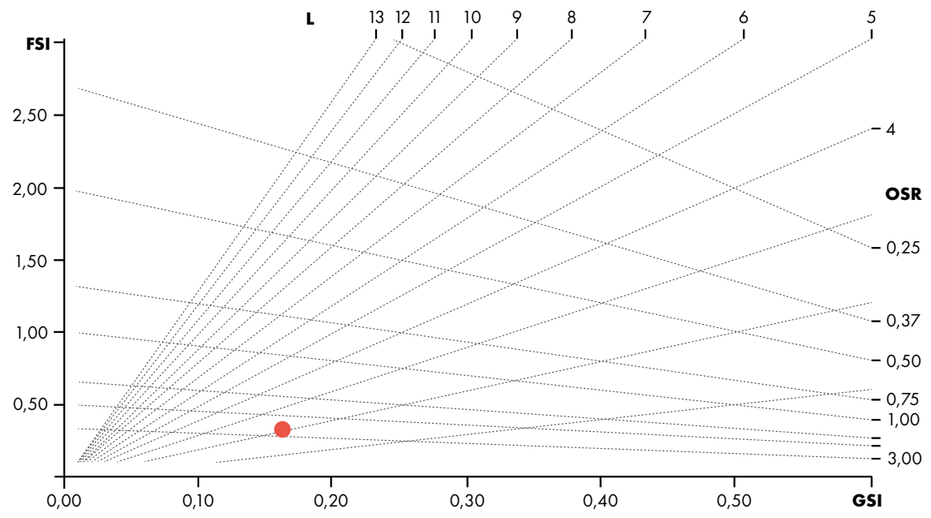
HÅKANSTORP

Håkanstorp is an area mostly characterized by single-family houses. However, the area has changed during the times in terms of urban typologies. In 1905 it started as a suburb to the city with a small dense urban structure. In the 1920, the homeowner's movement (In Swedish: Egnahemsrörselsen, Swedish equivalent of the garden city ideas) housing structure took form in Håkanstorp and further on the area was densified with single-family villas and multifamily housing in 1960's, row houses in 1980's and more multifamily housing in the 1990's.

The open spaces are mostly streets and private yards with the main public space being a green park in the middle of the neighborhood. The street patten is made of an angular grid that makes navigation in the area straightforward. Although, the long distance in several streets before a crossing have a negative impact on accessibility and legibility.

Urban form & quality

- Different typologies in clusters
- High amount of private open spaces
- Streets mainly for communication
- Taller buildings adjacent to main traffic roads



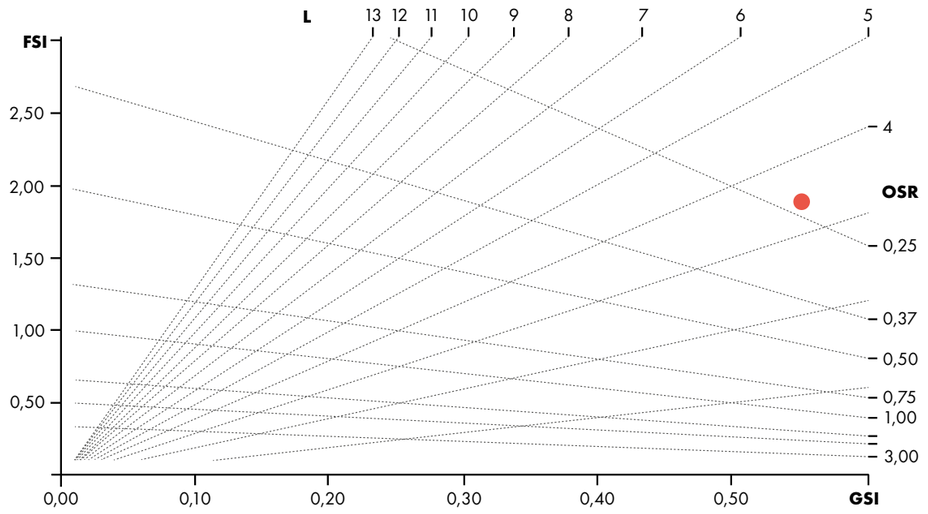
(Malmö Stad, 2021)

GAMLA STADEN

The urban structure of Gamla Staden (The Old Town) with its medieval core has its origins from 1250. The buildings are mainly located in closed blocks with variating heights ranging from 1-7 floors. The streetscape is small scale with high amount of crossings that facilitate navigation in the area. Some structures have been densified with added recessed floor that contribute to a less dense perception of the intimate and narrow streetscape, despite the extra compactness. There is a lack of public spaces as well as open spaces in the investigated area leaving an impression of repetitiveness in the corresponding scales. The myriad of active-bottom floors has a positive influence of the perceived density, adding life and attention in the dense environment, although the narrow streets make some spaces feel overcrowded.

Urban form & quality

- Compact block structure
- High diversity in building structure and heights
- Streets mainly for communication
- Small and subtle variation of intimate open space (street width, crossings)
- Larger scale open space in the form of squares



(Malmö Stad, 2021)

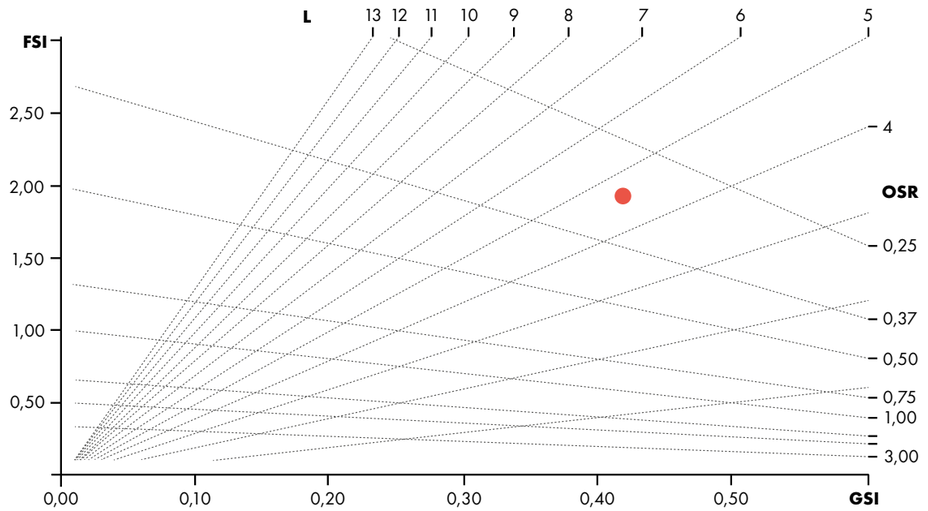
DAVIDSHALL

Davidshall consists mainly of multifamily housing structures from the first half of the 20th century. One of the main open space in the area, Davidshallstorg, is made up of a square, framed by several buildings with both active-bottom and non-active-bottom floors. The perception of the openness that the square gives to the area gives a positive experience of the density. Although a high amount of the open space is used for parking, the narrow, but short, streets leading to the square, Davidshallstorg, gives a pleasant variation in the scales of the urban rooms. The materiality of the buildings is mainly brick and stone.

There is a pedestrian friendly shopping street that offers activity to the area as well as a different choice of moving through the area to adjacent neighborhoods in relation to parallel motor traffic streets. The choice of traveling through the area through crowded, but active, streets as opposed to less crowded, but motor traffic filled, streets is something that contribute to a positive perception of the density.

Urban form & quality

- Closed block structure
- Squares as the main larger scale open space
- Mixture of streets with active- and non-active bottom floor
- An urban network that goes through nodes (squares, commercial streets)s



(Malmö Stad, 2021)

RIBERSBORG

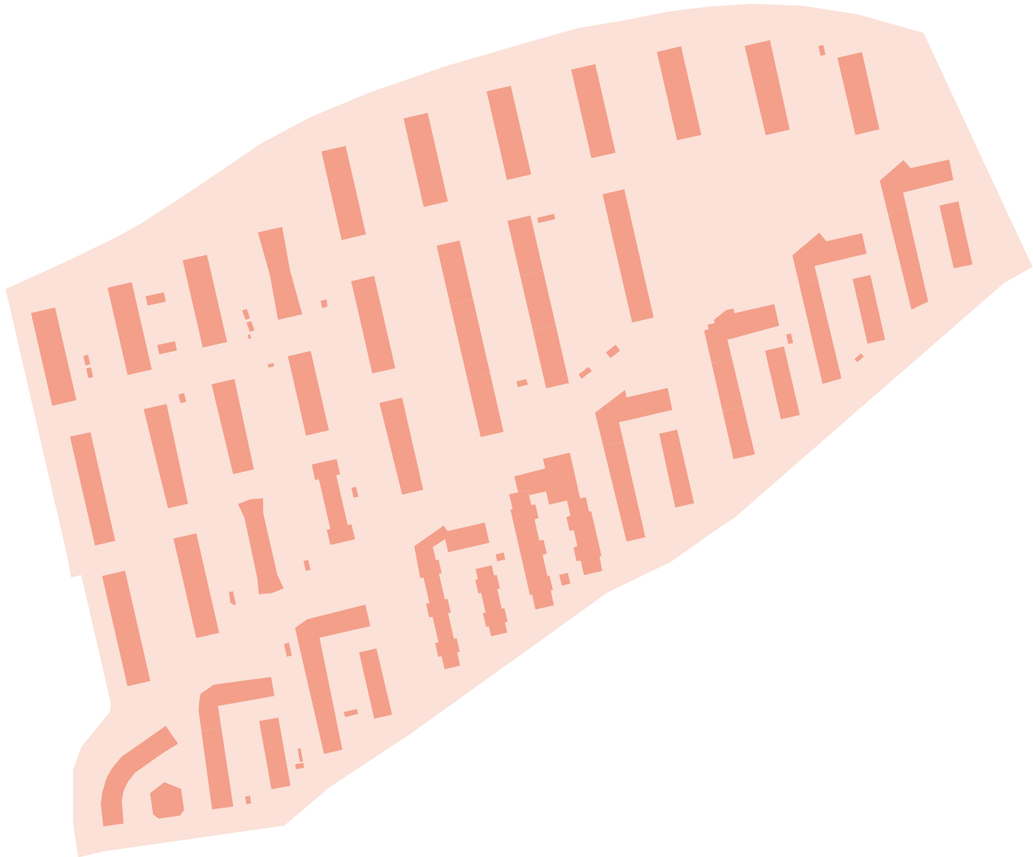
The current urban structure has its source from a city plan proposed in 1936 and the area was fully constructed in the 1970's. The area is characterized by open blocks with either panel houses (with an average of 9 floors) or strip houses (with an average of 5 floors). The wide distances between buildings, both in terms of streets and courtyards, influenced the perception of low density, despite the height of the structures.

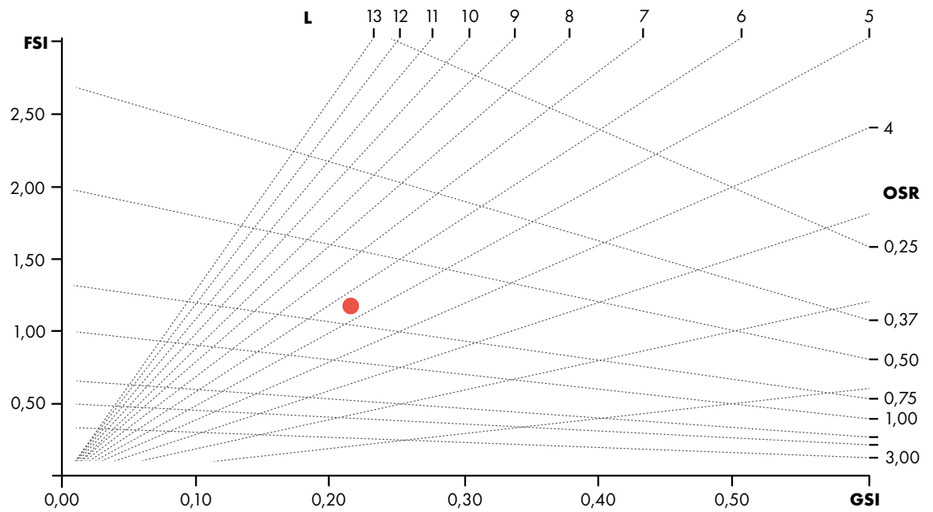
The active-bottom floors are mostly concentrated along the main road going through the area with the crossings acting as nodes. The small-scale square spaces at the crossings, located in front of active-bottom floors, helps to break up the repetitiveness of the urban rooms alongside the streets by offering different open spaces as well as being guiding points. The former facilitates a positive perception on the density in the area.

Several of the housing structures has a front garden of approximately 1 meter depth planted with bushes, shrubs or trees that helps to break down the scale and contributes to a positive perception of the density, especially on streets with none or few active-bottom floors.

Urban form & quality

- Active-bottom floors at main street and crossings
- Strip building and open block structure
- High amount of open spaces
- Low variation of building structures and heights





(Malmö Stad, 2021)

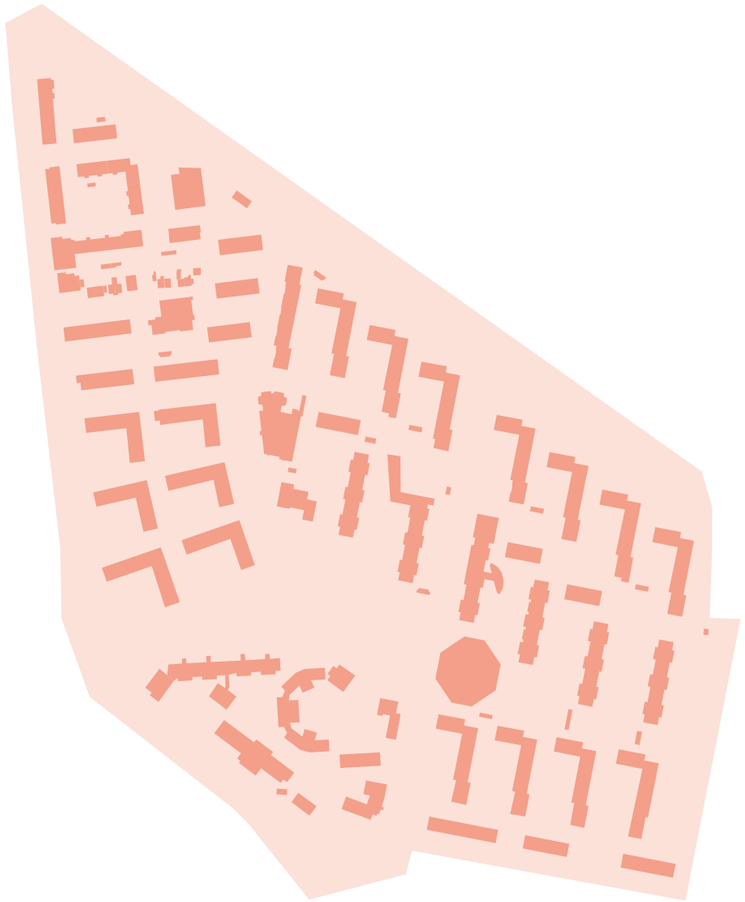
AUGUSTENBORG

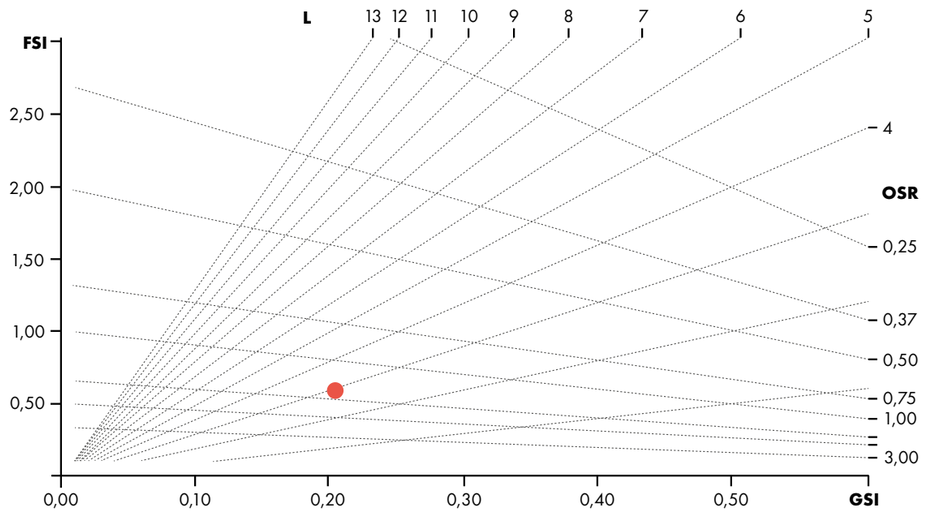
Augustenborg was constructed in the 1940's with additional densification in the end of the 1990's. The area is characterized by L-shaped building structures that form open courtyards.

Despite the distance between the buildings on a street level being wide, the variation of greenery gives a perception of positive density in the streetscape by breaking up the scales. There is a path going through the area with different scales of green spaces, offering a variation of open spaces as well as a sense of direction from a pedestrian viewpoint. The tower building in the area offers a landmark that facilities navigation. There are also several small-scale open spaces that functions as meeting spots scattered around the area, contributing to a positive perception of density.

Urban form & quality

- Mainly open block structure
- Variation of green spaces
- Tower and octagonal buildings as both vertical and horizontal landmarks
- Streets mainly for communication





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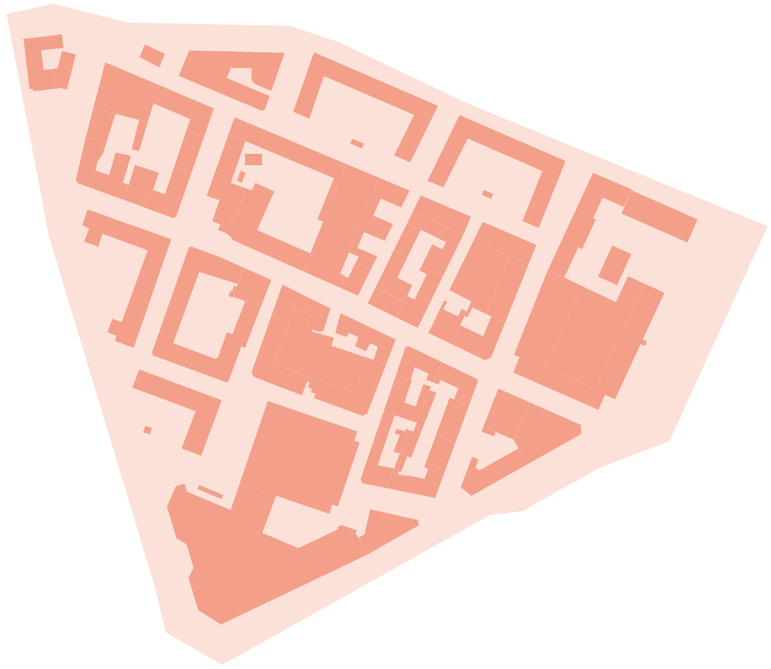


SLUSSEN

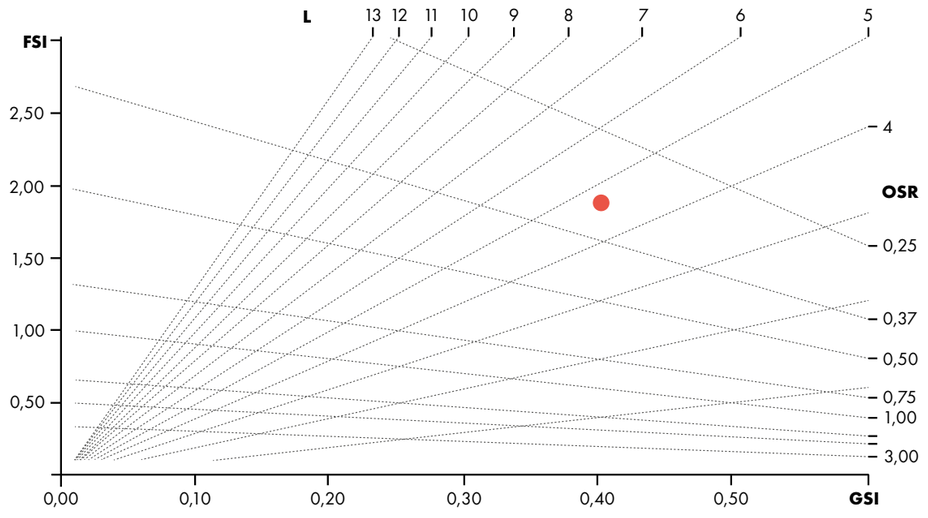
Slussen has its origins from the end of the 18th century, being an entrance to the city with smaller housing structures. However, the current urban character is mainly multifamily housing in a mid-rise block structure established in the start of the 20th century.

There is a main street cutting through the area were functions such as shops, restaurants, offices and public transportation are concentrated. The amount of spaces for pedestrian, constituted of small scale sidewalks, makes the area feel dense and intimate.

There is a lack of scales in the open spaces and streets between and around the buildings, leaving an impression of repetitiveness and disorientation despite the grid like structure. The public spaces are mostly located on the periphery of the area between adjacent neighborhoods.

Urban form & quality

- Closed and open block structures
- Active-bottom floors at main street cutting through the area
- Small variation of public open spaces
- Diversity in building structures and heights



SPACEMATE STUDIES: ALL AREAS

FSI
The areas closed to the inner city of Malmö (Gamla Staden, Davidshall, Slussen and Möllevången) scored around and between 1,5 and 2 on the FSI scale. None of the studied area scored higher than a FSI of 2.

GSI
The ground space index vary through all of the studied areas. Gamla Staden scored the highest on the GSI-scale with over 50% of the ground area built, while Rosengård scored the lowest with around 10% of the ground area built. The average GSI for the studied areas are between 0,20 and 0,35 GSI.

OSR
The areas in group F has similar FSI but the OSR differs between them. Studied areas with higher FSI tend to score lower on OSR

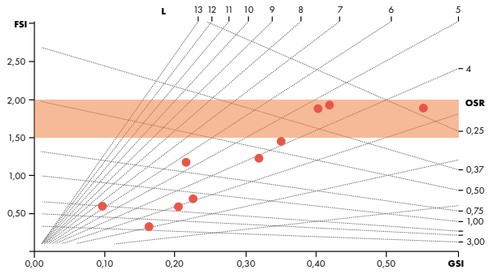
Layer
Majority of the sites studied scored along 4-5 on the layer variable. Areas with the highest average of layers (Rosengård & Ribersborg) scored in the lower spectrum of FSI as well as GSI.

- Areas located in closer proximity to the central station also scored higher on FSI
- Areas in groups E & F has a larger span of diversity in building heights
- Higher FSI in the studied areas puts higher pressure on open space (OSR)

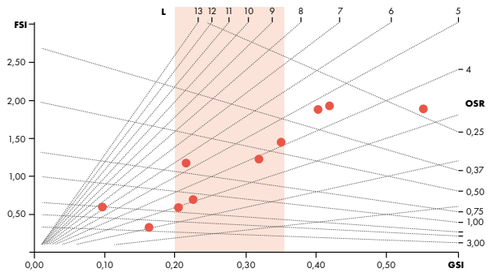
We can see that the investigated areas with highest FSI, being Gamla Staden, Davidshall and Slussen, tend to have an urban form of mid-rise closed building blocks in Malmö. The mentioned areas also have the highest ground coverage.

A higher average of buildings heights doesn't necessarily mean a higher density as seen in areas such as Rosengård and Ribersborg, which scored in the lower or medium spectrum of FSI but in the higher spectrum in the layer variable. While they have a higher average height, they have a low amount of ground coverage, with a higher share of open spaces.

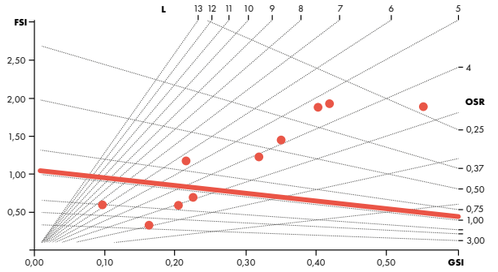
In order to test a higher density in the design of Mellersta Hamnen, urban forms to build upon, according to the Spacemate study, is the mid-rise compact building structure and mid-rise closed block structure.



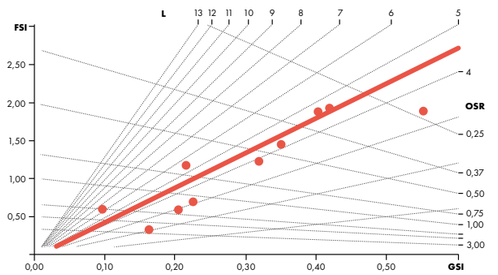
Highest scoring FSI



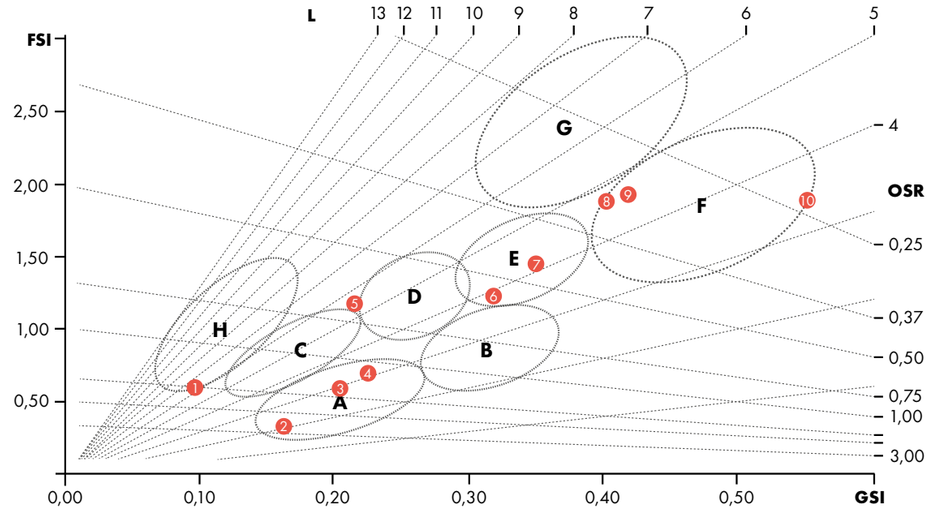
Average span of GSI



Average OSR of 0.9



Majority of areas scored around 4-5 on layer scale



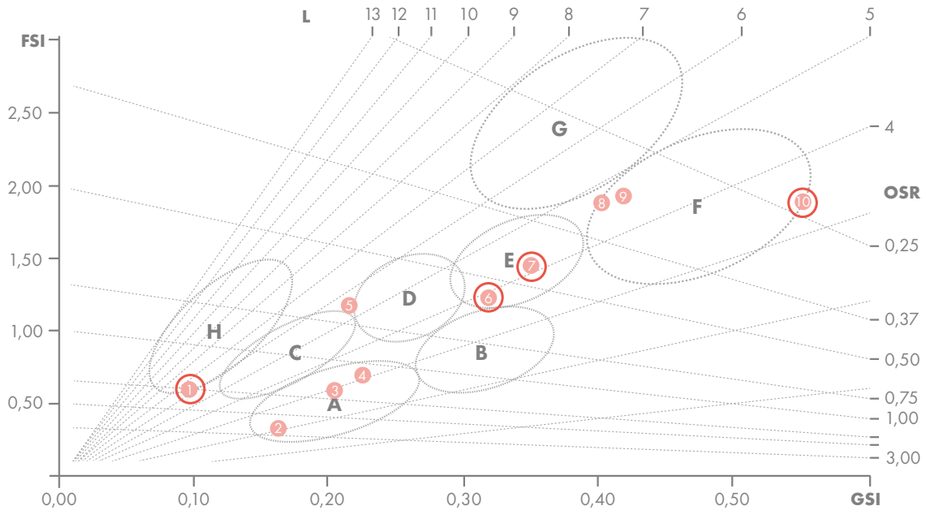
A. Low-rise spacious strip development blocks
B. Low-rise compact strip developments blocks
C. Mid-rise open building blocks
D. Mid-rise spacious building blocks
E. Mid-rise compact building
F. Mid-rise closed building
G. Mid-rise super blocks
H. High-rise developments

1. Rosengård
2. Håkanstorp
3. Augustenborg
4. Sorgenfri
5. Ribersborg
6. Bo01
7. Möllevången
8. Slussen
9. Davidshall
10. Gamla Staden

All of the investigated areas in Malmö


1. Rosengård 2. Håkanstorp 3. Sorgenfri 4. Augustenborg 5. Ribersborg


6. Bo01 7. Möllevången 8. Slussen 9. Davidshall 10. Gamla Staden



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Selected areas for perceived density studies

Selected areas for perceived density studies

PERCEIVED DENSITY: VISUAL STUDIES

Four areas in Malmö from the Spacemate studies has been selected for an in-depth analysis of the perceived density. Due to time-restraints in this thesis, it has been necessary to make a selection of areas from the Spacemate studies.

The findings from the Spacemate studies in the associated chart (see above on the page) has been the basis for the selection of areas for the perceived density study. In order to evaluate different types of density and the adhered urban qualities, choices have been made with the following criteria:

- One area in the lower spectrum of density chart
- One area in the higher spectrum of density chart
- Two areas in the middle spectrum of density chart

The aim in the perceived density studies is to identify urban qualities from the positive perceptions of density in the chosen areas that will be the basis for a set of design principles when designing Mellersta Hamnen.

The visual studies on perceived density will be based on an analytical framework with inspiration from studies by Nasar (1996) reworked by me to suit the task. When visiting the study areas, the following factors will be evaluated in relation to the perceived density:

Variation: The perception of the variation in building typologies, building heights, open spaces and public spaces

Greenery: The perception of greenery in an area in relation the urban environment

Spaciousness: The perception of how open spaces works in an area in relation to the navigation, views and sizes

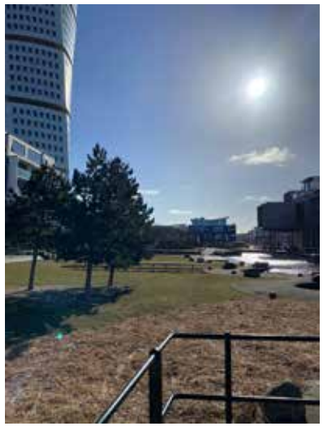
The study will be using a serial vision format and the perceived density will be studied by taking a walk through different parts of the selected areas. Additionaly, photos of the spaces in the area will be used for further visual studies. The study will survey the negative and positive factors and how they contribute to the perceived density of an area.

The four investigated areas will be compared to each other regarding the perceived density and will conclude with an assessment of identified qualities that contribute to a positive perception of the density. The aforementioned qualities will then be used to formulate design principles that are to be used in the thesis site of Mellersta Hamnen.

Street area with a variety of open space

Intimate streets with small scale greenery

Street with active-bottom floors



Public open green space

Water features between the buildings

A variation in building heights

BO01

Walking through Bo01 gives a pleasant perception on the density regarding the buildings. At first glance the urban fabric gives a chaotic impression with the many unaligned buildings and a disjointed street network. However, at a further glance the high diversity in heights and typologies in the buildings creates visually interesting views of the streetscapes.

One quality that was experienced as positive was the high amount of diverse spaces to linger in. In the small intimate streetscapes as well as the larger open parks there was possibility to enjoy greenery and sit down. The choice of having many different scales of open space, contributed to a positive perception of the density. However, in several of the more intimate streetscape there was no or little greenery. The streets with greenery were experienced as less dense than the ones without green elements. It should be noted that very little or sparse greenery was needed in order to give a positive perception on the density. Small elements of greenery in the streets, such as shrubs, helped to frame the streetscape and give an order to otherwise irregular street network. The greenery in the streets also worked as navigation marker to larger scale green areas, contributing to a positive perception.

There is a landmark, in the form of the Turning Torso tower, that function as a guide and a node in the area. The tower is visible from almost every area and combined with the uniform use of ground material, facilitated the navigation further. A majority of the spaces in the area is pedestrian prioritized with little amount of space reserved just for vehicles. The former gave a positive perception on the density.

Streets with active bottom floors were mainly concentrated at paths going to or through public spaces and in taller buildings. This gave a positive perception on the density due to there being a visually element on ground level that attracted the focus from the heights of the structures. However, streets with non-active bottom floors were perceived as empty at several of the areas in Bo01, a factor that contributed to a negative perception of the density.

- High variation in scales of open spaces
- Small amount of greenery in the streetscapes
- High diversity in building structures
- Concentration of active-bottom floors areas as nodes
- Tower as a landmark

Overall perception of area:
medium density with a high visual diversity in the urban fabric & rooms

Street with non-active bottom floors

Repetitiveness in the urban room

Tree that break down the scale

Street with active bottom floors

Market Square that function as a node and public open space

Market Square that function as a node and public open space

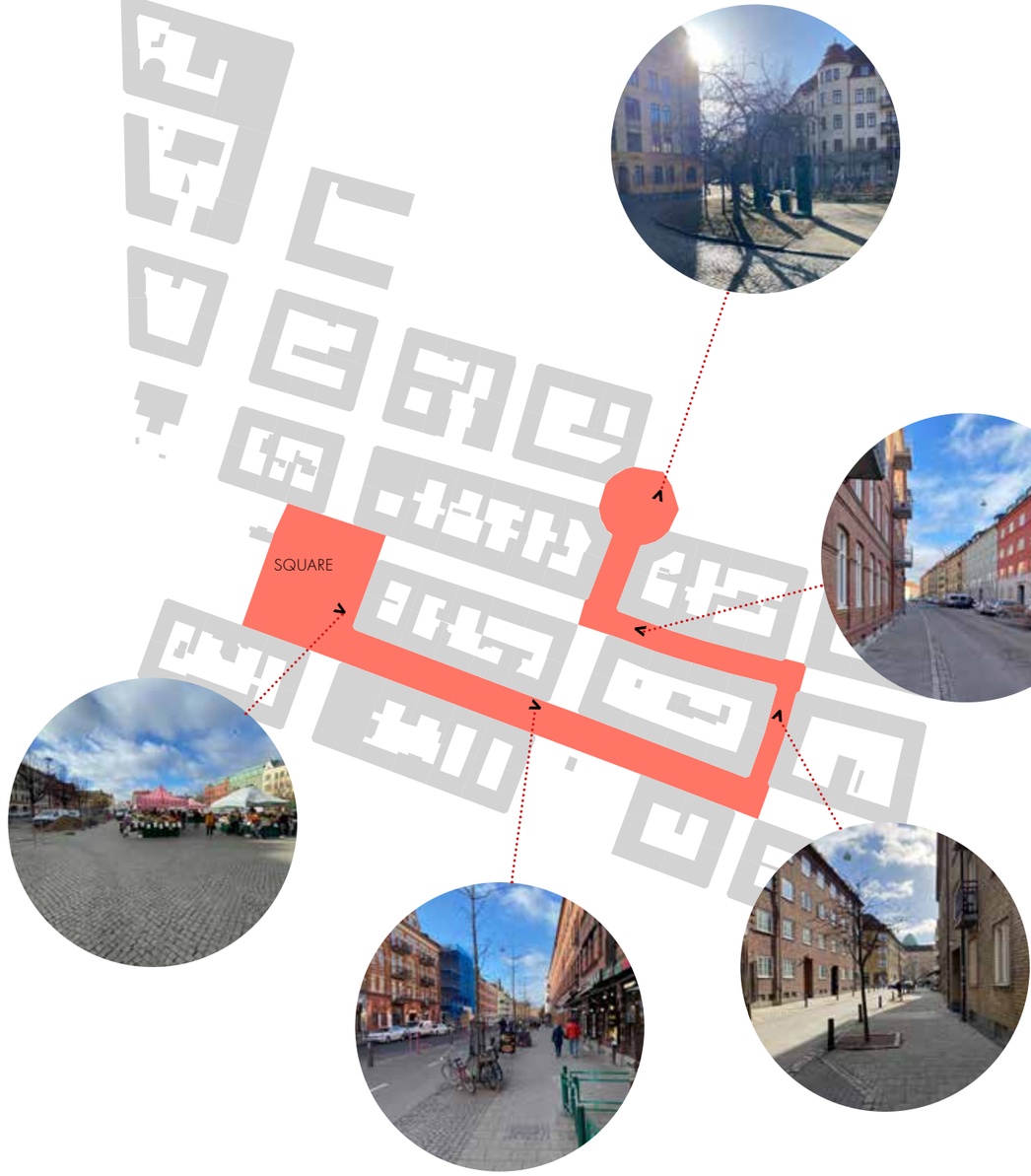
MÖLLEVÅNGEN

The block structure in combination with the grid plan makes navigation in the area easy that is further emphasized by the many interjections. However, there is little diversity in the height of the buildings, giving the impression of repetitiveness in the street views of the area. The lack of diversity in heights is a factor that dulls the stimulus and brings forth a negative perception of the density.

The square functions both as a visual node and meeting space in the urban environment, being a larger open space in an area with otherwise similar streets. The possibility in having the square as a larger scale open room in combination with more intimate streets is something that contributes to the positive perception of the density in the area.

Several of the streets have buildings with an active-bottom floor that brings life to the spaces and attention from traffic. The streets with non-active bottom floors offers a negative perception on density by giving attention to the height of the buildings and vehicles, although in some places the still standing vehicles offers a sense of urbanity to the otherwise empty streetscapes.

The streets with greenery, in form of trees, gives a positive influence on the density by breaking the scales and monotony of the otherwise hard surface characterized urban rooms. Streets with tree rows that connect to each other was also experienced as a positive quality regarding the navigation, by acting as a visual guide through the area as well as drawing the attention away from the building heights. Little amount of greenery is needed in, exemplified by small scale trees in one of the streets, in order to offer a positive perception on the density.



- Easy to navigate due to urban form (grid plan)
- Square as an open space node
- Vertical greenery helps to break down the scales
- Little diversity in building heights
- Active-bottom floors and components in the streets-cape (e.g. trees) contribute to a shift of attention from building heights
- Streets perceived as longer than they are due to uni-form heights of buildings

Overall perception of area:
medium density with an easy to navigate structure

Square along a urban path functioning as a node

Square as a meeting place

High amount of greenery

Lower height building differentiate the open space from other places

Little interplay between buildings and the surrounding urban components

The greenery breaks down the scale of the tall panel buildings

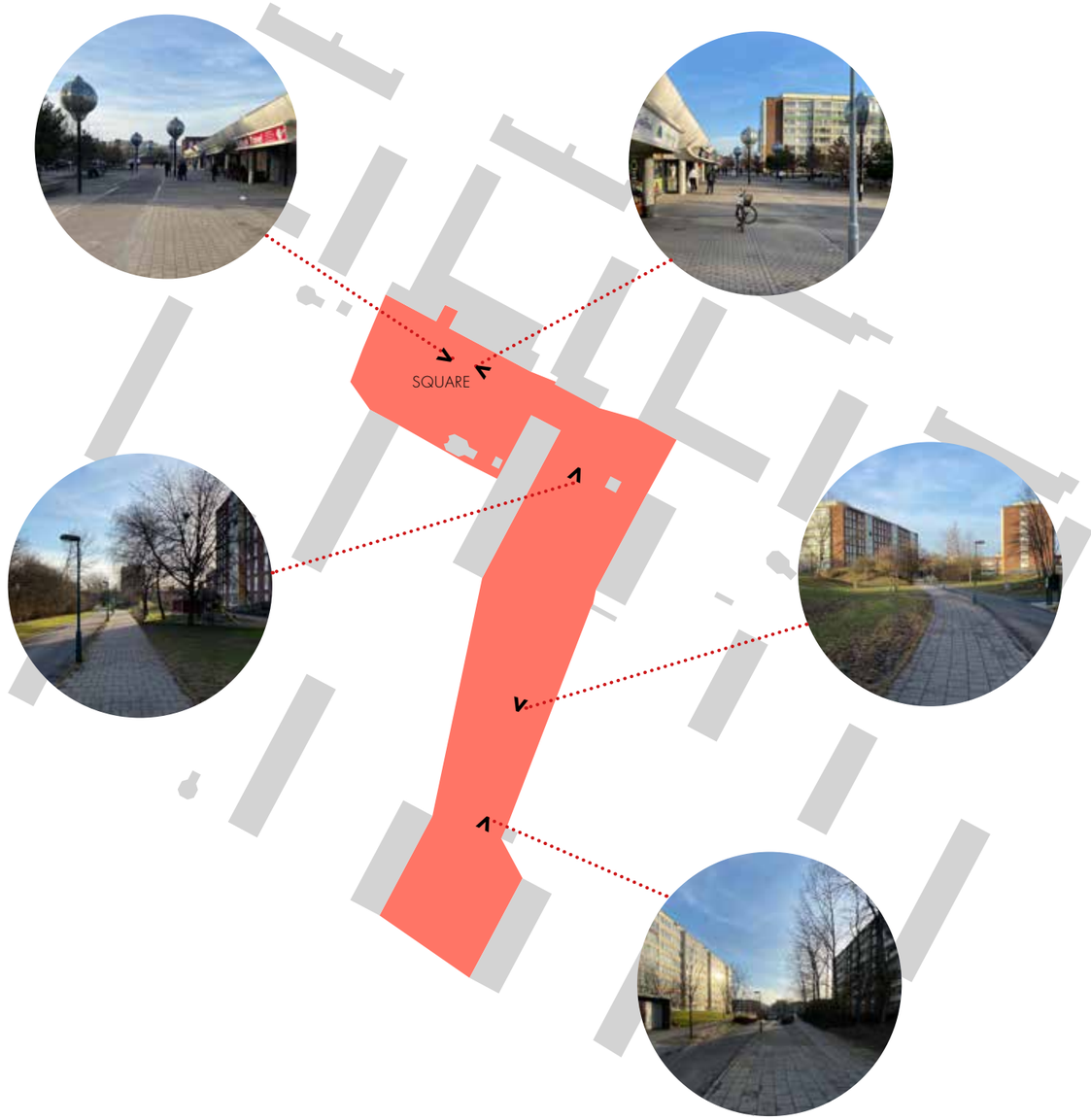
ROSENGÅRD

At a distance the most striking feature of Rosengård is the tall panel buildings that stand like monoliths in the landscape. Further on, there is little diversity among the buildings, both in typologies and functions with the panel and strip buildings being mainly residential. The buildings in the area are mainly setback from the streets and urban pathways, making the constructions feel disconnected. The former mentioned aspects give a negative perception of the density in the area.

The greenery is one of the prominent factors in Rosengård, although it can be more of a quantity than quality regarding the open spaces. The high amount of green spaces gives the impression of low density despite the presence of the tall buildings. There is also a high amount of greenery with no clear use or function, giving the impression of a coulisse with no defined stage. However, the greenery, especially the trees, helps to break down the scales of the taller contractions, giving a positive perception of the density.

One of the main public space in the area is a square that is part of an urban path through the area. The space is functioning as a clear node in the otherwise structural confusing area. The square has been densified with lower building structures, functioning as premises, that differentiate the open space from others. The variety that this space offer makes a positive perception on the density in the area. However, there is little variation in the open spaces, with the high amount larger scale green lawns and hard surfaces.

The former mentioned urban path that goes through the square also helps to give a hierarchy of movement in the otherwise disorganized and hard-to-navigate pathway network. The urban path connects with adjacent areas and contributes to a positive perception of the density.



- Little variation in open spaces
- Large scale open spaces
- Urban form is hard to navigate in
- Vertical greenery helps to break down the scales
- Little diversity in building structures
- Lower height buildings at square helps to different the latter from other open spaces
- Urban path connecting the square in the area with adjacent areas

Overall perception of area:
low density with a high amount of green and open spaces

Street with active bottom floor and car parking

Street with sparse variety in urban components

Street with non-active bottom floors and parking

Intersections as small nodes

View of buildings with variated heights and inclined top floor

Street with active bottom floors and a little amount of greenery

GAMLA STADEN

Overall, the open spaces in Gamla Staden were often perceived as to dense and crowded. Although the building structure is variated in both heights and facades, there is little diversity in open spaces. The experience of not having a choice for more intimate and calmer public spaces, in close proximity, gave a negative perception of the density. There are streets and areas where pedestrians have priority, but these areas are often at paths where commercial and tourism functions are concentrated leading to busy environment. The major larger scale open space was a square, while being a welcome open space in an otherwise intimate urban environment, the amount of commercial functions that spilled out in the space made it feel like either an area you would need to be part of the consumption in or traverse through.

The lack of greenery and the high presence of hard surfaces and small streetscapes gave the impression of high density in Gamla Staden. However, some streets had very small spruces of greenery, such as small shrubs at the bottom of the facades. This small types of greenery was enough to give the spaces a positive perception of the density.

Some of the buildings in the area have inclined top floors, a feature that makes the urban spaces at ground level being perceived as less dense than what they may be. The inclined top floors, in combination with a variety of building heights, also gave an visually interesting dimension to the area.

The streets with car parking alongside the sidewalk give a negative perception of the density when they are combined with active bottom floors. Streets with still standing vehicles but no other urban components, such as trees or active bottom floors, made a positive impression in the density by giving something visually different in the streetscape. Streets with none of the former mentioned components shifted the focus on the building heights, leading to a negative perception of the density.

The navigation in the area in relation to the density gave a positive perception. The grid like structure favored the orientation and the many intersections worked as small nodes in the area.

- little diversity of open spaces
- little and subtle variation in open spaces
- streetscape perceived as crowded
- small amount of greenery
- high diversity in building structures
- inclined top floors on several buildings

Overall perception of area:
high density with little variation in open spaces

SUMMARY VISUAL STUDIES
identified qualities

Amount of Vehicles on the studied areas contributed to the perception of higher density but both in negative and positive ways. In spaces with little variation in terms of urban components (e.g., trees, active-bottom floors), vehicles could give the impression of the area being more crowded in a positive way and in extension a perception of safety from the traffic. In areas with additional elements in the streetscape the vehicles were perceived as being in the way, in a negative manner, both visually and physical.

Landmarks can help to guide in dense urban areas. The landmark can be situated in places functioning as nodes to reach synergy effects in terms of public transportation, squares, public spaces, commercial functions and such as seen in the Bo01 area with the Turning Torso tower. It can also be argued that an open space can be a landmark, such as the larger scale square in Möllevången, functioning as a visual contrast among the heights from buildings.

Materiality of ground material eased the perception of density by giving a sense of familiarity and direction. In the disjointed street network of Bo01, the navigation was at first glance complex but the continues use of the same ground material made it easier to find a way through the area. A likewise case can be made for the ground material in Gamla Staden, being mainly made up by cobble stone in combination with a grid plan.

Non-active bottom floor had a negative influence on the perception of density. The non-active bottom floor contributed to an increased focus on the height of the buildings, a trait that become more apparent in urban rooms without greenery. Urban spaces with active-ground floor gave a positive perception of the density by having more activity in them.

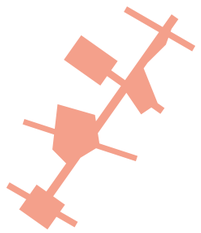
Greenery gives a positive experience on the density by breaking up the scales as well as adding variation in the urban rooms. An interesting note was that several areas in Bo01 had sparse greenery in the streetscape, but the high variation in open space and buildings was sufficient with the little amount of greenery to contribute to a positive perception. In the Rosengård area the greenery was especially helpful in breaking up the scale of the tall monolith buildings, although the abundance of open green spaces in combination with an isolated building structure gave a negative impression of the density. Regarding the amount of greenery in different sizes of urban rooms, little or sparse green elements was sufficient in intimate streetscapes to offer a positive perception of the density. Greenery was also experienced as a quality that can help with connectivity in the urban environment, as seen in Möllevången and Bo01. The use of tree rows and street plantings in the former mentioned area was experienced as positive when they connected to adjacent green areas or paths in the area. While Rosengård had a higher share of greenery in the aforementioned areas, the amount and distribution of the greenery was experienced as to monotonous and repetitive , leading to a diffuseness in how the green areas was connected with each other.

A variation of scales, functions and typologies, interwoven, such as buildings and open spaces can contribute to a positive perception of density as seen in the areas of Bo01 and Gamla Staden. Bo01 had a greater share of open spaces and diversity in buildings than the latter, while Gamla Staden had more activity between the buildings. However, Gamla staden is perceived as too dense and crowded when factoring in the open spaces. Rosengård and Möllevången was similar in the context of little diversity regarding building heights and typologies despite having different urban forms with panel housing and block structure, respectively.

Based on the visual analysis in the investigated areas, I can conclude that a visual diversity in the urban fabric, spaces and connections as an overall summary of the positive perception of the density. With a higher share of diversity in the urban components, there exists visual stimulations that draw the attention away from factors that can be experienced as negative regarding the density, such as uniform building heights or urban spaces. However, to much of a variation in the urban environment does not necessarily mean a positive perception, as seen in areas such as Bo01, which was at a first glance being perceived as chaotic with the high variation in heights and open spaces. I conclude with Nasar (1998) that there must be a thoughtfulness and order in the variation of urban components in our cities.

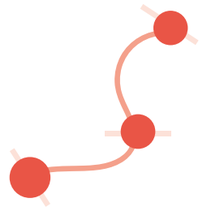
This conclusion is based by my experience and perception of the density in the studied areas. Since every individual perceive spaces differently depending on context and culture, another person can experience the studied areas differently from me. However, the identified qualities can be used as pointers for design solutions and principles in order to build upon the characteristics of the urban forms and uses in Malmö. Since the qualities is based on the density in Malmö, an argument can be made that the mentioned qualities can relate to the existing characters and identity of the city. It is also important to mention that the perceived density is a complex topic to measure and that the perceived density studies have been more an evaluation of the positive experiences of density in the investigated urban settings than a measurement.

QUALITIES CONTRIBUTING TO A POSITIVE PERCEPTION OF DENSITY



VARIATION IN SCALE
OF OPEN SPACES

- Mixture of intimate and more open spaces
- Visibility
- Navigation
- Spaces to linger on
- Different sizes and characters of street-scapes
- Greater share of intersections



NODES IN THE
URBAN STRUCTURE

- Landmarks for orientation
- Public transports
- Public spaces
- Functions
- Uses
- Navigation

DIVERSITY IN
BUILDINGS

- Variety in building heights
- Mixture of functions among the buildings
- Inclined floors
- Active-bottom floors

GREENERY ENHANCING THE
SCALES AND CONNECTIONS

- Vertical greenery (trees, facade greenry)
- Streetscape greenery (trees, plantings)
- Greenery in public spaces
- Green paths that create a continuation in the urban environment

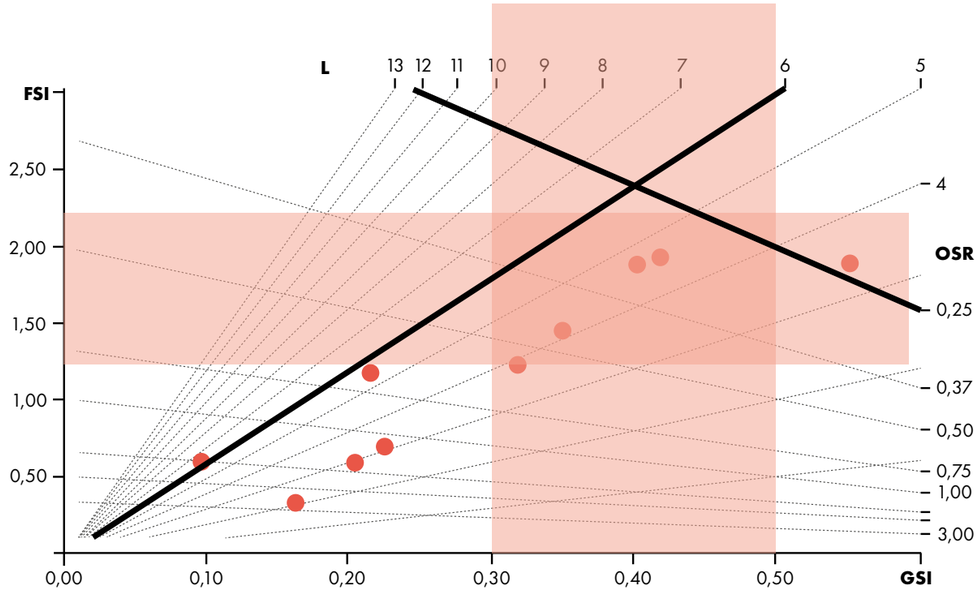
= A VISUAL DIVERSITY THE URBAN FABRIC, SPACES & CONNECTIONS

DEFINING THE DENSITY FOR THE DESIGN

DEFINING THE DENSITY

Physical density and Perceived density qualities

With the physical and the perceived density studies concluded, it is possible to start the process of defining the density for the design in Mellersta Hamnen. The process will start with addressing the four variables that has been used in the Spacemate method and how they relate to the density that has been studied in Malmö. Additionally, the knowledge and experiences from the literature overview and perceived density study will also be factors in defining the density values to be used for the design in Mellersta Hamnen. Further on, the values will be tested by generic modeling, in order to visualize the findings in a 3-dimensional way.



Defining the preferred density for design

DEFINING THE PHYSICAL DENSITY

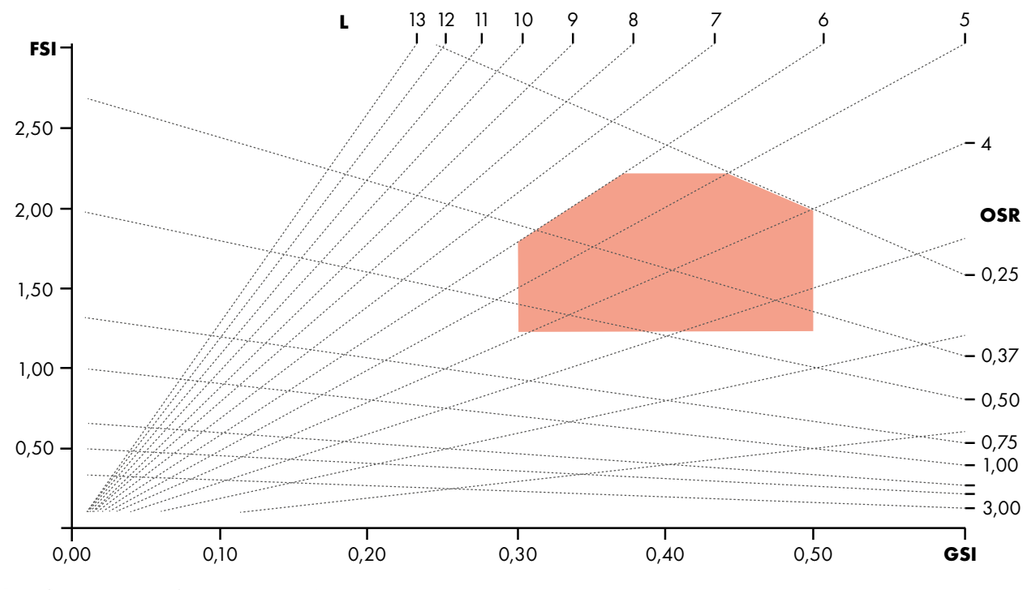
The four variables

FSI
The areas closed to the inner city of Malmö (Gamla Staden, Davidshall, Slussen and Möllevången) scored around and between 1,5 and 2 on the FSI scale. None of the studied area scored higher than a FSI of 2. Since this thesis is about exploring density as well as testing an increased density for a new urban development the minimum threshold for FSI has been set at 1,25 and the maximum at 2,25.

GSI
Ståhle et al.(2017) recommends a maximum threshold of 0,40 GSI in order to facilitate public spaces, street-scapes and private outdoor spaces in a district. Group E, defined as mid-rise compact buildings, has been the outline for the minimum threshold of 0,30 GSI. In order to further explore how density can influence public spaces in design the maximum value will differ from the one recommended from Ståhle et al. Thus, the scope for the GSI in the design part has been set to 0,30-0,50.

OSR
The minimum value for OSR in this project will be set at 0,25 based on the conducted visual and perceived studies. Gamla Staden scored under an OSR of 0,25 and during the site visit I perceived the open space as scarce. Furthermore the amount and perception of open spaces at higher OSR (over 1 OSR such as Rosengård or Augustenborg) was deemed to much in relation to other urban components such as buildings.

Layer
Majority of the sites studied scored along 4-5 on the layer variable. In order to explore a higher density in Malmö the average layer will be set at 6 to offer a larger span of diversity in building heights.



The defined density values for use in designing Mellersta Hamnen

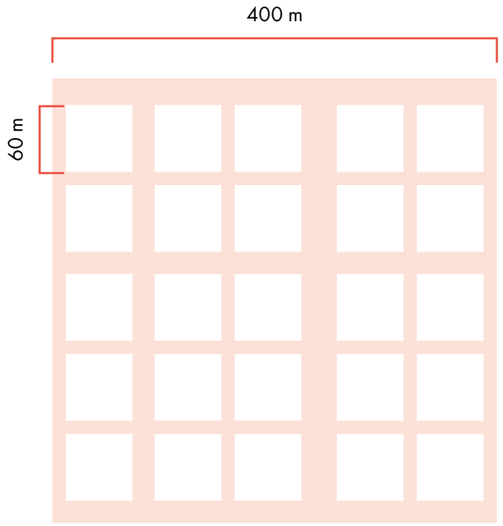
PREFERRED DENSITY FOR DESIGN

With the physical density defined, a set of preferred density values has been formulated, as seen in the chart above. The design of the density in Mellersta Hamnen should aim for these values in regard to the floor space index, ground space index, open space ratio and layers. A relevant aspect to note is that the preferred physical density values is based on the existing density in Malmö. Thus, it can be argued that it takes the context of the city in consideration. Coming up next, it is time to explore the preferred values even further by visualizing them in a generic model.

- *The highlighted area in the chart above gives an outline of how the density can be formulated in the design of Mellersta Hamnen*
- *The preferred density values is based and defined from existing densities in Malmö*

preferred density values

FSI: 1,25-2,25
GSI: 0,30-0,50
OSR: min 0,25
L: 6



The structure used in the generic modelling

preferred density values

FSI: 1,25-2,25
GSI: 0,30-0,50
OSR: min 0,25
L: 6

GENERIC MODELING

The generic modelling is used as a tool to further understand the preferred density values that has been defined in earlier chapters. With the generic modelling it is possible to visualize the findings from the physical and the perceived density studies on a more abstract and general level. While the Spacemate charts can tell us the density in a 2-dimensional way, it lacks the clarity and perspective that a 3-dimensional representation can have. Therefore, the tool to use generic modelling can be helpful for both me and the reader to understand the findings in a more nuances perspective.

In the perceived density studies, the grid plan was perceived as a positive factor regarding the density. The grid structure of Gamla Staden and Möllevången was easy to navigate in and was experienced as a feature that gave a positive perception of the density in the investigated areas. Thus, the generic modeling will use a grid plan as a basis due to the former mentioned factors.

The process in the general modelling started with testing the preferred density values from the Spacemate studies and how they relate to different typologies to get a better understanding of an urban form that would be suitable for the desired density. I tested three common typologies that have been featured in the investigated areas in Malmö, being the strip, block and tower structure. The modelling unraveled that the strip and tower alone would not be suitable for the preferred density values. The block structure was identified as the most appropriate urban form of the three tested typologies regarding the density values. Further on, I tested how the identified qualities from the perceived density studies can be incorporated with the block structure.

The generic modeling was also a way to get new perspectives and findings of the density studies. During the process of testing the density values, there was a possibility for the tower typology to be incorporated into the block structure, introducing an element that could be introduced into the urban form to foster a diversity in building heights.

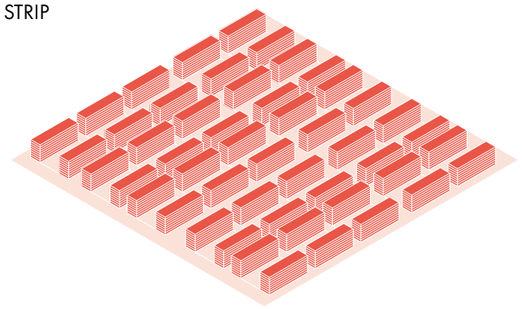
To pinpoint the basis for the model, the following factors has been taken into consideration:

- *The model is using a 400x400 m (16 ha) plan area with 60x60 m plots to facilitate a greater share of intersections*
- *The street widths in the model range from 12-32 m to facilitate urban communications such as main roads and streets*
- *The building depths chosen are between 10-20 m to facilitate sun access and communication areas in the buildings*

GENERIC MODELING

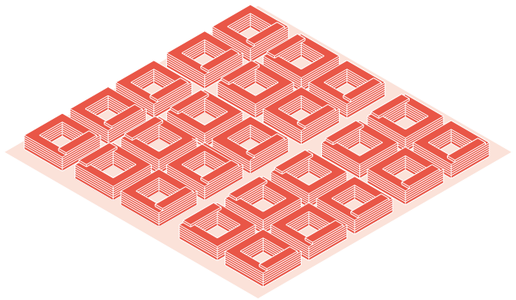
exploring the preferred density values with typologies

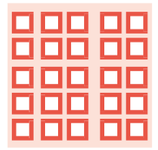
STRIP



FSI: 2,25
GSI: 0,28
OSR: 0,32
L: 8

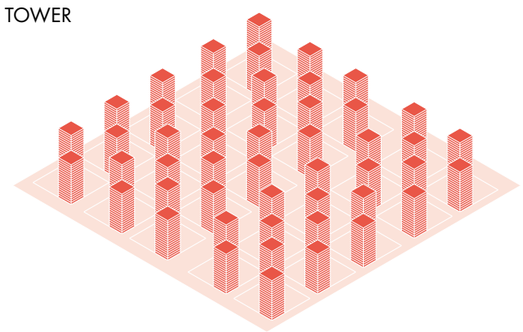
BLOCK

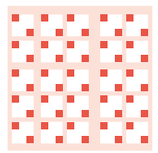




FSI: 2,25
GSI: 0,36
OSR: 0,28
L: 6,25

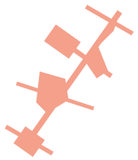
TOWER





FSI: 2,25
GSI: 0,125
OSR: 0,38
L: 18

Testing the preferred density values with common typologies

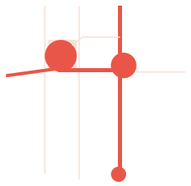


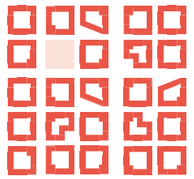
VARIATION IN SCALE
OF OPEN SPACES

NODES IN THE
URBAN STRUCTURE

DIVERSITY IN BUILDINGS

GREENERY TO
ENHANCE THE SCALES





Incorporating the identified qualities in Malmö of the posetive perception on density into the model

GENERIC MODELING

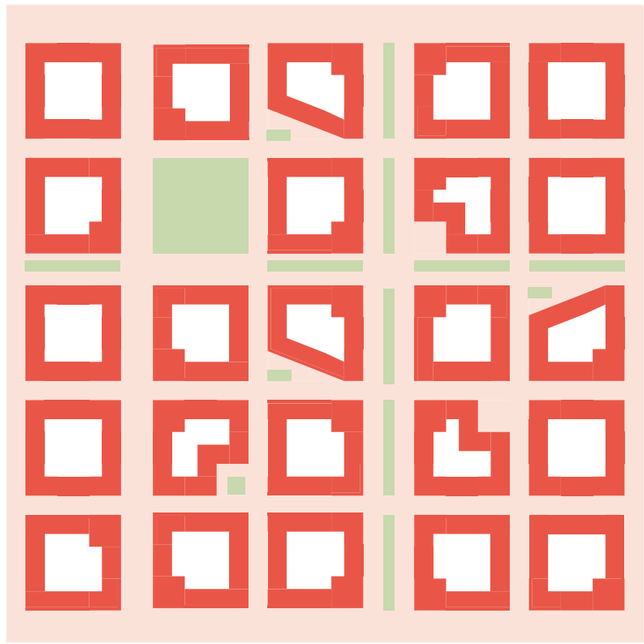
WITH PREFERRED DENSITY VALUES
& PERCEIVED DENSITY QUALITIES

The final testing in the generic modeling integrated some of the identified qualities from the perceived density studies. The modeling in this stage has put an emphasis on creating a diversity in building heights as well as involving greenery, urban paths and a variation in open spaces in the plan area of the model. During the modeling some interesting findings surfaced regarding how the density can be handled in design. A higher density could be adjacent to larger scale open spaces (e.g. main streets, parks, crossings, nodes) while lower levels of density could be located at intimate streetscapes and urban paths. Green paths can be used to connect public spaces and/or open spaces in an area as well as the surrounding area. A horizontal as well as a vertical diversity in the building structures can contribute to higher density while maintaining the perception of a lower scale of density (e.g. inclined floors, towers, rowhouses).

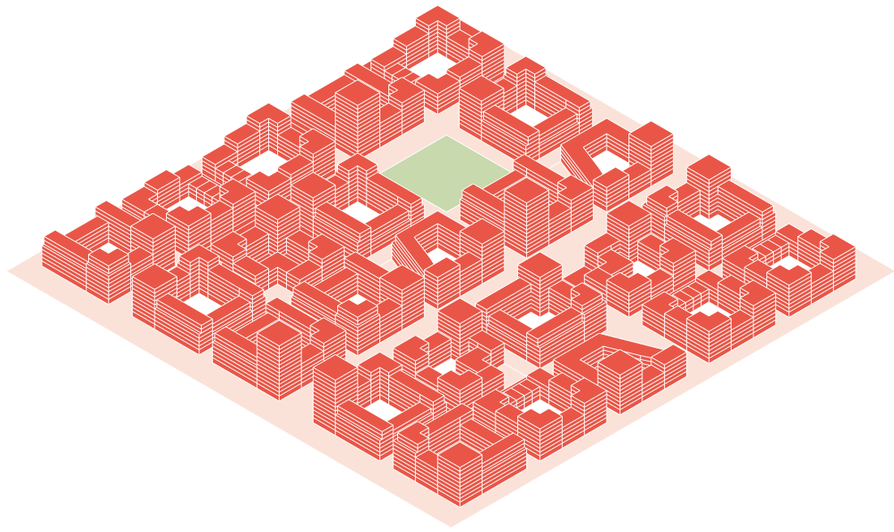
By testing the preferred density values and the perceived density qualities in a model, a further understanding on how the density can impact the urban form has been explored. New findings regarding how the density can be handled in design has also emerged as exemplified above. The next step is to implement the findings from the density studies and the general modeling in an existing area, namely the design site for this thesis in Mellersta Hamnen.

Density values of model
FSI: 2,16
GSI: 0,35
OSR: 0,30
L: 6

Preferred density values
FSI: 1,25-2,25
GSI: 0,30-0,50
OSR: min 0,25
L: 6



Section and plan of the modeling ith both the preferred density values and the identified qualities in the positive perception of the density in Malmö



Axonometry of the generic model with both the preferred density values and the identified qualities in the positive perception of the density in Malmö

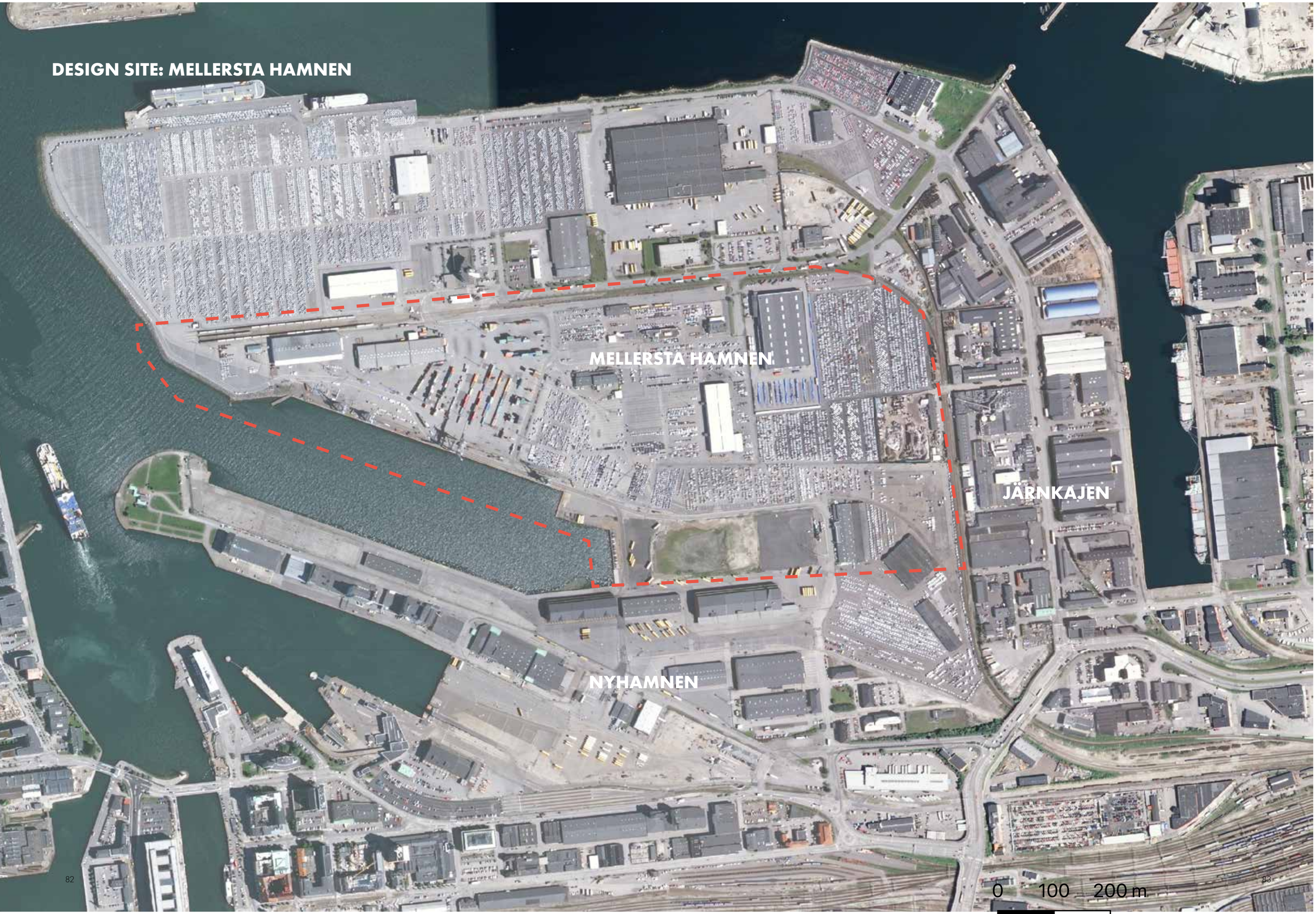
ANALYSIS: MELLERSTA HAMNEN

CONTEXT IS IMPORTANT

Before we can test the findings from the density studies and the general modeling, a further analysis of Mellersta Hamnen and its surroundings is necessary in order to get a contextual understanding of the design site. While the generic modeling showed the preferred density values and perceived density qualities in a vacuum with no regards to a context, the same approach can't be used in Mellersta Hamnen. To put it in other words, the generic model, shown in the previous chapter, is not to be seen as a definite urban form that can be drag and dropped into an existing urban fabric. Thus, the context of Mellersta Hamnen in relation to surrounding areas need to be examined in order to create a design that fits into the city.

There is also a challenge that exist in the area being developed by the municipality, namely Nyhamnen, south of Mellersta hamnen. Since the area is still in an early development phase, the proposed structure of Nyhamnen by Malmö municipality is yet to be finalized. This will be taken into consideration when designing in Mellersta Hamnen. The material available by the municipalty regarding the proposed structure will be included into the analysis. Thus, the design of Mellersta Hamnen will not take the existing built structure of Nyhamnen in regard but rather expand on the proposed future structure planned by the municipality. This has been a deliberate choice, since the use of the areas in the design site of Mellersta Hamnen are leased to a company by the municipality until the year of 2035. A majority of the areas in Nyhamnen are predicted to be constructed by the year of 2035, with the finalization of the project in 2050. Thus, the construction in the design proposal in Mellersta Hamnen will be started after 2035.

DESIGN SITE: MELLERSTA HAMNEN



SIZE & SCALE CONTEXT

CENTRAL AMSTERDAM

CENTRAL PRAGUE

EDINBURGH NEW TOWN

MALMÖ GAMLA STADEN

Structure plan by malmö municipality (Malmö Stad, 2020)

Proposed main streets in the harbor area with future connections in dotted lines (Malmö Stad, 2020)

ONGOING PROJECTS

Transformation of Nyhamnen

In 2019, the municipality of Malmö approved the comprehensive plan for a transformation of the area south of this thesis design site. The aim by the municipality in the comprehensive plan is to develop the harbor area of Nyhamnen with mixed use structures interwoven with green and blue loops. With a close proximity to regional transportation, in the form of the Central Station, and the water, the municipality proposes a high density in the development of Nyhamnen. Higher buildings are suggested to be located at large scale open spaces such as parks, water bodies or main streets. A green spine, with different sizes of green areas, spans through the whole area of Nyhamnen and creates possibilities for diverse urban paths. (Malmö Stad, 2019)

The design area for this thesis in Mellersta Hamnen is suggested by the municipality as a future area for planning. While the municipality propose the area to be a mixed-use district, they are no suggested structures (e.g., building structure or green structure) besides a continuation of the main street from Nyhamnen through Mellersta Hamnen in north-south direction. The recommended main street from the municipality will be incorporated into the thesis design site.

The comprehensive plan from the municipality is mainly highlighting a proposed structure of the area and thus data about the suggested building footprints have been limited. There is however a spatial model available on the municipality website that, together with the structure plan in the comprehensive plan, have been the basis when planning for this thesis projects design site. Thus, the building footprints shown in the area of Nyhamnen are an estimation of my interpretation in the available material from the municipality and are subject to change.

Development plan of future transformation areas in the harbor area of Malmö (Malmö Stad, 2019)

PHOTOS OF THE SITE & SURROUNDING AREAS

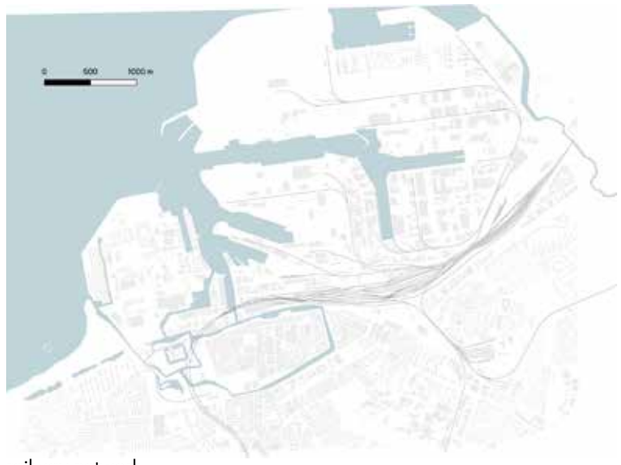
STREET NETWORK

The street network in Mellersta Hamnen is disconnected from the inner city. A majority of the area is fenced offed from all directions, leading to the roads inside Mellersta Hamnen being inaccessible. However, there exist possibilities to connect to the new proposed street network, by the municipality, in Nyhamnen.

road & street network

RAILWAY NETWORK

In the eastern parts of the design site of Mellersta Hamnen there are existing railway connections that are used for goods transportation. However, the railway in Mellersta Hamnen is proposed by the municipality to be deconstructed and moved to other parts of the harbor.



railway network

HEIGHT DIFFERENCES

The height differences on the site range from 1-3 m above current sea level with a majority being 2 m. Areas closest to the water border can be as low as 1 m. Overall the area is characterized by flat surfaces with little variation in heights of the ground..

height differences (1m)

INDUSTRY

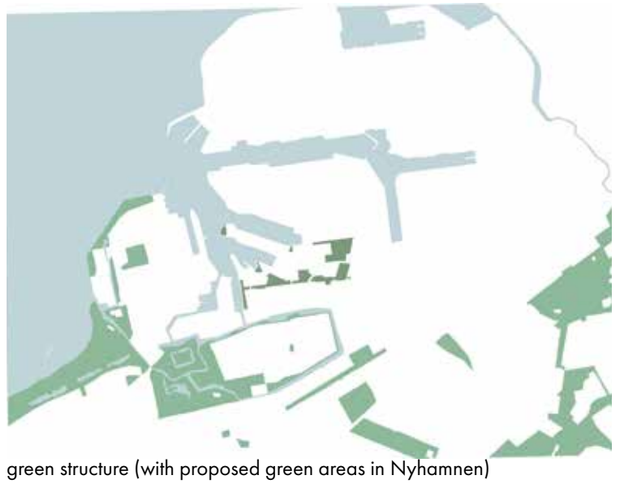
The whole area of Mellersta Hamnen is used for industrial functions such as storage, logistics and transport.

industry

BLUE & GREEN STRUCTURE

There is no coherent green structure present in the site of Mellersta Hamnen. However, the proposed green structure, by the municipality, in Nyhamnen offers a possibility to expand and connect the greenery of Nyhamnen with the deisgn site in Mellersta Hamnen. In a grander scale, there is possibilities to connect to surrounding green areas in the inner city and the western harbor.

Nearly the whole area of the design site is fenced off, hindering public access to the waters in the harbor area.

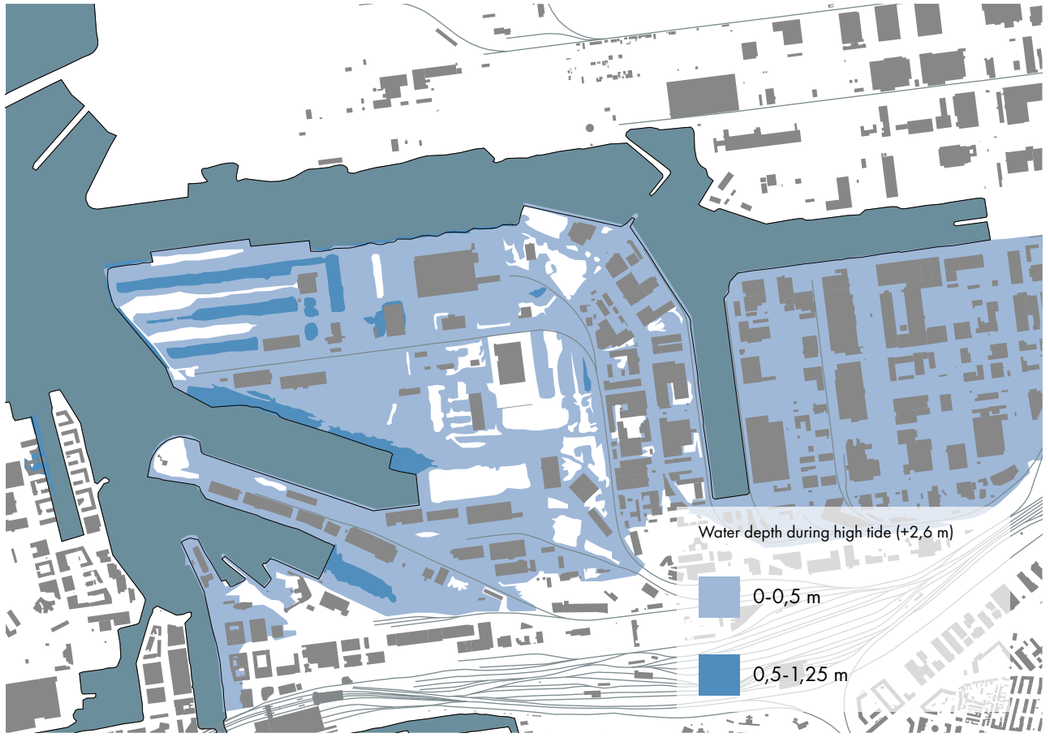


green structure (with proposed green areas in Nyhamnen)

BUILDING STRUCTURE

A majority of the existing buildings, in the site of Mellersta Hamnen, functions as warehouses for storage and logistics. The current buildings on the site are regarded to have no specific cultural value. .

building footprint



The impact of extreme high tides in Mellersta Hamnen and Nyhamnen

100 YEAR HIGH TIDE WATER (+2,6 m) YEAR 2065

Due to the coastal proximity, the city of Malmö is highly susceptible to high water levels. In 2013 the storm "Sven" raised the sea level to 1,5 m over the medium tide height and nearly caused a flooding of Citytunneln, an important railway infrastructure that facilitates train connections from Malmö to Öresund and settlements in Skåne. (Sweco 2018). The threat of extreme weather also applies to the harbor area in Malmö.

The majority of the site in Mellersta Hamnen has a ground level of +2 above current sea level with areas closest to the water border being as low as +1. In a study of future sea level scenarios by Sweco, Mellersta Hamnen and surrounding harbor areas are being shown to be threatened by high tide water. Thus, a greater part of Mellersta Hamnen will be flooded with water during extreme high tide with a water depth of 0,0-0,5 m (Sweco, 2018). Sweco and Malmö municipality suggest solutions that involve protective walls and/or raising the ground level to a minimum of +3.0 m above average sea level in order to handle the threat of extreme weathers (Sweco, 2018; Malmö Stad, 2019).

However, the municipality also sees opportunities for urban uses such as buildings or public spaces to be part of the solutions regarding the design of the high tide protective measures in the harbor area. Some examples being boardwalks or flood-able spaces, that lets the user get a closer contact with the water (Malmö Stad, 2019)

SITE ANALYSIS: SUMMARY

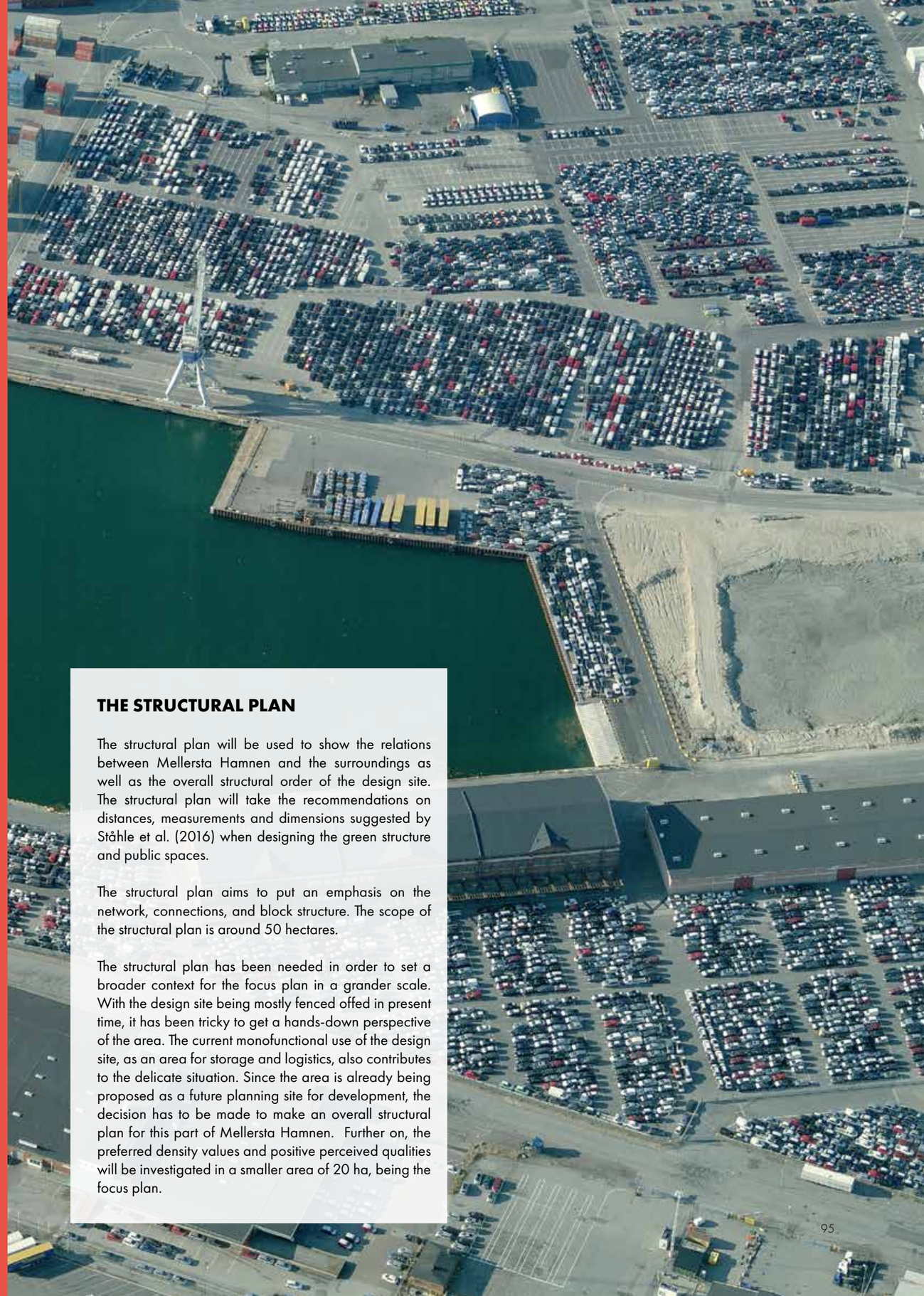
CHALLENGES

- FLAT AREA
- CHARACTERIZED BY HARD-SURFACES
- THREATENED BY HIGH TIDE WATER LEVELS
- DISCONNECTED FROM THE CITY
- NO CHOERENT GREENRY

OPPORTUNITIES

- CLOSE PROXIMITY TO REGIONAL PUBLIC TRANS-PORTATION (2-3 km)
- POSSIBILITY TO CONNECT CITY TO THE SEA
- POSSIBILITIES TO BUILD UPON PLANNED DEVEL-OPMENT IN NYHAMNEN

DESIGN: MELLERSTA HAMNEN



THE STRUCTURAL PLAN

The structural plan will be used to show the relations between Mellersta Hamnen and the surroundings as well as the overall structural order of the design site. The structural plan will take the recommendations on distances, measurements and dimensions suggested by Ståhle et al. (2016) when designing the green structure and public spaces.

The structural plan aims to put an emphasis on the network, connections, and block structure. The scope of the structural plan is around 50 hectares.

The structural plan has been needed in order to set a broader context for the focus plan in a grander scale. With the design site being mostly fenced offed in present time, it has been tricky to get a hands-down perspective of the area. The current monofunctional use of the design site, as an area for storage and logistics, also contributes to the delicate situation. Since the area is already being proposed as a future planning site for development, the decision has to be made to make an overall structural plan for this part of Mellersta Hamnen. Further on, the preferred density values and positive perceived qualities will be investigated in a smaller area of 20 ha, being the focus plan.

VISION

CONNECT THE CITY THROUGH DIVERSE DENSITY AND GREEN & BLUE LOOPS

- Connecting the city both physically and visually
- Making the waterfront accessible in the city
- Mellersta Hamnen as an area that can connect with existing and future developments

The scope of the Structural plan

STRATEGIES

GREEN & BLUE LOOPS

- Public spaces & paths with different characters
- Connect the spaces in the site with each other as well as the surrounding areas through greenery

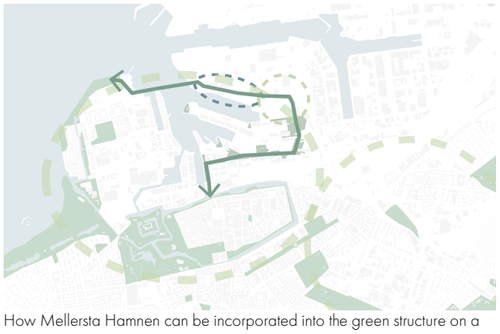
DIVERSE DENSITY

- Density in the structures that adhere to surrounding contexts, e.g. higher density at nodes and open areas such as waterfronts
- A variation in heights and widths
- A variation in functions & uses

STRATEGY: GREEN & BLUE LOOPS

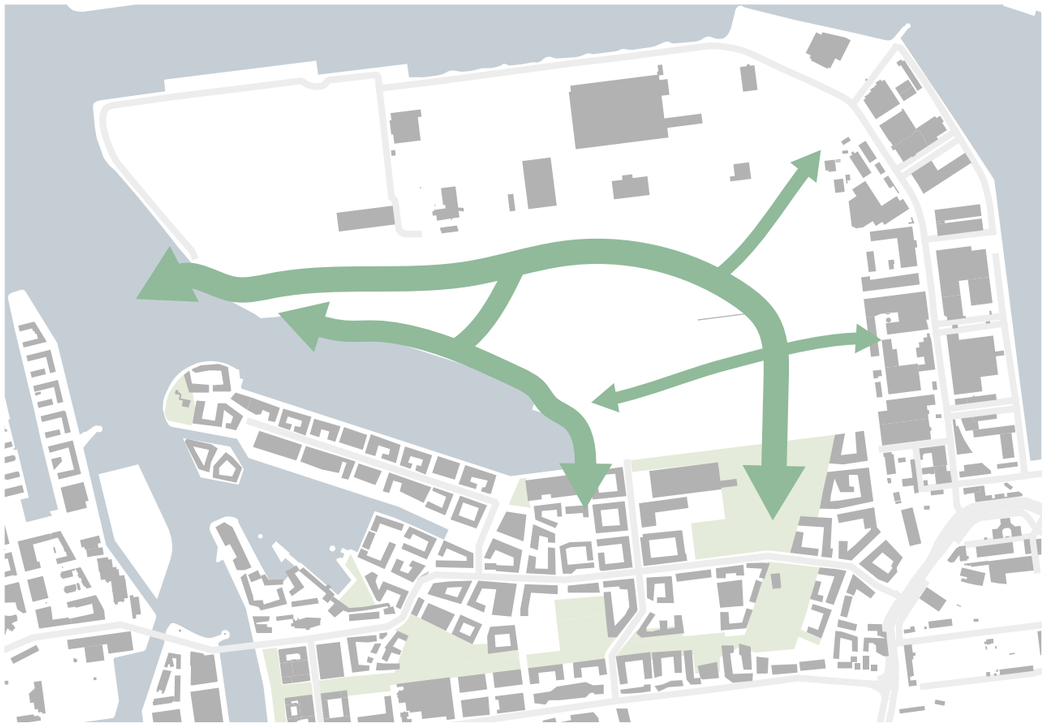
With green connections that connect to other green areas, Mellersta Hamnen can be integrated in to the green & blue loops of the city, especially to the surrounding green areas of Nyhamnen and the Western Harbor. The suggested green gestures in Mellersta Hamnen also takes future planning of areas such as Järnkajen and the Northern Harbor into consideration, by creating possibilities for future extensions of the green paths.

The green & blue loops should have different sizes of open areas to foster diversity in the urban environment.

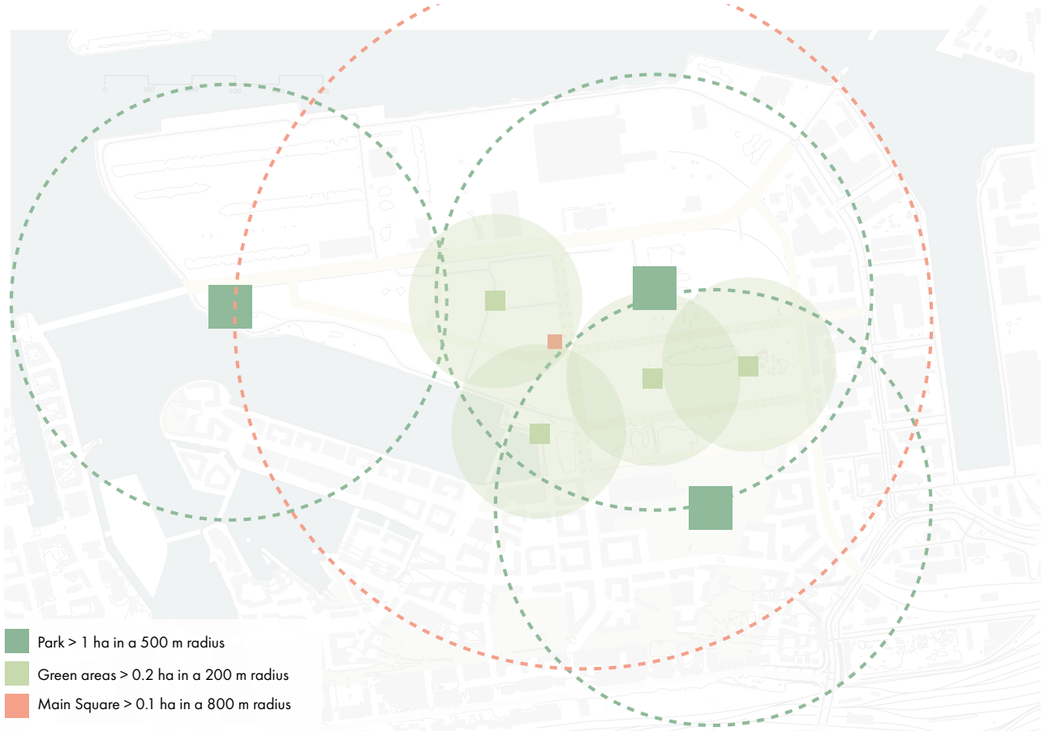


How Mellersta Hamnen can be incorporated into the green structure on a city scale level

Proposed gesture of the green & blue connections in Mellersta Hamnen



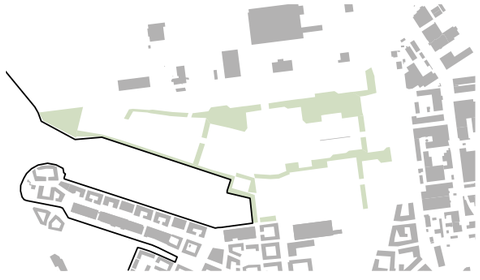
GREEN STRUCTURE



FORMING THE STRUCTURE

GREEN STRUCTURE & PUBLIC SPACES

- Using recommended values of density in public spaces from research by Ståhle et al. (2016)
- The aim for public spaces is to be part of green loops in the city
- Walkability and accessibility are defining qualities in the green structure and public spaces



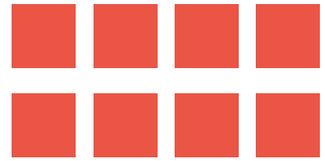
A connected greenery with a diversity in open spaces

STRATEGY: DIVERSE DENSITY

The blocks in the development of Mellersta Hamnen is proposed with a variety in sizes in order to facilitate an assortment of open spaces between the buildings. This will make it possible for diverse character in open spaces along the proposed green paths in the area.

- Started with 60 x 60 m blocks (As used in the generic modeling)
- Re-sized the blocks to create variety in open spaces
- Nudge few blocks from streets to create space in front buildings
- Higher density at larger scale open spaces such as waterfront and main & secondary streets
- Lower density at smaller scale green spaces and streets

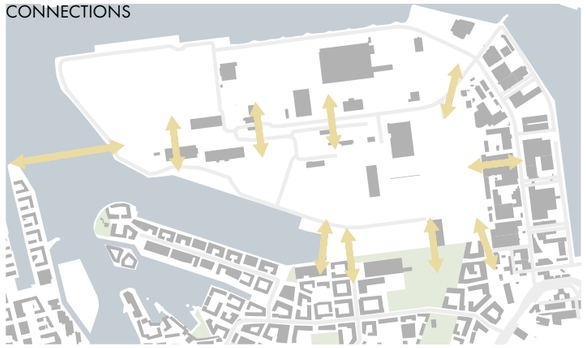
BLOCKS

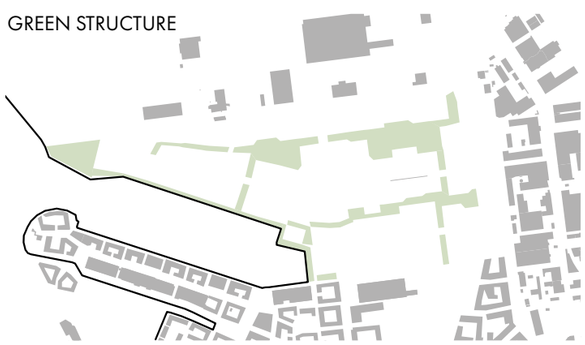


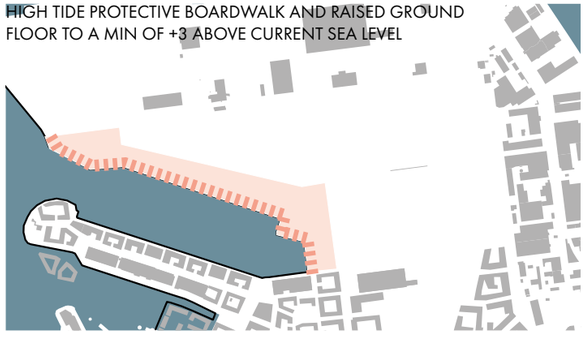
RE-SIZE

NUDGE

The block structure in Mellersta Hamnen







THE STRUCTURAL PLAN

The main street is the predominant connection between Mellersta Hamnen and the central parts of Malmö in terms of mobility by walking, public transportation, bicycle and motor traffic. The main street is a further continuation by the street network proposed by the municipality. Proposed street network makes the possibility to connect to existing and future developments in the harbor area of Malmö.

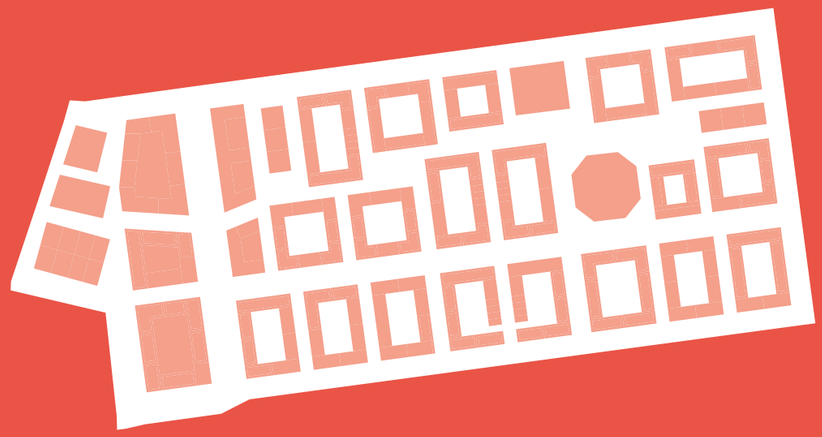
Important connections will be treated as entrances to the area and can be formulated in urban elements such as streets, green paths or public spaces. The design will incorporate the municipality's proposal of a bridge that connects Mellersta Hamnen with Västra Hamnen. In my design a public green park is suggested to be placed adjacent to the aforementioned bridge to offer a larger scale green area at the waterfront. The park at the bridge is to be seen as a node.

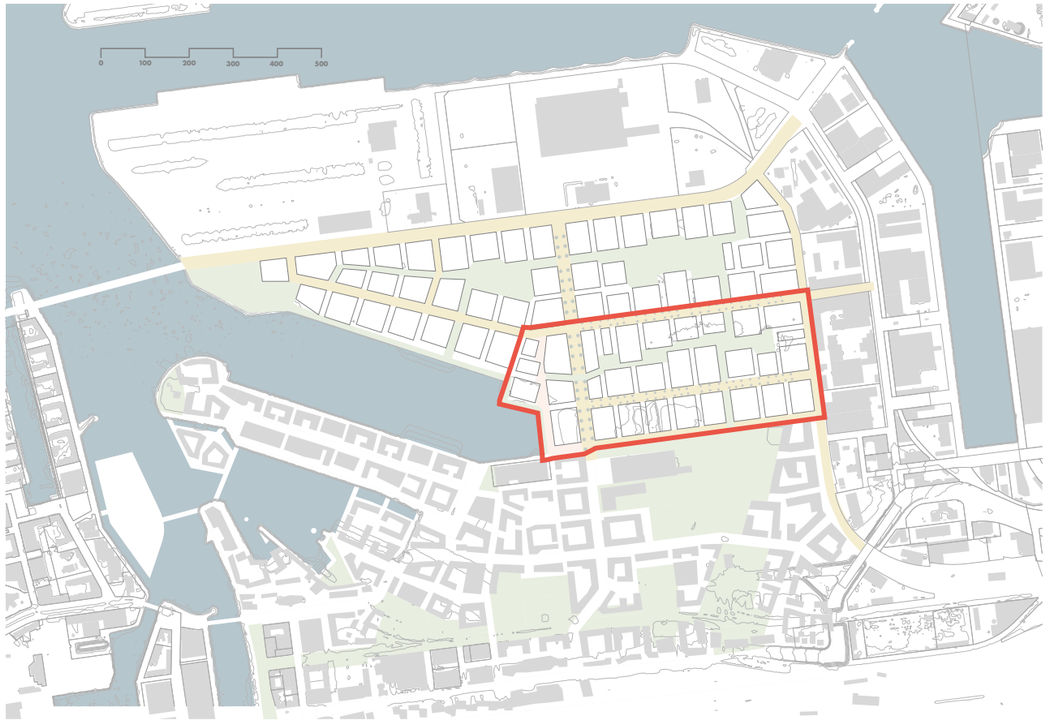
The ground level will be raised at strategic locations to handle rising sea levels. The area most sensitive to flooding by extreme high tides is the waterfront, located in the south-western part of the design site. A raised boardwalk is proposed at the south-western waterfront in the area to function both as a protective measurement as well as a public space and path. The boardwalk is also proposed to be part of the green & blue loops, offering a public path alongside the waterfront that connects with Nyhamnen and the proposed bridge to Västra hamnen.

The coherent greenery in the form of connected green paths and green areas promotes accessibility and walk-ability to the former mentioned qualities. By seeing the greenery as part of a city-wide green network, the possibilities exist for a greater green connection in the city of Malmö.

The variation in sizes in the block structure promotes the possibility for a diversity in the open spaces and spaces with different characters in Mellersta Hamnen.

THE FOCUS PLAN





The scope of the focus plan

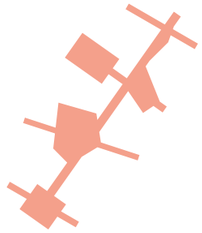
THE FOCUS PLAN

The aim of the focus plan is to explore the preferred density values and the identified positive qualities of the perceived density that has been defined in earlier chapters. The focus plan is to be seen as a first phase in developing Mellersta Hamnen.

The main public spaces are the waterfront area in the western part, with a larger scale open space, and the urban green path, going through different intimate green areas, spanning a west-east axis. Public buildings are part of the urban paths, located at the waterfront and the green path, respectively. The former creates the basis for a green loops that connects the area of focus plan with its surroundings.

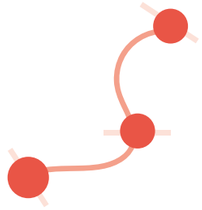
To promote a diversity regarding the built environment, building heights are determined based on the location and size of adjacent open spaces. Taller buildings are placed at larger open spaces such as the waterfront, main streets and secondary streets. Lower height buildings are placed at smaller scale spaces such as block streets and urban green paths.

DESIGN PRINCIPLES: DENSITY



VARIATION IN SCALE OF OPEN SPACES

- Mixture of intimate and more open spaces
- Visibility in and by open spaces
- Spaces to linger on
- Different sizes and characters of street-scapes
- Greater share of intersections



NODES IN THE URBAN STRUCTURE

- Landmarks to highlight nodes, public spaces, paths or green spaces
- Nodes should be part of green loops or communication streets
- Public buildings can be part of a node

DIVERSITY IN BUILDINGS

- Taller buildings facing main streets or larger scale open spaces
- Lower buildings facing smaller-scale green areas or paths
- Active-bottom floors to diversify the streetlife
- Inclined top floors to variate the sights as well as maintaining sun access

GREENERY ENHANCING THE SCALES AND CONNECTIONS

- Green elements & areas as a way to enhance the streetscapes
- Different sizes of connected green areas
- Use the streets as green links connecting the green areas in the site as well as the surrounding ones

STREET NETWORK

MAIN STREETS

SECONDARY STREETS

BLOCK STREETS/
PEDESTRIAN PRIORITIZED SPACES

GREEN STRUCTURE

GREEN AREAS
& PATHS

STREET TREE
PLANTINGS

INTIMATE STREET
GREENERY

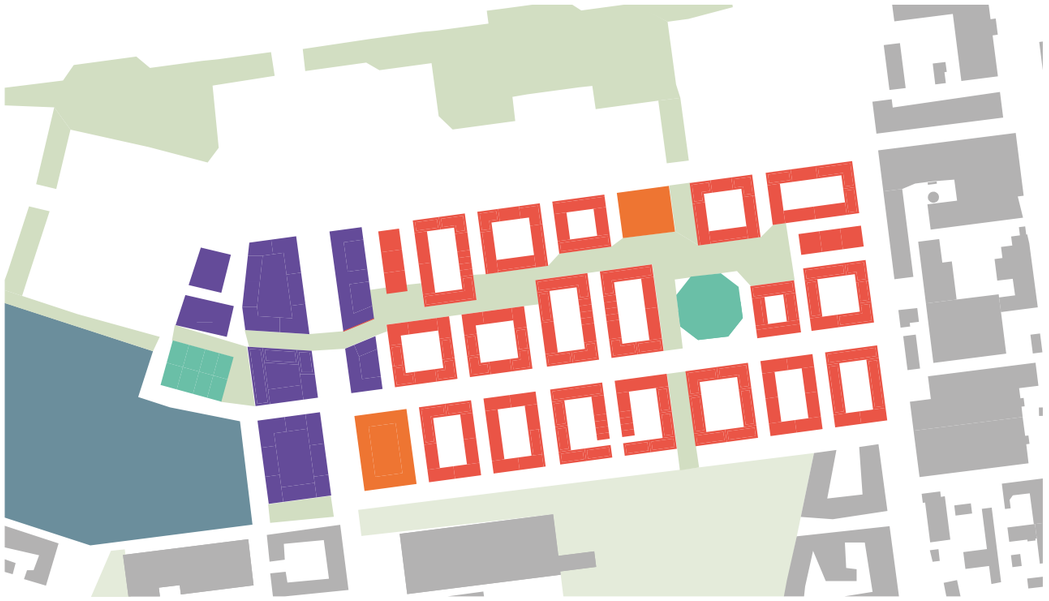
PROPOSED GREEN AREAS IN
NYHAMNEN

NODES

PUBLIC
BUILDINGS

PUBLIC SPACE NODE

BUILDING FUNCTIONS



MIXED-USE

RESIDENTIAL WITH
ACTIVE-BOTTOM FLOORS

PUBLIC
BUILDINGS

MIXED-USE
PARKING STRUCTURE

FOCUS PLAN

P

PUBLIC BUILDING

PUBLIC BUILDING

AXO: THE FOCUS PLAN

In the axonometry, we can see of the focus plan relates to its surroundings. The axonometry also shows the diversity in the building heights and structures as well as the variety of urban spaces in between them.

The greenery is connected in a network that spans both the proposed design in Mellersta Hamnen and surrounding areas such as Nyhamnen and the inner city.

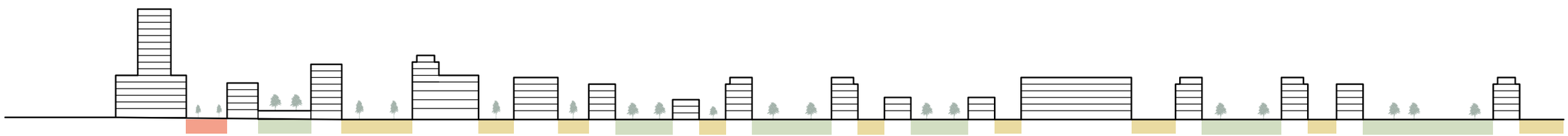
SECTIONS

Streets

Courtyards

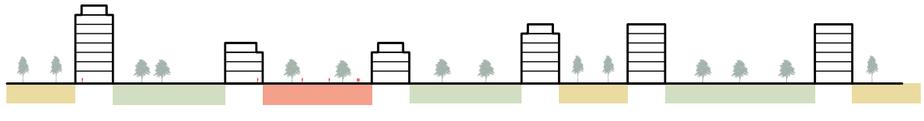
Public open spaces

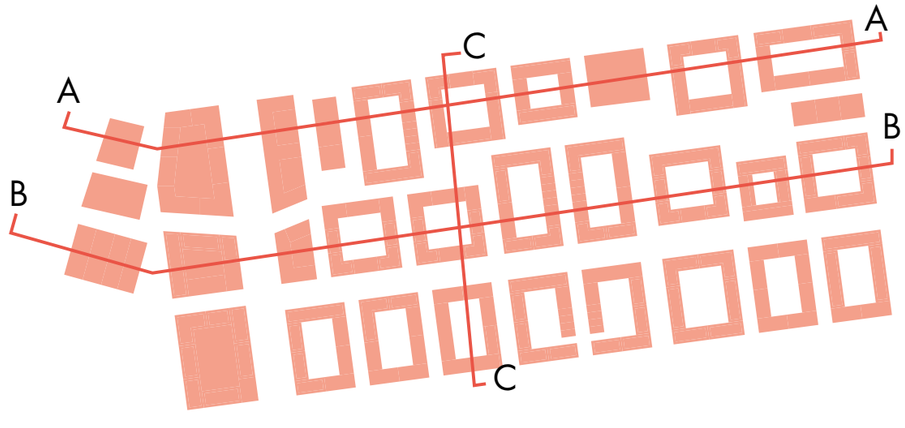
A:A

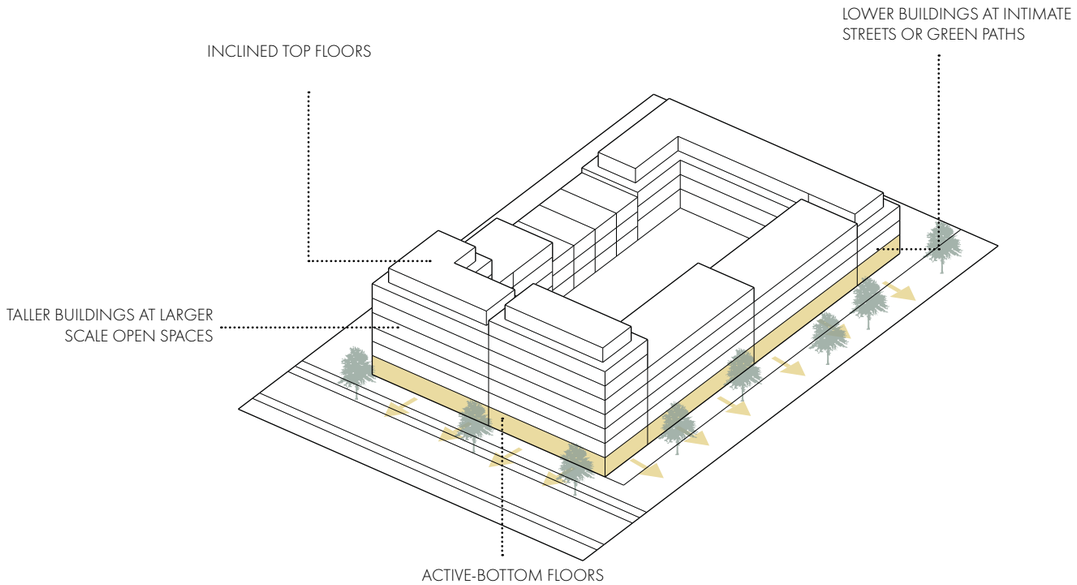


B:B

C:C







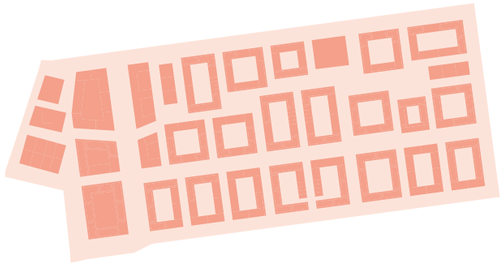
BUILDING & BLOCK STRUCTURE

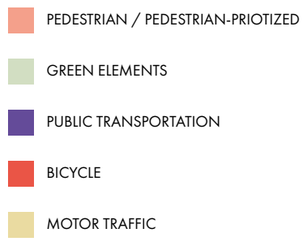
In the analysis of the density in Malmö as well as in the generic modelling, the block structure was identified as a suitable urban form to reach the preferred density values.

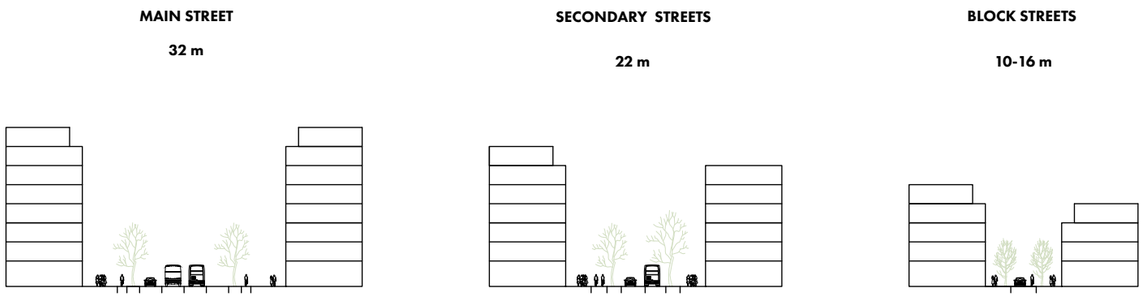
The blocks in the development of Mellersta Hamnen is proposed with a variety in sizes in order to facilitate an assortment of open spaces between the buildings. This will make it possible for diverse character in open spaces along the proposed green paths in the area.

The building heights are determined based on the facing or adjacent open spaces. Taller buildings are placed at larger scale open spaces such as main streets and the waterfront with lower buildings facing more intimate block streets or green areas and paths. This will open up for a higher diversity among buildings in the urban fabric of Mellersta Hamnen.

Active-bottom floors in lets the functions in the buildings spill out on the street facilitating a vibrancy in the streetscape.







STREET TYPOLOGIES

MAIN STREETS
Street with a priority on sustainable transportation such as public transport, bicycle and walking. Main street will also function as a commercial path through the area with a higher share of offices and other commercial functions. Parking buildings, either as separate entities or incorporated in bottom floors of buildings, will be placed alongside the main streets at strategical locations to hinder through traffic in areas with smaller scale streets. Greenery in the form of tree rows and street plantings create breaks down the scales of the taller building structures as well as offering a green connection to adjacent streets

SECONDARY STREETS
The secondary streets follow the logic of the main streets, although they differ in width, being narrower. The secondary streets emphasize the communication between the main street and block streets, functioning as a mediator between them.

BLOCK STREETS
Street with shared spaces and greenery that links to a green network. Parking spaces are mainly reserved for bicycle and disabled parking. The accessibility for motor traffic is mainly for emergency vehicles, goods transport or inhabitants or visitors with disability.

STREETS AS PUBLIC SPACES
The street design in the project aims to have a greater share of the street as public spaces such as meeting points with seating and greenery. The public spaces in the street can both function as resting spots as well as an extension of the functions in adjacent buildings (schools, offices, commercial activities). The idea is for the street to be more than a communication space by enabling the possibilities to stay, linger or even play in the streets. Active bottom floors in combination with generous space for pedestrian use is proposed to facilitate vibrancy in the urban environment, aiming to foster safety, social interactions and activity.

Perspective of the main street

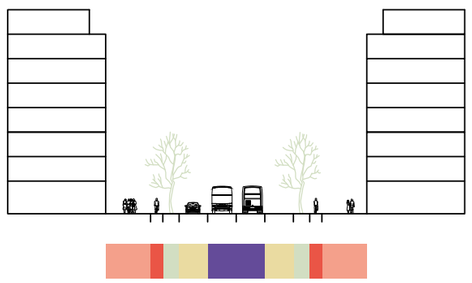
MAIN STREET

The main street is the major communication way, connecting with Nyhamnen and the industrial area north of the site. A higher share of commercial functions is concentrated alongside the main street with premises for shopping, restaurants, business, office and such.

The main streets have long sightlines to facilitate navigation and clarity in the area, in contrast to the intimate block streets. The main streets are also wider to facilitate sufficient spaces needed for pedestrians, public transportation, bicyclists, and motor traffic.

A higher share of taller buildings is placed at the main street to offer a variety in the area as well as offering spaces with a grander scale. The taller buildings also follow the principle of variety in heights with a span of 5-9 floors.

Greenery is used to break up the scales of the taller buildings, with trees and plantings in the streets. Tree rows offer a sense of direction and connection with surrounding green areas.



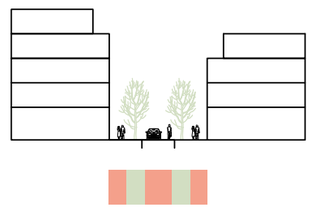
Perspective of a block street functioning as both a communication way and public spaces

BLOCK STREETS

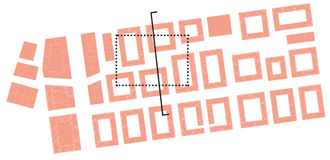
The block streets are to be seen as both a communication way and a public space. The building heights in the block streets are also lower than other proposed streets, in order to cater to a more human scale as well as offering a diversity regarding characters of urban spaces in Mellersta Hamnen.

By prioritizing a higher share of the street for pedestrian and non-vehicle functions, the spaces between buildings can be a quality for the inhabitants and visitors in a dense city. Elements such as greenery, benches and ground markings create soft borders that enables different types of usage of the spaces in between the buildings as well as offering clarity. The greenery and seating are proposed to create an environment where one could linger. The higher share of pedestrian space also allows the functions of premises to spill out on the streets such as café and restaurants. The greenery, with trees and planting, facilitates the block streets to function as green links to the different green areas in the surrounding, by giving gesture and awareness.

The block streets have a uniform ground material, with yellow bricks, in order to offer a familiarity when navigating through them as well as announce the spaces as pedestrian prioritized for the visitors and the inhabitants. However, ground markings in the form of red strips in another ground material is proposed to offer a subtle distinction of the space. Thus, creating a basis for the interaction between different mobility methods such car, bicycle or walking.



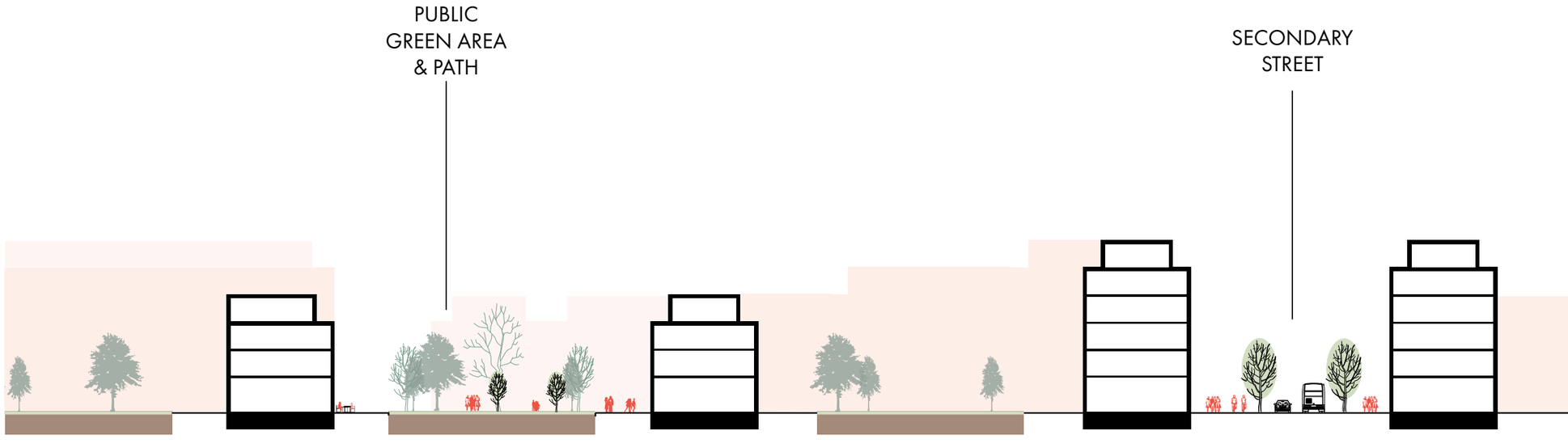
Perspective of one of the spaces along the green path



SMALL-SCALE GREEN AREAS & PATH

The area is part of a green path network that connects to the waterfront, the park area in Nyhamnen as well as future phases of Mellersta Hamnen. The idea is to have a green path that goes through several green open spaces with different sizes. The block streets are to be seen as links to the surrounding green areas by having green elements in the streetscape that both makes a visual connection to adjacent green areas as well as a pleasant public space.

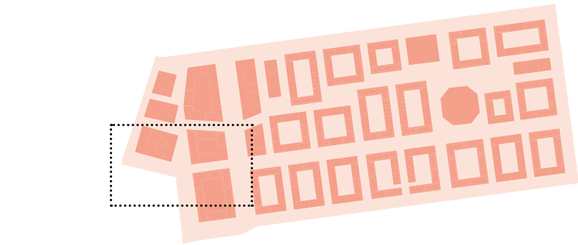
The green areas and path are to be seen as another option to use the spaces in Mellersta Hamnen by offering a path that through different green spaces framed by buildings with lower height than the ones at the main streets or secondary street. The path, as well as the connecting block streets, are pedestrian prioritized, meaning one can walk and linger in another tempo than the more fast-flowing communication streets. The green area & path between lower scale buildings is also meant to offer more intimate public spaces than the larger scale ones such as the parks in Nyhamnen or the waterfront area.

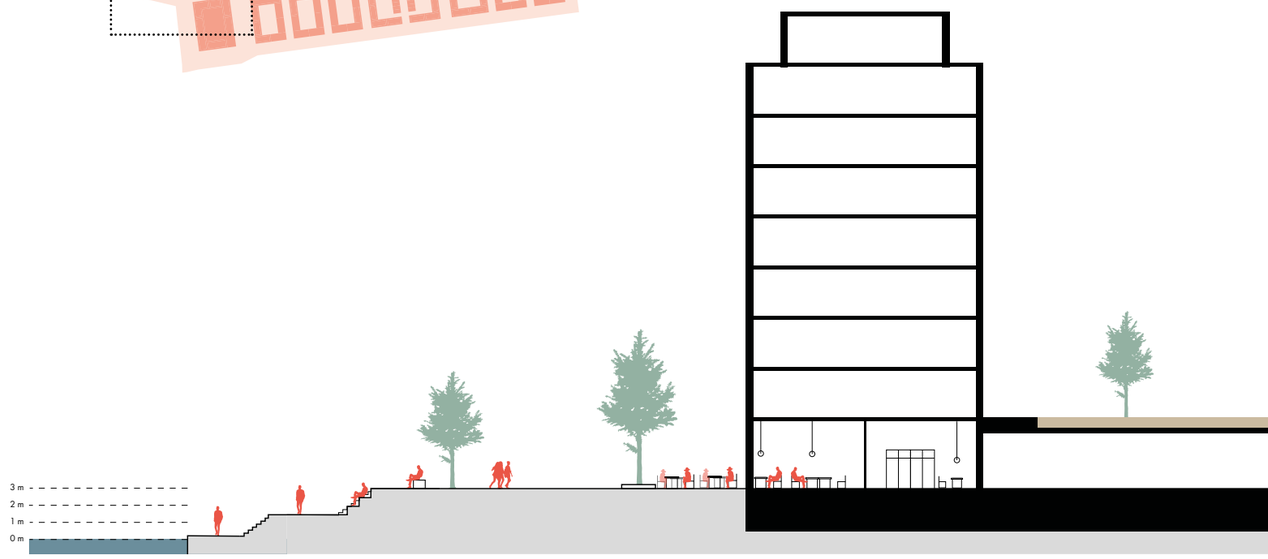


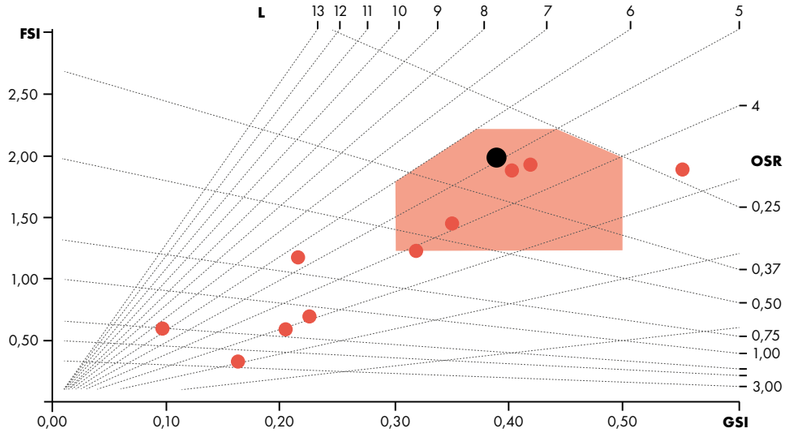
WATERFRONT

The context of the waterfront area with larger open spaces in the form of the sea to the west and the main street on the east opens the possibility for buildings with a grander gesture towards the sky. One of the main public spaces is a boardwalk that offers both protection from extreme high tides while maintaining the contact with the water. The waterfront is also part of a green loop that connects with surrounding areas.

The boardwalk is part of an area in the focus plan that are proposed to have a higher share of commercial and public functions in the buildings and open spaces to offer accessibility to the waterfront for both inhabitants and visitors. A public building, with proposed use of a library, a university or similar, is placed at the edge of the waterfront to create a landmark in area that connects the waterfront both physically and visually to the surrounding districts. Likewise, blocks with tower structures also offer a visual distinction from a longer distance in the city, signifying the waterfront area as a node for commercial and public functions.







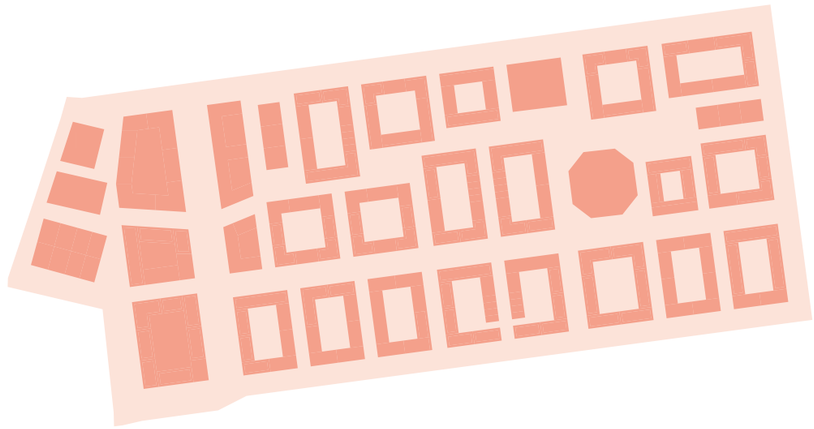
Preferred density values

FSI: 1,25-2,25
GSI: 0,30-0,50
OSR: Min 0,25
L: 6

Mellersta Hamnen

FSI: 2
GSI: 0,39
OSR: 0,3
L: 5

Explored areas in Malmö



PUTTING THE FOCUS PLAN INTO SPACEMATE

With the design of the focus plan being decided, it is possible to calculate the density and put it into the Spacemate chart. Since the preferred density values has been the basis when deciding the amount of buildings and their heights as well as the open spaces and the ground coverage in the focus plan, the final design lands in the

FSI
The floor space index in the focus plan is 2. While the value is not at the maximum preferred threshold (being FSI of 2,25), the focus plan has a FSI in line with the highest of the investigated areas in Malmö.

GSI
The ground coverage of the focus plan fits in the preferred threshold of 0,30-0,50. With a score of 0,39, the GSI of the focus plan also aligns with the recommended max value of 0,40 by Ståhle et al. The ground overage is in similar range as

OSR
The open space ratio in the focus plan is 0,3. The pressure on open space in the focus plan is higher than all of the investigated areas in Malmö, excluding Gamla Staden.

L
The average height of the buildings is 5 in the focus plan.

The FSI of the focus plan is roughly the same as the highest scoring areas from the Spacemate studies in Malmö and it can be argued if the proposal is of a higher density. However, by taking the layer variable in the areas into consideration, one can see that the average height in the focus plan is higher than similar investigated areas in Malmö with the same FSI. It should be noted that the L variable is a medium value and the span of heights in the focus plan range between 3-16 floors, having a greater variety of building heights than nearly all of the investigated areas in Malmö

POPULATION, WORKPLACE & DWELLING ESTIMATION

As a concluding assessment it would be interesting to make an estimation of how much the proposed structures in the focus plan of Mellersta Hamnen could fit.

In the calculation of the estimated population and dwellings the following data and parameters will be used:

The design of the focus plan contains a gross floor area of 382 059 m2

The average size of a household in Sweden is 57 m2 (SCB, 2016)

The average amount of people living in a household in Sweden is 2,2 persons (SCB, 2017)

The average size of a workplace is 25 m2 per person (including communication areas, staff room, meeting rooms and such), (Malmö Stad, 2019)

Ståhle et al. recommends a share of spaces for premises of 40-60 % of the total gross floor area (2016). In this estimation of population, a share of 50% each on premises and dwellings is accounted for.

Number of new dwellings in the focus plan of Mellersta Hamnen: **3351**

Expected number of new workplaces: **7641**

Expected number of new inhabitants: **7373**

CONCLUSIONS

CONCLUSIONS

For my conclusion I will tie back to my research questions for further discussion and reflections about the outcome of this thesis work.

- *How can density be used as an urban design tool?*

In this thesis, one of the purposes was to explore a higher density proposal in Malmö. The Spacemate method was used as a tool to define the existing physical density in the city in a multivariable way in order to capture both the urban form as well as the density values that relate to the forms in an area. Additionally, the study of my perception of the densities in Malmö helped to further nuance what qualities that contribute to a positive experience, in relation to the physical density. In the end, I contentedly reached a density in the focus plan of Mellersta Hamnen that was in the preferred scope regarding FSI, GSI, OSR and L and that integrated the identified positive qualities of the perceived density in Malmö.

The density values, provided by the conducted Spacemate studies, guided the design process of Mellersta Hamnen. With the preferred density values, there were possibilities to tie back to the values during the whole design process and, for example, add or detract building floors or adjust the open spaces. Furthermore, during the sketching I could move or re-size some building blocks to create additional space for greenery or other urban components. In regard to the aforementioned, the preferred density values from the Spacemate studies offered a sort of freedom when designing.

Berghauser Pont & Haupt argues that decisions about density based on values from the Spacemate method has an objective character. I believe this is fair to some extent. The preferred density values were based on the existing measurements of the investigated areas in Malmö. On the other hand, the perceived density also influenced the maximum or minimum values while defining the physical density, especially concerning the open space ratio.

During the Spacemate analysis, a few uncertainties regarding the calculations arose. In both the investigation phase of existing areas in Malmö and in the design proposal there happen to be blocks with raised courtyards. Since the raised courtyards both include a building footprint as well as open space, a dilemma regarding the calculations of these urban components appeared. The available material that has been used about Spacemate in this thesis doesn't handle the former topic, hence the calculation of density using only the building footprint when these situations emerged. A similar case can be made for the uncertainty of public spaces or open spaces on building roofs. Thus, the amount of open space in existing areas and the design proposal in Malmö can be higher than what is being calculated by the Spacemate method. Future research could investigate how open spaces on raised courtyard and on building roofs can be calculated regarding the Spacemate method or similar density measurement tools.

Since the Spacemate studies was conducted in areas that already was built and data for yet-to-be constructed areas could not be obtained, a lot of newly planned areas in Malmö was ruled out. It would be interesting how the density in new development areas in Malmö would look when analyzed through the Spacemate method to further nuance the density in the city.

As shown in the generic modelling, the strip or tower typology alone was deemed not suited for the preferred density values, leading to the use of the block structure. However, other typologies beside the block could be

incorporated, as shown in the design with the towers among the block structures. Overall, the generic modelling was also helpful as a first step to test my findings on a more abstract and general level.

The perceived density studies were helpful to identify design principles regarding the urban qualities in the experienced density. The identified qualities were in a way based on existing conditions in Malmö and could be argued to be qualities that adhere to the character and identity of the city. It is important to note that the identified qualities stemmed from my perception of the density and could be experienced differently by another individual. With more time, a study including urban walks through the selected areas could be used with multiple individuals to further nuance and evaluate the perceived density of the investigated areas. Since this thesis work was in process during a pandemic, the application of urban walks with other persons was ruled out due to the risks associated by gathering groups of people.

Further on, it can be discussed if the density in the focus plan should be classified as high density. To tackle this, we need to be reminded that density can have contextual meanings. The density proposed in Mellersta Hamnen is higher than the investigated areas in Malmö when all four variables in the Spacemate method is considered. For that reason, in the aforementioned context, the density in Mellersta Hamnen can be seen as high. However, there are possibilities that the density in the focus plan would be seen as having a lower one when comparing with high density developments in bigger and denser cities such as New York or Shanghai. However, since the design of my site area have a completely different setting regarding mentioned cities, I believe that there is of little relevance to directly compare them in this situation. The importance is that context matter, especially with regard to a complex subject such as urban density. I stress that my design in Mellersta Hamnen can't and shouldn't be put into another context than the one it has been proposed it. I would however recommend the usage of the process behind defining the density. If I would have explored a different city and context with the same research questions, I would probably end up with different preferred density values and perceptions of the density, but that density would have a relation to that particular city or area. Here in lies the usefulness of density as a design tool.

- *How can public spaces be designed in dense urban areas?*

Regarding public space in a higher density development, the design of Mellersta Hamnen incorporates the streets as a space where one could linger, with functions and uses such as greenery and seating. Since streets are an essential urban element in terms of offering accessibility to buildings and paths to adjacent areas, they have a possibility to be further expanded and developed as public spaces. The design also proposes the use of green paths that goes through and in between green areas and buildings, having a variation of sizes to offer different public spaces in the denser urban environment. Thus, demonstrating that connections can be further expanded as public spaces in dense urban areas. Furthermore, context is important regarding public spaces. The possibility to use the existing qualities in Mellersta Hamnen, such as the waterfront, was helpful to create a variety of public spaces. Another way of offering public spaces in the dense city could be in or on the buildings, especially the roof areas. Further research could test how public spaces on roofs could take form in a high-density area.

SUMMARY

- Spacemate has been used to calculate existing density in Malmö and formulate a preferred density values for a development of Mellersta Hamnen
- The preferred density values has guided the design process in terms of building heights and open spaces
- The result of the perceived density studies have been the basis for urban qualities that can be incorporated in denser developments
- Both the spacemate study and the perceived density study have influenced the urban form of the focus plan
- The space between buildings, especially streets, is important in higher density developments and can be designed as part of green paths to offer a variety of public spaces
- Context matter in a complex topic such as urban density.

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