DENSIFICATION BY DESIGN

Tony Nielsen

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SUMMARY

In order to achieve sustainable development, there is perhaps not one strategy more often used in contemporary urban planning than density. Many cities have a dedicated densification strategy of their inner city, such as HafenCity in Hamburg or Älvstaden in Gothenburg. However, one critique of contemporary architecture is how new urban developments are becoming generic; more and more similar to each other, no matter where in the world the project is located. Therefore, the purpose of this thesis is to explore the concept of city density, and to try to understand if there is any tension between increasing density and withholding a city's character and identity.

Density can be measured in many different ways, one of which is the Spacemate multivariable method. Spacemate measures an area in terms of the built intensity, its compactness, the amount of public space and the average building heights. The purpose of the thesis is to use the Spacemate as a design tool, in order to test how density can shape an urban design proposal.

The city of Utrecht has been chosen for these questions to be researched.

TABLE OF CONTENTS

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PREFACE

“Space should be regarded as a scarce product.”

- Berghauser Pont & Haupt 2009

INTRODUCTION

The world, and how we humans have come to treat it, is, to say the least, often very problematic. Mankind continuously tear apart the environment, deplete natural and limited resources and studies have generally confirmed that humans have had a significant impact on the recent global climate changes. Furthermore, social issues continues to arise on various scales, for example; globally, the migration flows from middle eastern conflicts give rise to reactionary xenophobia in Europe; locally, gang involvement and violence is often the cause of poverty and unemployment. There is also the issues of an unstable, unpredictable and potentially catastrophic global economy, which can lead to the collapse of nations.

But it is not all doom and gloom. As much as we are able to produce and reproduce problems, humans are equally capable and willing to combat them. This could often be seen manifested into strategies and goals, such as the United Nations Sustainable Development Goals on the global scale, or a municipal development plan on the local scale. Here, one specific term is often used; sustainability. What is it?

The term sustainable development was popularized in the Bruntland Report from 1987, in which it is defined as: *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*[1]. This (arguably too vague) definition is then often further embodied in the three pillars of sustainable development; the environmental, the economic and the social pillar (other similar terms may be used).

But this thesis cannot encompass the sheer amount of literature and the incredible complexity of the topic 'sustainable development', and in order to bring it into the relevant field of urban theory, an urban planning

1 Our Common Future 1987

reductionist explanation of it may be offered as: *if the development have a positive impact on the social, economic and environmental aspects of the city, then it is sustainable* (my own formulation). In my view, this seems to be how the majority of planning offices interpret the term.

In order to achieve sustainable development, there is perhaps not one strategy more often used in contemporary urban planning than density. But what is density? There is a few ways to look at it; either it's population density or how tightly built a city is. Density can also accompany other urban design aspects, such as vegetation density or parking density. Density can thus be used very broadly. As the focal point in this report, the term will be more in-depth explained further on.

But it is interesting to think that contemporary urban planning has concluded that density, or an increase in the compactness of cities, is the way to sustainable development. What reasons are there? These arguments will also be further discussed. One interesting point is the idea which serves as this report's preface, expressed by Berghauser Pont and Haupt; the idea that space should be regarded as a scarce product[1]. Many believe that we are running out of space.

However, if we simply regard population density, we can easily observe that this is not the case. Taking all the world's population - a little over 7 billion - and bunching them all together, the space we would take up equals roughly to the size of New York[2]. Although, that would mean having a population density of ten people per square metre. While theoretically possible, it would not be very enjoyable. But what about fitting the world population into the size of Texas? In that case, each person would have 100 m2 at their disposal, which is well enough for a comfortable living[3]. This is both the issue and the *raison d'être* of measuring population density; that it only measures population density. Such calculations fail to consider the actual physical aspect of space - if everyone lived in a city the size of Texas, how much space would be needed for everyone's workplace (different jobs require different amounts of space)? How green would such a city be? How wide would the roads be? Population density cannot tell us the entire truth of the size and form of a liveable, compact city.

How, then, should density be measured? This will be discussed further on. One model for measuring density is the Spacemate, which will be used as the foundation for the design proposal.

1 Berghauser Pont & Haupt 2009

2 Urban 2015

3 Population Research Institute 2019

One country in which the sentiment 'space as a scarce product' is very much of concern is the Netherlands. The Netherlands is the fifth most densely populated country in the world, (not counting nation-cities such as Monaco), and have thus been forced to consider the density factor of city planning. This is especially evident in the Randstad region. Randstad is the megalopolis area consisting of the four largest cities in the Netherlands; Amsterdam, Rotterdam, The Hague and Utrecht, among other settlements. These cities takes the form of a circle shape, which surrounds the "groene hart" (the green heart). This is a large rural area, vital for the Dutch agriculture, the biodiversity and recreational activities. A reasonable strategy for the surrounding cities is thus to avoid developing on the Green Heart, and as a result of space becoming more scarce, the cities will now have to be more compact.

Another interesting aspect of the Dutch cities is their specific character. The canal running through the streets, facades made up of thin buildings of various colours of brick. Large windows and furniture hooks. A photograph of Amsterdam is instantly recognizable, and while they are all quite similar, each city also have a distinct identity. Utrecht, for example, remarks itself by having

the canal one level below street level, and the canal is lined by the old wharf warehouses. These wharfs, unused and unnecessary today, have been turned into restaurants and shops, meaning that Utrecht essentially have two levels of ground floor commerce.

So Dutch cities around Randstad have an appreciated character and identity which they will do well to uphold. However at the same time, they want to increase the density of these cities. Is there any tension between these two ideas? One efficient way to increase density today is to go tall. Many cities are, or have been, turning their more central parts into high-rise blocks and skyscraper-land. One example of that is the new Älvstaden project in central Gothenburg; the single, largest city development project in all of the Nordic countries[1]. One critique of contemporary architecture is how new developments are becoming more and more similar to each other, no matter where in the world the project is located. In America, in China and in Europe, can be found the same large, glass and steel constructions in central cities. There are of course many underlying factors to this, such as efficiency in building construction, the latest trends in architectural style, and the ever-globalising economy and culture. The genius loci is gone. Does Älvstaden care about the history of Gothenburg? With a quick glance, one could argue that it does not. Densifying cities therefore begs the question; does an increase in density come at the cost of the uprooting of a city's identity?

To study this, the city of Utrecht have been chosen. Admittedly, any of the cities around Randstad could have been chosen for this theme, but in Utrecht was found a location, where all the questions that have been raised in this introduction could be explored and tested.

1 Göteborgs Stad: Älvstaden 2019

PURPOSE

The purpose of this thesis is to explore the concept of city density, and to try to understand if there is any tension between increasing density and withholding a city's character and identity. Furthermore, the purpose is to see how the Spacemate method can be used as a design tool.

RESEARCH QUESTIONS

- Does an increase in density affect a city's identity?
- How can density be used as a design tool?

These research questions are aimed at the empirical findings of the thesis and will be discussed and answered in the chapters Analysis, Design and Conclusions.

THESIS OUTLINE

After this introductory chapter follows a discussion about the theory behind city density and density measurement in Chapter 2. Utrecht and the project site is introduced in Chapter 3. The neighbourhood analysis conducted in this thesis is presented in Chapter 4, which consists of the density study and the visual study. Here is included the results, findings and conclusions of the analysis. The design proposal of the project site is presented in Chapter 5. Lastly, in Chapters 6 and 7 follows an account of the thesis' conclusions and personal reflections.

THEORY

DENSITY: DEFINING THE TERM

As has been mentioned already, there is no one, clear-cut, black and white definition of the term density in the urban context. It depends on what type of density, and how that density is measured. For example, density can be defined and measured by how many people populate a given area, and thus meaning that a higher amount of people within the area equals to higher density. This is the most frequent use of urban density, and often takes the form of Floor Space Index (or Floor Area Ratio). What such measurements fail to consider is the physical space. The number of population within an area won't tell us about how the area looks or how the land is used[1]. The building mass can, in contrast, be measured by calculating the total building footprint in the area. Here, the outcome is reversed; such calculations won't tell us about the amount of inhabitants and how they use the area. Other aspects of urban planning and design can also be measured in terms of density, such as greenery, where one can measure how high the concentration of vegetation is within an area and conclude if an area has a high or low amount of greenery.

Furthermore, there is the issue of perceived density versus actual density. For example, a place could be perceived to be dense, while statistically it isn't. Similarly, a place that includes a high amount of people in a small area, can be perceived as being devoid of people. In this polarization, the movement patterns and street frequency of people is highly important. An inner city neighbourhood, with mixed use functions and ground floor services, can have a high amount of visitors that daily frequent the streets. Comparably, in a peripheral neighbourhood, which might be

1 The Density Atlas 2011

Bijlmermeer, Amsterdam (1966). An example of high Floor space index, whilst having a very low ground coverage.

entirely residential, there is no reason to visit the area. These two examples may have the same type of density, but have their density perceived differently. Thus, density can't tell us everything; other aspects, such as mixed-use, is vital to consider.

Churchman, in her effort to disentangle the definition of density, also notes the importance which different countries and cultures has on the term; meaning that countries has different ways of measuring the density of cities, and cultures can have varying perceptions of what is deemed dense[1]. For example, an area may be viewed as medium density in a Chinese context, but classified as high density from a European perspective.

This subsequently raises the question; what is low density, medium density or high density? To be sure, a single-family housing suburb without a commercial centre will most likely be a low density district, while it is hard to argue against Lower Manhattan being anything but high density. But the line between distinguishing low, medium and high density is often blurred[2].

It can therefore be said that defining density is not as easy as it first seems. The density can be specified, as in population density or built density; it can be both measured or experiential, as in statistical or perceived density; and it can be interpreted differently by different cultures and countries. However, in an attempt to understand and to try to explain the term for further use in this thesis, a broad definition can be applied thus; density is about the concentration of something within an area.

1 Churchman 1999

2 The Density Atlas 2011

DENSITY: HISTORY AND *THE GOOD CITY*

Despite all its difficulties to be defined, density has frequently played a big part in the discussions about the good city. In Jane Jacobs groundbreaking release, The Death and Life of Great American Cities, she criticised the modernistic planning practice and proposed a new way to develop cities. Jacobs argued that developing a good urban district is determined on four conditions; one of which is as follows:

> *Condition 4: The district must have a sufficiently dense concentration of people, for whatever purpose they may be there. [This includes people there because of residence.]*[1]

Although she doesn't specify how dense this concentration of people would be and believe that the exact density cannot be defined. However, what Jacobs implied in her work went totally against the views of many of her predecessors. Other voices before her preached that cities were, in fact, too dense.

One such voice belonged to Ebenezer Howard, who, in his work Garden Cities of To-morrow, argued that both city and countryside have their strengths and weaknesses and that a good city lies in the marriage of city and country[2]. A city is too dense, a village is too sparsely populated; thus Howard's Garden City is the perfect equilibrium. Other architects went even further in the subsequent years. Unwin argued that the ideal is to have 12 dwellings per acre in his pamphlet Nothing Gained by Overcrowding[3], while Frank Lloyd Wright in The Disappearing City proposed the Broadacre City plan: a density of only 1 dwelling per acre[4]. These views were, of course, influenced by the history of cities, and with overcrowding followed unsanitary living conditions. By building less dense, more room would be given to necessary infrastructure and open, green spaces, creating healthier environments.

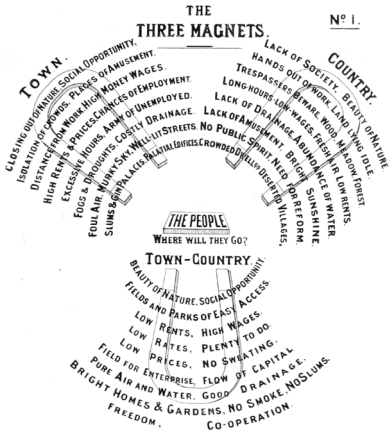
This functionalistic building approach would arguably be taken too far in the subsequent modernistic planning period. This is what many oppositions, including Jacobs, pressed. Modernist planning created cities which was devoid of public life; a city in which the human scale got lost among the huge buildings and vast open spaces; and the seemingly most important inhabitant in the city was the private car. Not to mention the lack of respect shown to minority groups living in impoverished areas which were on the cusp of redevelopment. So, it is perhaps not a surprise that, in the years following the aftermath of modernism, the new trend in urban

1 Jacobs 1968, p 200

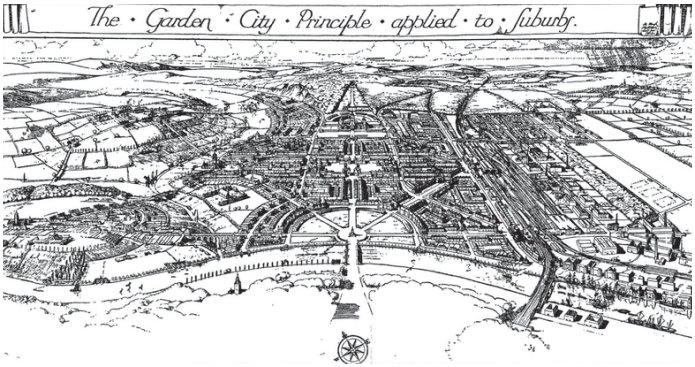
2 Howard 1902

3 Unwin 1912

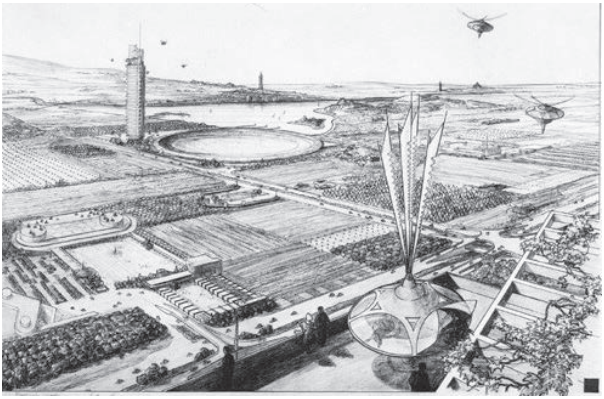
4 Lloyd Wright 1932



Ebenezer Howard's Magnets.



Raymond Unwin's idea.



Frank Lloyds Wright's Broadacre City.

planning became, instead, a more densely concentrated city.

So what are the benefits of a more densely concentrated city? The arguments for its sustainability, naturally, comes in contrast with the unsustainability of low density. Remaining on Jacobs, she explains that low density will not generate city liveliness or public life - their population are too thin - nor will they help maintain city sidewalk safety[1]. Churchman also notes how low density areas are often criticized for having social homogeneity and are commonly socially segregated[2]. Thus, a higher density offer a greater potential for segregation to be combated.

The social aspect is not the only benefit, there is also the environmental. Berghauser Pont & Haupt summarise it convincingly:

> *Certainly, high-density alternatives to sprawling cities do not provide an instant solution to the problems of energy consumption and CO2 production caused by car mobility, but they are prerequisites for other policies to combat climate change such as fiscal incentives, carbon rationing, investments in public transport, and so forth. These will be largely incompatible with low densities. The idea to densify our cities is more and more regarded as the key solution to arrive at a more sustainable city form.*[3]

In short, it is argued that high density is a requirement for a city to be environmentally sustainable.

Many economical benefits has also been explored. A high density city is argued to be more energy- and land-use efficient; more people help entertain and maintain services and amenities and thus support the local economy; it reduces the cost spent on car-related parts (such as roads, parking lots, driveways) in new development projects; less cost is spent on constructing housing units if they are compiled within a small area; and construction is profitable as developments are often carried out on high-value land[4]. These profits can subsequently help fund energy-efficient technologies, can establish well-functioning transportation systems and increase the standard of public life in the city.

So a highly dense city sounds great! It is shown to be socially, environmentally and economically sustainable. There can be no way to disprove this, right?

1 Jacobs 1968, p 209

2 Churchman 1999, p 5

3 Berghauser Pont & Haupt 2009, p 204

4 Churchman 1999, p 13

DENSITY: A SHORT CRITIQUE

There is, of course, a huge caveat when determining what is the best density. What the historical discussion about density has taught us is that there is no 'magic number', no one density regarded as the most sustainable. As Berghauser Pont & Haupt puts it:

> *Every aspect of density, high or low, has its advantages and disadvantages, depending on the context (place and time) in which it is assessed. Attempts to describe the 'best densities' or the 'good city' have a long history, but all tend towards highly prescriptive recommendations based on the subjective leanings of individual authors in specific contexts.*[1]

Churchman is of the same idea:

> *One of the problematic aspects of attempting to link density and positive or negative consequences is the tendency to make assumptions about how various levels of density affect people's lives. There is no systematic evidence as to whether higher densities affect everyone or most people the same, who is affected, and to what extent they are affected.*[2]

As much argument that can been found of the sustainability of a higher density, so too can arguments be found to argue against it. For example, a higher land-use concentration can lead to less recreational and open spaces; to traffic congestions that produces pollutants; less space for vegetation to absorb these pollutants; or reduced rainfall absorption capacity. Potential social issues caused by high density can be anxiety and feelings of constrain caused by overstimulation and crowding; less sense of community; can increase segregation and lead to social groups competing for spaces. For a complete account of the advantages and disadvantages of increased density, Arza Churchman produces an excellent list of arguments in her paper Disentangling the Concept of Density[3].

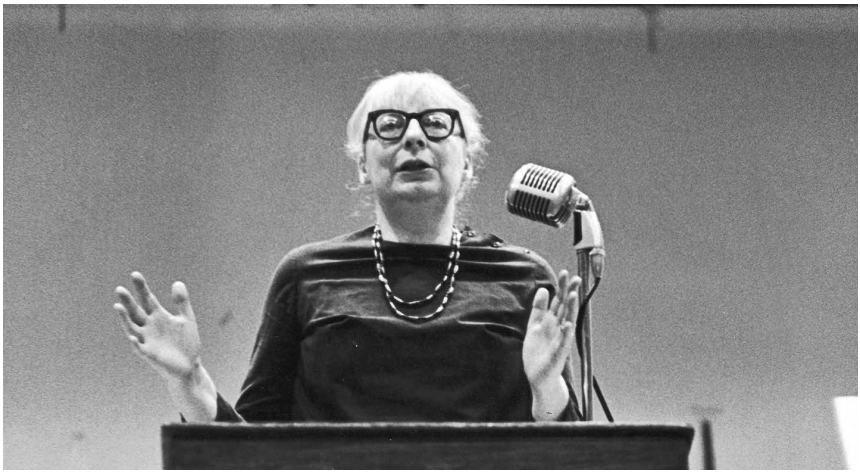
Another common argument against high density concerns the access to sun, light and fresh air, and a higher density is usually said to cause a reduction of these. Stromann-Andersen & Sattrup conducted research on this, testing out the solar and light access in urban canyons in Copenhagen[4]. By urban canyon means the height/width ratio of the space between buildings. Their study, however, shows that an increase in density (a more narrow urban canyon) does not necessary equal to a reduction in daylight access and solar energy. In fact, through materials such as glass windows,

1 Berghauser Pont & Haupt 2009, p 145

2 Churchman 1999, p 11

3 Ibid.

4 Stromann-Andersen & Sattrup 2011



daylight reflection of buildings in a dense urban setting can actually have a positive contribution to the energy and comfort performance of neighbouring buildings[1]. In their study, Stromann-Andersen & Sattrup concludes that daylight and energy consumption does not depend on the density of a city, but that other qualities is at play:

> *What becomes apparent is the way that consumption is more dependent on use patterns and material and geometrical patterns other than urban density.*[2]

DENSITY: CONCLUSIONS

What this discussion has shown is that higher density is not a bulletproof strategy towards sustainable development. However, the consensus seems generally to be that a higher density is more sustainable than a lower one. It's simply a case of the good arguments outweighing the bad. Lastly should be mentioned the manner in which an increase in density can determine if the urban procedure would lead to a better city. Therefore, I conclude with Jacobs:

> *In short, densities should be raised - and new buildings introduced for this purpose - gradually rather than in some sudden, cataclysmic upheaval to be followed by nothing for decades. The very process of increasing densities gradually but continually can result in increasing variety too, and thus can permit high ultimate densities without standardization.*[3]

1 Stromann-Andersen & Sattrup 2011, p 2

2 Ibid. p 8

3 Jacobs 1968, p 216

MEASURING DENSITY

As has been mentioned, measuring density is not necessarily an easy task and different factors can play large roles. Calculations can differ significantly. Firstly, one need to know what is being measured; be it population, ground coverage or other. Secondly, one need to know how the calculations will be carried out. Lastly, one need to know what parameters to include. All things mentioned will determine the results and one also need to be aware that the measurement may not always be comparable to other studies, given that the calculation parameters may differ. How a density study is conducted must be clearly defined in order for us to communicate ideas and learn from each other[1].

When measuring an area, the boundaries are important[2]. Where the boundary is drawn can determine if an area is highly dense or not. If different areas are measured, it is vital beforehand to recognize the rules of boundary lines in order for the calculations to be comparable.

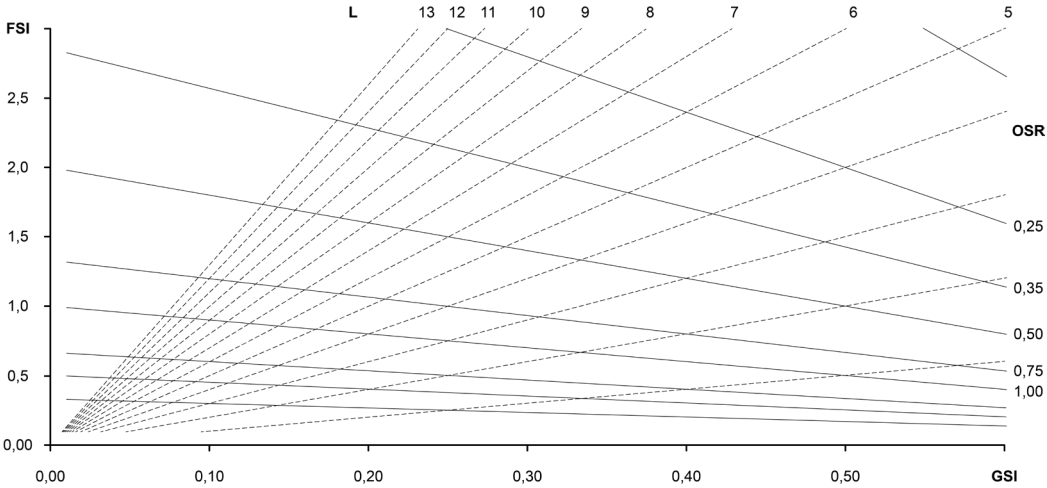
There is also the issue of density argued not being measurable, given that any numerical answer doesn't tell us about the lived, experienced density[3]. In line with this, it should be stated that there seems to be no relationship between density and building type. As Lozano puts it; the same density can be obtained with radically different building types, and the same type can be used to obtain different densities[4]. Therefore, no matter how much density is calculated, it will never tell us everything about an urban area.

Despite all aforementioned issues, Berghauser Pont and Haupt have developed a method for measuring density, called the Spacemate. The Spacemate is a multivariable approach with the intent of being specific enough to allow for the definition of urban types, as well as economic enough to ensure that excessive amounts of data can be managed without drowning in over-detailed definitions.

> *We have redefined density as a multivariable and multi-scalar phenomenon to counter the existing Babel-like confusion in the terminology currently being used by those working in the urban field.*[5]

The Spacemate is based on the four variables, Floor Space Index (FSI), Ground Space Index (GSI), Open Space Ratio (OSR) and Layers (L). FSI measures how much total floor space is fitted into an area and

1 Churchman 1999, p 19
2 Berghauser Pont & Haupt 2009, p 73
3 Jacobs 1968, p 212
4 Berghauser Pont & Haupt, p 19
5 Ibid. pp 91, 201



The Spacemate multivariable table includes Floor Space Index, Ground Space Index, Open Space Ratio and Layers.

gives a reasonable idea of how many inhabitants the area can hold. This represent how much building intensity is within the area. GSI measures how much of the total ground coverage consists of buildings, meaning that it represents the area's compactness. OSR defines the ratio between built space and open space, and here is borrowed Unwin's explanation of OSR; if the population of all buildings in an area goes out at a given moment, how much room would there be for them in the streets and other non-built ground? Lastly, L is a measurement of the average floor number and gives a rough estimate of the height in the area. Given these variables, different urban forms can be differentiated in an efficient way[1].

This forms the basics of the Spacemate, but it should be mentioned that the authors of the model have developed it further. The upgraded version is called the Spacematrix and it takes into account the four aforementioned variables, but also considers Network (N). N represents infrastructure with certain structural robustness, such as streets and roads[2]. This would add another axis to the calculations, meaning that it visualizes the density of an area in 3 dimensions. However the Spacematrix will not be used in this study, as data regarding network density could not be easily obtainable, as well as a feasible Spacematrix 3D-representation not being available.

1 Berghauser Pont & Haupt 2005, pp 58-59

2 Berghauser Pont & Haupt 2009, p 65

So, what benefits lies in measuring density using the Spacemate? Firstly, by being a multivariable measurement approach, a more complete understanding of what kind of density is present in Utrecht can be obtained, more so than if only single indications such as FSI is used. Secondly, by measuring densities of different areas in this way, a relationship between densities and urban forms in Utrecht can be gathered. Lastly, the Spacemate is a tool for density, and an increase of it, to be used in the urban design process in a visually understandable way.

BACKGROUND

THE NETHERLANDS

The Netherlands is a country in Europe with a population of 17 million inhabitants. With a total area of 41 543 km^2, the country is of a rather small size. The population density in The Netherlands is about 500 people per km2 (number vary across different sources). This results in The Netherlands being the most densely populated country in Europe and the fifth most densely populated country in the world (not counting city-nations such as Monaco)[1].

Land is becoming scarce in The Netherlands, and outside the cities are agriculture fields dominant. Due to the climate of the country, as well as major technical innovations within the agriculture sector, The Netherlands is the second largest food exporting country in the world and frequently competes for the top spot in terms of vegetable and flower exports[2]. All this, despite competing against countries which are more than 200 times its size, such as USA and China. The Netherlands would do well not to urbanize its highly productive fields.

The population of The Netherlands is expected to grow by 1 million in the coming 30 years[3]. With such land scarcity and such a high population density already, the country will need to utilize urban densification strategies in order to accomodate the population growth.

RANDSTAD

The four largest cities in The Netherlands is Amsterdam, Rotterdam, The Hague and Utrecht, and, together with some smaller settlements, these form the megalopolis called Randstad. Randstad accounts for 40 % of the country's total population. The settlements of Randstad has the shape of a circle, which encompasses the "groene hart" (green heart). The green heart is a large rural area, and

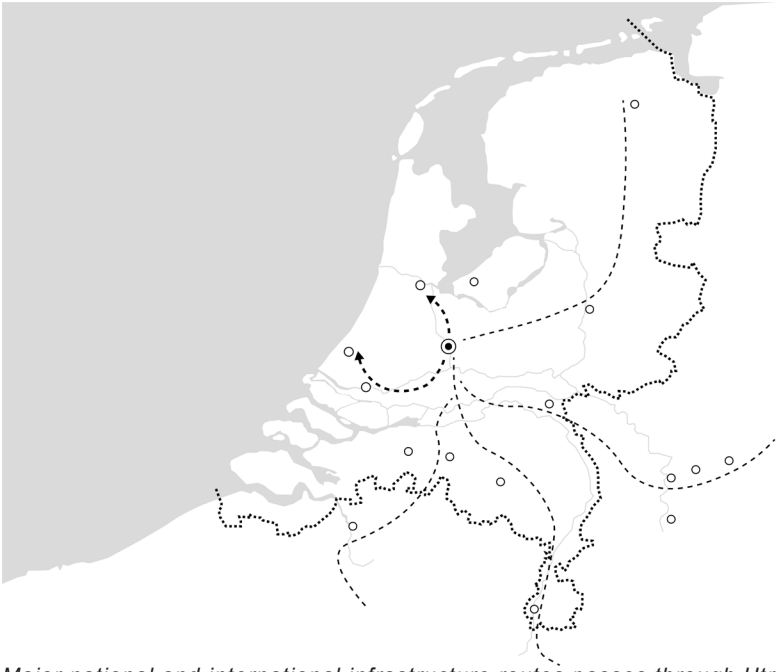
1 Holland.com 2019

2 Investopedia 2012

3 World Population Review 2019

The Netherlands and major cities.

Randstad conglomeration and the green heart.



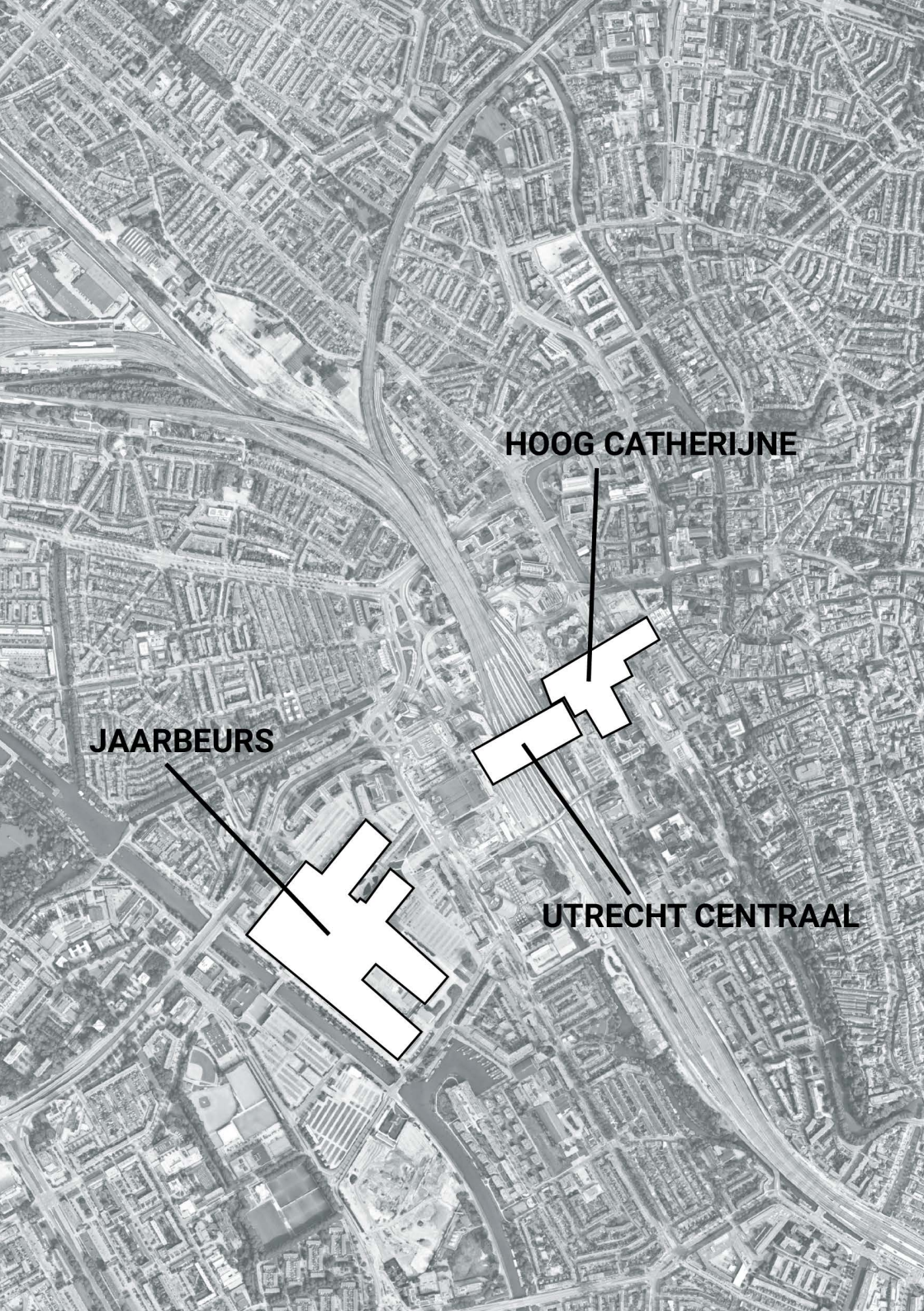
Major national and international infrastructure routes passes through Utrecht.

has significant value to the country in terms of agriculture, biodiversity and recreation. Due to its importance, the Dutch government have limited the abilities of the bordering cities to develop the land inside the green heart.

UTRECHT

Utrecht is the fourth largest city in The Netherlands with a population of 345 000 inhabitants, and is located centrally in the country. Major infrastructure routes, both national and international, pass through Utrecht, effectively making Utrecht the entrance to Randstad. This in turn has made the Utrecht central station the biggest and busiest in the country and a new business and commercial area has sprung up around it. The city recently constructed the Hoog Catherijne shopping mall, which also acts as the easiest route to go through, between the central station into the inner city. Utrecht central station also hosts the world's biggest bicycle garage and Jaarbeurs is located nearby; the largest convention hall in the Netherlands.

Considering these national, regional and local arguments, the idea to densify central parts of Utrecht seems like a good idea. Now it is time to find a project site.


HOOG CATHERIJNE
JAARBEURS
UTRECHT CENTRAAL

PROJECT SITE

Such a site has been found in central Utrecht, being just north of the central station. The project area is about 9,7 hectares and consists of mostly underutilised urban land with a few large-scale factory buildings.

On its western, southern and south-eastern borders runs many of the city's railway track into the central station. These tracks connects Utrecht to Amsterdam, Rotterdam and Amersfoort and the trains pass frequently.

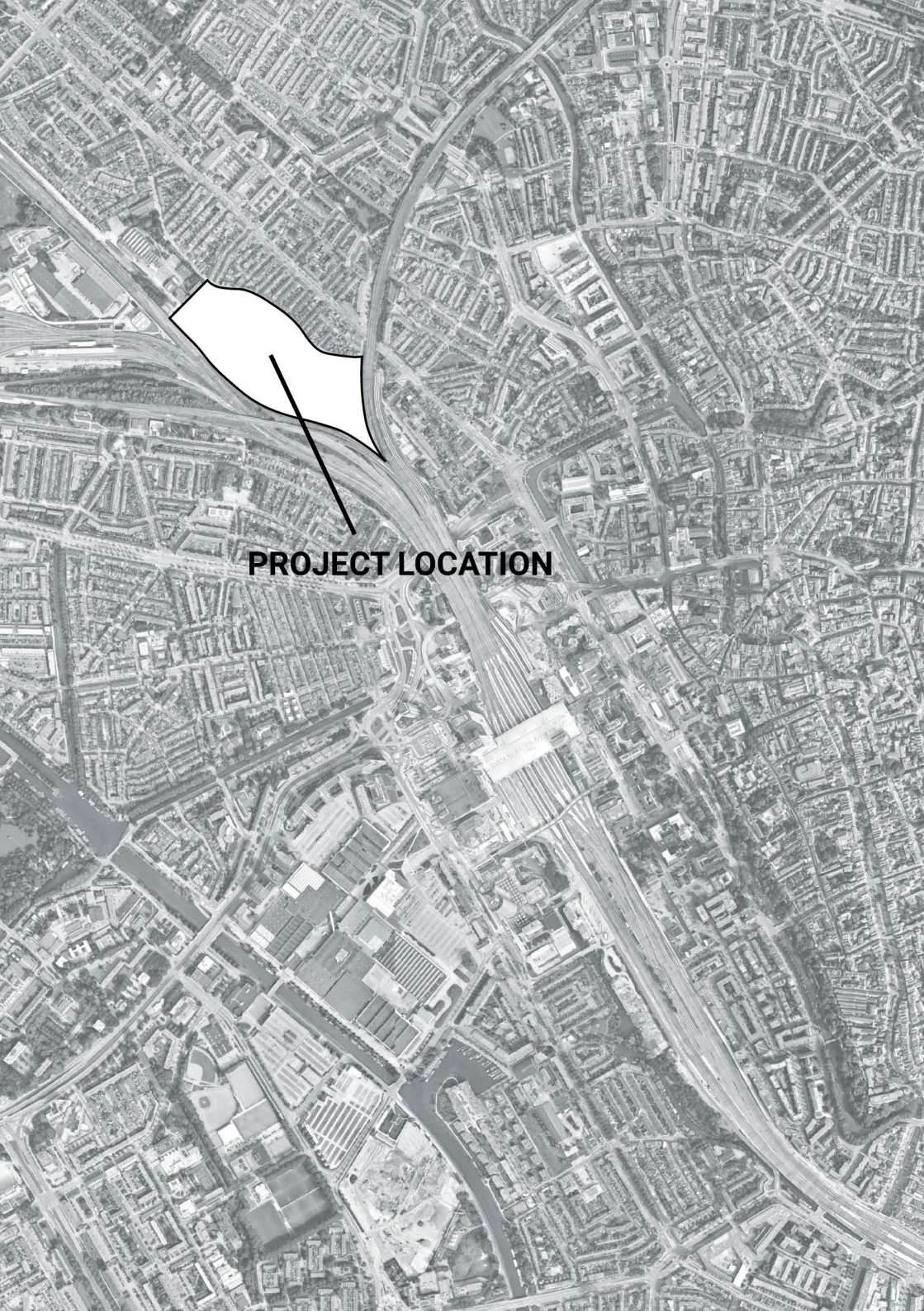
On the northern border, the site is connected to the neighbourhood Tweede Daalsebuurt, which consists of traditional worker's houses constructed between 1880 and 1890. These are rowhouses of two storeys and follows a regular street pattern with narrow blocks.

The area has its roots as a rail yard from the 1800s, and the site was used for maintenance of state-owned train wagons and locomotives. This workshop flourished in the following decades, but was somewhat diminished in the 1950s, due to the workplace being deemed outdated and unproductive, and the Dutch Railways did not have enough resources for renovation. The rail yard was entirely discontinued in 2003, after the privatization of the Dutch Raiways[1].

The site used to house many more train factory buildings, a lot of which has now been demolished. Nevertheless, a few buildings still remain and has since been repurposed. These old brick buildings still breathes the area's industrial heritage.

In the 19th century, the city had not yet expanded much, and the rail yard was considered outside the urban border. As the city grew, the area has now become part of central Utrecht. At the time of writing, the city of Utrecht have plans to redevelop the area into a mixed-use residential and workplace neighbourhood, and will begin constructing the first buildings in 2019.

1 den Boer 2018


PROJECT LOCATION

An aerial photo from 1994[1].

1 Het Utrechts Archief 1994

Project site boundary.

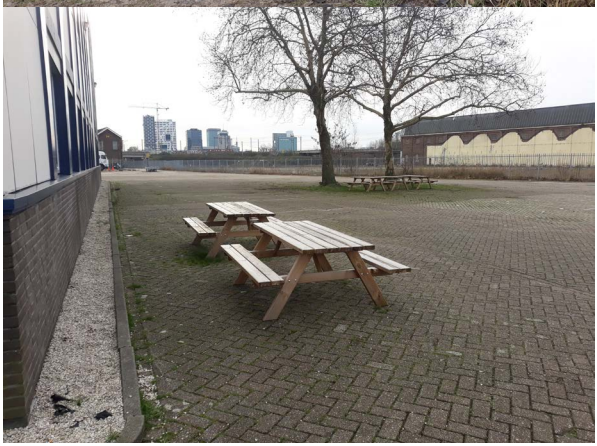
Places of interests in close proximity to the site.

Existing buildings on the site.

Railway track surrounds the site and acts as barriers to other parts of the city.

The site is dominated by railway wagon factory buildings.

The site features an abandoned building, ready to be repurposed.



The new area around the central station is visible from the site.

The site borders Tweede Daalsebuurt, a typical neighbourhood of two stories.

Utrecht Community (UCo) is a community of entrepreneurs working towards sustainable development.

The courtyard of the existing buildings includes many trees and bushes.

Utrecht Community entrepreneurs uses the space to try out their ideas.

Apart from the railway tracks, the site has little topographic difference.

On-site buildings are between two to three stories high.

Ground surface material vary between pavement bricks, concrete slabs and soil

Many parts of the site is currently inaccessible due to high fences.

The railway is constantly a part of the site, especially in the south, where the tracks are elevated.

ANALYSIS

A neighbourhood analysis has been conducted in this thesis, which has served as the foundation for the project's design. The neighbourhood analysis is a two-fold study; on one hand the density of the neighbourhood have been extracted using the Spacemate method; on the other, a visual study of the neighbourhood reveals its appearance. In the visual study has aspects such as material usage, facade design, roof tilts, appearance diversity, street pattern, etc, been included. The reason for this, is to understand the character and identity of Utrecht which will later on influence the design.

ANALYSIS PROCESS

To give the study transparency, the process of how the analysis was conducted need to be presented.

Firstly, I needed to choose which neighbourhoods to analyse. This was done by setting a few criteria that the neighbourhood needed to reach in order to be eligible for study. When the criteria was set, online maps were studied in order to locate potential neighbourhoods to include. A total of 22 neighbourhoods was located in central Utrecht. These neighbourhoods were subsequently visited in person in order to confirm their eligibility, during which the visual analysis of the neighbourhoods was also conducted. All 22 neighbourhoods were visited, out of which 21 was deemed eligible.

Then it was time to gather metric data from these neighbourhoods. All data was extracted in the form of dwg-files from the website Cadmapper (cadmapper.com). From this source can be gathered, for free, simple geographical data, such as the area of a building's footprint, railway lines and water bodies. Here, however, a huge caveat need to be mentioned; namely, that I cannot control the accuracy of the data. I

can only compare the information to other free sources such as Google Maps. On the website, Cadmapper states that the data is transformed from public sources such as OpenStreetMap, NASA and USGS (Cadmapper 2019). Again, I am aware that I do not know how the underlying geographical data was gathered. In total, data from 20 neighbourhood was collected, seeing that one of the chosen neighbourhoods was too recent and did not have the necessary information.

After the data was extracted, it was inserted into the CAD-software ArchiCAD. From this, using the 'measurement'-tool, the area measurements needed was collected. This included Total Area and Ground Floor Area. Gross Floor Area was then calculated using the Ground Floor Area with the number of floors noted during the visit (and with the help of Google Maps 3D and Google Street View). The variables FSI, GSI, OSR and L was then calculated using these parameters.

When all the density variables of the neighbourhoods had been calculated, the neighbourhoods could be placed into the Spacemate diagram.

ELECTING NEIGHBOURHOODS

Different neighbourhoods can have varying levels of density depending on how the measurements are conducted and what is included in the measured area. In order to get a comparable density measure across all the neighbourhoods of analysis, some criteria are needed to be set. These criteria are as follows:

- The neighbourhood have to be approximately the same size as the project location (10 hectares), and approximately the same sizes in relation to each other. Consequently, as the neighbourhood is usually a lot larger than the project location, the entire neighbourhood will not be measured, only what is deemed a generic cut-out of the neighbourhood.
- As the project will mostly be a neighbourhood with a predominantly residential function, so too will the analysed neighbourhoods need to be predominantly residential. This means that areas such as the new development by the central station, which is mostly business and commercial focused, have been ruled out, even though it might be an interesting case regarding density.
- The area of analysis has to be bordered by streets, and the entirety of these streets have to be included in the density measurement, as a street is deemed an important part of the built form that it surrounds. In some cases, the neighbourhood

borders water. In that case, the area of analysis uses the water line as its border.

- The density of an area can differ notably if the area includes parks, green areas or other public open spaces. In order to get a comparable measurement across the different areas, the chosen area of analysis may not include any public open space over the size of 4 000 m^2. This does not include streets.
- A variety in year of construction is preferred, to see how density has changed in time.
- The area have to be centrally located in Utrecht.

NEIGHBOURHOOD INDEX

Now when the criteria have been set, here follows an index of the 20 neighbourhoods that was chosen for analysis:

Binnenstad
Buiten Wittevrouwen
Kanaleneiland-Zuid
Lombok-Oost
Lombok-West
Ondiep
Oog in Al
Oudwijk
Parkhaven
Rivierenwijk
Sterrenwijk
Taag- en Rubicondreef
Tolsteeg en Rotsoord
Transwijk-Zuid
Tuindorp
Tuindorp-Oost
Tuinwijk
Tweede Daalsebuurt
Vogelenbuurt
Wittevrouwen

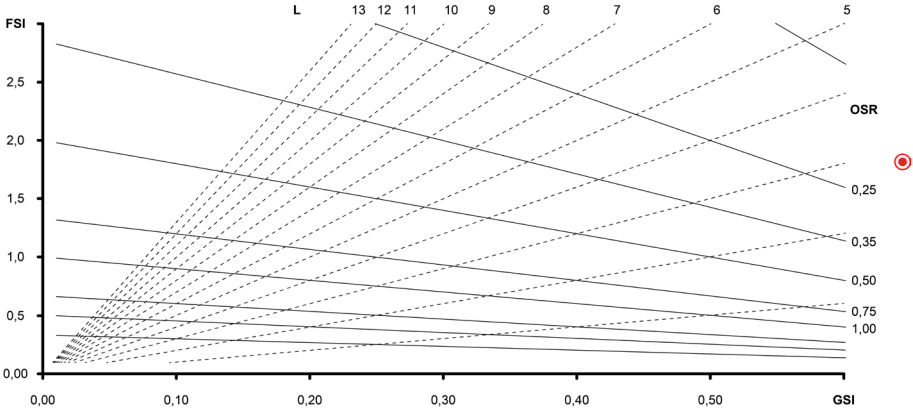
Lastly, I want to mention that the new neighbourhood in Pijlsweerd could not be included due to its not being finished constructing, and no geographical information could be gathered from the area. I wished to include this area to retrieve more data about the density of contemporary projects, as well as older. As it stands, the only new development I've included in my analysis is the Parkhaven neighbourhood.

The following pages will provide the results of the neighbourhood analysis, where each page is dedicated to one neighbourhood. The analysis presents a short description of the neighbourhood; a figure ground plan of the analysed area; its position in the Spacemate; and a photograph taken from the visit.


TAAG- EN RUBICONDREEF
TUINDORP
TUINDORP-OOST
ONDIEP
TUINWIJK
TWEEDE DAALSEBUURT
VOGELENBUURT
WITTEVROUWEN
BUITEN WITTEVROUWEN
LOMBOK-OOST
BINNENSTAD
LOMBOK-WEST
OOG IN AL
OUDWIJK
PARKHAVEN
STERRENWIJK
TRANSWIJK-ZUID
RIVIERENWIJK
TOLSTEEG EN ROTSOORD
KANALENEILAND-ZUID

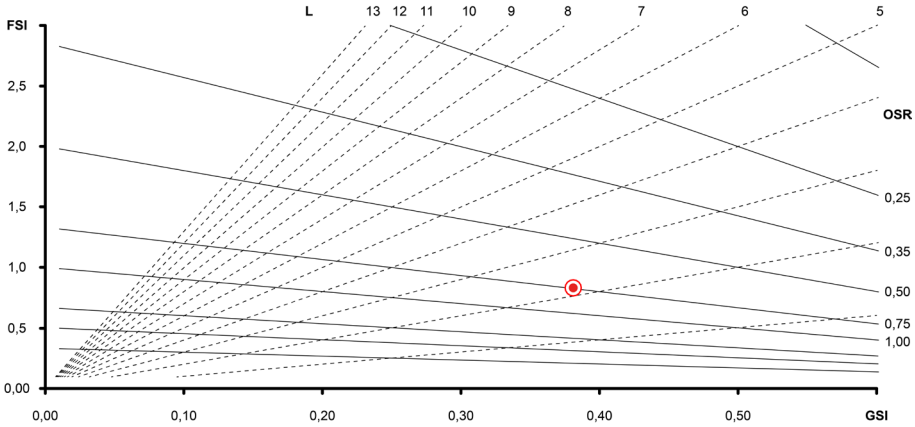
BINNENSTAD

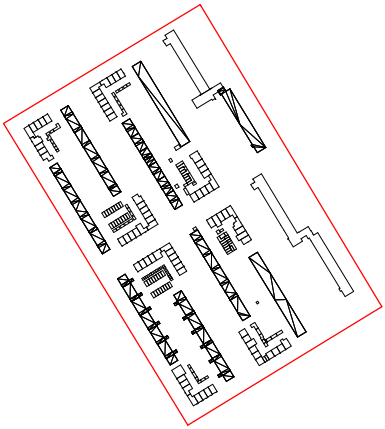
Binnenstad has roots from the 11th century. It has high variety in material usage and facade design. Roof is gabled, mostly pitched perpendicular to street. Street pattern is highly irregular.



BUITEN WITTEVROUWEN

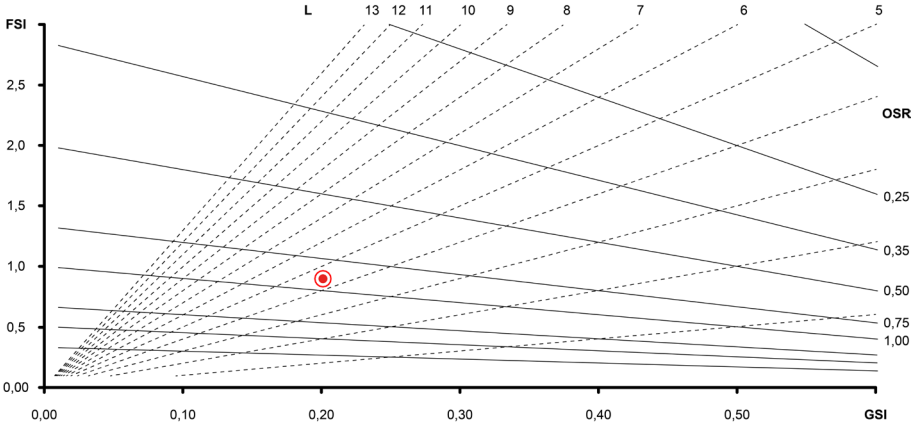
Buiten Wittevrouwen was constructed in the 1860s. It includes a variety of bricks in colours red, pink, brown and white plaster. The area has gabled roofs pitched parallel to the street and the street pattern has some irregularity.





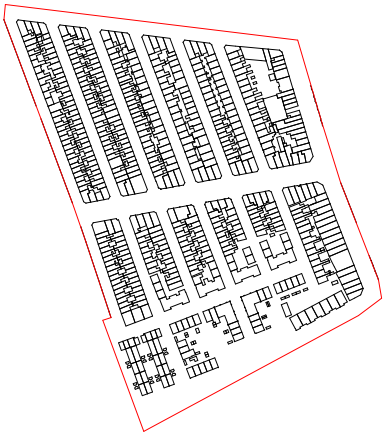
KANALENEILAND-ZUID

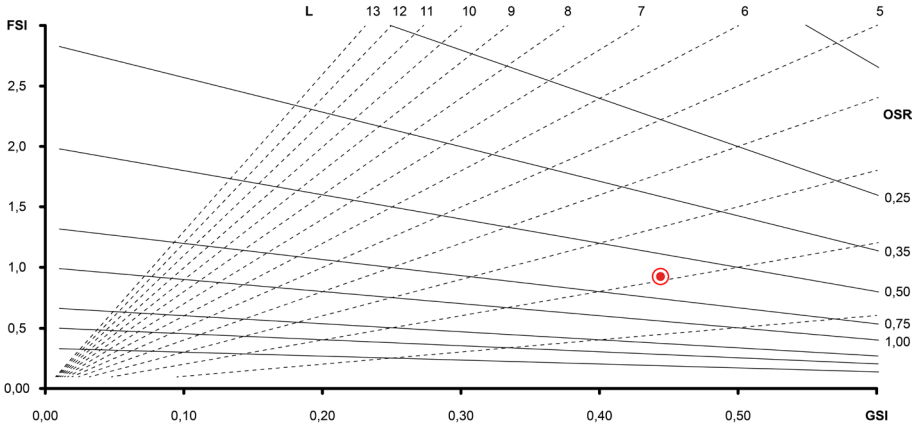
The Neighbourhood was constructed in 1960. Material vary from brown brick, plaster and wooden panelling. Building typology varies from 5- and 11 storey housing block, to 2 storey rowhouses. Roofs are predominantly flat and the street pattern is regular. Streets are asphalt and the area features many grass lawns.

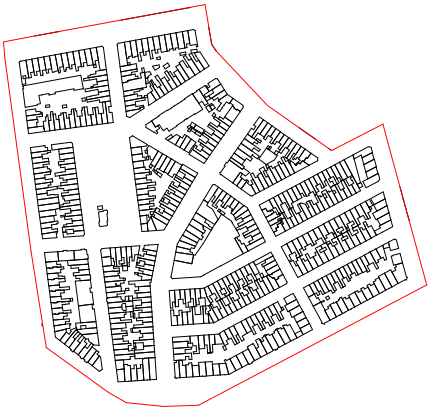


LOMBOK-OOST

This eastern part of Lombok was built in 1880s and features rowhouses in a highly regular street pattern and little variation in material and facade detailing.

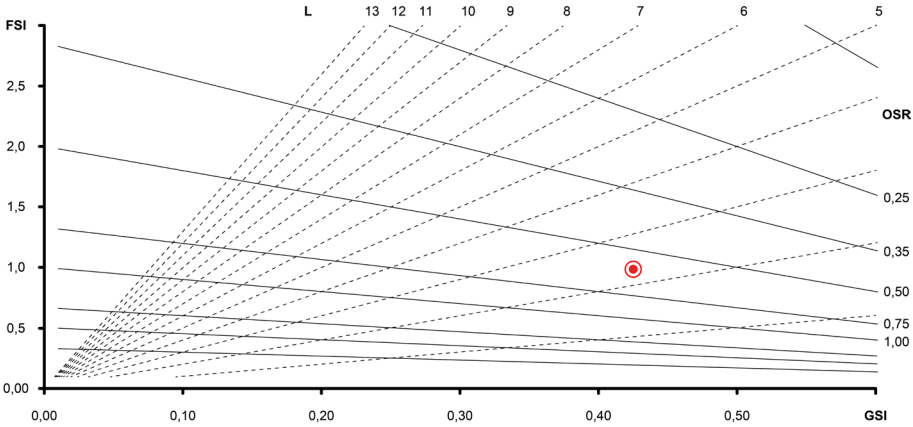






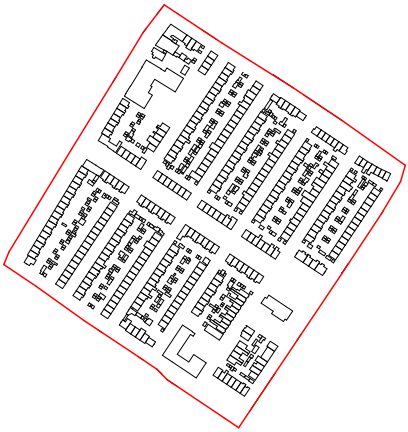
LOMBOK-WEST

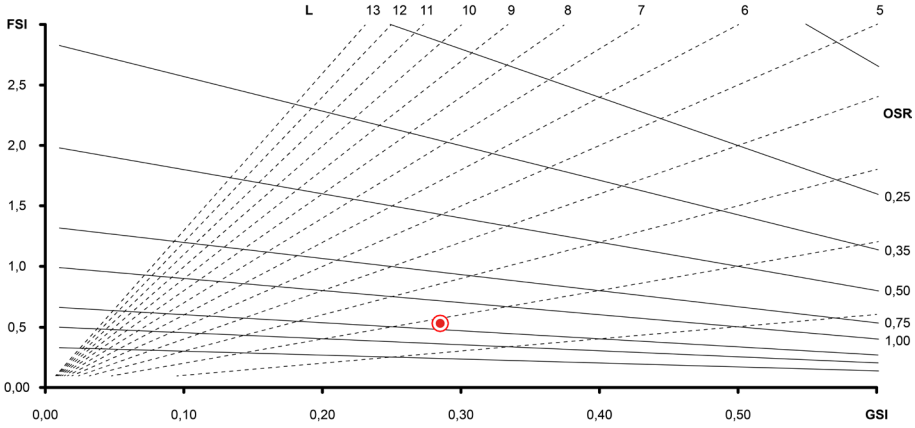
The western part of Lombok was constructed shortly after the eastern part and is very similar in appearance. However, the difference is that the street pattern is not as regular in Lombok-West.

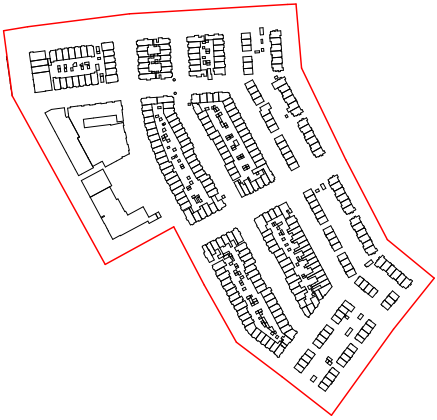


ONDIEP

Ondiep was constructed between 1915 to 1920. The area is all in one style; red brick buildings of two storeys with gabled roof of red brick, and directed in a regular street pattern. Pavement is also red brick.

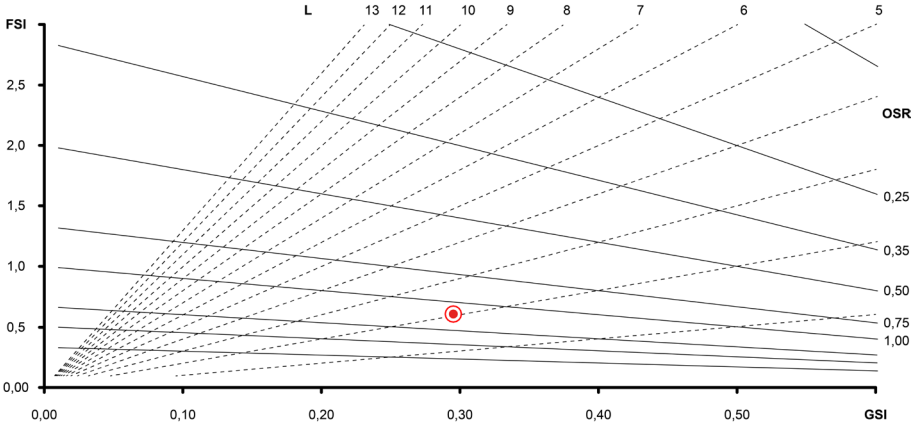






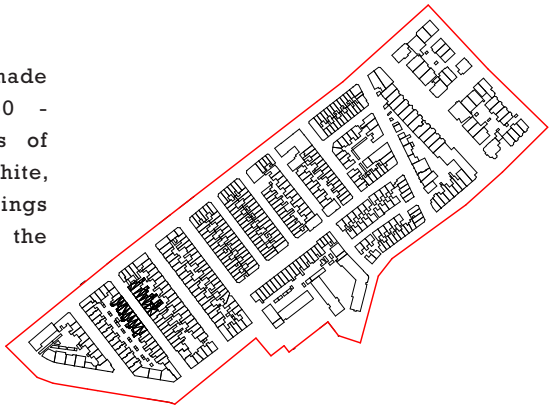
OOG IN AL

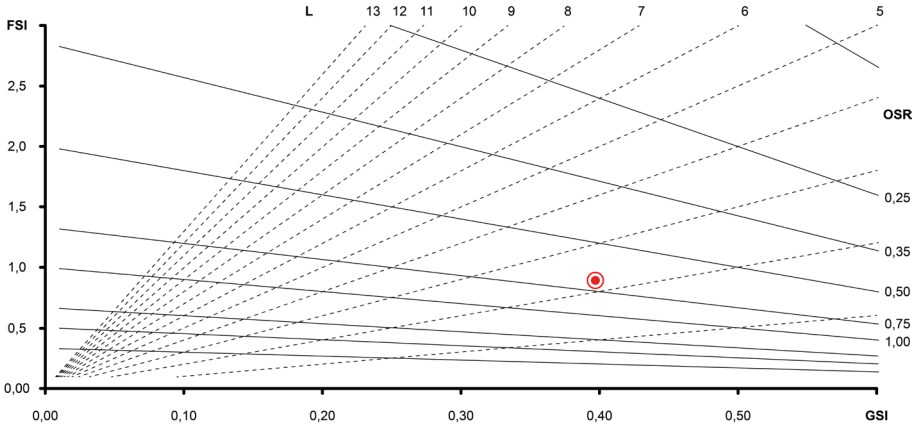
Oog in Al was constructed as a garden city in the 1920s. It includes building blocks of brown brick with red tiled roof, which are gabled and pitched parallel to the street. The streets are asphalt.

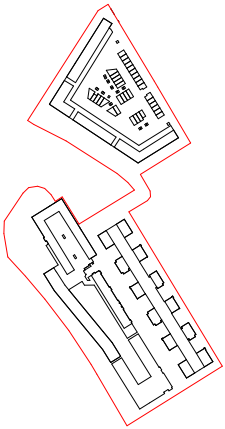


OUDWIJK

The neighbourhood was made somewhere between 1860 - 1890 and features bricks of many colours; red, brown, white, beige and pink. The buildings vary in appearance and the street is regular.

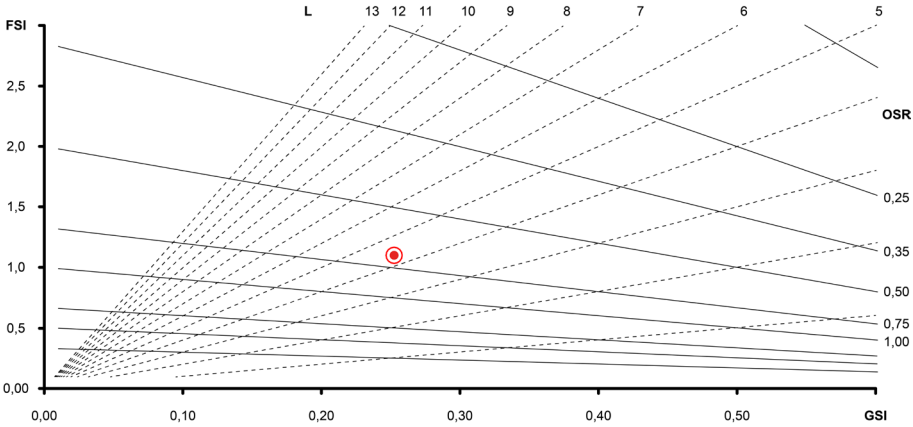






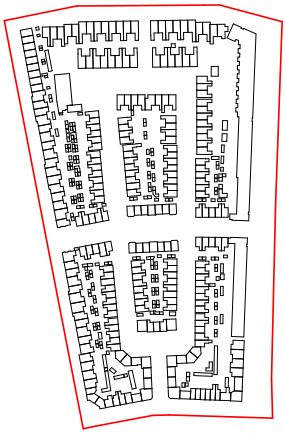
PARKHAVEN

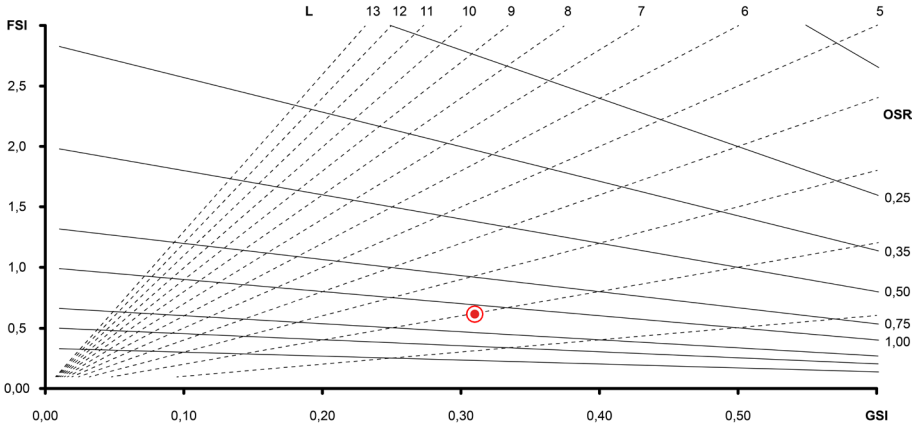
Parkhaven is the most recently developed neighbourhood, some parts currently ongoing construction. Buildings are always in red bricks with flat roofs, but vary in terms of size and height. Pavement is of larger concrete tiles and the area has a lot of grass lawns between the buildings.



RIVIERENWIJK

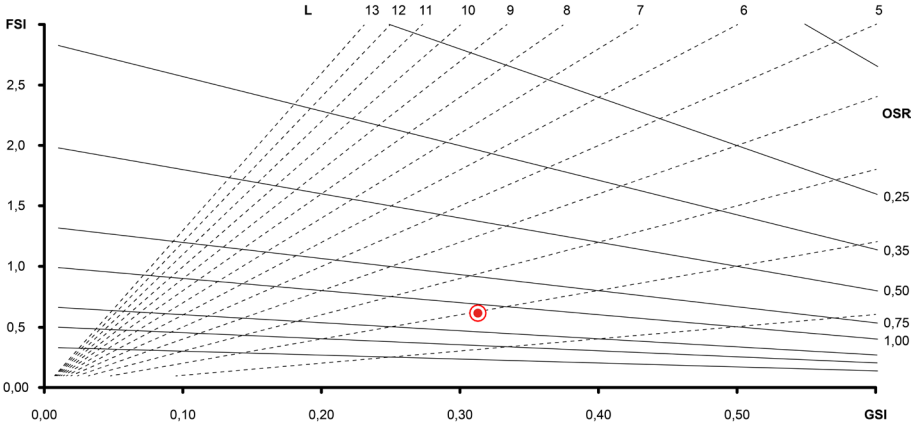
This neighbourhood was built in the 1920s, made of red and brown brick buildings with red tiled roof and red brick pavement. While the buildings uses the same material, they vary in facade and roof detailing.





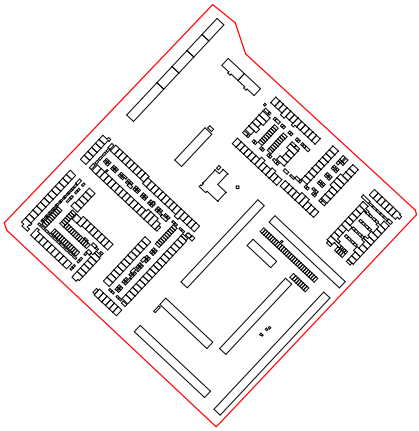
STERRENWIJK

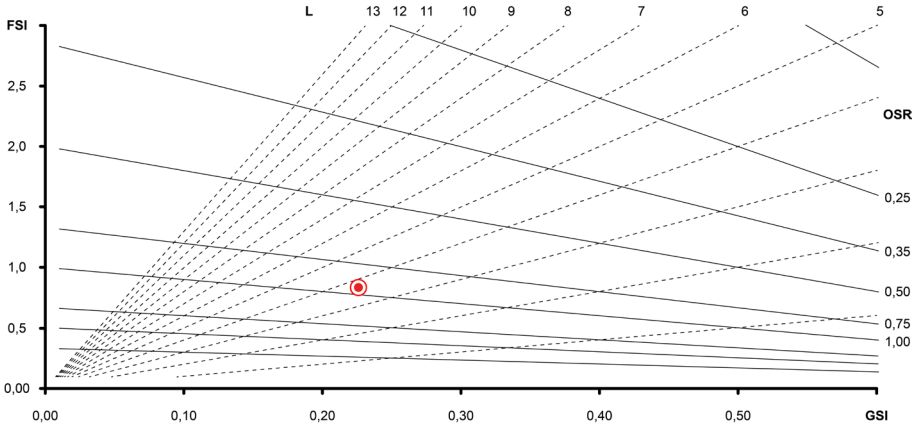
Sterrenwijk has its roots from the beginning of the 20th century, but was almost entirely reconstructed in the 1980s. Buildings are of two storey rowhouses of grey and red bricks with gabled, black tiled roof, placed in an irregular street pattern.



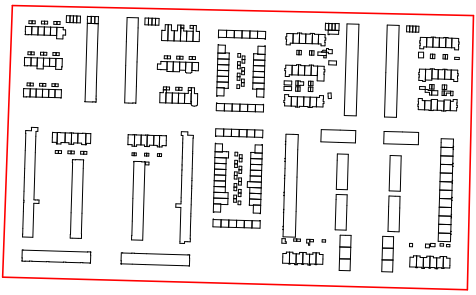
TAAG- EN RUBICONDREEF

Taag- en Rubicondreef is a modernist housing area constructed in the 1960s. It consists mostly of multi-storey residential blocks in wooden panelling, white plaster and concrete. Streets are asphalted and the area includes large spaces of grass.

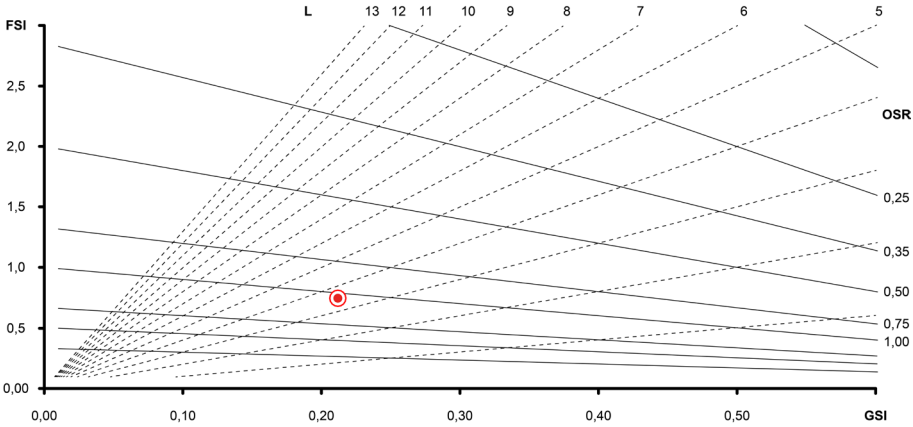




TOLSTEEG EN ROTSOORD

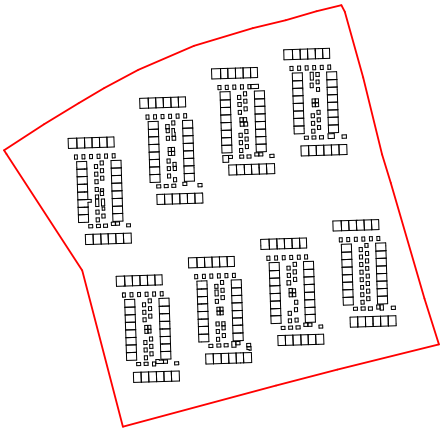


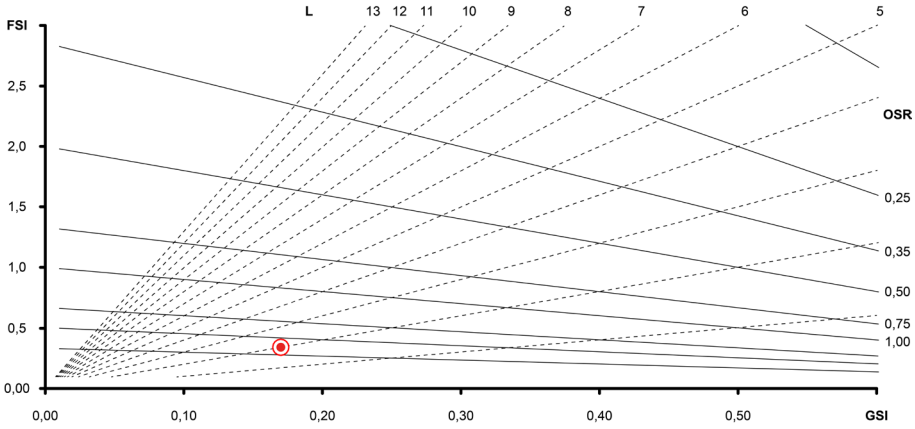
The area was constructed in 1956 and consists mostly of brown bricks and flat roof. Street is regular and includes large spaces between street and building. Buildings are mostly of 4 - 5 storeys, but 2 storey buildings occur.



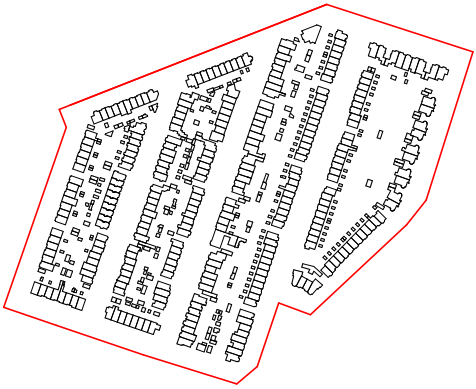
TRANSWIJK-ZUID

Transwijk-Zuid is the least dense neighbourhood and was constructed somewhere between 1960 - 1980. Material is a mix of yellow plaster and grey bricks on the buildings and has many open green spaces. Buildings have flat roofs.

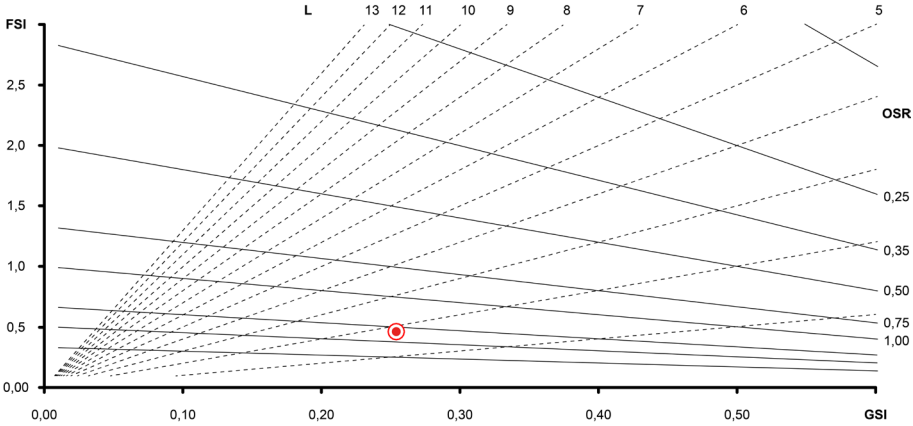




TUINDORP

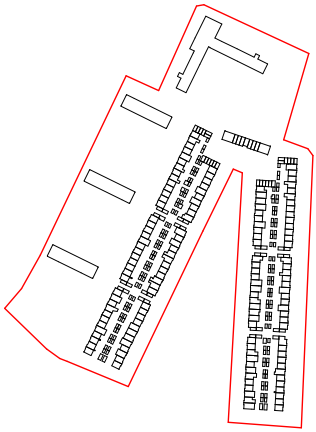


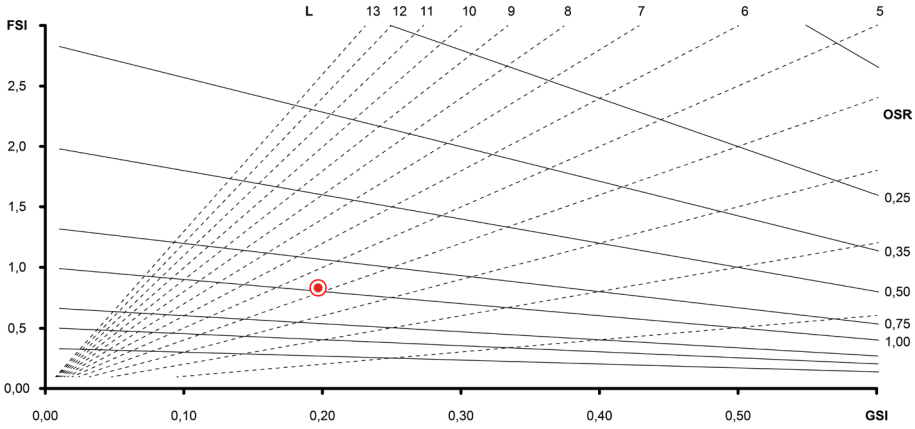
Tuindorp was built in the 1930s as a garden village. The area features many trees and grass lawns and the buildings are of brown brick with gabled, black tile roof. The streets are in a regular pattern and the area do not differ much in character.



TUINDORP-OOST

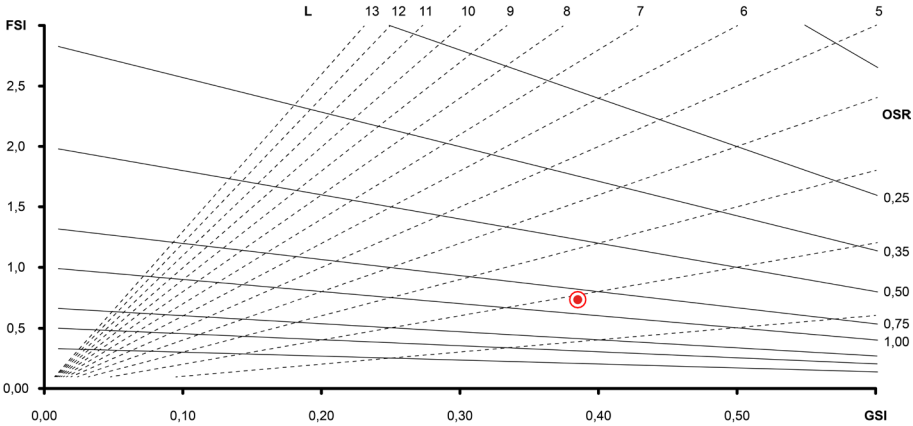
The eastern part of Tuindorp was constructed in 1950s and here is noticed the change from the garden village ideal to the new modernist ideal. It includes high-rise apartment blocks of 13 storeys, but also two storey rowhouses in brown bricks.





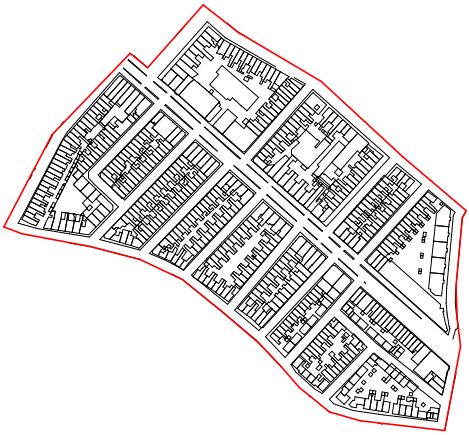
TUINWIJK

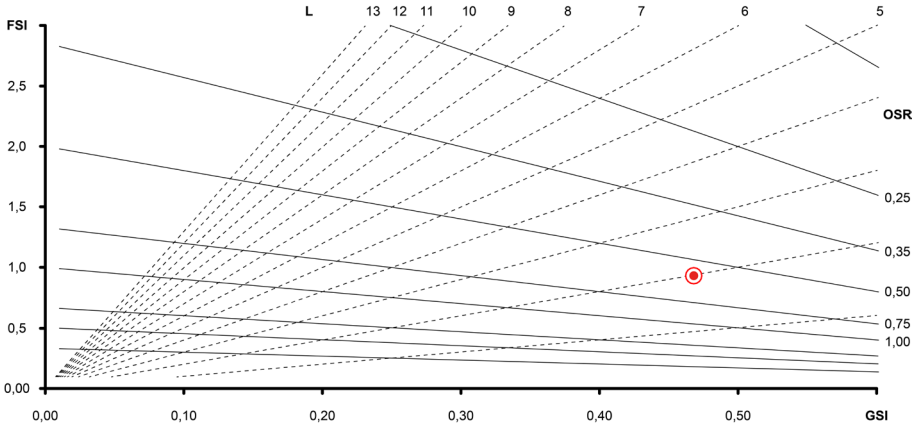
Tuinwijk was constructed right after the 1900s in the then popular garden village suburb-style. It consists of red and brown brick facades, and red and black tile roofs. Streets are laid out in an irregular street pattern and paved with red bricks.

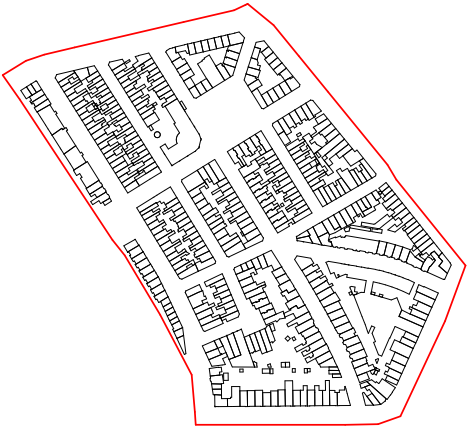


TWEEDE DAALSEBUURT

This is the neighbourhood which is in contact with the project site, and it was constructed between 1880 to 1890. It features traditional worker's houses in red and brown brick with gabled roofs, pitched parallel to the street. It has a regular street pattern and little variation in appearance.

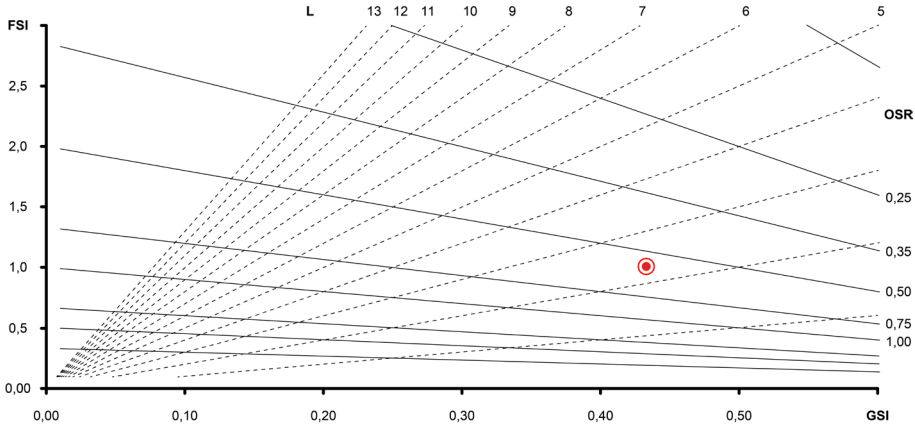






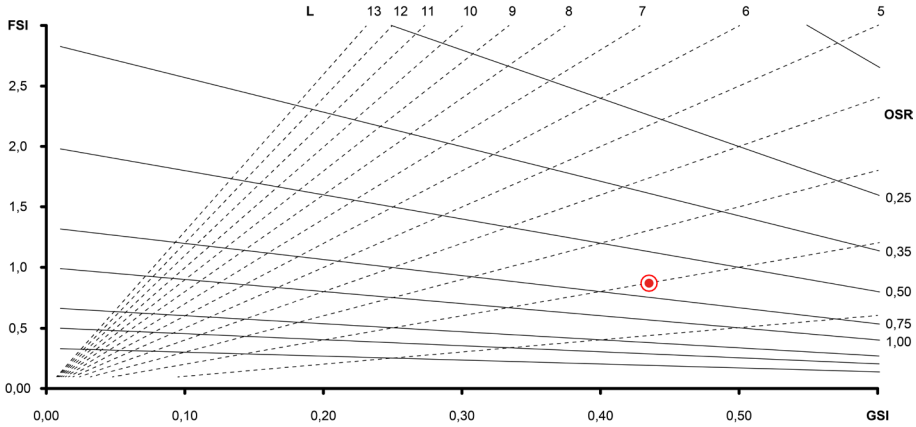
VOGELENBUURT

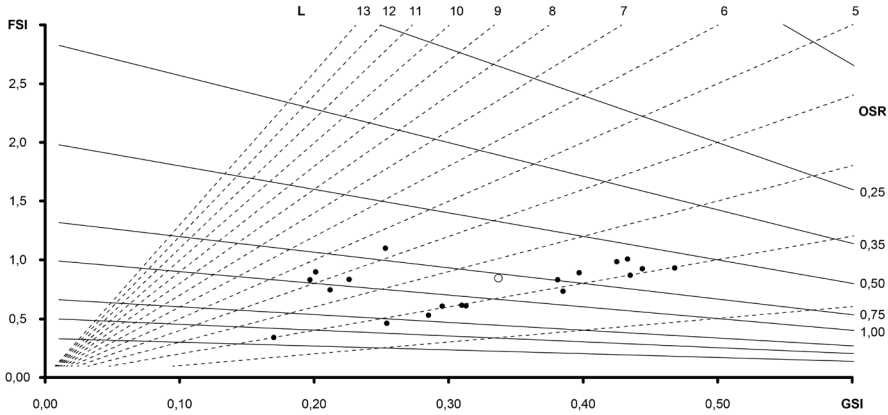
Vogelenbuurt was the first neighbourhood to be built after the town fortifications were removed, in 1850s. It includes brick buildings in a somewhat irregular block pattern and the gabled roof is pitched both parallel and perpendicular to the street.



WITTEVROUWEN

Wittevrouwen was constructed in the middle of the 19th century in the form of tightly packed blocks of red and pink brick buildings with black tiled roof. The streets are highly regular and paved with bricks. Some variation in facade detailing occur.





All 20 neighbourhoods in the Spacemate, with result average (white dot).

SPACEMATE CONCLUSIONS

From the conducted Spacemate analysis, a few interesting conclusions can be made about the density in Utrecht.

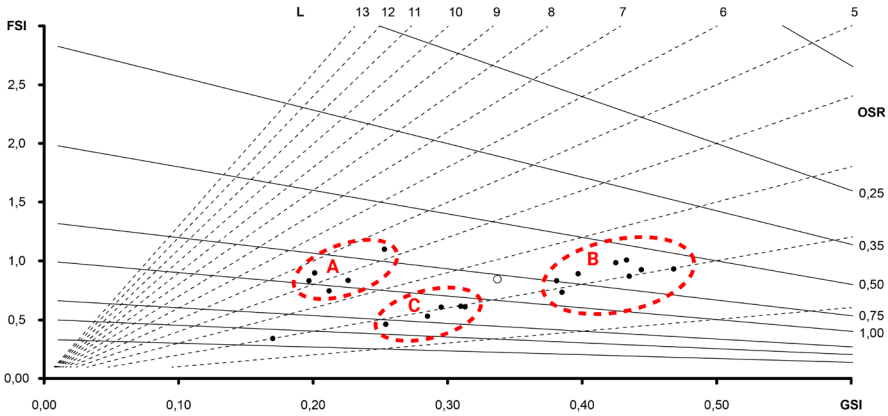
Three different groups

In the Spacemate chart, the neighbourhoods can be grouped into three different categories, depending on how similar the neighbourhoods scored to each other. I've chosen to name these categories group A, group B and group C.

Group A consists of the neighbourhoods Parkhaven, Kanaleneiland-Zuid, Tolsteeg en Rotsoord, Taag- en Rubicondreef and Tuidorp-Oost. These neighbourhoods all scored similar results in FSI and GSI in comparison to the other neighbourhoods. While this group have similar FSI as group B, they differ significantly in GSI, meaning that group A includes a lot of open

spaces while maintaining the same capacity of inhabitants as group B. In fact, only around 20-25 % of the total area consists of built form. Group A seem however to have no inter-relation regarding Layers, with the area scoring all between 3,3 to 4,7

Group B consists of the neighbourhoods Lombok-Oost, Lombok-West, Wittevrouwen, Buiten Wittevrouwen, Vogelenbuurt, Tweede Daalsebuurt, Oudwijk and Tuinwijk. This category includes the highest amount of neighbourhoods. Again, the difference between this group and group A revolves around GSI, with group B having a larger building footprint on the overall area. Around 40-45 % of the total area consists of



Neighbourhoods can be divided into three groups.

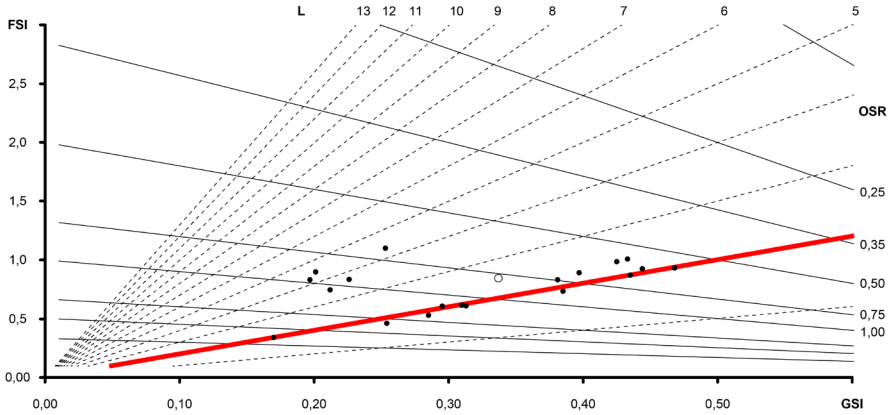
built form. However, similar FSI was scored in this group and group A. Group B also scored similar results for the Layer variable, only differing between 2 to 2,4.

Group C consists of the neighbourhoods Sterrenwijk, Rivierenwijk, Ondiep, Oog in Al and Tuindorp. As with group B, group C also scored results along the Layer 2 variable. However, the group doesn't equal to the same amount of GSI as group B, nor does it have as high FSI as neither other group. Approximately 25-30 % of the total area consists of built form. This means that group C cannot maintain as high capacity of inhabitants than either group A nor B, and the area includes less open spaces than group A but more open spaces than group B.

Another interesting find to note about the different groups is the correlation between the groups and the visual analysis. Larger variation in floor number, building materials and appearance diversity can be found in group A, as well as having flat roofs. In contrast, group B and C has a bigger chance of consisting of neighbourhood with brick facades, tiled, gabled roofs with a slope parallel to the street and having little to no diversity in appearance.

Outliers

There are also two outlier neighbourhoods which could not be placed in any of the three categories. These are Transwijk-Zuid and Binnenstad. In Binnenstad's case, no other neighbourhood can come close to its GSI, where the built form takes up about 64 % of the total area. It is



Majority of neighbourhoods score along the 2 Layer variable.

also the area which can include the highest amount of inhabitants.

Transwijk-Zuid, on the other hand, can maintain the lowest amount. The neighbourhood scored the lowest in both FSI and GSI. This means that no other neighbourhood comes close to its Open Space Ratio, being as high as 2,325. Transwijk-Zuid is the least dense in terms of both population capacity and built form.

Layer relation

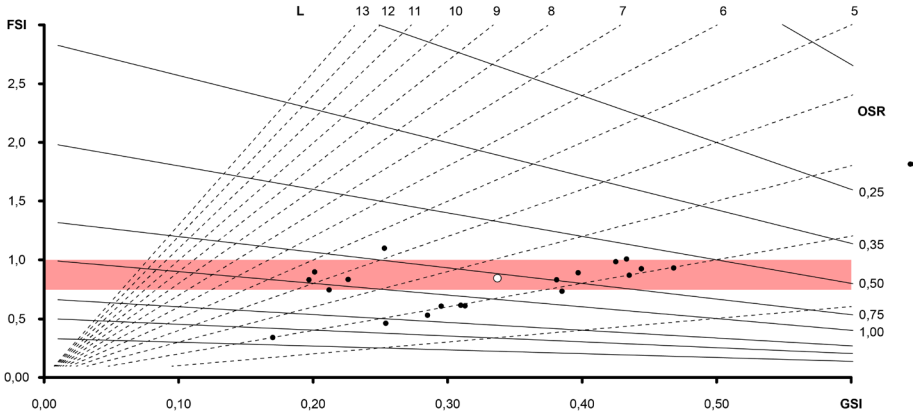
As the majority of the analysed neighbourhoods consisted of an average of two floor buildings, the majority of these neighbourhoods in the Spacemate are along the 2 Layer variable. A total of 14 out of 20 neighbourhood scored along this variable. By this result follows the conclusion that Utrecht mainly consists of neighbourhoods with an average floor number of two.

Average Floor Space Index

A total of 12 out of the 20 neighbourhoods scored between 0,75 - 1 on the Floor Space Index variable. Since this is the majority of the neighbourhoods, one can conclude that this is the average FSI density in central Utrecht. This result is interestingly the case for neighbourhoods in both group A and B, despite other significant differences such as Ground Space Index, Layers, and the difference in the visual analysis.

Correlation between position and year of construction

One last point to conclude is the correlation between the year of construction and the



Majority of neighbourhoods score between 0,75 - 1 on Floor Space Index.

neighbourhood's position in the chart. The neighbourhoods in group B was built around the same time, from 1850 - 1930, Vogelenbuurt being the earliest and Tuinwijk being the latest. In contrast, the neighbourhoods in group A was constructed from 1950 to present time, Kanaleneiland-Zuid being the earliest and Parkhaven the latest (which is still not entirely finished by the time of this thesis). The neighbourhoods in group C was built between 1920 - 1980.

Another interesting aspect regarding year of construction, is that the two neighbourhoods with the highest FSI is Parkhaven (1,108) and Binnenstad (1,830), which is the newest and the oldest area respectively.

DESIGN PREFERENCE IN THE SPACEMATE

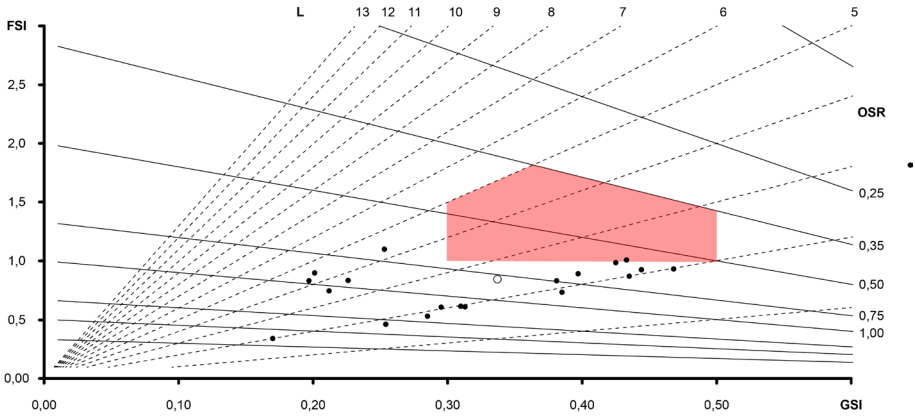
Now that the density of Utrecht have been analysed, a preferred location in the Spacemate for the design project can be obtained.

Most neighbourhoods have a Floor Space Index between 0.75 - 1. Since the purpose of this project is to test out an increase in density, the area should have a Floor space index higher than 1. This forms the minimum line in the preferred design area in the Spacemate.

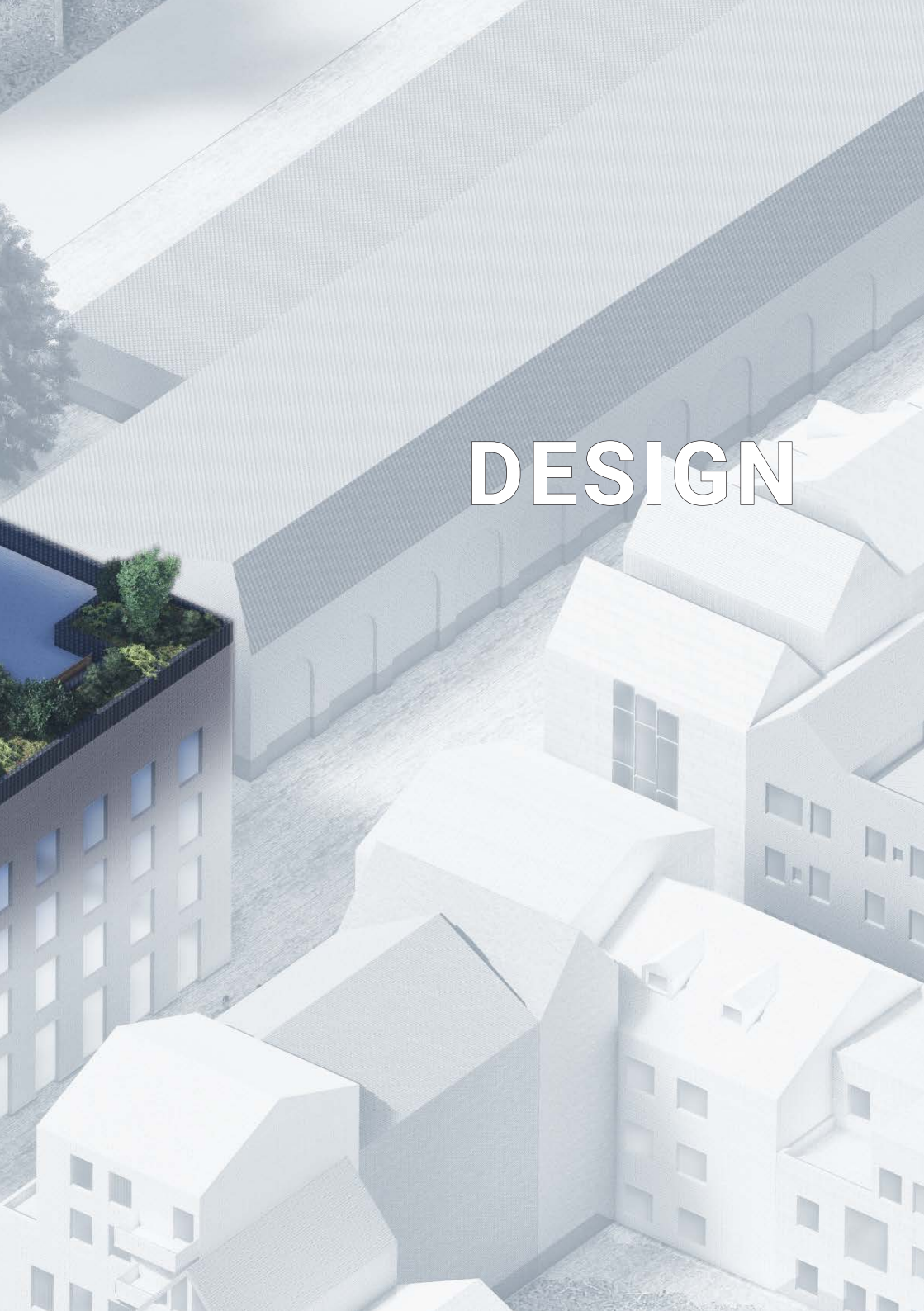
The majority of neighbourhoods have a Ground Floor Index between 0,30 - 0,50. This seem to be the typical Utrecht neighbourhood and the neighbourhood bordering the project area (Tweede Daalsebuurt) score 0,46 GSI. During the site visit, I concluded that this amount of ground coverage seems to be reasonable for the typical block typology. Therefore, the two sides of the preferred design area in the Spacemate is marked by 0,30 and 0,50 GSI respectively.

Utrecht's neighbourhood score predominantly along the 2 Layer variable, but since the set minimum of the design is at 1 FSI, we note that the average floor number has to be more than two in order to reach the densification goal. However, no neighbourhood scored higher than 5 Layer, and as such, a designed average of 5 floors is not deemed to fit into the context of the city. Therefore, the set maximum of the preferred design is at the 5 Layer variable.

The preferred design position in the Spacemate is also capped off by 0,35 on the Open Space Ratio variable. The reason for this is that a higher OSR than 0,35 is deemed as having too few public open spaces to be enjoyable.



Concluding the analysis, a preferred position for the design project can be marked.



DESIGN

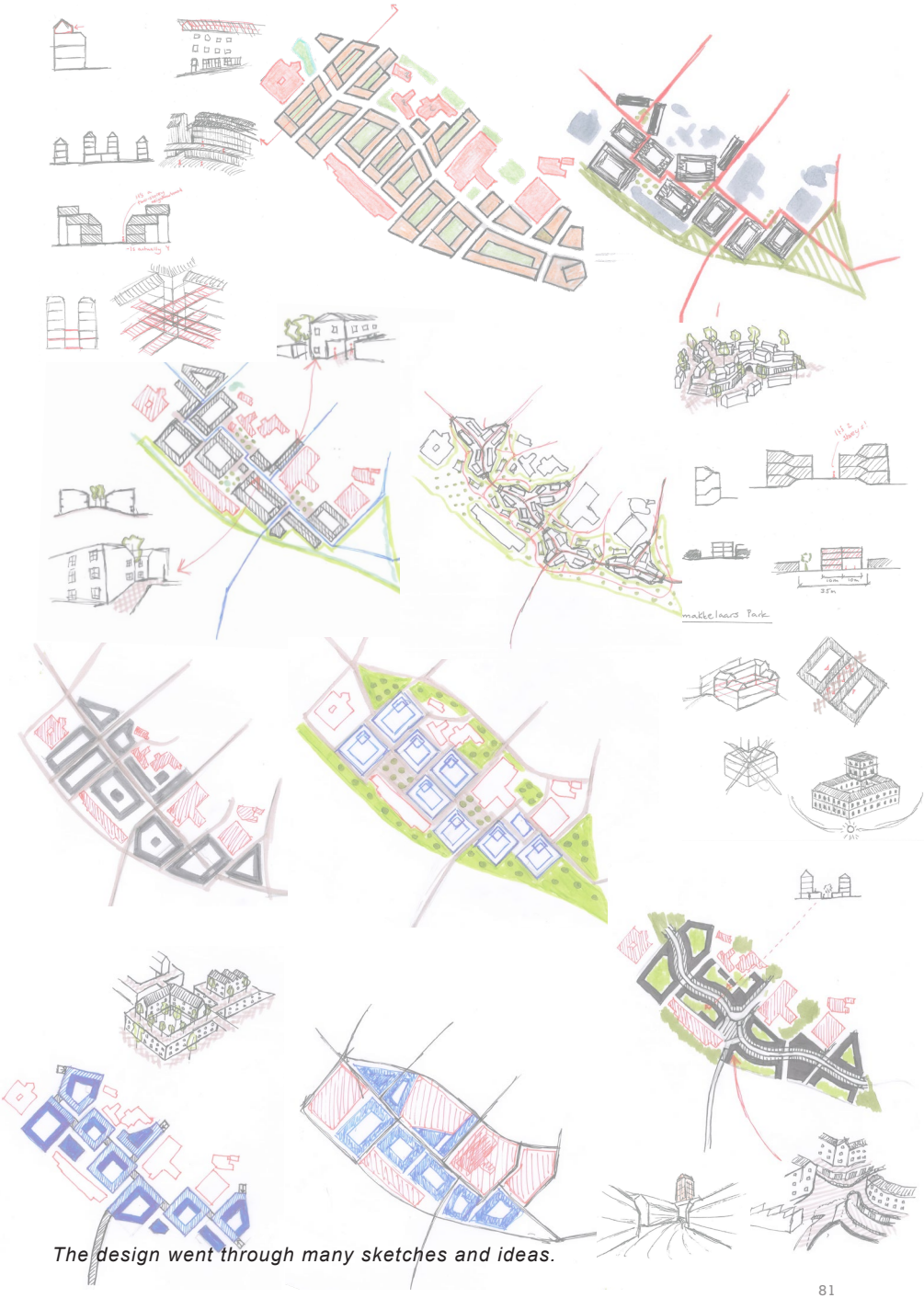
DESIGN PROCESS

The design of the area went through many revisions, until I found one I was happy with. Many different ideas was sketched on the site, but I had a few general ideas that was often reoccurring on the sketching paper.

One was that I wanted to minimize the barrier effect of the railway tracks, and to introduce either bridges or underpasses in order to connect the area to previously distant parts of the city. I knew that having effectively only one accessible side to the site would reduce the amount of activities and movement possible for a new, lively neighbourhood, and thus, bridging over the railways was vital for the creation of an attractive urban environment.

Even though the increasing of density was driving the design, I wanted to reserve much space for the public, for healthy green areas and recreational opportunities. In the design, I wanted to show how a city could be more compact, without diminishing the public realm. I found it quite hard to find a balance between public space and densification.

A question raised in this thesis was if density has to affect a city's identity. To explore this, I had to be gentle to the existing character of the site and its surroundings, as well as using inspiration from the neighbourhoods' character gathered after the analysis. To me, that meant that I had to start from the bordering neighbourhood, Tweede Daalsebuurt, to see what character was present. It had a strict street grid, many streets leading into the site, and buildings were of two storeys. This became the starting point of the design. However, such a character was not deemed dense enough, so one idea was to gradually increase the floor number towards the railway tracks. A sensitive, gradual transition in height would allow the site to increase in density, while



The design went through many sketches and ideas.

not necessarily be experienced as much more dense than the existing neighbourhood.

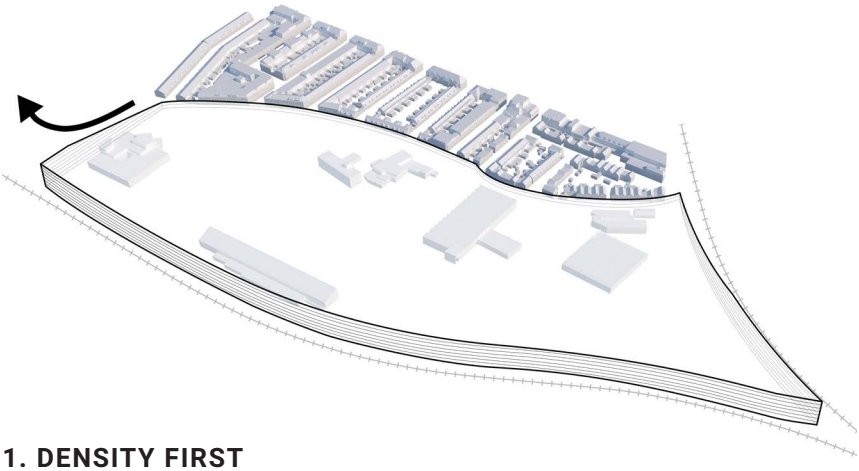
Relating to the ideas of soft density, many sketches were produced in order to experiment with solutions on how to 'hide density'. For example, the top floor of a building can be pushed inward to be hidden from street view, or how streets can be on top of buildings.

The human scale was also very important. It is in my opinion this scale that makes Dutch inner cities enjoyable, which I attribute to its buildings generally not exceeding five or six storeys, the blocks features high design variation and the streets are narrow. This led me to conclude that I needed to find a maximum building height and to find a diversity in appearance.

The old factory buildings is what gives life and history to the site, and my intention was to highlight this. These buildings needed to be present in the main connections of the design, and preferably beside nodes and gathering spots.

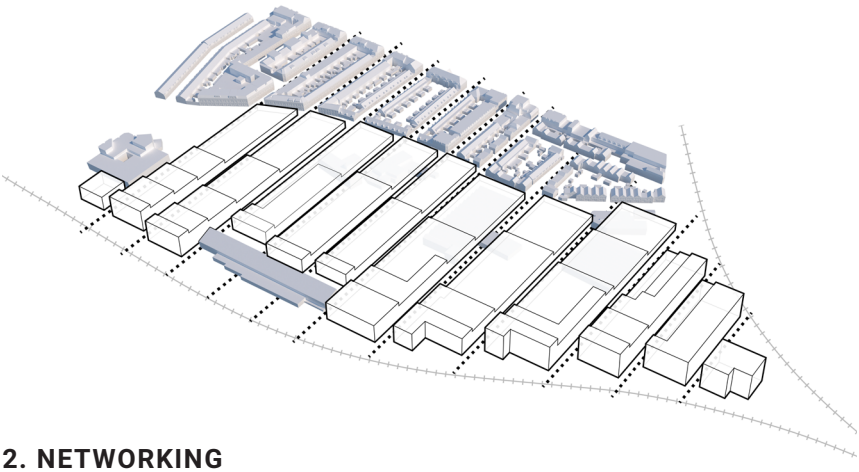
Lastly, I need to mention that I regularly consulted my design with the Spacemate chart. Using this, I could see if I needed to add more buildings to reach my goal, where I could add or remove buildings, if the ground coverage or Floor Space Index seemed reasonable, etc. The Spacemate was a great design tool to use in order to visualize how the urban environment may be experienced.

In the end, I found a design that I was happy with, which is explained by the following six steps.



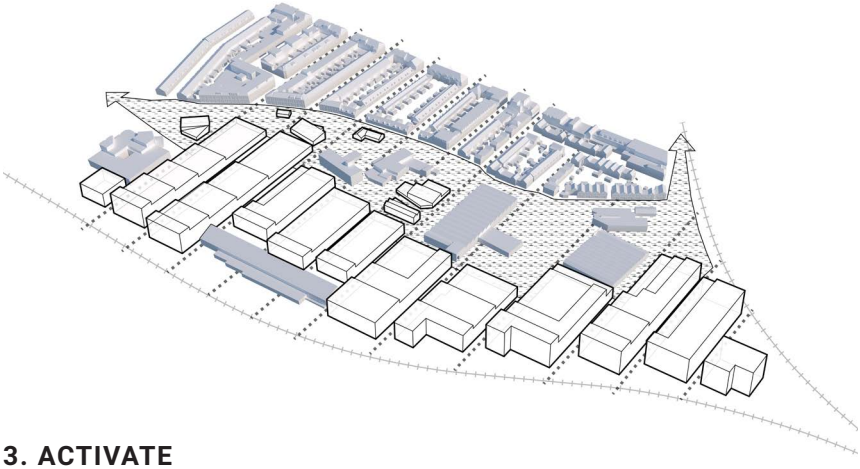
1. DENSITY FIRST

Considering the entire site as building mass, the design has a maximum of 2 floors by existing neighbourhood and going up to 7 floors by the railway tracks.



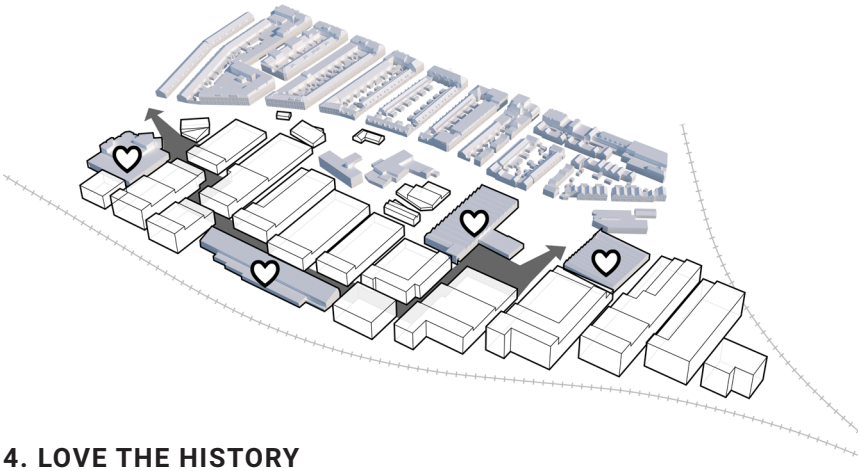
2. NETWORKING

Streets follow the simple directions of the existing pattern.



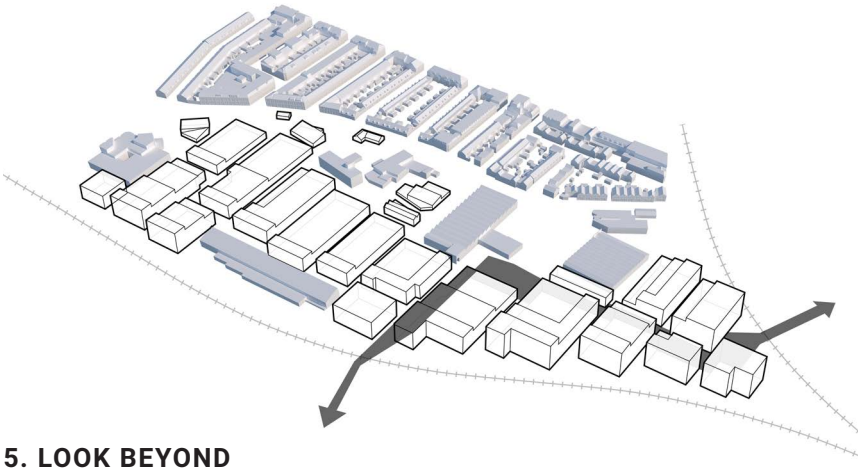
3. ACTIVATE

To activate the area, public facilities, recreation and activities are located at easy access for both the new and old areas. This strip of activities also constitutes a larger city connection.



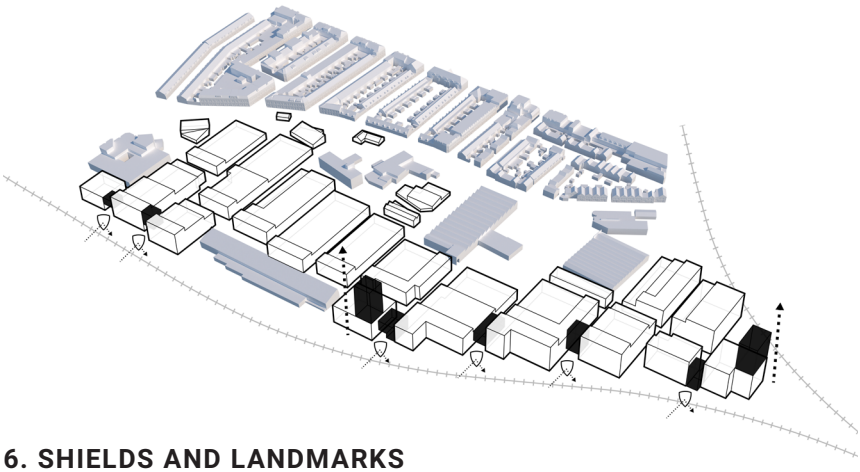
4. LOVE THE HISTORY

Another connection is created to ease the access to the repurposed railway buildings.



5. LOOK BEYOND

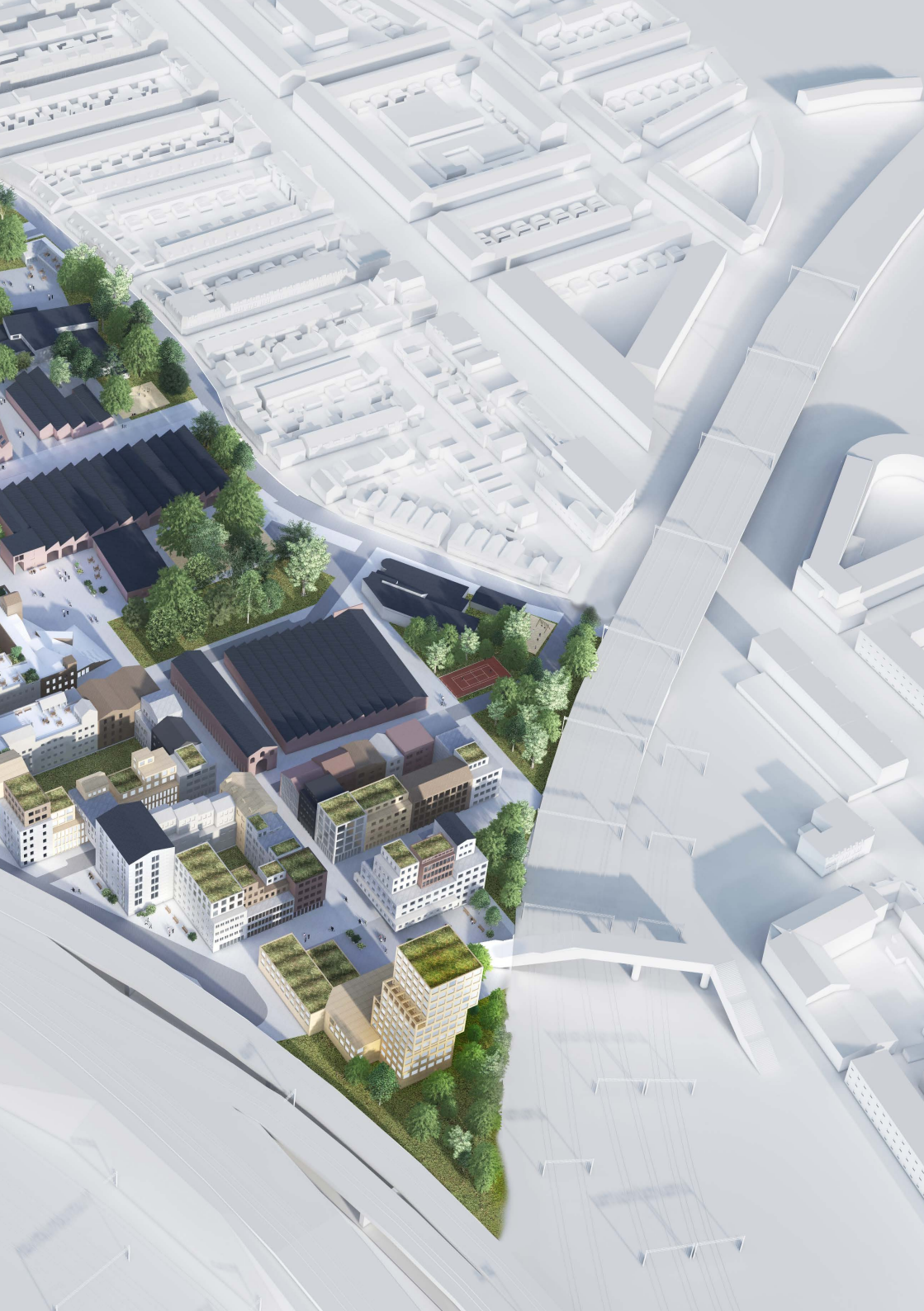
Two bridges connects the site across the railway tracks, opening the site up to new parts of the city, as well as creating easier access to Utrecht Centraal.



6. SHIELDS AND LANDMARKS

New landmarks are added by the bridge entrance points for people to navigate. Additional buildings are added to reduce the railway effect.

The results of the six steps is an urban design in the form of dense, mixed-use neighbourhood blocks, influenced by characteristics present in the city of Utrecht.




A
LIBRARY
B
PARKING GARAGE
A
N


COMMUNITY CENTRE
UCo
BIKE GARAGE
B
BIKE GARAGE

MASTER PLAN

This text applies to the masterplan on the previous page.

As shown on the plan, the block sizes and the street widths are similar to that of Utrecht as a whole; and similar to the neighbourhood Tweede Daalsebuurt more specifically. This is a narrow block structure making, the courtyard fairly small. It also includes many neighbourhood streets that feeds into the site, and these have been extended upon.

The plan shows the activity link, composed of a seperate bike and pedestrian path, programmed activities such as sporting areas and playgrounds, as well as many green spaces. The link also integrates many of the old buildings on the site and new buildings are added. These new buildings will have public uses, such as cafés, local library and the like.

Motor traffic is mostly directed on the site's two longer sides, and is fed through smaller local streets. Heavier transport needs is dedicated on the larger street that runs along the railway tracks.

The plan is detailed with outdoor hangout spots and meeting places, plants and decorations, and bike and car parking.

CONTEXT PLAN

The context plan is on the right side of this spread.

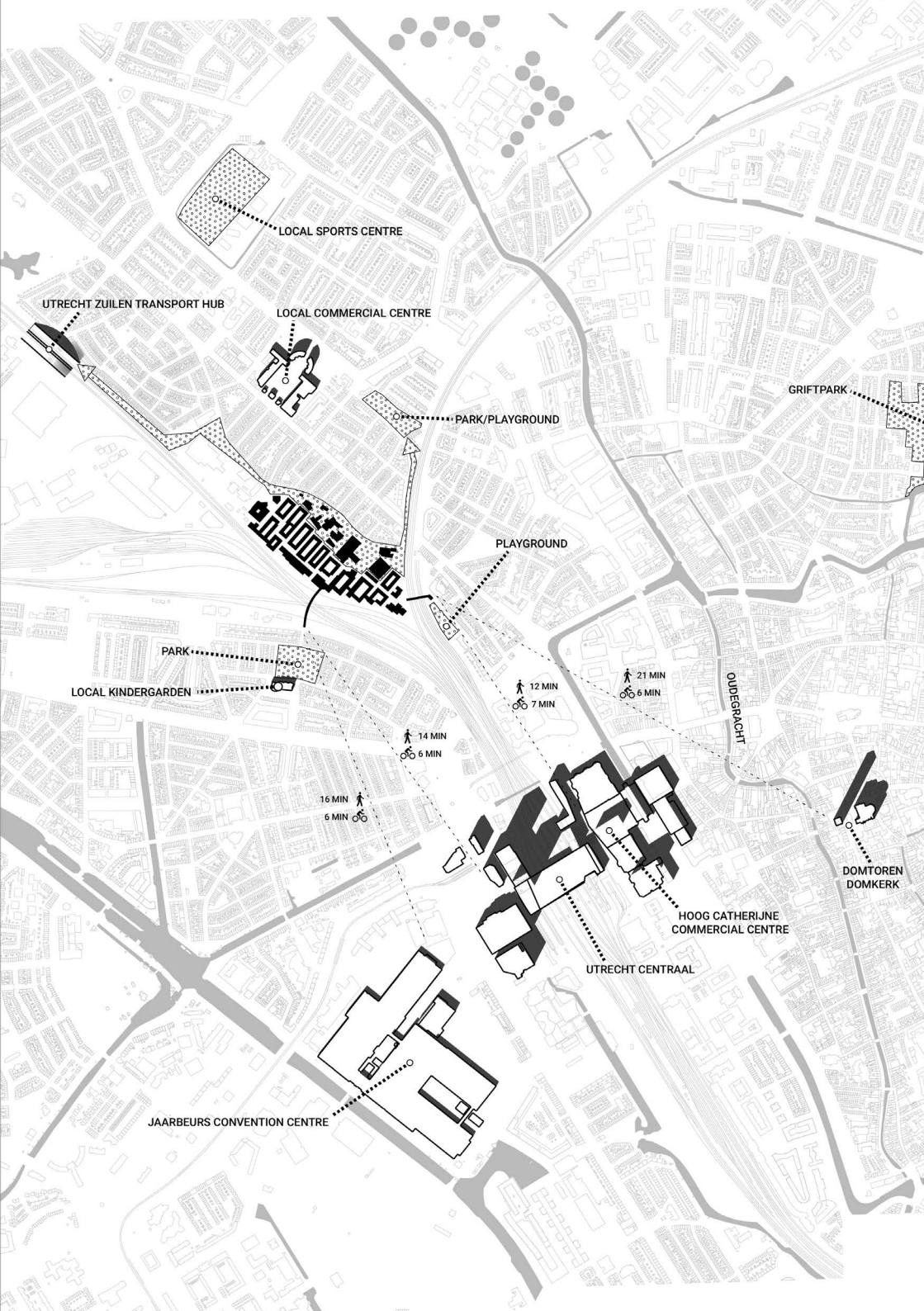
The new bridge connections will make the central parts of Utrecht more accessible, and significant places of interests are reach within 6 - 8 minutes by bike. The western bridge also opens the site up to new, previously unconnected, parts of the city. Just by the two bridge's landings are existing parks and playgrounds, as well as a kindergarten.

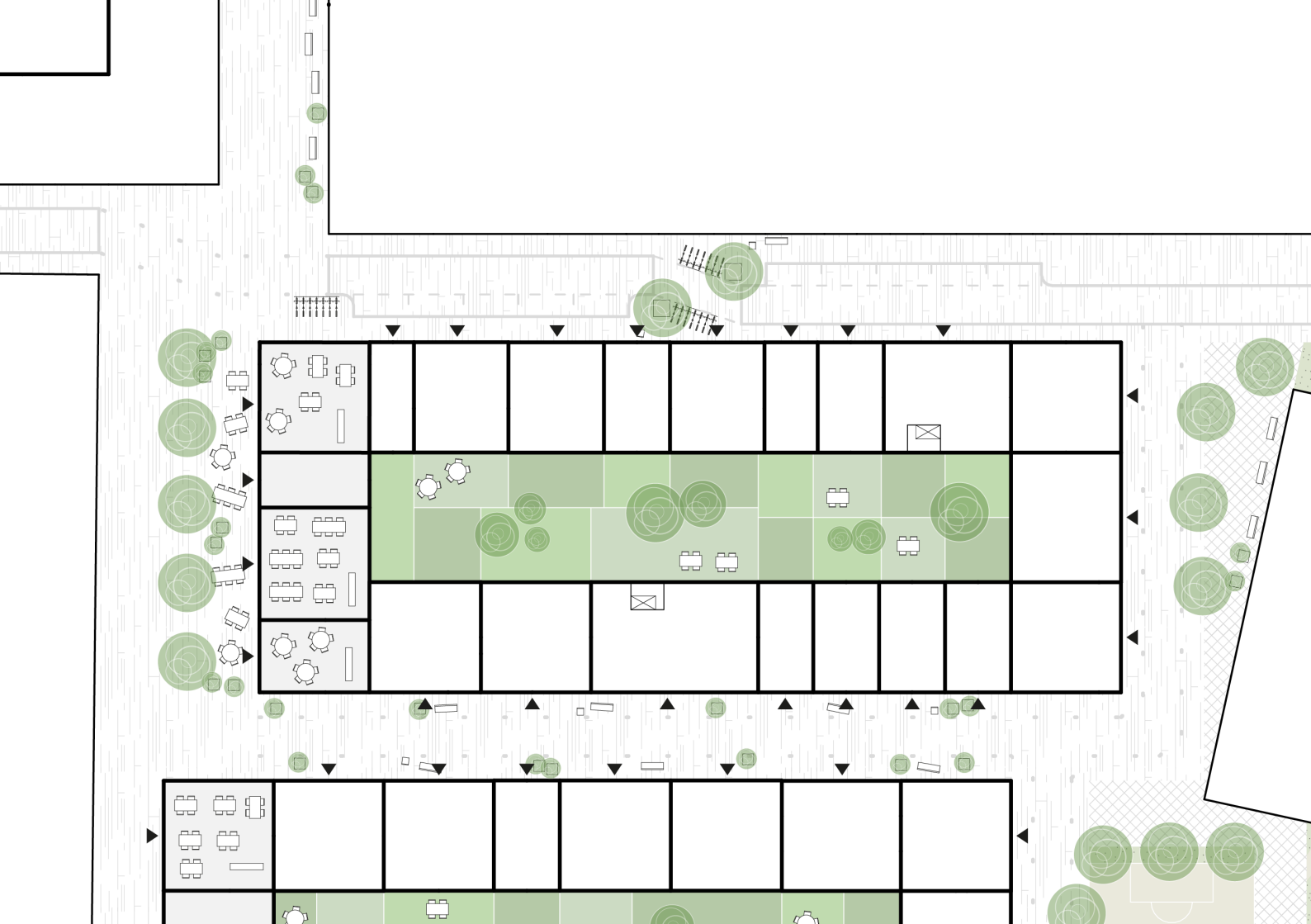
The aforementioned activity link is shown to be part of a bigger ambition to connect recreational areas surrounding Tweede Daalsebuurt to the local transportation hub, Zuilen. The context plan furthermore demonstrates the proximity of the site to a smaller local commercial centre and an area of sports facilities.

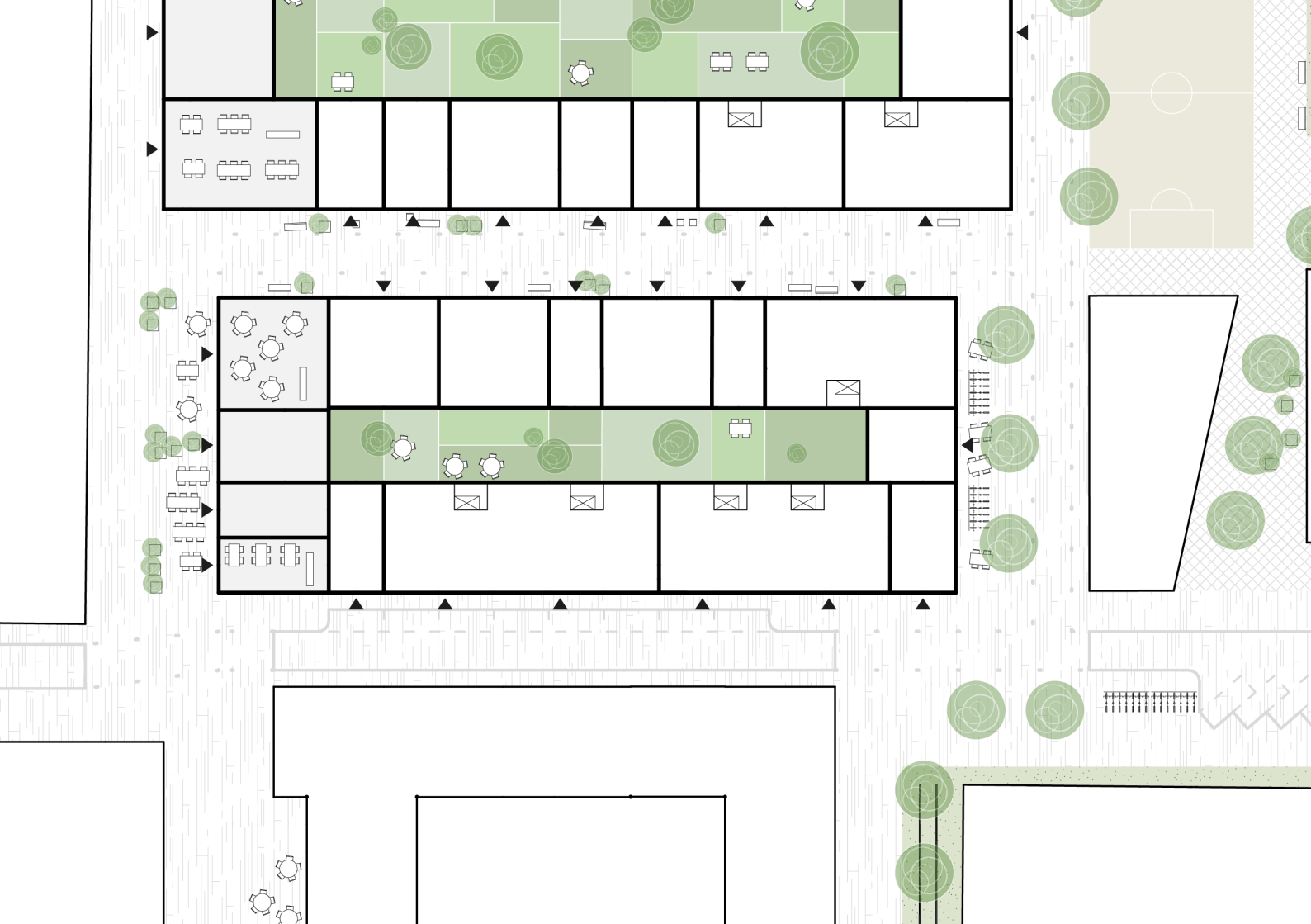
BLOCK STUDY PLAN

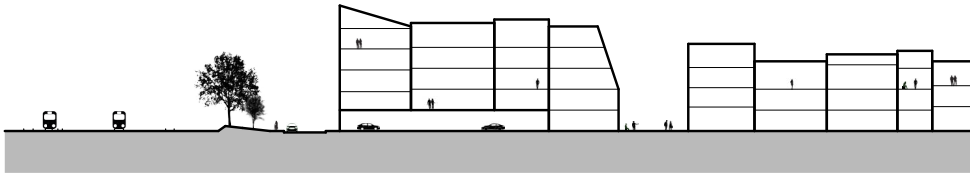
The following page feature a block study plan.

In it are shown that the building blocks are directly facing the streets, towards which the entrances are placed. As is usual in Utrecht, the buildings' depth is 10 meters. Unit sizes vary within each block. Courtyards are private and shared by the surrounding buildings.


LOCAL SPORTS CENTRE
UTRECHT ZUILEN TRANSPORT HUB
LOCAL COMMERCIAL CENTRE
PARK/PLAYGROUND
GRIFTPARK
PLAYGROUND
PARK
LOCAL KINDERGARDEN
12 MIN
7 MIN
21 MIN
6 MIN
OUDEGRACHT
14 MIN
6 MIN
16 MIN
6 MIN
DOMTOREN
DOMKERK
HOOG CATHERIJNE
COMMERCIAL CENTRE
UTRECHT CENTRAAL
JAARBEURS CONVENTION CENTRE

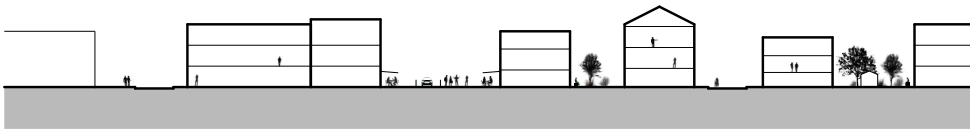






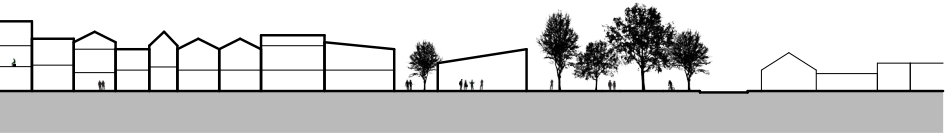
SECTION 1

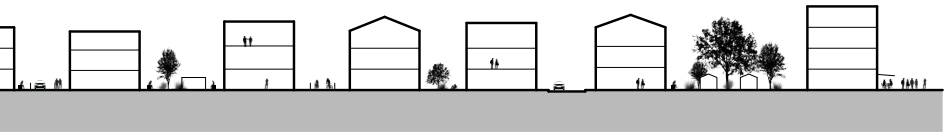
Shown in Section 1, the number of floors is akin to that of the existing buildings, but gently increase in number closer towards the railway tracks. The different buildings which constitutes the blocks, and their varying facade appearance, will make for a high diversity of building expression.

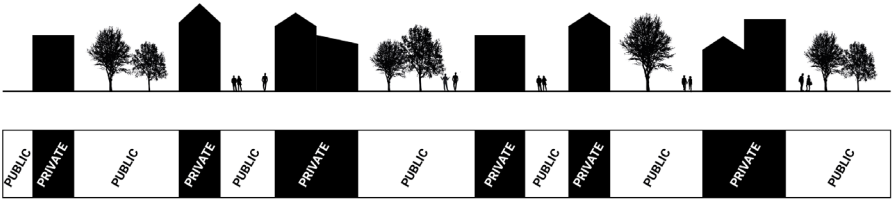


SECTION 2

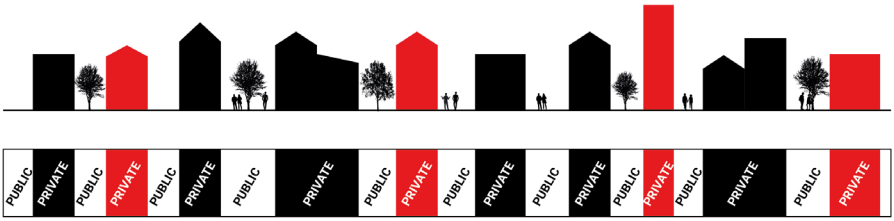
Section 2 explains the relation of widths between the neighbourhood streets, the buildings and the courtyards. Cutting through this angle, the buildings are of a similar height relation.



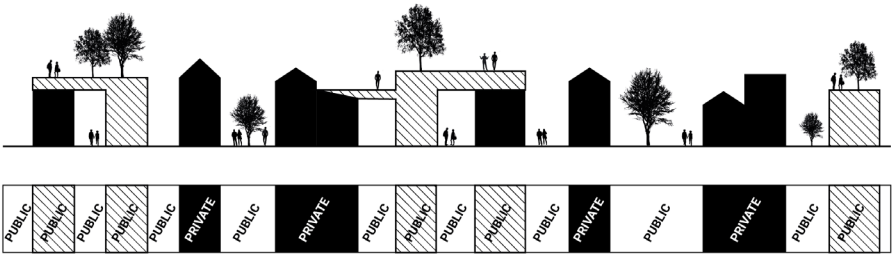




TRADITIONAL CITY



DENSIFIED CITY



PUBLIC + DENSITY CITY

DENSITY VS PUBLIC SPACE

The way we typically view cities is that it is made up of buildings - which are usually private - and the spaces between the buildings, which are the public spaces. These are often viewed as two seperate entities.

If we simply densify that same area with more buildings, the effect of the compact city becomes that less space is reserved for the public realm. These spaces have a high chance of being overcrowded or overshadowed.

A new type of densification needs to be installed in order to give back to the public realm. The solution may be to break the mindset of buildings and public space as being two seperate entities, and to integrate the buildings into the public realm.

To try and experiment with an increase of public spaces in a compact city, the design features a public rooftop on one of the blocks. This space includes café opportunities, hangout spots, and green spaces.

Another benefit of being on a roof is the addition of sun-exposed public spaces and new, interesting views in an otherwise flat city.

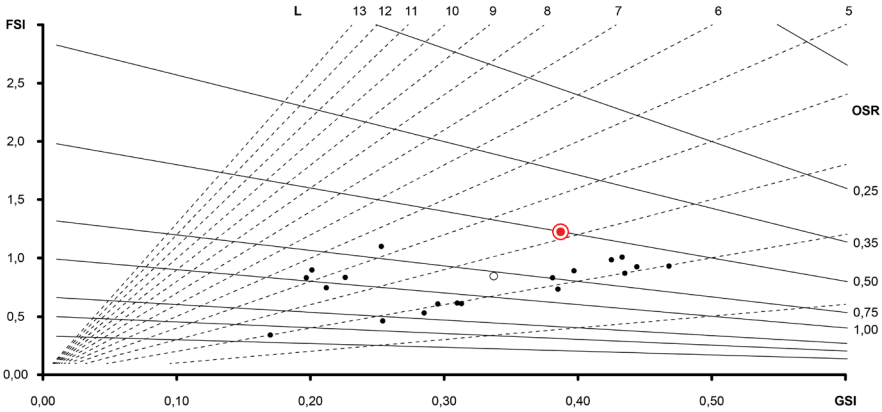
The public rooftop is furthermore the link between the railway bridge and the main square, and serving this purpose ensures the movement of people through the public space.

Buildings affected by this roof will not be of residential type.


FIETSENSTALLING / BIKE GARAGE

View of main square. Here, many paths combine and much movement is expected. The entrance to the public rooftop features steps for hangouts and houses a bike garage underneath. Using lifts, the public roof is entirely accessible for mobility-impared people. The tower marks the entrance to the bridge.

View of neighbourhood street. Brick is the most wide-spread material used in Utrecht, and comes in a variety of colours. High facade diversity in the blocks, as well as breaking sightlines of streets, leads to a human scale environment. Narrow blocks, where the building directly reacts to the street, pushes activities out onto the streets, leading to a lively public realm.



The red dot indicate the density position of the design.

SPACEMATE RESULTS

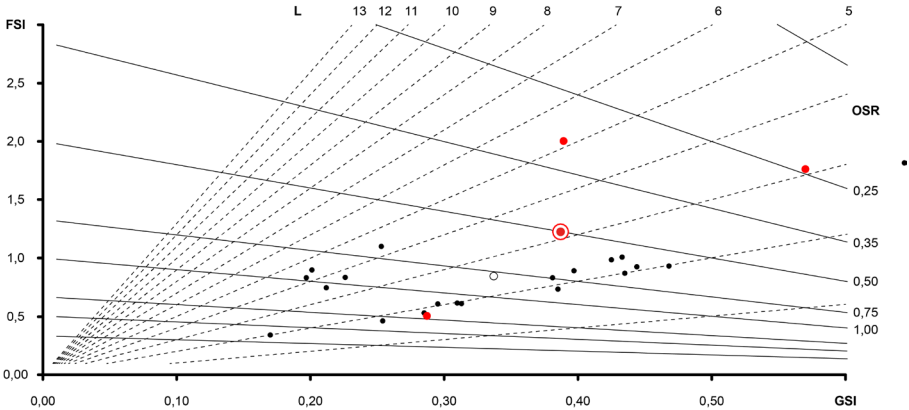
The density of the design has been calculated and can now be properly placed within the Spacemate chart, and I am happy to announce that the design is located inside the preferred location. Although, this does not come as a surprise, considering that Spacemate has been used regularly throughout the design process to ensure that the design ends up in the correct spot.

At first glance, it might not seem like a big increase in density compared to the existing neighbourhoods. This is true, considering that the overall Floor Space Index of the design is 1,212, which is not a significant upgrade. However, what is important to note is the the density has been increase in relation to the context of the city, and as such, the design is made to fit well in Utrecht, while at the same time being more dense.

Furthermore, it was my ambition to demonstrate that a higher density does not have to come at the cost of a decreased public realm. Seeing how much public space the plan feature, while still being the most densely built neighbourhood in central Utrecht, I believe this goal was reached.

Another significant point to consider regarding the Spacemate position, is that the density in the design differ between different areas of the site. This has been illustrated by breaking the site in three areas, where these three areas have been calculated separately.

It is no surprise that the least dense part of the site is the activity link,



The design features varying amounts of density. Splitting the site into three parts, reveal different results.

which leaves much open space for recreation.

The six most southern blocks scores fairly average in terms of Ground Space Index, but is the area with the highest Floor Space Index number, going as high as 2.05.

The seven northernmost blocks did not score as such a high Floor Space Index, due to this area consisting mostly of three storey buildings. However, it is the area in the design with the most amount of ground coverage.

One last point to add is that the public rooftop could not be included in the Spacemate calculations, meaning that the amount of public space is a bit more than illustrated in the chart.

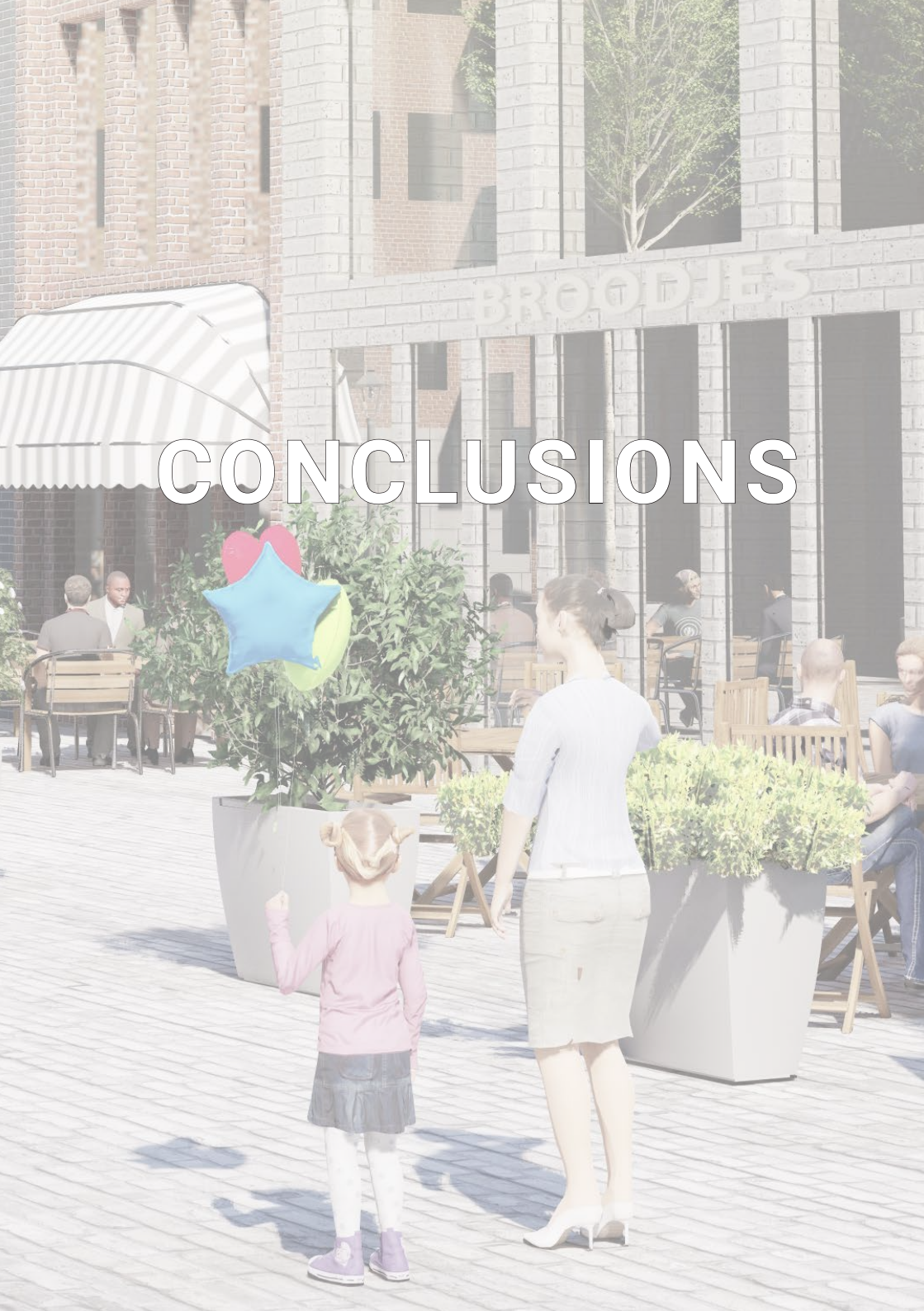
POPULATION RESULTS

In the end, the design features a total floor area of 118 308 m^2, and a rough estimation accounts 66 % of this floor area to be of residential use. That leaves a total of 78 873 m^2 of residential floor space. The average household size in The Netherlands is 65 m^2. These calculations leaves us with the following household results:

number of households added
= 1 213

Taking into account the average amount of people living in a household in The Netherlands, which is 2,2 persons, this is the following results:

Expected number of inhabitants
= 2 670



CONCLUSIONS

To conclude this thesis, I will circle back and discuss the research questions. The first research question stated is as follows:

- does an increase in density affect a city's identity?

There are a few points to discuss here, but in my findings, I believe the answer for the most part to be; *it depends*. Firstly I want to mention that it is my opinion that the design presented in this thesis is done to the best possible character of Utrecht and with the utmost care for the city's identity, while simultaneously being more dense than previously done in the city.

However, one important thing to keep in mind is the scale of the project. The project of this thesis is just short of 10 hectares and as such, would always have very little impact on the identity of the whole city. This stands in contrast to previously mentioned densification projects, such as Älvstaden in Gothenburg. That project is of such a huge scope that it will most certainly affect the identity of the city. I would need to add here, that changing an identity isn't necessarily something negative.

So the project design is an example of an increased density, while not affecting a city's identity. However, it most certainly affect the immediate character of the redeveloped area. It was formerly a rail yard, later abandoned and left mostly empty. The proposal envisions this same area transformed into a lively, mixed-use neighbourhood. Here, one can thus conclude that to densify an urban area would always affect the area's identity. However, the identity of the city might not be altered in any significant way.

In discussing this question, the issue of subjectivity needs to be brought up. I, as the urban designer, can argue for the design being considerate towards Utrecht's identity, based

on my findings from the visual- and density analysis, which led me to conclude that my design had to feature blocks and streets of certain sizes; a strict grid pattern; and brown and red bricks; etc. But that is just my interpretation of Utrecht, and someone else, perhaps a local, may find arguments why they would consider my design to *not* appreciate the city's identity.

So does an increase in density affect the city's identity? As has been shown in this thesis, densification always affect the identity in one way or another; however, the scope of the change may differ.

The second question to research in the thesis is:

- How can density be used as a design tool?

This thesis has demonstrated how density can be used as a design tool, by applying the Spacemate method. The thesis presents two ways in which the Spacemate method can be used; firstly it had been used to analyse neighbourhoods in central Utrecht, and secondly, it has been a guideline during design and sketching.

Using the Spacemate to calculate the existing neighbourhoods in Utrecht gave me an overview of what kind of density was present in the city. Connecting to the previously discussed research question, this was beneficial for me to understand the character which I would have to consider in my design. Ultimately, the neighbourhood density analysis gave me plenty of information which served as the background of my design.

Whenever I was sketching and designing the area, I regularly consulted with the Spacemate in order to see how dense the design would be. Did I need to add buildings or more storeys? Was too much ground covered by building footprint? Utilising the method in this way, the density always guided the design to ensure that a viable urban density was reached.

To conclude this topic, I state that the extent to which density was used as a design tool in this degree project, was, in my opinion, very helpful.

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