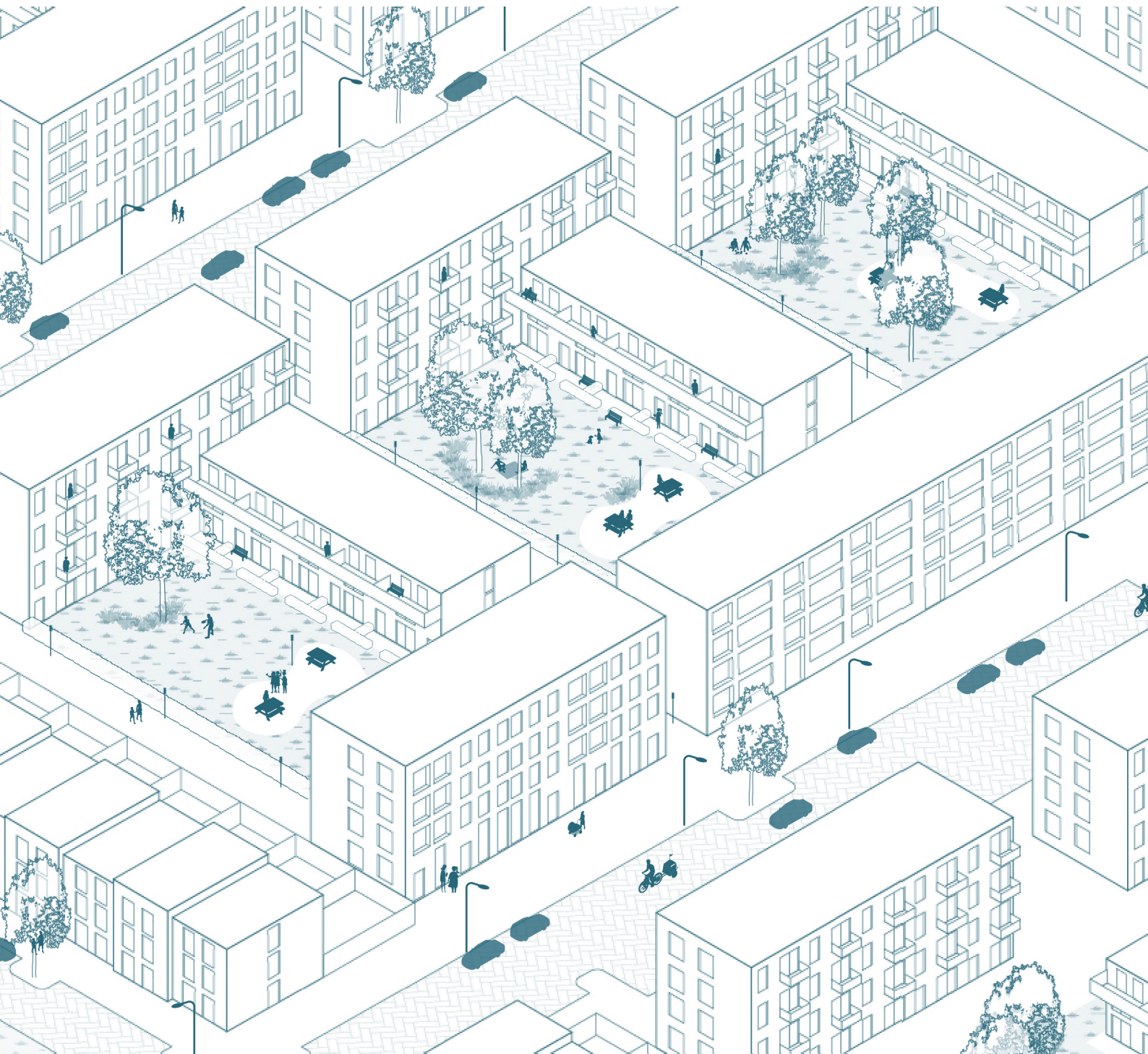


UNSAFETY

Improving perceived safety through spatial design in Pendrecht

Thesis report / Lieke Marijnissen / 4368525
July 2020





Title	Unsafety - Improving perceived safety through spatial design in Pendrecht
Keywords	perceived safety, social safe design, social control, public space, neighborhood transformation
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Delft, The Netherlands, July 2020
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And lastly, I would like to thank my family and friends for always being there for me and believing in me. Your kind words, interest, feedback, and help have supported me a lot.

Preface

Before you lies the thesis report “Unsafety - improving the perceived safety through spatial design in Pendrecht”, the documentation of a project that has researched how spatial elements and characteristics influence perceived safety and how these elements and characteristics can be integrated into urban design. It has been written for the graduation of the master Urbanism at the Delft University of Technology.

The research and design are conducted in the neighborhood Pendrecht, a post-war, modernist neighborhood in the South of Rotterdam. The research has identified the effects of the spatial environment on perceived safety and has validated design principles that aim to improve perceived safety. The final outcome of this thesis is a neighborhood transformation design that integrates the validated design principles in combination with other urban design challenges.



fig 1. Zuidwijk - Pendrecht aerial view 1971 (source: www.vanamen.net)

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1 / Introduction

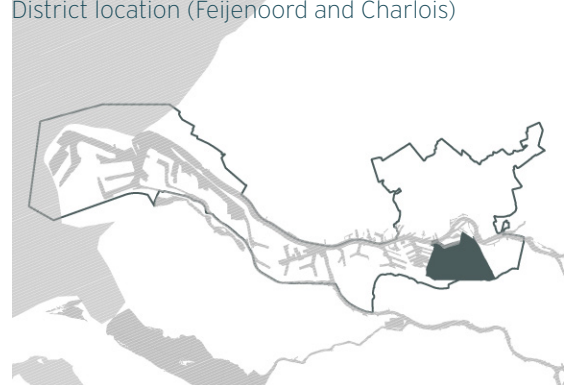
1.1 / Introduction

The population in cities is growing globally, this rapid urbanization in the Dutch context is dealt with by densifying the existing urban areas. The Netherlands is already a densely populated country, but according to the population growth forecast, by 2030 there will be another 350,000 inhabitants in the G4, the four biggest cities in the country (Amsterdam, Rotterdam, The Hague, Utrecht) (CBS, 2016). Rotterdam, as the second biggest city in the Netherlands, is estimated to grow an additional 50.000 inhabitants. The current population count is 644.400 inhabitants (Gemeente Rotterdam, 2019). With this growth the city is facing challenges to accommodate the growing population and still maintaining a quality of life and a sustainable living environment.

Municipal location



District location (Feijenoord and Charlois)



Neighborhood location



Rotterdam-Zuid has become a highly populated part of the city in the last century. There are 144,100 inhabitants in the neighborhoods of the districts Charlois and Feijenoord, which form the largest part of Rotterdam-Zuid. Charlois is subdivided by the neighborhoods Tarwewijk, Charlois, Carnisse, Zuiderpark, Pendrecht, and Zuidwijk. Feijenoord is subdivided by the neighborhoods Noordereiland, Feijenoord, Kop van Zuid, Katendrecht, Afrikaanderwijk, Bloemhof, Hillesluis, and Vreewijk. The average population density in both districts is high. In the Feijenoord district the average population density is 11.150 inhabitant per km². In the Charlois district the average population density is lower, but nonetheless the density is considered high, with an average of 5.960 inhabitant per km² (fig 2).

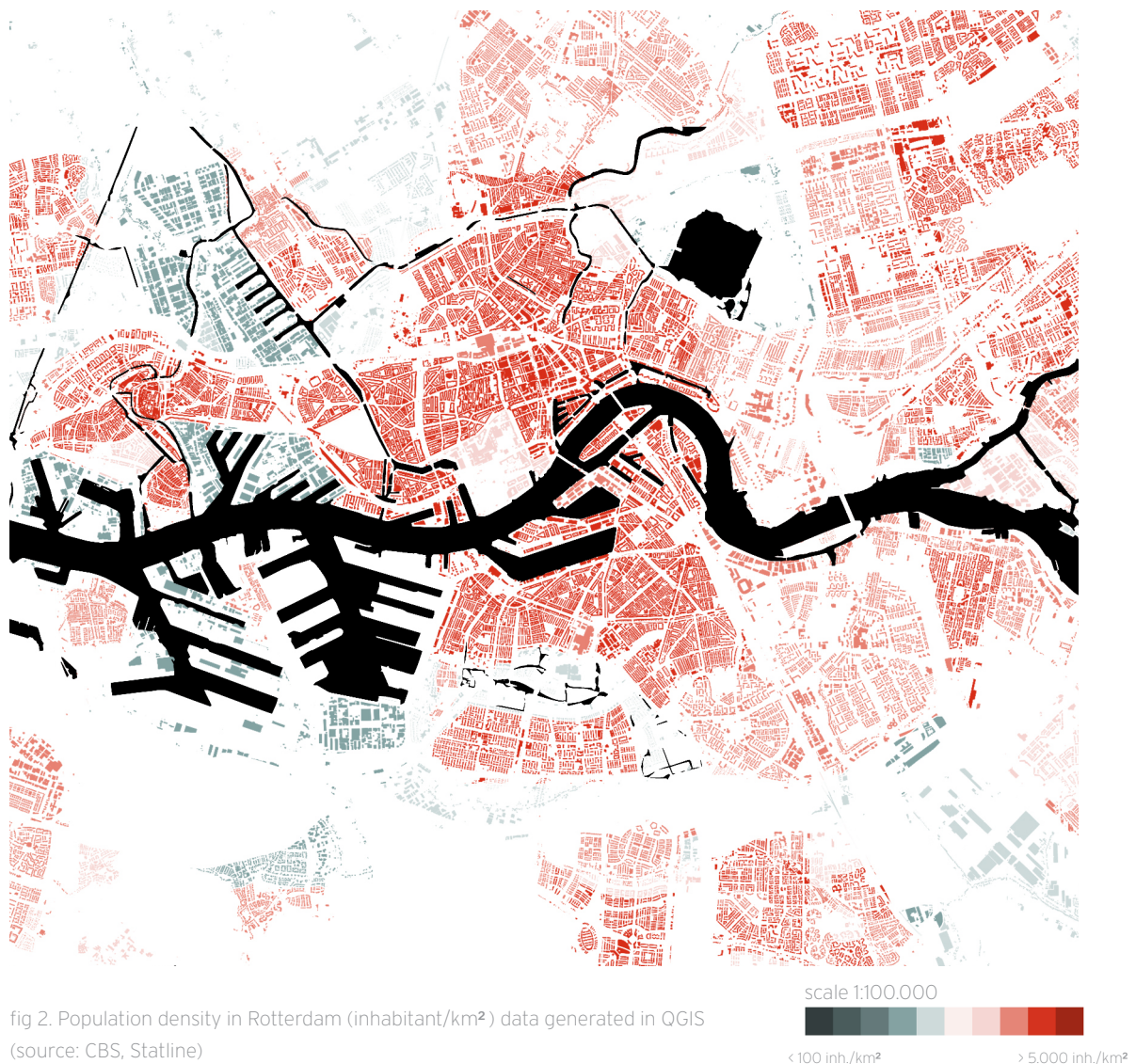


fig 2. Population density in Rotterdam (inhabitant/km²) data generated in QGIS
(source: CBS, Statline)

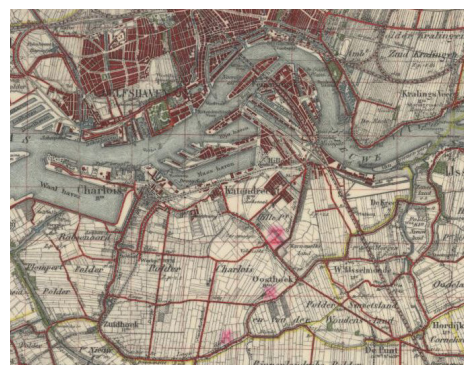
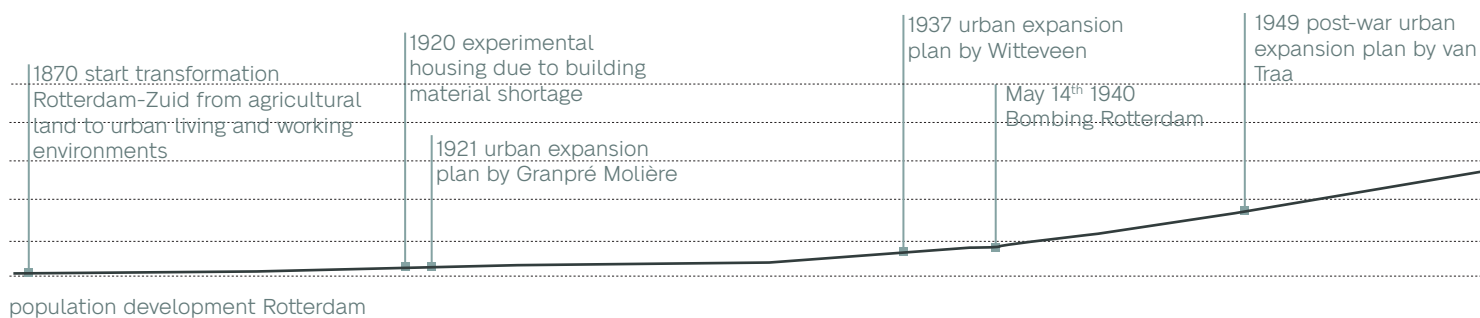
1.2 / Historic development

Rotterdam is the second-largest city in the Netherlands. The city itself has 576.000 inhabitants (Gemeente Rotterdam, 2018) and inside the municipality boundaries, it has 644.000 inhabitants (CBS & PBL, 2016). Its current urban form is a result of two processes that have had a big influence on the city. These processes are understood in two main lines of development: on the one hand, the city's position as an international port and the subsequent extension of the port from the city center towards the north sea; on the other hand, the restructuring and transformations of neighborhoods throughout the city after the bombing of 14th of May 1940.

The city is situated along the Maas, the river separates the city in the northern and the southern part, which

for a long time have been considered as independent functioning parts of the city. The southern part of the river was for a long time destined for the working class with assigned appropriate facilities. This phenomenon stems from the port function of the area, which was its predominant function until 1900. During the interbellum, the function of the area shifted to a residential function. The poor housing qualities of the northern part of the city and the increasing housing demand for the working-class asked for an urban development plan on the southern part (Meijel, Bet, & Hinterthür, 2008).

In Van Witteveen's urban expansion plan (1937), based on Granpré Molière's guidelines (1921), a new vision emerged that considered north and south as one integral spatial unit. This was possible because of the new north-south connection of the Maastunnel. Despite the partial realization of van Witteveen's vision, a new plan was made by van Traa (1949) after the Second World



War. His vision included a center that was subordinate to the center of the northern part of the city. The center's main function was traffic and the infrastructure, this can still be seen around Zuidplein.

The focus of urban development from 1940 to 1960 was to realize new garden cities in the area. The regeneration of the outdated neighborhoods was made impossible by the high housing shortage and therefore a higher urgency for new neighborhoods. It caused the older residential areas to deteriorate, become impoverished and the living environment deteriorated. The initial residents, who could afford it, moved out of the area and the area attracted foreigners and young people because of the cheap housing.

From 1975 up till 1990, the municipality initiated several project to renewed the neighborhoods. This was done on different scales: city, neighborhood and dwelling. This, however has caused a fragmented street scape in some

parts of the area (Meijel et al., 2008). Nowadays, the area still deals with cheap housing that attracts concentrations of residents with low income, low education and other socially excluded groups (Marlet, Poort, & van Woerkens, 2009).

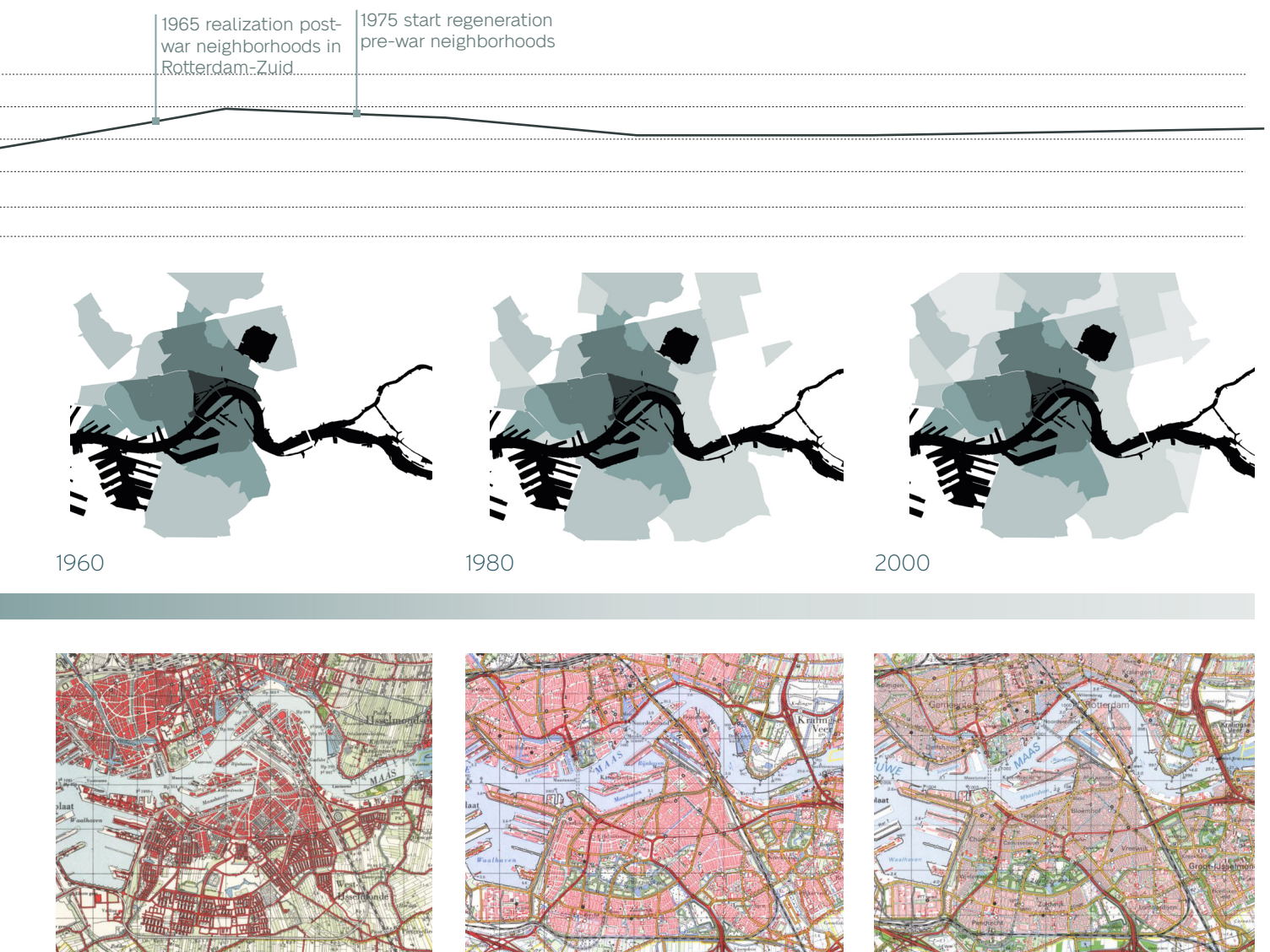


fig 3. maps retrieved from www.topotijdreis.nl

1.3 / Motivation

This research project is rooted in my personal interest in the psychology of people related to the building environment. In the last few decades researchers, like Jan Gehl and Jane Jacobs, have put an emphasis on the human-minded design and the human scale. This approach to design focusses on the perception of the environment and the well-being of the people. There is a psychological explanation for the way in which people experience their social and physical environment. This research attempts to elaborate on this by looking at the safety perception of people.

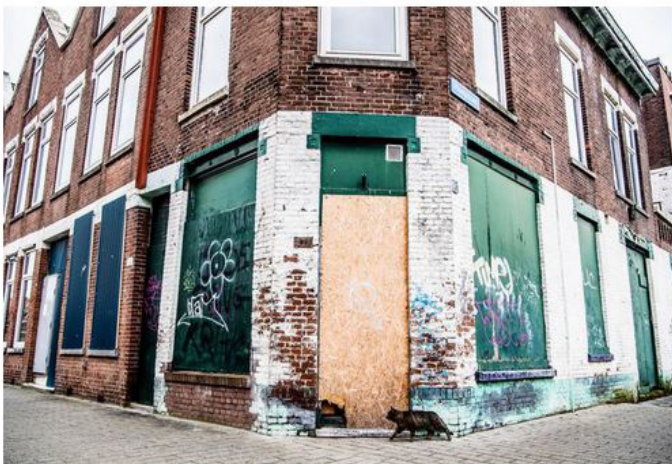
The studio 'Design of the Urban Fabric' involves researching the physical form of urban environments and the complex relationships between the physical form and social processes that occur in the urban environment. The perception of safety is only one of these complex relationships. The perceived safety is influenced by the social environment and the physical environment.

Rotterdam-Zuid has had a bad image related to safety and livability for a very long time, but now that it has developed into a significant part of the city of Rotterdam, the poor image of Zuid is an obstacle for development in the area. In my personal search for housing in Rotterdam, I avoided Rotterdam-Zuid because I was told the area is not safe. However, nobody could really tell why. This sparked an interest in looking at the livability and safety in Rotterdam-Zuid from an urban planning and design point of view. The problems related with safety are covered by local and national newspapers. Publication spread the word about the poor performance of livability and safety in Rotterdam-Zuid, adding to the negative stigma of the area.

Rijk trekt 130 miljoen uit voor Rotterdam-Zuid

Voorwaarde is dat de gemeente zelf evenveel geld bijlegt. Het bedrag is bedoeld om de leefbaarheid in het stadsdeel te verbeteren.

Eppo König & Vincent Sondermeijer · 15 maart 2018 · Leestijd 2 minuten



Verpauperde panden in Rotterdam Zuid.
Foto Robin Utrecht/ANP

fig 4. [Government gives 130 million to Rotterdam-Zuid; the condition is; the municipality itself contributes the same amount of money. The amount is intended to improve the quality of life in the city district] (NRC, 2018)

Hoe goed gaat het met Rotterdam?

Wijkprofielen Op alle fronten scoort Rotterdam een paar puntjes extra, maar niet in alle wijken gaat het zo goed. Onder meer Charlois en Feijenoord blijven achter.

Lucette Mascini · 26 januari 2018 · Leestijd 5 minuten



Naast de Turkse bakker bij het Amelandse plein is dit weekend een bushokje gesloopt.
Foto Walter Herfst

fig 5. [How well is Rotterdam doing? Rotterdam scores a few extra points on all fronts, but not so well in all neighborhoods. Charlois and Feijenoord, among others, are lagging behind] (NRC, 2018)

1.4 / Glossary

CPTED

CPTED stands for Crime Prevention Through Environmental Design. the term refers to a research field from the USA where it is assumed that crime and insecurity can be combated through environment-oriented physical and social measures. The four main principles applied in CPTED are; territoriality, natural surveillance, activity support, and access control (Sohn, 2016)

Perceived Safety

Perceived safety is an subjective form of safety. Subjective safety is the feeling or perception of safety. Improving perceived safety is related to improving peoples experience of being in a safe environment. Perceived safety is depending of the social and physical environment which can be subdivided several influential factors: socio-cultural context, individual context, and situational context.

Social control

Social control is composed by mechanisms that regulate individual and group behavior, leading to compliance to the rules of a given place or group. Informal social control includes peer and community pressure and collective responses to undesired behavior. Formal control is expressed through law, rules, and regulations against undesired behavior (Ceccato, 2012, p. 11).

Social safe design

Social safe design is a variation of CPTED, the definition of social safe design that is used in Dutch literature is: a social safe environment is an environment in which people can move free from the threat of or confrontation with violence. Objectively a social safe environment is free of threats and criminality, and subjectively a social safe environment ensures the perceived safety. (Luten, 2008). Social safe design includes measures in the design of the public space that are against feelings of unsafety and crime (Van der Voordt & Wegen, as cited in Luten, 2008). Social safety is influenced by design, construction, layout and management. The guidelines for social safe design are visibility, legibility, accessibility, and attractiveness

2 / Problem Definition

This chapter aims to gain a better understanding of the current status of safety and the socio-economic conditions in the neighborhood Pendrecht. In addition, the same data is collected for the neighborhood Bloemhof as preliminary research for the case study on the neighborhood in one of the following chapters of this project. The contents elaborate on the problem introduction, problem field, problem statement, and problem analysis related to the project subject; perceived safety. The problem field includes the triangular relationship between people, design, and safety. Based on the problem introduction and the problem field a problem statement is formulated. The analysis looks at several socio-economic, demographic, and safety statistics in order to gain insight in the current status of the neighborhood.

2.1 / Problem Introduction

In 2007 the Dutch government formulated a list of 40 problem neighborhoods in the Netherlands. Out of the 40 neighborhoods, 7 were located in Rotterdam, and 3 of those were in Rotterdam-Zuid (fig 6). In these problem neighborhoods, social housing associations often dominate the housing market. This creates concentrations of groups of people with low education in combination with a low income and other socially excluded groups (Marlet, Poort, & van Woerkens, 2009). Compared to other neighborhoods in the Netherlands, these neighborhoods tend to have a high percentage of non-western, poor skilled immigrants (de Rooij and van Nes, 2015). According to Anderson (in Marlet et al, 2009), these problem neighborhoods are often described as 'pockets of poverty', he argues that these neighborhoods should be considered as excluded places. The exclusion is in most cases caused by negative media attention, which results in a stigmatization of the neighborhood. Residents, who have the option, leave the neighborhood, and the concentration of low educated, low income, and other socially excluded groups increases. This way the negative image of the area continues.

The characteristics of a problem neighborhood are still reflected in the performance of the neighborhood. The maps in fig 7 on page 19 show the performance of the physical environment, the perceived safety, and the social environment of the neighborhoods of the municipality of Rotterdam in 2020 (Gemeente Rotterdam; OBI, Wijkprofiel 2020). The neighborhoods on the south bank of the river Maas score lower on most aspects than the neighborhoods on the north bank of the river. On page 23 the construction of the index is explained. The socio-economic segregation on the two sides of the river, which originated during the interbellum from 1918 to 1939, are still happening in the municipality.

In order to act upon this negative status of the neighborhoods in Rotterdam-Zuid, the National Program Rotterdam-Zuid (NPRZ) is initiated. The focus of the program is to improve the level of education, labor participation and housing quality by 2030 (Nationaal Programma Rotterdam Zuid, n.d.). Besides the program, the municipality has also set goals to improve the safety. Their ambition is to maintain the safety level and strengthen it where needed. The ambition includes a sustainable and inte-

gral approach, collaborate with residents, entrepreneurs, organizations and other institutions, information-driven and knowledge-driven and lastly, neighborhood-focused and neighborhood tailored (Gemeente Rotterdam, 2018). The objectives to improve the safety in Rotterdam-Zuid by the municipality and the NPRZ are mainly focused on socio-economic aspects that contribute to the unsafety in the area. Changes in the physical environment and the urban fabric are not sufficiently included in the objectives.

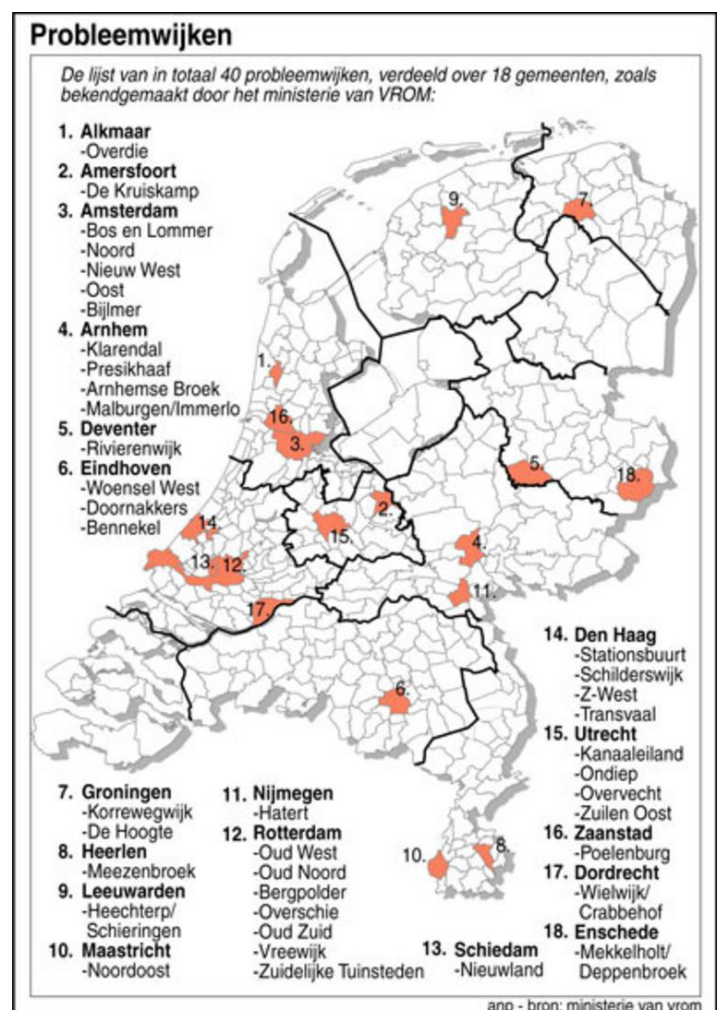


fig 6. List and map of the problem neighborhoods in the Netherlands composed by the Dutch government (source: www.volkskrant.nl)

Physical index



Safety index



Social index

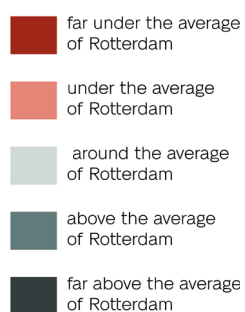
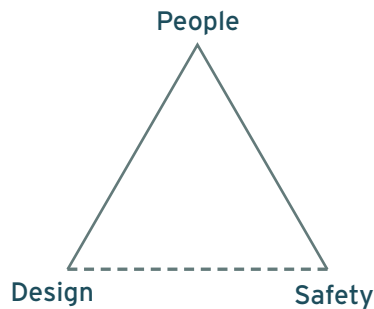


fig 7. Index scores of the aspects physical environment, social, and safety of all the neighborhoods in Rotterdam
(source: Gemeente Rotterdam; OBI, Wijkprofiel 2020 (edited by author))

2.2 / Problem Field



People-Safety

The relationship between people and the sense of feeling safe is widely researched in the discipline of sociology. However, this relationship is also being researched in the discipline of urban design. In urban design the relationship is often understood as the more people are on the street, the more social safety there is. Jane Jacobs argues that there are three conditions for safe streets. First, a clear sense of distinction between what is public and what is private space. Second, the buildings along the street should be oriented in such a way that there are enough eyes on the street to secure safety for both residents and visitors. Third, the sidewalk must be used continuously, this adds to the effective eyes on the street and induces the people in the buildings along the sidewalk to watch the sidewalk in sufficient numbers (Jacobs, 1961).

Design-People

Studying human behavior in relation to space is complex, the activities that can be registered by observing public life are part of processes undergoing continuous change (Gehl & Svarre, 2013). According to Gehl (2013) the following issues should be investigated in order to collect the desired quantitative and qualitative data: "how many", "who", "where", "what" and "how long". The results of studying human behavior compose the dynamic of the city or the area. Components of physical and social characteristics are equally important in order to describe the dynamics.

Jane Jacobs (1958, p. 128) states that "There is no logic that can be superimposed on the city; people make it, and it is to them, not buildings, that we must fit our plan". This is in line with the research approach of this

project. The dynamic of a city can only be understood, when the human behavior is completely understood. The physical characteristics facilitate the human behavior and therefore the social interaction between people.

Safety-Design

The relationship between safety and design is investigated in the Crime Prevention Through Environmental Design (CPTED) research field which first arose in 1961 (Luten, 2008). Jane Jacobs (1961) was one of the first to publish on the topic of safety through design, she argues that not people but space is responsible for the feeling of safety. Luten (2008) supports this argument and states that there is a clear relation between perceived safety and the neighborhood satisfaction of residents. Research by López et al. (as cited in www.omgevingspsycholoog.nl) shows that social safety can be influenced by design, built form, organization, and maintenance. The desired outcome is to diminish the undesired use of the space through reconciliation between physical design and its future users. In order to achieve this the following guidelines should be applied in conjunction (Luten, 2008):

- Visibility
- Legibility
- Accessibility
- Attraction

The problem in this field is the lack of empirical research with the aim of measuring the individual physical and social environment and targeted changes to evaluate their effectiveness (Harvey et al., 2015). This causes a lack of scientific evidence for the effect in practice of the guidelines as mentioned before.

Perceived density

The aforementioned relationships all have a connection to the concept of density, either in a direct or indirect manner. From the beginning of the twentieth century, the definition and meaning of density has often changed, in which the definition was usually expressed in the number of dwellings per hectare. This way of measuring urban density is considered inconsistent (Berghausers Pont & Marcus, 2014). Therefore density should be not only be measured by quantitative parameters but should also include qualitative parameters.

Alexander (as cited in Berghausers Pont & Marcus, 2014) states that the measured density should be distinguished from notions such as physical and perceived density. The concept of physical density includes the design aspects such as typologies. The concept of perceived density includes the individual cognitive and socio-cultural factors (fig 8). Individual cognitive factors are a result of the fact that areas with the exact same dwellings per hectare can have a different perceived density (fig 9)(Rapoport, 1975). Cultural preferences also have an effect on the perceived density, a preference for low-density environments with low social interaction can also be experienced in a high-density environment depending on the configuration of buildings (Wilmott et.al. in Rapoport, 1975). From the perspective of the subject of this thesis, perceived safety, this perceived density approach will be used. Because of the fact that both the aspects, perceived safety and perceived density, include the analysis of individual cognitive factors and socio-cultural factors. Therefore the concept of density will be used in this project from the perspective of perceived density and density as the context in which problems will be analyzed and a design will be created. However, the neighborhood transformation design of this project, will take into account the densification of the area and how perceived safety can be ensure while densifying.

Problem statement

Contemporary mainstream urban design tends to focus on the delivery of professionalized urban form and lack often lack the focus on the levels of control over the environment by the user of the space (Romice et al., 2016). This results in the absence of successful integration of safety goals in urban transformations. Numerous theories exist on the relationship between safety and the physical environment, but the empirical evidence of the psychological effects of this relationship is meager (Harvey et al., 2015).

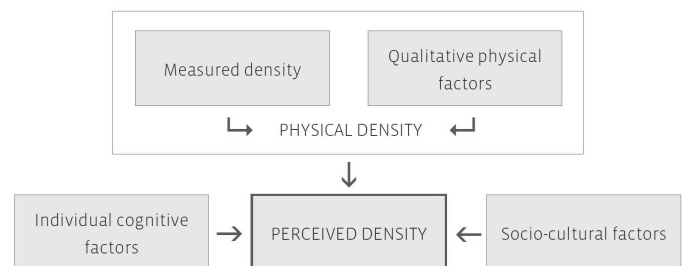


fig 8. Measured density, physical density and perceived density (Alexander, 1993, p.183).

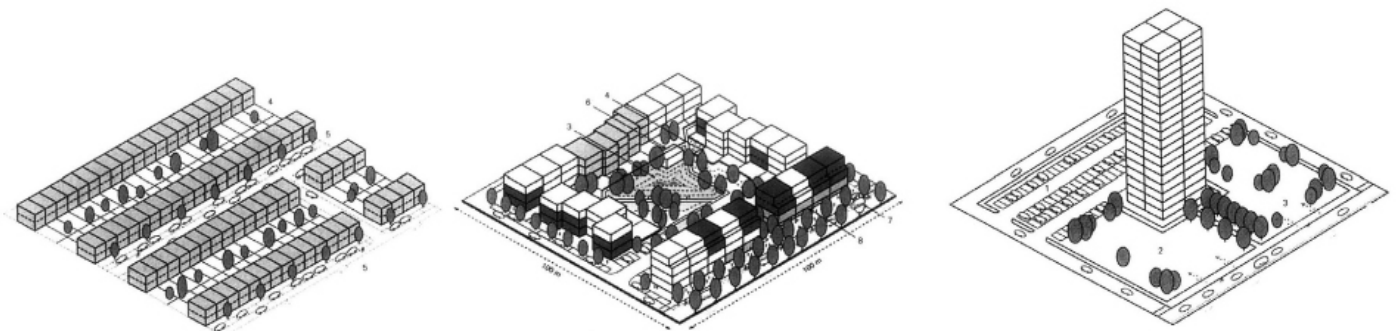


fig 9. Three areas with the same density of 75 dwellings per hectare (Fernandez Per and Mozas, 2004, pp. 206-207).

2.3 / Problem analysis

The problem analysis focuses on some of the interrelations mentioned in the problem field. To be able to analyzing these interrelations data is collected. The data is mapped on the project site and its surroundings or are shown in diagrams. This way the overall performance of the area on the selected parameters can be assessed.

Livability

The map on the left (fig 10) shows the livability of neighborhoods assessed by the government based on five parameters: housing, residents, services, safety and physical environment. The results show a low livability in Rotterdam-Zuid, a more detailed assessment on the livability is shown in figure 7 and 8. The score is composed by the deviation from the average score of the total of Rotterdam on each of the different aspects. However, it must be noted that the data that is used to compose the score of the livability is based on objective data. Therefore, it does not determine the actual livability, which is largely defined by how people perceived and use their environment. The data is used to indicate the expected livability based on the registered data.

Important to note is that not every aspect counts equally in the overall score of the livability. The distribution is as follows; housing 18%, residents 15%, services 25%, safety 24% and, physical environment 18% (www.leefbaarometer.nl). For this research the aspect residents, safety and physical environment are important to look at, as they are important determinants of perceived safety. These aspects are subdivided. Residents: income, education, household composition, age, residential mutation. Safety: nuisance, loitering youth, vandalism, litter, criminality. Physical environment: distance to main roads, land use, green, water, density. The graphs show that both neighborhoods, Bloemhof and Pendrecht, score the lowest on residents and safety. The problem analysis will look further into the aspect residents, whereas the spatial analysis will focus on safety and physical environment.



fig 10. Livability in Rotterdam (www.leefbaarometer.nl)

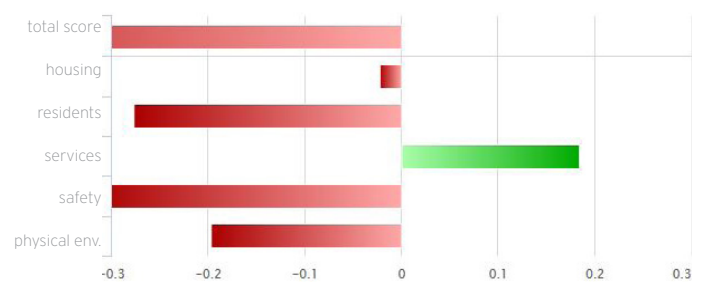


fig 11. Livability score of Bloemhof (www.leefbaarometer.nl)

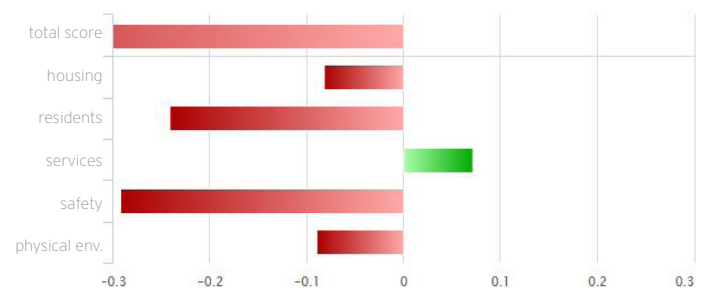


fig 12. Livability score of Pendrecht (www.leefbaarometer.nl)

Neighborhood profiles

The neighborhood profile “wijkprofiel” is an open data tool of the municipality of Rotterdam to show the performance of neighborhoods by indexing the scores. The indexes project the deviation from the performance of Rotterdam its average on each of the domains. The data is collected through surveys among the residents and facts and figures collected by the municipality.

The neighborhood profiles are composed of three different layers; domains, themes, and types of measurements. The first layer include the following three domains: physical, social and safety. These three domains are parameters for the livability in a neighborhood. The second layer divides each domain in themes. The themes related to each domain are listed below.

- Physical: real estate, public space, facilities, and environment.
- Safety: theft, violence, burglary, vandalism, nuisance.
- Social: capacities, living environment, participation, integration.

The third layer includes the types data used to define the index. The surveys among the residents are used to separate the data in general data, subjective data and objective data. The general data represents the general opinion of

the residents on the neighborhood. The subjective data is based on the experiences, personal opinions and valuations residents have expressed in the surveys. The objective data is gathered through registrations or facts about the residents and their participation in society.

For this project the subjective measurements of the different themes are relevant. The subjective data represents the perception of the neighborhood by the residents. A neighborhood might perform well according to the objective data, but if the subjective data does not align, the residents will be less satisfied with the livability in their neighborhood. Therefore, the subjective data contribute more to the overall livability than the objective data. This discrepancy is captured in the general data. The general assessment of the safety index is defined as the overall perceived safety by the municipality of Rotterdam.

The most important conclusion that can be drawn from the neighborhood profile of Pendrecht is the difference in the objective and subject safety in the neighborhoods. The results show that the subjective safety is assessed further under the average than the objective safety for all the aspects of safety. This means that people perceived their environment less safe than it is according to the registered data. The only aspect that scores better on the subjective scale than on the objective scale are the facilities in the physical domain.

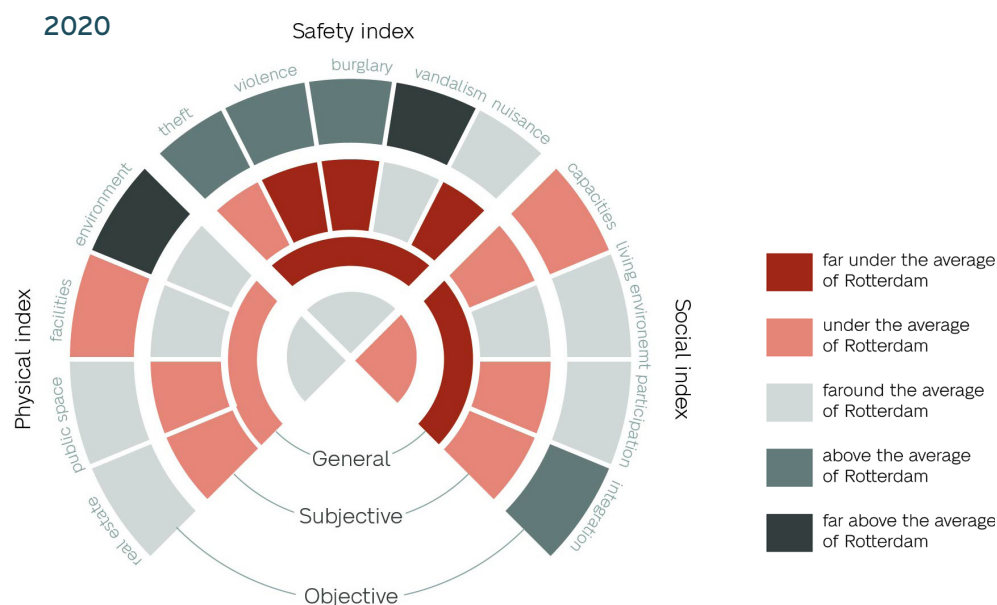
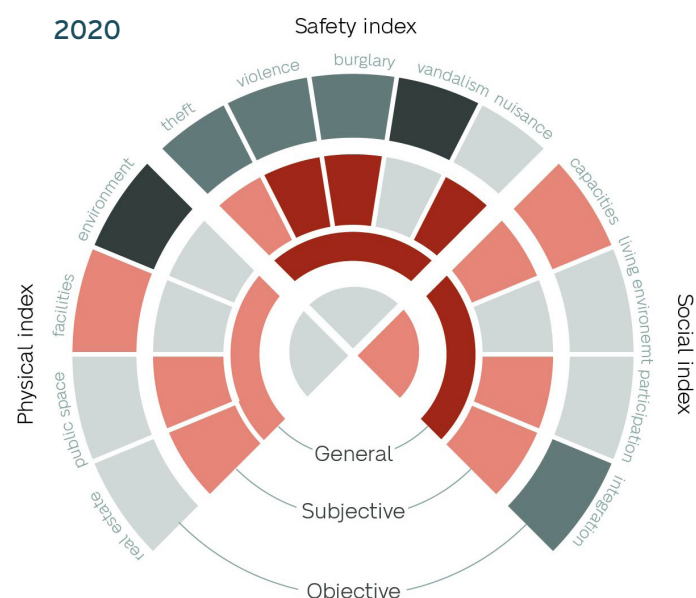
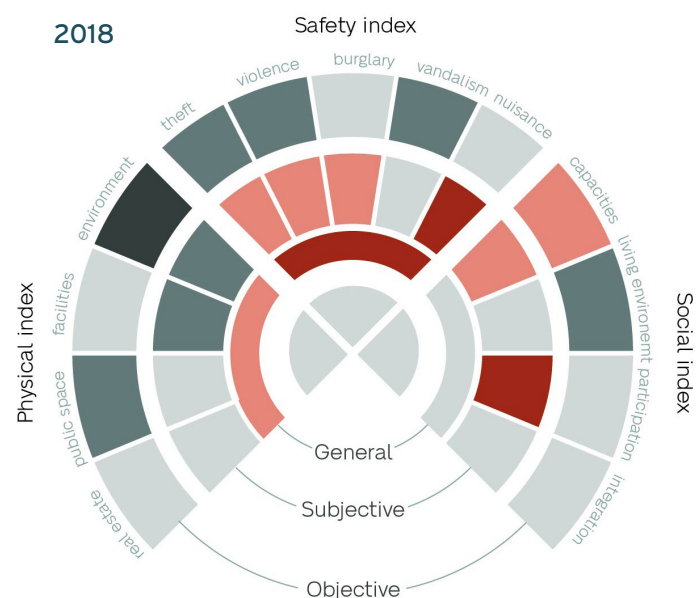
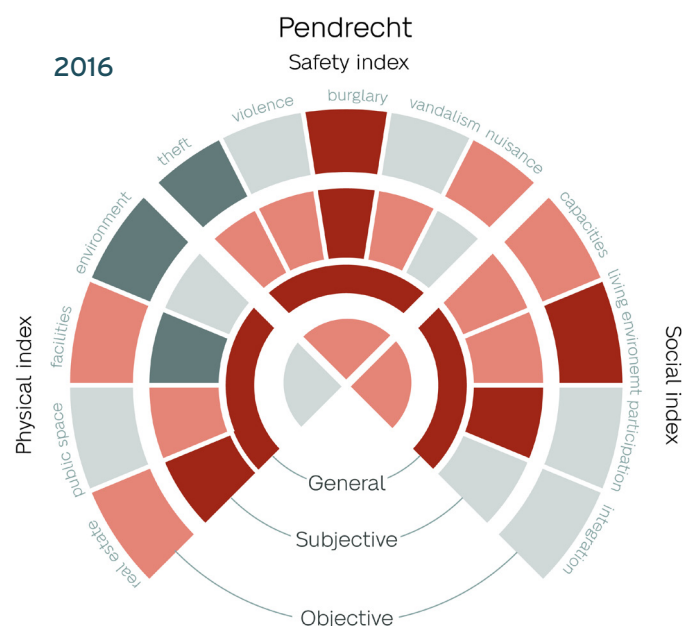
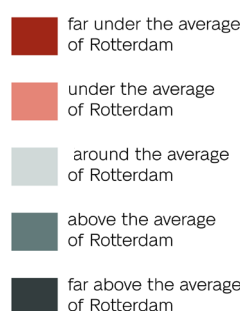


fig 13. Neighborhood profile of Pendrecht 2020 (source: Gemeente Rotterdam; OBI, Wijkprofiel 2020) (edited by author)



The municipality of Rotterdam publishes the neighborhood profile every two years. The images on the left depict the neighborhood profiles from 2016, 2018, and 2020. The overall assessment of the neighborhood of 2020 has slightly improved since 2016, but was performing better in 2018. Compared to the profile of 2016 the physical index is the only one that improved, on both the subjective and the objective scale. The general assessment of the social index performed better in 2018, but was assessed far under the average in 2020 again. The three aspects, capacities, participation, and integration were subjectively assessed more negative than they were assessed objectively. To clarify, the assessment tool defined capacities as self-reliance. The most remarkable issue that stands out in this array of profiles is that the general assessment of the safety index, which is defined as the overall perceived safety, has not improved since 2016 and has been assessed far under the average in each of the profiles. Even though the objective assessment shows more positive results, the subjective assessment has not improved and in some aspects became more negatively assessed. The only aspect that has improved since 2016 is the vandalism aspect. The aspects violence and nuisance have become far under the average of Rotterdam in the subjective assessment. It shows that there is an urgency to improve the perceived safety, in order to increase the livability and make the neighborhood prosper again.



Socio-economic characteristics

Characteristics that can indicate a low socio-economic status of a neighborhood are income, education, and occupation. This paragraph shows the data that is collected on these themes with regard to Rotterdam-Zuid. The perception of safety is often negatively affected in neighborhoods with a low socio-economic status, a high rate of one-parent households and a high percentage of non-western immigrants (Maas-de Waal in Luten, 2008).

The Dutch government has determined five classes of income ranging from; minimum, lowest, average, highest, and maximum. The minimum class includes an average yearly income between €7.700 to €19.000 and occurs in 10% of the regions in the Netherlands. The graph on the left (fig 14) shows the average yearly income per inhabitant of each neighborhood in Rotterdam. The neighborhoods that include the biggest part of Rotterdam-Zuid-Charlois, and Feijenoord - are the two lowest income

neighborhoods in Rotterdam. Respectively they have an average annual income of €18.500 and €19.100 per inhabitant. This means that both neighborhoods are positioned around the upper limit of the minimum income group. The red line in the graph shows the average of annual income per inhabitant in Rotterdam, in this case too, both neighborhoods are far below average. Unemployment and low income create a situation in which people tend to hang out, often in public spaces, because they have nowhere else to go and they have limited resources and mobility (Madanipour, 2009)

The low average income can be explained the employment status of the neighborhood (fig 16 on page 26). Compared with the rest of Rotterdam, the percentage of inactive labor force in Charlois and Feijenoord is respectively 16% and 18,7% of the total population of

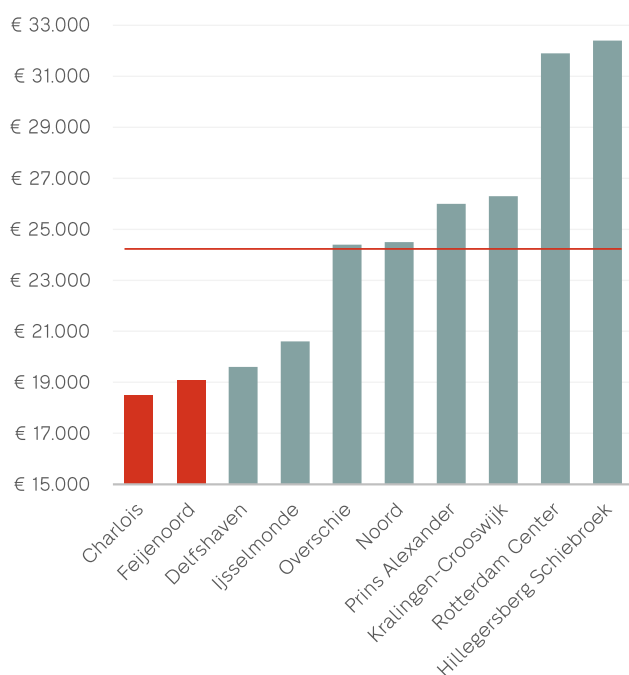


fig 14. Average annual income per inhabitant (www.allecijfers.nl)

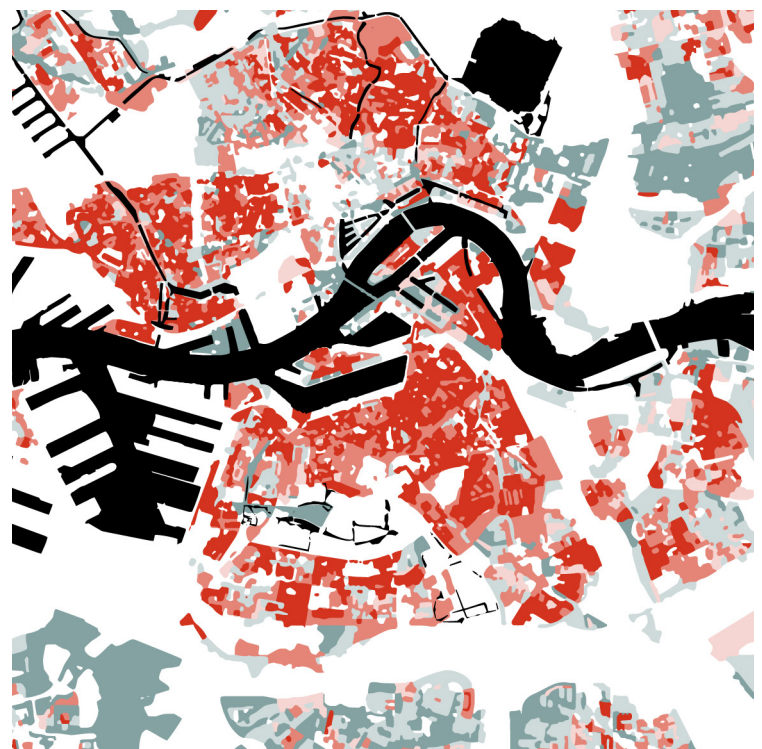


fig 15. Income deviation from median in Rotterdam. The neighborhoods Charlois and Feijenoord are outlined with black (CBS)

the neighborhoods. Additionally, in both neighborhoods respectively 5,6% and 6,4% of the population are students, who usually have no income or a low income. Even more remarkable is the big difference with Dutch society, where the unemployment rate is only 3,5%, which puts the Netherlands in the group of countries with the lowest unemployment rate in the European Union. In the research by Marlet et.al. (2009) on problem neighborhoods, it was stated that housing associations have large share in the existing housing stock and that people with low education and low income often reside in social housing. The Dutch government maintains a maximum income for those who are eligible for social housing. This consequently means that neighborhoods with a large share of social housing attract people with low income. The map below (fig 17) shows the percentage of social housing per zip code. Patches of high concentrations of social housing are spread throughout the area. Remarkable are the large patches on the left in which almost 100% of the housing stock exists of social housing.

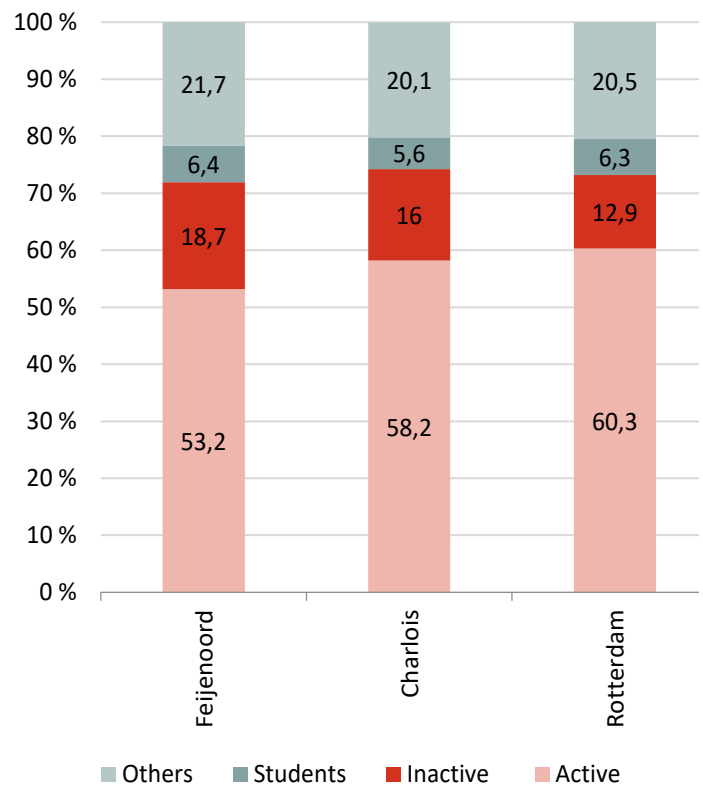


fig 16. Employment status population (15-67 years) (CBS)

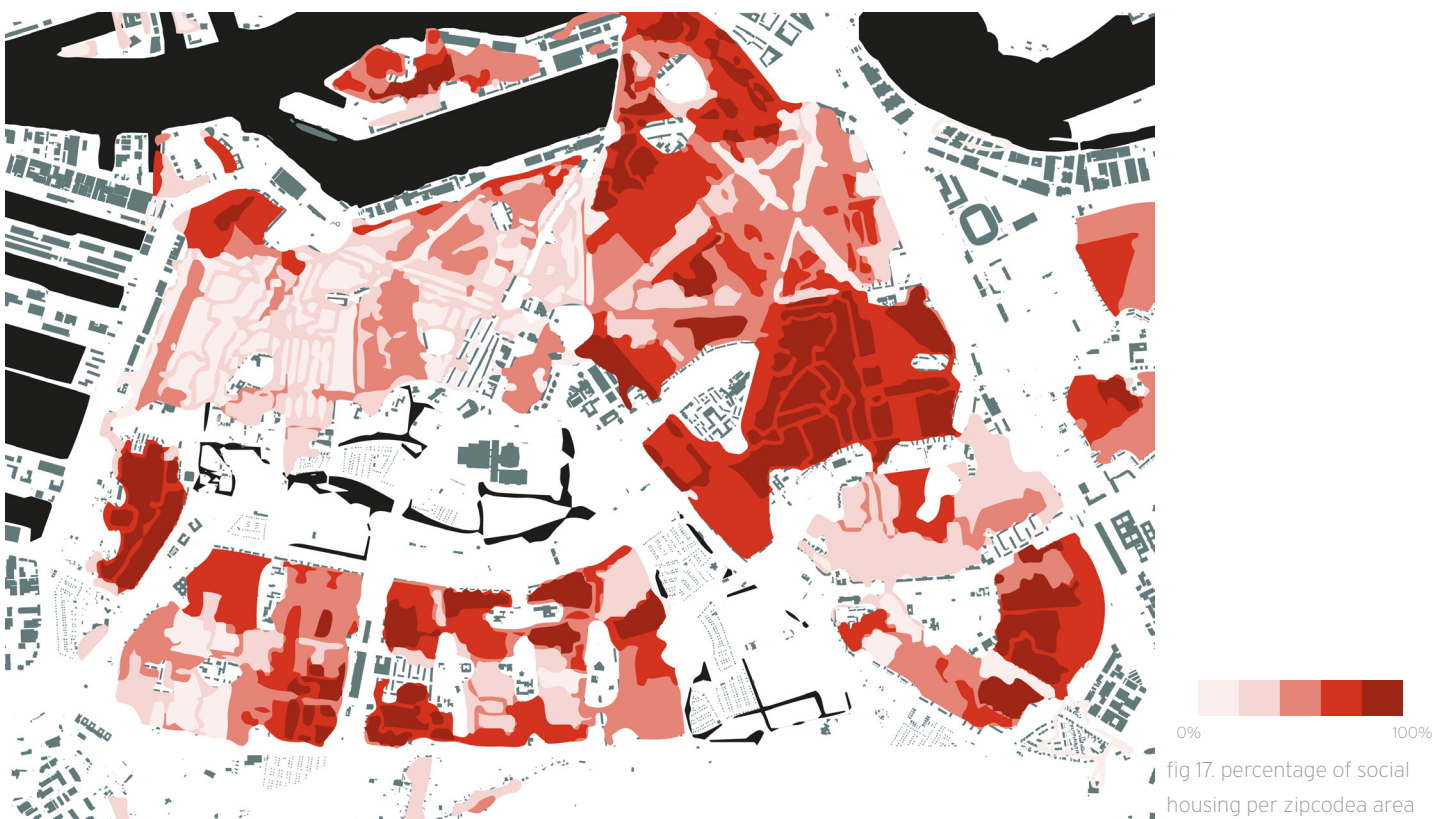


fig 17. percentage of social housing per zipcode area

Diversity

Rapid urbanization does not only cause cities to densify, but also to diversify. This diversification includes a population of different nationalities, ages, and gender that need to coexist. Groups within this diverse populations have different lifestyles, cultures, values, and needs. If done correctly this creates a well functioning neighborhood, in which the neighborhood is the relation between people and places, and relationships between people (Sim, 2019). Being neighbors with different lifestyles, cultures, values, and needs can sometimes cause conflict. In this case, colocation can easily become a problem. The diversity and differences of the population in a neighborhood creates an opportunity to create places in the public realm for everyone (Sim, 2019).

Diversity is a sensitive topic, multicultural populations are often dealing with prejudgments and racist behavior. Often people make superficial observations about other

people. These social signals are concerned with the interpretation of who has the “power on the street”. This issue is often focused on the position of the autochthonous residents or immigrants (Blokland, 2009).

The quantitative data (fig 19) shows the ethnic composition of the neighborhoods Charlois and Feijenoord. The non-western population in the areas Charlois and Feijenoord exists of approximately 50% to 60%. The autochthonous population is around 32%. Compared to other parts of Rotterdam the share of non-western immigrants is high. This diverse composition of the population can also be seen in the streets. As mentioned before the different cultures have different lifestyles and needs, this multicultural brings a wide variety of shops, restaurants, and places of worship that are defining the street scape and dynamics of the neighborhood.



fig 18. Percentage non-western immigrants in Rotterdam

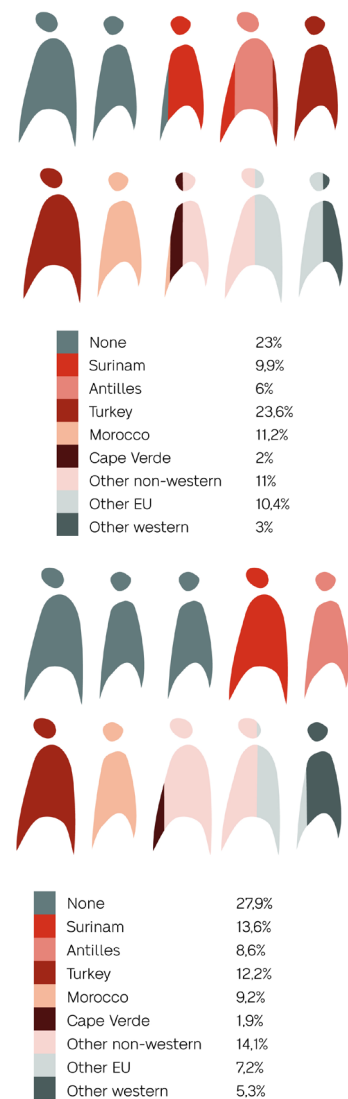


fig 19. Ethnic diversity in Bloemhof and Pendrecht, percentages of ethnic groups (Gemeente Rotterdam, n.d.)

Safety

The municipality of Rotterdam has made a safety program for the period 2018 - 2023. With this program, they continue to build on the results achieved in earlier safety programs and tackle still existing problems. The program is based on three pillars; involved city, resilient city and the city in balance. The latter focuses on safe housing, living and entertainment climate in Rotterdam. In this ambition, special attention is paid to Rotterda-Zuid, which is seen as an area with major challenges, but also with great potential (Gemeente Rotterdam, 2018).

Although often differently understood, research shows that the actual crime rate of a neighborhood does not affect the perceived neighborhood safety (Baba & Austin, 1989; Blokland, 2009). Baba and Austin studied the relation between perceived neighborhood safety and neighborhood environmental satisfaction, victimization and social participation. Their statistical approach on measuring the correlations of variables showed that there are no statistically significant direct effects of personal victimization and social participation on the perceived neighborhood safety. This can be underpinned by the research done by Blokland in which she states "the actual level of crime does not determine the perceived safety" (Blokland, 2009, p21). Furthermore, in the research done by Baba and Austin, a strong negative effect of property victimization on the perceived neighborhood safety was found. Additionally, the environmental satisfaction has a direct

positive effect on the perceived neighborhood safety. This environmental satisfaction is measure by variables related to the usability of public space, abandoned buildings, and loitering youth.

The graphs below show data collected on safety. Compared with the four largest Dutch cities residents in Rotterdam feel unsafe more often. The residents in Rotterdam-Zuid feel unsafe even more often. The sense of feeling unsafe is different per personal characteristic (fig 21). Women tend to feel unsafe more often than men. Younger people also tend to feel more unsafe than older people, this can be explain on the base of the time spend outdoors. Older people stay inside more often, which decrease the change of feeling unsafe (Blokland, 2009).

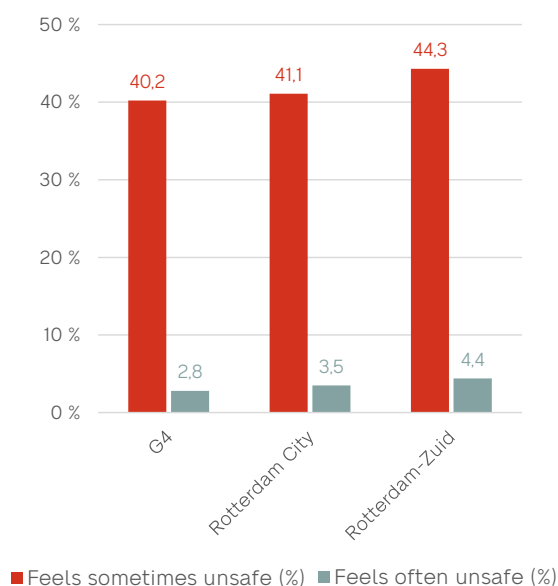


fig 20. Occasions of feeling unsafe. G4 (Amsterdam, Rotterdam, The Hague, Utrecht) compared with Rotterdam and Rotterdam-Zuid. (CBS)

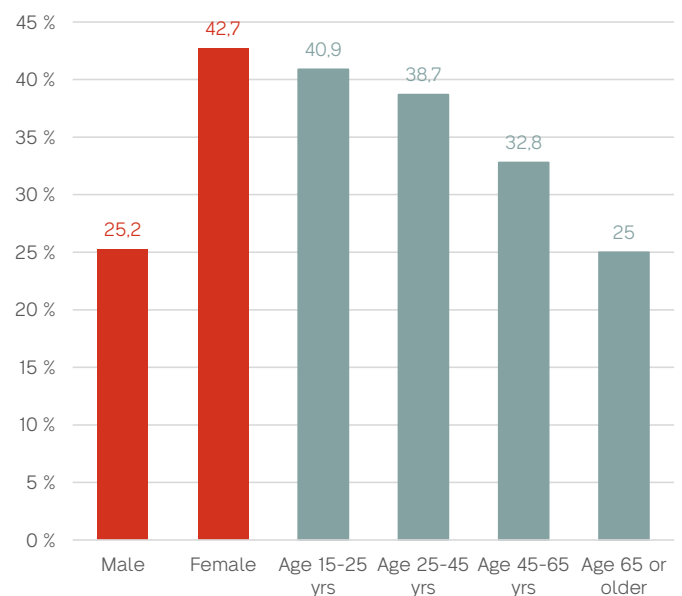


fig 21. Experience of feeling unsafe per personal characteristics (CBS).

3 / Methodology

This chapter introduces the methodology used during the research project on the relation between (perceived) safety and space in Rotterdam-Zuid. It sets out a research approach and related methods that need to be used in order to obtain answers to the research questions. The methodology is included in the project to have a clear research design, this way the research objectives, questions, and approach are aligned throughout the project. The conceptual framework makes clear how the subject of perceived safety is approached in this project. The chapter concludes with research limitations, ethical consideration, and scientific and societal relevance related to the project.

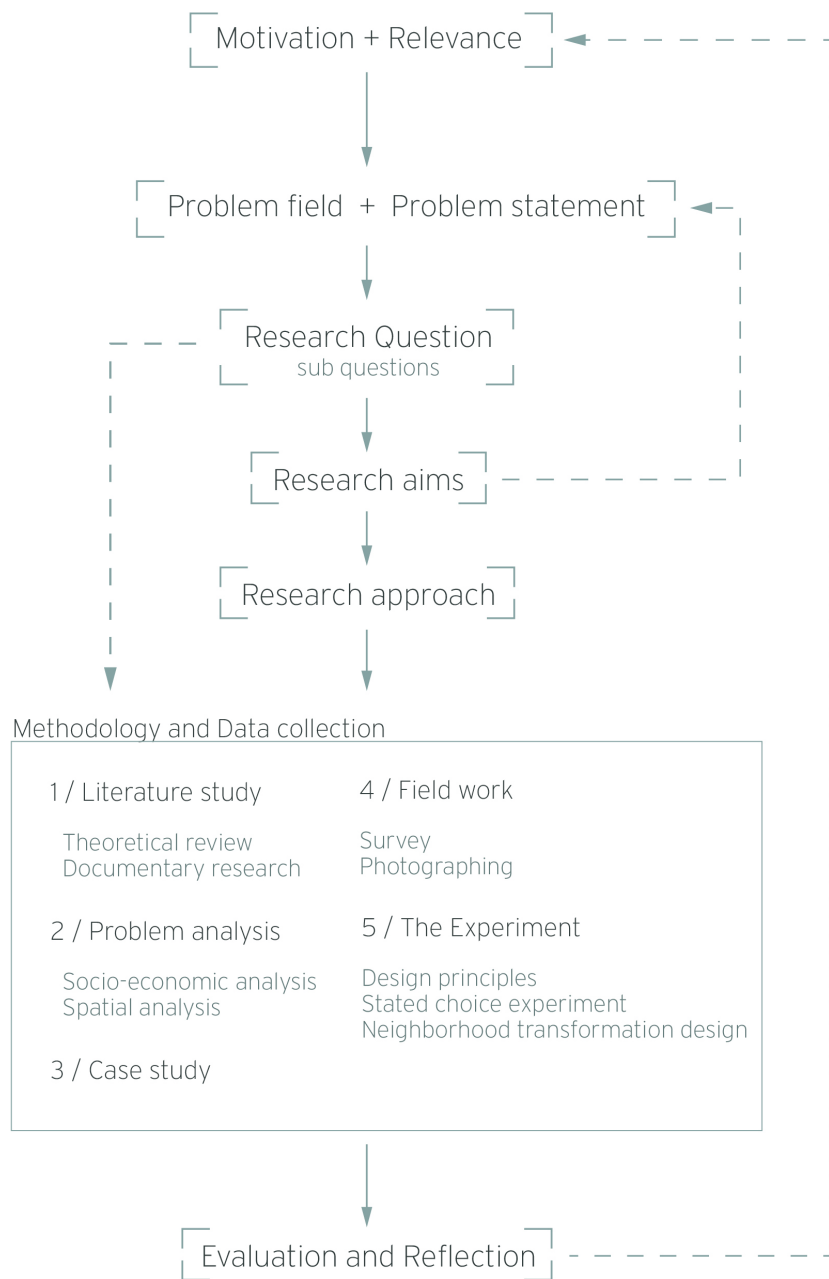


fig 22. Research framework

3.1 / Research question

How can **perceived safety** be improved through **neighborhood transformation** in **Pendrecht**?

SQ 1, 2, 5

SQ 6

SQ 3, 4

Sub-Questions

1. What are the social and spatial conditions that can lead to an (perceived) unsafe public space?
2. How do different types of urban fabric influence perceived safety?
3. What are the socio-economic and spatial conditions in Pendrecht?
4. How do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht?
5. How are targeted spatial changes experienced by people with the condition to improve perceived safety?
6. How can design principles that improve the perceived safety be implemented in an integral neighborhood transformation design?

3.2 / Research aims

This research aims to develop a neighborhood transformation design that improves the perceived safety in the neighborhood Pendrecht. To achieve this aim, the research will develop a theoretical framework on perceived safety and its relationship with the social and physical environment. The theoretical framework will form the base for the development of design principles that are intended to increase the perceived safety. Subsequently, the research aims to validate the effect on the perceived safety of these design principles through a stated-choice experiment. The experiment will be conducted among a random sample, of which the participants will decide whether they prefer the environment with or without the design principle. Once the results from the experiment are analyzed, the design principle will be integrated in the neighborhood transformation design. This design showcases a situation in which all the design principles are integrated and where the living environment has been made socially sustainable by focusing on collectivity. The design includes interventions on the neighborhood scale, street scale, building, and dwelling level. By designing the transformation on different scales, the complexity of creating a perceived safe environment becomes apparent.

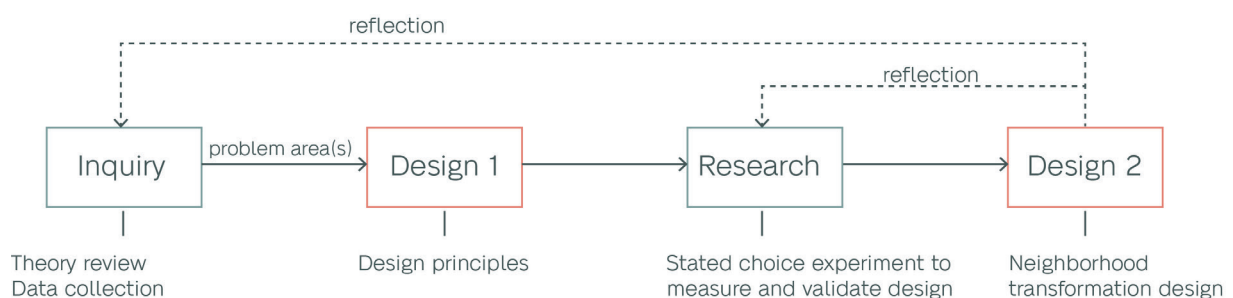
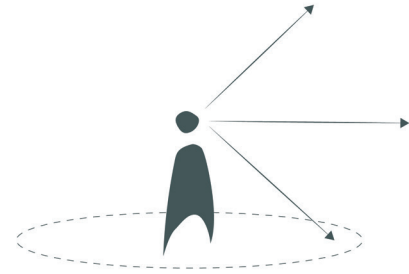


fig 23. Overall research approach. The diagram shows in a simplified way the twofold research approach: inquiry of data which form the design principles and the stated choice experiment which validates the design principles so they can be integrated in the neighborhood transformation design

3.3 / Research output

The research outcome is the answer to the main research question: How can perceived safety be improved through neighborhood transformation in Bloemhof and Pendrecht? In order to be able to answer this question, the research calls for a comprehensive understanding of the relation between people's environment and their perception of a safe environment with regard to both their social environment and their physical environment. Simultaneously, keeping in mind that the discipline of urban design does not extend its knowledge and abilities in solving all the problems in the social environment. The main outcomes are embedded in the sub-questions; a complex understanding on how public space can stimulate and facilitate a perceived safe environment, taking in account both the physical and social environment; understanding the local social dynamics and how they are related to space; validated design principles that have aim to stimulate and facilitate an increased perceived safety. The first outcome 'a comprehensive understanding of perceived safety', provides theoretical support that is needed to develop the design principles and eventually the neighborhood transformation design. The second outcome bridges the gap between theory on social behavior and spatial design. Data is collected by observing local public life, sending out a questionnaire on neighborhood safety and safety mapping. This will provide the information needed to understand the local social dynamic and relate this to the local public space. The last outcome 'validated design principles that increase perceived safety', provides a set of design principles that are used for the final design that involves a neighborhood transformation design. The validation of the effectiveness of the design principles is being done by VR experiments. The participants of this experiment is a diverse group of people who presumably have a different perception of safety. The outcome, therefore, is an experienced-based design that is focused on eye-level, street scale and neighborhood scale. The eye level is used to get insights on how people perceive and experience their physical and social environment. The street level is used to get insights on the social dynamics in public spaces throughout the neighborhood. The neighborhood level is used to look at the overall qualities and potentials of the neighborhood. The final outcome consists of a neighborhood transformation design that improves the perceived safety of the neighborhood and that densifies the area to accommodate the population growth.



Eye level



Street scale



Neighborhood scale

3.4 / Conceptual Framework

The conceptual framework (fig 24) illustrates the fields and relations that shape the research. Urban environments always consists of a social environment and a physical environment.

The social environment as a system moves between anonymity and community. When talking about the social environment from the perspective of the individual it consists of the people in their living environment and their social interactions (Van Dorst, 2005). The physical environment includes only physical elements such as buildings. The physical environment has the ability to facilitate the social environment. When both environments perform complementarily, this can increase the livability of an area. Likewise, if these environments do not perform complementarily, this can lead to poor livability in an area. Livability in the sense of comfort (Romice et al., 2017) and the interaction between people and their environment (Van Dorst, 2005). When studying and designing a livable space both the social and physical environment should be taken into account. In order to establish livability a third factor is important, this factor is safety. When both social and physical environment perform complementarily the sense of safety will be high in this environment, which adds to the livability.

This project focusses on the relationship between the social environment and the physical environment and the feeling of safety by using environmental psychology theories and methods. The aim is to fill the knowledge gap that is the lack of effective synthesis of theory on connecting the form of the physical environment with the social processes and the implementation of this synthesis in a spatial design.

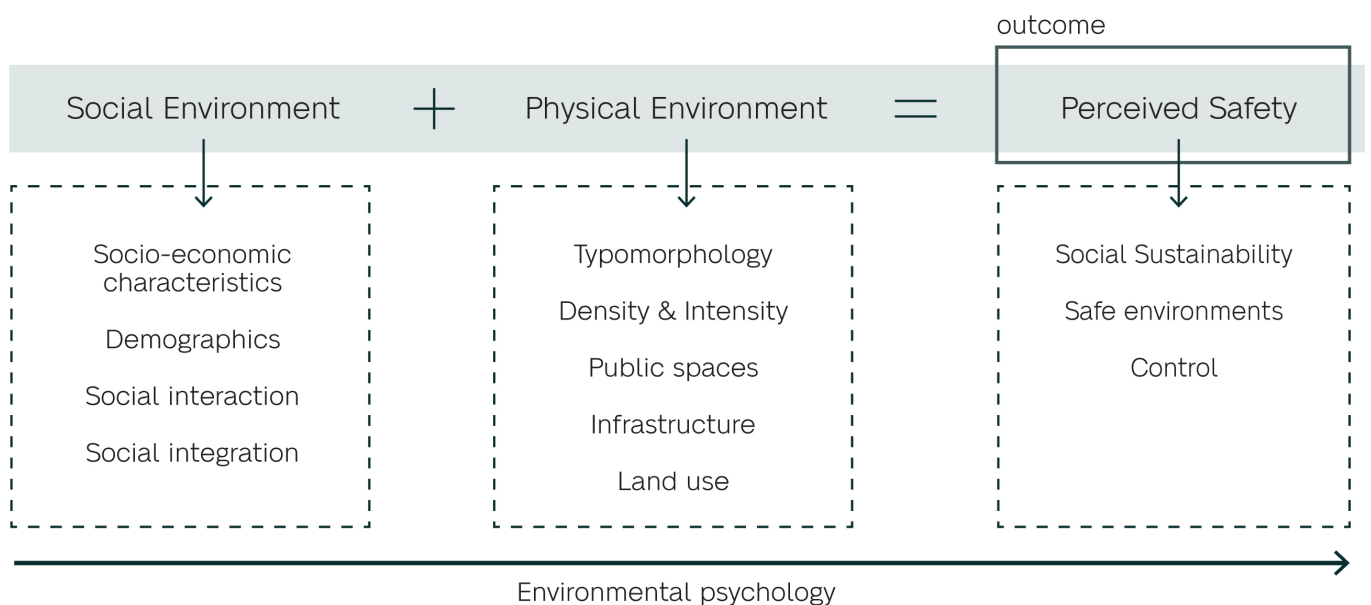


fig 24. Conceptual framework

3.5 / Methodology

The methods and related technique sthat have been selected for this project are the following:










- 1 / Literature study**
 - a / Theoretical review
 - b / Documentary research
- 2 / Problem analysis**
 - a / Socio-economic analysis
 - b / Spatial analysis
- 3 / Case study**
- 4 / Survey**
- 5 / The Experiment**
 - a / Design principles
 - b / Stated choice experiment
 - c / Statistical analysis
 - d / Neighborhood transformation design
- 6 / Evaluation and reflection**

1 / Literature study

The literature study intends to gain a better understanding of perceived safety and the current goals from the municipality related to safety. The study includes a theoretical review and a documentary research to obtain this understanding. The theoretical review is essential for constructing the theoretical framework of this research and creates a body of knowledge which is built upon throughout different phases of the research. The theoretical framework looks at theories on perceived safety and how this is related to the social and physical environment. A more detailed elaboration on the theories that support this research can be found in the chapter Theoretical Framework on page 43.

The documentary research includes inquiry of mainly qualitative data on safety from documents published by governmental institutions and local initiatives. This method is applied in order to obtain the vision and goals from the municipality and government related to safety and densification. The municipality has set goals in order to improve the safety of the living environment, by collecting this data the project has a clear guideline on what the municipality wants to achieve in terms of safety. Furthermore, a densification vision has been published by the municipality, which in this project is related to the final outcome, a neighborhood transformation design.

-  Literature study
 - a) Theoretical review
 - b) Documentary review
-  Problem analysis
 - a) socio-economic analysis
 - b) spatial analysis
-  Case study
-  Survey
-  The Experiment
 - a) Design principles
 - b) Stated choice experiment
 - c) Neighborhood transformation design
-  Evaluation and reflection

-  1. What are the social and spatial conditions that can lead to an (perceived) unsafe public space?
-   2. How do different types of urban fabric influence perceived safety?
-   3. What are the socio-economic and spatial conditions in Pendrecht?
-  4. How do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht?
-  5. How are targeted spatial changes experienced by people with the condition to improve perceived safety?
-   6. How can design principles that improve the perceived safety be implemented in an integral neighborhood transformation design?

2 / Problem analysis

a / Socio-economic analysis

The socio-economic analysis is used in order to get insights in the current socio-economic status of the area. Research has shown that the socio-economic status of an area can have an influence on the safety performance of the area, therefore it is important to determine the socio-economic characteristics of the project area. A descriptive analysis is used to introduce, organize and summarize the statistical data collected on the socio-economic characteristics. The outcome are sets of quantitative data that will be presented in visualizations and maps that related the data to their localities.

b / Spatial analysis

The spatial analysis is intended to give insight into the relation between space and human behavior. The techniques of mapping and observing public life will be applied to gather the required data. The intention is to use the software GIS and Space Syntax to identify relations between spatial characteristics and behavioral and social aspects. By using GIS and Space Syntax the interrelation between buildings and streets can be identified. Furthermore, multiscalar mapping will be used to gain a spatial understanding on the following scales: city scale, neighborhood scale, and street level. In order to gain a behavioral and social understanding observation will be done, which will be visualized and mapped.

In order to be able to measure the increases perceived safety during the VR experiment, the problem areas must be assessed. An assessment tool will be used. The assessment tool consists of the four spatial guidelines (visibility, legibility, accessibility, and attractiveness) that need to be present in conjunction in a physical environment to ensure perceived safety. Parameter have been defined for each guideline and the problem area will be assessed on the basis of these parameters. Examples of parameters are the inter-visibility of the front doors, the spatial integration in the urban fabric, and the esthetic quality of the environment. The results shown in the assessment tool will define on what aspects the problem area is performing well and which aspects need improvement.

3 / Case study

As mentioned earlier in the conceptual framework, perceived safety depends on the physical and social environment of an individual. And because this research mainly examines the influence of the physical environment perceived safety, a case study was carried out with

a neighborhood that is also located in Rotterdam-Zuid. This neighborhood, Bloemhof, has similar socio-economic characteristics to Pendrecht, but the spatial characteristics are very different. More knowledge can be gained by comparing the spatial characteristics of these two neighborhoods in relation to perceived safety. The two neighborhoods with their distinct typologies cover a wide variety of spatial characteristics.

The case study was conducted in the problem analysis, in which the socio-economic and spatial analysis was performed. The different topics that were analyzed in the problem analysis were carried out for both neighborhoods. In this way, the differences or similarities of the spatial characteristics of the neighborhoods become visible. Finally, the findings of the case study are summarized and conclusions are drawn in relation to perceived safety. The results will further on be included in the development of the design principles and the design of the neighborhood transformation of Pendrecht.

4 / Survey

In order to collect both quantitative and qualitative data on neighborhood satisfaction and perceived safety a survey was conducted among residents of the neighborhood. The survey consisted of 9 multiple-choice questions, 18 statements that the respondents had to answer on a 5-point Likert scale (strongly disagree - disagree - neutral - agree - strongly agree), and 8 open questions. The participants took an average of 5 to 10 minute to complete the survey. The aim was to hand out the survey online and on the streets and reach a sample size around 50 residents of the neighborhood. The survey mainly reached its respondents online by sharing posts in neighborhood related social media groups. Because the response rate was lower than expected and not all respondents were from the neighborhood, 32 survey results were valid and have been included in the analysis.

The initial intention of the survey was to gather quantitative data on how safe residents of the neighborhood feel and relate this to demographic and situational characteristics. But because the response rate was lower than expected, the results have been used to get useful insights in the residents' experience of the neighborhood. The answers to the open questions gave the participants the opportunity to point out what they did and did not like about their neighborhood. These answers were used later in the design phase of the project.

5 / The experiment

a / Design principles

The design principles have been developed on the basis of the theory in the theoretical review and form the basis of the subsequent experiment. They are the first design step after with the design principles will be tested and validated in the experiment. The information collected in the spatial analysis is used to determine where the problem areas in the district are located. These problem areas are the context in which the design principles are developed. Small-scale design principles allow you to focus on one or two problems that arise in the given context. However, these small-scale interventions can be applied on a larger scale for similar effects in other contexts. Per problem area, two or three scenarios have been designed, each with a different main design principle applied. The results of developing the design principles will determine the best combinations of design principles and places in the neighborhood. This is important for the next step of the research in which the design principles are modeled in places in the neighborhood.

b / Stated choice experiment

A stated choice experiment is defined as a methodology that assumes that when people have a choice between different alternatives, they will choose the alternative that yields the highest level of happiness to an individual (Van Dongen & Timmermans, 2019). The goal of the stated choice experiment is to validate the design principles that have been developed with the aim to improve perceived safety. The validation is done through a survey that asks the participant to select their preferred environment. The survey consists of 7 choice task questions and 4 demographic questions.

A stated choice experiment is often used to elicit preferences about attributes (Kløjgaard et al., 2012), in this case spatial attributes. The selection of the spatial attributes is based on the theoretical review. The context in which the spatial attributes are applied is based on the spatial analysis and the survey among the residents, the results of these methods have shown where the improvement of perceived safety is most urgent. The attributes used in this experiment are qualitative because they focus on the preference of an environment, therefore the results of the experiment will also be qualitative. A narrative was presented to the participants by each of the choice tasks. This narrative has been carefully constructed to simultaneously create the sense of being lost in an environment you do not know without feeling stressed or rushed. Each of the choice task questions one spatial attribute has been

tested, in order to avoid contaminating the results.

The survey was created using the Qualtrics software and has been distributed as an anonymous link and shared on various social platforms (WhatsApp, Facebook, LinkedIn). The results have been collected by the Qualtrics software. The participant took on average 5 minutes to complete the survey. The aim was a response rate of 100 respondents. There was no specific definition for the respondent because the experiment wanted to reach a large and diverse group of people. The anonymous link to the survey was scheduled to be open for two weeks, but was prematurely closed after 11 days due to the large response in the first three days. Within this time 344 respondents completed the survey.

c / Statistical analysis

In order to validate the design principles that were tested in the stated choice experiment, the data from the survey have been statistically analyzed. The software SPSS was used for the data analysis. The goals of the analysis was to validate the preferences of the choice tasks presented to the participants. Furthermore, the statistical analysis is used to measure the dependence of the variables. The analysis consists of a binomial test and crosstabulations.

d / Neighborhood transformation design

In order to develop the neighborhood transformation design, a set of guidelines needs to be defined. These guidelines derive from the previous steps of the research (theoretical review, analysis, survey, experiment). The knowledge and insights that are gained in the previous stages of the research need to be integrated into one cohesive design that aims to improve the perceived safety in the neighborhood but also responds to other issues like climate change, multicultural societies, densification, mobility, and health. Due to time limitations, the neighborhood transformation design focusses only on the south-east quadrant of Pendrecht but uses design principles that can be applied throughout the neighborhood. The is used to showcase how a modernist neighborhood can be restructured or use small interventions to improve the perceived safety.

3.6 / Scope and timeframe

The general purpose of the study is to develop a neighborhood transformation design that improves perceived safety. This is done by conducting experience-based research in the neighborhood Pendrecht. The in-depth research on which spatial characteristics affect perceived safety and how this is experienced by the observer takes careful decisionmaking and a lot of time. The time period in which this thesis was carried out and the development of stages of the project is shown below (fig 24). The roadmap provides an indication of how long it takes to carry out one phase of the research and which parts of the project can be carried out simultaneously. It shows that effective and intensive work is required to conduct comprehensive research within the given timeframe. The bars that indicate the time available for a chapter of the research do not represent an exact date but represent an aim. It is used to guide the project and stimulates to complete parts of the project. It is a helpful tool to make sure the project research its final outcome within the given timeframe.

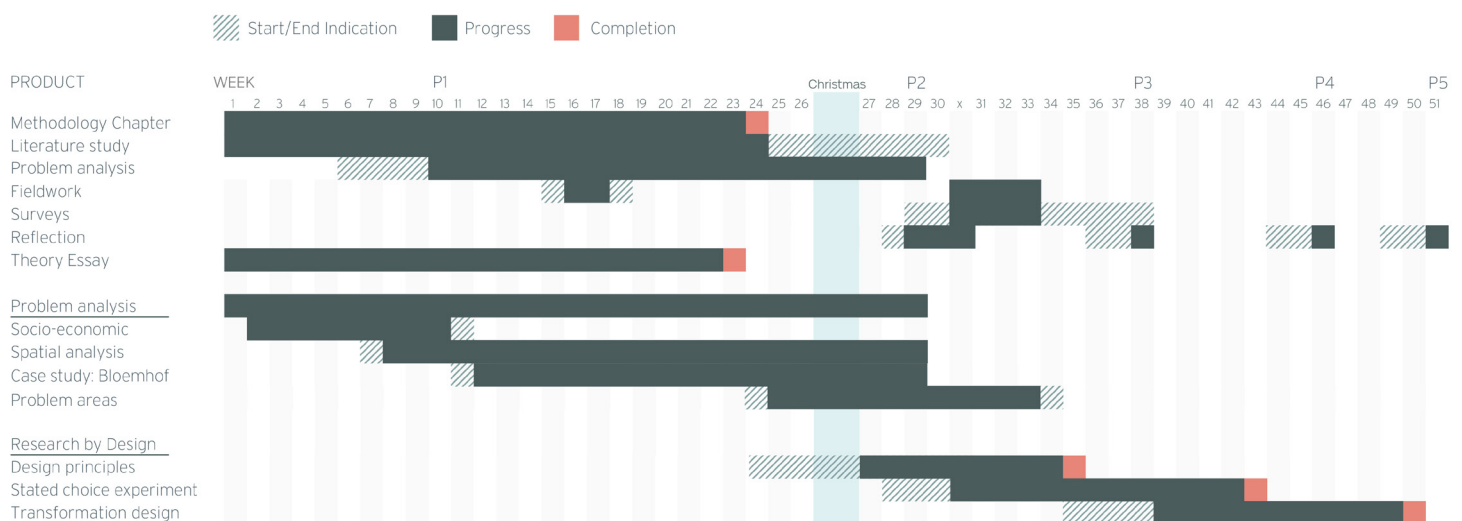


fig 25. Roadmap thesis

3.7 / Societal & Scientific Relevance

Societal relevance

Safety is one of the human needs and is included as second most important need in the pyramid of Maslow. This means people will seek to find safety before meeting their social needs, esteem needs, and self actualization. Safety, therefore, is a basic need in life. The social and physical environment are equally important to establish a safe environment. However, in cities, where the building density and population density is high, creating a safe environment has become more and more complex. The well-being of people is depending on feeling safe in the direct living environment. However, the safety performance of the neighborhoods Bloemhof and Pendrecht are not in line with the desired performance (fig 11). The government has a budget of 130 million euros to increase the safety in Rotterdam-Zuid, the area in which the neighborhoods are located. The money must be invested in housing, education, work, safety, and culture. The neighborhoods also gained special attention in the safety vision of the municipality of Rotterdam (Gemeente Rotterdam, 2018). Their goal is to minimize the risks and tackle the challenges they foresee in regards to perceived safety in the neighborhood. When the safety in the neighborhood increases the quality of the living environment will increase as well. This largely benefits the residents of the neighborhood and might take away the bad image the area has for a long time.

Scientific relevance

This research add to the body of knowledge on social safe design and perceived safety. According to Romice et al. (2016) there is a lack of effective synthesis of the theory on connecting the form of cities with the social processes and its implementation in mainstream practice. Despite the extensive knowledge on links between urban form and socio-economic processes, this is not sufficiently applied in practice. Furthermore, there is a lack of empirical evidence about the effects of the physical environment on the perceived safety (Harvey, et al., 2015, p. 2)

The development of research on designing for people has caused an over-professionalized form of urban place-making, which makes people believe that everything related to shape and management of environmental form is a professional problem (Romice et al., 2016). This thesis will explore methods where the design outcome is based on the experience of the user. The results therefore will be determined by users and observers of the public space, which is examined in the stated choice experiment.

The graph below (fig 26) shows how often the key words, which are relevant to this project, occur in books. Remarkable is the low occurrence of the word perceived safety and the high occurrence of CPTED. Although they are somehow related, CPTED focuses on crime prevention and is used more internationally, and not so much on the perception of safety. The term social safety has been declining since the beginning of the 2000s, but is an important topic related to perceived safety. It can be concluded that these topics have been researched in the 1990s and this knowledge is currently still being used. However, society, cities and how cities function have changed since then, so it is important to research if these principles, from both CPTED and Social Safety, can be applied in a contemporary context, which is more dense, diverse, and sustainable.

3.8 / Conclusion

The methodology chapter has described the aims and approaches of the research on perceived safety in Bloemhof and Pendrecht. Introducing theories on environmental psychology, human behavior and perceived safety in relation to a spatial design calls for a clear methodological framework that focusses on answering the research the research questions. The purposed of this chapter was to structure the research design and identify suitable methods for data gathering, analysis, and design to achieve the desired research output. The conceptual framework has been guiding throughout this chapter by focusing on both social and physical environments and the connection to perceived safety can be made. The elements of the conceptual framework are indicator that are included in the analysis. The stated choice experiment is crucial in the research process as it validates the design principles and it gaps the bridge between theory and the spatial design. The neighborhood transformation design will in the end be a concluding product that summarizes all theory and spatial implications.

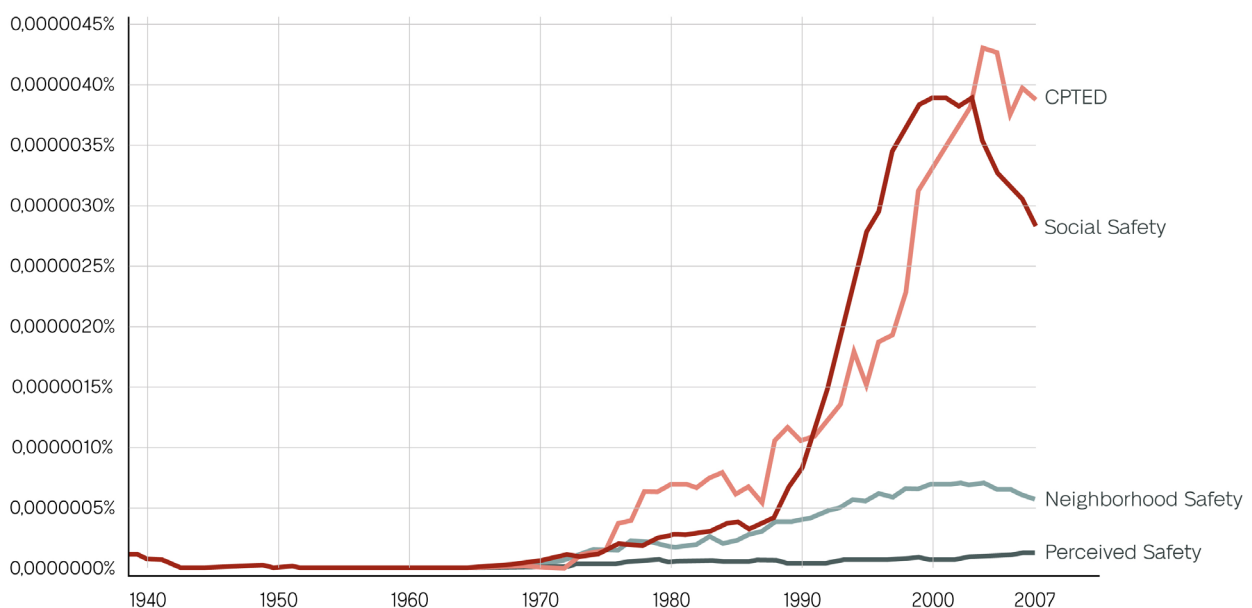
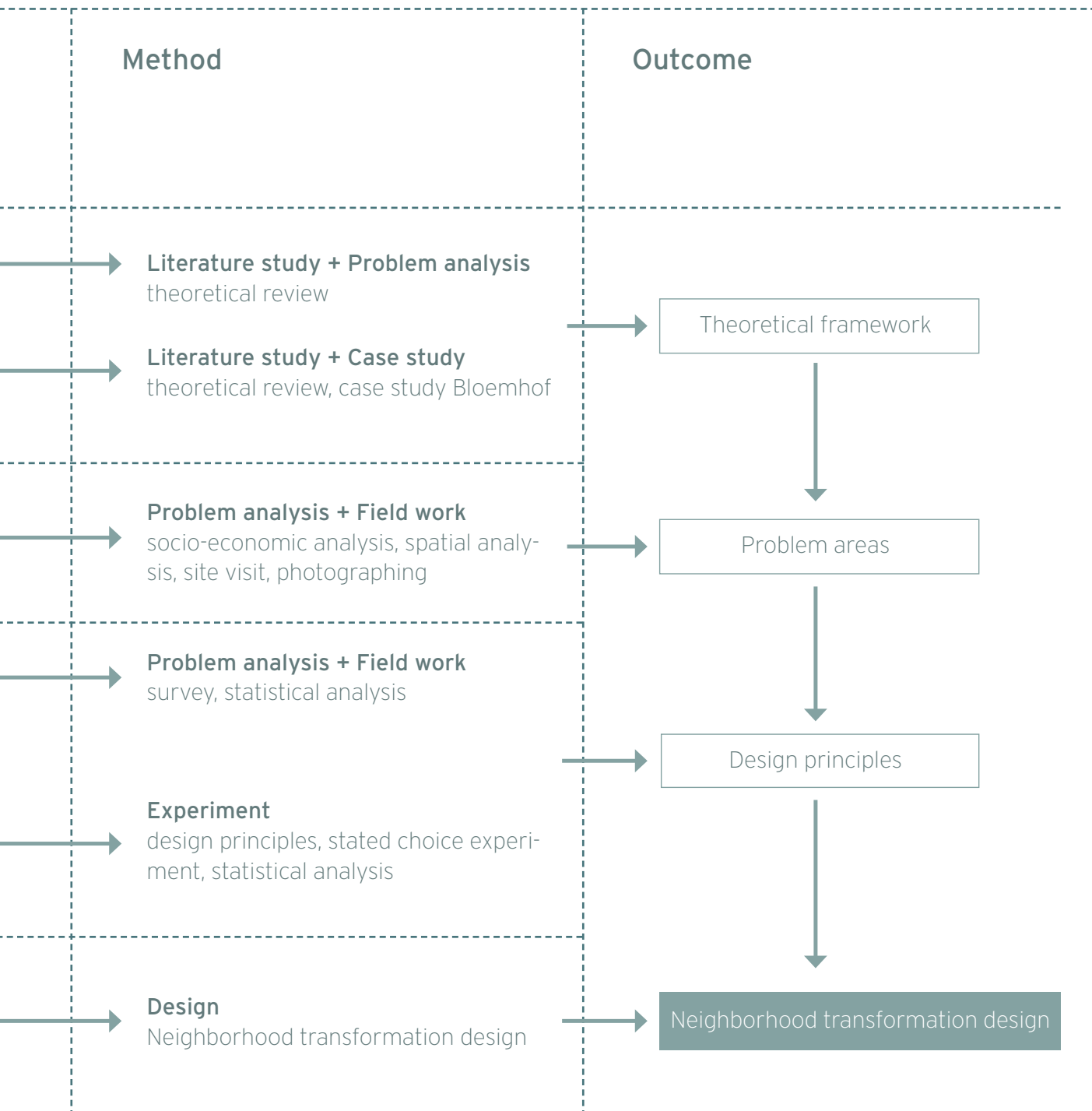


fig 26. Occurrence of terms and sentences in published books (www.books.google.com/ngrams)

3.9 / Methodology summary

Main research question	Sub research question
How can perceived safety be improved through neighborhood transformation in Pendrecht?	
Aim How can perceived safety be improved	<div>What are the social and spatial conditions that can lead to an (perceived) unsafe space?</div> <div>How do different types of urban fabric influence perceived safety?</div>
Scope through spatial design	<div>What are the socio-economic and spatial conditions in Pendrecht?</div>
Context in Pendrecht - Rotterdam (NL)	<div>How do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht?</div> <div>How are targeted spatial changes experienced by people with the condition to improve perceived safety?</div>
Design outcome integrated in a neighborhood transformation design.	<div>How can design principles that improve the perceived safety be implemented in an integral neighborhood transformation design?</div>



4 / Theoretical Framework

This chapter introduces the theoretical framework. The theoretical framework support the research with relevant literature on perceived safety. Perceived safety is depending on a persons social environment and physical environment. Therefore, the theoretical framework is divided into three main categories: perceived safety, perceived safety & social environment, and perceived safety & physical environment. Several theories will be explained per categorie. The included theories are: disorder perceptions, control, broken window theory, ethnic diversity, planning and designing for ethnic diversity, and the four guidelines for social safe design: visibility, legibility, accessibility, and attractiveness.

4.1 / Perceived safety

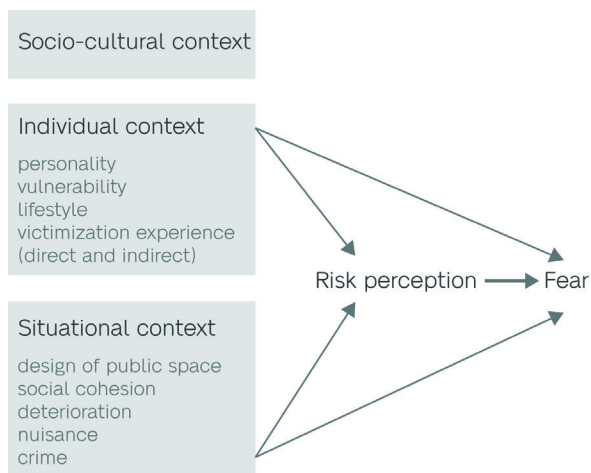


fig 27. Key factors of perceived safety (Luten, 2008, p. 28)

Safety is one of the basic needs for people (Luten, 2008). When people feel unsafe, they experience fear. Fear is a fundamental, deeply wired reaction to protect people against perceived threat to their integrity or existence. Our natural instinct when experiencing fear is 'fight or flight' (Javanbakht & Saab, 2017). When feeling fear people become hyperalert and it increases stress levels. These bodily changes happen in order to defend ourselves to the possible threat. The human brain is able to interpret the perceived threat and processes the context. People learn fear through experiences and through (social) interaction. Personally experiencing fear or seeing other people experience fear learns people to assess a threatening situation. Interactions which teach fear are talking about threat or signs that indicate a threat (Javanbakht & Saab, 2017). For example somebody tells you to avoid a certain place because it is perceived unsafe, or when there is a sign near a house that says the dog is dangerous. Safety can be defined as objective and subjective safety. Objective safety can be put into numbers and can be measured. Improving objective safety is related to reducing crime rates and safety risks. Subjective safety is the feeling or perception of safety. Improving subjective safety is related to improving peoples experience of being in a safe environment. Perceived safety is depending of several different factors, the three main factors are: socio-cultural context, individual context, and situational context (fig 27). Urban designers have an important role in facilitating the right situational context, as their designs should guarantee quality of public space, stimulate social cohesion, prevent deterioration, and avoid creating unpleasant spaces. The urban fabric plays an important role in facilitating a safe environment as it generates people movements. This movement can be disturbed by a lack of clear guidance, or due to the high complexity of the street pattern.

Disorder perceptions

The disorder theory is used to explain how safety is perceived by people with different demographic characteristics. The theory explains how people perceive their environment as unsafe and disorganized. Because, the survey and experiment of this research examines the perception of an individual's environment and looks at different demographic characteristics, such as gender, age, and the urbanity of the living environment, it is important to recognize that the perception of someone's environment is not equal to that of another.

According to Wallace (2015), people with different demographic characteristics can perceive disorder differently, he states that their perceptions are compromised by personal and situational biases. In his article he explains the variation of disorder perceptions based on theory and individuals' socio-economic and demographic characteristics. Firstly, based on the theoretical explanations, he explains that the perception of disorder in a neighborhood depends on routine activities, which means that the perception of someone's environment depends on when and how someone uses the public space in their neighborhood. This is due to the fact that how and when someone interacts with the public space in the neighborhood influences how they expose themselves to possible disorder, which in turn affects the disorder perception. Secondly, he explains that the perception of disorder in a neighborhood depends on neighborhood attachment. Residents who are more attached and satisfied with their neighborhood and community tend to perceive less disorder. This is due to the fact that long-term residents have years of information and experience in their community which frames their disorder perceptions (Wallace, 2015).

Based on socio-economic and demographic characteristics he states that in general women and older adults and individuals with a western ethnic background are most likely to perceived disorder more negatively. Although, older age groups perceive larger, negative effects on disorder, their fear of crime is lower than younger age groups. This refers back to the routine activities, because older people tend to use their neighborhood less actively than younger people. Wallace states that females do perceive more disorder than man. Furthermore, he states that individuals with a non-western ethnic background perceive less disorder, the explanation is that they might have been exposed to high levels of disorder, through generations of segregation and stratification, which could create more tolerance for disorder perceptions. However, it must be noted that this research is conducted in the United States and that socio-economic situation and political environment is different in the Netherlands.

4.2 / Perceived safety & Social environment

Control

Perceived safety is related to the sense of having control over a person's social and psychical environment. Control over a person's environment is important as it affects the health and safety and has proven to improve people's engagement with their environment. The term control is related to other aspects that are affecting the livability of an area, like social safety, social relations, participation and engagement, legibility, tolerance, privacy, and social interaction (M. Van Dorst, 2005). The social environment influences how the environment is controlled. Hillier and Hansen (1984) introduce a system in which strangers and inhabitants police one another. In an urban environment the effectiveness of this system is depending on the urban fabric and to which extent the strangers and inhabitants are able to police and control their environment.

The simplest spatial structure in which one can understand the sense of control is a building. The building consists of a boundary, a space within the boundary, an entrance, and a space outside the boundary defined by the entrance (Hillier & Hanson, 1984, p. 19) (fig 30). The space inside the boundary is associated with the inhabitant, of which the boundary of the space forms the control. The space outside the boundary is known as the domain of potential strangers. Who can provide safety at first sight, but according to Hillier and Hanson (1984) can also be a source of danger. This is not as black and white as it seems because the presence of strangers humanizes the street and makes it feel more secure (Hillier, 2004). Hillier (2004) addresses two types of building configurations that change the view and behavior between inhabitants and strangers.

A continuous street with housing entrances on both sides (fig 28) stimulates the acceptance of strangers on the street, as their complete absence in the street would make you feel more insecure. The second configuration is a patchwork of inward-looking enclaves (fig 29), in which the inhabitants would notice a stranger immediately, their behavior will be defensible. This behavior has to do with territoriality in the enclaves.

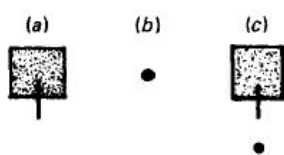


fig 30. a. space defined by boundary b. open space/outside space c. building defined by a boundary and connected to the openspace by an entrance (Hillier, 1984)

Broken window theory

The broken window theory is based on the 'developmental sequence where neighborhoods decline into high-crime area through disorderly conditions' (Welsh, Braga, & Bruinsma, 2015, p. 448). The name is derived from the principle that a broken window left unrepaired implies that social control is weak (Ceccato, 2012). Social incivilities and physical incivilities cause residents and workers in the neighborhood to experience fear. These incivilities include, among others, loitering, trash, and abandoned buildings. Because of the experienced fear, people tend to avoid places or move out of the neighborhood or isolate themselves, which results in anonymity and a decreasing level of informal social control (Welsh et al., 2015). An experiment by the researchers who initiated the broken window theory, Wilson and Kelling (1982), showed that vandalism and serious crimes increasingly occur when the sense of mutual regard and obligations of civility are lowered by action that signal that 'no one cares' (Wilson and Kelling in Welsh et al., 2015).

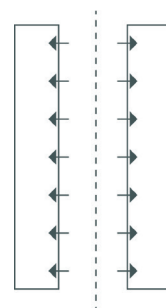


fig 28. Continuous buildings with entrances on both sides of the street.

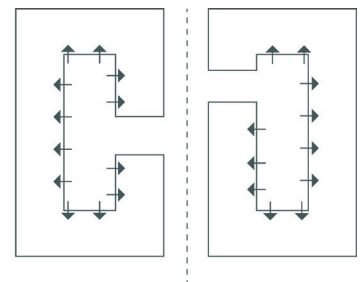


fig 29. Building enclaves with inward entrances.

Ethnic Diversity

International migration flows have caused our society and cities to diversify. There are different definitions of diversity depending on the context in which it is used. Planners often refer to diversity as mixed uses or ethnic-racial heterogeneity, where designers often refer to diversity as mixed building types and create a range of architectural styles in the streetscapes (Fainstein, 2005). This theoretical framework will look more specifically at ethnic diversity, this definition includes the variety of people with different ethnic backgrounds that need to coexist. As Sim (2019) mentioned in his book *Soft City*, the values, needs, behavior, and lifestyle of people with different ethnic backgrounds might conflict as they are neighbors living in a shared environment (Sim, 2019, p. 11). This environment might not be compatible with the different ethnic groups. Therefore, the task of the planners and designers is to create places that are compatible for every ethnic group,

so that social exclusion can be prevented, and inclusive public spaces are created. In the contemporary multicultural urban environment ethnic diversity is very meaningful. It is able to foster creativity, encourages tolerance and it urges city officials to see value in underappreciated lifestyles that shape the city's dynamics (Fainstein, 2005). Ethnic diversity can generate awareness and acceptance of multiculturalism, which creates an inclusive and involved society.

Multiculturalism in the context of diversity refers to demographic ethnic-racial diversity, recognition and support of different cultures through policies, and ideological beliefs and discourses (Verkuyten & Yogeeswaran, 2020). An ethnic group involves people that identify with one or more shared characteristics. These characteristics are for example the same nationality, race, religion, language, culture or history (van Dorst, 2008). A positive attitude towards other cultures and ethnic diversity makes people potentially more open to establish inter-ethnic social relations. A stronger inter-ethnic social relation increases the integration of ethnic groups in a neighborhood (Peters & de Haan, 2011). A remark on how multiculturalism is often approached in empirical research is the focus on differences between ethnic groups instead of commonalities between the groups. This creates bounded categories, which can cause stereotyping and exclusion of ethnic groups.

Ethnic diversity can cause conflicts and hostility between different ethnic groups. Research shows that these conflicts of distrust and possible feelings of threat are often associated with economic conditions and residential mobility, meaning the frequent change of the local population. The perceived change in diversity increases feelings of threat and expressions of explicit and implicit racial bias. This is mainly due to the fact that people feel threatened when they notice a rapid increase in the relative proportion of ethnic minorities in their environment (Verkuyten & Yogeeswaran, 2020). A negative perception of a multicultural neighborhood can create a negative stigma, this is often related to the problems and weak socio-economic status of the ethnic minorities. The negative stigma is even stronger for the people outside the neighborhood who perceived it as a place of crime (Madanipour, 2010). Socio-cultural integration is crucial for people with a migration background, but often takes a long time, sometimes even generations, to integrate. If the ethnic minorities are unable to integrate in their social environment, chances of social segregation will increase.

Planning and designing for ethnic diversity

The public space is the place where people observe other people and where social encounters take place. Public space is defined as a place that is accessible for everyone and secures a level of anonymity. Accessibility creates a sense of equality for the different users. Anonymity is important in public spaces as it implies possibilities without obligations, which is seen as a quality for the individual and the society (van Dorst, 2008). When relating public space and ethnic diversity the conflict generally is related to the principle of 'unknown is unloved'. This principle is based on that people have to deal with unfamiliarity and distrust concerning different ethnic groups, which in this case happens in public space. According to Peters and de Haan, the social performance in public space is strongly related to the way that people have a feeling regarding how to behave and what is "normal" and unobtrusive (Peters & de Haan, 2011, p. 173). The feeling of not knowing how to behave can cause conflict in situations when there are different moralities in public spaces. It results in uncertainty, fear or avoidance. In some neighborhoods public space is limited or has limited capacities. This can result in one of the main conflicts in public space; the claim of public space by a specific group of people. Public spaces facilitate an environment where diversity of ethnic groups is experienced. Social encounters between an individual and strangers often happen in public space. In some neighborhoods public space is limited or has limited capacities. This can result in one of the main conflicts in public space; the claim of public space by a specific group of people. Referring to neighborhoods with weak socio-economic position, residents in these neighborhoods often have a limited prospect. Unemployment and low income create a situation in which these people tend to hang out often in public spaces, because they have nowhere else to go and they have limited resources and mobility. This could cause other people who are just passing by discomfort or intimidation. When people sense that a group has dominated a place it results in a lack of safety for other people, in specific vulnerable people.

Urban Planners and designers have an important role in creating public spaces that can be used by all ethnic groups. The planners and designers have the expertise and imagination to translate values and needs of different ethnic groups into spatial qualities and designs (Juwet, 2010). In order to do so, the urban planners and designers must research the following questions: what happens in public space, who is there, what are people doing, and who is interacting with whom? (Peters & de Haan, 2011). The urban planner and designers must work to avoid exclusion. In order to do so, it is important to understand who is

invisible in public space, who claims the public space, and how space is claimed (Juwet, 2010). When more stakeholders are involved in the planning process, the chance of success will be increased. Stakeholders must consist of a diverse group of people.

The pressure on public space due to limited space and capacities in combination with the weak socio-economic status of the residents of the neighborhood can result in heavy use of the public spaces. Therefore, the quality of the public space is important. The design should take in account the durability of the materials that are used. Furthermore the design should enable flexibility, as single-purpose spaces are most likely to be unsuccessful because of the varying uses of the space (Madanipour, 2010).

4.3 / Perceived safety & Physical environment

The following guidelines for social safe design need to be designed and implemented in conjunction in order to have the desired effect on the perceived safety.

Visibility

The first guideline to ensure the perceived safety is visibility, which in principle is about seeing and being seen. The visibility of an area is directly linked to a clear overview of the area, sightlines, lighting, presence of other people and supervision. Overview in an environment is important to one's personal sense of control. Being able to predict what the situation ahead is going to be, adds to this sense of control. On the downside, when there is too much overview a person can lose focus and then it loses the purpose of a clear overview. Too much overview can also create an ideal situation for a possible perpetrator (Luten, 2008). Sightlines add to the visibility and easy orientation in an area. Sightlines do not only apply in the streets, but are equally important through windows. In order to have social control, the sightlines through a window must be unobstructed, in order for the resident to have eyes on the street. Physical elements like fences, hedge, or blind walls reduce the social control. Research by Hillier (2004) showed that highly spatially segregated streets with low movement and low visibility were the places with the most burglaries.

Inter-visibility has proven to be influential for the social control in an area. The more entrances and windows are connected and oriented opposite each other on the ground floor level, the chance of someone watching the street increases. Research showed that the perceived safety, and therefore appreciation of the area, is de-

pendent on the density of entrances and the degree of inter-visibility (De Rooij & Van Nes, 2015).

Legibility

The guideline legibility can be defined as to what extent the observer is able to interpret its environment wherein the perceptions are consistent with existing cognitions (M. Van Dorst, 2005). This definition indicates clear boundaries between public and private spaces and all types of territories in between (collective, semi-public, semi-private). The presence of clear boundaries increases the ability of the observer to recognize and understand ownership of the space and gives the space meaning. Unclear defined boundaries of territories reduces the sense of responsibility by users and the informal group of owners. A lack of sense of responsibility for an unclear defined space results in a decreased level of social control. As a result of the lack of social control the anonymity in the area increases. With an increased anonymity residents of the area are less motivated to call out other people on undesired behavior (M. Van Dorst, 2005). Ill defined territories, like semi-public and semi-private space, often cause issues related to use and management. This is caused by the fact that it is not clear who is supposed to use the space and for what the space is intended (Luten, 2008). As mentioned before, the sense of control has an influence on people's safety. Legible territories enable people to control their social and physical environment.

Accessibility

The definition of accessibility is formulated as follows: "Accessibility of the built environment is the characteristic of outdoor space, buildings, and houses that makes sure people can do what they are meant to do" (Wijk as cited in Luten, 2008). The quality of public space is determined, among others, by its accessibility and openness. It ensures that everyone, including vulnerable people, can use and access the public space. Therefore, accessibility is highly dependent on the design of the space. The ease of access, use and being able to leave with regard to the diversity of the users and visitors. Special attention should be paid to vulnerable groups when designing public space, these groups (e.g. elderly, children, disabled, young women), should be able to use public space without any obstruction.

On a larger scale accessibility plays a part when talking about spatial segregation. A spatially segregated street with low integration in the street network affects the amount of people in the street, because the street less

ways to access than a spatially integrated street (De Rooij & Van Nes, 2015). This influences the social control because there are less people passing through the street and seeing what is happening in the street. Furthermore, a spatially segregated street with few or no people passing through could provoke undesired behavior. Lower social control and awareness of undesired behavior can cause lower perceived safety.

The street network must be planned and designed in such a way that users can use the streets intuitively. According to the natural movement theory people have intuitive knowledge on how to move through a city. They have an expectation pattern on where and when other groups of people will be. For example: during a Saturday morning a local shopping street will be busier than during a Tuesday morning. People adjust their behavior according to this expectation pattern (Hillier as cited in Luten, 2008). The street network should resonate with the users' intuition in order to increase the accessibility of the total network.

To create a safe environment the right balance between accessibility and alternative routes needs to be established. The street pattern can contribute to a (potentially) high concentration of possible perpetrators. Too many side streets and alleys, however, decrease the legibility of the area and therefore decreases the positive effect that accessibility can have on the perceived safety.

Attractiveness

The attractiveness of an area has a positive influence on the perceived safety. Luten (2008) defined six conditions for a attractive environment:

1. Esthetic quality

Esthetic quality can be established by using different materials, textures, colors, acoustics, and architecture. However, different people appreciate these differently when their personal preferences or cultural background does not align with the esthetic. A universally appreciated esthetic value is nature (green, water, sun, shadow). Universally unappreciated esthetic is large-scale environment, for example: Bijlmermeer in Amsterdam. In large-scale environments the human-scale gets lost and people tend to feel less safe.

2. Attractive land use and functions

In order to attract people to public space, people need to have a reason to go there. Creating functions to stay in a public space attracts people, for example: a playground, benches in the sun, or facilities like shops connected to the public space. Once this attraction is established the theory by Gehl et al. (2013) that people attract other people will most likely happen.

3. Maintenance and management

Public spaces that have signs of poor maintenance like, waste, insufficient lighting, inadequate repair, signs of vandalism, or untrimmed vegetation, are often perceived as unsafe and neglected. The lack of maintenance and care degrades the quality of life in the neighborhood around the public space and can continue the negative image of the area (Madanipour, 2009, pp. 122-123). On the other hand, overly maintained public space are considered unpleasant places to stay, it signals that people don't use the space. Lively use of a public space wears materials out and causes a degree of messiness (Luten, 2008).

4. Esthetic durability

Esthetic value is dependent on architectural and design trends. An architectural style from the 1950s for example does not fit the current day esthetic values. Therefore, design of public space, buildings and houses should be flexible to be able to change over time.

5. Technical durability

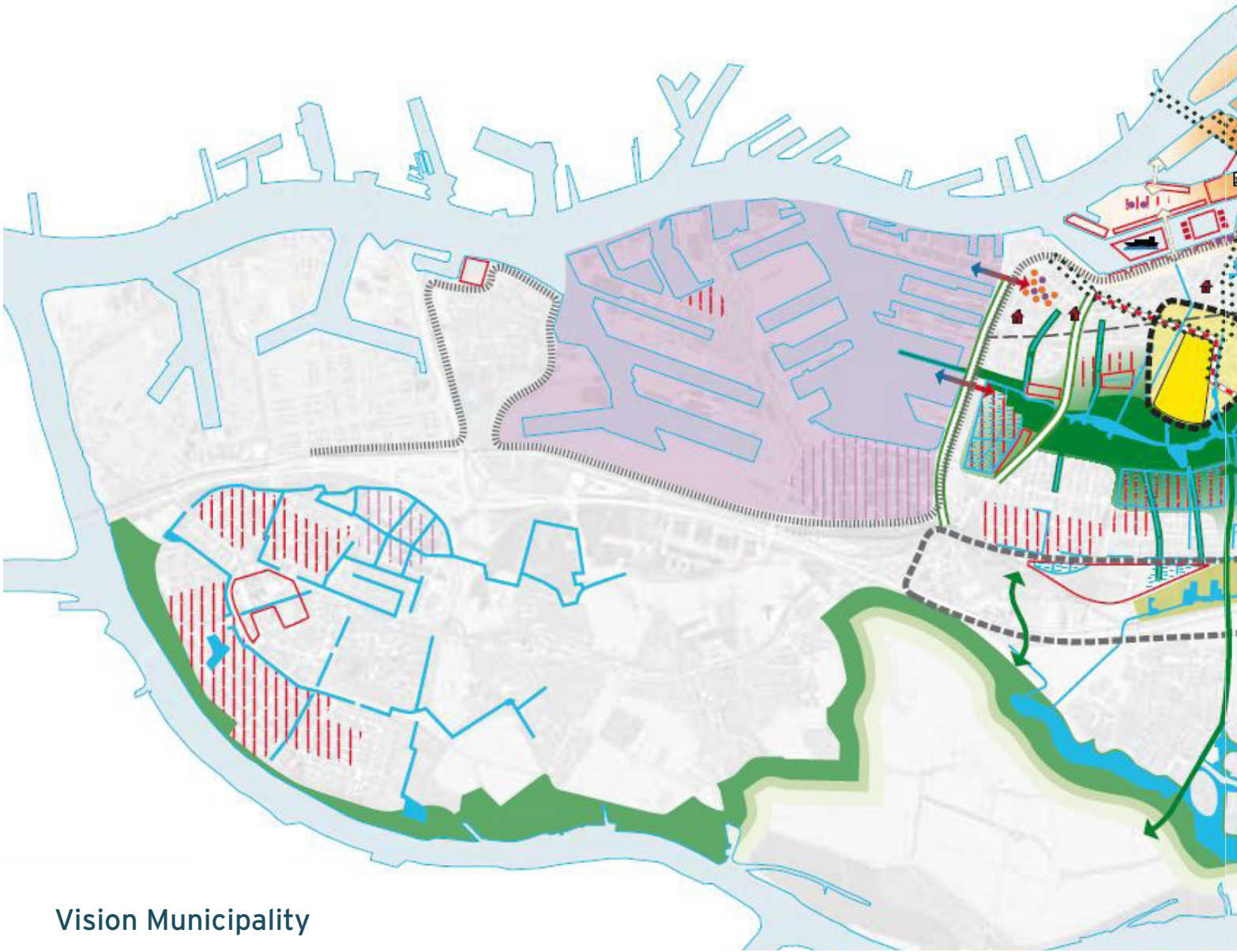
Material and object in public spaces should have a certain robustness in order to endure the intensive use or possible vandalism. When used materials and object are not durable signs of deterioration and vandalism will occur more easily, which affect the perceived safety.

6. Social sustainability

Perceived safety is highly dependent of social cohesion. Social cohesion and being able to identify with your neighbors as residents of an area is called social sustainability. When residents are prepared to help each other and trust each other the social sustainability will increase. Residents of a neighborhood with low levels of social cohesion are more likely to feel unsafe in their neighborhood.

5 / Spatial Analysis

This chapter includes the spatial analysis of the neighborhoods Bloemhof and Pendrecht. Bloemhof functions as a case study of which the differences with Pendrecht give an insight into a neighborhood with similar socio-economic characteristics but many spatial differences. The analysis covers several spatial aspects that are used to understand the neighborhoods and the relation of the spatial aspects with perceived safety. The maps highlight the differences between the neighborhoods. The chapter concludes with a brief summary of the lessons that are learned from the case study and the general spatial analysis.



Vision Municipality

The municipality of Rotterdam made a vision for the development in Rotterdam-Zuid. This vision is mainly focused on: restructuring both the physical and social aspects of the neighborhood, develop the leisure economy, and regenerate the public space. The vision, however, is two folded for Rotterdam-Zuid. Besides the physical changes that are needed, there is an urgency to change the social structure in the area. National Program Rotterdam-Zuid (NPRZ) is initiated with the aims to improve the social structure by focusing on education, work, culture, and safety.

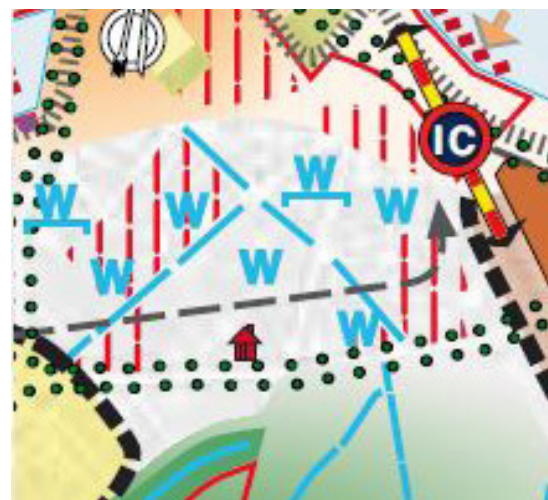
With regard to the physical aspect, the vision includes the profiling of neighborhoods in Rotterdam-Zuid. There is a lack of identity and diversity of the living environments and housing the supply is not up to par with the quality that is needed. This prevents people from being able to identify with their direct living environment, which results in dissatisfaction of their environment and can lead to low social control. In some cases the current neighborhoods do not align with the lifestyle and needs of the residents, which needed to achieve an inclusive living environment.

Regarding public space quality, the residents of Rotterdam have expressed their dissatisfaction with pollution in the public space. This is the second biggest concern after criminality by the residents. Although Rotterdam is considered a green city compared to other big cities in the Netherlands, this is not experienced like this by the residents. The quality of the green public spaces are low. Furthermore, the municipality wants to improve the connection in the city by increasing the legibility and recognizability of the roads.

(Gemeente Rotterdam, 2007)



fig 31. Vision map Rotterdam-Zuid (Gemeente Rotterdam, 2007)



Vision Bloemhof



Vision Pendrecht

Legend



Large restructuring location



Improving recreational cycling route city landscape



Search location watersquare



Search location green roofs



Living environment
Kop van Zuid



Intercity station



Regeneration to boulevard



City park



Pro-active approach
private housing



Quality improvement main
roads (existing + new)

Historic development

The map below shows the building ages in Rotterdam-Zuid. The red and pink buildings are prewar buildings, the green and light purple buildings are post-war buildings, and the dark purple buildings are new buildings or transformations from the past decade. From the gradient of the colors shown in the map the growth and development of the area can be deduced. It clearly shows that the southern part of the area are post-war reconstruction neighborhoods. The urban fabric of the different neighborhoods also shows a change in typologies. The red buildings are often closed and show clear neighborhood edges. In contrast to the green and purple buildings which have a more open urban fabric and vary more in size.

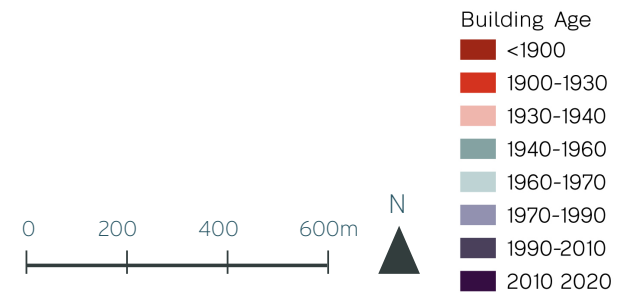
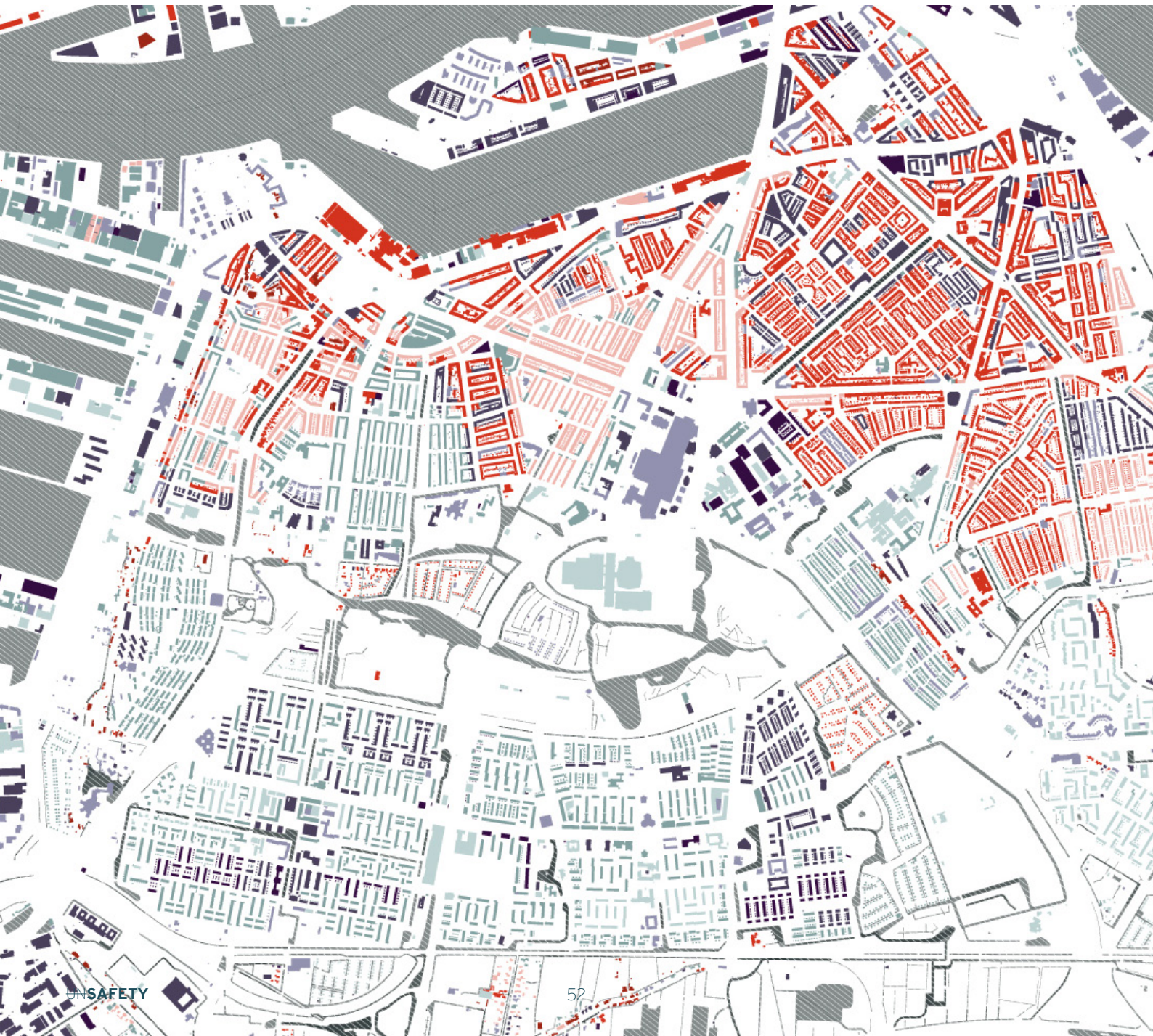



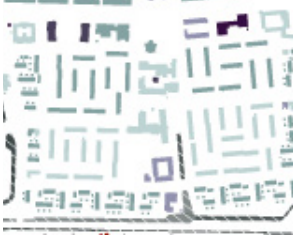
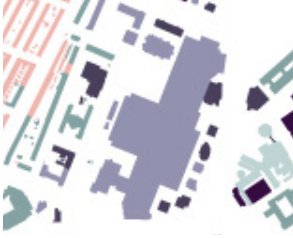




fig 32. Building ages in Rotterdam-Zuid



1900-1930		The first urban planning activities in Rotterdam-Zuid were the development of garden city and experimental architecture neighborhoods to accommodate the port workers. The neighborhoods were developed by either the employers of the working class or the municipality (Meijel et al., 2008)
1930-1940		The growing housing demand required the development of affordable housing, which resulted in standardized portico apartments in parallel building form (Meijel et al., 2008).
1940-1960		The post-war reconstruction included new neighborhoods like Pendrecht and Zuidwijk, modernist neighborhood based on the 'light, air, space' ideology. The extension plans made by Lotte Stam Beese included principles of the 'wijkgedachte' (neighborhood idea). The principles included: a central location for the facilities, mixing building block types, and the placement of the building blocks in relation to each other and the public space (Heeling, Meyer, Westrik, & Sauren, 2002, p. 155).
1960-1970		
1970-1990		The opening of the Zuidplein shopping mall in 1972 attracted people from all over the country, it was and still is the biggest shopping mall in the Netherlands. The connected elevated metro line and station facilitates a fast connection between the south and the north of the city.
1990-2010		The Erasmus Bridge opened in 1996, it is the second north-south bridge connection over the Maas. At the same time, the Wilhelminapier was being transformed from a desolated docking area to a high-density, mixed-use, urban area.
2010-2020		The area around Zuidplein is being regenerated. The development includes a new public library, swimming pool, and theater. The development is supposed to give a positive boost to the area.

Site Selection

The neighborhoods that have been selected for this project are Bloemhof and Pendrecht. This decision is based on their demographic and socio-economic similarities and their spatial differences. Throughout this report the neighborhood Bloemhof has been used as a case study. The lessons learned from analyzing this neighborhood, both socially and spatial, will be taken into consideration in the next steps of the project.

As shown in the problem analysis there are several neighborhoods in Rotterdam-Zuid that have weak socio-economic characteristics. From this problem analysis it became apparent that the neighborhoods Bloemhof and Pendrecht are similar based on demographics and socio-economic characteristics. From the historic development analysis and typology map it can be seen that the neighborhoods differ a lot in their spatial structure. This

is mainly due to the different eras in which the neighborhoods have been developed. Bloemhof is a pre-war neighborhood that has been built around 1900 for the working class. Pendrecht is a post-war neighborhood built in the 1950s and 1960s, with very distinctive modernist characteristics.

A safe environment is depending on the social and physical environment. Given the fact that the research field of urbanism focuses more on the physical environment and within this project the influence of the physical environment on the perception of safety, it is helpful to choose two neighborhoods with similar socio-economic characteristics. This way, when analyzing the two neighborhoods on multiple levels, the social variable will not differ significantly.





Bloemhof

source: www.google.maps.com



Pendrecht

source: www.google.maps.com

Site visit

Bloemhof



Pendrecht

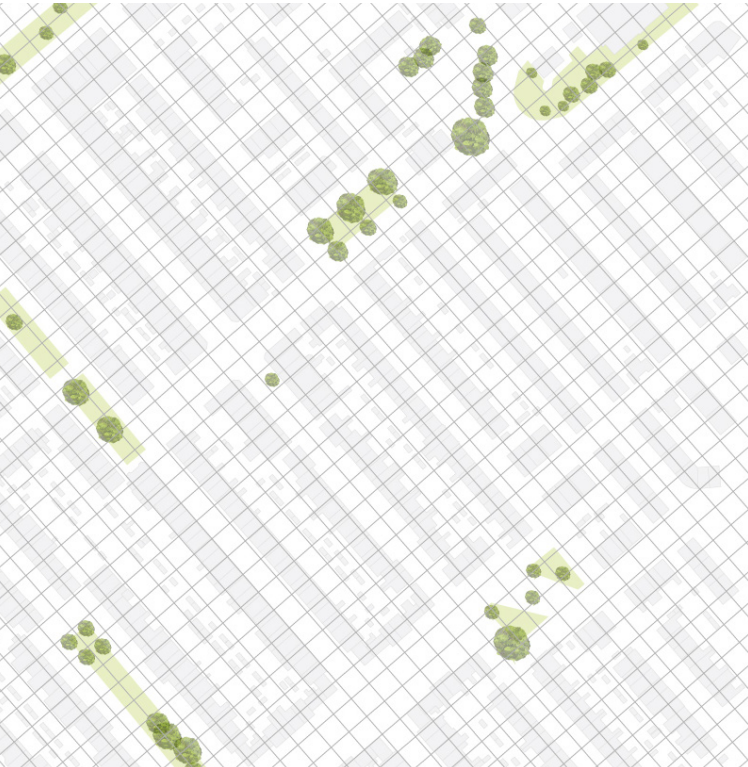


Typology

fig 33. Isometric view on a part of Bloemhof that characterizes the modernist typology

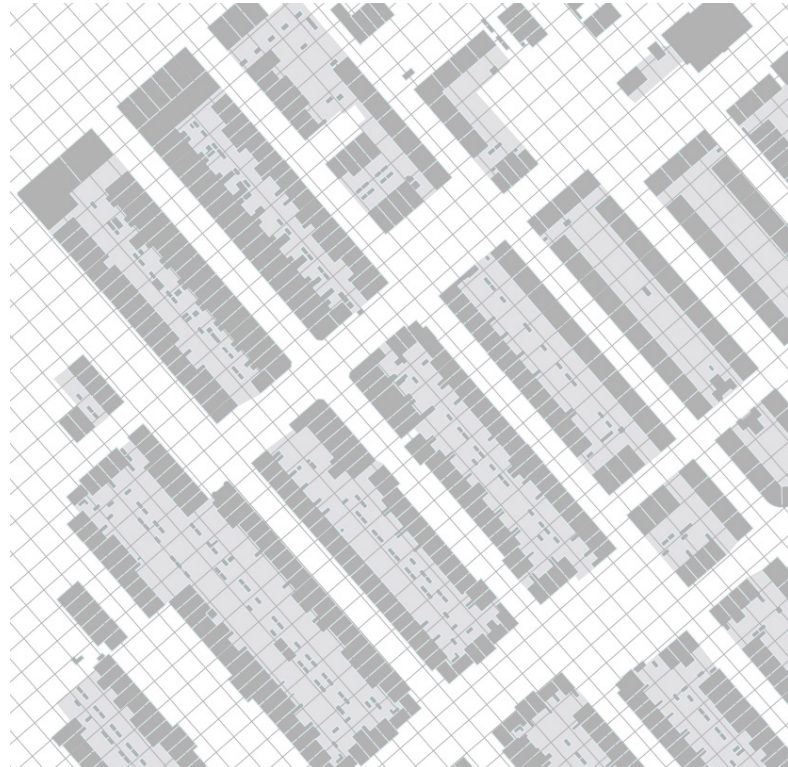


fig 34. Public green



Most of the public space in Bloemhof is designed for traffic and therefore paved. This leaves little room for public places and public green.

fig 35. Public and private domain



Dark grey = private building
Light grey = private outdoor space
White = Public space

Bloemhof

Bloemhof is a pre-war neighborhood that has been built between 1900-1930. The urban fabric is built upon and around the dike that creates the edges and smaller residential neighborhoods between the dikes. The building height of the edges of the neighborhood is higher than the inner residential part of the neighborhood, which is densely built with low-rise houses. The height of the buildings on the edge of the neighborhood is also referred to as the Rotterdamse laag (Rotterdam layers). Which refers to the majority of the pre-war building blocks throughout the city. The Rotterdamse laag consists of between 4 and 5 layers with an average total height of around 11 meters (fig 36).

Bloemhof predominantly consists of closed building blocks. The configuration of the buildings blocks are, like most pre-war neighborhoods, parallel to each other. This creates collective or private space inside the building block. The continuous streets with entrances on both sides increases the inter-visibility of the area which creates a situation with higher levels of social control.

The residential inner part consists of many typologies ranging from courtyards to traditional workers houses. This is due to the experimental period in which the neighborhood has been built. As a result the historical architectural value of some parts of the neighborhood is high.



fig 37. Historic map of Bloemhof with visible (source: www.topotijdreis.nl)

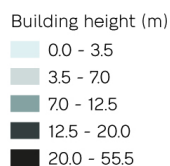


fig 38. Building heights in Bloemhof

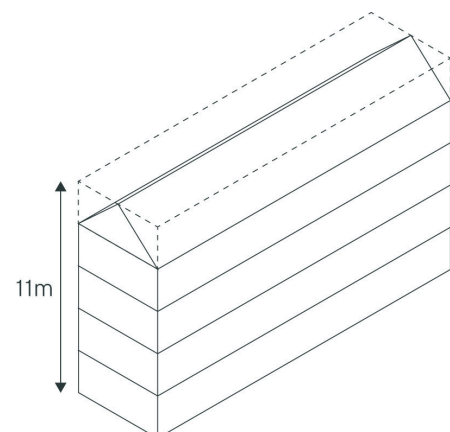


fig 36. Illustration of the 'Rotterdamse laag' (Rotterdam layers)

fig 39. Isometric view on a part of Pendrecht that characterizes the modernist typology

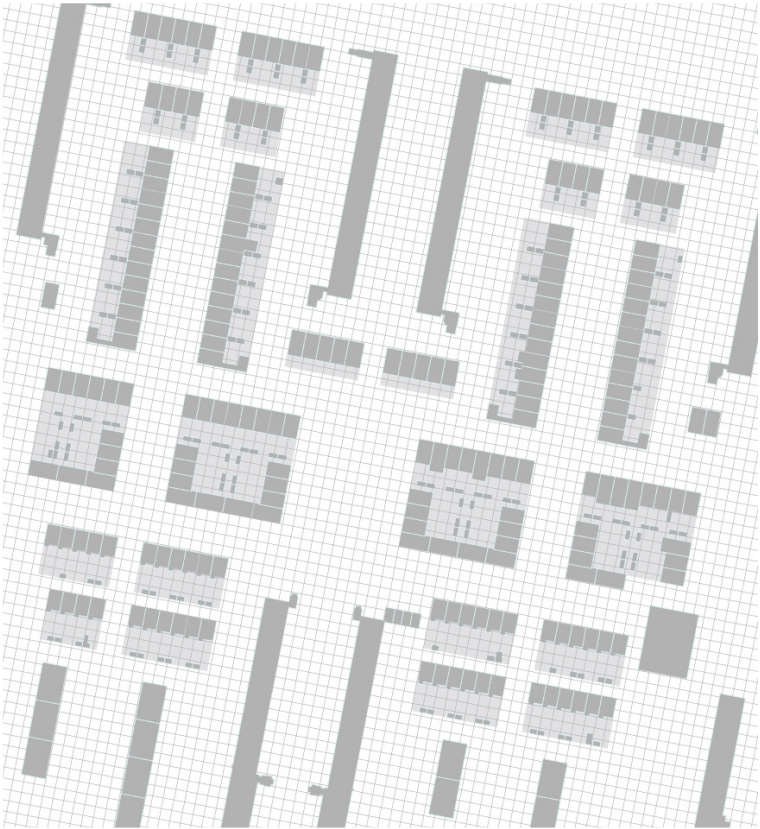


fig 40. Public green



The neighborhood has a lot of public green, but the quality of these places are lacking behind. This is mainly due to unclarity of ownership of the spaces.

fig 41. Public and private domain



Dark grey = private building
Light grey = private outdoor space
White = Public space

Pendrecht

Pendrecht was part of the urban expansion plan during the post-war reconstruction and is designed by architect Lotte Stam-Beese (fig 42). During this time there was a housing shortage and architects and urban planners were pushed to design a new typology. The CIAM, founded in 1928, discussed design principles for a ideally designed, healthy cities. Their modernist ideals were based on cities that are hygienic, green, spacious and light, with efficient traffic systems. It resulted in the functional city, with rationale arrangement of functions of living, working, recreation, and traffic. This way the architects and urban planners believed that the society was 'malleable', by creating the right environment (Bruijne, van Hoogstraten, Kwekkeboom, & Luijten, 2002). Based on the principles, wide street profiles and a lot of green space and open building blocks can be recognized in Pendrecht. The configuration of the buildings are, unlike pre-war typologies, not parallel. The buildings are perpendicular to each other, this creates large open spaces between the buildings, of which the control and ownership has become unclear. This results in a low level of social control.

The ideals from the 1950s and 1960s do not align with the current day wishes of the residents, the houses and apartments are too small and the green spaces lack quality. As a result, Pendrecht pauperized.

Furthermore, the 'wijkgedachte' (suburb-idea) has been applied in Pendrecht. This concept is based on decentralization of the city, in which each centrality has its own center. Pendrecht therefore is split into four units around a center square (Plein1953). The configuration of the buildings and streets is strictly orthogonal and is characterized by a clear hierarchy. The neighborhood is connected to the city by a main road that branches out to residential streets. The buildings within an urban block have a height different, which varies between low-rise, mid-rise, and high-rise (fig 43). Each urban block fits the 'wijkgedachte' as they aimed to create communities among the residents.

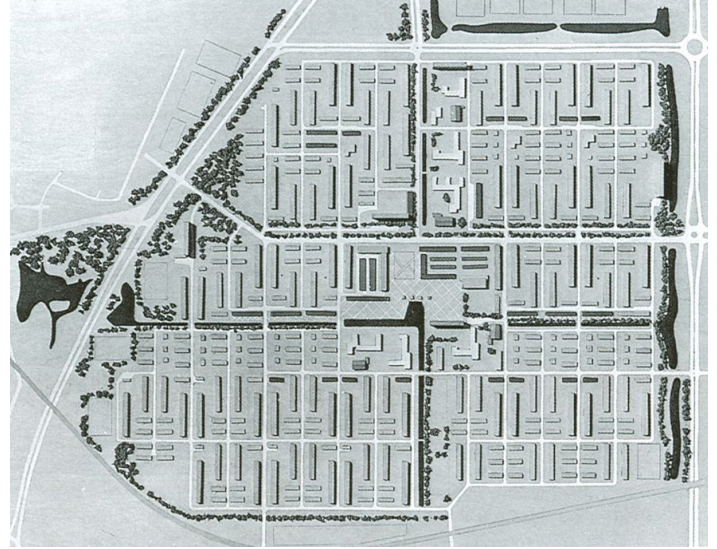


fig 42. original plan of Pendrecht by Lotte Stam-Beese (<http://www.mario-bosch.nl>)



fig 43. Building heights in Pendrecht

Urban Fabric

The urban fabric of Bloemhof and Pendrecht have a recognizable different in openness. The building blocks in Bloemhof can be defined as closed and continuous, the opposite is true for Pendrecht, where the building block are defined as open and fragmented. The level of openness of an urban block is defined as the share of total border length accompanied by buildings and is expressed in percentage. A lower percentage of openness contributes to the definition and legibility of the public and private realms (Berghauser Pont & Hausleitner, 2017). Closed

buildings blocks have proven to increase the interaction between the building and the street, as the large share of border length accompanied with buildings enable the passer-by to walk along a facade of a building. A open building block, like in Pendrecht, decreases the legibility of the environment because the building block has less clear borders and definition.

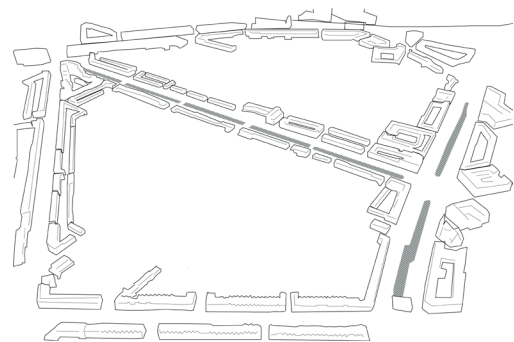


fig 44. Continuous urban structure in Bloemhof

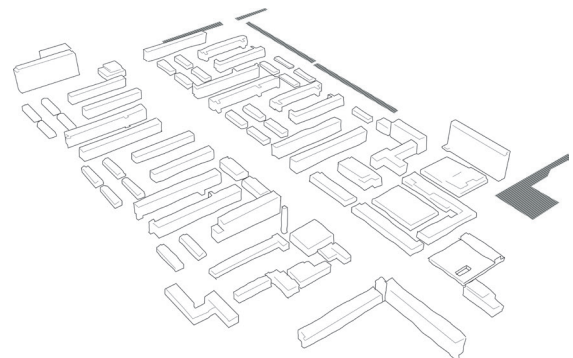


fig 45. Open urban structure in Pendrecht

Density

One way to measure density is using FSI (Floor Space Index) and GSI (Ground Space Index). The FSI indicates the built intensity of the urban block and the GSI indicates the compactness of the urban block. The FSI is measured by dividing the gross floor area (GFA) by the surface area of the urban block (AREA)

$$\text{FSI} = \text{GFA (m}^2\text{)} / \text{AREA (m}^2\text{)}$$

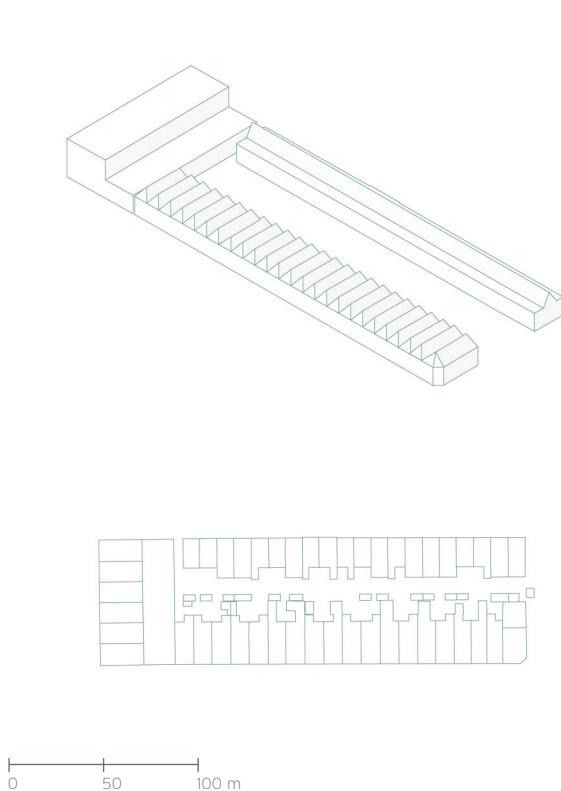
The outcome of the equation expresses the amount of floors that the total area has been built on.

The GSI is measured by dividing the sum of footprint of the buildings in the urban block by the area of the urban block.

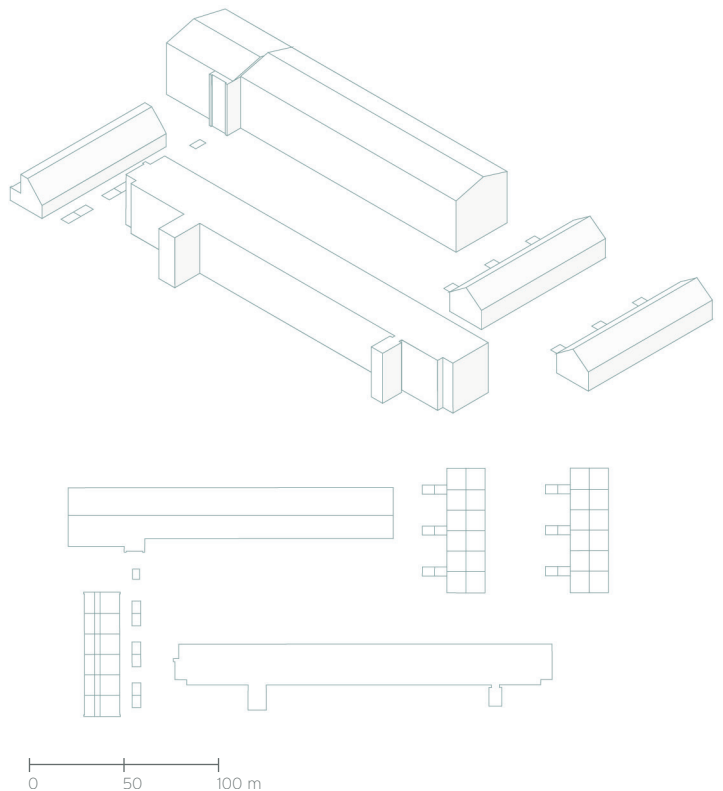
$$\text{GSI} = \text{footprint (m}^2\text{)} / \text{AREA (m}^2\text{)}$$

The outcome of the equation expresses the compactness of the buildings within the urban block.

As mentioned in the previous chapter (page 21) areas with a similar FSI can be perceived differently.



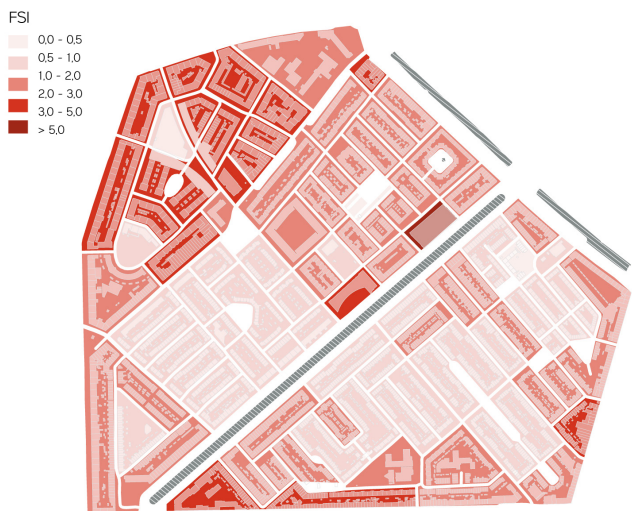
Typical pre-war urban block in Bloemhof, FSI = 1.1



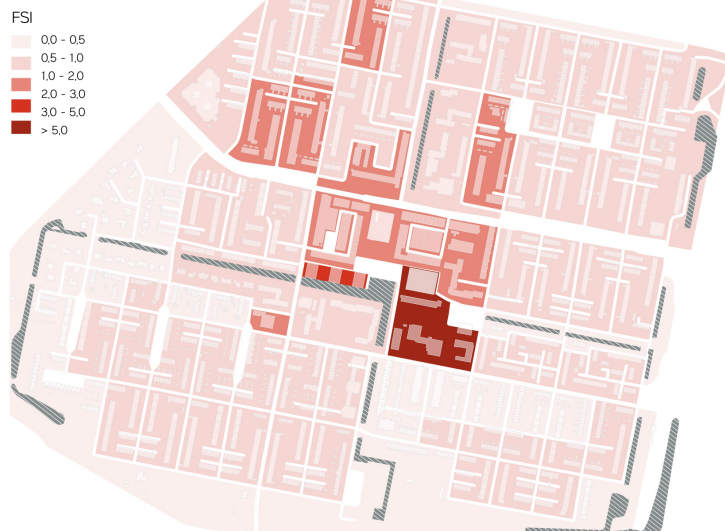
Typical post-war urban block in Pendrecht FSI = 1.1

The maps below show the built density and the compactness of both neighborhoods Bloemhof and Pendrecht. Bloemhof has a higher built density and compactness than Pendrecht. This can be explained by the ideology behind the design of the Pendrecht. The modernist typology consists of an open urban block. This lowers the compactness of the urban block. As can be seen in the maps of the GSI, the average GSI of Bloemhof is twice as high as the average GSI of Pendrecht. This difference in compactness and density is also experienced by the user of the area.

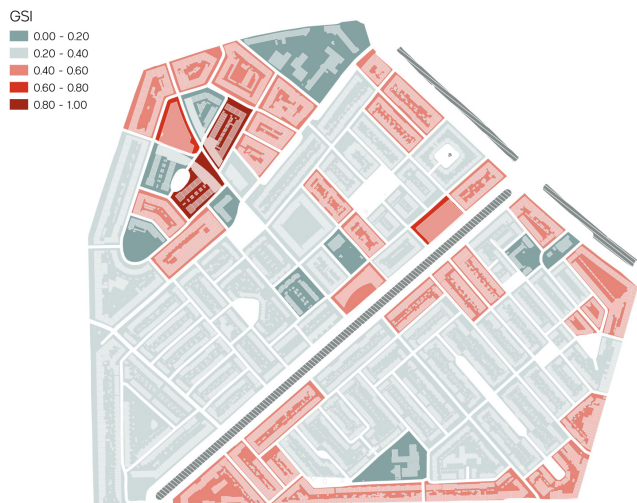
Average FSI of Bloemhof = 1,43



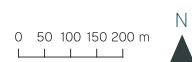
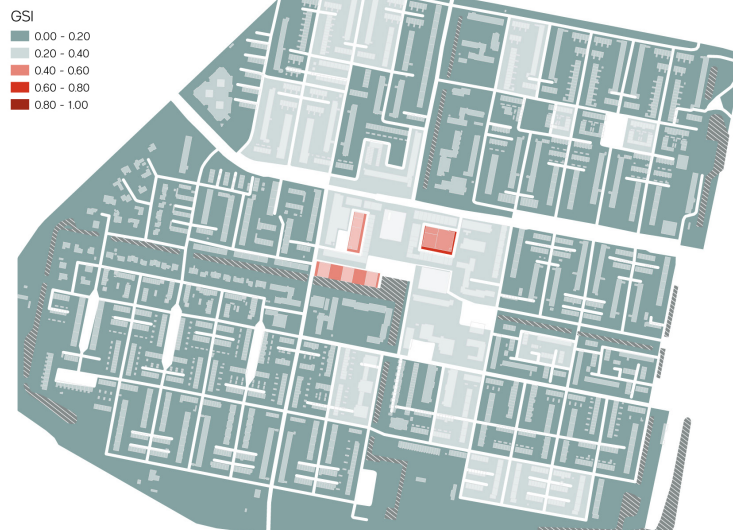
Average FSI of Pendrecht = 0,95



Average GSI of Bloemhof = 0,42



Average GSI of Pendrecht = 0,23



Street network

Road hierarchy

The street network in a city can be classified according to the degree of openness and accessibility. The classification shows a hierarchy of the importance of the street as a part of the total street network. Each class connects two or more different scales ranging from neighborhood to national level. A class can contain different street typologies. The classification that is chosen to identify the importance of the road in the city and neighborhood in this project is: (1) primary road, (2), secondary road, (3) tertiary road, and (4) residential road.

1. Primary road

A primary road is an important road in the city that often connects different neighborhoods, links to the highways, and often connects to neighboring and nearby cities or towns. The roads facilitate a fast connection throughout the city. It is also referred to as the arterial road. Typologies that are considered primary roads have a wide profile, separates fast traffic from slow traffic and do not have parking spaces.

2. Secondary road

A secondary road is the main road of a neighborhood and connects the different communities within a neighborhood, and sometimes connected to neighboring and nearby cities or towns. It is also referred to as the collector and distributor road. Typologies that are considered secondary roads have two lanes, often separates fast traffic for slow traffic, might have parking spaces along the road. A specific typology of a secondary road is a boulevard or city lane.

3. Tertiary road

A tertiary road connects the communities within the neighborhood and in most cases the street itself is the neighborhood center. Fast traffic and slow traffic are often using the same lane. The roads connect residential area, but also connect local functions, like shops, schools, and churches. The roads are also referred to as city streets. Typologies that are considered tertiary roads have two lanes, fast traffic and slow traffic share the road, and have parking spaces along the road.

4. Residential road

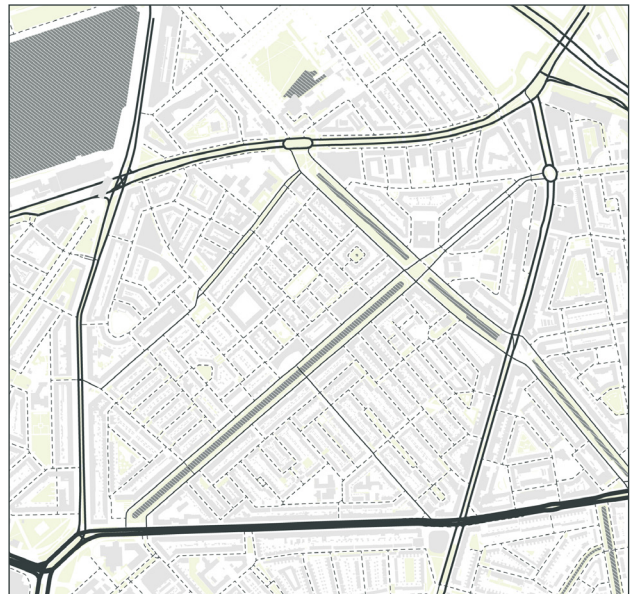
A residential road is a local road that has a single purpose, which is to facilitate access to people's houses. The roads are not used as through routes but have one destination. Typologies that are considered residential roads have one or two lanes, fast traffic and slow traffic share the road, can be a one direction road or a dead end road and often have parking spaces along the road or it is allowed to park on the road.



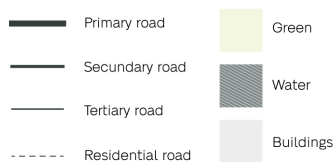
fig 46. Road hierarchy diagram (Author, 2019)



Pendrecht



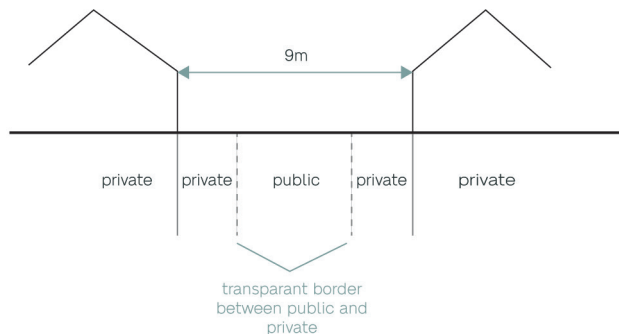
Bloemhof



Public - Private domain

Bloemhof

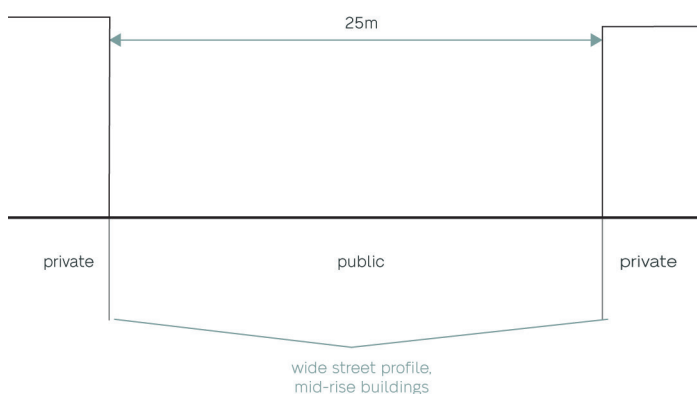
The majority of the street profiles in Bloemhof are characterized by small residential streets with low-rise houses. These streets do not have a side walk and have limited space for parallel parking. The houses in these streets often have a small front garden, which creates a buffer zone between public and private, but often remains transparent in the sense that the border between public and private is still at the facade of the house.



source: author, 2019

Pendrecht

The majority of the streets in Pendrecht are characterized by the wide street profile which is public. Most of the time the profile reaches a width of 25 meters inside the neighborhood, but can be up to 50 meters when it is a main road of the neighborhood. The border between public and private in Pendrecht is clearly demarcated, as the border is often the facade of a building.



source: author, 2019

Streetprofiles / Bloemhof

Pre-war neighborhoods were built in an era where cars did not dominate the street. With the rise of car use, more parking spaces were required. this makes the profiles in these neighbourhoods seem small. the parking spaces are in most cases parallel and on one side of the streets.

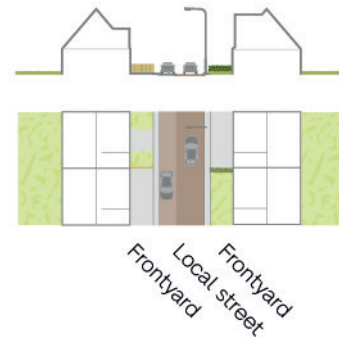
1. Jasmijnstraat

Typology: Local street

Hierarchy: Residential road

Characteristics:

Destination roads, one-way road, no side walk, parallel parking



2. Putsebocht

Typology: Local street

Hierarchy: Residential road

Characteristics:

Destination roads, one-way road, no side walk



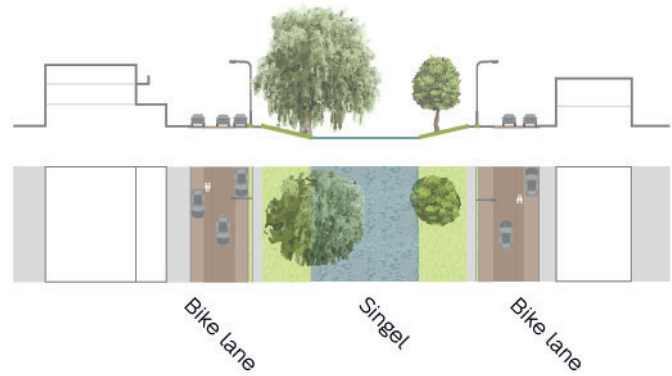
3. Lange Hilledijk

Typology: Local street

Hierarchy: Residential road

Characteristics:

Destination roads, roads that lead to parking pockets, dead end streets.

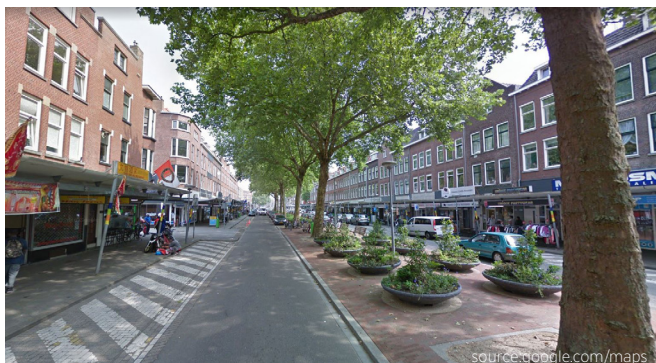
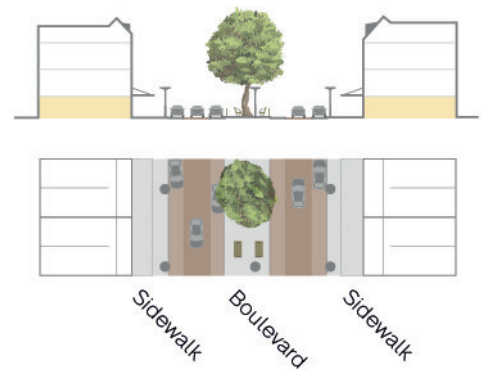


4. Groene Hilledijk

Typology: City boulevard

Hierarchy: Secondary road & Residential road

Characteristics: Connects the neighborhood to the rest of the city, Separated car lanes with parallel parking,



Street profiles / Pendrecht

Post-war neighborhoods were built with the ideology that revolves around the car. Therefore the traffic flows are separated and the streets have wide profiles. The road hierarchy in these post-war modernist neighborhoods is strong.

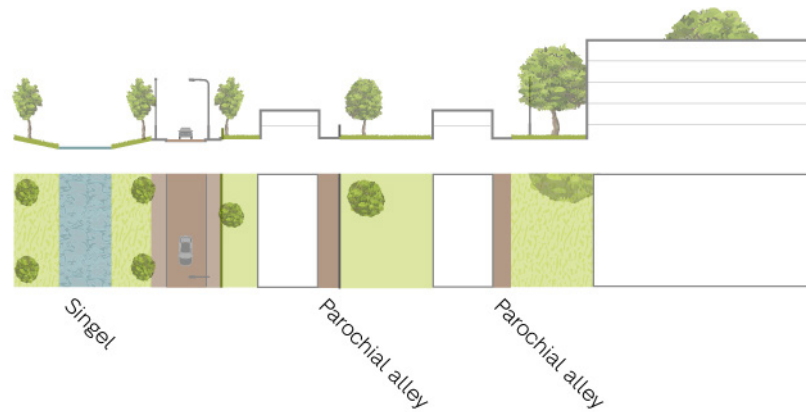
1. Tiengemetensingel

Typology: Singel

Hierarchy: Tertiary road

Characteristics:

Quality of the public space provided by the body of water, lawns and trees, roads are parallel to the water,

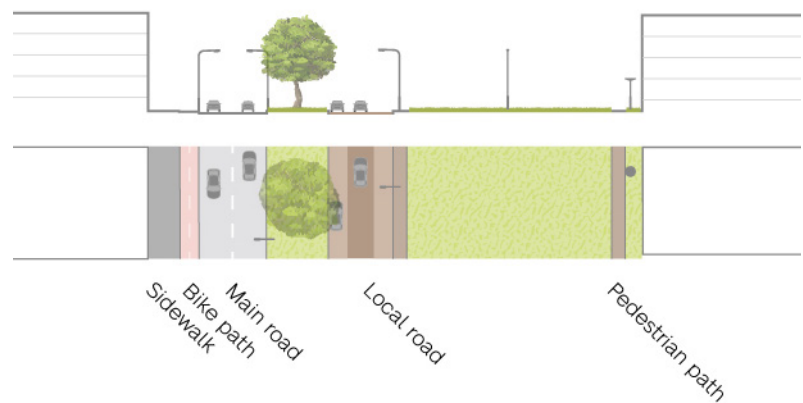


2. Slinge

Typology: City street

Hierarchy: Secondary road & Residential road

Characteristics: main connector of the neighborhood, separated traffic flows, wide street profile with priority for cars,.



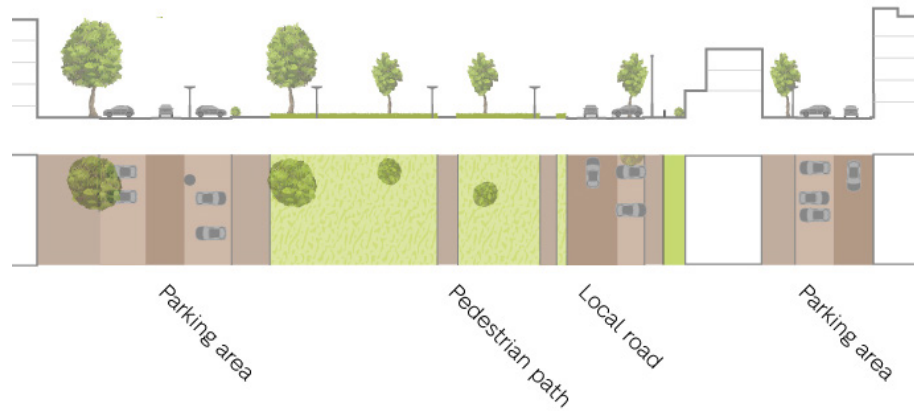
3. Herkingenstraat

Typology: Local street

Hierarchy: Residential road

Characteristics:

Destination roads, roads that lead to parking pockets, dead end streets.



4. Oldegaarde

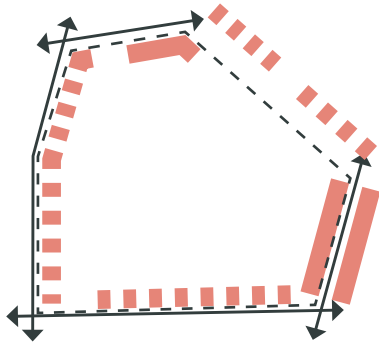
Typology: City boulevard

Hierarchy: Secondary road & Residential road

Characteristics: Connects the neighborhood to the rest of the city, separate car lanes with parallel parking, parallel road and separate bike lane.

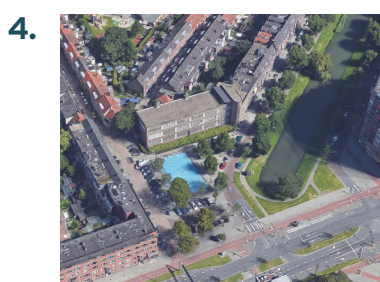
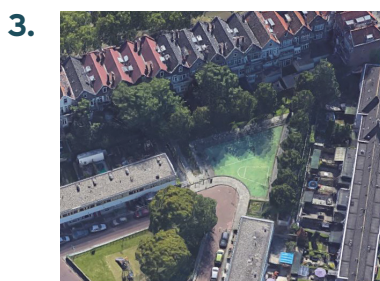
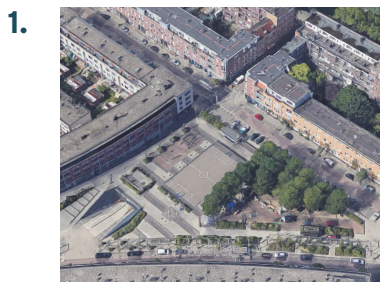


Public space



Landuse

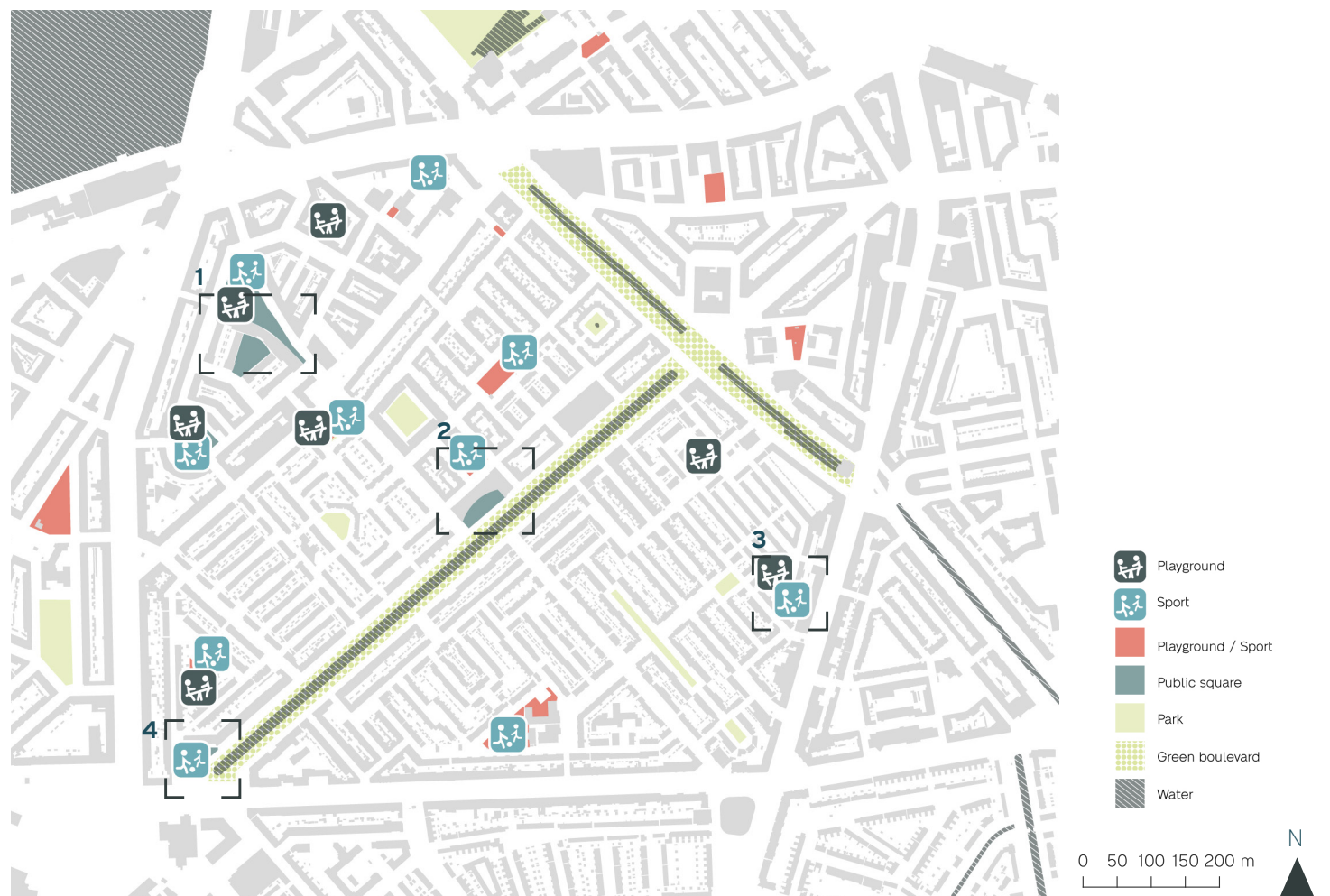
Most of the facilities in Bloemhof are located on the edge of the neighborhood. The main location is the Groene Hilledijk, which is located on the western edge of the neighborhood. This boulevard has developed over time from the 1900 into a well-known shopping promenade. Nowadays the boulevard is still in use and multicultural shops can be found here. On the east side of the neighborhood the same land use can be found, shops and restaurants on the edge of the neighborhood. Right in the middle of the neighborhood is a local shopping centre and schools can be found on the inner part of the neighborhood as well.

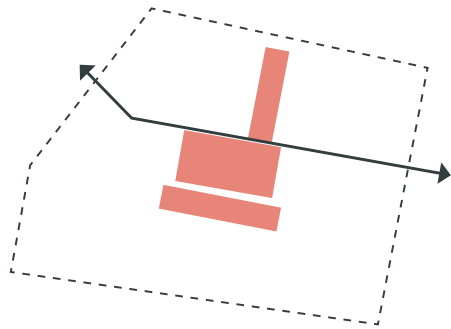


sources: google.com/maps

Public Space

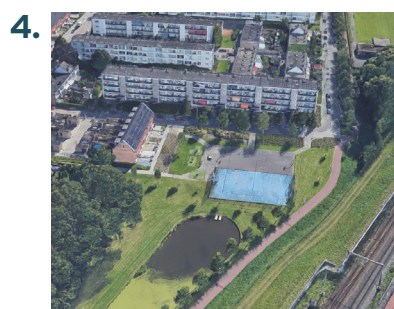
Due to the high density of the buildings in Bloemhof most of the spaces are privatized, which leaves less public space. The public spaces that are present, are small scale and fragmented. Most of the public spaces have a designated function like playgrounds and sports facilities (pictures 1, 3, and 4). Due to the fragmented public space spread throughout the neighborhood. The green axis in the middle of the neighborhood, Lange Hilledijk, and the green axis on the north-east fringe of the neighborhood, have no quality for staying for a long period of time and have only one adjacent public space which is located in front of the local shopping centre (picture 2).





Land use

Pendrecht is built with a strong belief in the separation of functions. This can still be seen today, with a center where the urban functions are located, an area of schools and four residential areas around the center. The separation of functions is rarely applied nowadays and urban development focuses mainly on mixed-use. Mixed-use fits the contemporary lifestyle better as it facilitates a close proximity to urban services and facilities. The center of facilities in Pendrecht is located on the main road of the neighborhood, and is best accessible from the north, as the south is merely only assessible for pedestrians and cyclists.



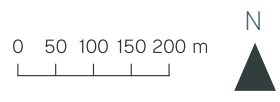
sources: google.com/maps

Public Space

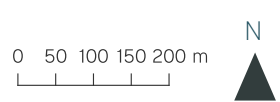
Pendrecht has one main square, Plein1953 (photo 2). The square is surrounded by mainly shops, restaurants, and water. There are small public spaces throughout the neighborhood, of which most are playground. The metro-station Slinge has a public square on the edge of the neighborhood (picture 1). It is important to note that the public space present, especially the playgrounds, are located on the edges of the neighborhood. These playgrounds are tucked away in a corner of the neighborhood with little visibility (for example photo 4). The quality and usability of the urban green in the neighborhood is low and has no function besides being scenery for passers-by and residents with direct view on the green area.



- Bar
- Restaurant
- Local grocery shop
- Supermarket
- School
- Church
- Mosque



- Playground
- Sport
- Playground / Sport
- Public square
- Park
- Green boulevard
- Water



Public Lighting

In order to facilitate good visibility in an area in the evening and at night, public lighting is very important. Poorly lit areas tend to be avoided by people, because people experience a higher level of unsafety in the dark. The light radius of a street lantern can be calculated with a formula (fig 47):

$R = H \times 3$

R = Radius projected on the ground
H = Height of the street lantern.

The height of most street lanterns in residential areas in Rotterdam is 6 meters. This creates a radius of 18 meter around the street lantern that can be lit.

Public lighting in a residential street is often well organized and the light reflect on the buildings. In some cases the public lighting of public spaces can be poor. This makes poorly lit public spaces an unpleasant place to be during the evening and at night as they often attract unwanted and sometimes illegal behaviour

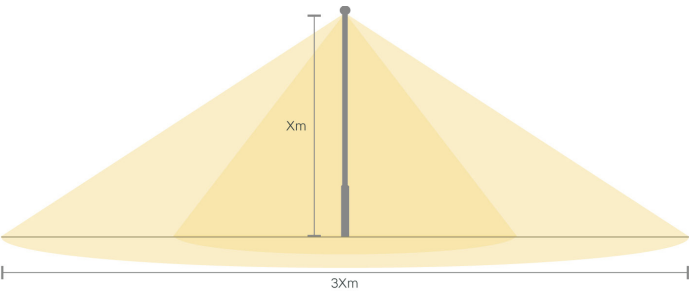
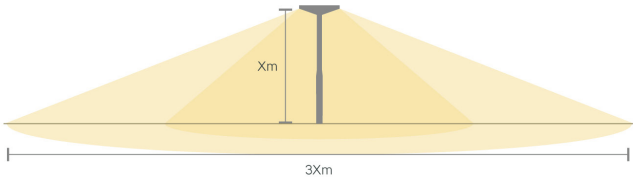
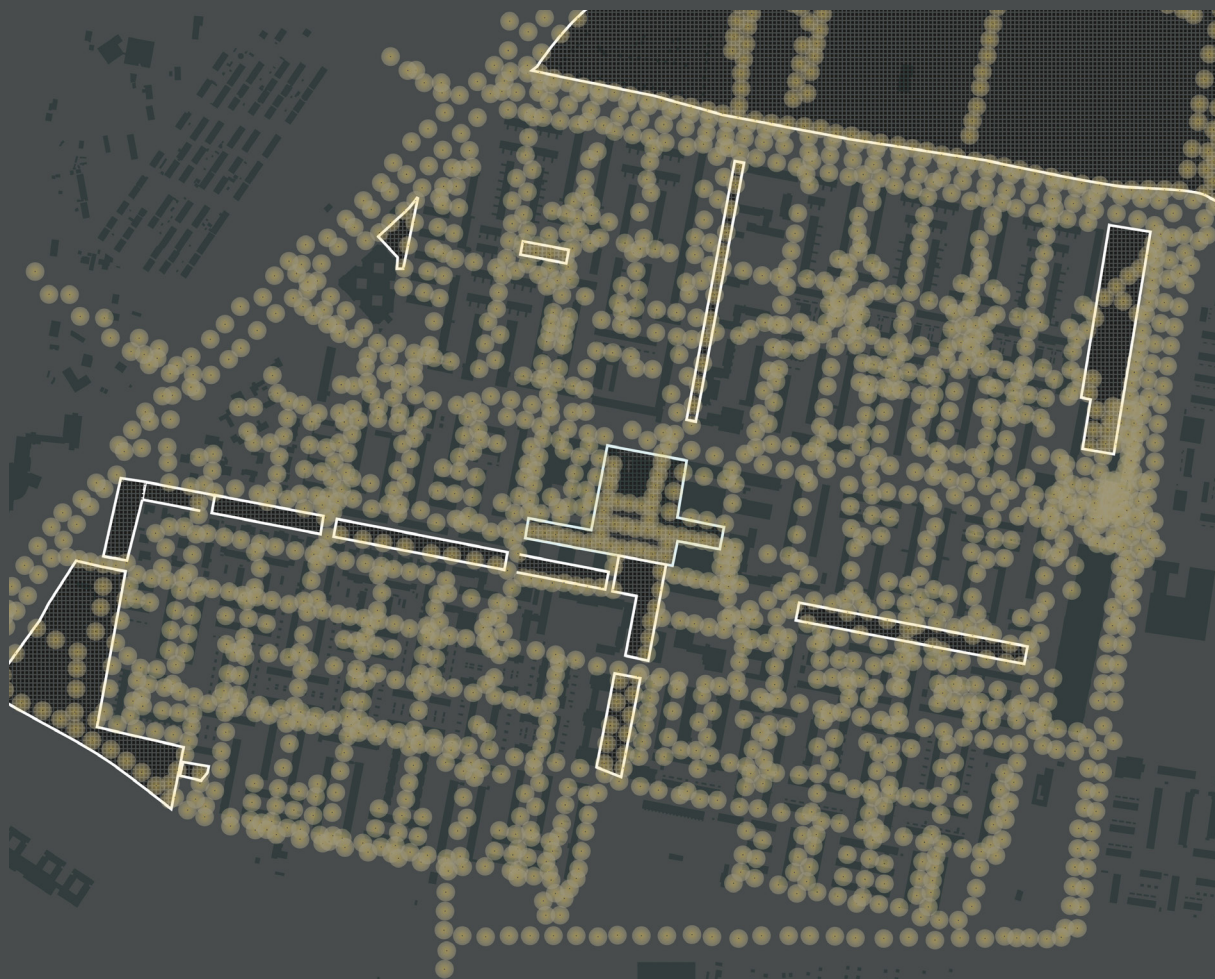


fig 47. lighting radius of a streetlantern.





Visibility

Frontdoor density

According to research done by de Rooij and van Nes (2015) the density and degree of inter-visibility between front doors has an influence on the liveliness and degree of social control on streets. In their research they state that 'the more entrances and windows connected and oriented towards the streets on ground floor level, the greater chance that someone keeps an eye on the streets' (De Rooij & Van Nes, 2015, p. 139:4).

The data mapped (fig 49 and fig 50) on the front doors in the neighborhood Bloemhof and Pendrecht is generated and calculated in QGIS. In order to calculate the density the following equation is used:

$$N / \text{length} = \text{Density}$$

N = number of front doors

Length = length of the street in meters

The outcome is number of front doors per meter of the street. The lower the density of the front doors in a street the higher chance of low perceived safety. There are, however, other spatial characteristics that can have an influence on the relationship between front door density and perceived safety. For example, a street can have high density of front doors, but the front doors are visibly blocked by a hedge.

Figure 29 shows the front door density in Bloemhof, the calculated average front door density in the neighborhood is 0,13. This means that ever 10 meters of street in the neighborhood has 1,3 front doors. Most of the front doors in the neighborhood are entrances to individual dwelling of rowhouses.

Figure 30 shows the front door density of Pendrecht, the calculated average front door density in the neighborhood is 0,09. This means that every 10 meters of street in the neighborhood has 0,9 front doors, so there is less than 1 front door per 10 meters. Besides the low density of the front doors in Pendrecht, in some cases the distance between front doors can range up to 20 or 30 meters, which creates a long distance without front doors and lowers the social control. In contrast with Bloemhof, a large part of the front doors in Pendrecht are entrances to apartment blocks, which are used by multiple residents. This lowers the amount of front doors.

The research by de Rooij and van Nes (2015) on perceived neighborhood safety in three neighborhoods in Rotterdam, they research Pendrecht. They found out that most streets in Pendrecht lack front doors along streets, which results in a low intervisibility of front doors (fig 48). Their analysis showed that the north-south direction streets have the least inter-visibility in the neighborhood.

In the appendix (page 215) four additional maps can be found on the frontdoor density, among them two heat-maps of the frontdoor density.

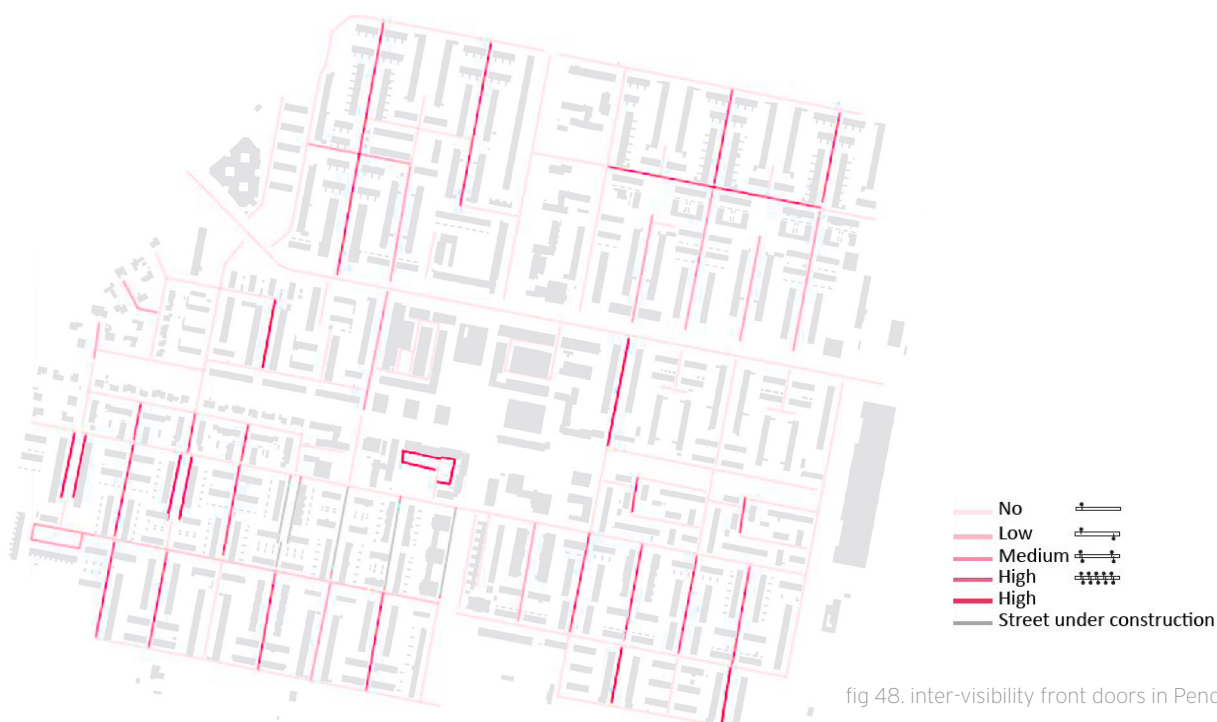


fig 48. inter-visibility front doors in Pendrecht (L. van Rooij, 2011, edited by author)



Frontdoor density

0.00 - 0.09
0.10 - 0.19
0.20 - 0.29
0.30 - 0.40

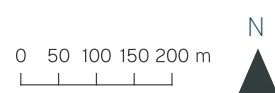


fig 49. Front door density in Bloemhof. Data generated and calculated in QGIS by author



Frontdoor density

0.00 - 0.09
0.10 - 0.19
0.20 - 0.29
0.30 - 0.40

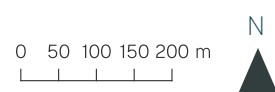


fig 50. Front door density in Pendrecht. Data generated and calculated in QGIS by author

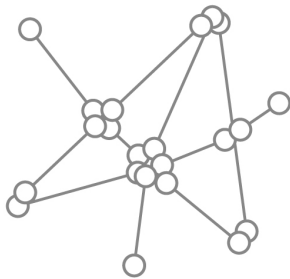


fig 51. Irregular sightlines

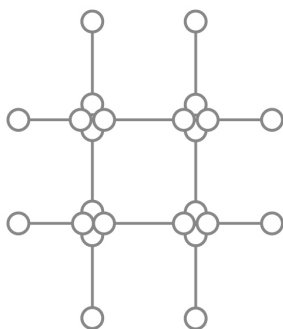


fig 52. Regular orthogonal sightlines

Sightlines

In order to facilitate good visibility in the built environment their need to be sufficient uninterrupted sightlines. Because people tend to follow the longest sightline that leads to where they are heading. "Visibility graph analysis can be used to characterize a built environment by imposing either a regular or an irregular grid on top of the space accessible for movement. The graph is created in terms of how each point of the grid is visible to other points." (Natapov & Fisher-Gewirtzman, 2016). The urban fabric has a large influence on the orientation, length and continuity of sightlines. Through careful urban design it is possible to create many views and sightlines that connect different parts of an area. Sightlines also can connect a semi-private or collective courtyard with the public spaces outside (Ceccato, 2012).

Bloemhof has, due to its pre-war nature, a less regular street pattern. This creates an irregular pattern of sightlines, which can result in multiple sightlines having a view at the same location, explained in the conceptual drawing on the left (fig 51). The length of a sightline is also important for the visibility of an area. A sightline can be infinitely long but people can only see up to a distance of 4,7 kilometers, which marks the horizon. The sightline length in Bloemhof is 201m. The sightlines along the edges of the neighborhood are around 1 kilometer, where the sightlines inside the neighborhood can be very short.

In Pendrecht the sightlines are oriented orthogonally. A regular orthogonal orientation structure of sightlines causes a lack of a central location in the urban fabric (fig 52). In Pendrecht the north-south sightlines are long, of which some extend throughout the neighborhood. The east-west sightlines tend to be shorted with a few exceptions.

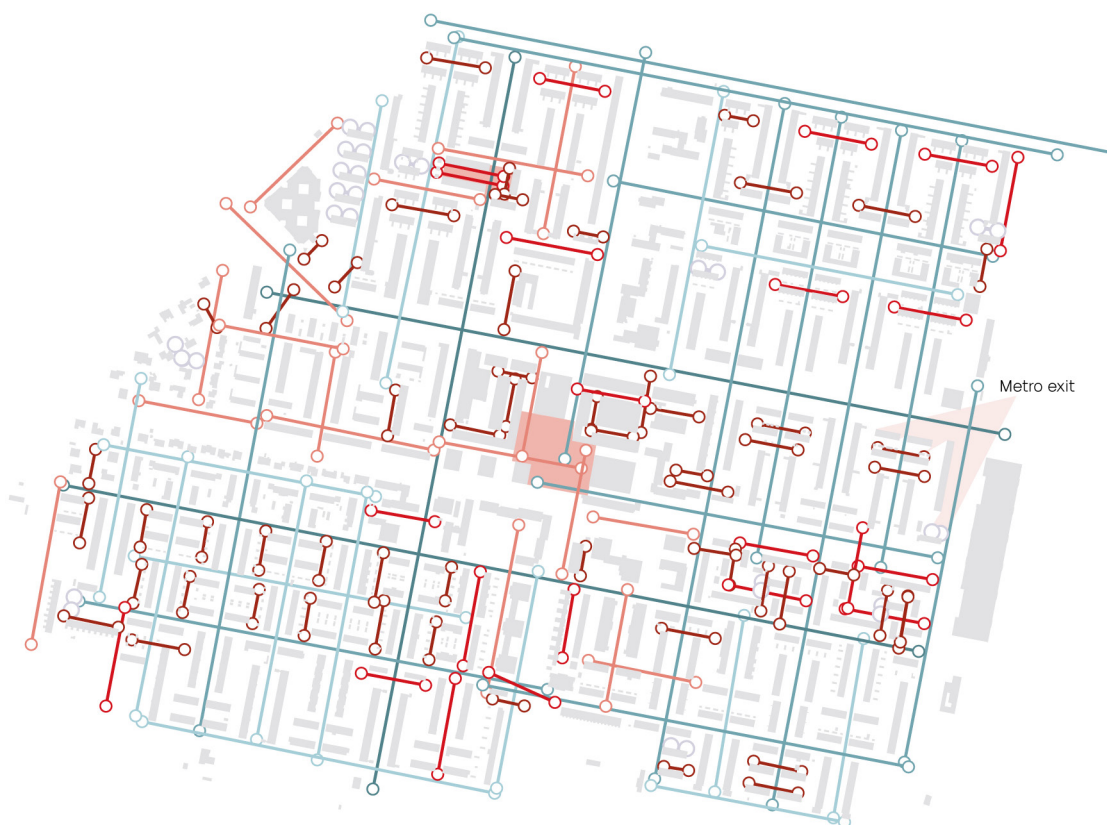
It must be noted that this analysis on this scale has not taken into account the other physical elements, like trees, signs and cars can interrupt the sightlines and therefore the visibility. In a later phase of the project, when the analysis will be done on a smaller scale these physical elements will be taken into account in order to assess the visibility.



Sight lines (meters)

- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 250
- 250 - 500
- 500 - 1000
- > 1000

0 50 100 150 200 m



Sight lines (meters)

- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 250
- 250 - 500
- 500 - 1000
- > 1000

0 50 100 150 200 m



Spatial integration

Pendrecht has become, due to its modernist ideologies of the 'wijkgedachte', strong hierarchy in streets and orthogonal urban structure a very spatially segregated neighborhood. The graph below, generated by de Rooij (2011) in space syntax, shows the integration of the street network. The spatial segregation is not only due to the orthogonal orientation of the street pattern, but also due to the areas general disconnect from the rest of the city. Another spatial cause of the segregation is the amount of dead-end streets (see page 83), inside the neighborhood and on the edges of the neighborhood.

A remarkable conclusion that can be drawn from the space syntax analysis is the fact that the most highly integrated street is not the main street, but a parallel street on the south.

As mentioned in the theoretical framework (page 47), the accessibility in a neighborhood depends on the spatial integration of the street network. Spatially segregated streets tend to have less people in the street, which influences the social control and therefore the perceived safety in an area.

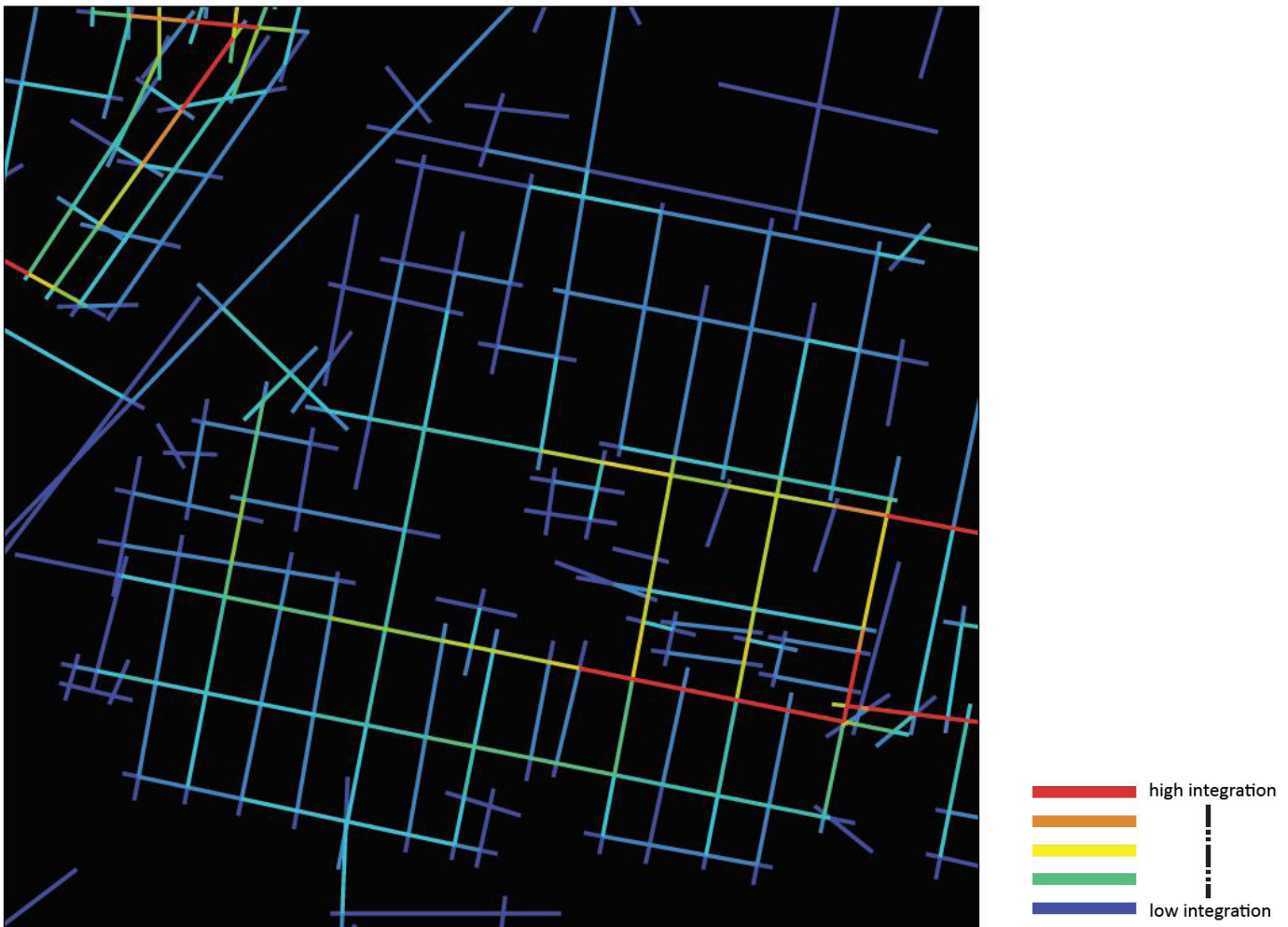


fig 53. Spatial integration street network Pendrecht, Space syntax analysis, angular choice analysis, with low metric radius (source graphic: de Rooij, 2011)

Parking in dead-end streets

The dominant presence of infrastructure and car use in Pendrecht has created space in the neighborhood that are potentially unsafe. The specific spaces of concern are the parking areas that are at the end of a dead end street. Even more markable that the same space is a transition to a pedestrian green zone, which is located between mid-rise/high-rise buildings. Due to the spatial segregation or these T-junctions, the low inter-visibility of frontdoors and the fragmented pedestrian network these areas are potentially unsafe spaces.



Conclusion

There are several spatial characteristics that became apparent during the analysis that were related to perceived safety.

Visibility

The orthogonal orientation of the neighborhood create a grid-like sightline structure, this reduces the chance visibility on central locations.

The frontdoor density and inter-visibility in some parts of the neighborhood is low or non existing, which reduces the social control and causes blind walls.

Legibility

The openness of the building blocks in combination with the ill defined territories reduces the legibility in the neighborhood. The green public spaces are planned according to the 'light', 'air', 'space' concept from the modernist movement, but the intended collective function of the green areas do not function due to the poor legibility and lack of ownership.

Accessibility

The space syntax analysis showed the spatial integration of the street network. It became apparent that certain areas are less integrated and therefore, less accessible. The public square is nearly visible from the main street. The accessibility and visibility of the public square, Plein1953, can be improved.

Attractiveness

The architecture and public space designs are outdated, with a few exceptions and need to be regenerated in order to provide a level of quality. The photo study showed the amount of trash laying around in the neighborhood. When people take responsibility for public space and the social control increases it is more likely that people will not leave trash on the streets.

Results case study Bloemhof

The case study of the neighborhood Bloemhof resulted in insights that are useful for the next phase of the project. Both positive and negative spatial characteristics will be considered in the next phase.

A few lessons are learned from looking simultaneously at a pre-war and post-war neighborhood.

1. The urban structure of Bloemhof in comparison with Pendrecht is irregular instead of orthogonally, this results in a more diverse street pattern, in combination with the various architectural characteristics in the neighborhood, this results in a more interesting and attractive neighborhood.
2. Bloemhof, like Pendrecht, has spatially segregated streets. However, the segregated streets in Bloemhof have a higher frontdoor density and inter-visibility than the segregated streets in Pendrecht. This increases the social control and on a small scale can create a community among the residents of the street.
3. The building blocks in Bloemhof have a higher GSI, which means the building blocks are more compact. As a result the share of total border length accompanied by buildings is higher. A lower percentage of openness contributes to the definition and legibility of the public and private realms. The continuous building blocks on the edge of the neighborhood house mostly facilities, which creates a lively streets with multicultural shops and restaurants. The compactness of the enclosed building blocks creates streets with high front doors density and inter-visibility. The building blocks in Pendrecht are very open and the neighborhood has a central shopping area, which is poorly connected. Due to the orientation of the open building blocks, there is less inter-visibility between the front doors.
4. The residential street profiles of Bloemhof are narrow and therefore less car oriented. The narrow streets create the possibility of building a community, because the chance of meeting your neighbors in the street is higher and this could increase the social control.

6 / Survey on Perceived Safety

This chapter shows and elaborates on the survey that is conducted among residents of the neighborhood. The aim of the survey is to answer the research question: *how do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht?* Participants were asked to share their views on various (perceived) safety aspects and overall satisfaction in the neighborhood. The results from the survey are used to gain useful insights from the residents and will be used later on in the project to develop the neighborhood transformation design.

6.1 / Survey

The survey is conducted in order to answer the research question: how do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht? The survey focusses on the perceived safety in the neighborhood, the neighborhood satisfaction, and demographic characteristics of the participants. The intention of the survey is to gain insight into how the residents experience and use their neighborhood. Therefore, the survey was only conducted among residents of the neighborhood, who regularly use their neighborhood and not only visit the neighborhood.

Participants were asked to answer several questions related to perceived safety, neighborhood satisfaction, and several demographic questions. Because the questions are personal, the participants were always given the option to not answer the question, with exception of the residential zip code which was needed to confirm that the participant is a resident of the neighborhood.

The survey has been distributed in a Facebook group that is related to the neighborhood and on the street. The risk of sharing the survey in a social media group that is related to the neighborhood, is that the members of these groups are often more involved and attached to their neighborhood. As mentioned in the disorder perception theory (page 44), people who are attached to their neighborhood and are satisfied with their community tend to see less disorder (Wallace, 2015). However, in this case, after observing the social media behavior of the members in this group, these residents are very concerned with their environment and might perceive disorder more than other people.

There were 32 participants who completed the survey. The demographic composition of the participants is shown in the tables on the right. Among the 32 participants were 13 men, 18 women, and one participant of which the gender is unknown. The majority of the participants are older than 50 years. In this sample the younger ages groups are less represented, this should be taken into account when interpreting the results. Therefore, the average age of the men who participated is 52 years and the average age of the women who participated is 60 years old.

Age group					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30 year	3	9,4	9,7	9,7
	30-40 year	3	9,4	9,7	19,4
	40-50 year	3	9,4	9,7	29,0
	50-60 year	9	28,1	29,0	58,1
	60-70 year	7	21,9	22,6	80,6
	70-80 year	6	18,8	19,4	100
	Total	31	96,9	100	
Missing	System	1	3,1		
Total		32	100		

Average age male participants			
Age			
N	Valid	12	
	Missing	1	
Mean		51,83	

Average age female participants			
Age			
N	Valid	18	
	Missing	0	
Mean		60,17	

A copy of the survey can be found on page 216 in the appendix.

6.2 / Results

One of the main questions in the survey is whether residents feel safe walking alone on the street during the day or at night. These two questions assess the overall safety in the neighborhood. The graphs on the right show the results of the answers. The top graph shows the results of feeling safe during the day, and shows that almost all participants assess their safety positively during the day. The graph below shows the results of feeling safe during the night, the results of this graph show that the participants assess their safety more negatively during the night. Over 50% of the participants disagreed with the statement 'I feel safe when I walk alone on the street during the night'.

Building on these results, it is interesting to analyze this data for subgroups. Therefore, it was further investigated whether there is a difference between age groups and safety perception and between gender and safety perception. It is important in this analysis to note that the sample is not large enough to demonstrate a significant relationship. Furthermore, it should be taken into account that the sample mainly consists of people over 50 years old and that the relationship between age and safety experience can be influenced by this.

Table 1 and Table 2 show whether the sense of feeling safe during the day and at night correlates with age. Both tables show a negative correlation between the variables. Which means that the older participants feel less safe than younger participants. Although, the correlations are not significant, because the p-value is not less than 0.05, it does show an important insight that older people feel less safe.

Correlations				
Spearman's rho	Age groups	I feel safe if I walk alone on the street during the day		
		Correlation Coefficient	1,000	-,260
		Sig. (2-tailed)	.	,158
		N	31	31
	I feel safe if I walk alone on the street during the day	Correlation Coefficient	-,260	1,000
		Sig. (2-tailed)	,158	.
		N	31	32

Table 1. correlation between age and feeling safe during the day

Correlations				
Spearman's rho	Age groups	I feel safe if I walk alone on the street during the night		
		Correlation Coefficient	1,000	-,192
		Sig. (2-tailed)	.	,300
		N	31	31
	I feel safe if I walk alone on the street during the night	Correlation Coefficient	-,192	1,000
		Sig. (2-tailed)	,300	.
		N	31	32

Table 2. correlation between age and feeling safe during the night

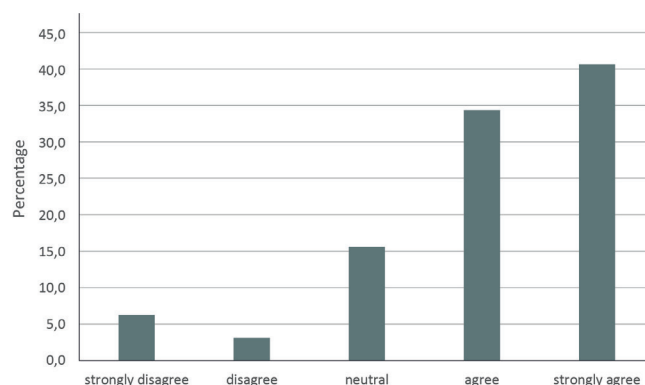


fig 54. results of the question I feel safe when I walk on the street alone during the day

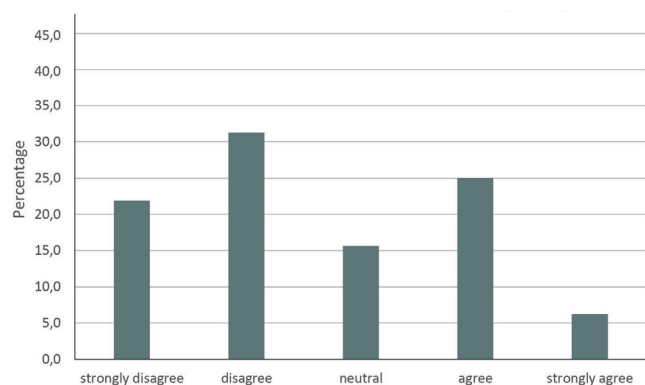
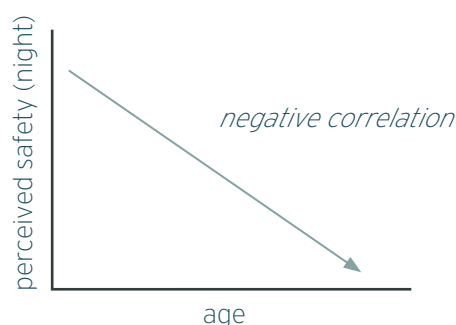
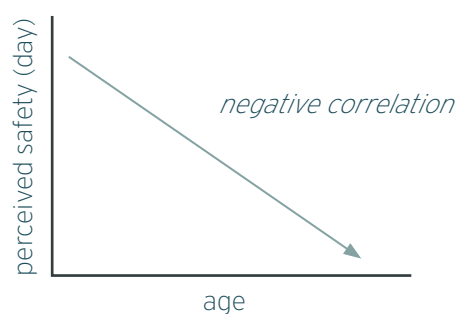


fig 55. results of the question I feel safe when I walk on the street alone during the night



Furthermore, it was examined whether the feeling of safety during the day and at night depends on gender. The results are shown on the next page. A crosstab and a Chi-square test were used to measure significance. However, with a sample of N = 32 this will never really be significant and because such a small sample has been used, the significance is measured with a lower value, $p < 0.10$. The first dependence that has been investigated is the feeling of safety during the day and gender. The Chi-square table indicated that this dependence is not significant (Table 4) but it does show that men feel less safe than expected. This is derived from Table 3 from the observed count and the expected count, in the disagree categories the observed count of the male participants is higher than the expected count.

Feeling safe during the day X Gender

Crosstab					
			What is your gender?		Total
			Male	Female	
I feel safe when I walk alone on the street during the day	Disagree	Count	2	0	2
		Expected Count	,8	1,2	2,0
	Neutral	Count	2	3	5
		Expected Count	2,1	2,9	5,0
	Agree	Count	9	15	24
		Expected Count	10,1	13,9	24,0
	Total	Count	13	18	31
		Expected Count	13,0	18,0	31,0

Table 3. crosstabulation of feeling safe during the day and gender

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2,971 ^a	2	,226
Likelihood Ratio	3,680	2	,159
Linear-by-Linear Association	1,896	1	,169
N of Valid Cases	31		

a. 4 cells (66,7%) have expected count less than 5. The minimum expected count is ,84.

Table 4. Chi-Square test of feeling safe during the day and gender

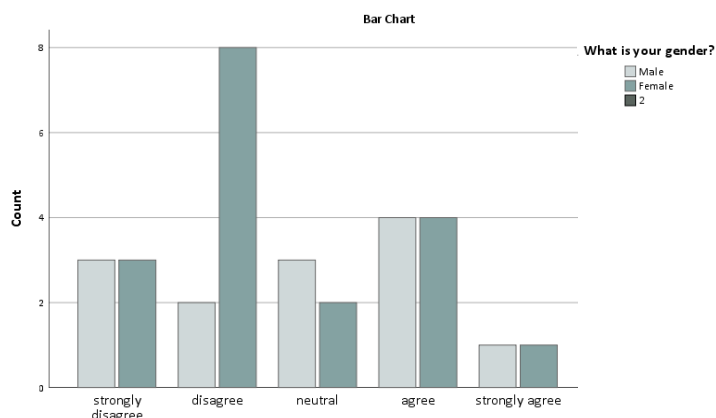


fig 56. Results of the sense of feeling safe during the day for men and women separately

The second dependence that has been investigated is the feeling of safety during the night and gender. The Chi-square test (Table 6) shows that there is no significant dependence between feeling safe during the night and gender. This means that neither men or women are feeling more (un)safe during the night. The graph (fig 57) also shows that the distribution of men and women are spread. Although, there is one bar that stands out, which is women who disagree with the statement 'I feel safe when I walk down the street during the night'.

Feeling safe during the night X Gender

Crosstab					
			What is your gender?		Total
			Male	Female	
I feel safe when I walk on the street alone during the night	Disagree	Count	5	11	16
		Expected Count	6,7	9,3	16,0
	Neutral	Count	3	2	5
		Expected Count	2,1	2,9	5,0
	Agree	Count	5	5	10
		Expected Count	4,2	5,8	10,0
	Total	Count	13	18	31
		Expected Count	13,0	18,0	31,0

Table 5. crosstabulation of feeling safe during the night and gender

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1,687 ^a	2	,430
Likelihood Ratio	1,697	2	,428
Linear-by-Linear Association	1,013	1	,314
N of Valid Cases	31		

a. 3 cells (50,0%) have expected count less than 5. The minimum expected count is 2,10.

Table 6. Chi-Square test of feeling safe during the night and gender

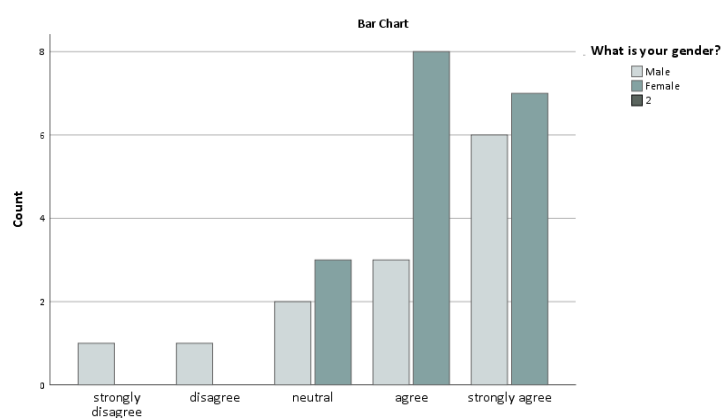


fig 57. Results of the sense of feeling safe during the night for men and women separately

Besides the statements about feeling safe during the day and at night, the participants were also asked to give their opinion on other statements related to perceived safety, neighborhood satisfaction, and disorder. The graph below (fig 58) shows the mean scores on a 5-point scale. Overall, the neighborhood satisfaction is assessed positively. The disorder, which are the last four statements, is assessed worse. The participants mainly assess the nuisance of waste on the streets negatively, and the results show that they often experience waste on the streets. This is a sign that could influence the perceived safety, because waste on the streets show that not a lot of people care about the environment and that there is no sense of responsibility.

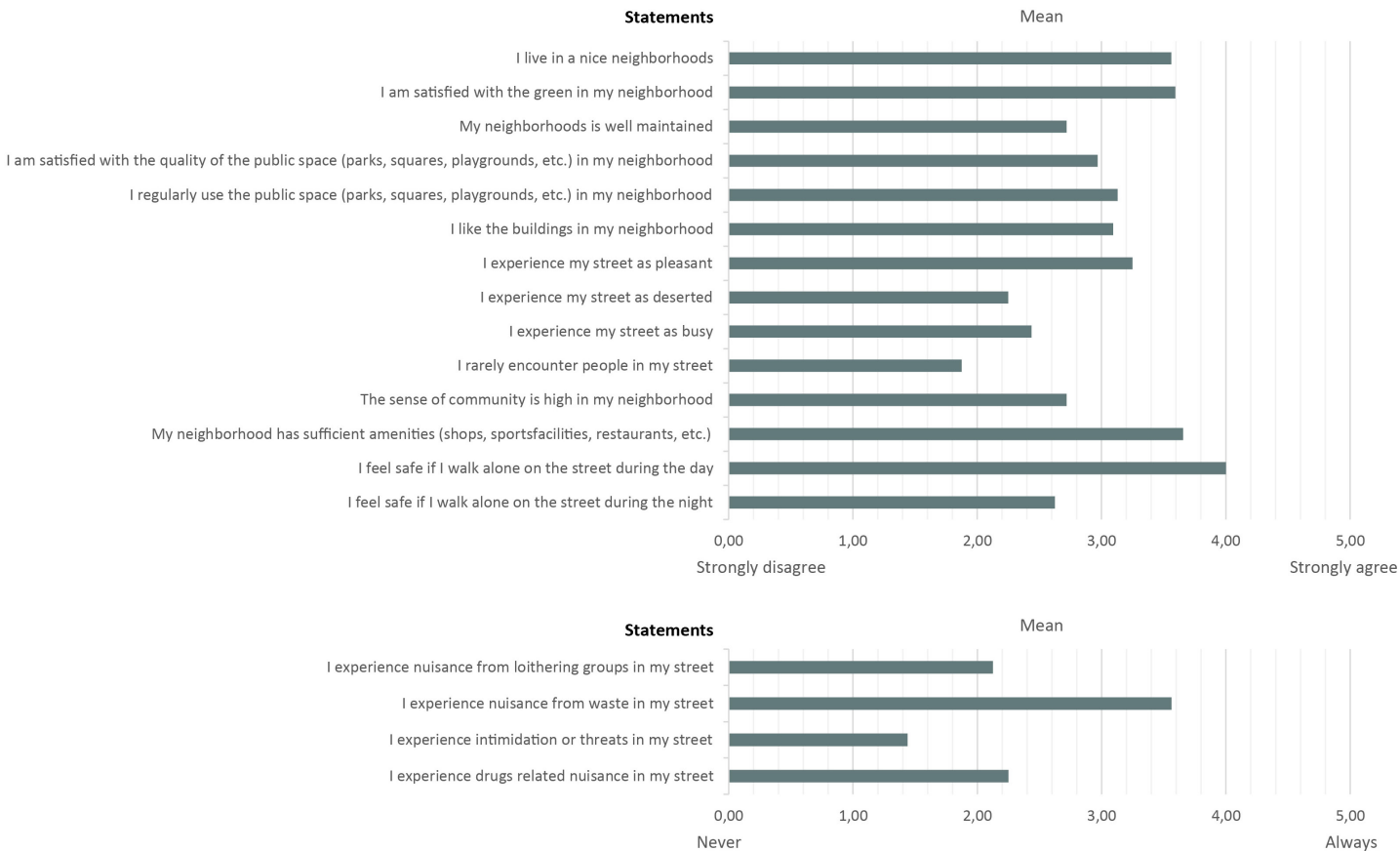


fig 58. Results of the statements, presented as the mean of the results on a 5-point scale

Length of residence x experiencing nuisance

The disorder perception theory stated that neighborhood attachment influences the perception of disorder (Wallace, 2015). Therefore, I have also tried to find a correlation between how long the participants have been living in Pendrecht, and how often they experience nuisances. The table on the right (Table 7) shows these correlations. Because of the small sample size (N=32), a less strict p-value is used to measure the correlation. The p-value needs to be below 0.10 to be significant. None of the results have a p-value below 0.10. However, the correlation coefficient of experiencing intimidation or threats with how long the participant has been living in the neighborhood is close to being significant. This means that people who live longer in the neighborhood more often experience intimidation. This can also be explained based on the fact that people who live longer in the neighborhood, might be older in age, which could be in line with the disorder perception theory that older people are more likely to fear crime.

Other relationships that have been investigated based on the disorder perception theory are the relationships between how many neighbors the participants know and the sense of community with feeling safe during the day and at night. These results are shown in the four tables on the right. Again, the significance is measured less strictly than normal, which a p-value lower than 0.10.

The relationships between how many neighbors the participants know and feeling safe during the day and at night is not significant. However, the relationship between the sense of community and feeling safe during the day and at night is significant. Which means that the participants who rate a higher sense of community also feel more safe during the day and at night. This is in line with the disorder perception theory, which states that people who rate a higher level of community in their neighborhood perceive less disorder and have less fear of crime (Wallace, 2015). This can be explained based on the fact that the sense of community can increase the perception of social control in an environment. But again, due to the small sample, this can only be speculated.

Correlations			
			How long have you been living in Pendrecht?
Spearman's rho	How long have you been living in Pendrecht?	Correlation Coefficient	1,000
		Sig. (2-tailed)	.
		N	32
	I experience nuisance from loitering groups in my street	Correlation Coefficient	,073
		Sig. (2-tailed)	,691
		N	32
	I experience nuisance from waste in my street	Correlation Coefficient	-,133
		Sig. (2-tailed)	,469
		N	32
	I experience intimidation or threats in my street	Correlation Coefficient	,206
		Sig. (2-tailed)	,258
		N	32
	I experience drugs related nuisance in my street	Correlation Coefficient	,173
		Sig. (2-tailed)	,344
		N	32

** . Correlation is significant at the 0.01 level (2-tailed).

Table 7. Relationship between length of residence and experiencing nuisance

Correlations			
			How many of your neighbors do you know?
Spearman's rho	How many of your neighbors do you know?	Correlation Coefficient	1,000
		Sig. (2-tailed)	.
		N	32
	I feel safe if I walk alone on the street during the day	Correlation Coefficient	-,146
		Sig. (2-tailed)	,424
		N	32

Table 8. Relationship between how many neighbors the participants know and how safe they feel during the day

Correlations			
			How many of your neighbors do you know?
Spearman's rho	How many of your neighbors do you know?	Correlation Coefficient	1,000
		Sig. (2-tailed)	.
		N	32
	I feel safe if I walk alone on the street during the night	Correlation Coefficient	-,029
		Sig. (2-tailed)	,875
		N	32

Table 9. Relationship between how many neighbors the participants know and how safe they feel during the night

Correlations			
			The sense of community is high in my neighborhood
Spearman's rho	The sense of community is high in my neighborhood	Correlation Coefficient	1,000
		Sig. (2-tailed)	.
		N	32
	I feel safe if I walk alone on the street during the day	Correlation Coefficient	,430
		Sig. (2-tailed)	,014
		N	32

* . Correlation is significant at the 0.05 level (2-tailed).

Table 10. Relationship between the sense of community and how safe they feel during the day

Correlations			
			The sense of community is high in my neighborhood
Spearman's rho	The sense of community is high in my neighborhood	Correlation Coefficient	1,000
		Sig. (2-tailed)	.
		N	32
	I feel safe if I walk alone on the street during the night	Correlation Coefficient	,419
		Sig. (2-tailed)	,017
		N	32

* . Correlation is significant at the 0.05 level (2-tailed).

Table 11. Relationship between the sense of community and how safe they feel during the night

The participants have also been asked some open questions on places in the neighborhood they tend to avoid, or place they like the most. These results are listed and show below.

When asked which places people tend to avoid, the participants have indicated the following places in the neighborhood:

- Metro station Slinge
- Plein 1953 at night
- Sliedrechtstraat
- Kerkwervesingel
- Places where people come together at night

What do you like the most in your neighborhood?

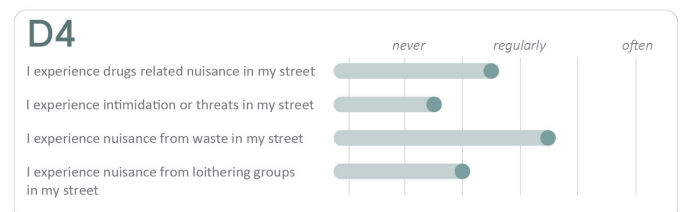
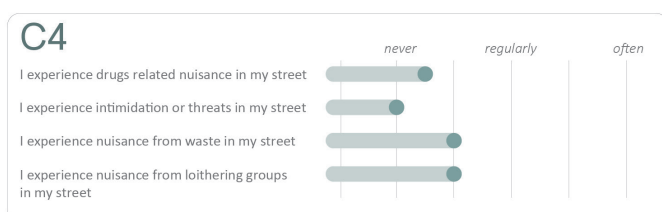
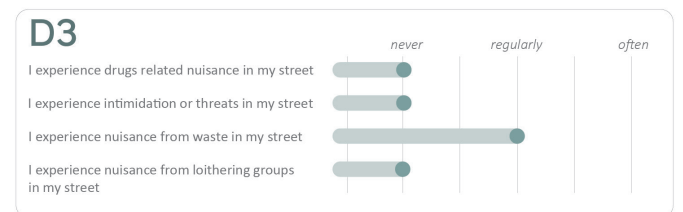
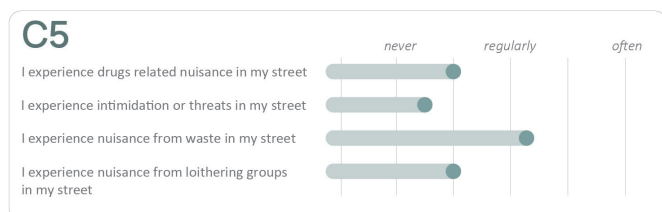
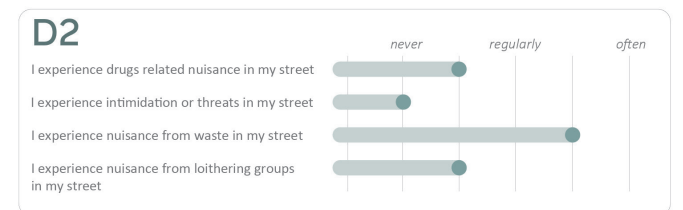
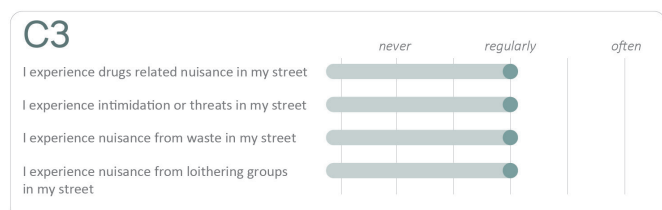
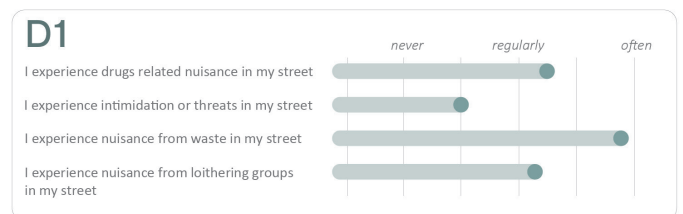
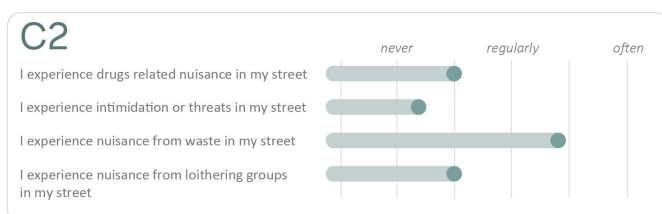
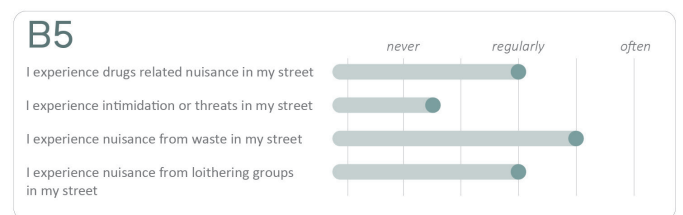
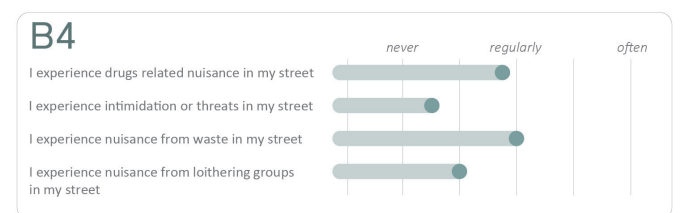
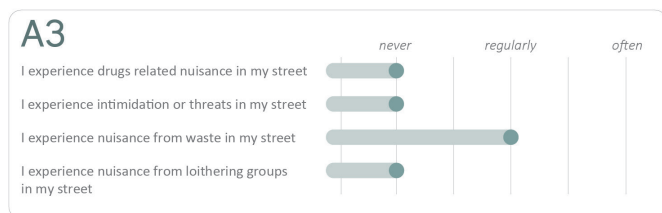
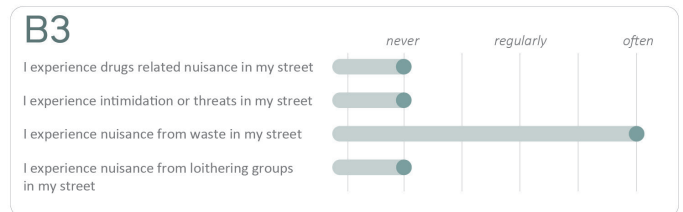
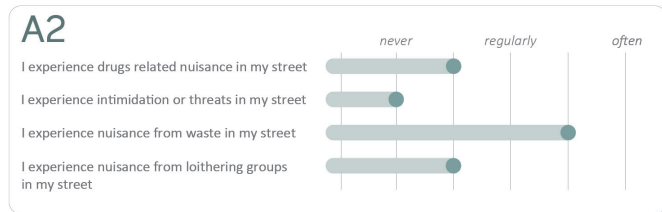
- The proximity of shops
- The proximity of public green
- The openness of the neighborhood
- The people: interaction and diversity
- Residents initiatives
- Nostalgia

What do you like the least in your neighborhood

- Loitering youth
- Litter and waste on the streets
- The quality and aesthetics of the buildings
- Issues with parking



Finally, the results of the occurrence of experienced nuisance were mapped based on the zip codes of the participants. The mean of the results are shown in the graphs that represent the nuisance profiles of the areas. It must be noted that there is no or little data for some areas.





7 / Design Principles

This chapter introduces and explains the design principles that, according to theory, improve the perceived safety. The theories that support the principles are briefly elaborated. The principles are based on 5 distinctive places in the neighborhood, which are selected based on the spatial analysis and survey results. The combination of several principles are shown in scenarios.

7.1 / The spatial context

Public green space

The following map shows the open green spaces in the neighborhood. The neighborhood has a lot of open green spaces because it is designed and built according to the modernist principles of light, air, and space. These open green spaces are often only used as public greenery without a specific function and are mostly located between two long buildings. While the neighbourhood appears to have a lot of public greenery, these places tend to feel semi-private because of their location between the buildings.



Parallel short building blocks

The following map shows a prevalent stamp in the neighborhood. This stamp consists of multiple rows of houses that consist of 4 to 6 single-family houses. The rows are configured so that the back of one row faces the front of the other row. The front doors overlook the fences or hedges of the back yards of the other row. The rows are placed at an angle of 90 degrees to the road they are on, creating narrow alleys leading to the houses.



Long building blocks

The following map shows the long building blocks in the neighborhood. The stamp in which these buildings often occur consists of two long buildings opposite each other. The buildings have two or more shared entrances that lead to the apartments located in the building. The map only highlights the long buildings that contain apartments. In the district are comparable long building blocks. These consist of single-family houses and the relationship between building and street is more direct than in apartment buildings.



7.2 / Design principles

The design principles have been developed based on the theory found during the theoretical review. Five sample locations in the neighborhood have been selected in order to develop the design principles. These locations have been selected because the spatial configuration is repeated throughout the neighborhood, or because the spatial configuration is unique in the neighborhood and therefore offers opportunities. Based on the knowledge gained in the literature study, one or more scenarios are designed for each sample locations. First of all, the current situations of the sample locations are analyzed for elements that have a negative effect on the perceived safety. Based on what is concluded in the analysis, scenarios are designed that contain spatial elements that have a positive influence on perceived safety. The main theories applied in the design principles are described below.

1. Spatial diversity

Spatial diversity includes diversity of the buildings and the diversity of the public spaces. A spatially diverse environment creates identity and it helps wayfinding and orientation. According to Lynch (1960), the legibility of an environment depends on identity, structure, and meaning. In addition to these characteristics of an environment Lynch (1960) and Kaplan and Kaplan (2005) advocate some value of mystery or surprise in an environment. By creating mystery and surprise in an environment the observer experiences interesting visual experiences that trigger curiosity and fulfilled the observers' informational needs.

Sim (2019) argues that a stand-alone building block in an open landscape generates fewer kinds of space than an enclosed building block. An stand-alone building in an open landscape often creates a spatially monotonous environment. In contrast with a stand-alone building, an en-



Stand alone building blocks in an open field



Spatial diverse enclosed building block

closed, layered building block creates spatial diversity. The front/street side of the building can be identified as the public side of the building, while the back/courtyard can be identified as the private side of the building and thus increases the legibility of the territories. (Sim, 2019, p. 68-69). In addition to Sims' theory, Kaplan and Kaplan (2005), argue that peoples exploration and understanding of the environment is based on the degree of coherence and complexity. These aspects are in contrast with each other. A lack of coherence can create a sense chaos and can be overwhelming. Whereas a lack of complexity can create a sense of "there is nothing going on", which negatively affects the domain of exploration of an environment. Creating spatial diversity can reduce the lack of complexity in an environment, which can positively affects peoples environmental preferences.

2. Adding frontgardens

One of the simplest ways to encourage social encounters in a city is to have a front garden. The presence of a front garden softens the boundary between public and private. The current streets in Pendrecht often miss this soft transition from public to private and, in combination with the low presence of front doors, this makes for unattractive streetscapes. In a densely built environment it is not always possible to have a backyard, so building front gardens and placing balconies is a good solution to stimulate the outdoor living, which can create a sense of community. The sense of community has a positive effect on the social control in an area. Sim (2019) classifies 5 sizes of urban front gardens in which different activities are possible. A front garden of 10 to 15 cm deep gives the possibility to put flower pots outside. A bicycle can be placed in a front garden of 15 to 50 cm deep and a bench can be added in a front garden of 50 to 90 cm deep. A table can be placed in a front garden of 90 to 150 cm and in the largest front garden of 150 to 180 cm deep it is possible to enjoy more time outdoor and it becomes more likely to socialize with your neighbors.

4. Adding front doors

One of the best known principles to guarantee social safe environment is the presence of windows on a street. Jane Jacobs was one of the first to introduce the "eyes on the street" principle. But only eyes on the street is not enough to guarantee a social safe environment, the presence of front doors is equally important. As Sim (2019) states, front doors ensure that you can not only be seen on a street, but that you can also be reached directly. Front doors are the direct physical link between the public and the private realm.

Modernist building, as they are also present in Pendrecht,

often only have access to public space from one side of the building, often in the form of a shared entrance. As a result, the residents have no direct access to public space. In addition, the presence of front doors can lead to a lively street, because residents use the street to enter their homes or to chat with neighbors and the street does not just act as a means of getting to your destination.

3. Define territories

Defining territories is linked to the legibility of an environment. As mentioned before, legibility is one of the guidelines for creating a social safe environment, as it enables the observer to recognize and understand ownership of the space. In the neighborhood Pendrecht most of the public green spaces are not defined, which create an environment with stand-alone building block in an open space. There is no difference between front and back of the building, they are both directly connected to the public realm. The open green spaces that are created by this configuration of buildings often have no specific use or activity and since there is no clear definition of who this space belongs to, or who has the responsibility for this space, the environment lacks legibility. These types of open public spaces without sense of responsibility from any of the nearby residents can provoke undesirable behavior. The design principles attempt to increase the legibility of the territories by creating physical borders. The hypothesis behind this design principle is that if there is a clear boundary between two territories, the observer can better understand the ownership of the space and is able to identify differences between the spaces.

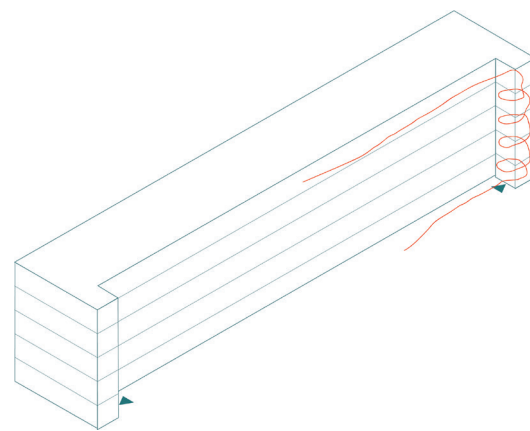
5. Creating alternative routes

The presence of alternative routes increases the accessibility of an area. It makes the street network more connected and the streets are better integrated into the network. Furthermore, the presence of alternative routes ensures that an individual has the opportunity to walk a different route when an unsafe situation arises that the individual wants to avoid. However, there should not be too many alternative routes, this can have a negative effect on perceived safety, because the environment becomes unpredictable and lowers the legibility of the environment.

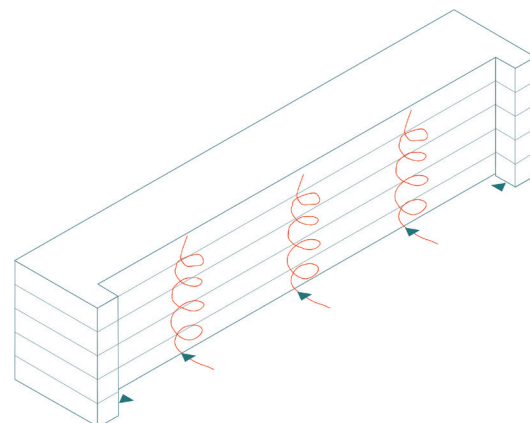
A modernist neighborhood, like Pendrecht, often has long building blocks which can sometimes function as a barrier for pedestrians. In Pendrecht these long building blocks range from 70 to 200 meters. In these cases it is important to assess where or not the environment has enough alternative routes to make sure an individual can feel safe. The design principle related to creating alternative routes proposes to split the long building block and create new paths for the pedestrians.



fig 59. Neighbors talking to each other in their frontgardens in the Grunobuurt Groningen (de Zwarte Hond)



Current situation, two shared entrances on the ends of the buildings, no connection between dwelling entrance and street



Frequent entrances for a more direct connection between dwelling and street

Sample location for the design principles

Alley houses



source: Google Maps



source: author, 2019

Apartment buildings



source: Google Maps



source: Google Maps

Public greenery

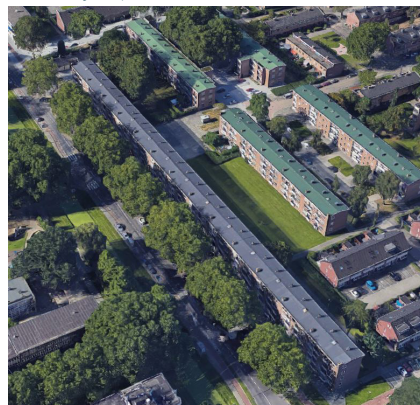


source: Google Maps



source: Google Maps

Long building



source: Google Maps



source: Google Maps

Public square

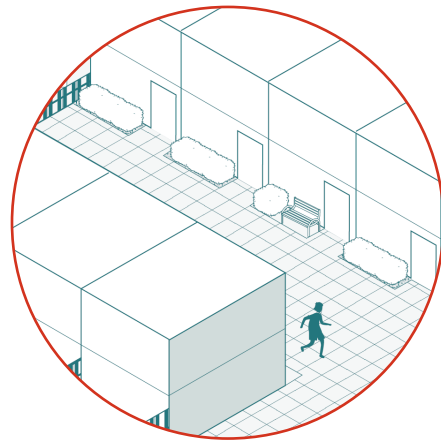
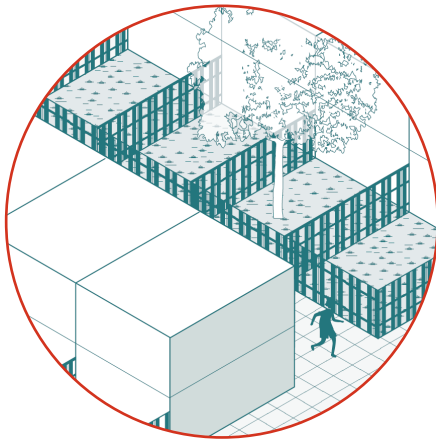
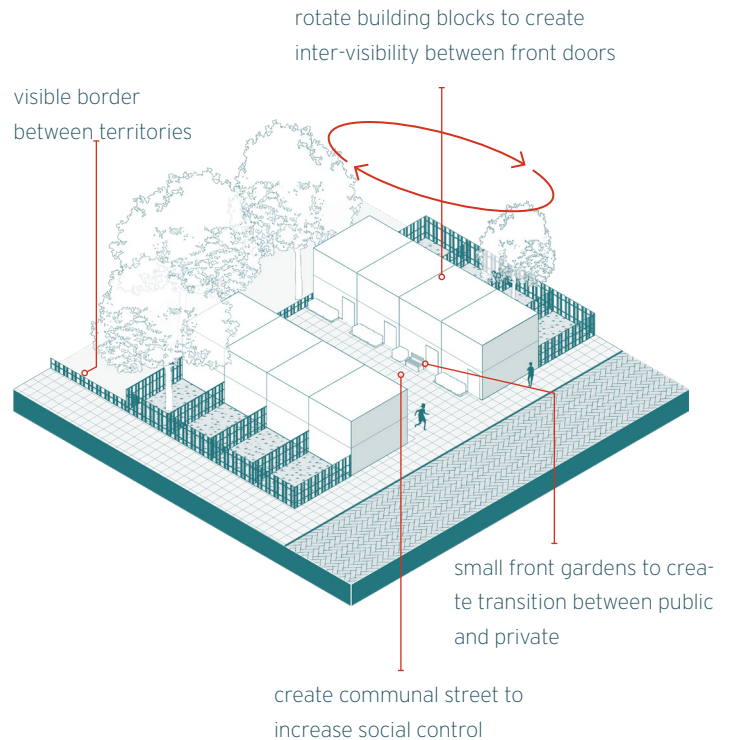
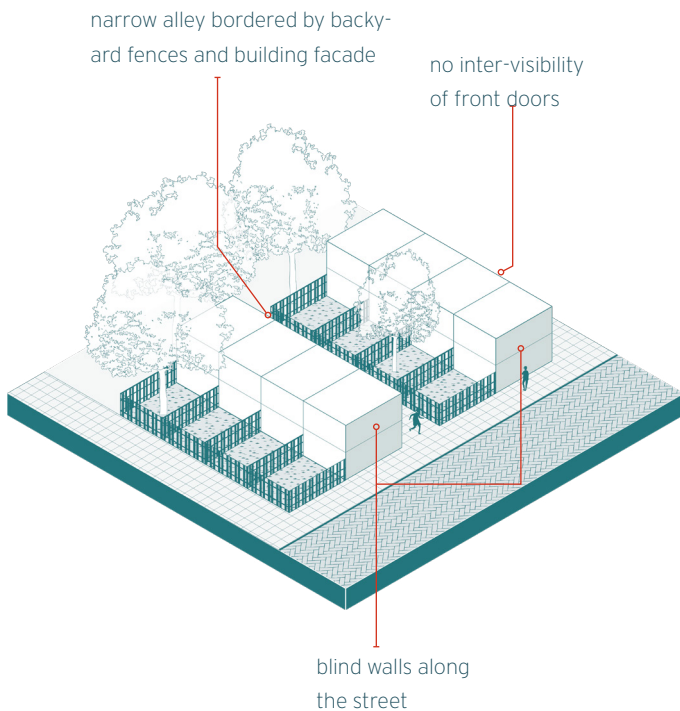


source: Google Maps



source: author, 2019

Alley houses



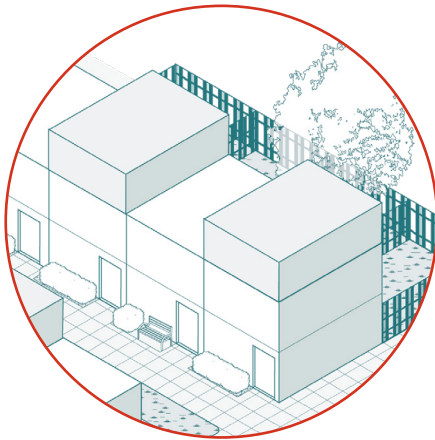
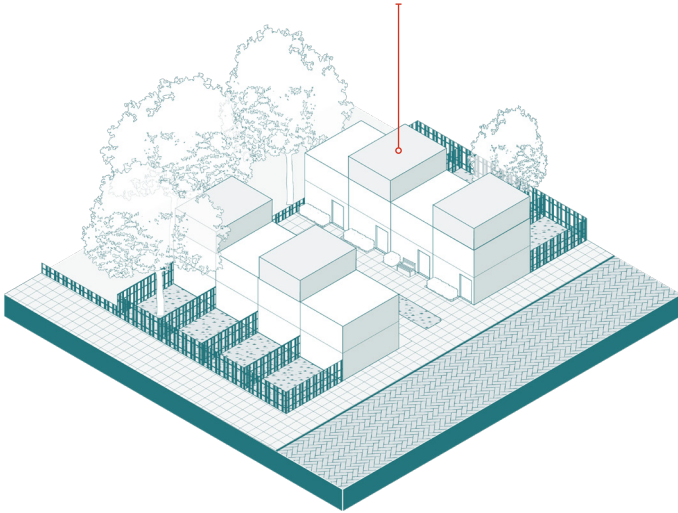
1. Current Situation

A common stamp of building configurations in Pendrecht includes a short row of houses with the backyard of one row facing the front doors of the other row. Due to this configuration, the front doors of the houses are not located on the main road, but on a narrow side alley. The walls that face the main road often have no windows, creating a blind wall that is continued through the backyard hedge or fence. In most cases, the configuration is the same on the other side of the main road, causing that there is no intervisibility between the front doors in this stamp.

2. Rotate building block

The first scenario rotates one of the building blocks 180 degrees. In this way, the front doors of both building blocks are placed opposite each other, this ensures inter-visibility of the front doors. Creating intervisibility of the front doors increases social control in a street, neighbors can watch the street together and know that more eyes are on the street when they are here. Another advantage of rotating the building block is that it can create a sense of community in the street and thereby enhance the sense of responsibility for the space.

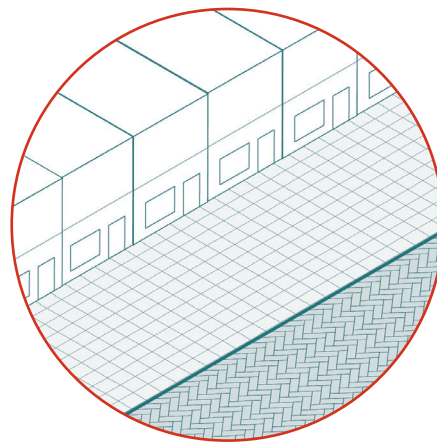
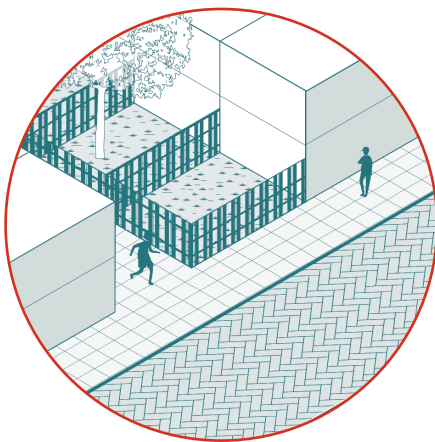
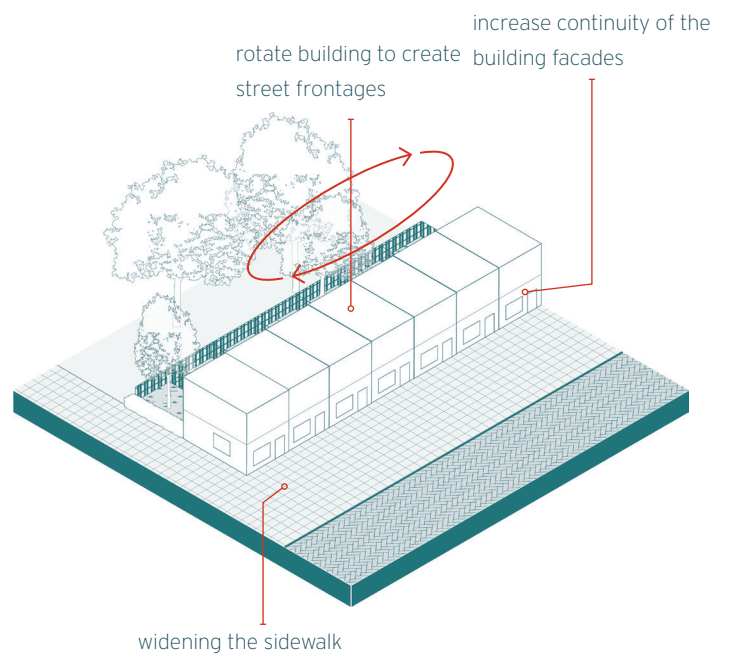
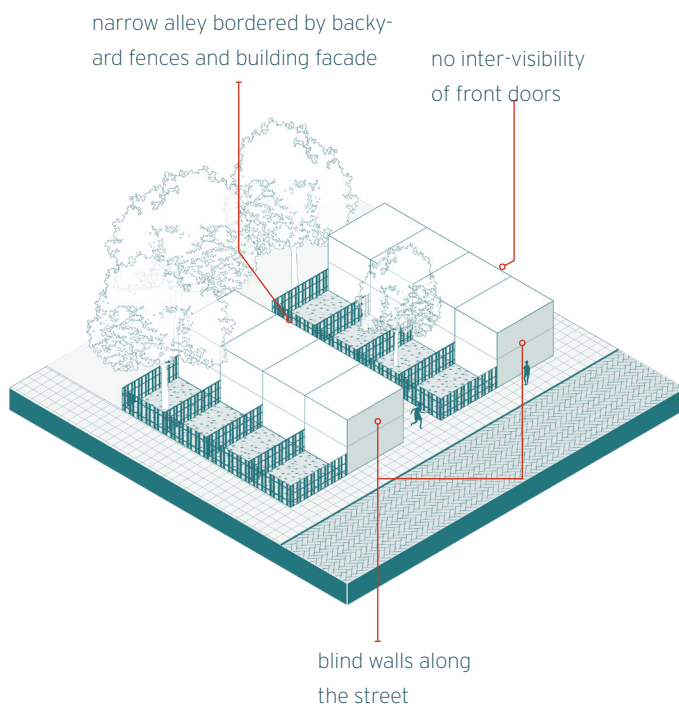
adding floors to diversify architecture
and increase built density



3. Add floors

The second scenario builds on the first. The scenario diversifies the architecture of the building block. Currently the architecture of these types of stamps are very homogeneous and the buildings are not well maintained. The houses can be made attractive again by renovation or new construction of these blocks. The diversification of architecture can increase the complexity of the environment, according to Kaplan and Kaplan (2005), people have a need for a certain complexity in their environment. In their research into environmental preference, it appears that a certain degree of complexity of an environment provokes people to want to explore their environment and ensures that people find the environment more attractive. However, a too complex environment can confuse people.

Alley houses

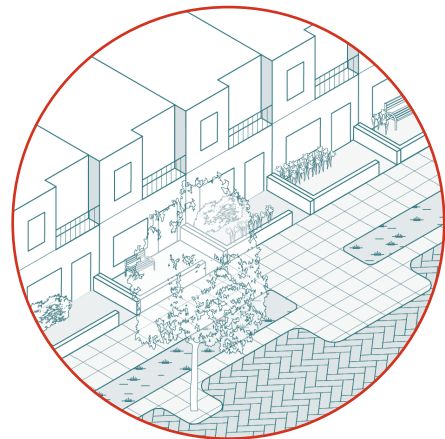
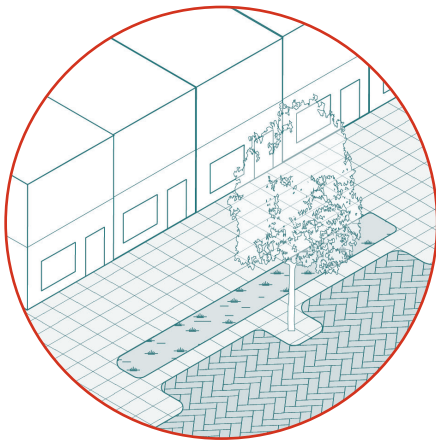
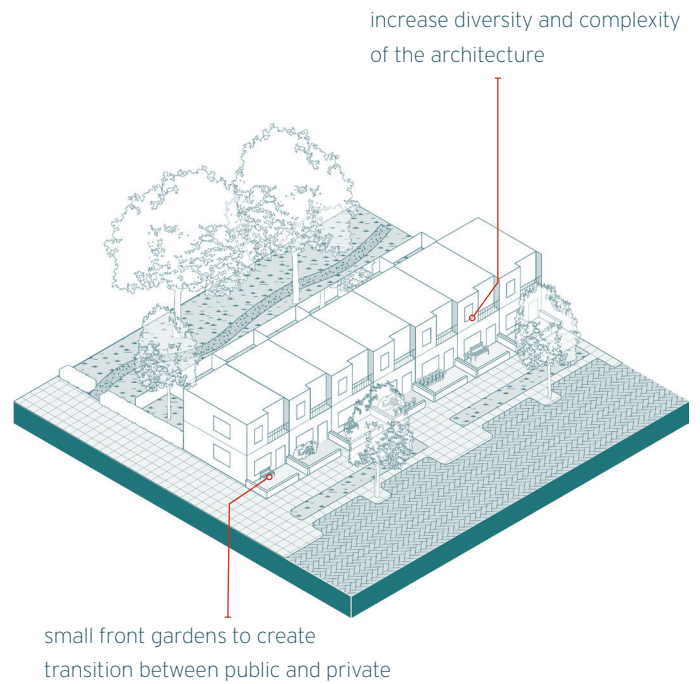
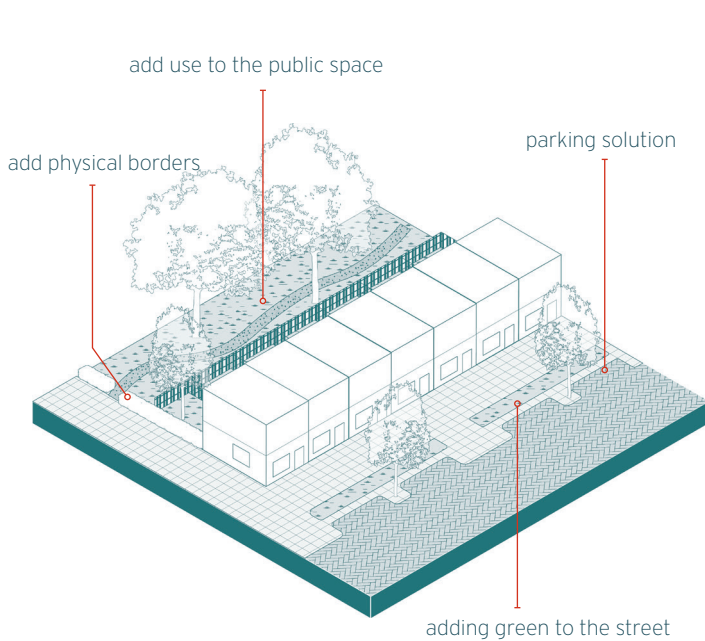


1. Current Situation

The current situation where the following design principles are applied to is the same as the current situation described on page 102. A common stamp of building configurations in Pendrecht with a short row of houses with the backyard of one row facing the front doors of the other row. This configuration has blind walls along the main street, which lowers the social control on the main street.

2. Rotate building

The first scenario replaces the current buildings with a new building block with the front doors facing the street. Doing this increases social control on the main road, as more windows and front doors face the street. It creates a wider sidewalk, because the building block can be placed further to the back. According to Sim (2019, p. 225) the front of a building conveys an understanding an acceptance of rules and a certain kind of behavior



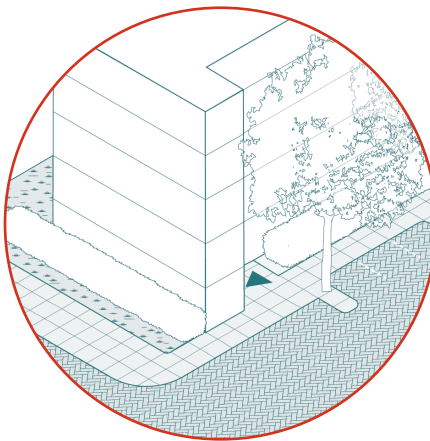
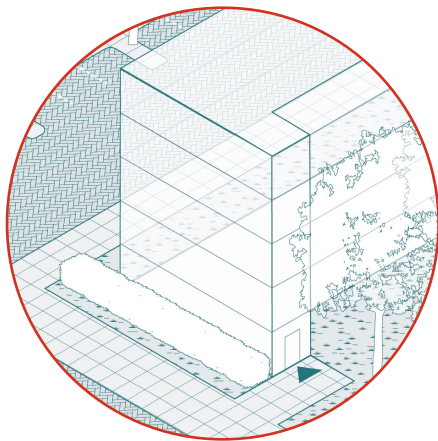
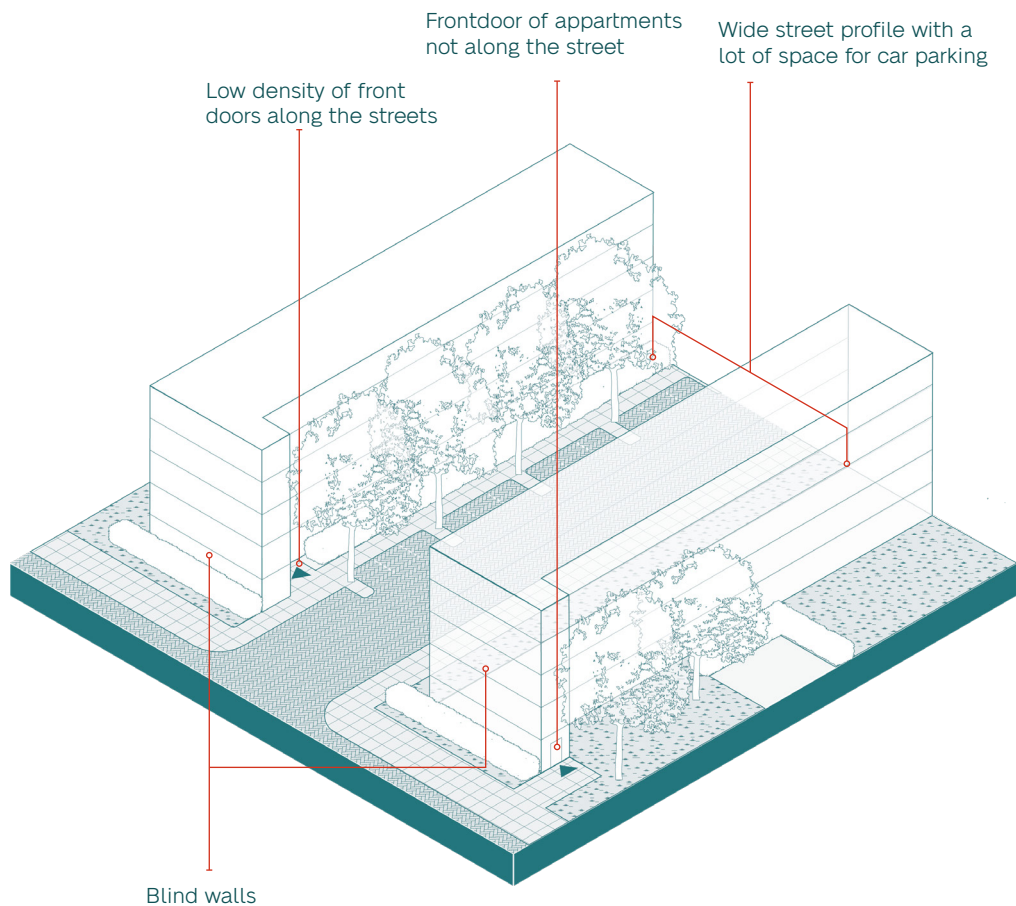
3. Improve public space

The wide sidewalk allows for more green in the street and more parking spaces. Whereas in the current situation the cars are parked on the street, in this scenario the cars have been given a place in street and in combination with more green in the street, the street becomes more attractive. The public space behind the building block is defined by a physical border, which makes for a more recognizable space (Sim, 2019).

4. Diversify architecture

The principle of diversifying the architecture creates identity and makes for more interesting sensory experiences. Creating identity can help improve the wayfinding in the area through distinctive and recognizable spatial elements. Adding small front gardens to the homes provides the opportunity to create identity by the residents. It softens the edge between private and public space but also public and private life, which can promote encounters that create the sense of community (Sim, 2019).

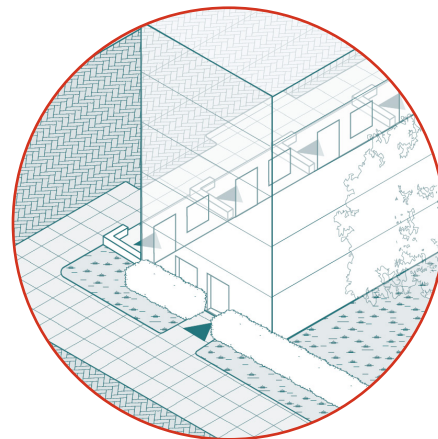
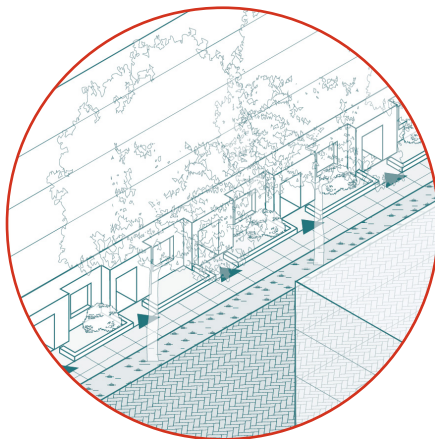
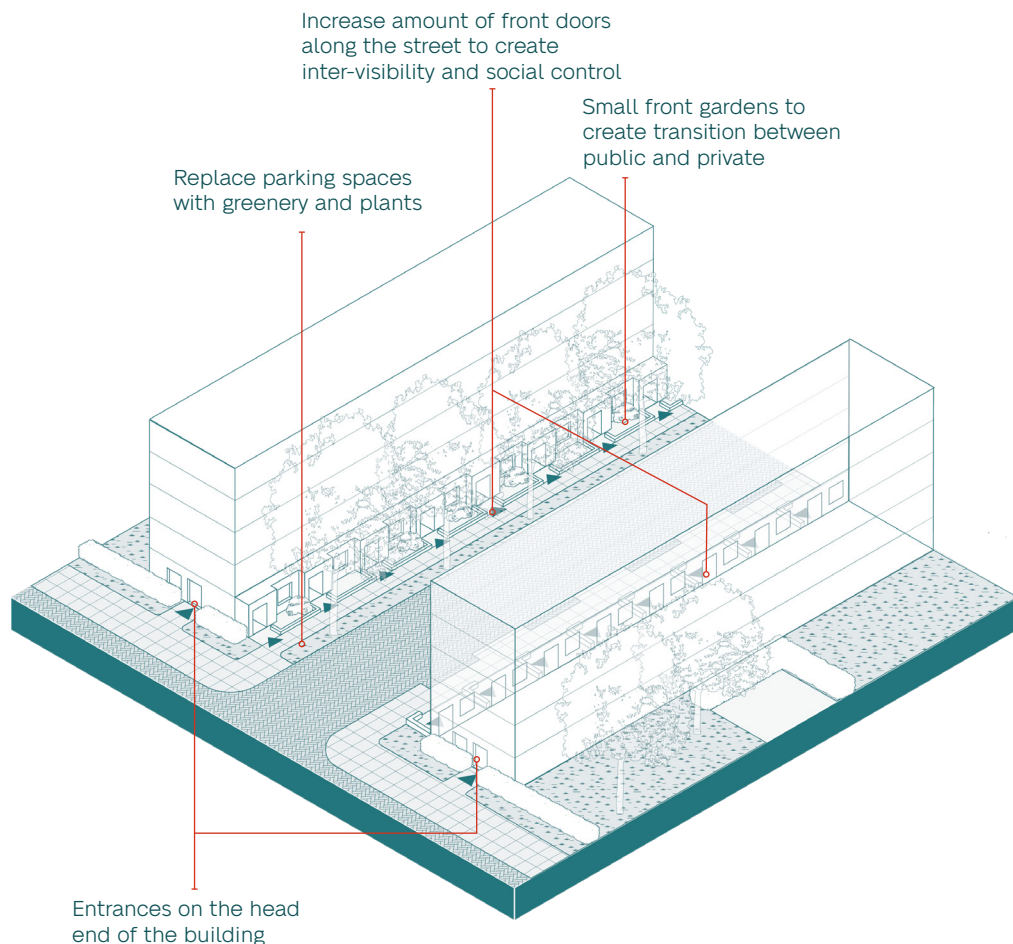
Apartment buildings



1. Current Situation

A common building configuration stamp is two apartment buildings positioned opposite each other. In most cases, these building blocks have two shared entrances located at the ends of the building. From here the residents can enter the building and reach their home through a gallery. However, the shared entrances at the ends are not always on the street where the building is located. This creates a street where there are few to no direct entrances and prevents a direct relationship between the building and the street. This relationship between building and street is important to create liveliness and social control in the street (De Rooij & Van Nes, 2015). Furthermore, the buildings of this stamp often have a blind walls on the short sides of the building, which lowers the social control on the street.

The streets of this type of stamp are designs with the modernist principles that the car dominates the street. This makes for a wide street profile and a lot of space for parking. However, this creates an unattractive street and less space for pedestrians.

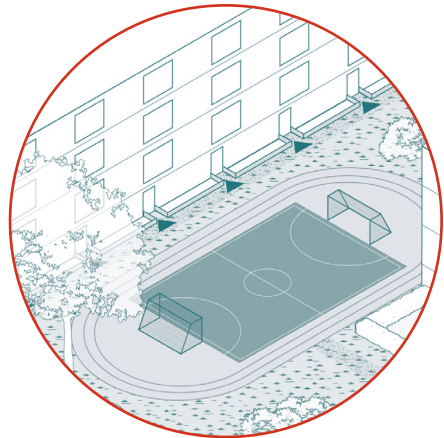
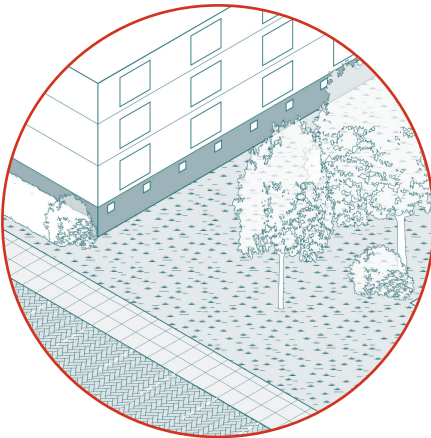
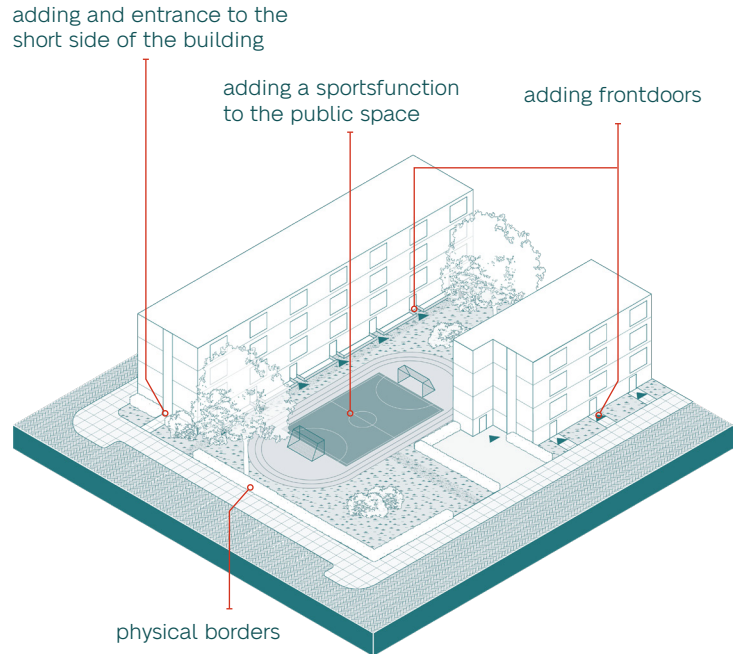
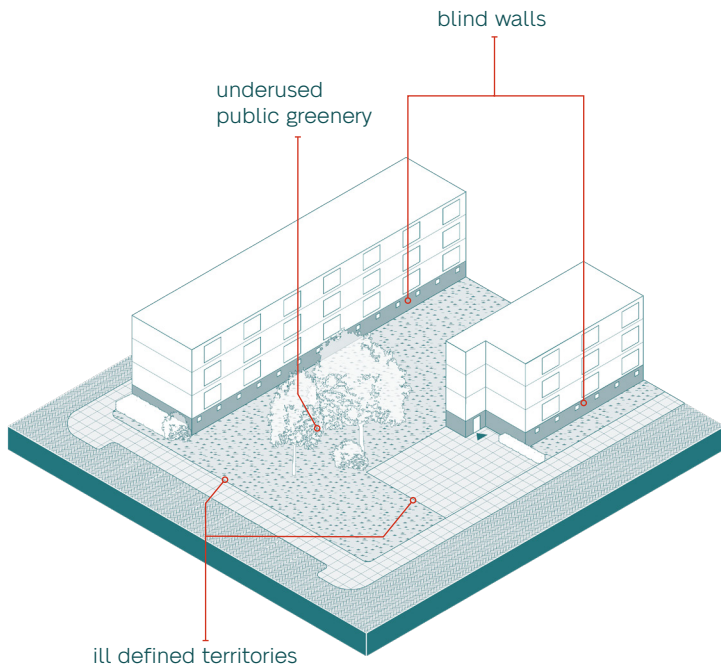


2. Add Front doors

In the alternative scenario, design principles have been applied with regard to the relationship between building and street and an attractive street profile. The scenario suggests that front doors and windows are added directly to the street. Windows aimed at the street already increase perceived safety, but front doors provide a direct physical connection between the building and the street. When something happens on the street, the resident has direct access to the street. Furthermore, front gardens are added to the houses on the ground floor, as explained on page 105, this creates a more attractive street scape, creates identity and softens the transition between private and public. The shared entrances will be placed on the short side of the building, so that this street will also become more lively and safe.

The scenario further proposes to redesign the street profile so that the car takes on a less dominant role in the street and there is more space for pedestrians. The space created by smarter distribution of parking spaces can be used to add greenery to the street and thereby make the street more attractive.

Public greenery

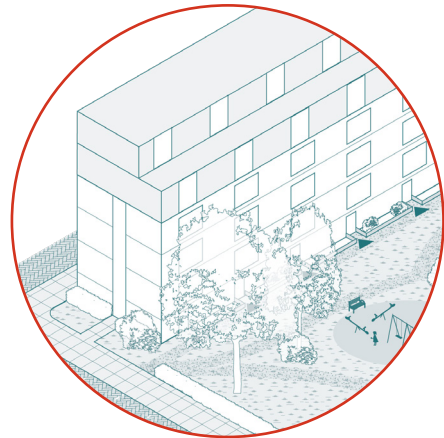
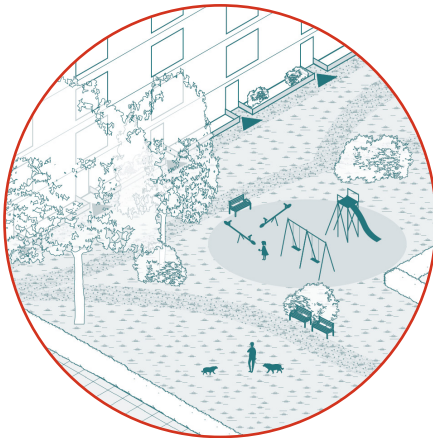
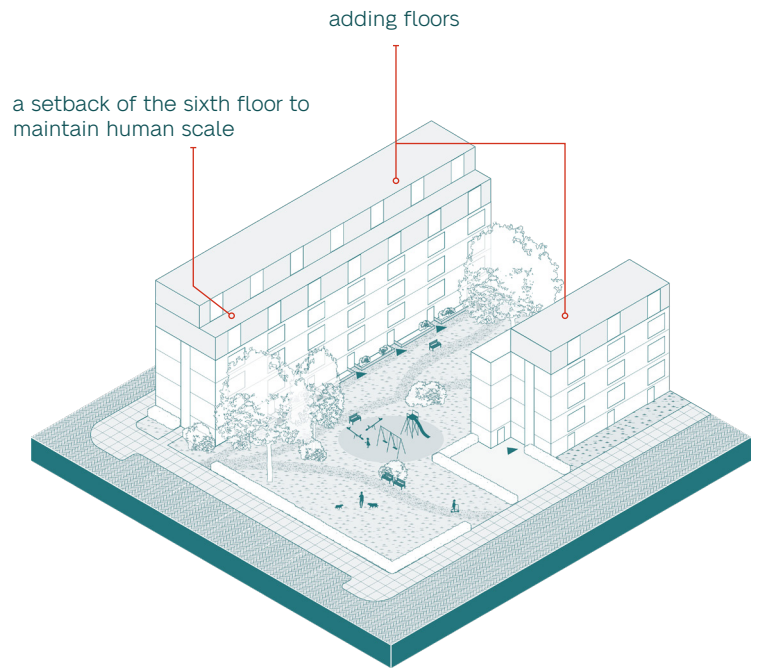
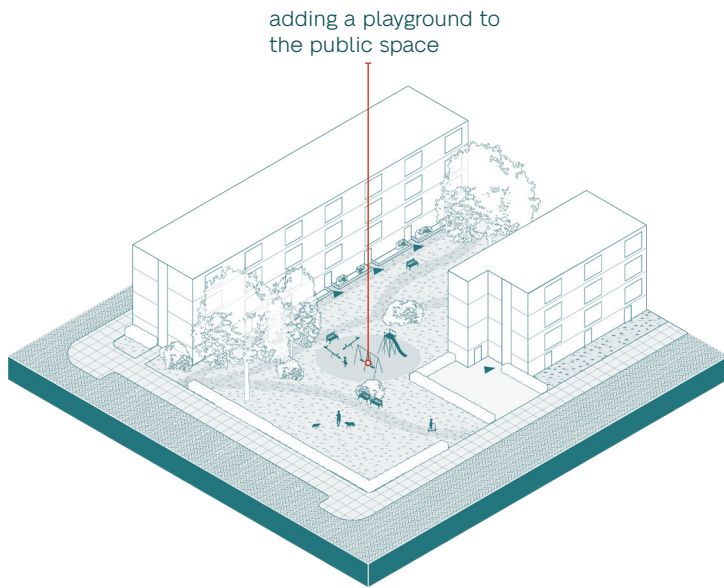


1. Current Situation

The modernist principles applied in the neighborhood result in repeating homogeneous public green spaces. The public green spaces often lack a specific function or use and the ownership of the territories is not clear. A sense of responsibility for a space is important to ensure the social control. The legibility of territories influences perceived safety because people then know how to behave in this space. In this way, socially undesirable behavior can be avoided. Another common spatial characteristic of these types of stamps are the blind walls on the ground floor. Often the ground floors are used as storage spaces for the residents, which limits the used of the ground floor.

2. Adding land use to the public space

In the first scenario, different design principles are applied. Firstly, a specific activity is facilitated in public space, namely a sport function. A football field gives the opportunity for young and old to exercise in public space. Secondly, front doors and front gardens are added to the public green space. This ensures that the ground floor of the initially standalone building can be entered on two sides. It also ensures that more eyes are on the public space. Thirdly, in this scenario public space is bounded by a physical boundary in the form of a hedge. This increased the legibility of the territories. Finally, a shared entrance is added on the short side of the building, so that this side is no longer a blind wall and the street becomes more lively and safe.



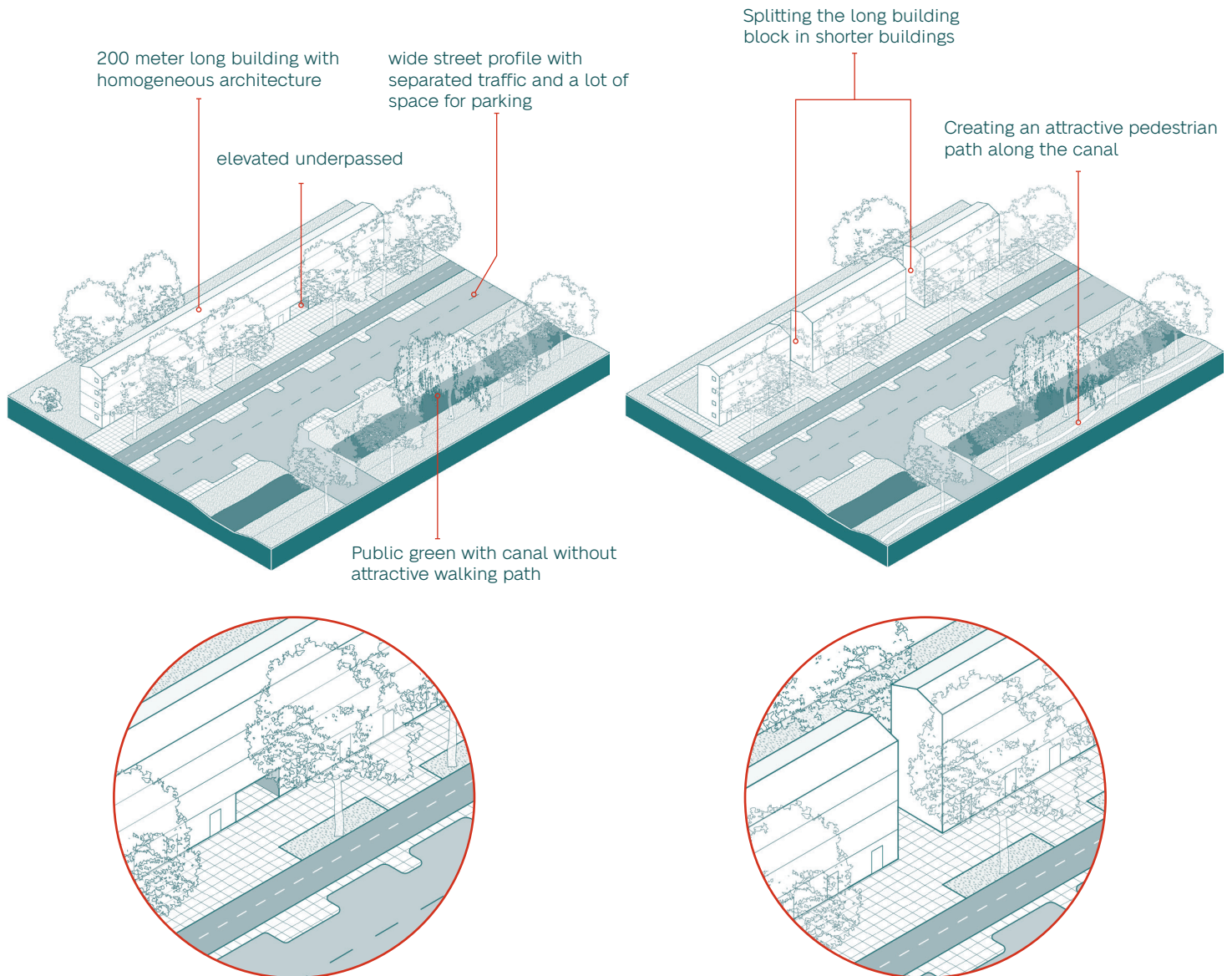
3. Adding land use to the public space

The second scenario builds on the first scenario. In this scenario, another activity is facilitated, namely a playground and a park. Children can play, people can walk their dog and there are places to sit in the public greenery. The residents who live around the public space provide social control and the configuration of the buildings around the public space allows it to be regarded as a communal park. The space remains flexible and can therefore be used by various groups without exclusion.

4. Adding floors

The last scenario involves adding floors to the buildings surrounding the public space while still maintaining human scale. The sixth floor has a setback so that enough sunlight is allowed into the public space and space is created for a spacious balcony or roof garden. The principle of added floors creates more eyes on the public space, which can increase perceived safety. Furthermore, it fulfills the demand for more living space and answers the question of the densification of the city

Long building



1. Current Situation

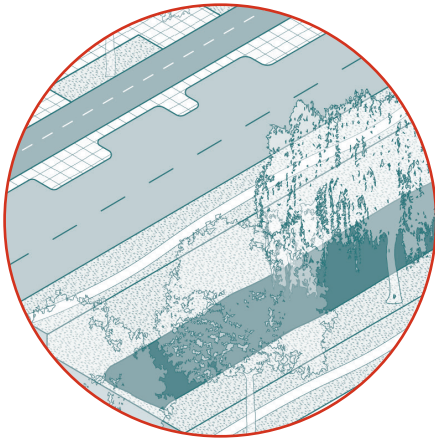
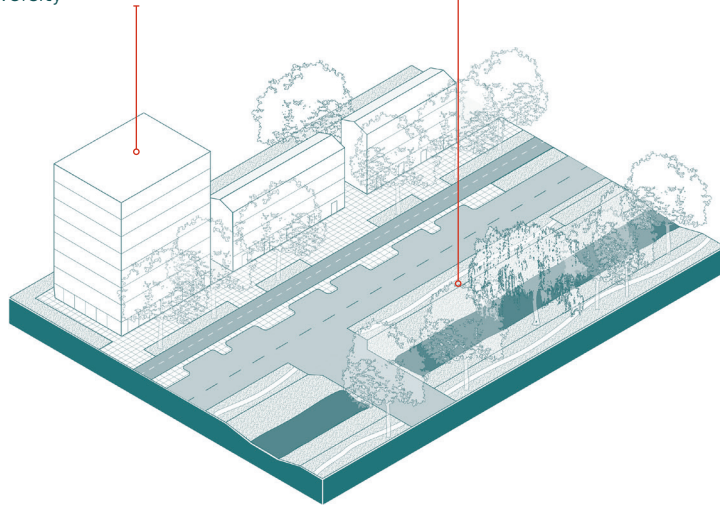
The situation shown above is a unique situation in the neighborhood. It is a very long building of 200 meters, with a facade design that repeats itself, resulting in a monotone appearance. The building has two underpasses that are slightly elevated, which limits access to certain groups of people. Because there are no houses across the street and there is little to no view on these underpasses, it can be perceived as unsafe. The street is wide and laid out according to modernist principles where the traffic is separated. Across the street is a canal, although it is a spatial quality, it is not used because there is no attractive path for pedestrians and the canal on the other is bordered by parking spaces.

2. Split up the long building

In the first scenario, the main design principle is to split the long building into three shorter buildings. In this case, the splits were made at the places where the current building had the underpasses, this was done because these underpasses connected the pedestrian network. Splitting the building creates alternative routes, this increases perceived safety, because the person then has the option to avoid unwanted situations ahead. However, it is important to properly light up these alternative routes to make sure that when it is dark the alternative routes are clearly visible and no unwanted behavior will be provoked. In this scenario, a footpath has also been added to the canal, so that pedestrians can use the public green areas.

Replacing a shorter building block with a new building to increase density and spatial diversity

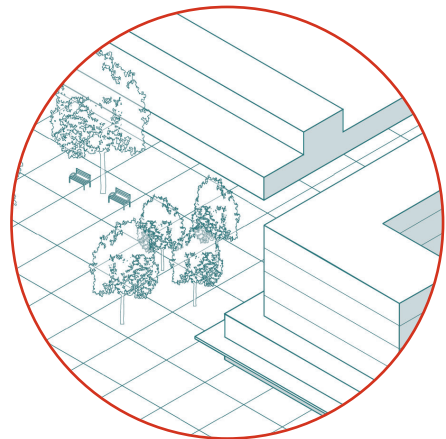
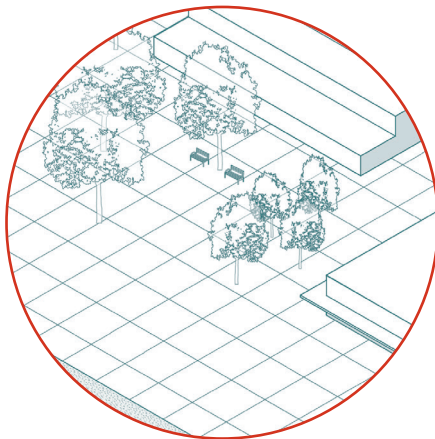
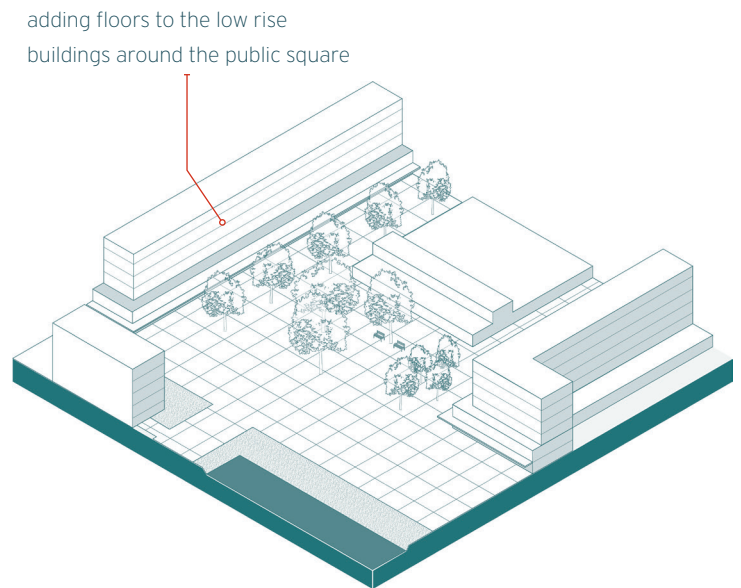
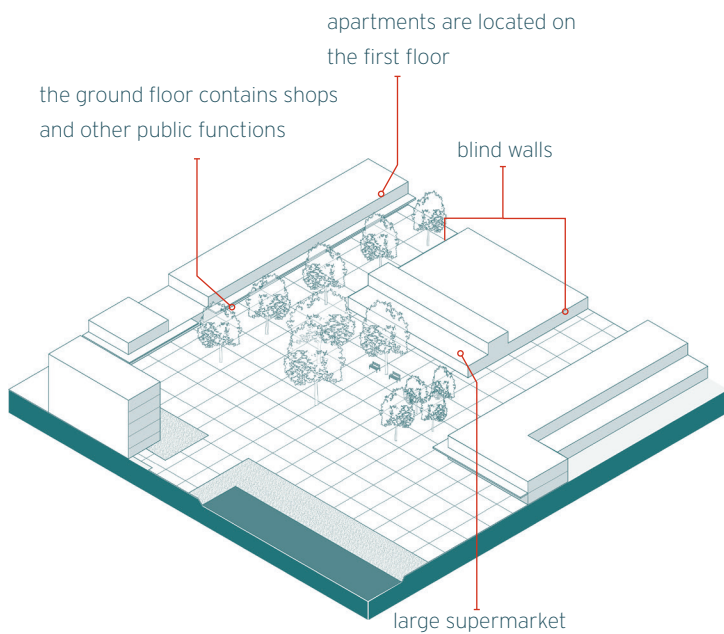
Replacing parking spaces along the canal with more space for pedestrians



3. Densification

The second scenario builds on the first. The main applied design principle in this scenario is to replace one of the short buildings with a new building block. This creates spatial diversity and the buildings are less homogeneous. It also densifies the area and can respond to the housing demand of different types of homes. Furthermore, the parking spaces along the canal have been replaced by more public green areas and a pedestrian path, making better use of the canal's potential.

Public square

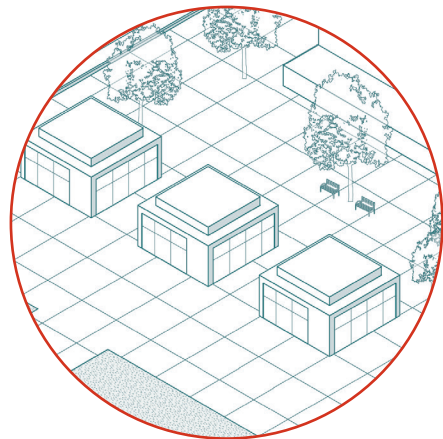
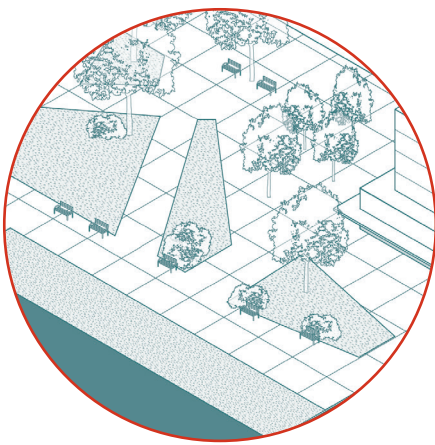
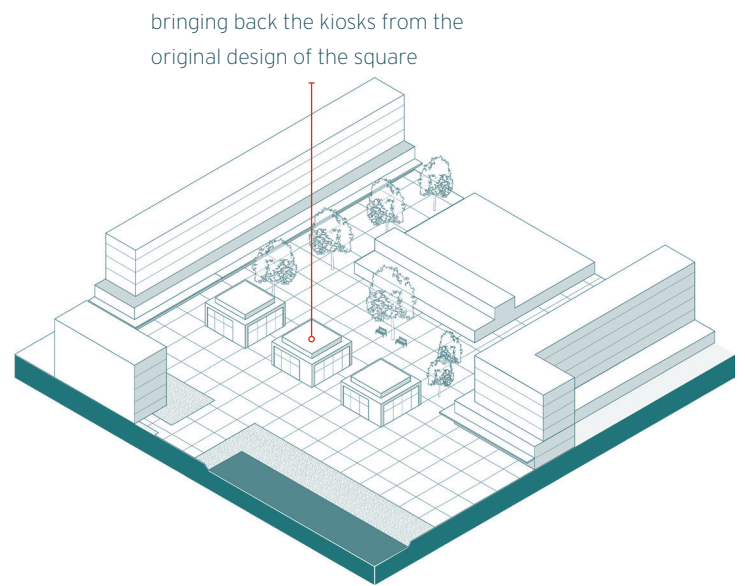
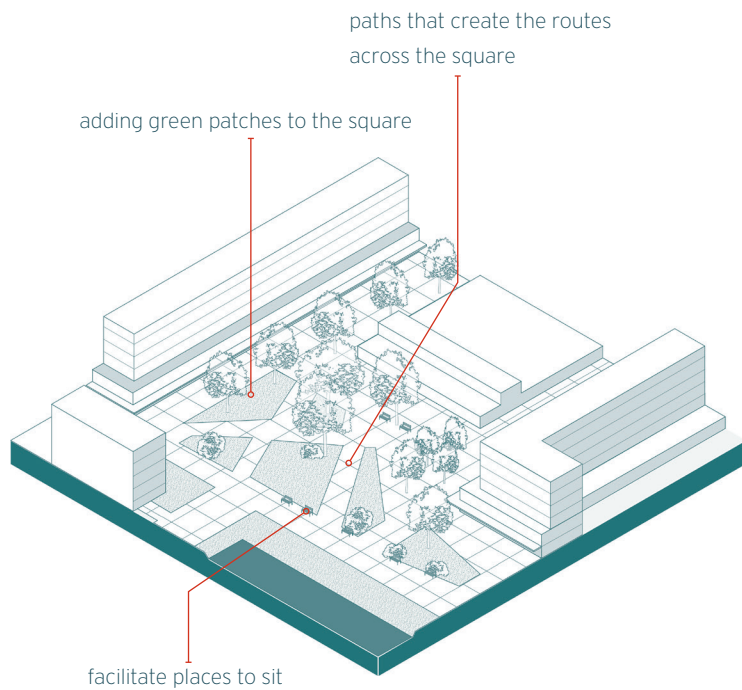


1. Current Situation

The situation above shows the current main square of the neighborhood. The square is surrounded by shops on the ground floor with houses on the first floor. The disadvantage of only shops on the ground floor is that the square is deserted after the store closes. Because there are relatively few houses around the square, social control is low here. In addition, there are blind walls in the streets that lead to the square. The square itself is mainly paved with a few trees and few places to sit. The square is therefore not an attractive place to stay.

2. Add floors

In the current situation the buildings surrounding the main public square have a ground floor with shops and other public function and the first floors contain living spaces. This means that after the shops close the streets and the square are desolate. By adding floors above the shops, more space is created for homes. These houses have a view of the square and therefore provide more eyes on the square. This is especially important after the shops have closed, when the square is deserted. Undesirable behavior can be prevented with this, because the social control is increased.



3. Improve public square

In the second scenario, space is created for more greenery on the now mainly paved square. This has advantages for the climate because it cools the surface and makes it a more attractive square. In addition, more places to sit are created, so that the square stimulates more social interaction. The paths created in this design are based on the possible walking lines in the square, so that the routes across the square are not blocked.

4. Restore historic plan

The third scenario for the main public square of the neighborhood includes bringing back the three kiosks that were initially placed on the square in the design from the 1950s. The three small buildings included shops and were placed in the middle of the square. It adds more use to the space, but it also includes removing trees from the square. Adding more shops in or around the square can attract more people and make the square more livid.

8 / Perceived Safety Assessment

This chapter introduces the problem area assessment tool which measure the performance of an area based on the four guidelines of social safety design; visibility, legibility, accessibility, and attractiveness. The selected problem areas are analyzed and assessed according to the aspects that construct each of the guidelines.

8.1 / The assessment tool

The assessment tool assess the problem areas that have been identified by the spatial analysis and the survey results on several aspects which are subdivided by several parameters. The aspects are derived from the literature study on social safe design. The aspects are the guidelines that need to be present in conjunction in order to establish a social safe environment. The parameters are defined based on literature. The aim of this analysis is to chart the perceived safety for the selected problem area, and gain insight in the various spatial problems related to perceveid safety at the project location.

The four aspects that are defined by the parameters, need to be applied in conjunction in order to establish a social safe environment. Which means that an area can, for example, score very well on three out of the four aspects, but performs poorly on one. In this case more attention should be paid to the aspect that is lagging behind, in order to reach the effect of the performance of the four aspects in conjunction.

Each parameter is assessed on a 4 point scale, ranging from bad to good. The 4 point scale is represented by the pie parts of the tool.

The performance of each of the parameters is measured in different values, and are shown on the right page. These values depend on what is being measured. For example, to measure the parameters visibility and length and number of sightlines, the isovist software is used. This software displays the visibility of a specific spot in a color gradient from red to blue. This gradient has then been translated into a 4-point scale; red means poor performance and dark blue means good performance on the aspect of visibility (see scale conversion below).



aspect _____
parameter _____

4 point scale _____

For some of the parameters objective assessment is used to define the performance. This means that the parameter is assessed based on how the environment has been perceived during the location visits.

On pages 118 to 121 the problem areas have been introduced and the analysis maps are shown of the inter-visibility of front doors, blind walls, public spaces, visibility, length of sightlines, continuity, and spatial integration. Thereafter, the assessment for each problem area is explained, and it is summarized which spatial aspects constitute the problems in the area.

Assessment Tool Variables

A1: Visibility

- P1: Intervisibility of frontdoors
Map of intervisibility of frontdoors (De Rooij & Van Nes, 2015)
- P2: Visibility
ISOvist analysis directed visibility map > average color in gradient
- P3: Length of sightlines
ISOvist analysis > Vistalength
- P4: Physical visibility obstacles
Google streetview, photos, observations and subjective assessment

A2: Legibility

- P1: Defined territories
Google streetview, photos, observations and subjective assessment
- P2: Continuity of building blocks
Compactness of the urban block measured by the GSI
- P3: Clear orientation
Google streetview, photos, and observations
- P4: Clear function of the public space
Land use map

A3 Accessibility

- P1: Spatial integration in street network
Space syntax integration map > average color gradient
- P2: Entrances directly at the street
amount of entrances and frontdoors that are directly connected to the streets
- P3: Physical accessibility
Ease of access for vulnerable population, subjective assessment
- P4: Alternative routes
Analysis of street integration

A4 Attractiveness

- P1: Public space
Quality of the public space, photo, survey
- P2: Buildings
Quality of the buildings in the area, subjective assessment, photos, Google streetview
- P3: Maintenance
Photos, survey, subjective assessment
- P4: Liveliness
Observations (research by van Nes), subjective assessment

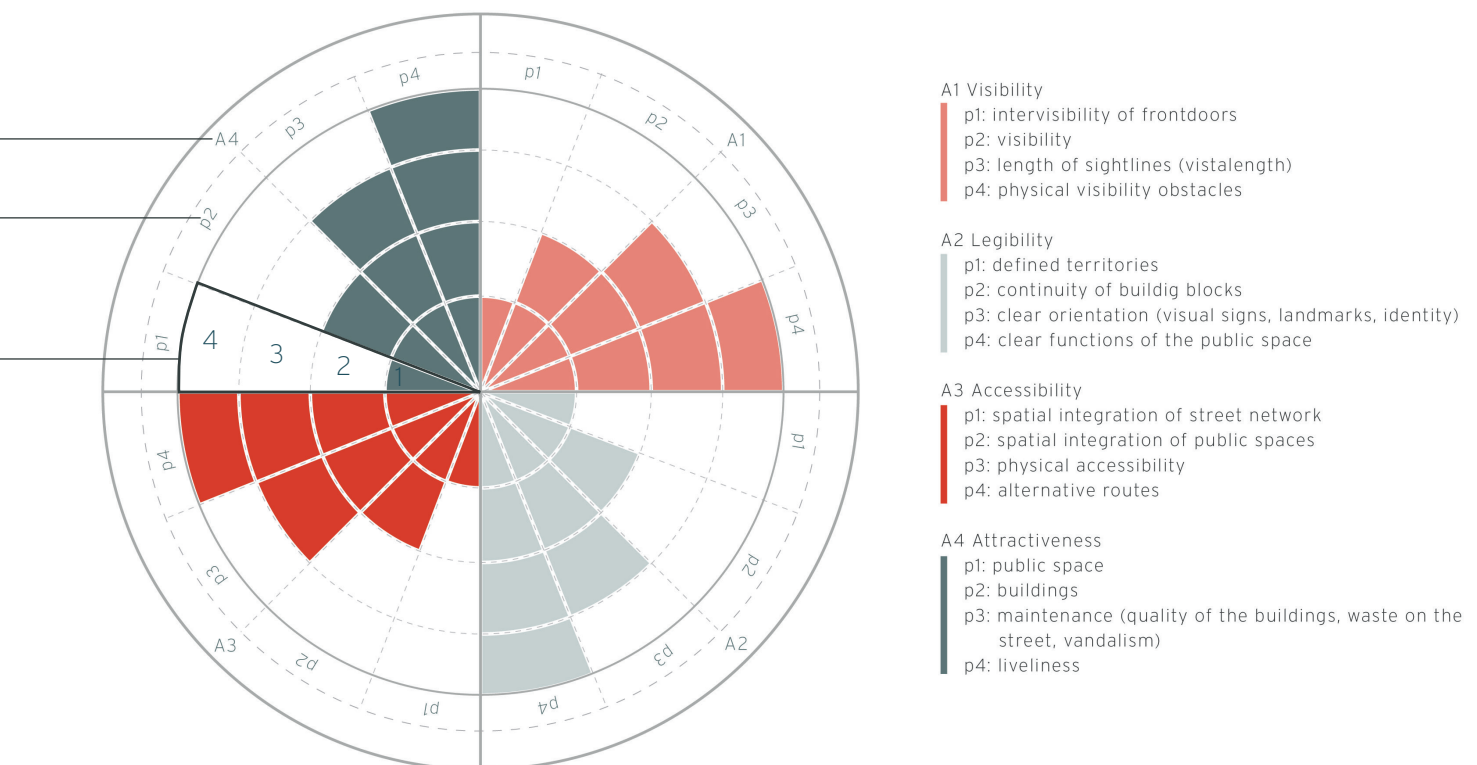
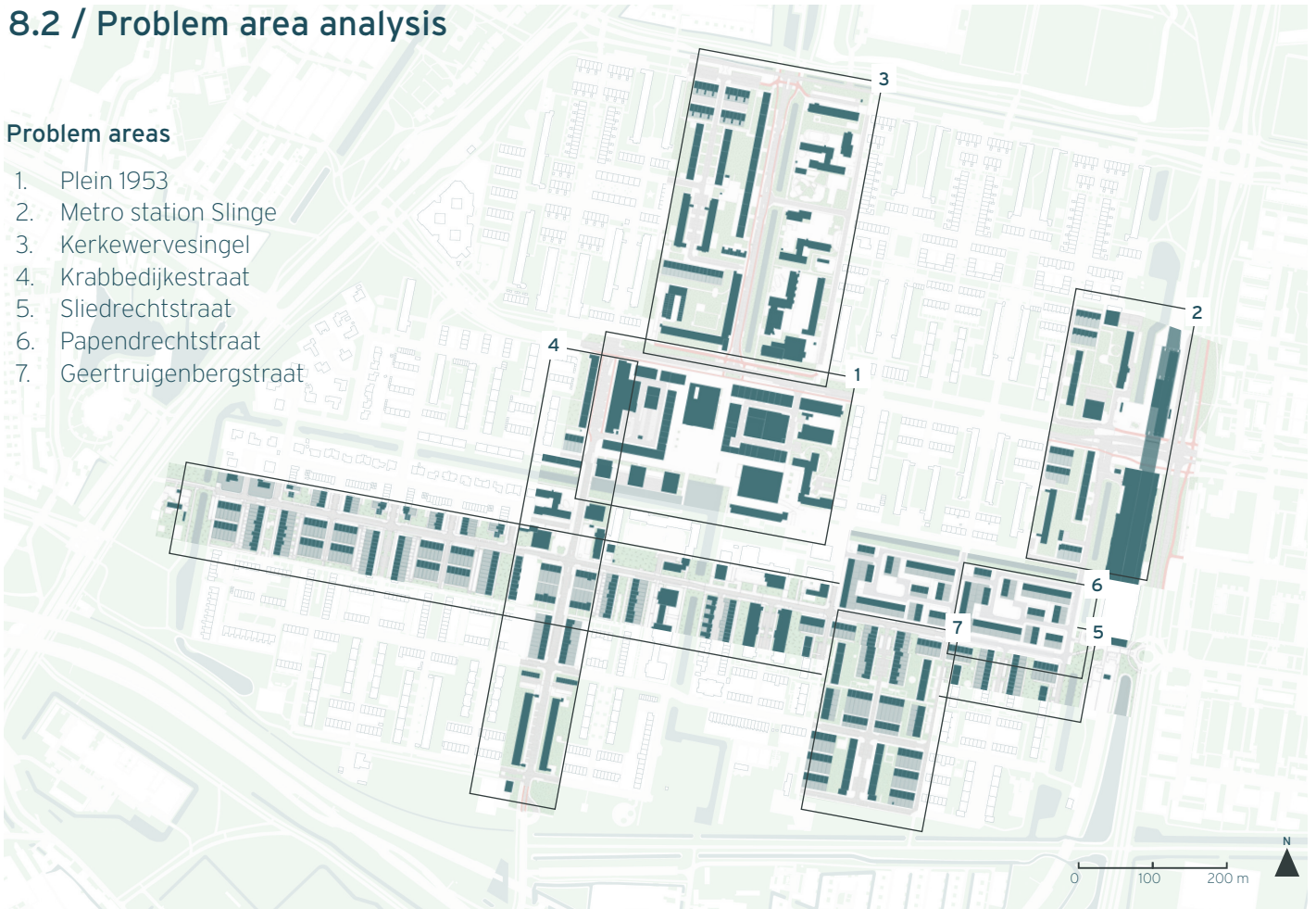


fig 60. Problem area assessment tool

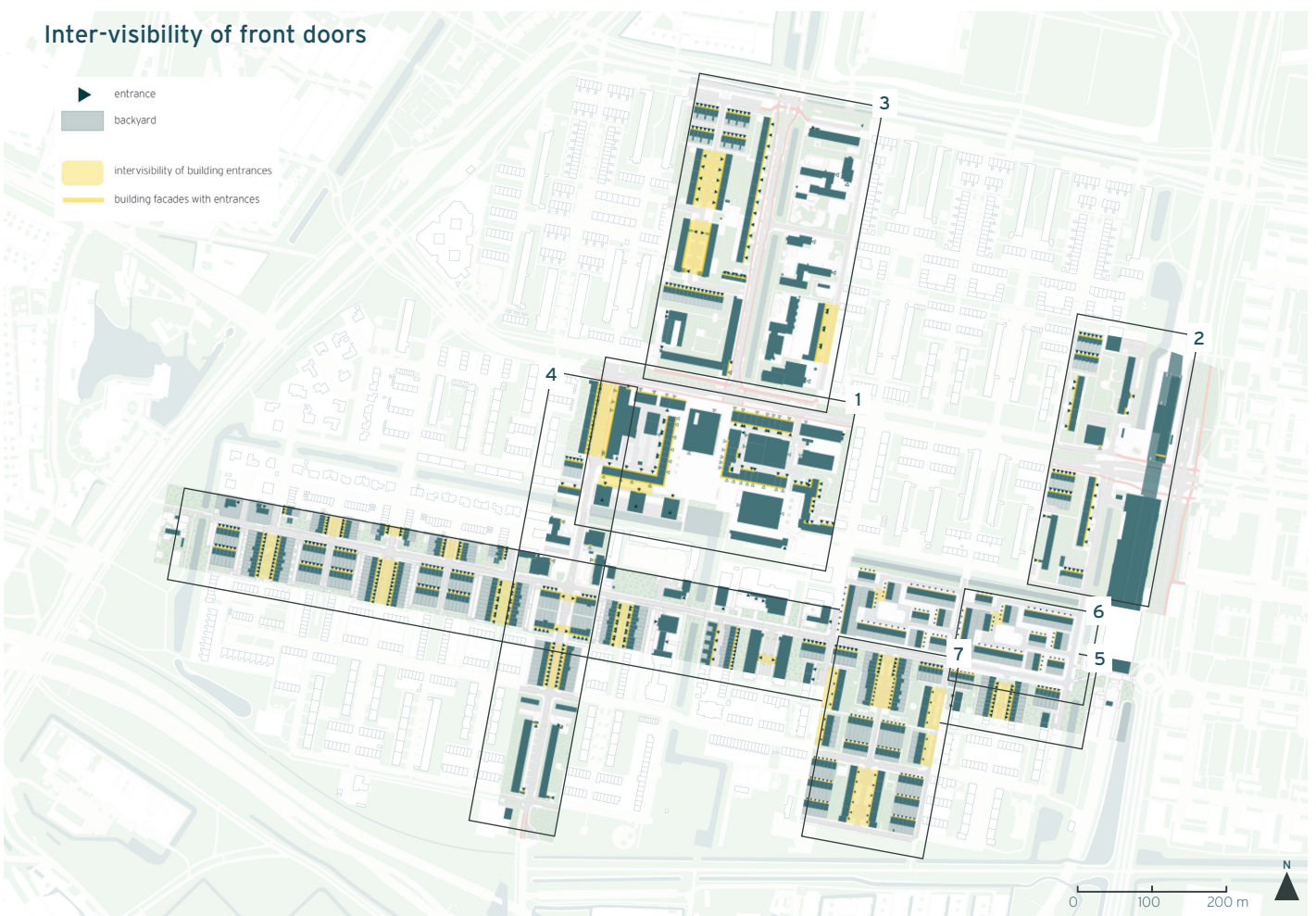
8.2 / Problem area analysis

Problem areas

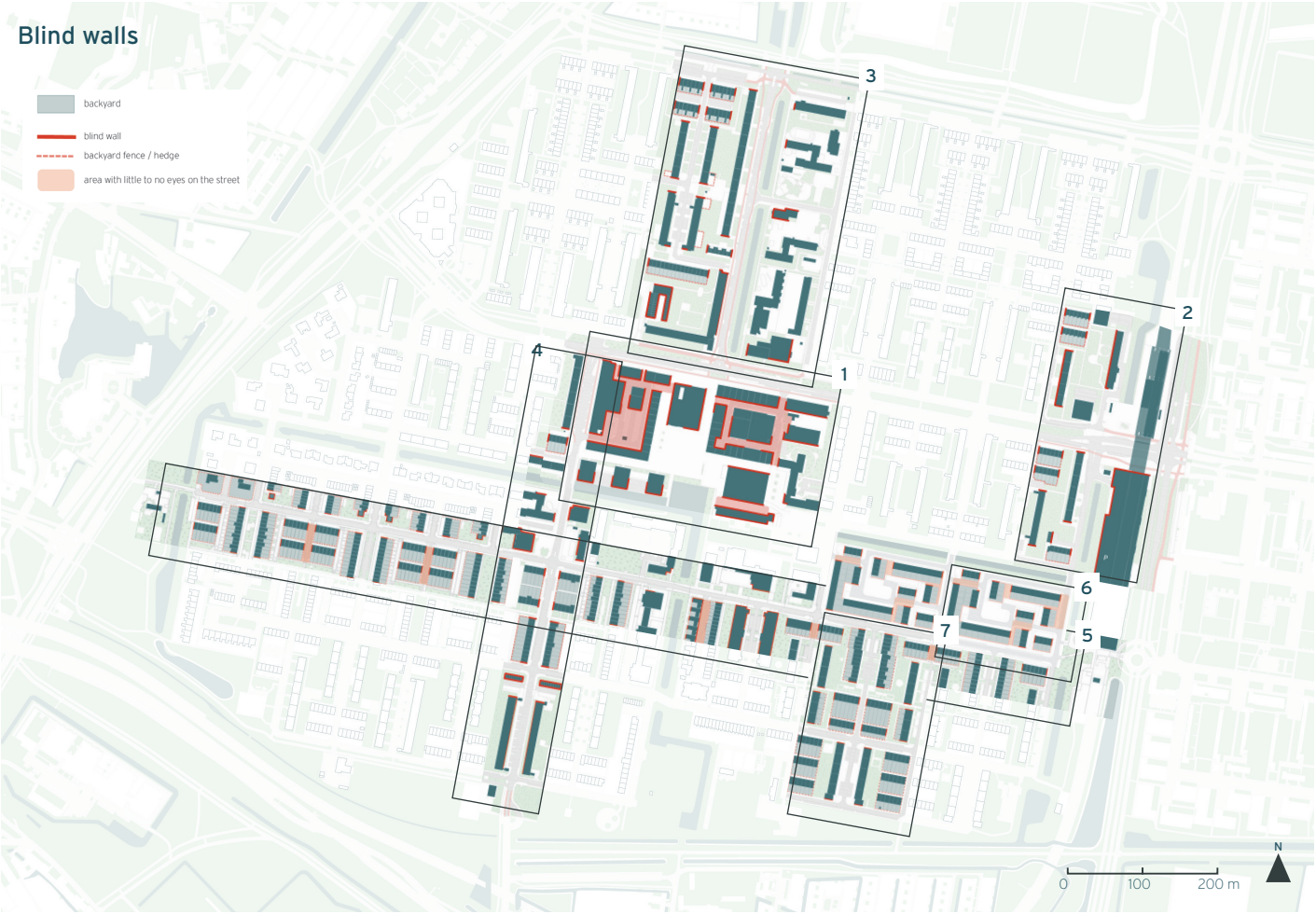
1. Plein 1953
2. Metro station Slinge
3. Kerkewervesingel
4. Krabbedijkestraat
5. Sliedrechtstraat
6. Papendrechtstraat
7. Geertruigenbergstraat



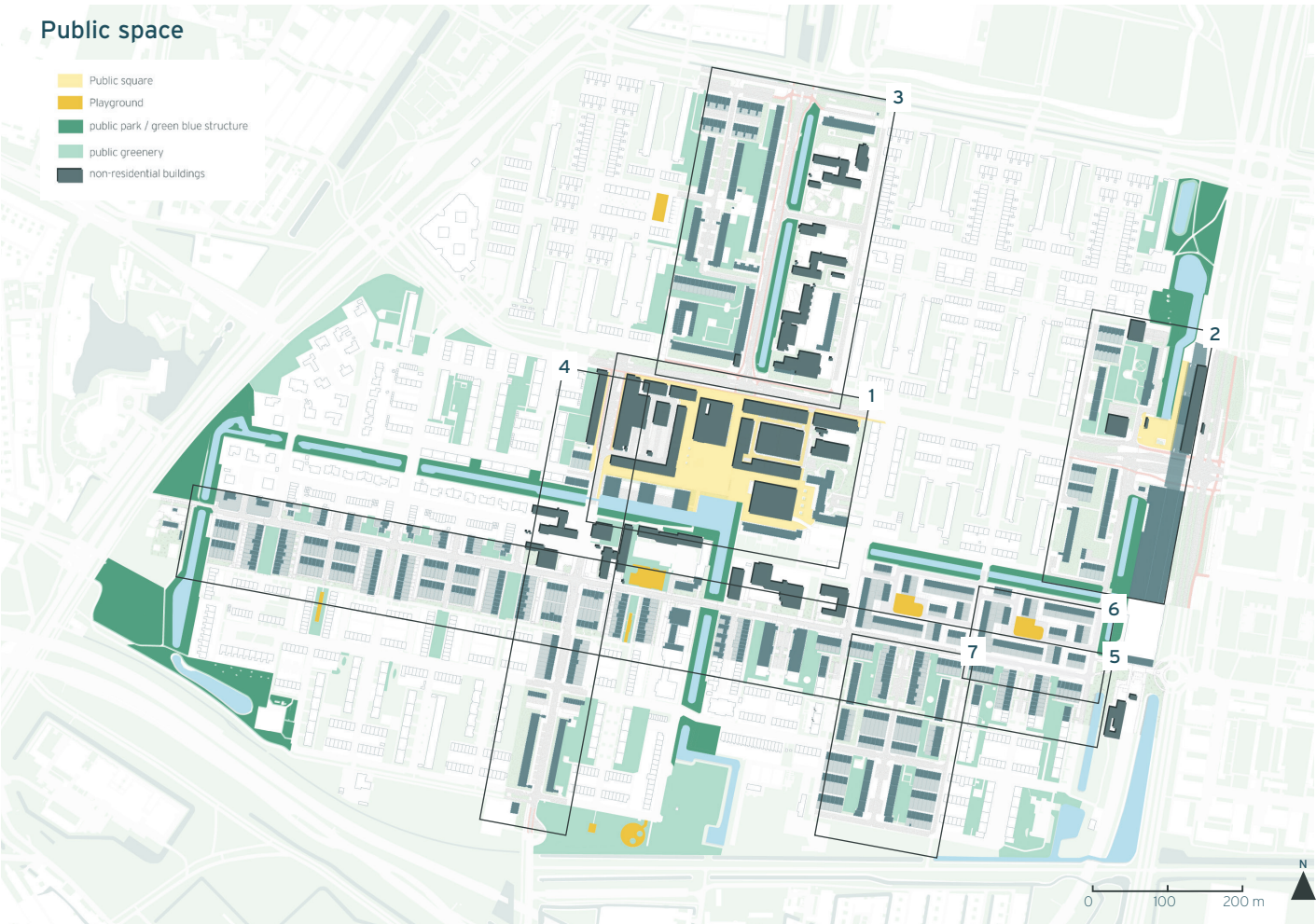
Inter-visibility of front doors



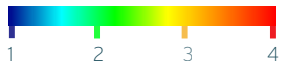
Blind walls



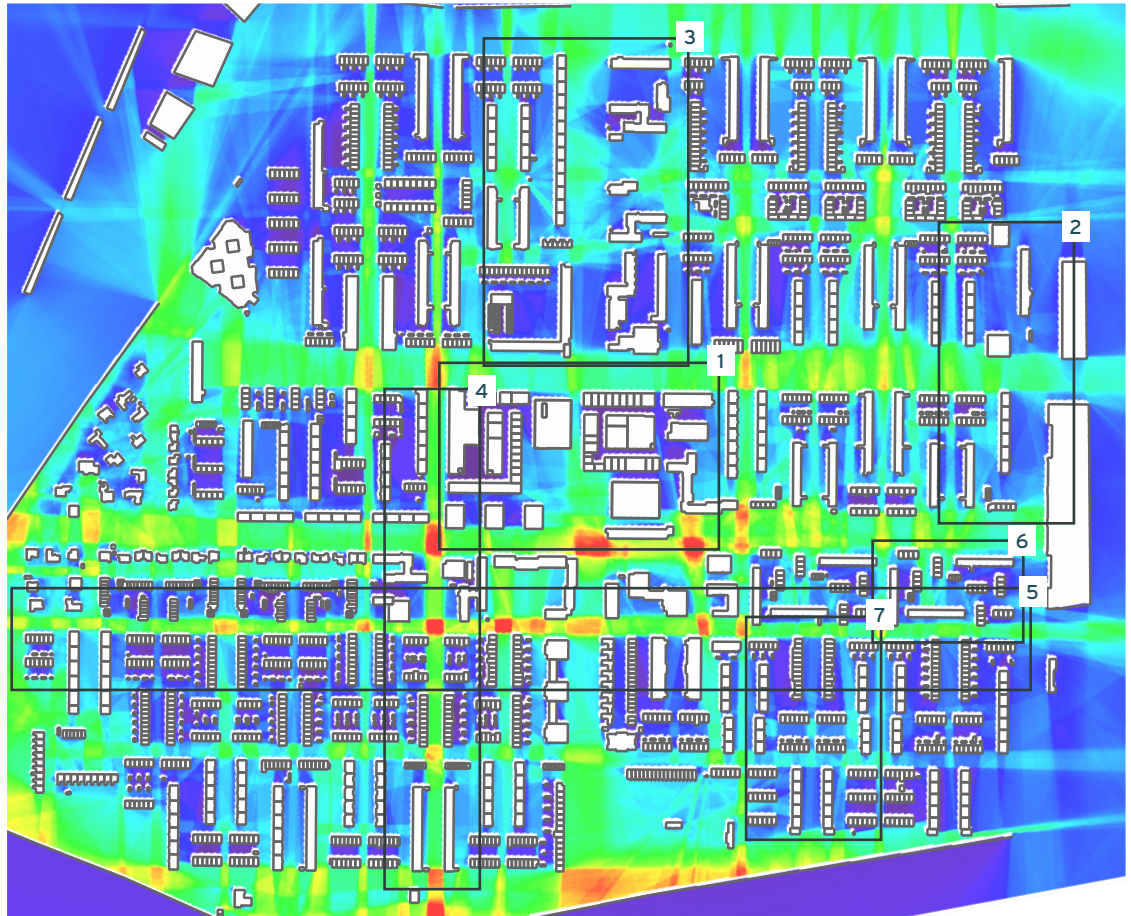
Public space



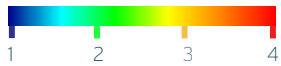
Visibility



1. Plein 1953
2. Metro station Slinge
3. Kerkewervesingel
4. Krabbedijkestraat
5. Sliedrechtstraat
6. Papendrechtstraat
7. Geertruigenbergstraat



Vistalength - length of sightlines



1. Plein 1953
2. Metro station Slinge
3. Kerkewervesingel
4. Krabbedijkestraat
5. Sliedrechtstraat
6. Papendrechtstraat
7. Geertruigenbergstraat

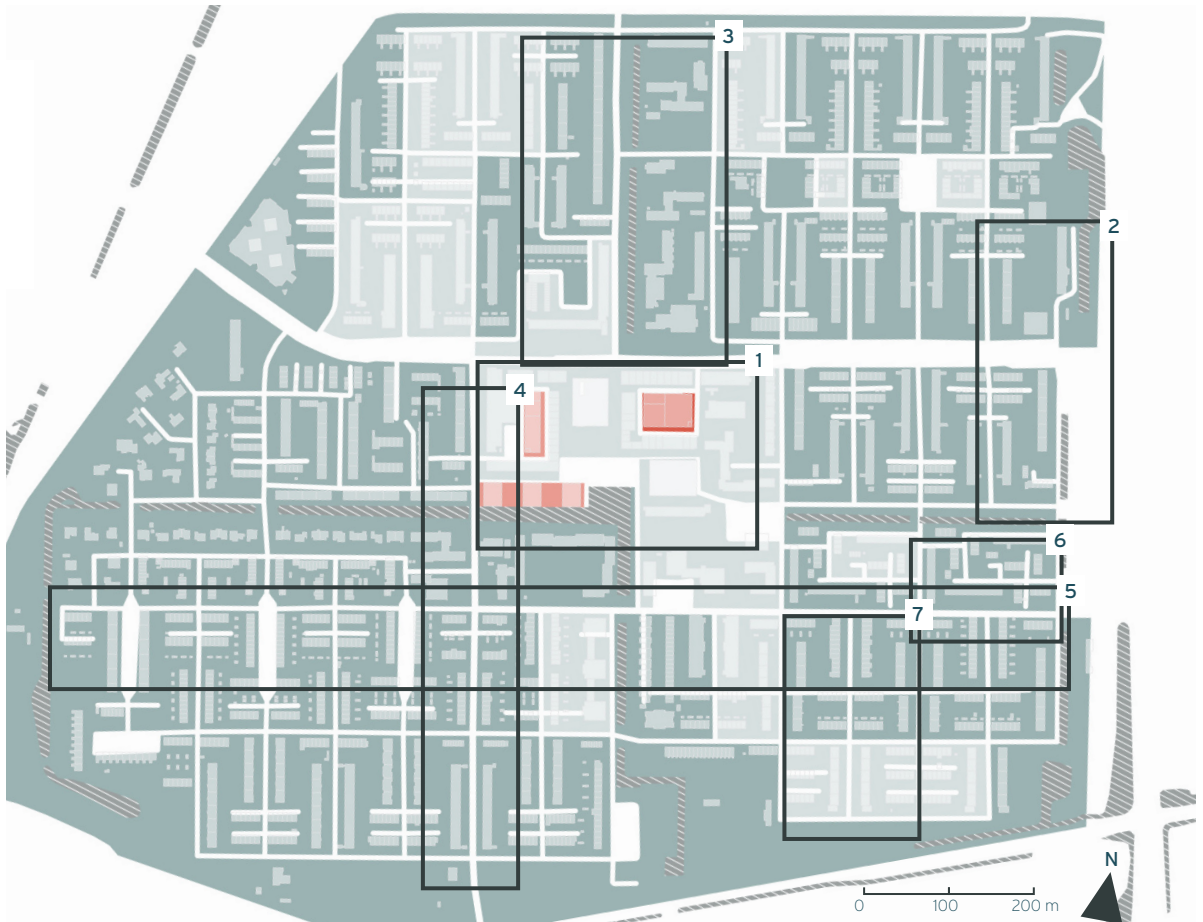
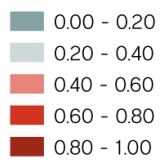


0 100 200 m



Continuity

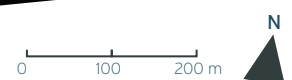
GSI



Spatial integration



fig 61. Space syntax analysis of Pendrecht (analysis conducted by and image by L. de Rooij & van Nes, 2011)



8.3 / Problem area assessment

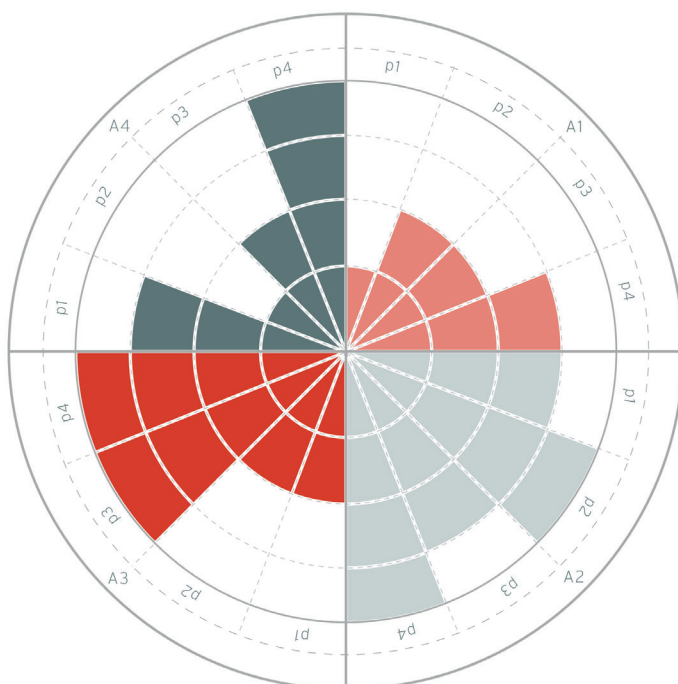
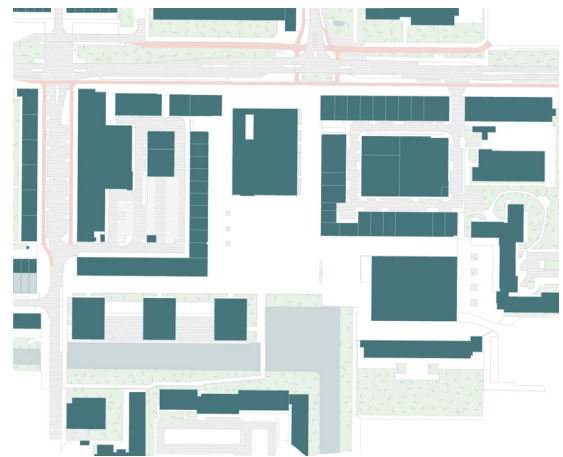
Plein 1953

Plein 1953 is the main public square of the neighborhood and most of the shops in the neighborhood are located around or near the square. The layout of the square is very open and most of its current form is from the original design from the 1950s. The central part of the square has its own distinctive pavement pattern, which defined the public space. The buildings surrounding the square are two storey high, of which the first floor facilitates the shops and the first floor facilitates apartments. However, some of the shops are vacant and the buildings are poorly maintained. The entrances of the apartments above the shops are located at the back of building, which is laid out for parking and logistics. This area behind the shops has a messy and cluttered appearance (photo 5). The balconies of the apartments are located on the side of the parkinglot and logistics area, instead of looking out on the main square to improve social control. There are only a few places to sit on the square, and there is one playground element added to the space. The openness of the square enables flexibility to organize neighborhood events, but in general, it leaves the space unused. The paths that lead to the main square have partially blind walls, which in combination with the stores that close in the evening, cause for a uncontrolled and perceived unsafe space in the evening/night.

Overall the assessment of Plein1953 shows that the area can improve most on the aspects related to the amount and intervisibility of frontdoors, and making the main square attractive again.

Signs of unsafety

- blind walls
- no entrances directly at the main square
- chaotic parking aspects and logistics area
- signs of deterioration
- no specific use for the public sapce
- not many "eyes on the street"
- vacant shops



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



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source: Google maps



6

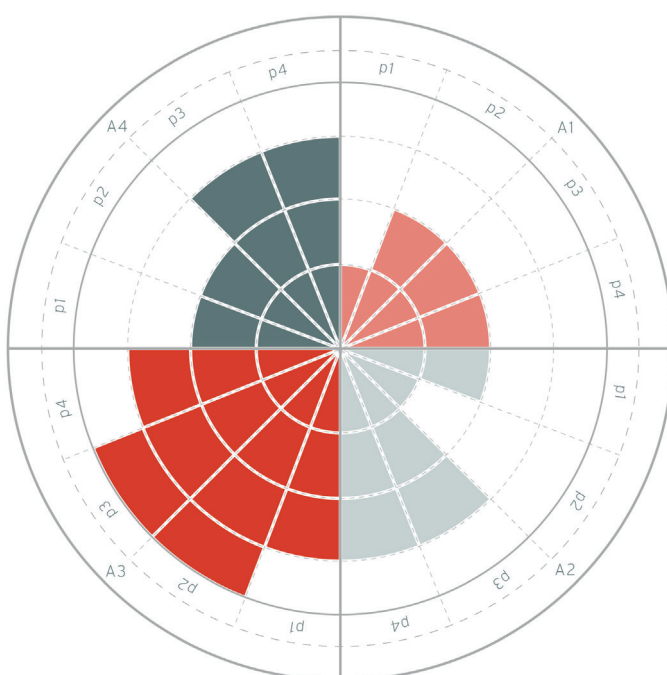
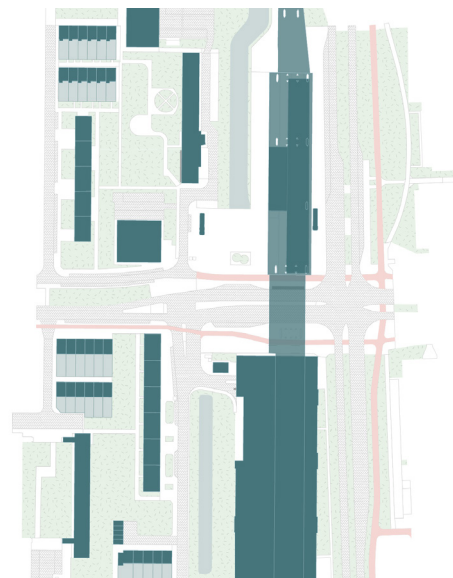
Metro station Slinge

Metro station Slinge is the only metro station that serves Pendrecht and the neighboring neighborhood Zuidwijk. It is located on the border between Pendrecht and Zuidwijk. The square in front of the area is paved, with a pattern of red and grey brick, which highlights the path to the metro entrance. The exit of the station is underneath concrete structure that elevates the metroline. This obstructs the visibility on the metro entrance and could possibly provoke unwanted behavior. The environment around the station and its public square is not defined on any side by continuous building block, which creates a undefined and very open public space. In addition, there are no directly connected building entrances on the street, which is a sign of low social control.

Overall the assessment of the metro station area shows that the area can improve by increasing visibility on the area, this can be done by creating more "eyes on the street" and create more directly connected entrances to the square to increase social control. The assessment shows that the area can also be improved by making the area more attractive. The mostly paved square can be redesigned into a more friendly and inviting square where visitors of the neighborhood get a positive first impression. Lastly, the area could improve by adding a landmark to help visitors orient themselves once they exit the metro station.

Signs of unsafety

- Very few "eyes on the street"
- No directly connect building entrances
- Entrance of the metro under the concrete structure
- No clear orientation point or landmark
- No continuity of buildings surrounding the square
- Unattractive square
- Unaccessible from surrounding buildings



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



source: Google maps

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source: Google maps

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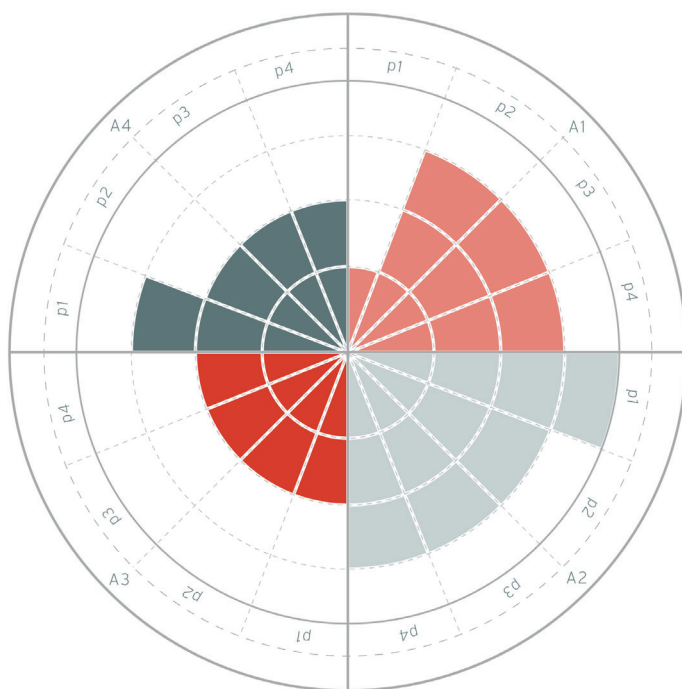
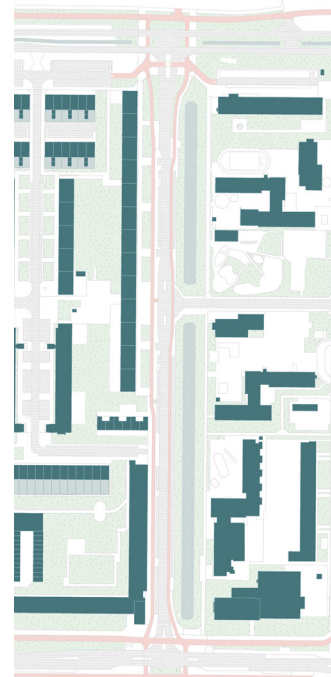
Kerkwervesingel

The Kerkwervesingel is the a street that directly connects the ring road on the north of the neighborhood with the neighborhood centre. Schools are located on the east side of the road and apartment buildings are located on the west side of the road. One of the apartment buildings on the east is around 200 meter long and has two underpasses. These underpasses are slightly elevated, which makes it less/not accessible for vulnerable groups. In addition, there is no visibility from other buildings on these underpasses, which could provoke unwanted behavior. The street profile is a prime example of a modernist layout, the profile is wide and there is parallel parking on both sides of the road, and the cycling path and sidewalk are separated. The canal which is located on the east side of the road, has no recreational value, since there is parking on the one side and fences on the other side of the canal.

Overall the assessment of the Kerkwervesingel is performing the worst on the aspect of accessibility. There are no clearly visible alternative route due to the long building blocks. The alternative routes that are present (the underpasses) are inaccessible for certain groups and could be perceived unsafe due to the low visibility. The street could also improve by utilizing the possibilities of the canal and become a more attractive environment.

Signs of unsafety

- Blind walls
- Underpasses that are not visible from other buildings
- Underpasses less / not accessible for vulnerable groups
- Waste on the street
- Long building block (200m)
- Unaccessible public green and blue



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



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source: Google maps



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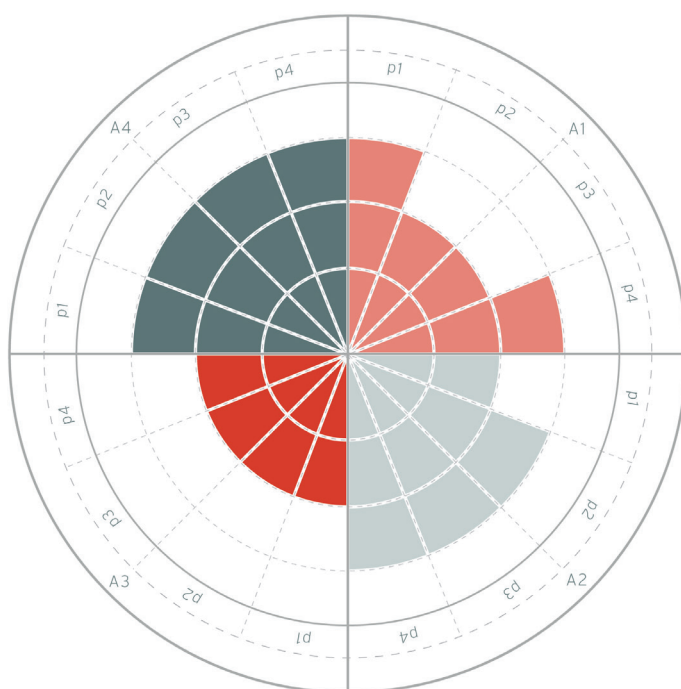
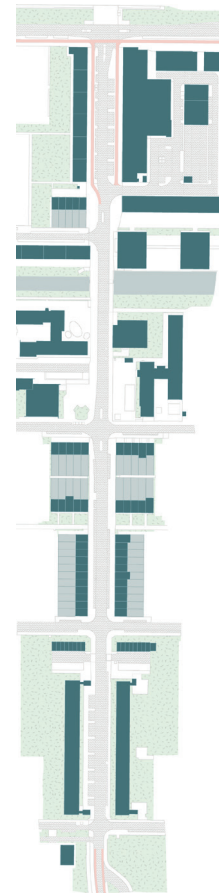
Krabbedijkestraat

The Krabbedijkestraat is a road that connects the south of the neighborhood with the neighborhood centre. The north part of the street is part of the shopping centre and facilitates several shops (picture 5). More to the south the street is residential with both apartment buildings and single family houses. The apartment buildings have shared entrances on the ends of the buildings (pictures 1 and 2). This creates a long part of the street without directly connected entrances. The buildings on the street vary between the original buildings from the 1950s and newer buildings. The older buildings appear to be poorly maintained and some of the newer buildings are oriented at a right angle to the street (picture 3). Due to the varying orientation of the buildings to the street, the continuity is not continuous.

Overall the assessment of the Krabbedijkstraat shows that the street needs to improve on the aspect of accessibility. This is due to the poor spatial integration of the street and the low amount of alternative routes available. South of the shopping part of the street is a canal. Like the canal in the Kerkwervingseingle it is not accessible and remains to be public greenery. This could be a opportunity to create a recreational park for the neighborhood. The intervisibility of frontdoors needs to be improve on the parts of the street where the apartment buildings are and where the house are oriented at right angles to the street.

Signs of unsafety

- No directly connected entrances on the street
- Blind walls
- Unaccessible public green
- Low spatial integration
- Low intervisibility of front doors
- Poorly maintained buildings



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



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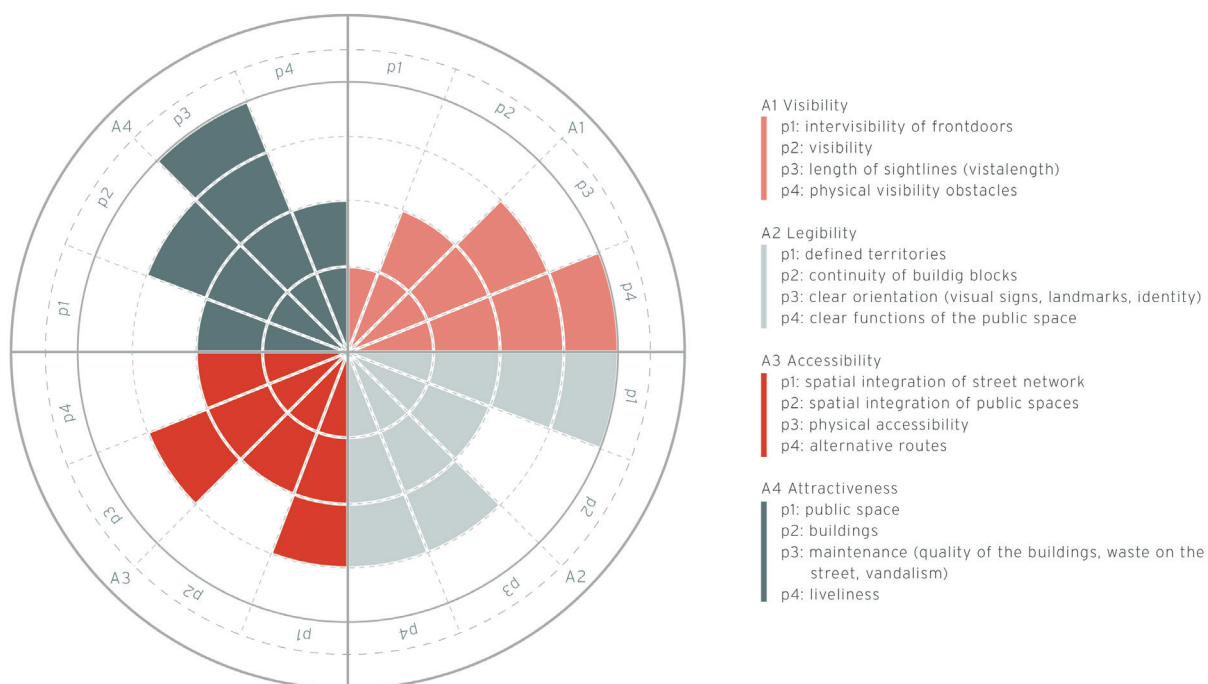
Sliedrechtstraat

The Sliedrechtstraat is the most spatially integrated street in the neighborhood. It is a long street that reaches all the way from the east to the west. Despite this, only a few buildings are oriented with their front doors to the street. Which has resulted in a large part of the street being borders by backyard fences or hedges (picture 2, 3, and 5). In addition, a lot of the buildings on the street are oriented at a right angle to the street, of which the walls are often blind walls. These two characteristics have caused a street without inter visibility of front doors which can be seen on the inter-visibility map on page 118. There are some public spaces in the street, however, these often lack definition and sense of ownership, which leaves the public spaces as void in the urban fabric (picture 2).

Overall the assessment of the Sliedrechtstraat shows that the street needs improvement on the aspect of intervisibility of front doors in order to establish social control. Furthermore, the continuity of the building block should improve in order to create a legible area. As a solution the increased continuity can be combined with adding front doors and create inter-visibility. Lastly, the public spaces along the street and the street as a part of the public space can be made more attractive.

Signs of unsafety

- Poorly maintained buildings
- Backyard fences fronting the street
- Low inter-visibility of front doors
- Undefined public spaces
- Low continuity of building blocks
- Unattractive street profile





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source: Google maps



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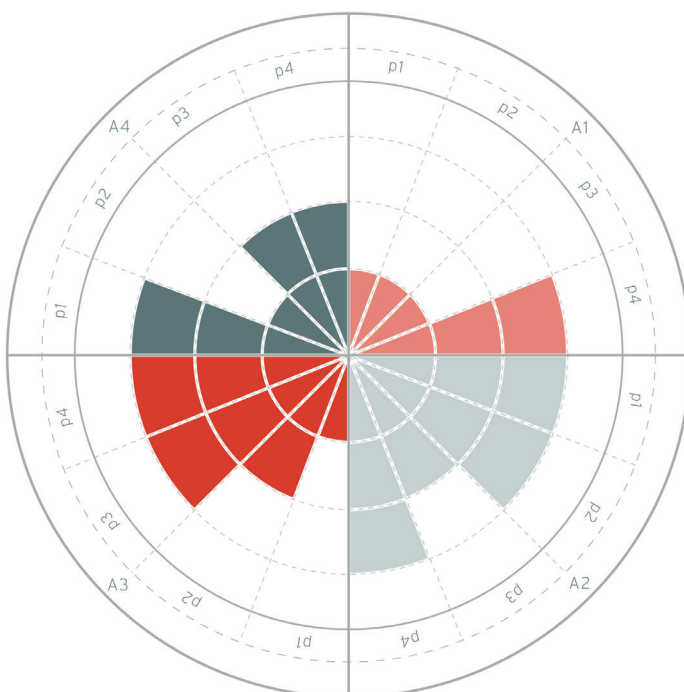
Papendrechtstraat

The Papendrechtsestraat is spatially the most problematic area in the neighborhood. This is due to the poor performance of all four of the aspects that define a social safe environment. Firstly, the street has very low inter-visibility between frontdoors and low overall visibility. Due to the street pattern, the sightlines are short and interrupted by physical elements. Secondly, the overall legibility of the area is poorly defined, the spatial layout suggests that the area is collective, but the sense of ownership is not there. Thirdly, the accessibility of the street is, in theory, performing well, but the many alleys that lead to the street can make it feel unsafe (picture 4). In addition, the street is poorly integrated in the street network of the neighborhood, which causes the street to be desolated and provoke unwanted behavior. Lastly, the street does not appear attractive. The buildings are deteriorating and the many backyard fences that are front the street are creating an uninviting environment.

Overall the Papendrechtstraat is not performing well on the guidelines for social safe design. In order to solve this, the buildings must be transformed or replaced, the sightlines need to be longer, the inter-visibility of the front doors needs to be increased, the streets need to be fronted by facades with windows instead of fences, and the street needs to be integrated in the street network. In conclusion, this street can not be improved with one spatial intervention, but must be improved with an integral solution.

Signs of unsafety

- Low inter-visibility of front doors
- Deteriorating buildings
- Blind walls
- Low spatial integration
- Short sightlines
- Backyard fences fronting the street
- Alleys between the buildings and fences



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

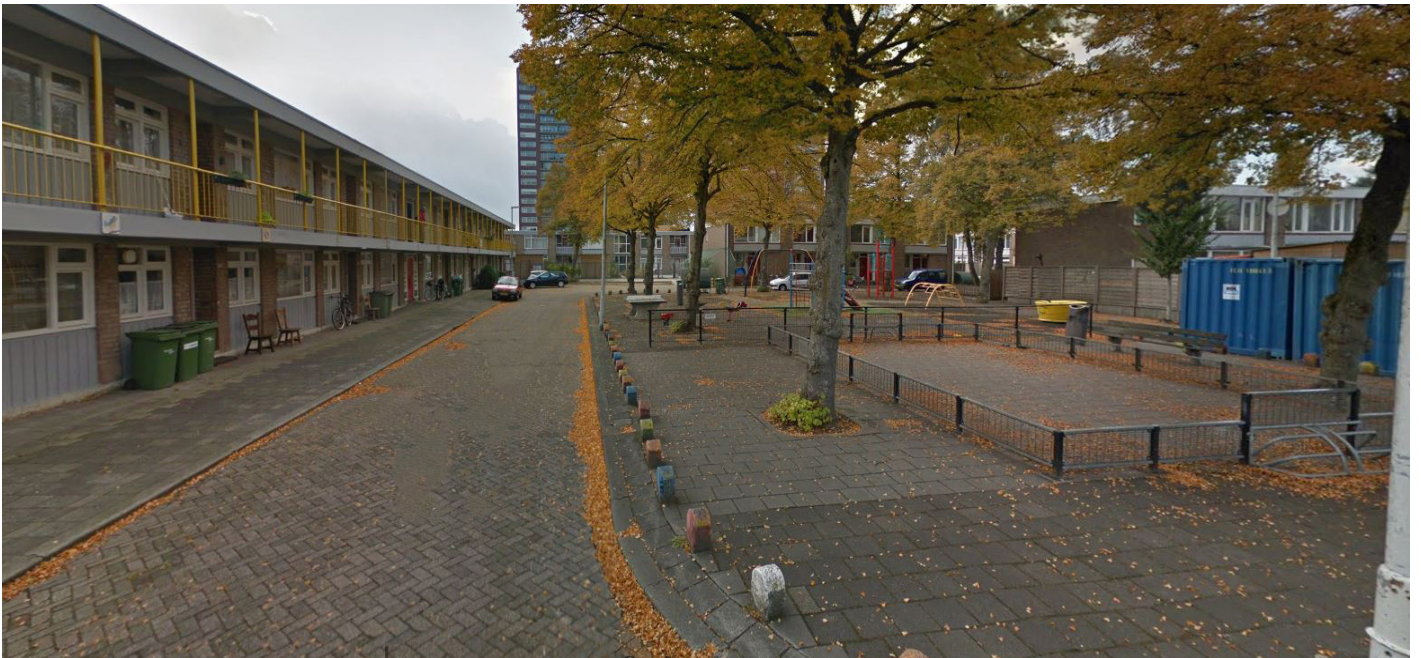
- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



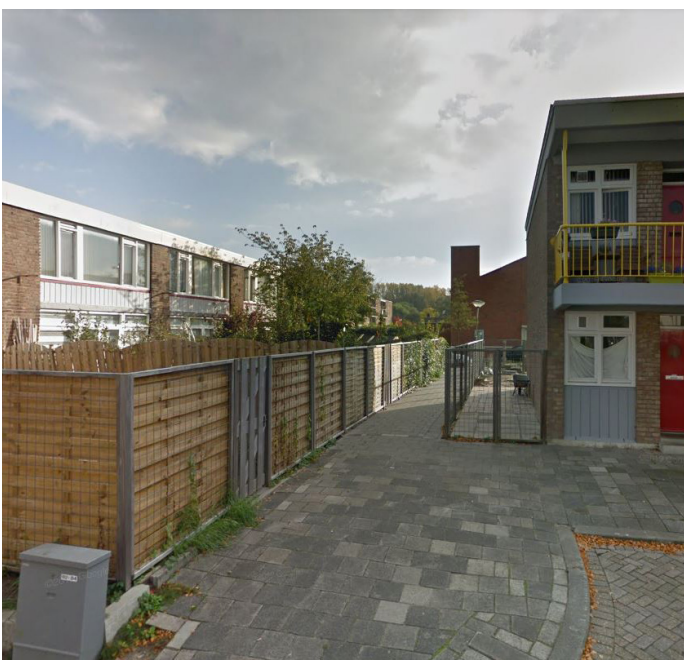
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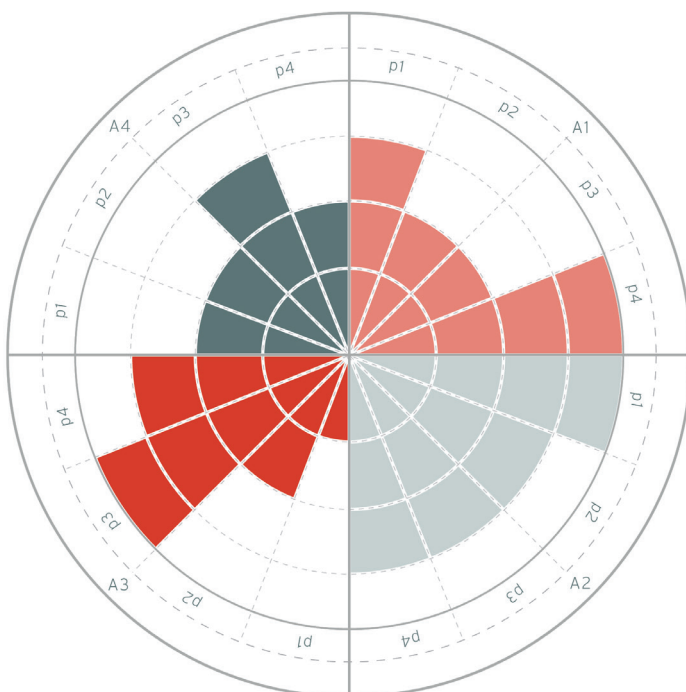
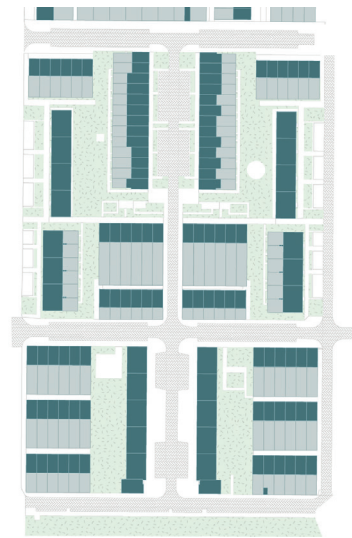
Geertuidentbergstraat

The Geertuidentbergstraat is an example of a common street and building configuration in Pendrecht. The street profile is wide for a residential street, because the modernist principles included that the car dominates the street. Therefore a lot of public space is reserved for parking (picture 1 and 4). The long apartment buildings alternate with low-rise row houses which are oriented at a right angle to the street. These row houses have pedestrians paths or alleys that lead to their front doors. Because of this configuration, some of the front doors are positioned opposite of the backyard fences of the other row houses. Due to this configuration the inter-visibility of front doors in the street is lowered. Although the layout of the north and south part of the street looks similar, the buildings in the south part are from the original plan of the 1950s and the buildings in the north are built in 2009. The older buildings have shared entrances, and blind walls on the ground floor. With regard to accessibility, especially the south part of the area is poorly integrated and appears desolated.

Overall the assessment of the Geertuidentbergstraat shows that the street can be improved on the aspects visibility, accessibility and attractiveness. This is mainly focused on the south part of the street which is less well integrated and the quality of the buildings is lower.

Signs of unsafety

- Cars dominate the street scape
- Blind walls
- Small alleys that lead to the houses



A1 Visibility

- p1: intervisibility of frontdoors
- p2: visibility
- p3: length of sightlines (vistalength)
- p4: physical visibility obstacles

A2 Legibility

- p1: defined territories
- p2: continuity of building blocks
- p3: clear orientation (visual signs, landmarks, identity)
- p4: clear functions of the public space

A3 Accessibility

- p1: spatial integration of street network
- p2: spatial integration of public spaces
- p3: physical accessibility
- p4: alternative routes

A4 Attractiveness

- p1: public space
- p2: buildings
- p3: maintenance (quality of the buildings, waste on the street, vandalism)
- p4: liveliness



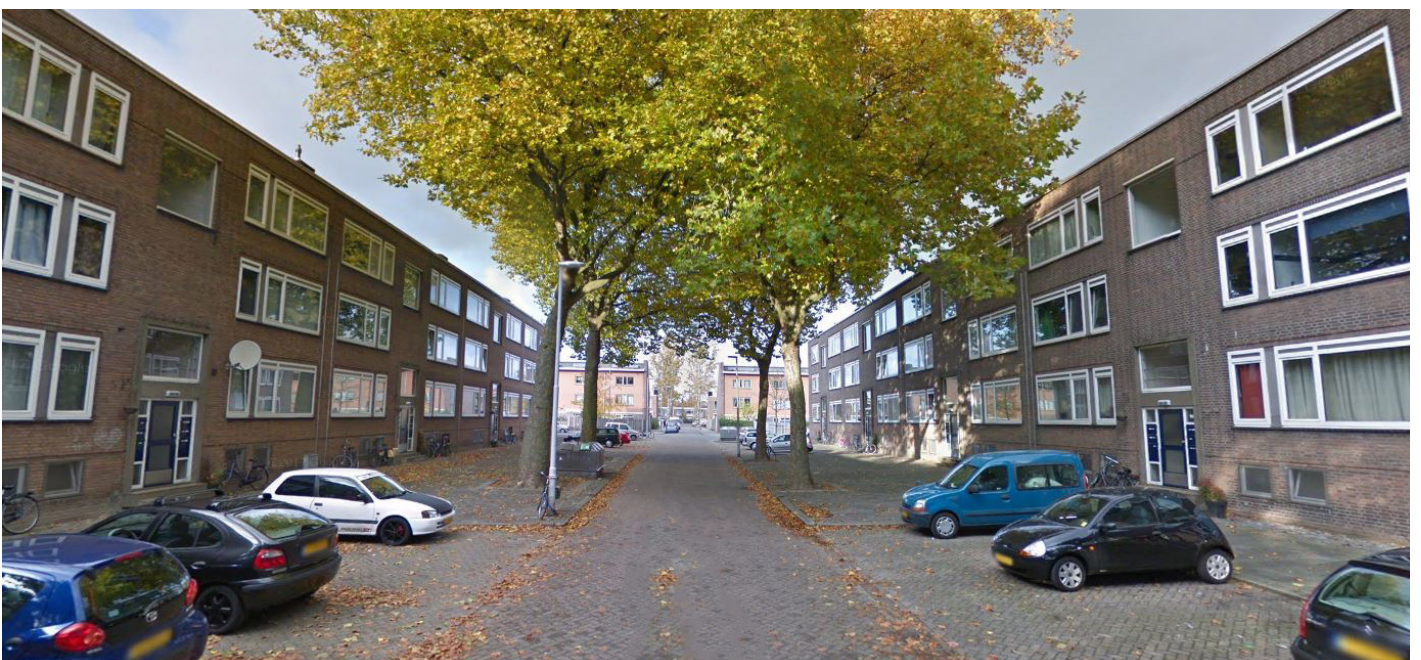
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9 / The Experiment

This chapter describes and shows the stated choice experiment that has been conducted in order to validate the selected design principles and answer the sub question: *How are targeted spatial changes experienced by people with the condition to improve the perceived safety?*. The selection of the design principles is based on the literature study and the spatial analysis from the previous chapters. The experiment explores the relationship between preference and spatial attributes that affect perceived safety. The experiment is conducted in the form of a survey, and the results are statistically analyzed in order to measure the significance of the preference.

9.1 / Stated choice experiment

Survey

The experiment is based on an online survey, that has been constructed using the online survey software Qualtrics. The survey consists of two parts, the first part includes 7 questions where the participants were given a choice task and the second part includes demographic questions (gender, age, ethnic background, zip code).

The survey is carefully constructed and took into account survey fatigue and the importance of the order of the questions. The survey comprises a total of 11 questions, of which the first part contains 7 questions that require concentration and focus. The second part contains 4 questions that are easy to complete and require little to no focus. The order of these parts has been deliberately put in this way, so that at the start of the survey the participant becomes interested in the displayed images instead of losing interest by the standard demographic questions.

Part 1 / Choice task

In the first part, the participants were presented with a situation. This situation has been carefully constructed with the aim of creating a recognizable situation for all participants, while it is emphasized that they are unfamiliar with the environment and that they are lost. In addition, when presenting the situation, it was important to avoid creating a sense of rushing, so that the participants would take their time to study the environment. The presented situation is the following:

"You have an appointment with someone at a location you have never been to. You have just got off the bus and walk into the neighborhood, but you are lost. The two street shown below are the options you have to get to your destination, which option would you choose to arrive at the appointment while feeling safe?"

Creating a recognizable situation is important when it is unknown who will participate in the survey. The situation must be comparable for each participant, so that the individual responses to the survey can be compared and results of the study are genuine. When a situation is proposed in which it is more recognizable for one participant than for the other participant, it influences how the environment and safety is perceived. This is mainly due to the fact that unknown situations can lead to increased levels of stress, unsafety and discomfort. According to Kaplan and Kaplan (2005), this is because the environment conveys information and processing this information requires attention. In certain unfamiliar environments and/or situations this attention requires effort by being more

alert. When this holds on for some time, this can cause mental fatigue, or in other words, stress.

The premise of this stated choice experiment is based on the fact that people, when given the option, will choose the alternative with the highest utility, also defined as "the level of happiness that an alternative yields to an individual (Van Dongen & Timmermans, 2019). Therefore, in this first part of the survey, the participant has to select their preferred environment within the context of the given situation. Each question includes two images, of which one is the current situation in the area and the other image includes a targeted change with the use of a spatial attribute. The choice sets have been randomized, this way not every first option is the current situation and not every second option is the targeted change or the other way around. This way, the participant will not get familiarized with the repeating current situation and targeted change options. The spatial attributes have been selected based on the theoretical framework of this research. For example, the first question includes an image of the current situation of a low rise building block where the front doors are directly connected to the sidewalk, and a second images where the spatial attribute includes adding front gardens to the building block, which creates a soft transition between public and private realm and increases the attractiveness of the street.

The spatial attributes that have been chosen for this experiment are:

1. Adding front gardens
2. Increase continuity of building blocks
3. Adding front doors
4. Splitting long building blocks
5. Adding a path to an empty public space
6. Creating physical borders between territories
7. Adding building floors

Part 2 / Demographics

The second part of the survey asks the following demographic characteristics of the participants: gender, age, migration background and, zip code. These questions are included in the survey for subgroup analysis purposes, where differences in preferences between gender, age group, ethnic background or degree of urbanity of the residential environment can be analysed. The degree of urbanity is measured based on the address density which ranges from very strongly urban (more than 2.500 addresses per km²) to not urban (less than 500 addresses per km²). Each of the demographic questions also included the option of not sharing this information for privacy reasons.

Participants

The survey is distributed by an anonymous link that has been shared via social platforms (WhatsApp, Facebook, LinkedIn). This distribution method resulted in 344 responses. In this experiment, a conscious decision was made not to distribute the survey to residents of the neighborhood. This decision is based on the fact that residents of the neighborhood are already familiar with the environment and are aware of the social and physical factors that are present in and around the displayed environments. This could contaminate the results of the experiment. For example, a resident of the neighborhood might live in one of the streets that are displayed in the questions, and therefore would be biased when selecting their preference.

Spatial attributes

As mentioned before, the experiment aims to validate 7 design principles based on spatial attributes. A hypothesis has been formulated for each of the spatial attributes in which it is assumed that the participant has a preference for the situation where the spatial attribute is displayed. In addition to the spatial attributes, adjustments have also been made to the atmosphere of the environment. Lighting in a public space influences the perceived safety a lot, so for some questions the conscious choice was made to display the situation in the evening. This should be taken into account when interpreting the results. When these design principles are applied in a design, it is important to take into account not only the situation during the day, but also the situation in the evening or night.

Current situation

Spatial attributes

Q1

Adding front gardens



Q2

Increase continuity of building blocks



Q3

Adding front doors



Q4

Splitting long building block



Q5

Adding a path to an empty public space



Q6

Creating physical borders between territories



Q7

Adding building floors



Q1 / Adding front gardens

Hypothesis:

The participants prefer the situation in which the front gardens have been added.

Theory:

Front gardens make a street more attractive, lively, and softens the transition between public and private.



Q2 / Increase continuity of building blocks

Hypothesis:

The participants prefer the situation in which the building blocks are rotated.

Theory:

By rotating the building blocks there are more front doors on the street and there is a higher intervisibility between the front doors, which increases the social control.



Q3 / Adding front doors

Hypothesis:

The participants prefer the situation with the added front doors.

Theory:

By adding front doors to the buildings the street becomes more lively and there are more direct physical connections between the dwelling and the street, which increases the social control.



Q4 / Split long building block

Hypothesis:

The participants prefer the situation where the building is split in two

Theory:

Splitting the building creates an alternative route, which gives the observer the opportunity to avoid unwanted situations ahead. The alternative route is well lit, which reduces the chance of unwanted behavior.



Q5 / Adding a path to an empty public space

Hypothesis:

The participants prefer to continue walking on the sidewalk

Theory:

The path that runs through the park is less well lit than the sidewalk. People can not see what is happening in the park, the reduces the perceived safety. In addition, surrounding residents also can not see what is happening in the park, as a results the social control is low



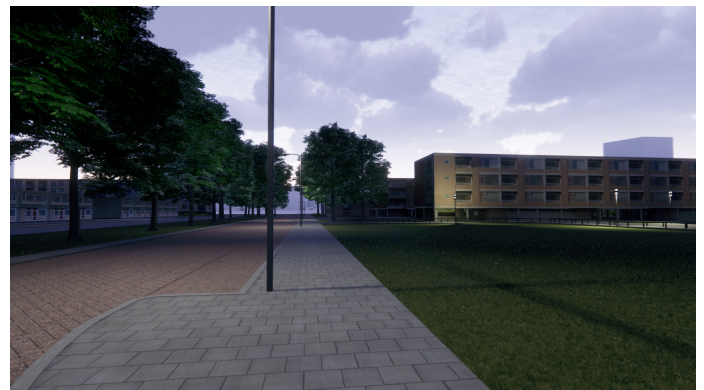
Q6 / Creating physical borders

Hypothesis:

The participant prefer the situation in which the hedge (a physical border) is added.

Theory:

By adding a physical border between territories the area becomes more legible and because the border is a hedge it also adds to the attractiveness of the street. Furthermore, an open field of grass can feel unsafe in the dark



Q7 / Adding building floors

Hypothesis:

The participant prefer the situation where floors are added to the current buildings.

Theory:

By adding floors to the existing buildings there are more windows, and therefore eyes, directed to the public space. Eyes on the public space increases the social control.



Q8 / Zip code

Each participant has been asked to enter their zip code. The data of the zip code can be converted to the degree of urbanization of the area in which the participant lives. To define the degree of urbanization that data from CBS (Central Bureau of Statistics of the Netherlands) is used. The scale that the CBS uses is based on the address density and is categorized by 5 categories, ranging from very strongly urban (2.500 addresses per km² or more) to not urban (less than 500 addresses per km²).

Q10 / Age

Each participant was asked to enter their year of birth. This data is converted to their age and age group. The age groups are classified by 10-year age periods. This data is used in the statistical analysis to see whether there is a strong difference in preference between different age groups.

Q9 / Gender

Each participant was asked to enter their gender. This is used in the statistical analysis to see whether there is a strong difference in preference between men and women.

Q11 / Migration background

Each participant was asked to enter their migration background. Like the gender and age group, this data was intended to look at differences in preferences of groups with different migration backgrounds. However, the data collected with this question was not as expected, 87% of the respondents are of Dutch descent. This makes it irrelevant to analyze the differences in preference. It is important to take into account when analyzing and interpreting the results that the majority of the sample has no migration background.

9.2 / Results

Demographic composition of participants

A total of 344 participants completed the survey. Among the 344 participants were 87 men, 254 women and 3 participants of unknown gender (Table 12). So there are many more women that have participated in the survey, this is a result that needs to be taken into account when the results will be interpreted. The distribution of participants by age group is fairly evenly distributed between the ages of 20 and 70, with a peak in the age group of 20 to 30 years old. The distribution of the degree of urbanity of the participants is as follows: 104 participants live in a highly urban environment, 65 participants live in a moderately urban environment, 58 participants in a less urban environment, and 71 participants live in a non-urban environment. In this table, and following tables that include the degree of urbanity, the category of very strongly urban is not included, because there were no results in this category. This distribution of degree of urbanity is useful for the subgroup analysis of the results, because the amount of participants from an urban environment and a non urban environment is almost even.

		Gender	
		Frequency	Percent
Valid	Male	87	25,3
	Female	254	73,8
	Total	341	99,1
Missing	Prefer not to say	3	,9
Total		344	100,0

Table 12. Distribution of gender of the sample

		Age group	
		Frequency	Percent
Valid	10-20	13	3,8
	20-30	90	26,2
	30-40	62	18,0
	40-50	60	17,4
	50-60	52	15,1
	60-70	45	13,1
	70-80	9	2,6
	80 or older	2	,6
	Total	333	96,8
Missing	missing	11	3,2
Total		344	100,0

Table 13. Distribution of age groups of the sample

		Urbanity	
		Frequency	Percent
Valid	2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	104	30,2
	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	65	18,9
	4. Little urban (address density from 500 to 1000 addresses / km ²)	58	16,9
	5. Non-urban (address density of less than 500 addresses / km ²)	71	20,6
	Total	298	86,6
Missing	System	46	13,4
Total		344	100,0

Table 14. Distribution of degree of urbanity of the sample

Gender * Age group Crosstabulation

% within Gender		Age group							
Gender		10-20	20-30	30-40	40-50	50-60	60-70	70-80	80 or older
Gender	Male	6,0%	28,6%	22,6%	15,5%	11,9%	10,7%	4,8%	
	Female	3,2%	25,9%	17,4%	19,0%	17,0%	14,6%	2,0%	0,8%

Table 15. Distribution of age groups among men and women

Gender x Age group

To gain a better insight into the composition of the sample, cross tabulations have been made to look at the different demographic characteristics. Table 15 shows the distribution of the different age groups among men and women. For both men and women the distribution of the age groups is fairly equal. Table 16 shows the distribution men and women among the different age groups. It can be seen from this table that the percentage of women in each age group is higher than men. This is due to the unequal ratio of men and women who participated in the survey.

Age group * Gender Crosstabulation

% within Age group		Gender	
Age group		Male	Female
10-20		38,5%	61,5%
20-30		27,3%	72,7%
30-40		30,6%	69,4%
40-50		21,7%	78,0%
50-60		19,2%	80,8%
60-70		20,0%	80,0%
70-80		44,4%	55,6%
80 or older			100,0%

Table 16. Distribution of men and women over the degree of urbanization

Age group x Urbanity

Furthermore, the distribution of the degree of urbanity among the different age groups has been analyzed (see Table 17). What is striking in this table is that the younger age groups more often live in a strong urban environment and the older age groups live in a less urban or non-urban environment. This is important to take into account when one of the choice task results show a significance for age groups or degree of urbanity.

Age group * Urbanity Crosstabulation

% within Age group		Urbanity			
Age group		2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)
10-20		40,0%	20,0%		40,0%
20-30		46,8%	27,3%	14,3%	11,7%
30-40		59,6%	15,4%	9,6%	15,4%
40-50		28,3%	18,9%	18,9%	34,0%
50-60		10,6%	6,4%	40,4%	42,6%
60-70		13,3%	37,8%	26,7%	22,2%
70-80		57,1%	14,3%		28,6%
80 or older			100,0%		

Table 17. Distribution of the degree of urbanity among the different age groups

Gender x Urbanity

Lastly, the distribution of the degree of urbanity among men and women of urbanity is examined (Table 18). The table shows that the degree of urbanity for both men and women are fairly equally distributed. However, for both men and women that majority lives in a strongly urban environment, but this difference in the distribution is relatively small.

Gender * Urbanity Crosstabulation

% within Gender		Urbanity			
Gender		2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)
Gender	Male	37,3%	30,7%	10,7%	21,3%
	Female	33,9%	19,0%	22,2%	24,9%

Table 18. Distribution of the degree of urbanity among men and women

Validation of the design principles

A binomial test is used to investigate the results of the preferences. It shows whether or not the results indicate a strong preference for one of the two given situations. The binomial test compares the theoretical expected distribution of observations to the observed distribution. In this case it aims to reject the null-hypothesis, which means the alternative hypothesis is true and therefore shows the significance of the distribution of observations.

H_0 : There is no significant difference between the distributions.

H_1 : There is a significant difference between the distributions.

In this case the binomial test assumes an equal distribution of the observations, which is indicated by a test probability of 0.5. The statistical significance is measured by the probability value (p-value). The null-hypothesis can be rejected when the p-value < 0.05. The table below shows the results from the experiment. For each question there were two option, one with the implemented design principle and one of the current situation. With the exception for question five, where the type of question is different from the other questions, but the observed outcome can

still be compared with the theoretical expected outcome. The expected outcome was a dominant preference among the participants for the option with the implemented design principle. The far right column of the table shows the significance of the preference. For all the questions the p-value proved a statistical significant with a $p < .001$. Which means that there is a difference in perceived safety between the current situation and the situation in with the design principle.

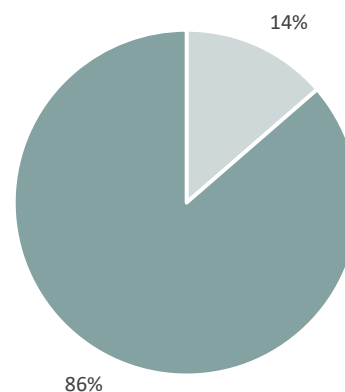
Since the preference results are significant for each choice task, it is also interesting to look at the differences between the demographic subgroups. Therefore, the dependence of the preference results will be compared with gender, age, and degree of urbanity of the living environment of the participants. In order to do so, Chi-square tests and crosstabulations are used to analyze the independence of the different variables. The analysis shows if there is a significant difference in the distribution of the results based on demographic variables (gender, age, level of urbanity of the living environment) and the current situation or the situation with the integrated design principle. The type of data that is used for this analysis is nominal data, which means that the data consists of two or more categories. When the p-value is lower than 0.05 the variables are dependent and thus have a significant relationship.

Binomial Test						
		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Current situation or added frontgardens	Group 1	Adding Frontgardens	297	,86	,50	,00
	Group 2	Current	47	,14		
	Total		344	1,00		
Current situation or increase continuity	Group 1	Continuity	123	,36	,50	,00
	Group 2	Current	221	,64		
	Total		344	1,00		
Current situation or added front doors	Group 1	Frontdoors	273	,79	,50	,00
	Group 2	Current	71	,21		
	Total		344	1,00		
Current situation or splitting long building into two	Group 1	Split	262	,76	,50	,00
	Group 2	Current	82	,24		
	Total		344	1,00		
Follow path straight ahead or enter park path	Group 1	Straight ahead	293	,85	,50	,00
	Group 2	Right to park path	51	,15		
	Total		344	1,00		
Current situation or added physical borders	Group 1	Current	118	,34	,50	,00
	Group 2	Adding physical border	226	,66		
	Total		344	1,00		
Current situation or added building floors	Group 1	Adding floors	295	,86	,50	,00
	Group 2	Current	49	,14		
	Total		344	1,00		

Added front gardens

There is a strong preference for the situation with the added front gardens compared to the current situation. This result is as expected and according to the theory that is used to develop the new situation. The piechart on the right shows the distribution of the observed preferences, 86% of the participants preferred the added front gardens. This preference does not depend on gender, age, or degree of urbanity of the living environment.

Preference results added front gardens



Current situation



Added front gardens



Crosstab

		Gender		Total
		Male	Female	
Current situation or added front doors	Frontdoors	Count	64	207
		Expected Count	69,1	201,9
		% within Gender	73,6%	81,5%
	Current	Count	23	47
		Expected Count	17,9	52,1
		% within Gender	26,4%	18,5%
Total		Count	87	254
		Expected Count	87,0	254,0
		% within Gender	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	2,500 ^a	1	,114	
Continuity Correction ^b	2,037	1	,153	
Likelihood Ratio	2,402	1	,121	
Fisher's Exact Test				,125
Linear-by-Linear Association	2,492	1	,114	
N of Valid Cases	341			

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 17,

b. Computed only for a 2x2 table

Added front gardens x Gender

$$p = 0.114$$

$$\alpha = 0.05$$

The preference for added front gardens does not depend on gender. There is no statistical significance between these variables.

Current situation or added frontgardens * Age groups Crosstabulation

			Age groups							
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	Total
Current situation or added frontgardens	Adding Frontgardens	Count	16	87	50	50	41	36	6	286
		Expected Count	15,5	81,0	49,1	52,5	41,3	39,6	6,9	286,0
	Current	Count	2	7	7	11	7	10	2	46
		Expected Count	2,5	13,0	7,9	8,5	6,7	6,4	1,1	46,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,607 ^a	6	,268
Likelihood Ratio	7,680	6	,262
Linear-by-Linear Association	6,040	1	,014
N of Valid Cases	332		

a. 2 cells (14,3%) have expected count less than 5. The minimum expected count is 1,11.

Added front gardens x Age group

$$p = 0.268$$

$$\alpha = 0.05$$

There is no statistical significant difference in preference between different age groups.

Crosstab

			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Current situation or added front doors	Frontdoors	Count	82	51	46	57	236
		Expected Count	82,4	51,5	45,9	56,2	236,0
		% within Urbanity	78,8%	78,5%	79,3%	80,3%	79,2%
	Current	Count	22	14	12	14	62
		Expected Count	21,6	13,5	12,1	14,8	62,0
		% within Urbanity	21,2%	21,5%	20,7%	19,7%	20,8%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	,080 ^a	3	,994
Likelihood Ratio	,081	3	,994
Linear-by-Linear Association	,057	1	,812
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,07.

Added front gardens x Urbanity

$$p = 0.994$$

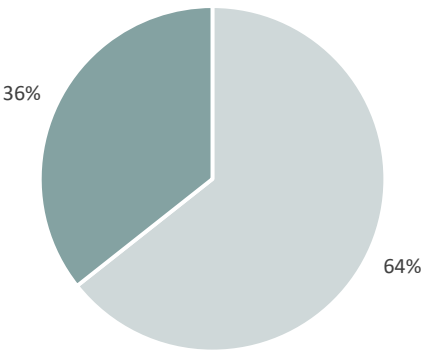
$$\alpha = 0.05$$

The preference for added front gardens does not depend on the degree of urbanity of living environment. There is no statistical significance between these variables.

Increased continuity

There is a preference for the situation with the current situation. This results is not as expected, which could be due to the design choices made in the situation with the increases continuity. The buildings in the designed make for a seeminly more narrow and darker street than the current situation. The piechart on the right shows the distribution of the observed preferences, 64% of the participants preferred the current situation. This preference does not depend on gender, age, or degree of urbanity of the living environment.

Preference results increase continuity of building blocks



Current situation



Increased continuity



Crosstab

		Gender		Total
		Male	Female	
Current situation or increase continuity	Current	Count	60	160
		Expected Count	56,1	163,9
		% within Gender	69,0%	63,0%
	Continuity	Count	27	94
		Expected Count	30,9	90,1
		% within Gender	31,0%	37,0%
Total	Count		87	254
	Expected Count		87,0	254,0
	% within Gender		100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1,010 ^a	1	,315		
Continuity Correction ^b	,766	1	,381		
Likelihood Ratio	1,024	1	,312		
Fisher's Exact Test				,364	,191
Linear-by-Linear Association	1,007	1	,316		
N of Valid Cases	341				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 30,87.
b. Computed only for a 2x2 table

Increase continuity x Gender

$p = 0.315$ $\alpha = 0.05$

The preference for the current situation does not depend on gender. There is no statistical significance between these variables.

Crosstab

			Age groups							
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	Total
Current situation or increase continuity	Current	Count	14	64	37	40	32	19	5	211
		Expected Count	11,4	59,7	36,2	38,8	30,5	29,2	5,1	211,0
	Continuity	Count	4	30	20	21	16	27	3	121
		Expected Count	6,6	34,3	20,8	22,2	17,5	16,8	2,9	121,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12,594 ^a	6	,050
Likelihood Ratio	12,266	6	,056
Linear-by-Linear Association	6,683	1	,010
N of Valid Cases	332		

a. 1 cells (7,1%) have expected count less than 5. The minimum expected count is 2,92.

Increase continuity x Age group

$$p = 0,050$$

$$\alpha = 0,05$$

There is a statistical significant difference in preference between different age groups. The preference for the current situation is stronger for younger people than for older people

Crosstab

			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Current situation or increase continuity	Current	Count	63	37	40	49	189
		Expected Count	66,0	41,2	36,8	45,0	189,0
		% within Urbanity	60,6%	56,9%	69,0%	69,0%	63,4%
	Continuity	Count	41	28	18	22	109
		Expected Count	38,0	23,8	21,2	26,0	109,0
		% within Urbanity	39,4%	43,1%	31,0%	31,0%	36,6%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3,272 ^a	3	,352
Likelihood Ratio	3,285	3	,350
Linear-by-Linear Association	2,062	1	,151
N of Valid Cases	298		

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 21,21.

Increase continuity x Urbanity

$$p = 0,352$$

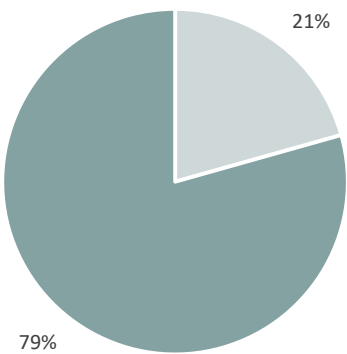
$$\alpha = 0,05$$

The preference for the current situation does not depend on the degree of urbanity of living environment. There is no statistical significance between these variables.

Adding front doors

There is a strong preference for the situation with the added front doors. This result is as expected and according to the theory that is used to develop the new situation. The piechart on the right shows the distribution of the observed preferences, 79% of the participants preferred the added front doors. This preference does not depend on gender, age, or degree of urbanity of the living environment.

Preference results added front doors



Current situation



Adding front doors



Crosstab					
		Gender			Total
		Male	Female		
Current situation or added front doors	Frontdoors	Count	64	207	271
		Expected Count	69,1	201,9	271,0
		% within Gender	73,6%	81,5%	79,5%
	Current	Count	23	47	70
		Expected Count	17,9	52,1	70,0
		% within Gender	26,4%	18,5%	20,5%
Total		Count	87	254	341
		Expected Count	87,0	254,0	341,0
		% within Gender	100,0%	100,0%	100,0%

Added front doors x Gender

$p = 0.114$ $\alpha = 0.05$

The preference for the added front doors does not depend on gender. There is no statistical significance between these variables.

Chi-Square Tests				
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2,500 ^a	1	,114	
Continuity Correction ^b	2,037	1	,153	
Likelihood Ratio	2,402	1	,121	
Fisher's Exact Test				,125
Linear-by-Linear Association	2,492	1	,114	,079
N of Valid Cases	341			

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 17,86.
b. Computed only for a 2x2 table

Crosstab

			Age groups							Total
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	
Current situation or added front doors	Frontdoors	Count	17	75	44	51	38	36	4	265
		Expected Count	14,4	75,0	45,5	48,7	38,3	36,7	6,4	265,0
	Current	Count	1	19	13	10	10	10	4	67
		Expected Count	3,6	19,0	11,5	12,3	9,7	9,3	1,6	67,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7,676 ^a	6	,263
Likelihood Ratio	7,546	6	,273
Linear-by-Linear Association	1,704	1	,192
N of Valid Cases	332		

a. 2 cells (14,3%) have expected count less than 5. The minimum expected count is 1,61.

Added front doors x Age group

$$p = 0.263$$

$$\alpha = 0.05$$

There is no statistical significant difference in preference between different age groups.

Crosstab

			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Current situation or added front doors	Frontdoors	Count	82	51	46	57	236
		Expected Count	82,4	51,5	45,9	56,2	236,0
		% within Urbanity	78,8%	78,5%	79,3%	80,3%	79,2%
	Current	Count	22	14	12	14	62
		Expected Count	21,6	13,5	12,1	14,8	62,0
		% within Urbanity	21,2%	21,5%	20,7%	19,7%	20,8%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	,080 ^a	3	,994
Likelihood Ratio	,081	3	,994
Linear-by-Linear Association	,057	1	,812
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,07.

Added front doors x Urbanity

$$p = 0.994$$

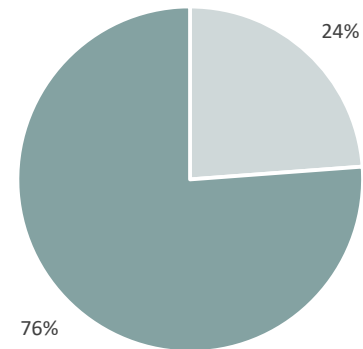
$$\alpha = 0.05$$

The preference for the current situation does not depend on the degree of urbanity of living environment. There is no statistical significance between these variables.

Splitting long building block

There is a strong preference for the situation where the building is split into two buildings. This result is as expected and according to the theory that is used to develop the new situation. The piechart on the right shows the distribution of the observed preferences, 76% of the participants preferred the situation where the building in split into two buildings. This preference does not depend on gender, age, or degree of urbanity of the living environment.

Preference results splitting long building block



Current situation



Splitting long building block



Crosstab

			Gender		Total
			Male	Female	
Current situation or splitting long building into two	Split	Count	67	195	262
		Expected Count	66,8	195,2	262,0
		% within Gender	77,0%	76,8%	76,8%
	Current	Count	20	59	79
		Expected Count	20,2	58,8	79,0
		% within Gender	23,0%	23,2%	23,2%
Total	Count		87	254	341
	Expected Count		87,0	254,0	341,0
	% within Gender		100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,002 ^a	1	,963		
Continuity Correction ^b	,000	1	1,000		
Likelihood Ratio	,002	1	,963		
Fisher's Exact Test				1,000	,545
Linear-by-Linear Association	,002	1	,964		
N of Valid Cases	341				

a. 0 cells (0%) have expected count less than 5. The minimum expected count is 20,16.

b. Computed only for a 2x2 table

Split building x Gender

$p = 0.963$

$\alpha = 0.05$

The preference for splitting a long building block does not depend on gender. There is no statistical significance between these variables.

Crosstab

			Age groups							Total
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	
Current situation or splitting long building into two	Split	Count	13	68	42	45	43	37	6	254
		Expected Count	13,8	71,9	43,6	46,7	36,7	35,2	6,1	254,0
	Current	Count	5	26	15	16	5	9	2	78
		Expected Count	4,2	22,1	13,4	14,3	11,3	10,8	1,9	78,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6,570 ^a	6	,362
Likelihood Ratio	7,403	6	,285
Linear-by-Linear Association	2,977	1	,084
N of Valid Cases	332		

a. 2 cells (14,3%) have expected count less than 5. The minimum expected count is 1,88.

Split building x Age group

$$p = 0.362$$

$$\alpha = 0.05$$

There is no statistical significant difference in preference between different age groups.

Crosstab

			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Current situation or splitting long building into two	Split	Count	76	49	49	53	227
		Expected Count	79,2	49,5	44,2	54,1	227,0
		% within Urbanity	73,1%	75,4%	84,5%	74,6%	76,2%
	Current	Count	28	16	9	18	71
		Expected Count	24,8	15,5	13,8	16,9	71,0
		% within Urbanity	26,9%	24,6%	15,5%	25,4%	23,8%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2,869 ^a	3	,412
Likelihood Ratio	3,073	3	,380
Linear-by-Linear Association	,456	1	,499
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 13,82.

Split building x Urbanity

$$p = 0.412$$

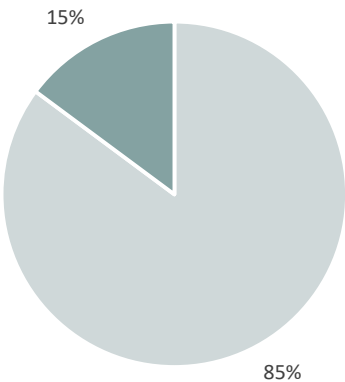
$$\alpha = 0.05$$

The preference for splitting long building blocks does not depend on the degree of urbanity of living environment. There is no statistical significance between these variables.

Adding a path to an empty public space

There is a strong preference for continuing to walk on the sidewalk. This result is as expected and according to the theory that is used to develop the situations. The piechart on the right shows the distribution of the observed preferences, 85% of the participants preferred to continue walking on the sidewalk. This preference is dependent on the demographic characteristics of both age group and degree of urbanity. The results show that there is a less strong preference for older people and people from a less urban or non-urban environment.

Preference results from adding a path to an empty public space



Continue walking on the sidewalk



Turn right on the park path



Crosstab					
			Gender		Total
			Male	Female	
Follow path straight ahead or enter park path	Straight ahead	Count	73	217	290
		Expected Count	74,0	216,0	290,0
		% within Gender	83,9%	85,4%	85,0%
	Right to park path	Count	14	37	51
		Expected Count	13,0	38,0	51,0
		% within Gender	16,1%	14,6%	15,0%
Total		Count	87	254	341
		Expected Count	87,0	254,0	341,0
		% within Gender	100,0%	100,0%	100,0%

Chi-Square Tests				
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,118 ^a	1	,731	
Continuity Correction ^b	,029	1	,865	
Likelihood Ratio	,117	1	,732	
Fisher's Exact Test				,730
Linear-by-Linear Association	,118	1	,731	,425
N of Valid Cases	341			

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 13,01.
b. Computed only for a 2x2 table

Park path x Gender

$p = 0.731$ $\alpha = 0.05$

The preference for continuing walking on the sidewalk does not depend on gender. There is no statistical significance between these variables.

Crosstab

			Age groups							Total
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	
Follow path straight ahead or enter park path	Straight ahead	Count	18	86	52	49	41	32	6	284
		Expected Count	15,4	80,4	48,8	52,2	41,1	39,3	6,8	284,0
	Right to park path	Count	0	8	5	12	7	14	2	48
		Expected Count	2,6	13,6	8,2	8,8	6,9	6,7	1,2	48,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18,775 ^a	6	,005
Likelihood Ratio	19,850	6	,003
Linear-by-Linear Association	14,914	1	,000
N of Valid Cases	332		

a. 2 cells (14,3%) have expected count less than 5. The minimum expected count is 1,16.

Park path x Age group

$$p = 0.005$$

$$\alpha = 0.05$$

The preference for continuing walking on the sidewalk does depend on age because there is a statistical significant difference in preference between different age groups. There is a less strong preference for continuing walking on the side walk for the age group 60 -70 years old. There is a possibility that this might be due to the ability to clearly see the difference between the two situations.

Crosstab

			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Follow path straight ahead or enter park path	Straight ahead	Count	93	51	44	65	253
		Expected Count	88,3	55,2	49,2	60,3	253,0
		% within Urbanity	89,4%	78,5%	75,9%	91,5%	84,9%
	Right to park path	Count	11	14	14	6	45
		Expected Count	15,7	9,8	8,8	10,7	45,0
		% within Urbanity	10,6%	21,5%	24,1%	8,5%	15,1%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9,905 ^a	3	,019
Likelihood Ratio	9,788	3	,020
Linear-by-Linear Association	,005	1	,945
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,76.

Park path x Urbanity

$$p = 0.019$$

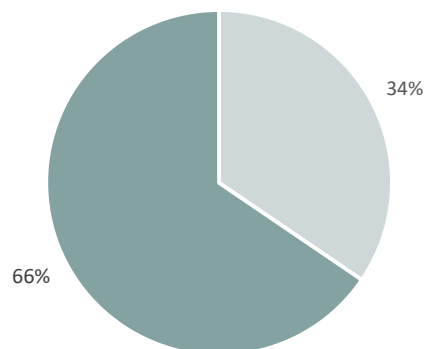
$$\alpha = 0.05$$

The preference for continuing walking on the sidewalk does depend on the degree of urbanity of the living environment. There is a statistical significant difference in preference between the level of urbanity. There is a stronger preference to continuing walking on the sidewalk from people who live a strongly urban environment.

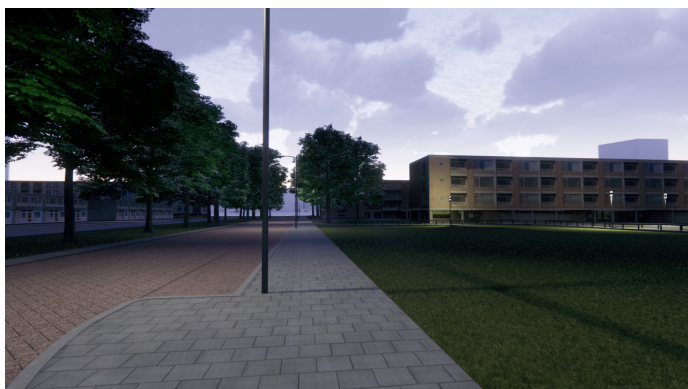
Adding physical borders

There is a strong preference for the situation with the added physical borders. This result is as expected and according to the theory that is used to develop the situations. The piechart on the right shows the distribution of the observed preferences, 66% of the participants preferred the added physical borders. This preference is dependent on the demographic characteristic age group. The results show that there is a stronger preference the age group of 20 to 30 years old.

Preference results from adding physical borders



Current situation



Adding physical borders



Crosstab

			Gender		Total
			Male	Female	
Current situation or added physical borders	Adding physical border	Count	56	167	223
		Expected Count	56,9	166,1	223,0
		% within Gender	64,4%	65,7%	65,4%
	Current	Count	31	87	118
		Expected Count	30,1	87,9	118,0
		% within Gender	35,6%	34,3%	34,6%
	Total	Count	87	254	341
		Expected Count	87,0	254,0	341,0
		% within Gender	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,055 ^a	1	,815		
Continuity Correction ^b	,011	1	,918		
Likelihood Ratio	,054	1	,816		
Fisher's Exact Test				,896	,456
Linear-by-Linear Association	,054	1	,816		
N of Valid Cases	341				

a. 0 cells (,0%) have expected count less than 5. The minimum expected count is 30,11.

b. Computed only for a 2x2 table

Physical borders x Gender

$$p = 0.815$$

$$\alpha = 0.05$$

The preference for added physical borders does not depend on gender. There is no statistical significance between these variables.

Crosstab			Age groups							Total
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older	
Current situation or added physical borders	Adding physical border	Count	16	72	33	38	27	26	5	217
		Expected Count	11,8	61,4	37,3	39,9	31,4	30,1	5,2	217,0
	Current	Count	2	22	24	23	21	20	3	115
		Expected Count	6,2	32,6	19,7	21,1	16,6	15,9	2,8	115,0
Total	Count		18	94	57	61	48	46	8	332
	Expected Count		18,0	94,0	57,0	61,0	48,0	46,0	8,0	332,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14,675 ^a	6	,023
Likelihood Ratio	15,759	6	,015
Linear-by-Linear Association	9,540	1	,002
N of Valid Cases	332		

a. 1 cells (7,1%) have expected count less than 5. The minimum expected count is 2,77.

Physical borders x Age group

$$p = 0.023$$

$$\alpha = 0.05$$

The preference for added physical borders does depend on age. There is a statistical significance between these variables. The preference for added physical borders compared to the current situation is stronger for the age group 20-30 years old and less strong for older age groups.

Crosstab			Urbanity				Total
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)	
Current situation or added physical borders	Adding physical border	Count	68	47	37	44	196
		Expected Count	68,4	42,8	38,1	46,7	196,0
		% within Urbanity	65,4%	72,3%	63,8%	62,0%	65,8%
	Current	Count	36	18	21	27	102
		Expected Count	35,6	22,2	19,9	24,3	102,0
		% within Urbanity	34,6%	27,7%	36,2%	38,0%	34,2%
Total	Count		104	65	58	71	298
	Expected Count		104,0	65,0	58,0	71,0	298,0
	% within Urbanity		100,0%	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1,797 ^a	3	,616
Likelihood Ratio	1,832	3	,608
Linear-by-Linear Association	,402	1	,526
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 19,85.

Physical border x Urbanity

$$p = 0.616$$

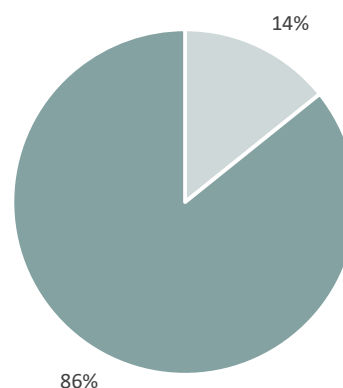
$$\alpha = 0.05$$

The preference for added physical borders does not depend on the degree of urbanity of the living environment. There is no statistical significance between these variables.

Adding building floors

There is a strong preference for the situation with the added building floors. This result is as expected and according to the theory that is used to develop the situations. The piechart on the right shows the distribution of the observed preferences, 86% of the participants preferred the added building floors. This preference is dependent on the demographic characteristic gender. The results show that there is a stronger preference for the added building floors for women. This could mean that women are more in need of social control than men.

Preference results from adding building floors



Current situation



Adding building floors



Crosstab

			Gender		Total
			Male	Female	
Current situation or added building floors	Current	Count	19	30	49
		Expected Count	12,5	36,5	49,0
		% within Gender	21,8%	11,8%	14,4%
	Adding floors	Count	68	224	292
		Expected Count	74,5	217,5	292,0
		% within Gender	78,2%	88,2%	85,6%
	Total	Count	87	254	341
		Expected Count	87,0	254,0	341,0
% within Gender		100,0%	100,0%	100,0%	

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5,296 ^a	1	,021		
Continuity Correction ^b	4,513	1	,034		
Likelihood Ratio	4,918	1	,027		
Fisher's Exact Test				,032	,019
Linear-by-Linear Association	5,281	1	,022		
N of Valid Cases	341				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,50.

b. Computed only for a 2x2 table

Adding building floors x Gender

$$p = 0.021$$

$$\alpha = 0.05$$

The preference for added building floors does depend on gender. There is a statistical significance between these variables. Women have a stronger preference for added floors. This can be interpreted as a preference for women for more social control, in other words, more eyes on the street.

		Crosstab							
		Age groups							
			10-20	20-30	30-40	40-50	50-60	60-70	70 or older
Current situation or added building floors	Current	Count	4	16	12	4	3	8	1
		Expected Count	2,6	13,6	8,2	8,8	6,9	6,7	1,2
	Adding floors	Count	14	78	45	57	45	38	7
		Expected Count	15,4	80,4	48,8	52,2	41,1	39,3	6,8
Total		Count	18	94	57	61	48	46	8
		Expected Count	18,0	94,0	57,0	61,0	48,0	46,0	8,0

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9,419 ^a	6	.151
Likelihood Ratio	10,339	6	.111
Linear-by-Linear Association	2,003	1	.157
N of Valid Cases	332		

a. 2 cells (14,3%) have expected count less than 5. The minimum expected count is 1,16.

Adding building floors x Age group

$$p = 0.151$$

$$\alpha = 0.05$$

The preference for added building floors does not depend on age. There is no statistical significance between these variables.

		Crosstab				
		Urbanity				
			2. Strongly urban (address density from 1500 to 2500 addresses / km ²)	3. Moderately urban (address density from 1000 to 1500 addresses / km ²)	4. Little urban (address density from 500 to 1000 addresses / km ²)	5. Non-urban (address density of less than 500 addresses / km ²)
Current situation or added building floors	Current	Count	16	13	6	9
		Expected Count	15,4	9,6	8,6	10,5
		% within Urbanity	15,4%	20,0%	10,3%	12,7%
	Adding floors	Count	88	52	52	62
		Expected Count	88,6	55,4	49,4	60,5
		% within Urbanity	84,6%	80,0%	89,7%	87,3%
Total		Count	104	65	58	71
		Expected Count	104,0	65,0	58,0	71,0
		% within Urbanity	100,0%	100,0%	100,0%	100,0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2,594 ^a	3	.459
Likelihood Ratio	2,575	3	.462
Linear-by-Linear Association	,727	1	.394
N of Valid Cases	298		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,56.

Adding building floors x Urbanity

$$p = 0.459$$

$$\alpha = 0.05$$

The preference for added building floors does not depend on the degree of urbanity of the living environment. There is no statistical significance between these variables.

9.3 / Conclusion and discussion

The experiment intended to answer the research questions: *How are targeted spatial changes experienced by people with the condition to improve perceived safety?* The targeted spatial changes are presented to the participants in a choice task, in which the participants have to select their preferred environment. The aim was to validate the targeted spatial changes in order to apply them in the neighborhood transformation design and improve the perceived safety in the neighborhood.

The results show that the preference for the targeted changes is significant for 6 out of the 7 choice tasks. This has been concluded from the statistical analysis. Therefore, the design principles that have been developed and selected in the earlier stages of the project have been validated by the experiment. Furthermore, the theories that have been studied in the literature study and that have been used to develop the design principles for the experiment have also been validated by the experiment. However, it is important to realize that the design principles have been tested as single spatial elements in the environment, and it is therefore, important for the next phase of the project to apply the design principles in conjunction.

Each of the validated design principles have different implication for the neighborhood transformation design.

1 / Adding front garden *validated*
Dwellings on the ground floor on a public road should have a front garden where possible. This increases the attractiveness of the environment, stimulates social interaction with neighbors, and ensures a transition from public to private.

2 / Increase continuity *not validated*
Although this design principle has not been validated, it is important to include it in the transformation design. The reason for this is that some of the other design principles can only be applied if this design principle is applied, for example adding front gardens and front doors.

3 / Adding front doors *validated*
The density and frequency of front doors must be increased on the public side of an apartment building. This increases social control and entrances are shared with fewer people, reducing anonymity.

4 / Splitting long building block *validated*
The design of long building blocks should be avoided. By design shorter building blocks, more alternative routes are created, which increases the perceived safety in the street. It can also allow for a better integrated pedestrian network.

5 / Adding a path to the public space *validated*
When in the design a path runs through a park, there should always be an option to take an alternative route along the public street. An addition can be that the path through the park can be closed in the evening.

6 / Adding physical borders *validated*
When an open spaces is designed, it should have a clear border between territories. This way the space becomes more legible and increases the sense of control over the environment.

7 / Adding building floors *validated*
The increase in the building height around a public or collective space increases social control. It also helps to visually define the space.

One of the targeted changes, the targeted change of increasing continuity, contradicted the hypotheses that the environment with the targeted change would be preferred by the participants. It can be assumed that the results are different than expected because the environment with the targeted spatial change brought about negative effects that affect the perceived safety. The environment with the targeted change allowed less light into the street and the buildings were close to the street, creating a narrow, dark street.

In addition, a number of comments were received from the participants. These were mainly focused on the visibility of the differences in the choice task. Some participants said they found it difficult to spot the differences, which may have affected their preference. Furthermore, a comment has been made that there were only two choices. The participant explained that he/she did not have a specific preference for one of the presented environments with regard to perceived safety, but that he/she had to make a choice due to the design of the survey. However, the choice was made consciously when designing the survey to prevent generating unusable data. However, it is interesting to see the results if the design of the survey would be changed and would measure the preference with a Likert scale. This way the strength of the preference could be measured.

In conclusion, the target changes were experienced as safer by the participants, with the exception of one of the changes. Therefore, the preference for the environment with the design principles has been validated and can be applied in the neighborhood transformation design. The results of the experiment addresses the problem statement of this project, in which was stated that empirical research lacks the measurement of the effect of physical environment changes. This experiment has shown that the relation between safety and design in environmental changes can be measured.

10 / Neighborhood Transformation

This chapter introduces the vision and neighborhood transformation design for the South-East part of Pendrecht. It aims to answer the research question: *How can design principles that improve the perceived safety be implemented in an integral neighborhood transformation design?* The neighborhood transformation design is used to showcase how the validated design principles and the knowledge gained by the literature review can be integrated in an urban design. Besides aiming for an overall perceived safe environment, the design also takes into account other pressing issues that urban designers have to tackle, like sustainability, mobility, and social cohesion.

10.1 / Vision introduction

The research question of this project noted: How can perceived safety be improved through neighborhood transformation in Pendrecht? The effect of spatial elements and characteristics on perceived safety and how this affects the perceived safety have been researched in the previous chapters. This led to a set of validated design principles that positively influence the perceived safety. However, these design principles have been researched as single elements added to the built environment. In order to answer the research question, the design principles need to be integrated into the neighborhood transformation design. The design is a proposal that showcases how the neighborhood can be transformed into an environment that is perceived safe. Furthermore, it is designed to improve perceived safety. Besides integrating the design principles and creating a perceived safe environment, the design aims to densify the built environment while at the same time ensuring the perceived safety. The neighborhood transformation design focuses on the south-eastern part of Pendrecht (fig 62), this area is included in the vision from the municipality as an area that needs to be transformed (see page 50). In addition to this, the area contains the most spatial elements that have a negative effect on perceived safety, which is why this part of the neighborhood has the most potential for the transformation.

In the vision, the focus is on improving perceived safety on different scales, these scales range from the neighborhood level to dwelling level. On each scale, the design will implement the guidelines of social safe design: visibility, legibility, accessibility, and attractiveness. In addition to this focus, attention is also paid to improving the existing public spaces, this is mainly done by making the main road, the square in front of the metro station and the existing green-blue structure more attractive and a better place to stay.

On a neighborhood scale, the vision consists of the following interventions. The existing main road will be transformed into an urban boulevard that connects the neighborhood with the adjacent neighborhood and the rest of the city. The road network is improved by extending the dead-end roads and thereby forming a connection between roads. The road network is oriented orthogonally, which creates long uninterrupted sightlines and clear orientation, which improves legibility. In the current situation, the residents of the neighborhood only have a city park, which is why the canal is being transformed into a local public park.

On street-level, the vision consists of creating continuity of the building facades and create a diversity of the buildings and territories. Continuity of the building facades creates linear elements that ensure a clear orientation in the area, it also allows for a high density of front doors and front door inter-visibility. The diversity of buildings creates a recognizable environment by having their own identity. For the most intensively used streets, which are mainly located in the north of the area, the plan ensures that there are sufficient alternative routes available. On building and dwelling level the vision ensures the location of the front doors on the public side of the building and the inter-visibility and density of front doors in order to ensure social control. Furthermore, front gardens will be added where possible to encourage social interaction between neighbors.

Besides the spatial changes in the area, the design also envisions increasing the sense of community. In the design this is done by creating collective spaces. This creates a social environment in which neighbors recognize and know each other and it creates a sense of responsibility for the living environment. For the perceived safety this means that anonymity decreases and the social control increases.

The page on the left shows the vision map, main design principles, and the guidelines and preconditions for the transformation.



fig 62. Location of the transformation design, the South-East part of Pendrecht

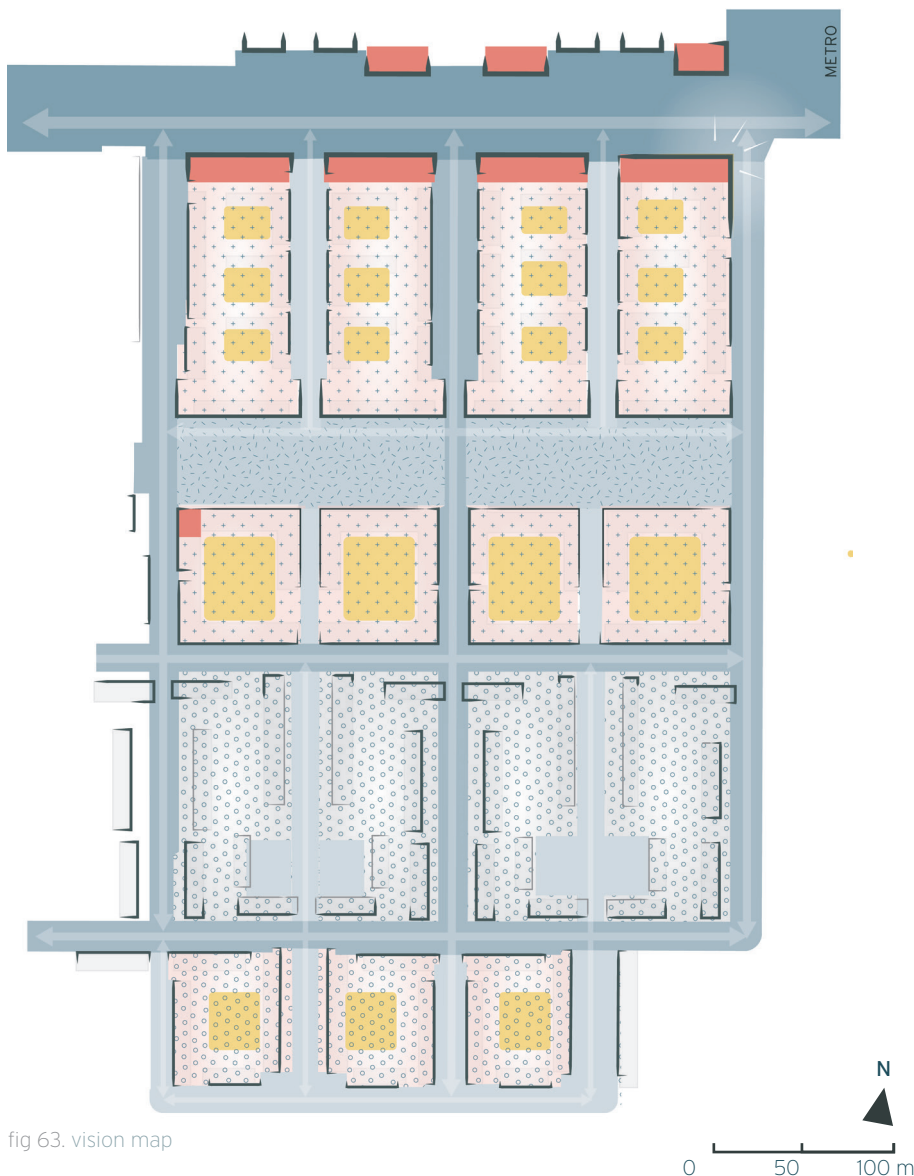


fig 63. vision map

Guidelines and preconditions design

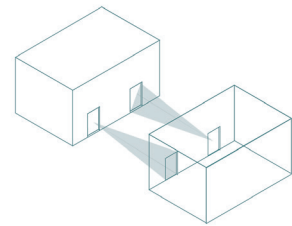
- Maintain green and blue structure and define open green spaces
- Optimize inter-visibility and density of front doors
- Clear borders between territories in the public spaces and in collective spaces
- A gradual transition between public and private at street to dwelling level
- Diversity of buildings, dwelling types, public spaces, and collective spaces
- The building entrances on the public side of the building
- The parking spaces can be seen from the houses and are a short distance from the house
- Increase the sense of community by creating community blocks and gardens

Legend

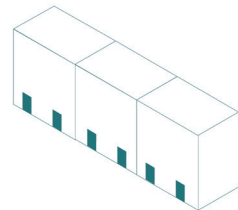


Main design principles

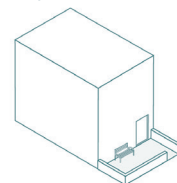
1 / Optimize front door intervisibility



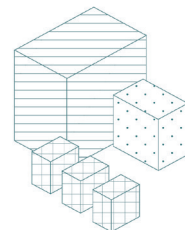
2 / Optimize front door density



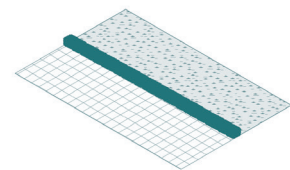
3 / Add front gardens on the public side of the building



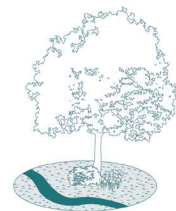
4 / Diversify the architecture and dwelling types



5 / Physical borders between territories



6 / Maintain public green/blue structure



7 / Increase the sense of community





fig 64. Neighborhood transformation masterplan

10.2 / Masterplan

Urban boulevard

The urban boulevard connects the center of the neighborhood with the metro station and the adjacent neighborhood. The sidewalks of the boulevard are not interrupted by the roads leading to the boulevard, this way the boulevard becomes more attractive and accessible for pedestrians. The existing dead end roads have been extended to the local park, this creates more alternative routes, which is especially important for intensively used streets (Luten, 2008, p. 168). The ground floor of the buildings on the boulevard offer flexible spaces for shops, horeca establishments, offices and the like. The area around the metro station is made more legible and attractive, so that this space can function as an entrance to the neighborhood. This is done by an accent building diagonally opposite from the metro exit, this way visitors have a clear visual attraction point that functions as a landmark. In addition, two buildings are added on the north side of the urban boulevard, this increases the inter-visibility of front doors, the social control, and the continuity of the building facades.

Urban living

Number of dwellings: 730

High density: 138 dwellings per hectare

The urban living area is located between the urban boulevard and the local park. The area has a high density and a mix of different housing typologies and building heights. The area can be reached via the public routes that run through the area from north to south and the roads at the edges of the area. Within the building blocks are collective gardens for the residents. This way it is ensured that, despite the high density, all residents have access to collective outdoor space. In relation to perceived safety, the area mainly takes into account the following spatial elements: front doors on the public sides of buildings, clear transitions of territories, sufficient alternative routes for pedestrians, social control over all public and collective spaces, inter-visibility of front doors, and parking a short distance from the house. In relation to the social environment, the area is designed to encourage social interaction with neighbors. This is mainly done through the collective spaces, and to minimize the number of households per entrance to avoid complete anonymity.

Local park

The local park is located south of the urban living area and functions as a park for the neighborhood residents since there are limited parks in the neighborhood. In the current situation, this canal is bordered by backyards and low-rise buildings and there are roads on both sides between the

sidewalks and greenery. In the new situation, there is only one road on the north side of the canal, this way more space is created for the public greenery. It is designed as a recreational area and a pleasant place to stay with benches and walkway. In relation to perceived safety, social control is ensured by the houses on both sides overlooking the park, to continue the same route as the path in the park, there is also a sidewalk along the road, and there is sufficient public lighting to ensure perceived safety during the evening/night.

Collective living

Number of dwellings: 440

High density: 109 dwellings per hectare

The collective living area is located south of the local park. As the name suggests, the area is focused on collective space. The enclosed form of the blocks provides a clear public and collective side. The design ensured that the houses on the ground floor have their front doors and front gardens on the public side of the building. At the corners of the blocks, accent buildings are placed to help make the area more legible and diverse in architecture. The collective spaces within the blocks can be reached from all sides for pedestrians. On the south side, the block can be entered by car, this access road leads to a parking lot for residents. From the dwellings, there is sufficient visibility on the parking lot and the collective space to ensure social control. In relation to perceived safety, the area takes into account the following spatial elements: front doors on the public side of the street, social control over public and collective space, inter-visibility between and high density of front doors, clear transitions between public and collective space, parking on a short distance from the house.

Family living

Number of dwellings: 186

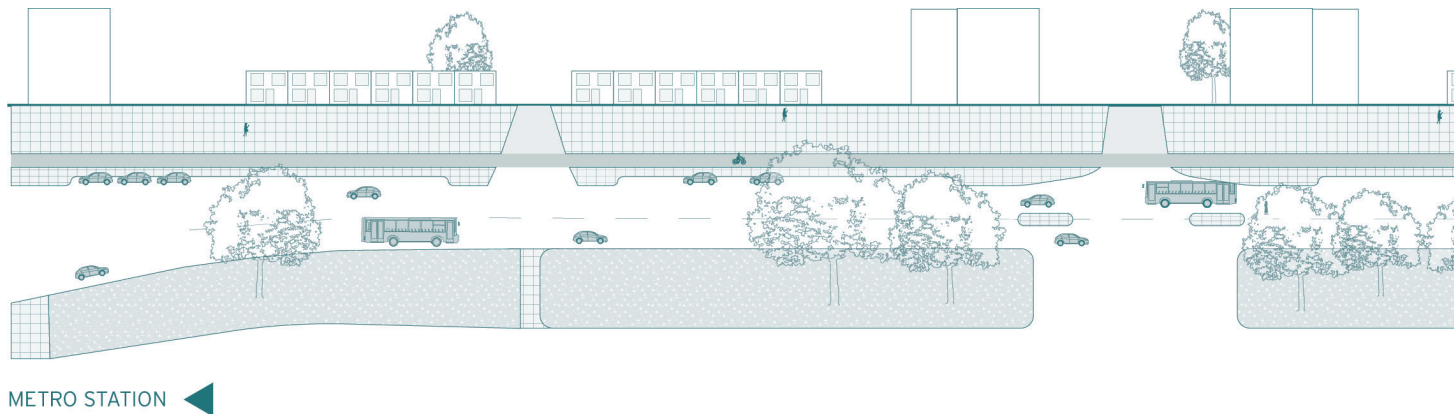
High density: 77,5 dwellings per hectare

The family living area is located in the south. This area is designed for families and therefore mainly has single-family homes. The single-family homes replace the alley houses that are there now. The design of the closed building blocks creates space for collective garden. These collective gardens are only accessible to the residents of the block. The single family homes can access this garden from their private backyard, and the residents of the apartment buildings can access the garden from their shared hallways. The blocks have a closed parking lot and parking spaces in front of the door. In relation to perceived safety, the design provides for a high density of front doors, continuity of building blocks, and increases the social control and encounters between neighbors.

10.3 / Urban Boulevard

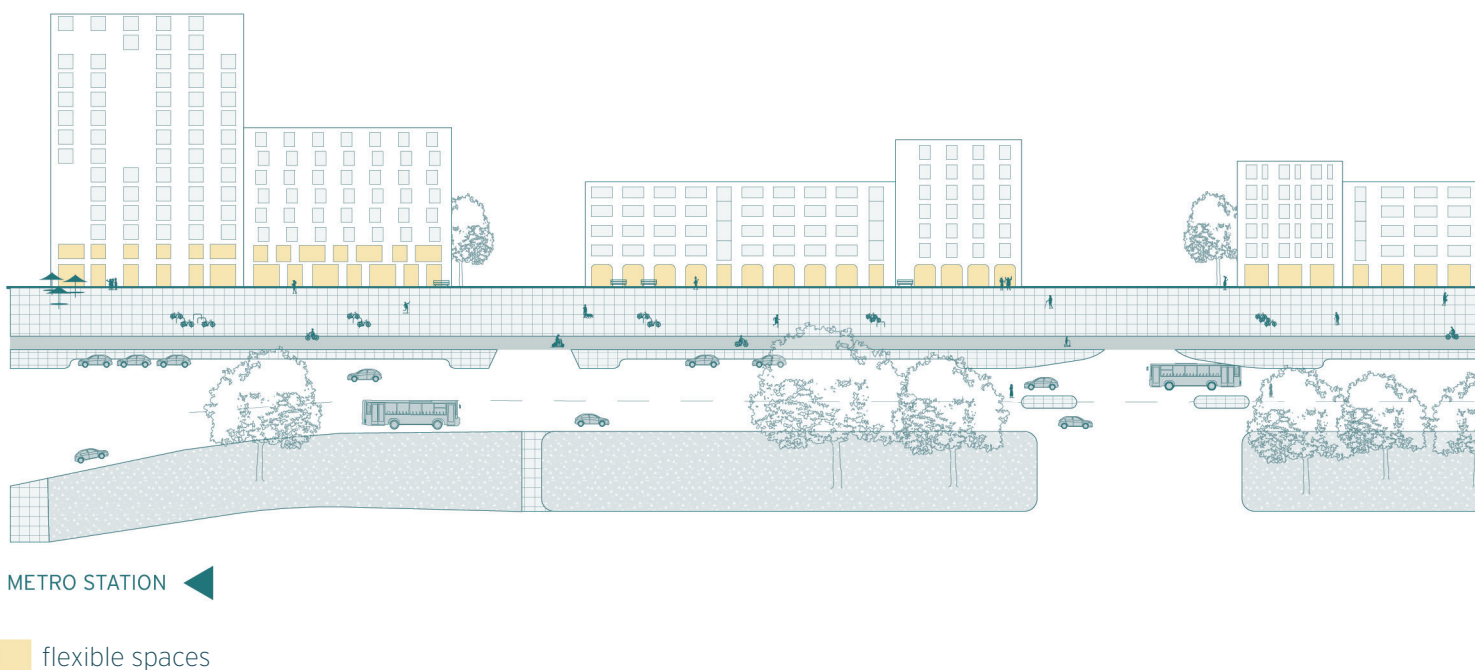
Current situation

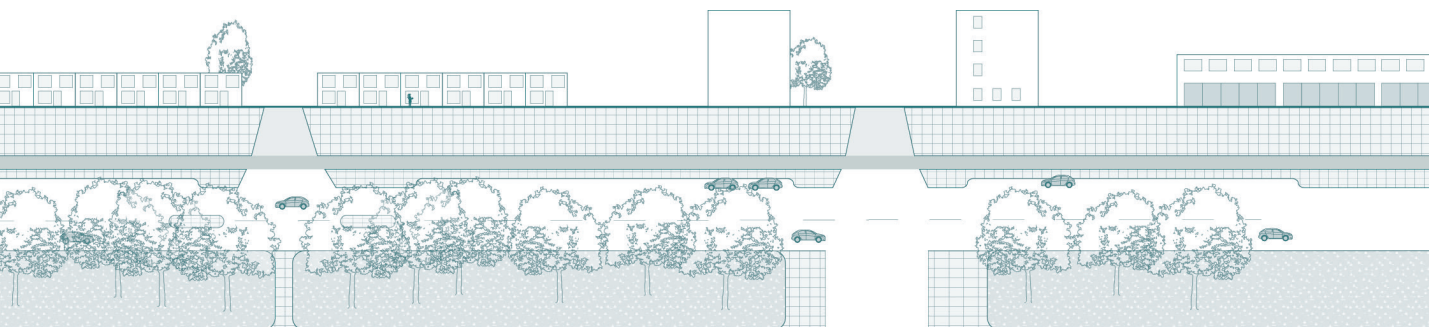
The mainroad connects the neighborhood with the adjacent neighborhood. It is also the road that leads from the metro station to the main square and shopping centre. In the current situation, along the main road, there are low-rise single-family homes, which are poorly maintained, and blind walls of the apartment buildings on the streets leading to the main road. There is a lot of car traffic on the road, but the street is unattractive for pedestrians.



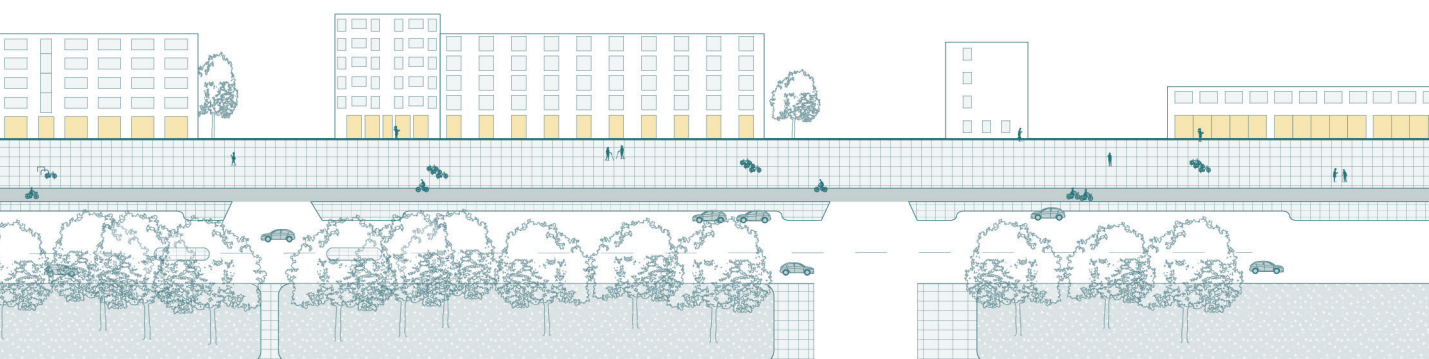
Transformation

The proposal for the main road is to transform the road into an urban boulevard. The low-rise residential buildings and blind wall are replaced by mid-rise and high-rise buildings with flexible spaces on the ground floor. The flexible spaces can be used as shops, offices, horeca, public functions, or places to meet for the youth or elderly. This will generate a bigger pedestrian flow and vibrancy on the street. Entrances to the apartments on the other floors are also located at the boulevard, which ensures that the street is being used even when the flexible spaces are closed. On the side of the metro there is a high-rise, this building works as a landmark that is immediately seen when you leave the metro station, this improves the legibility of the area.





► MAIN SQUARE



► MAIN SQUARE

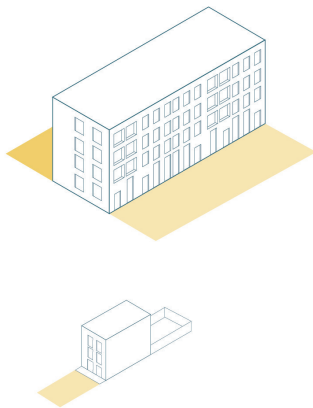
scale 1 : 1.000

10.4 / Urban living

The urban living area has a great diversity of housing typologies, which can result in a mix of different household compositions and income groups. Each house has a private outdoor space, but can also use the collective spaces.

With regard to improving perceived safety, the following principles have been applied: physical boundaries and clear transitions between territories, high density of front doors, collective spaces for social interaction, parking close to the houses, inter-visibility of front doors, short building blocks, and alternative pedestrian routes.

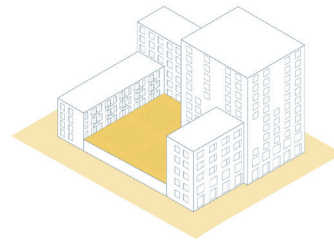
Privacy zoning



Apartment building

1. Private apartment
2. Apartment entrance
3. Shared staircase/elevator/hallway
4. Shared building entrance
5. Public street

Privacy zoning



Apartment building

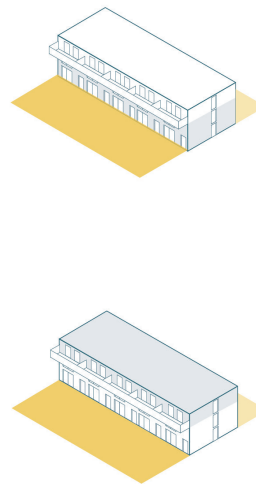
1. Private apartment
2. Apartment entrance
3. Shared staircase/hallway/elevator
4. Shared building entrance
5. Public street

Maisonette - ground and first floor

1. Private apartment
2. Apartment entrance
3. Semi-public street Private outdoor space
4. Public street Collective space

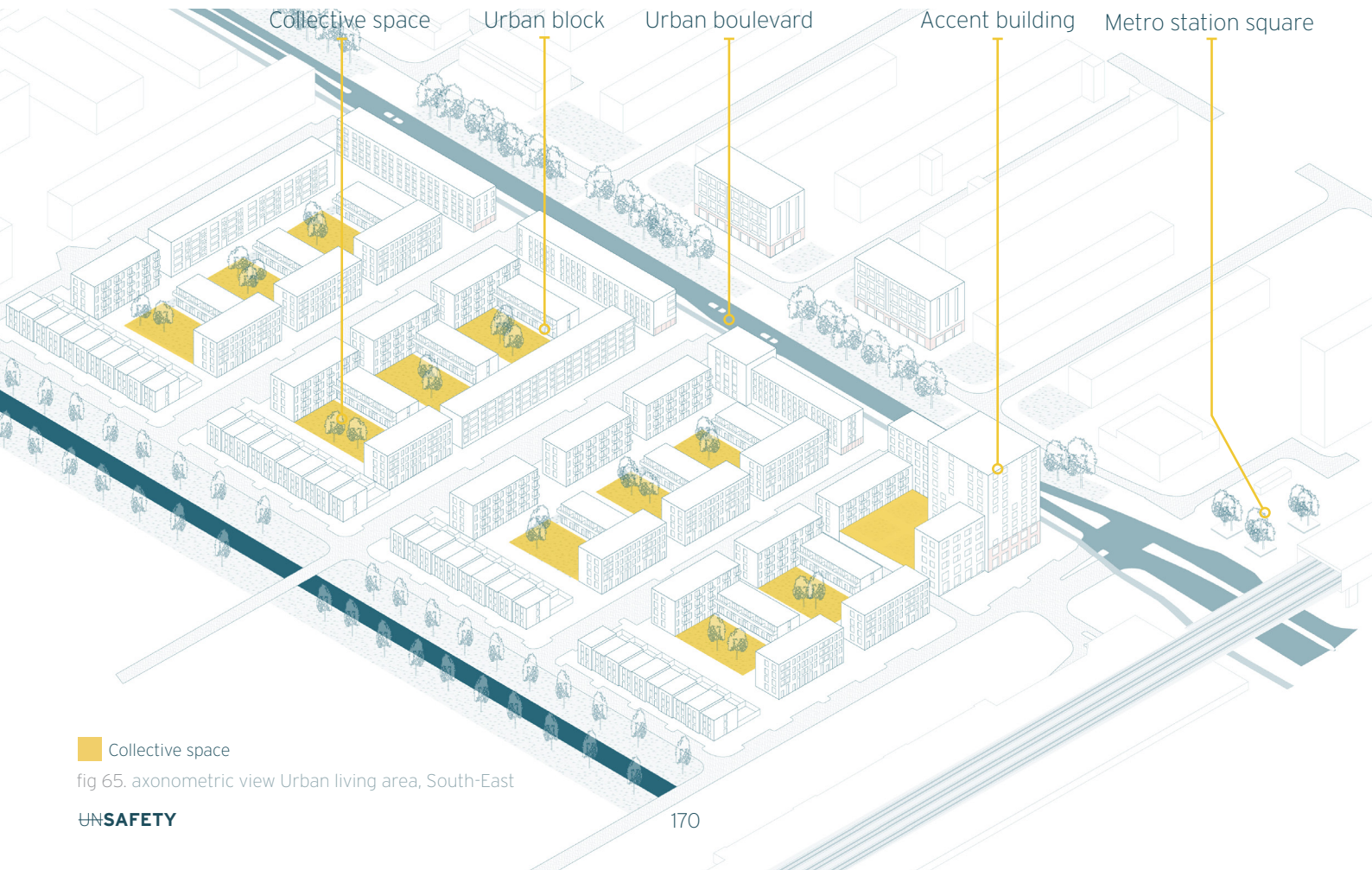
Single family house

1. Private house
2. House entrance
3. Backyard
4. Public street Collective garden



Studio

1. Private studio
2. Studio entrance on the ground floor
3. Semi-public street
4. Public street Collective space



Collective space

fig 65. axonometric view Urban living area, South-East

Target groups



One person household - adult



One person household - elderly



Two person household - adult



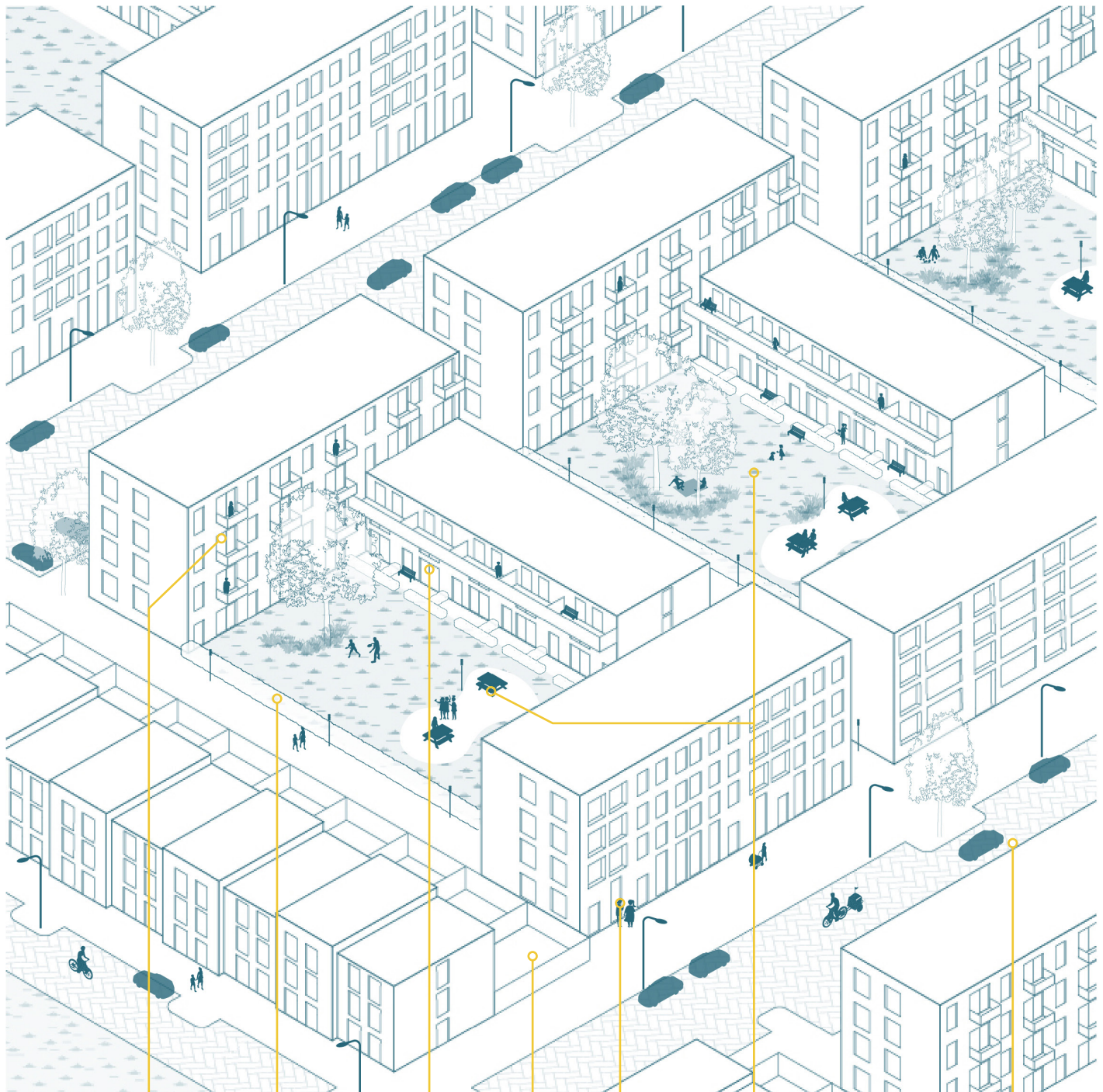
Two person household - elderly



Two person household - one parent family



Multi-person household - one parent family



Hedge defining the collective garden

Apartments overlooking the public street and the collective garden with balconies for informal supervision

Apartments adjacent to the collective garden for informal supervision

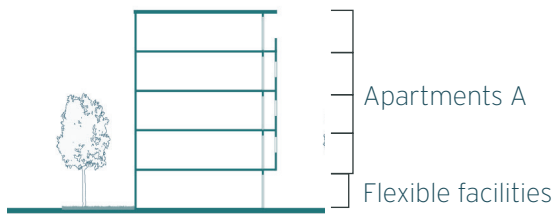
Fenced off backyards

Shared entrances on the public side of the building

Collective garden
seating area
flowerbeds and trees
places to play

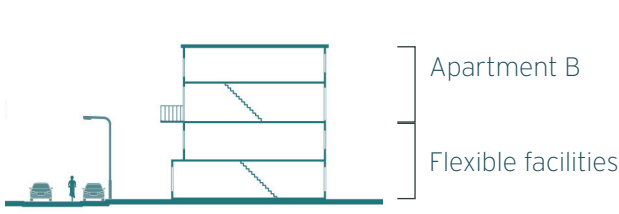
Public street

Urban boulevard section

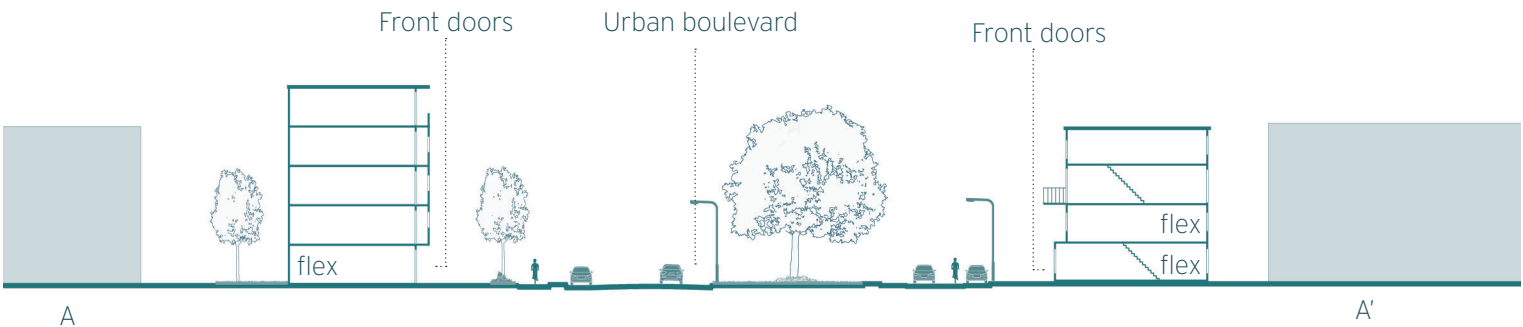
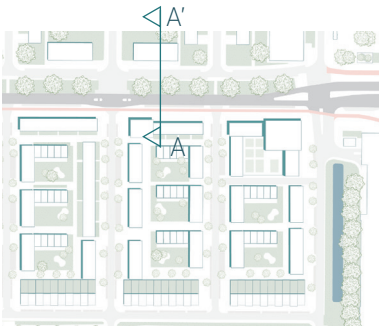


Flexible facilities are located on the ground floor and houses flexible spaces for different facilities, for example offices, shops, horeca establishments, or indoor sports functions. This will generate a pedestrian flow on the urban boulevard and makes the street more lively. Alternately with the entrance of the flexible spaces, there are shared entrances to the houses on the floors above.

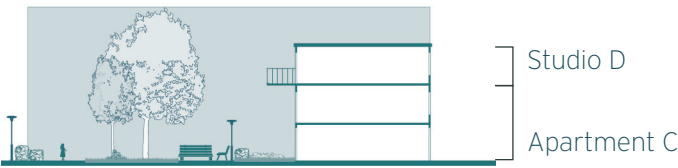
Apartments A are located first, second, third, and fourth floor of the building that is on the urban boulevard. To increase the social control on the boulevard, the apartment has balconys or loggias that are oriented to the street. The apartments can ben entered internally and have a shared entrance at the public side of the building. The target groups are single person or two-person households and preferably people who use public transport and bikes.



Apartment B is located on the second and third floor of the building and can be entered internally. On the public side of the building the apartment has a balcony that looks out on the boulevard. The target group for this apartment are single person or two-person households.

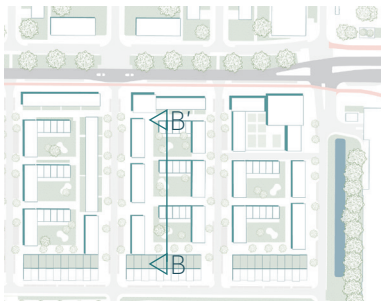


Urban living section



Studios D are located on the second floor of the building and is accessible from a front door located on the ground floor. The studios have a balcony that looks out over the collective space. The collective space is an extension of their personal outdoors space. TThe target group for these studios are mixed but are most suitable for a single person or two-person households.

Apartment C is similar to apartments F, but is located on the ground floor, and therefore has direct access to the collective space. The front door is located on the other side of the building. The collective space is an extension of the own small garden. The target group for these apartments is two-person and multi-person households of all ages.



Urban collective spaces

Backyard

Front doors

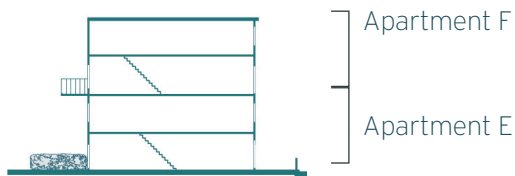
Front doors

B

B'

1:500

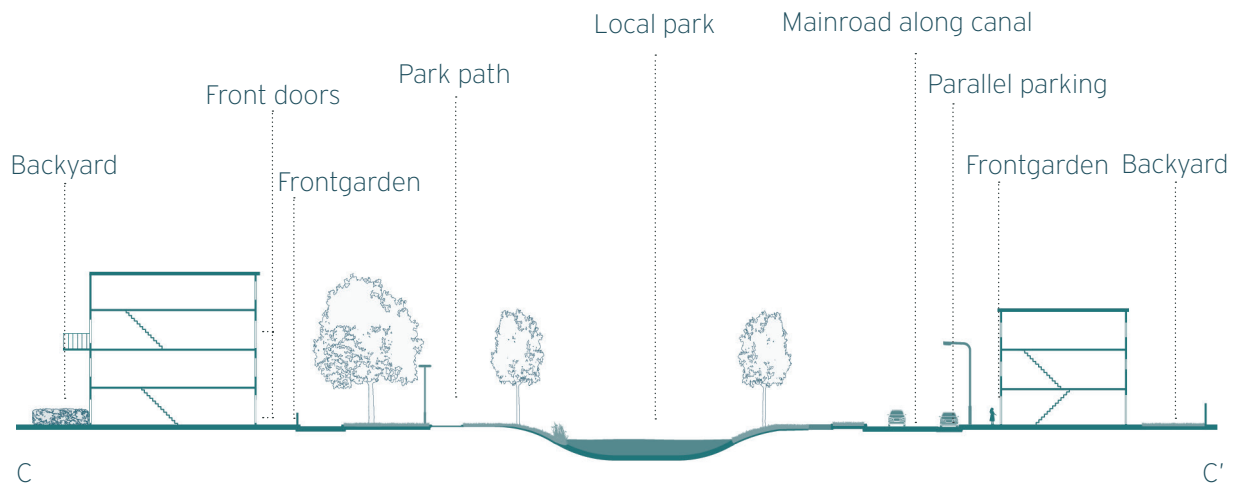
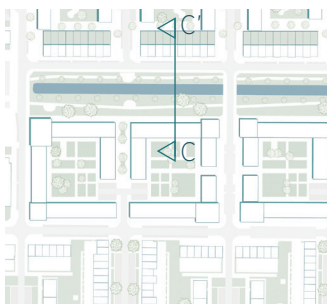
Local park section



Apartment E is located on the ground and first floor of the building. The building can be entered on the public side of the building where there is a front garden. The house has a backyard that transition into the collective space. The target group for this apartment are two-person or multi-person households.

Apartment F is located on the second and third floor of the building and can be entered via the gallery on the collective side of the building, the gallery can be entered one or two shared entrances on the ground floor. The collective garden of the building block serve as the outdoor space for the residents of these apartments. The target groups for this apartment are two-person or multi-person households.

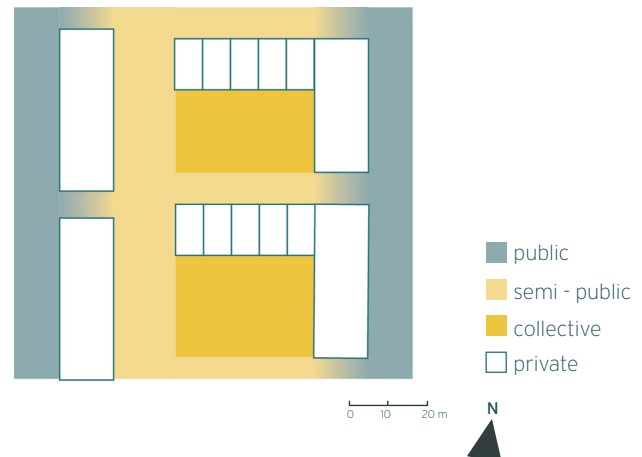
Single family house G is oriented to the local park and also had its entrance on this side of the house. On the private side the house has a backyard, which is bordered by either a fence or an hedge. The target group for these houses are mainly families, but are also suitable for two-person households.



1:500

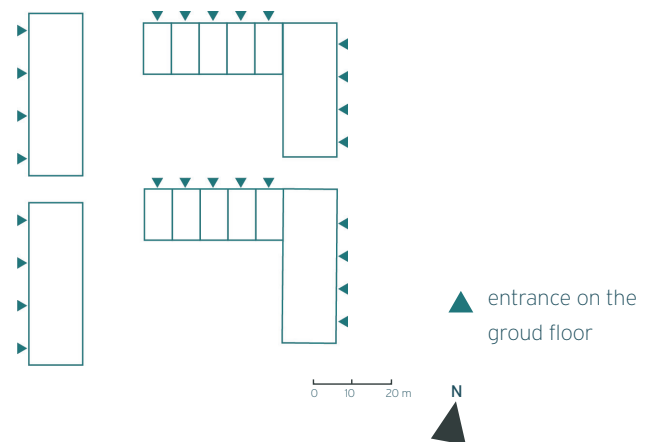
Domain

The urban living area is the most intensively used area in the masterplan. It is therefore important to clearly map out how the public domain transitions into semi-public, collective and private domains. In the case of the most common stamp in this area, this transition is made clear in the built form. The edges of the block are public and as you enter the block, the space transitions into the semi-public domain. This is made clear by the design and informal character of the environment. The collective spaces are bordered by low hedges, so it is clear that this space belongs to the L-shaped building block.



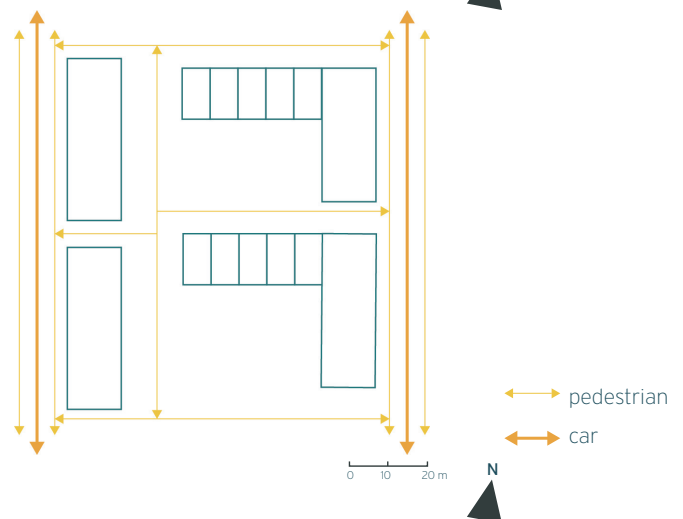
Entrances

In the urban block, the front doors are placed on both the public side and the semi-public side. In this way it is ensured that the area is lively and that social control is present through the use of the streets by the residents. Eventhough there is no inter-visibility between the front doors inside the block, the inter-visibility is ensures by the windows and garden doors of the dwellings



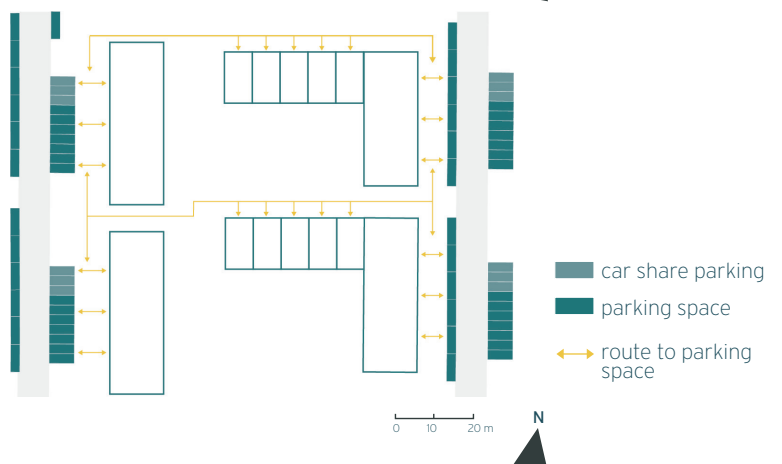
Movement

In the current situation, the streets are dominated by the car. Therefore, the design offers more space for the pedestrians. Pedestrians are given priority both inside and outside the block. Inside the block is a pedestrian zone and outside the block are uninterrupted footpaths on both sides of the road.



Parking

The area is more dense than the current situation. This increases the demand for sufficient parking spaces. The design has placed parking spaces close to the houses, which provides a view of the parked cars, which benefits perceived safety. A lower parking standard of 0.5 has been used to encourage the use of shared cars. There are also designated parking spaces for the shared cars. By applying this concept, fewer parking spaces are required, and public space becomes more accessible and attractive.

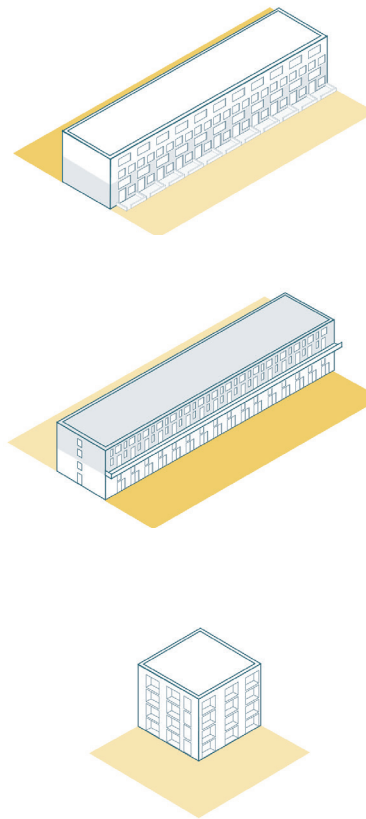


10.5 / Collective living

The collective living blocks are designed to stimulate social interaction and outdoor living. The area consists of 4 residential blocks, each with its own collective garden. Due to the closed shape of the block, the collective space is largely demarcated. However, the space is not inaccessible to visitors, but design interventions, such as an underpass and private gardens to the collective space, make it clear that the space belongs to the residents of the block. In several places hedges have been used to indicate the transition of territories.

With regard to perceived safety, the following principles have been applied: high density of front doors, front gardens on the public side of the building, inter-visibility of front doors, visibility on the underpass, sufficient lighting, view from the houses on the local park, clear transitions between public, collective, and private domain.

Privacy zoning



Maisonette ground floor

1. Private apartment
2. Apartment entrance
3. Front garden Backyard
4. Public street Collective garden

Maisonette second floor

1. Private apartment
2. Apartment entrance
3. Gallery
4. Shared staircase/hallway
5. Shared building entrance
6. Public street Collective garden

Single family home

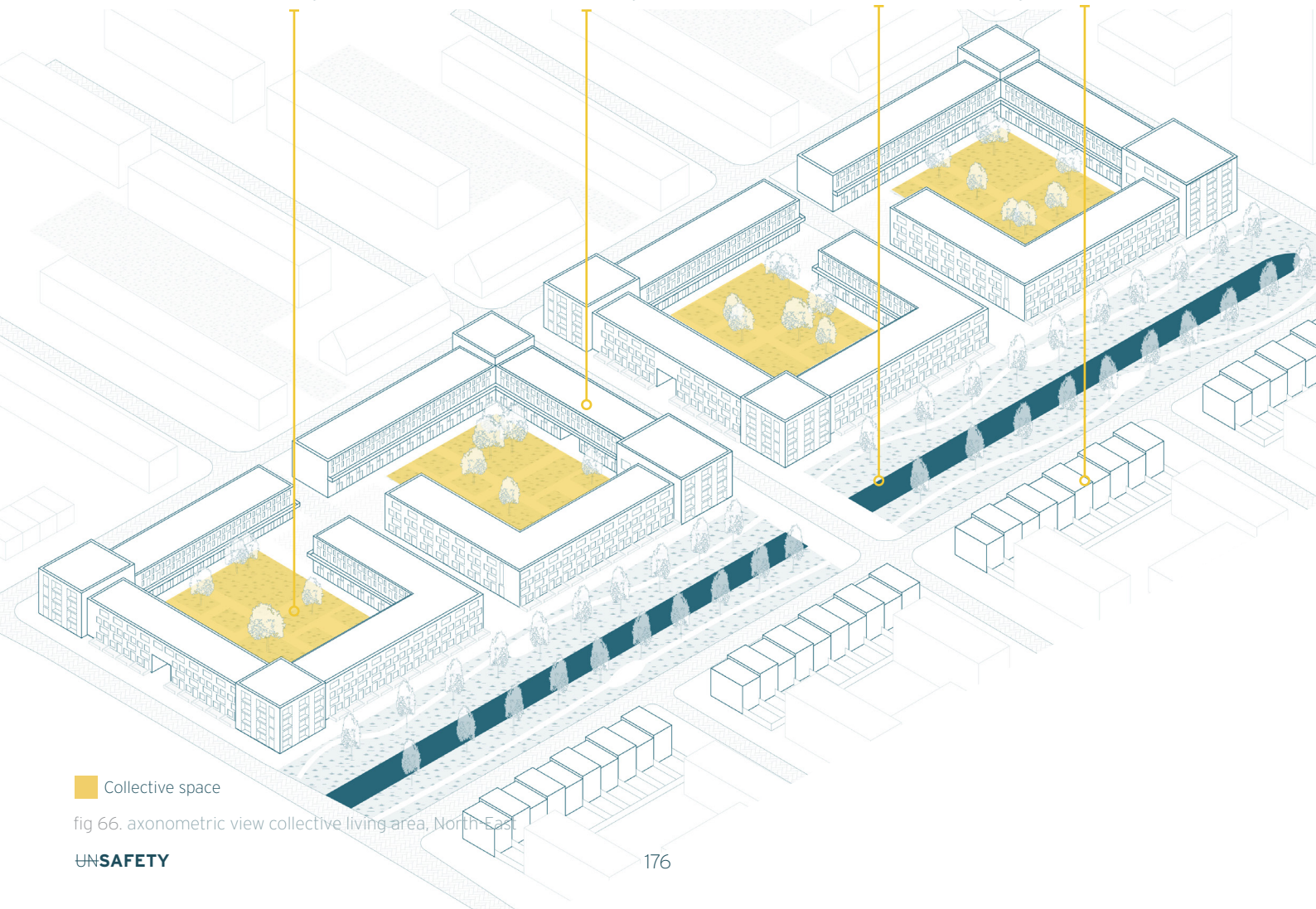
1. Private apartment
2. Apartment entrance
3. Shared staircase/hallway
4. Shared building entrance
5. Public street Collective garden

Collective garden

Collective building blocks

Local park

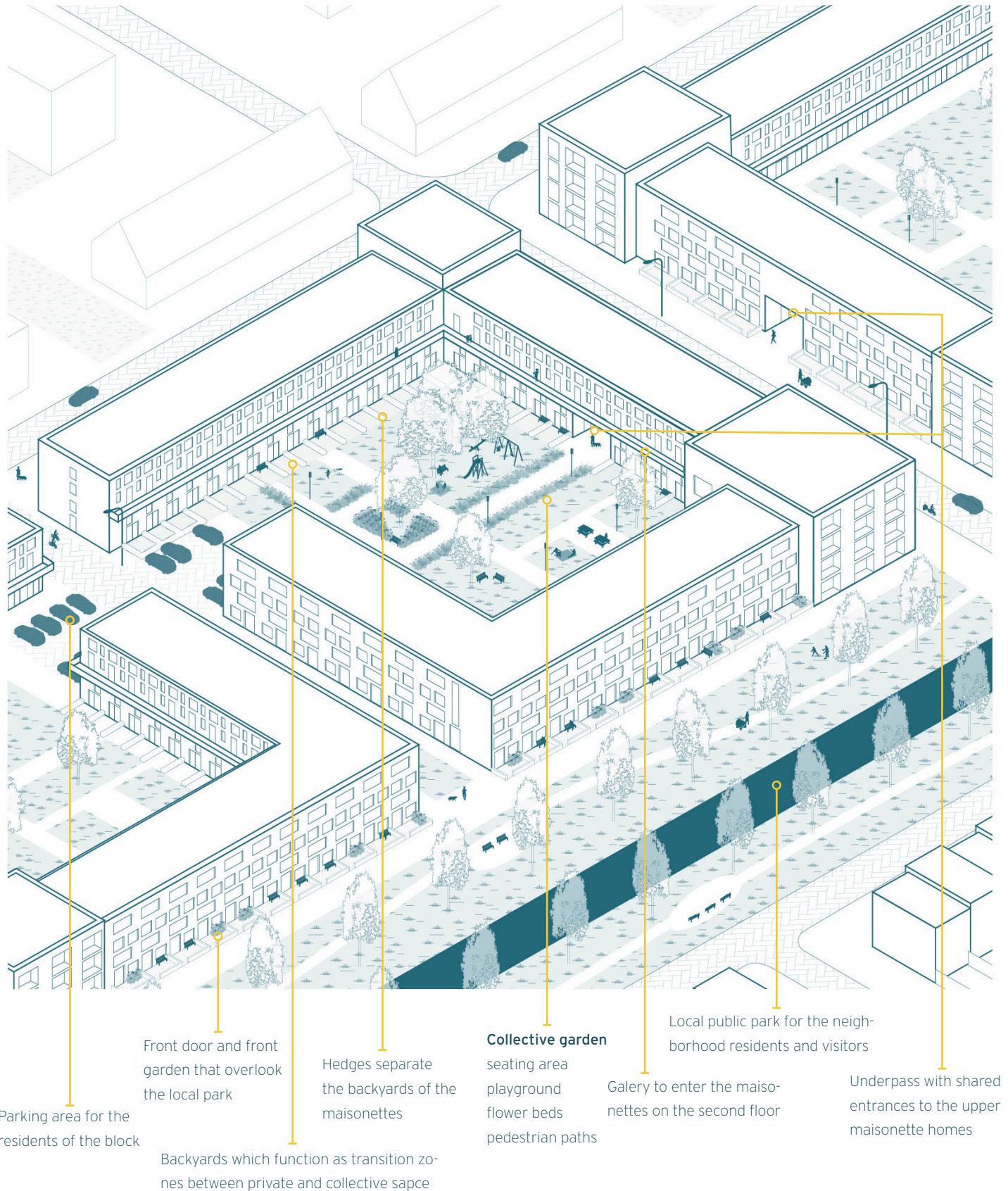
Single family houses



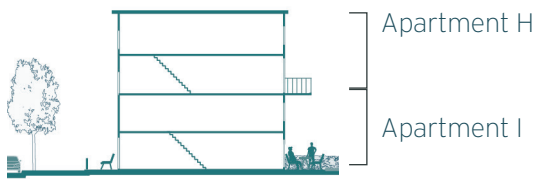
Collective space

fig 66. axonometric view collective living area, North East

Target groups

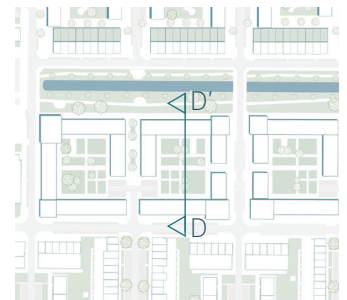


Collective living section



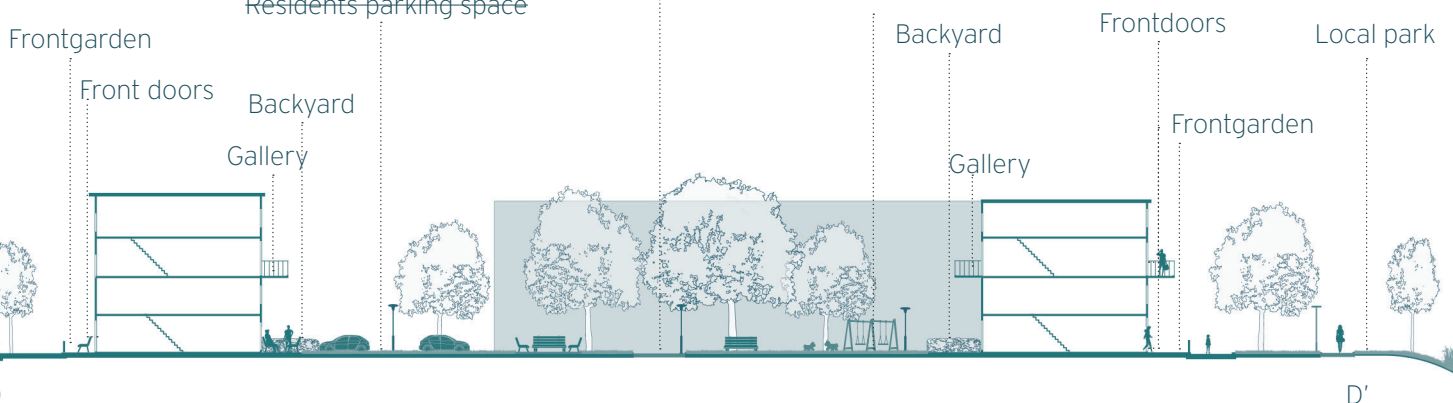
Apartment I is located on the ground and first floor of the building. The building can be entered on the public side of the building where there is a front garden. On the collective side of the building, the house has a backyard that is open to the collective space. The target group for this apartment is two-person households and multi-person households

Apartment H is located on the second and third floor of the building and can be entered via the gallery on the collective side of the building. On the public side of the building the apartment has a balcony. The target group for this apartment is two-person households and multi-person households



Collective space/garden

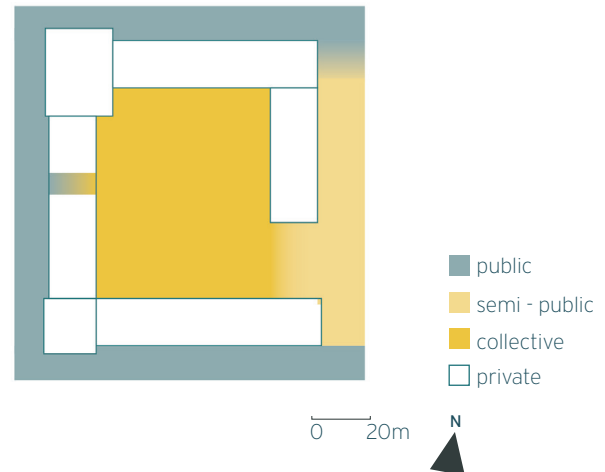
Collective playground



1:500

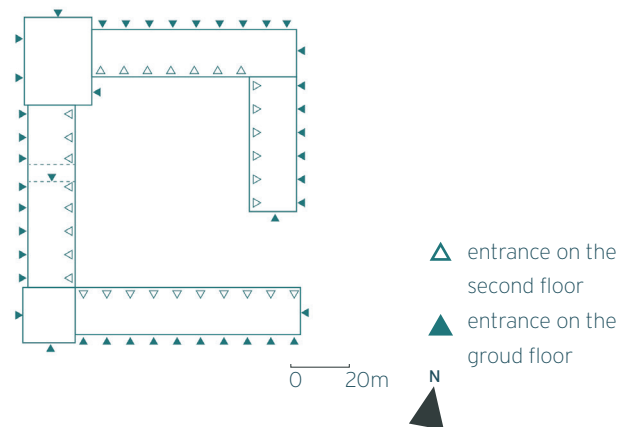
Domain

In order to make the transition between the different zones legible, the design uses the principle enclosed building blocks. Inside the building block is a collective garden, which can be entered on two sides. On one side by opening up the building block, and on the other side by a reasonably sized underpass of 6 meters wide and 3 meters high. The underpass is visible from the opposite houses, which ensures the social control. The closed character of the collective space ensures the legibility of the zone. The space outside the building block is public.



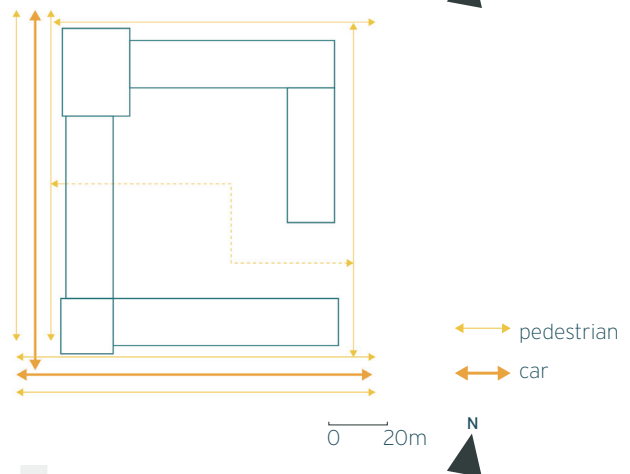
Entrances

The entrances to the houses on the ground floor are located on the public side of the building. The entrances to the homes on the second floor are located on the collective side of the building and are accessed via a gallery. The shared entrances that lead to the gallery are located on the public side of the building.



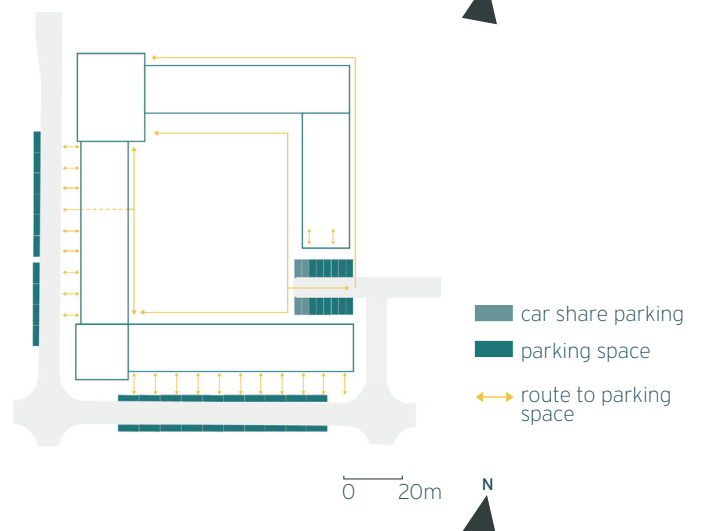
Movement

There is a public road on the west and south sides of the block that is accessible to cars and cyclists. There are sidewalks on both sides of the public roads. The local park is located on the north side of the block, making this side of the block accessible by a pedestrian path. The east side of the building connects to pedestrians, and connects the south of the project area to the local park. Finally, there is a pedestrian path through the block, this route is mainly intended for the residents of the block.



Parking

The demand for parking spaces in this area has been solved by parallel parking along the public road, and a parking space within the block. The parking spaces along the road ensure a short distance between the houses and the parking spaces. There is a good view from the houses on the parking area inside the block, which, due to its location, is exclusively for the residents of the block. In the parking area, places have been created for car sharing.



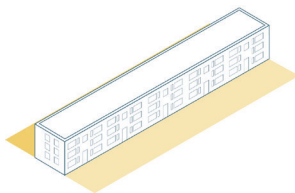
10.6 / Family living

The family living area is located on the edge of the neighborhood. The area consists of three closed building blocks, with a collective garden inside. North from the closed building blocks are Because it is located on the edge of the neighborhood it is used less intensively than the other parts of the plan. That is why the area is focused on families, in a less busy area it is safer for children.

The representation of the layout of the collective garden is one of the possible outcomes. The design offers the residents of the block the opportunity to design the collective garden through a participation process. This way, different functions can be designed in the garden, according to the wishes of the users. Possible functions for the collective space are: play areas, seating areas, flower field, sandpit, fruit trees, vegetable garden, herb garden

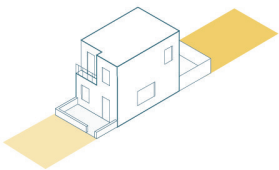
Privacy zoning

Collective space Public space



Existing apartment building

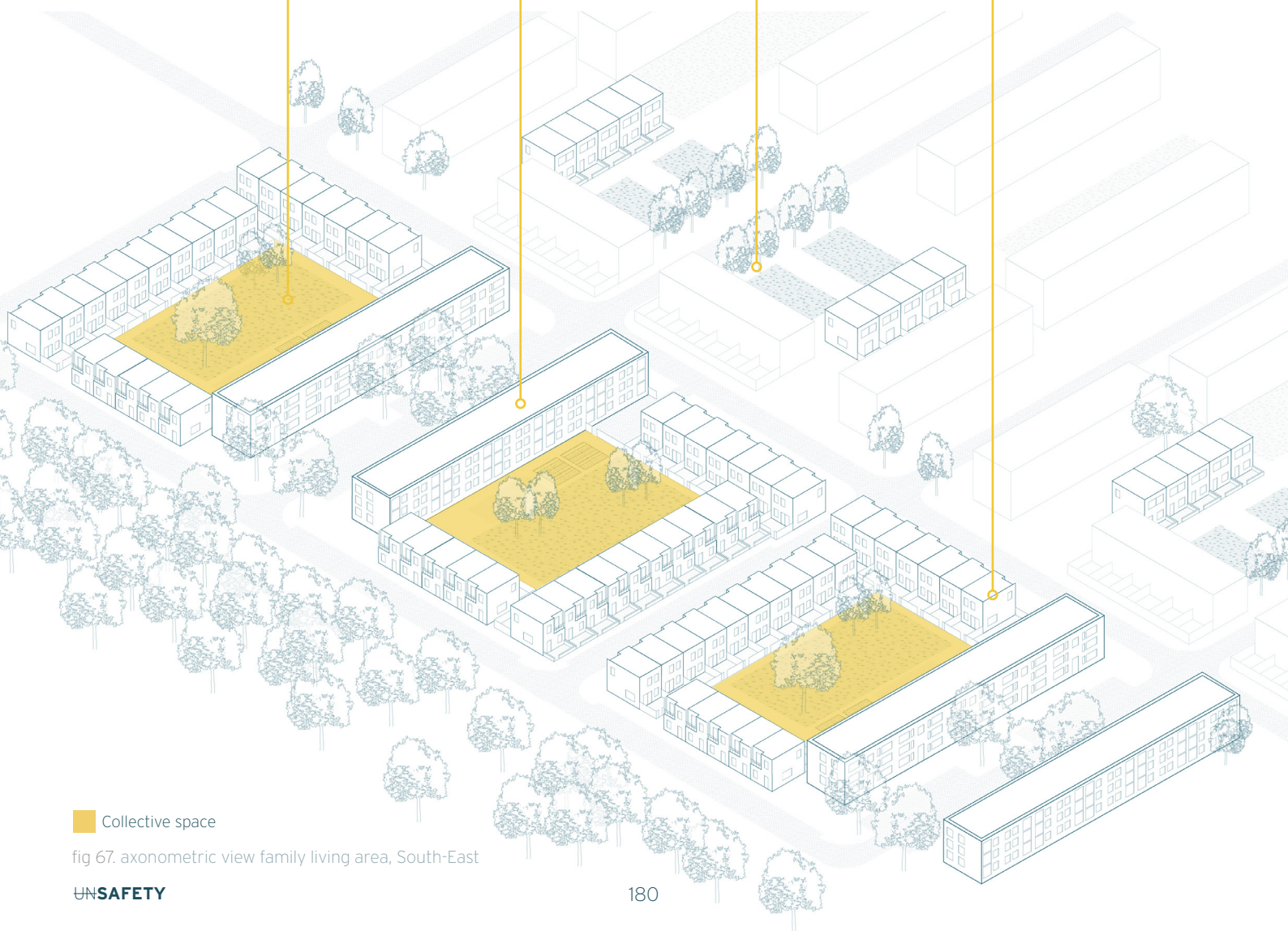
1. Private apartment
2. Apartment entrance
3. Shared staircase/hallway
4. Shared building entrance
5. Public street Collective garden



Single family home

1. Private house
2. House entrance
3. Front garden Backyard
4. Public street Collective garden

Collective garden Existing apartment building Residential square Single family houses



Collective space

fig 67. axonometric view family living area, South-East

Target groups



Two person household
- adult



Two person household
- elderly



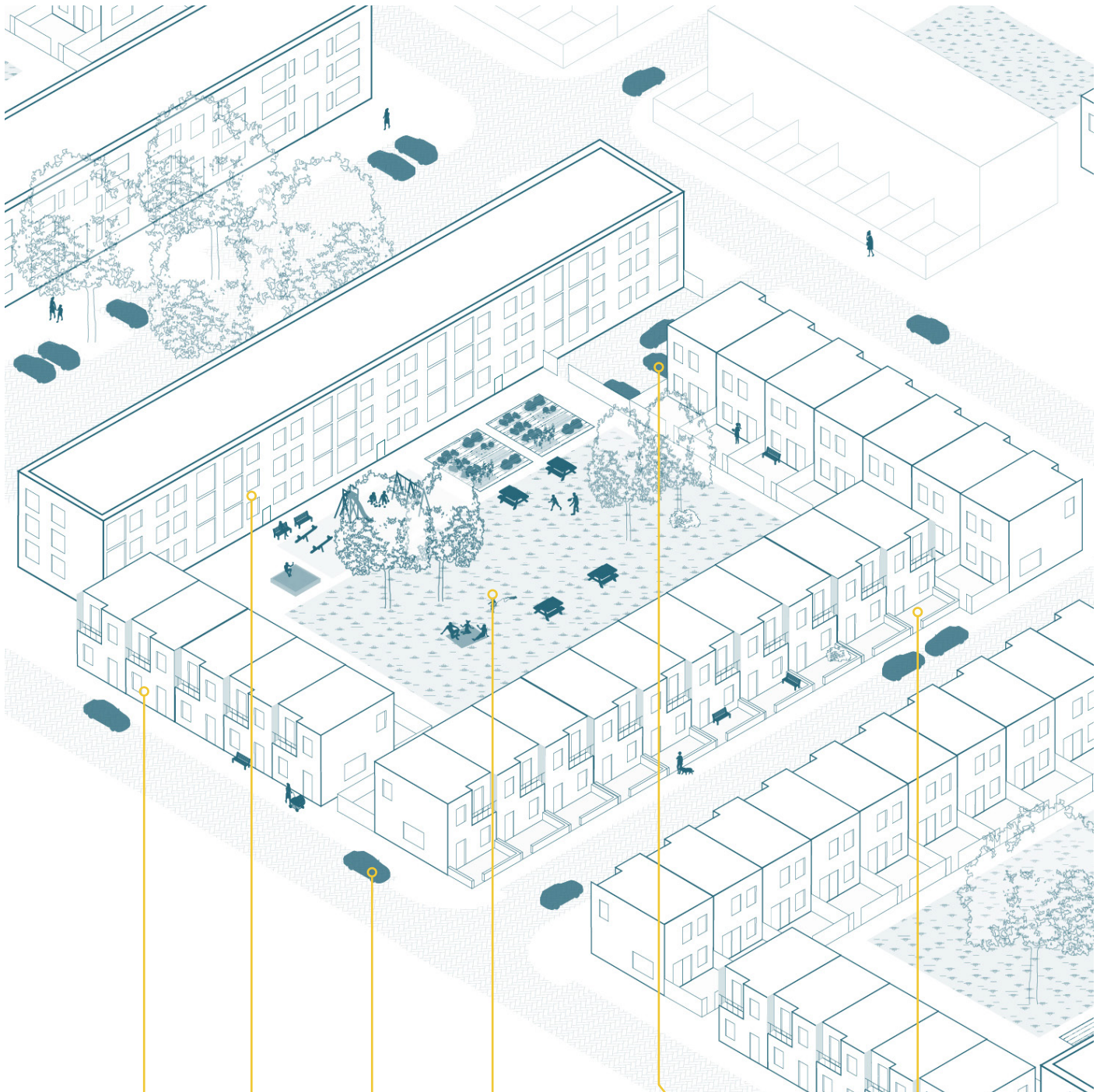
Two person household
- one parent family



Multi-person household
- one parent family



Multi-person household
- full family



Single family houses

Parallel parking in
front of the houses

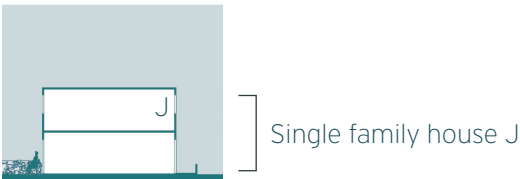
Existing apartment building with
added doors to the collective
garden

Collective garden
Program of the garden
will be determined by the
residents

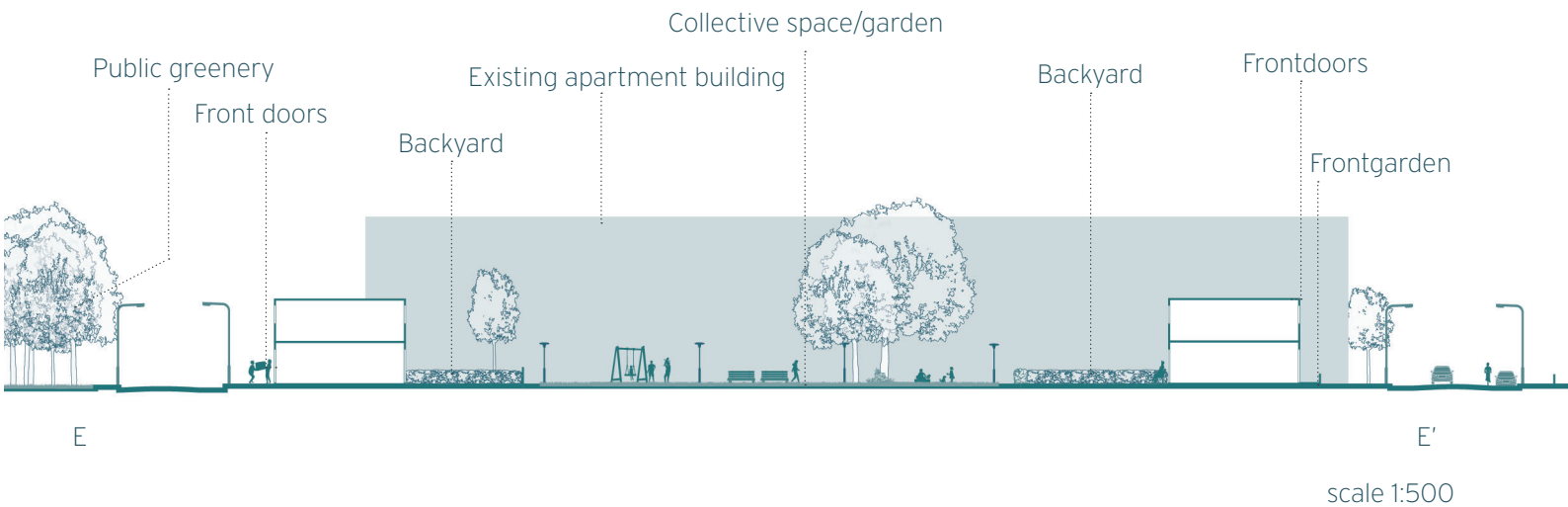
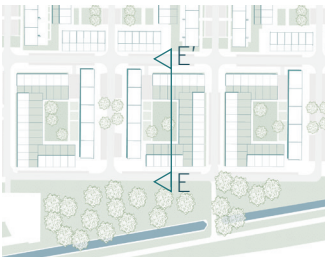
Parking area for the
residents of the block

Front gardens to
encourage encounters
between neighbors

Family living section



Single family house J is oriented to the public street, and has a small front garden and a backyard. The backyard allows the residents of the house to enter the collective garden, which is located inside the closed building blocks. Since the single family house is located in the family living area, the target group is multi-person households.



Domain

In the family living area there is no gradual transition from territories. The closed building block makes the transition from public to collect and private a hard border. in the family living area there is no gradual transition from territories. The closed building block makes the transition from public to collect and private a hard limit. Outside the closed block, the space is public, and inside the block are private gardens and a collective garden. The collective garden is only accessible to the residents of the block, the residents of the single-family houses can access the garden through their backyard, and the residents of the existing apartment building can enter the garden through a new entrance in the shared hallway.

Entrances

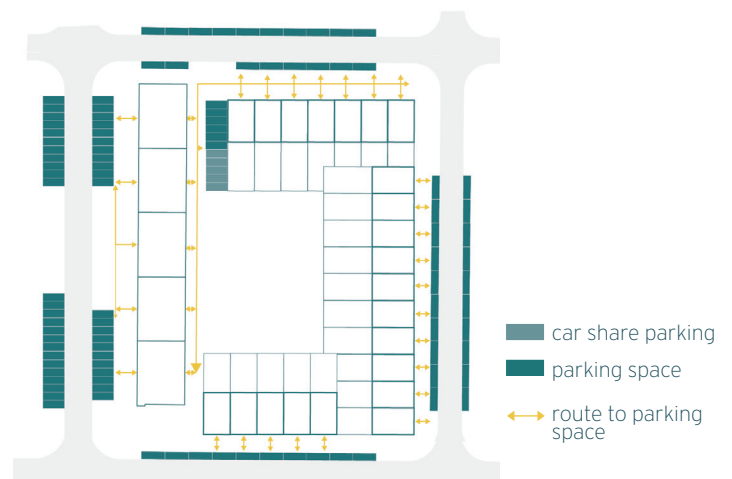
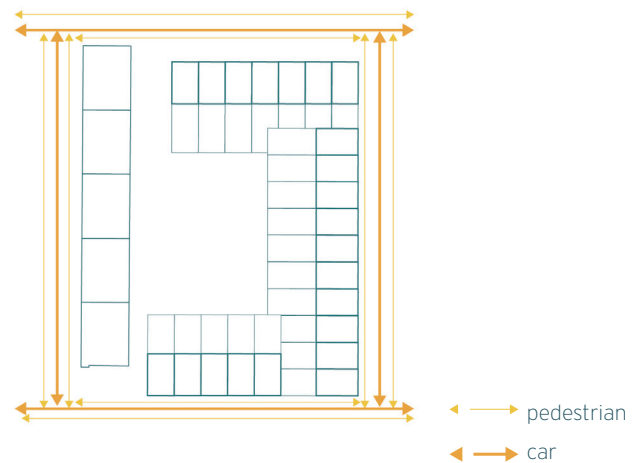
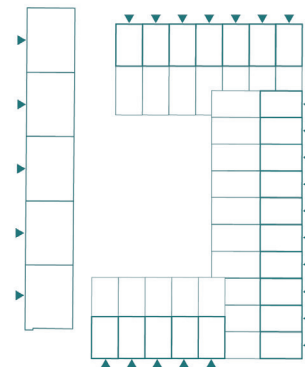
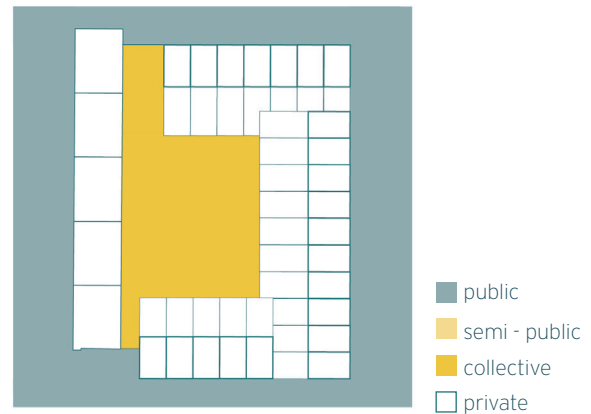
The entrances to the houses are on the public side of the block. This gives a view of the street on each side of the block and increases social control. The high density of the front doors ensures that social encounters between neighbors are stimulated.

Movement

The closed block is accessible on all sides by a public street, which is accessible to cars and cyclists, and there are sidewalks for pedestrians on both sides of the street. This situation is the same as the current situation, but the alleys that led to the house have been removed.

Parking

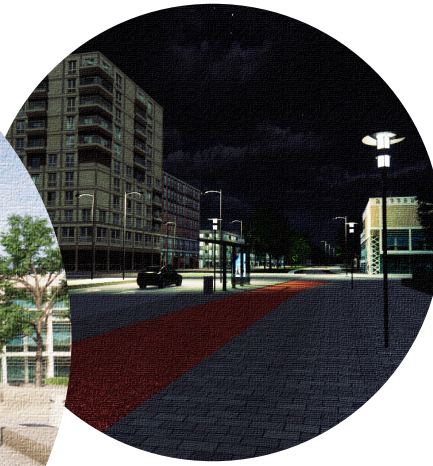
Parking is available along all roads around the block. The perpendicular parking spaces are already present, but in the other streets, parking is on the street in the current situation. That is why space is being created for parking spaces, so that the street remains accessible. The residents can park in front of the door, but space has also been created for a closed parking area in the north of the block. Space is reserved for shared cars in this parking area.



10.7 / A walk through the neighborhood

Urban living





1

Metro station Slinge

- High-rise building as landmark
- Places to sit on the square
- Visible from the high-rise building



2

Urban boulevard

- Spaces for flexible use in the plinth
- Wide sidewalk for the pedestrians
- Entrances to apartments at the boulevard
- Continuity of buildings



3

Residential street

- High density of shared entrances
- Continuity of buildings
- Perpendicular parking spaces

Collective living



Collective garden

- Zones for different types of use
- Wide underpass
- Gallery overlooking the collective space
- Backyards as transition zone between collective and private space

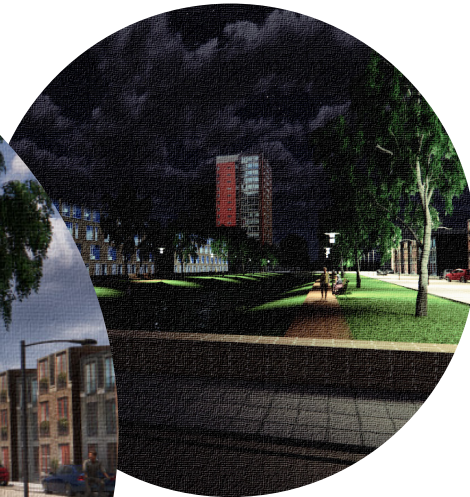




5

Local park

- Existing green/blue structure
- Added pedestrian paths
- Places to sit
- Visible from the houses on both side of the park



6

Outside the collective block

- Added front gardens
- Continuity of building blocks
- Diversity of architecture
- Parking on short distance from houses



Family living



10 Collective garden

- Enclosed collective space
- Use of the space chosen by the residents
- Added entrances from the existing apartment building
- Backyards as transition zone between collective and private space





8

Residential square

- Place to meet for people in the neighborhood
- Playground for the children
- Visible from the surrounding houses
- Parking on short distance from houses



9

Edge of the neighborhood

- Quiet residential street
- Front doors and windows overlooking the street
- Parking in front of the houses



10.8 / Summary

Visibility

The visibility in the neighborhood has been improved by ensuring that all public spaces, squares, parks, and collective spaces are visible from the houses and the use of back paths has been minimized. The public and collective spaces have sufficient lighting to ensure that the neighborhood is also perceived safe during the night. Long sightlines have been created by the design of the urban fabric, and it has been made sure that they are not interrupted by spatial elements. Finally, the design has optimized front door inter-visibility

Legibility

The legibility in the neighborhood has been improved by clearly indicating the transitions of territories with physical boundaries or by designing a (partly) closed building block. In addition, the unique architecture and layout of the public space of the different areas provide identity, so that the different areas can be recognized. The privacy zoning per building block has a clear transition from public to private and gives residents control over the possible social interactions with neighbors. In addition, the use of diverse high-rise and mid-rise buildings has added to the legibility by creating landmarks and identity.

Accessibility

The accessibility in the plan is to increase on neighborhood-scale by extending the existing dead-end roads and increasing and improving the pedestrian network. By designing short building blocks, instead of the existing long building blocks, more alternative routes have been created, that are well marked and have sufficient lighting. At the building level, accessibility has been improved by placing the entrance to the buildings/homes on the public side of the building. Finally, the accessibility has been improved by placing street furniture, like benches, so that the public and collective spaces can be used inclusively by people like the elderly, disabled, and parents with their children.

Attractiveness

The attractiveness in the neighborhood has been improved by adding functions to the public space, the main road has been transformed into an attractive boulevard with function, the canal is transformed into a local park, and the square in front of the metro station has become more pleasant by providing places to sit and ensuring social control by the surrounding buildings. In addition, the use of front gardens has been optimized at street level, which ensures a gradual transition from public to private, but also ensures that the street is more attractive.

Collectivity

An important part of the design is the collectivity. This has given the design the opportunity to influence the social environment. All spaces take the form of a collective space, which serves as an outdoor space for the residents. By creating the collective spaces, the social interaction between the neighbors is stimulated. This builds on the theory that being able to identify yourself with a group or place increases the sense of responsibility for the space. As a result, the space is better maintained and there is more social control. Besides the use of the collective spaces, the design also aimed to increase the collectivity by adding front gardens, shared entrances with small groups of people, and galleries. This increases the chance of social encounters between neighbors.

Housing

Current situation: 640 dwellings

Masterplan: 1.356 dwellings

The mix of different types of dwellings allows people with different incomes to find affordable housing. It also creates the opportunity to move within the neighborhood when there is a need for a smaller or larger home. The design has deliberately chosen to mix housing typologies for different household sizes, thereby trying to avoid single-parent families or elderly people feeling secluded. This is mainly included in the urban living and collective living area, where they can socialize with neighbors in neutral collective space.

Land-use

While the majority of the neighborhood is residential, the plan also includes non-residential functions. As explained in this chapter, these functions are located along the urban boulevard. These non-residential spaces are not defined, because it is beyond the space of this project. Therefore, the design assigned flexible spaces. Some examples for these spaces are: a community center, offices, horeca establishments, shops, or public functions.

Diversity

The plan includes various forms of diversity: architecture, outdoor spaces, dwellings, and household compositions. In urban design it is difficult to manage population diversity, nevertheless, the ambition of this design is to mix housing typologies and households as much as possible. This way an attempt has been made to create a place that fulfilled their housing wishes for everyone. The plan provides control over the degree of social interaction. With regard to the ethnic diversity, the plan facilitates neutral places without a specific use to meet and encounter people.

11 / Conclusion

The previous chapters of this thesis have contributed to answering the main research question of this thesis:
How can perceived safety be improved through neighborhood transformation in Pendrecht?

In the main research question, the problem has been highlighted that there is a low perceived safety in the neighborhood Pendrecht, in Rotterdam-Zuid. The first two chapters introduced and analyzed this problem and answered part of the sub research question: What are the socio-economic and spatial conditions in Pendrecht? From a socio-economic perspective, the research concludes that the label of "problem neighborhood" has created a negative stigma around Rotterdam-Zuid, and that the conditions that created the problem neighborhood were still present in Pendrecht. These conditions were related to low income, unemployment, a high percentage of social housing, and the percentage of the population with a non-western migration background. From a safety perspective, the research found that the safety has been performing poorly over the past couple of years. In the research done by the municipality (Gemeente Rotterdam; O-BI, Wijkprofiel 2020), the perceived safety in particular performed under average.

The fourth chapter of this thesis constructed the theoretical framework for the research, which has been developed to understand the relationship between the social and physical environment and perceived safety. This literature study aimed to answer the research question: What are the social and spatial conditions that can lead to an (perceived) unsafe public space? The main theories that have been used to answer this question are CPTED and Social Safe Design. These theories mainly focus on the spatial condition that can lead to a perceived unsafe public space and provided this research with guidelines for designing a perceived safe environment. The four guidelines that need to be present in conjunction in an environment from Social Safe Design, visibility, legibility, accessibility, and attractiveness, have been used throughout the project for both analysis and design. In order to answer the social aspect of the sub research question, the theoretical framework research the disorder perception theory, which provided knowledge on how different demographic characteristics determine how people perceive disorder, and that, therefore, the perception of safety depends on the individual. The literature review also put forward the importance of control over the environment and the dynamics of a multicultural population.

The fifth chapter of the thesis included the spatial analysis

of Pendrecht, and the case study, Bloemhof. This analysis in combination with the problem analysis answered the sub research question: What are the socio-economic and spatial conditions in Pendrecht? The spatial analysis concluded that the openness and orientation of the building blocks, the low density and inter-visibility of the front doors, the poor spatial integration, and the ill-defined territories in Pendrecht are affecting the perceived safety in a negative way.

After the problem analysis and spatial analysis, a survey among the residents of Pendrecht was conducted. The results of the survey provided insights into the neighborhood satisfaction and safety in the neighborhood and answered the sub research question: How do the residents of the neighborhood assess the perceived safety and neighborhood satisfaction in Pendrecht? The results showed that there is nuisance from waste and the main square of the neighborhood and the route from the metro station to the main square are perceived unsafe during the night. Overall the participants felt safe during the day and felt unsafe during the evening/night.

The next phase in the research included the development of the design principles for the stated choice experiment. The design principles are based on a literature study and spatial analysis. The experiment was conducted to answer the sub research question: How are targeted changes experienced by people with the condition to improve perceived safety? The stated choice experiment presented the participants with seven choice tasks. The design principles that were included are: adding a front garden, increase continuity, adding front doors, splitting long building blocks, adding a path to an empty public space, creating physical borders between territories, and adding buildings floors. The results showed that for all the choice tasks, except the "increase continuity", a significant difference between the distributions were observed. This means that there is a difference in perceived safety between the current situation and the situation with the design principles, and it, therefore, answers the sub research question, that the targeted changes are perceived safer by the participants.

The final phase of the project includes a neighborhood transformation design in which the validated design principles are integrated, and therefore will answer the last sub research question: How can design principles that improve the perceived safety be implemented in an integral neighborhood transformation design? The answer to this question is to use the design principles as the guidelines for the design process, and research which design interventions are needed to be able to apply these design principles at the same time. In the neighborhood transformation design, this has been done by carefully looking at the relationship between the street and the building,

and the relationship between the buildings themselves. For instance by combining the inter-visibility and frequency of front doors with short, continuous building blocks. The transformation design showcases an environment in which the current spatial characteristics that have a negative effect on the perceived safety are redesigned into an environment which has the spatial qualities to be perceived as safe. It is one of the many possible outcomes in which the design principles can be integrated.

The research process described above and the applied methodologies provide an answer to the research question. By analyzing the social and physical environment, applying the theories, and testing the design principles by users of the public space, a transformation design can be developed in which the perceived safety is improved.

Research limitations

The research has encountered some limitations that influence what can be concluded from this study.

The first limitation that has occurred in the study is the limited availability of data about perceived safety in the project area. The study had to rely on the scores published by the municipality. The published data was not detailed enough to conclude specific problems related to perceived safety in the neighborhood. More insight into why the neighborhood is perceived as unsafe would strengthen the research.

The second limitation that the research has encountered is the collection of more qualitative data. The method used to test and validate the design principles prevented participants from explaining their preferences and decision-making process. This qualitative data could provide more insight into why these design principles enhance the safety experience and could provide feedback to further develop the design principles.

Despite the limitations, the study did manage to achieve the intended research outcomes.

Future research suggestions

Several suggestions can be made for future research on the topic and results of this thesis.

Future research could build on the findings of this study, and in particular on the findings of the stated choice experiment. This research could be conducted by using VR, like this research intended. The choices that were presented to the participants could be presented again to a group and further explanation may be requested from the participant. In this way it is possible to search for a decision-making pattern for the different environments and more qualitative data can be collected.

A second suggestion to build on the findings of this research is to add the social environment in the stated choice experiment. This creates a complete picture of reality and it can be investigated whether the preferences for design principles depend on the social environment. A possible way to do this is to create an environment in which one of the validated design principles has been integrated and present the participant with one option without people and another option with people in the environment.

A third suggestion is to test the design principles integrally in a transformation design. The stated choice method can be used for this. In this way, the perceived safety of the design is tested and it can be said with certainty that the design meets the ambitions to improve perceived safety.

12 / Reflection

1 / On problem field

This thesis is rooted in my personal interest in environmental psychology and human behavior. The topics that can be explored within these research fields are endless. It was therefore important from the outset to narrow down the subject and define a clear framework. The location of the project had already been defined but needed to be narrowed down as well in order to research a manageable area. While defining the problems related to quality of life in Rotterdam-Zuid, it became apparent that the issue of unsafety was dominant in this area. Safety defines the quality of life, and if the sense of feeling safe is lacking in an area, the quality of life is affected by it. The development of urban areas creates an opportunity to improve safety. Urban development in the Netherlands often includes the densification of existing urban areas, which creates an opportunity to change both the social and physical environment from within the existing urban fabric and its already established social environment. The question is how the sense of feeling safe can be improved by spatial changes? Urban design has limited effects on quantitative crime rates but is able to improve perceived safety. This thesis, therefore, does not focus on actual crime rates but it focuses on the perceived safety and how this can be improved by urban design. Through studying literature and gathering information from the residents of the area in combination with the analysis of the local social and spatial environment the thesis aimed to improve the perceived safety.

Scientific relevance

This research contributes to the research field of perceived safety, social safe design, and the use of an experience-based experiment in empirical research. Furthermore, there is a lack of empirical research with the aim to measure the targeted changes in the individual physical and social environment (Harvey et al., 2015, p. 2). The development of research on designing for people has caused an over-professionalized form of urban place-making, which makes people believe that everything related to the shape and management of environmental form is a professional problem (Romice et al., 2016). Therefore, this project aimed to design for the user's experience. In addition, this research researched both the theories of CPTED and social safe design and has found a way of combining parts of both theories.

Societal relevance

Safety is one of basic needs for people. The social and physical environment are equally important to establish

a safe environment. However, in cities, where the building and population density is high, creating a safe environment has become more and more complex. The well-being of people is depending on feeling safe in the direct living environment. The neighborhood Pendrecht performs poorly on the aspect of perceived safety (Wijkprofiel Rotterdam, 2020). Therefore, the transformation design proposes spatial changes that will increase the perceived safety and create a safer, more livable, and social sustainable environment for the residents. Besides that the validated design principles can be applied in other areas that have problems with perceived safety, the design principles can also be applied in any other urban design because they will be beneficial for the residents and users of the public space.

This research relates to the following Sustainable Development Goals (SDG) of the UN: 3- good health and wellbeing, "ensure healthy lives and promote well-being for all", 11- sustainable cities and communities, "make cities and human settlements inclusive, safe, resilient, and sustainable", and 16 - peace, justice and strong institutions, "promote peaceful and inclusive societies for sustainable development" (United Nations, 2017).

2 / On methodology & approach

Methods and data collection

This thesis forms an integrated approach on how to measure, validate and integrate design principles based on how people experience of their environment. The problem statement has indicated that there is a lack of empirical research with the aim to measure and validate the effect of physical environment changes. In the context of this thesis, the neighborhood transformation design aimed to improve the perceived safety in the built environment. The methods that have been used to do so are a literature study, on which spatial changes would have an effect and why this would have an effect on perceived safety, a problem analysis, to gather data on the socio-economic and spatial characteristics of the area, a case study, to gather knowledge by compare two spatially different neighborhoods, a survey, of which the results indicate how the residents experience their neighborhood, an experiment, to develop design principles that improve the perceived safety, measure the effectiveness of the design principle, and finally apply the design principles in an holistic neighborhood transformation design.

Case study

The case study is conducted on the neighborhood Bloemhof, which has similar socio-economic characteristics, but differs a lot spatially from Pendrecht. The case study has been conducted in the inquiry phase (see fig 68 on page

194) of the project. The spatial differences enabled me to recognize the effect of a different urban fabric on perceived safety and to what extent changes could be made to improve the perceived safety. The case study involved analyzing the history of the area, the socio-economic characteristics, spatial characteristics. It has also been a way of determining which neighborhood offers the most opportunities to be transformed. Both neighborhoods, were interesting for this project and they would have had very different outcomes, if both were to be included throughout the whole project. However, it was not realistic to research both neighborhood due to the limited time that was available. Therefore, the decision was made to further research, analyze, and design for the neighborhood Pendrecht. It would be insightful to apply the same design methods and experiment to this case study to research how, in different type of urban fabric, the same principles could be applied, and if you would have the same effect.

Survey

The survey among the neighborhood residents was initially intended to collect data on perceived safety from the people who live in the neighborhood and use the public space in the neighborhood frequently. Ideally, the sample would consist of a diverse group of people, with different ages, ethnicities, and social connections. These expectations turned out to be too ambitious. The purpose of the data collected from the survey changed due to the low response rate and low demographic diversity of the sample. The most effective way of spreading the survey turned out to be the Facebook groups. However, the demographic of the people in this group were mainly people between the age of 50 to 75 years old, with a Dutch background, who had been living in the neighborhood for over 20

years. This resulted in an unrepresentative sample for the actual population of the neighborhood. Despite the limitations, conducting the survey provided useful insights into how residents experience safety in the neighborhood that have been used in the development of project.

Experience based experiment

The experiment to measure and validate the design principles has been an important part of the research. Unfortunately, due to the COVID-19 measures the method for the experiment required adaptation. The intended method for measuring and validating the design principles was a Virtual Reality experiment (VR experiment). This method was most fitting to an experience based, qualitative research. The VR experiment has been replaced by a stated choice experiment in which photorealistic renders have been used to simulate the same level of experiencing the environment. Although, research has shown that using a VR experiment increases the performance of immersion, movement, and concentration (Van Leeuwen et al., 2018) in an experiment, there are also positive sides for using a stated choice experiment for measuring and validating design principles. For instance, the sample size is much larger, the VR experiment intended to have 10 participants over 2 weeks, the stated choice experiment eventually collected 345 responses within one week. The downside of the online survey is the lack of interaction with the participant, which results in missing qualitative data and feedback on the experience.

3 / On theoretical framework

The theoretical framework supports the research with relevant theories on perceived safety. The most important insight in order to construct the theoretical framework

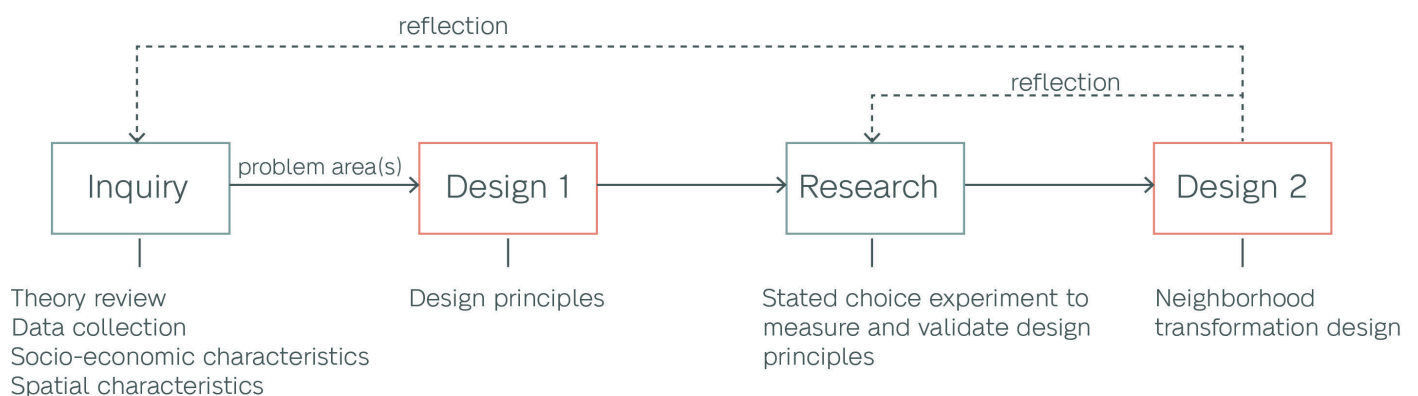


fig 68. Diagram explaining the overall research approach

has been the conceptual framework that shows that perceived safety depends on the social and physical environment on the perceived safety (fig 69). This has been the backbone for developing the theoretical framework, that separates itself in the effects of the social environment and the physical environment on perceived safety. In order to understand the relationship between the social environment and perceived safety the research mainly looked at the dynamics of a multicultural society. Much research has been done on inter-ethnic relations and conflicts between these groups in an urban environment and it is important to understand these dynamics in order to implement them. I did not grow up in a multicultural or urban environment, this limits my knowledge on how to design for multi-cultural societies. It was therefore important to gain information on this topic, so that I understand the social dynamics and can process them ethically correctly in the project. In the beginning, it was hard to grasp where these conflicts originated from and what makes it so hard for urban designers to create inclusive public spaces. I also looked at the disorder perception theory with regard to the social environment. This has been important in the project to correctly interpret the demographic differences in the survey results. However, these theories do not always translate directly to the survey results and it was required that I made some assumptions or speculate the results, in order to contextualize the results.

There is a wide range of literature available on the effect of the built environment on safety. The two main field of reserach that have been used in this research are Crime Prevention Through Environmental Design (CPTED) and Social Safe Design. Both theories focus on the design of a safe environment, however they are different. CPTED focuses more on the prevention of the incidence of crime (Queensland Government, 2007), and therefore often aims to actively prevent criminal activity. On the other

hand, Social Safe Design focuses more on how the urban fabric and public spaces have an effect on how safe people feel (sv-s, 2015). Both theories address several design principles to improve safety, some are similar and some a different. Although both theories have different approaches, this research uses design principles from both theories and combined the knowlegde gained from these research fields. I am aware that there are many more theories that could support my research, but due to the limited time available for this part of the project, the choice has been made to focus on these theories. By establishing this focus, I have managed to gain deeper insights into these theories.

4 / On design and experiment

Design principles

The design principles have been developed for the stated choice experiment and the neighborhood transformation design. They have been narrowed down based on applicability in the project location and whether or not they have proven to be effective based on the literature study. Design principles that have been proven multiple times to have a positive effect on the perceived safety will therefore not be included in the experiment. In the experiment seven design principles are presented to the participant. The amount of principles has been narrowed down to avoid survey fatigue, which could affect the sincerity of the answers. It is important to note that in the experiment the seven spatial attributes are separately tested, while in the neighborhood transformation design the design principles will be applied in conjunction.

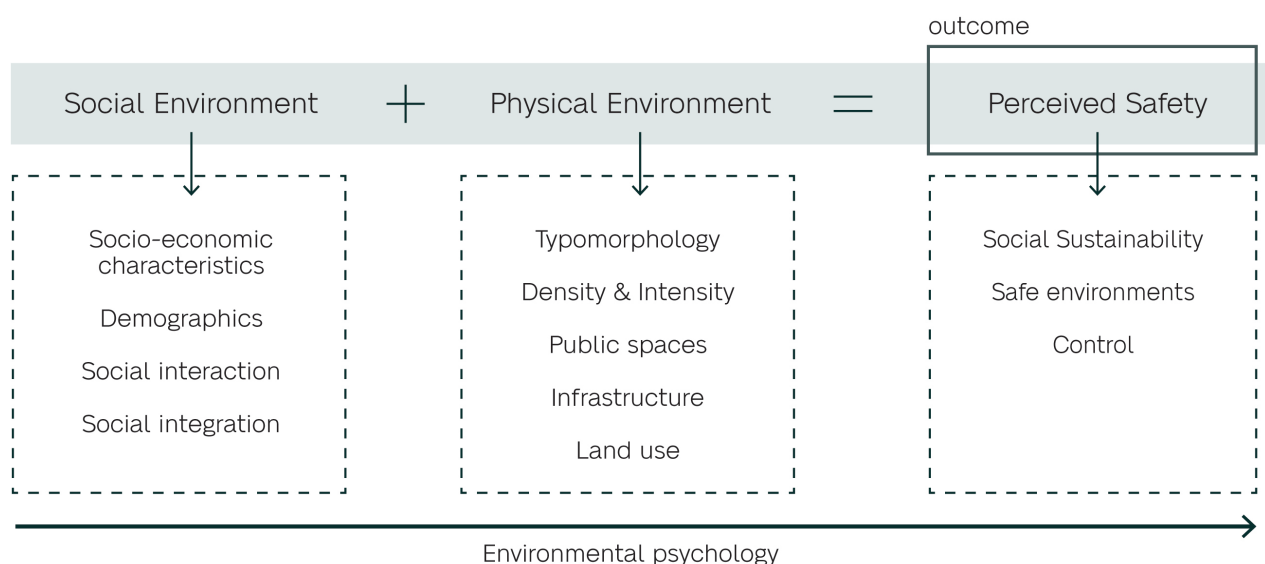


fig 69. conceptual framework

Stated choice experiment

The stated choice experiment aimed to validate the design principles by presenting choice tasks to the participants. It is important to mention that the experiment results are the individual's perception of the environment and that the local social environment is not presented to the participant. Based on the much-researched theory that people are social beings and prefer being and walking where other people are, it can be assumed that the results of the experiment are different when a situation is presented to the participant in which they are in the built environment as part of a group (Hillier, 2004). Being among people creates a sense of safety as a result of social control but to measure the effect of the targeted spatial changes on the perceived safety this research deliberately omitted social environmental factors. The results of the experiment support 6 out of the 7 hypotheses. Some remarks have been made by the participants regarding finding the differences between the two environments that were presented with each choice task. This may have had an impact on the answer of the participants, and could be improved in the creation of the environments that will be presented. Furthermore, the sample in this experiment mainly consisted of people with a Dutch background. It would be interesting to collect an ethnically diverse sample and test the same questions and see if there is a difference in the results or between subgroups. I aimed to have an ethnically diverse sample, but because the survey was distributed via my personal social connections and platforms which resulted in a sample that is predominantly Dutch.

Neighborhood transformation design

The neighborhood transformation design integrates the validated design principles with solutions for common urban development issues, including sustainability, affordable housing, mobility, and social sustainability. While the research has focused mainly on the physical environment, with the transformation design the project aims to also design for the social environment. It explores how different building configuration can create a sense of community, which is beneficial for the social control. Like any other urban development project, the social dynamic that is intended to be created by the design cannot be guaranteed. However, I think that when urban designers get the chance to design the physical environment, they should always think about the opportunities for the social environment. The physical and social environment are intrinsically connected, and within this research about perceived safety the changes made in the physical environment must be assessed by the effect they have on the social environment. Therefore, the neighborhood transformation design envisioned a strong social environment.

The design is quite radical and will, in reality, not be fea-

sible on all aspects. However, this way, during the development of the plan, it was possible to test how all design principles can be integrated with other urban design challenges.

One of the challenges that arose during the design process was the lack of ability to target a diverse population. Although the plan's vision contains a mix of different groups of people, as an urban designer you are limited in determining who will live where. This limitation has been attempted to resolve by creating different housing typologies in the different areas.

5 / On graduation Studio

The studio's approach is urban design, which puts forward the importance of understanding how to develop a sustainable, attractive, and vital urban space. The design of the urban fabric is a method to gain a deeper understanding of the area, both socially and spatially. This research added to this by studying the issue of perceived unsafety and how this relates to the social and physical environment. Although this year's studio topic was density and intensity, this has not been prioritized but has been interpreted as an objective that you must achieve as an urban designer. Especially in a city like Rotterdam, where the demand for housing is high and the space to build is scarce.

The research field of urban fabrics is about the multi-scalar interrelation between the built environment and the systems that create the dynamics in an urban environment. These systems are either tangible or intangible, in any case, these systems are connected. The intangible systems – the way people use the city and interact with each other, is stimulated and facilitated in the way the urban fabric is organized and designed. The increasing density of the urban environment has an influence on these systems, as they put more pressure on urban structures and how public space is being used. This is dealt with when designing these places, the right behavior of the individual or a group should be stimulated by both the social structure and the physical urban form.

This thesis touches upon different relevant topics within the urbanism research program. Within the Design of Urban Fabrics research group, we are dealing with the global issues of rapid urbanization, densification, and intensification. These developments create an increasingly complex relationship between tangible and intangible structures. One of these increasingly complex relationships in the city is safety, as a part of the livability in the city. Perceived safety relates to the social well-being and health of cities' residents. Sustainability is a broad subject in the research

field of urbanism in which social sustainability is only one of the several aspects. It focuses on the social dynamic and social resilience of an area. A sense of belonging to a community and social interaction and cohesion are integrated in the neighborhood transformation design along with other pressing issues like mobility, affordable housing, and vitality.

6 / Transferability

The design principles and the neighborhood transformation design are based on generic theories on perceived safety and can be used in other studies. The use of the validated design principles as a single spatial change is also generic and can be very useful in other studies or design. Also, the methods that have been used to validate the design principles are generic and can be recreated for any other context. However, it must be taken into account that the situational context in which the design principles of this project have been validated are location specific.

The research is based on how people experience their environment, this perception is subject to culture, values and behavior. Therefore, it is necessary to research the people who are in this environment and how this affects their experience.

Lastly, it is important to acknowledge that this research has focused itself on the spatial environment and its effect on perceived safety, while literature has shown that perceived safety depends on both the spatial and the social environment. The research field of urbanism is limited in its abilities to change the social environment. Nonetheless, this research has aimed to understand and gain knowledge of the social environment and its effect on perceived safety in order to integrate it into the neighborhood transformation. This means, that when perceived safety is more affected by the social environment than the physical environment this method would not be the most suitable.

7 / On ethical considerations

When addressing perceived safety and changing the living environment based on what is theoretically perceived as safer, or is believed to be perceived as safer, it is important to realize that perceived safety differs from person to person. The perception of the environment cannot be generalized, because it depends on an individual's socio-cultural, individual and situational context (Luten, 2008, p. 28). This means that, for example, factors such as gender, ethnicity or direct living environment have an influence on the perception of the environment and safety. This also means that my personal perception of safety has partly influenced the project, so I cannot speak to other people

about how they experience the environment. However, efforts must be made to design the environment in such a way that it is perceived safety for the most vulnerable groups of society. Most of the ethnic groups are under-represented in the results of the surveys that have been carried out. This could have influenced the results. It is, therefore, important to realize that the preferences that were expressed by the participants, in reality, would not be experienced that way by everyone since the actual population is more diverse than the groups of participants.

The second ethical consideration concerns the privacy of the survey participants. Two surveys were conducted during the project, in which the participants took part voluntarily. None of the participants was required to participate and participants were able to stop the survey at any time. Participants were also asked to share personal characteristics and information about their living environment. For privacy reasons, this data has been made anonymous and the data set is not shared with third parties. At the beginning of the survey, participants were informed about their privacy rights and the fact that they are not obliged to answer questions where they do not feel comfortable sharing the answer. Also in the design I have tried to realize housing for multicultural groups, but I realize that I lack knowledge about their customs and preferences of other groups in society.

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14 / Appendix

1. Theory essay (AR3U023)
2. Graduation Plan
3. Additional Maps
4. Survey 1

14.1 / Theory essay (AR3U023)

Multicultural public space

Planning and designing for ethnic diversity in public spaces

Abstract

International migration flows have caused our society to ethnically diversify. Different ethnic groups coexist with in proximity and encounter each other in public spaces. Ethnic groups differ in their needs, values, and behavior which can sometimes cause conflict. As a result, the social integration and social cohesion in a neighborhood decreases. This essay aims to determine how ethnic diversity is related to social cohesion and how we can plan and design for it. The research looks at migration flows and both positive and negative consequences it has on the contemporary multicultural society. Based on a literature study on migration, multiculturalism, and ethnic diversity various determinants have been defined. The research results indicated that conflicts are often caused by negative stigmatization and lack of acceptance and tolerance, supported by theories on conflict, constrict and contact. Negative perceptions of ethnic diversity can be avoided by mere exposure to different ethnic groups and facilitating inter-ethnic relations in public spaces. The research concludes with guidelines for planning and designing public space that can facilitate inter-ethnic relations. It is recommended to ensure an inclusive and participatory planning process, design for durability and flexibility, and finally adequate management of the public space.

Keywords: *Ethnic diversity, Migration, Multiculturalism, Public space, Social cohesion*

I. Introduction

Globalization has transformed society into a multicultural society. Planners and designers are urged to create places that allow for inclusiveness and ethnic diversity. Inclusiveness and ethnic diversity have an overlap with diversity, ethnicity, race, different needs, values, and behaviors as the important aspects (Juwet, 2010). This paper will focus on the ethnic diversity in society and how urban planners and designers can create public spaces that are comfortable and usable for everyone, regardless their ethnic and cultural background. However, it is noted that designing for ethnic diversity goes hand in hand with creating an inclusive public space. This paper will research *How ethnic diversity is related to social cohesion and how we can plan and design for it*. This is done by a literature review on ethnic diversity and multiculturalism, conflicts between different groups in public space, and how to plan and design public space for the different ethnic groups. In order to provide context, the first section will explain the historic development of migration that have led to a multicultural society. The second section will research the different concepts of diversity and more specifically at ethnic diversity. The third section will briefly explain multiculturalism, the ideology that beliefs different ethnic and cultural groups benefit from living together. The fourth and fifth sections will explore the cause of conflicts between different ethnic group and, more detailed, how and why these conflicts occur in public spaces. This sixth section will provide several guidelines on how to plan and design for ethnic diversity in public space. The final section will try to answer the research question and will discuss the research outcomes.

II. The trend of multicultural societies

International migration is the phenomenon that creates multicultural societies and leads to different ethnic groups to live together. It has an impact on the structure of the overall population, both short-term and long-term (Titan, Ghita, & Covrig, 2012). Therefore, it is relevant to know what causes people to migrate. This section discusses European migration trends since the 1950s. The effects of the colonial era before the 1950s have influenced the population structure. Therefore, these results are implicitly linked to the developments related to migration that followed the decolonization.

The cause of migration is often classified in the neoclassical theory. This theory on migration considers migration as a result of income differences between the origin and destination countries (Titan et al., 2012). The migrants, according to this theory, leave their countries, where they live in poverty, in search of better job opportunities and a stable income in economic strong countries. This migration process happened widely in the 1950s. After the second World War North-Western European countries experienced an economic growth. The native population became increasingly educated and was no longer willing to take up unhealthy and poorly paid jobs. North-Western European governments changed immigration policies and laws, which allowed them

to recruit labor force from peripheral countries (Titan et al., 2012; Van Mol & de Valk, 2016), also known as guest workers. In the beginning geographic proximity had a large influence on specific migration flows, but due to the Cold War division the European governments enlarged their recruitment zones (Van Mol & de Valk, 2016). Initially, the migrants were expected to return to their home countries after completing the labor. However, most of the immigrants stayed, as returning to their home countries would increase the chance to lose their residence permit in their destination country. In contrast, the migration to North-Western countries increased as a result of interpersonal and family relations (Titan et al., 2012; Van Mol & de Valk, 2016). Figure 1 shows the number of migrants that have migrated to Western-European countries through this migration process from 1950 to 1975. An increase in the number of immigrants throughout this period can be seen. Although in the beginning the migration trend was considered positive, because of the economic benefits, the migrants themselves experienced discrimination and economic and social deprivation (Van Mol & de Valk, 2016).

After the guest workers' migration process, the main flow of migration was from post-colonial countries. Followed by migration flows within Europe Union boundaries, because of its expansion. The most recent flow of migration is the inflow of refugees and asylum seekers. This ongoing process of migration and its consequences have become a major public issues (Janssen, van Ham, Kleinepier, & Nieuwenhuis, 2019). And negative social effects that resulted from the early migration processes can still be seen in current society.

III. Ethnic Diversity

There are different definitions of diversity depending on the context in which it is used. Planners often refer to diversity as mixed uses or ethnic-racial heterogeneity, where designers often refer to diversity as mixed building types and create a range of architectural styles in the streetscapes (Fainstein, 2005). This paper will look more specifically at ethnic diversity, this definition includes the variety of people with different ethnic backgrounds that need to coexist. As Sim (2019) mentioned in his book *Soft City*, the values, needs, behavior, and lifestyle of these people might conflict as they are neighbors living in a shared environment (Sim, 2019, p. 11). This environment might not be compatible with these different ethnic groups. Therefore, the task of the planners and designers is to create places that are compatible for every ethnic group, so that social exclusion can be prevented,

Country	1950	1960	1970	1975	As per cent of total population 1975
Belgium	354	444	716	835	8.5
France	2128	2663	3339	4196	7.9
West Germany	548	686	2977	4090	6.6
Netherlands	77	101	236	370	2.6
Sweden	124	191	411	410	5.0
Switzerland	279	585	983	1012	16.0
United Kingdom	1573	2205	3968	4153	7.8

Figure 1 Minority populations in the main Western-European countries of immigration (1950-1975) (thousands and as a % of total population) Source: Castles et al. in Van Mol & de Valk, 2016

and inclusive public spaces are created. Social exclusion is however not only experienced by ethnic minorities as it is defined as "a combination of different forms of vulnerability" (Madanipour, 2009, p. 114).

In the contemporary multicultural urban environment ethnic diversity is very meaningful. It is able to foster creativity, encourages tolerance and it urges city officials to see value in under appreciated lifestyles that shape the city's dynamics (Fainstein, 2005). Ethnic diversity can generate awareness and acceptance of multiculturalism, which creates an inclusive and involved society.

IV. Multiculturalism

Multiculturalism in the context of diversity refers to demographic ethnic-racial diversity, recognition and support of different cultures through policies, and ideological beliefs and discourses (Verkuyten & Yogeeswaran, 2020). An ethnic group involves people that identify with one or more shared characteristics. These characteristics are for example the same nationality, race, religion, language, culture or history (van Dorst, 2008). A positive attitude towards other cultures and ethnic diversity makes people potentially more open to establish inter-ethnic social relations. A stronger inter-ethnic social relation increases the integration of ethnic groups in a neighborhood (Peters & de Haan, 2011). Verkuyten and Yogeeswaran (2020) formulated three remarks on how multiculturalism is often approached in empirical research. The first remark is the fact that multiculturalism often tends to focus on maintaining the needs, values and behavior of the minorities. This ideology is often seen

as a threat to the culture of the majority. The second remark is the focus on the minority groups within multiculturalism, which as a result neglects the majority. This phenomenon causes resentment towards the minority by the majority, which prevents inter-ethnic social relations from being established. The last remark is the focus on differences between ethnic groups instead of commonalities between the groups. This creates bounded categories, which can cause stereotyping and exclusion of ethnic groups. Furthermore, Verkuyten and Yogeeswaran (2020) stated that a higher ethnic diversity increases the chance of establishing inter-ethnic social relations, but it could also cause a stronger feeling of threat. These opposing outcomes of ethnic diversity and social relations can be explained based on three theories: conflict, constrict, and contact. Conflict and constrict mostly focus on the negative outcome of ethnic diversity, where contact focuses more on the positive outcome. Firstly, the conflict theory is based on social identity, which holds the belief that everyone belongs to certain social groups (Janssen et al., 2019). Belonging to a certain group in society gives people the opportunity to identify oneself socially. However, according to the ethnic competition theory, the presence of ethnic minorities can lead to conflict between the social groups. This can be either due to socio-economic competition, or due to more symbolic, non-material competition (Janssen et al., 2019). Secondly, the constrict theory is based on the belief that people in a heterogeneous environment, faced with ethnic diversity, retreat themselves from social life. This often causes weak social cohesion in a neighborhood, because people no longer interact with each other (Meer & Tolsma, 2014). Thirdly, the contact theory takes a positive look at the effect of ethnic diversity. It believes that ethnic diversity in a neighborhood increases the chance of positive inter-ethnic relations. A distinction can be made between exposure and contact, of which the latter involves a deliberate decision and the first one requires mere observation of other people. Findings support that exposure has a positive effect on inter-ethnic relations and increases familiarity and tolerance towards other ethnic groups (Janssen et al., 2019).

V. Conflict between ethnic groups

As mentioned in the previous section, ethnic diversity can cause conflicts and hostility between different ethnic groups. Research shows that these conflicts of distrust and possible feelings of threat are often associated with economic conditions and residential mobility, meaning the frequent change of the local population (Verkuyten & Yogeeswaran, 2020). However, research also shows that it is not the actual ethnic diversity that causes conflict and feelings of threat, but the perception of diversity and the change in diversity proved to be of great influence (Verkuyten & Yogeeswaran, 2020). The perceived change in diversity increases feelings of threat and expressions of explicit and implicit racial bias. This is mainly due to the fact that people feel threatened when they notice a rapid increase in the relative proportion of ethnic minorities in their environment (Verkuyten & Yogeeswaran, 2020).

A negative perception of a multicultural neighborhood can create a negative stigma, this is often related to the problems and weak socio-economic status of the ethnic minorities. The negative stigma is even stronger for the people outside the neighborhood who perceived it as a place of crime (Madanipour, 2010). People without a migration background who are not accustomed to diversity might not have the acceptance and tolerance for the different ethnic groups (Junger-tas, 2001). This determines the socio-cultural integration of ethnic minorities, which is obstructed by the nonacceptance and intolerance by the people without a migration background. Socio-cultural integration is crucial for people with a migration background, but often takes a long time, sometimes even generations, to integrate. If the ethnic minorities are unable to integrate in their social environment, chances of social segregation will increase. By using the term 'immigrants' the negative stigma increases. For example, in the Netherlands policies often refer to non-western ethnic groups when using the term immigrants. This causes people to associate people of a non-western ethnic group with the socio-economic and socio-cultural status of their origin country (van Dorst, 2008). In some cases, these people have never lived in the country their status is associated with but are still dealing with the bias other people have with other ethnic groups.

VI. Ethnic diversity in public space

The public space is the place where people observe other people and where social encounters take place (van Dorst, 2008). To understand the relevance of public space in relation to ethnic diversity, a definition of public space will be given. Public space is defined as a place that is accessible for everyone and secures a level of anonymity. Accessibility creates a sense of equality for the different users. Anonymity is important in public spaces as it implies possibilities without obligations, which is seen as a quality for the individual and the society (van Dorst, 2008). When relating public space and ethnic diversity the conflict generally is related to the principle of 'unknown is unloved'. This principle is based on that people have to deal with unfamiliarity and distrust

concerning different ethnic groups, which in this case happens in public space. According to Peters and de Haan, the social performance in public space is strongly related to the way that people have a feeling regarding how to behave and what is “normal” and unobtrusive (Peters & de Haan, 2011, p. 173). The feeling of not knowing how to behave can cause conflict in situations when there are different moralities in public spaces. It results in uncertainty, fear or avoidance. Consequently, negative confrontations with different ethnic groups are the opportunities to test prejudices (Peters & de Haan, 2011).

Public spaces facilitate an environment where diversity of ethnic groups is experienced. Social encounters between an individual and strangers often happen in public space. In some neighborhoods public space is limited or has limited capacities. This can result in one of the main conflicts in public space; the claim of public space by a specific group of people. In his book ‘Whose Public Space’ Madanipour explains this conflict as follows:

As there is competition for the limited resources available, public spaces become battlegrounds. While some tend to dominate the public spaces others are intimidated, leading to a lack of safety and withdrawal from public areas and from engagement with others. (Madanipour, 2009, p. 115)

When claims of public space happen it shows the social fragmentation and the incompatibility between different groups within a neighborhood. The residents of these neighborhoods are often socially, politically and culturally different from each other. This diversity in population and the weak socio-economic position puts a pressure on the limited public space that is available in the neighborhood (Madanipour, 2009, pp. 114-115). Tensions generated by this pressure are most of the time related to the different patterns of use. Specifically, for different ethnic groups it shows in the way people use the public space as a result of the are used to by their culture. An example given by Madanipour (2009) in his book was the fact that some cultures use public space as an extension of their house. Referring to neighborhoods with weak a socio-economic position, residents in these neighborhoods often have a limited prospect. Unemployment and low income create a situation in which these people tend to hang out often in public spaces, because they have nowhere else to go and they have limited resources and mobility. This could cause other people who are just passing by discomfort or intimidation. When people sense that a group has dominated a place it results in a lack of safety for other people, in specific vulnerable people.

Another conflict that could arise is one concerning newcomers, who migrated from a country with different ethnicity and culture. Generally, the newly arrived immigrant experience a disadvantage in public spaces, as they are not yet accustomed to the local culture and the expected behavior (Madanipour, 2009, p. 114). Ignorance also plays a part, as the immigrant people are not aware of the presence of public spaces outside their neighborhood, or how to use the public spaces (van Dorst, 2008). The language barrier limits their ability to communicate in their social environment and hinders their integration and could cause social exclusion.

VII. Planning and designing for ethnic diversity in public space

Urban Planners and designers have an important role in creating public spaces that can be used by all ethnic groups. The planners of designers have the expertise and imagination to translate values and needs of different ethnic groups into spatial qualities and designs (Juwet, 2010). In order to do so, the urban planners and designers must research the following questions: what happens in public space, who is there, what are people doing, and who is interacting with whom? (Peters & de Haan, 2011).

Different parts of the planning process play an important role in creating public spaces that facilitate usability by diverse ethnic groups. Different steps in the process can help to understand who is using the space, how people use the space and who is interacting with who. However, Juwet (2010) states that there is not one way to plan or design for an inclusive, and thus multicultural, public space. Nonetheless, we can plan and design in such a way that avoids social exclusion. In order to do so, it is important to understand who is invisible in public space, who claims the public space, and how space is claimed (Juwet, 2010). When more stakeholders are involved in the planning process, the chance of success will be increased. Stakeholders must consist of a diverse group of people. For example, residents with different ethnic and cultural backgrounds, local retailers, planners, and the municipality. This way the public interest will be involved in the planning process. The different values should be made explicit in this participatory process as well as for whom the plans will be made (Juwet, 2010).

The quality of public space is determined, among others, by its accessibility and openness. It ensures that everyone, including vulnerable people, can use and access the public space. According to Madanipour

(2009) this does not directly mean that people will not claim public spaces, it could still cause tension between different groups. However, managing these conflicts by involving the residents on how to solve this problem could prevent this issue.

The pressure on public space due to limited space and capacities in combination with the weak socio-economic status of the residents of the neighborhood results in heavy use of the public spaces. Therefore, the quality of the public space is important. The design should take in account the durability of the materials that are used. Furthermore the design should enable flexibility, as single-purpose spaces are most likely to be unsuccessful because of the varying uses of the space (Madanipour, 2010).

Another important aspect of planning and designing for social integration is the management of public space. Public spaces that have signs of poor maintenance like, waste, insufficient lighting, inadequate repair, signs of vandalism, or untrimmed vegetation, are often perceived as unsafe and neglected. The lack of maintenance and care degrades the quality of life in the neighborhood around the public space and can continue the negative image of the area (Madanipour, 2009, pp. 122-123). Therefore, well-maintained public spaces are important in facilitating social integration. As the well-maintain public spaces function normally and are accessible and compatible for everyone and increase the chance of establishing inter-ethnic relations.

VIII. Conclusion

This research aimed to identify how we can plan and design for ethnic diversity. For this, the paper looked at; how ethnic diversity arises, what ethnic diversity means for society, what conflicts can arise between different ethnic groups and how we can plan and design public spaces to facilitate ethnic diversity. Based on a literature study on migration, ethnic diversity, multiculturalism, inter-ethnic relations, some social issues have emerged that influence social cohesion in ethnically diverse environments. Migration flows generate ethnic diverse populations including of people with different ethnic backgrounds, needs, values, and behavior. One of the reasons why people migrate is the socio-economic differences between the country of origin and the country of destination. The socio-economic status of the country of origin is often still related to ethnic minorities, resulting in prejudices and in some cases a negative stigma. This decreases the chance of establishing inter-ethnic social relations within a neighborhood and therefore hampers the socio-cultural integration of ethnic minorities in society. In order to establish inter-ethnic relations mere exposure to different ethnic groups can create acceptance and tolerance. An often-occurring conflict regarding ethnic diversity is the claim of public space which shows the social fragmentation in a neighborhood.

The remaining question is how urban planners and designers can create public spaces to facilitate ethnic diversity for which several guidelines are provided. Firstly, the planning and design process should be inclusive and participatory in order to fully understand the social dynamics of the place and to make use all interests are considered. Secondly, the public space must be durable and flexible in order to function well for all groups in the long term. Lastly, the public space must be well-managed for people to use it and allow for social interaction, which benefits the social integration.

IX. Discussion

It is noted that problems related to migration, conflicts between ethnic group, social exclusion, and other issues related with social processes cannot be solved by solely intervening in the physical environment. Measures should be taken by the government, institutions, and local authorities in order to solve socio-economic problems. As Madanipour (2009, p. 128) mentions, to achieve social integration economic integration should be established first.

The findings show that sometimes tensions can be caused between the different ethnic groups. These tensions are however not always necessarily conflictive, because it provides opportunity for awareness of different groups (Frank and Stevens as cited in Madanipour, 2009, p. 82). Therefore, these tensions are to a certain extend needed in a social environment.

In addition, greater emphasis should be placed on the commonalities between different ethnic groups, rather than the differences, in general and in planning and design processes. This new perspective on multiculturalism can help to better understand ethnically diverse populations and their behavior, values and needs. By focusing on the positive instead of the negative relations, exclusion of groups can be avoided.

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14.2 / Graduation plan

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Lieke Marijnissen
Student number	4368525
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Studio		
Name / Theme	Design of the Urban Fabric	
Main mentor	Machiel van Dorst	Urban Design
Second mentor	Heleen Janssen	Urban Studies
Argumentation of choice of the studio	<p>Urban fabrics is about the multiscale interrelation between the built environment and the systems that create the dynamics in an urban environment. These systems are either tangible or intangible, in any case these systems are connected. The intangible systems – the way people use the city and interact with each other, is stimulated and facilitated in the way the urban fabric is organized and designed. The increasing density of the urban environment has an influence on these systems, as they put more pressure on urban structures and how public space is being used. This is dealt with when designing these places, the right behavior of the individual or a group should be stimulated by both the social structure and the physical urban form. Socio-spatial processes, the relation between social systems and the physical urban form, are therefore important in order to move towards a social sustainable society.</p> <p>The studio's approach is urban design, which puts forward the importance of understanding how to develop a sustainable, attractive and vital urban space. Designing is an iterative process that reveals new challenges throughout. The design in this way is the method to get a deeper understanding of the area, both socially and spatially.</p>	

Graduation project	
Title of the graduation project	<p>Unsafety</p> <p>Stimulating the perceived safety in Rotterdam-Zuid through spatial design</p>
Goal	
Location:	Rotterdam-Zuid, neighborhoods Bloemhof (as case study during the spatial analysis) and Pendrecht (as design location)
The posed problem,	<p>In 2007 the Dutch government formulated a list of 40 problem neighborhoods in the Netherlands. Out of the 40 neighborhood, three neighborhoods are located in Rotterdam-Zuid. In these problem neighborhoods, social housing associations often dominate the market share. This creates concentrations of groups of people with low education, low income, and high percentages of non-western poorly skilled immigrants. The social exclusion of these neighborhoods is often caused by negative media attention, which results in a stigmatization of the neighborhood. Residents, who have the option, leave the neighborhood, and the concentration of low educated, low</p>

	<p>income, non-western immigrants increases. This way the negative trend continues.</p> <p>In order to act upon this negative status of the neighborhoods in Rotterdam-Zuid, the National Program Rotterdam-Zuid (NPRZ) is initiated. The focus of the program is to improve the level of education, labor participation and housing quality by 2030 (Nationaal Programma Rotterdam Zuid, n.d.). Besides the program, the municipality has also set goals to improve the safety. Their ambition is to maintain the safety level and strengthen it where needed. The results from a neighborhood performance assessment the difference in performance between the measured objective safety (registered crimes) and subjective safety (perceived safety) is significant. This research done by the municipality showed a lower score on the subjective safety than objective safety in, among others, the neighborhoods Bloemhof and Pendrecht. This means that the residents of these neighborhoods experience the safety worse than it is according to the registered data.</p> <p>The municipality does not focus enough on physical changes and adaptations in the urban fabric, despite the fact that research shows the importance of the physical environment for perceived safety. Therefore this research aims to improve perceived safety by changing the physical environment.</p> <p><u>Problem statement</u></p> <p>The relation between safety and design is studied in its own research field (Crime Prevention Through Environmental Design, CPTED), but integral implementation of safety goals in urban transformation design is nearly never successfully applied. The literature on the relationship between safety and design shows the lack of empirical research with the aim to measure the effect of physical and social environment changes.</p>
research questions and	<p>How can perceived safety be improved through neighborhood transformation in Bloemhof and Pendrecht?</p> <p>What are the conditions that lead to an unsafe public space? How can (perceived) safety be improved through spatial design? How does human behavior relate to public space? What are the spatial and socio-economic conditions in the area? What is the history of the area? What design principles have been applied in the past in relation to socio-spatial processes? Which patterns can be recognized in the behavior of people in the public space in Bloemhof and Pendrecht? How are targeted spatial changes experienced by people with the conditions to improve perceived safety?</p>
design assignment in which these result.	<p>Perceived safety is depending on the social environment and the physical environment. The municipality of Rotterdam and the NPRZ focus on improving the social environment. Their objectives to improve the safety in Rotterdam-Zuid are mainly focused on changing socio-economic processes that contribute to the safety in the area. Physical changes in the neighborhoods must be implemented to improve the perceived safety.</p> <p>Researchers state that there is a lack of empirical research with the aim of measuring the individual physical and social environment and</p>

	<p>targeted changes to evaluate their effectiveness. This causes a lack of scientific evidence of the effectiveness of designing for safety. Looking at this lack of scientific evidence from designer perspective provides a chance to design for the perception of the environment. Therefore the design asks for a multiscale approach varying between eye level, street level, and neighborhood level.</p> <p><u>Design principles</u></p> <p>Solutions for this context specific problems will be designed in a set of design principles with the aim to improve the perceived safety. The design principles will be combined and applied in a 3D model on street level and tested in a VR experiment. The results of this experiment will validate the effectiveness of the design principles.</p> <p><u>Neighborhood transformation design</u></p> <p>The validated design principles will be integrated in a neighborhood transformation design. The intention of the neighborhood transformation design is to improve the overall perceived safety in the neighborhood and put a special focus on the most unsafe area in the neighborhood.</p>
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Process

Method description

The methods selected for this project are:

1. Literature study
2. Documentary research
3. Socio-economic analysis
4. Spatial Analysis
5. Field work
 - i. Interviews/surveys
 - ii. Observing public life
 - iii. Mapping public life
6. VR experiment

1. Literature study

The literature study is intended to gain a body of knowledge of theories revolving around perceived safety and certain methods used in the research. This includes theories on human behavior, environmental psychology, social safe design, and CPTED. As well as literature about the methods used for this project. This includes literature about observing and mapping public life and conducting a VR experiment and how to structure a narrative and questions for the experiment.

2. Documentary research

The documentary research includes inquiry of both qualitative and quantitative data from documents published by governmental institutions and local initiatives. This method is applied in order to obtain the vision and goals from the municipality and government related to safety and densification. The municipality has set goals in order to improve the safety of the living environment, by collecting this data the project has a clear guideline on what the municipality wants to achieve in terms of safety. Furthermore, a densification vision has been published by the municipality, which in this project is related to the final outcome, a neighborhood transformation design.

3. Socio-economic analysis

The socio-economic analysis is used in order to get insights in the current socio-economic status of the area. Research has shown that the socio-economic status of an area can have an influence on the safety performance of the area, therefore it is important to determine the socio-economic characteristics of the project area. A descriptive analysis is used to introduce, organize and summarize

the statistical data collected on the socio-economic characteristics. The outcome are sets of quantitative data that will be presented in visualizations and maps that related the data to their localities.

4. Spatial analysis

The spatial analysis is intended to give insight into the relation between space and human behavior. The techniques of mapping and observing public life will be applied to gather the required data. The intention is to use the software GIS and Space Syntax to identify relations between spatial characteristics and behavioral and social aspects. By using GIS and Space Syntax the interrelation between buildings and streets can be identified. Furthermore, multiscalar mapping will be used to gain a spatial understanding on the following scales: city scale, neighborhood scale, and street level. In order to gain a behavioral and social understanding observation will be done, which will be visualized and mapped.

5. Fieldwork

Fieldwork will be conducted in order to gain first-hand information on the qualities and potentials of the project area. The data collected with this method is expected to differentiate from the data collected in the documentary research and socio-economic analysis, it is expected that by using this method the data will be experience-based and perception-based instead of statistical data. The fieldwork includes different techniques: surveys, observing public life, and safety mapping. These techniques are intended to collect quantitative and qualitative data on a local level and aim to answer the questions "how many", "who", "where", "what" and "how long" (Gehl & Svarre, 2013). The survey will be focusing on the perceived neighborhood safety by the residents. The questions on the survey will be carefully formulated in order to not influence peoples answers. The survey will be handed out via mail to the residents of the neighborhood in order to decrease the chance of gathering data from people who are not regular users of the public space in the neighborhood. The outcome of the survey is to determine (un)safe places in the neighborhood. Participants will be asked to rate levels of safety, satisfaction and other topics based on the Likert scale (strongly disagree – disagree – neutral – agree – strongly agree).

Observing the public life in the neighborhood will identify people flows and how people use public spaces. This technique will, furthermore, be used to measure the frequency and dynamic of the public space. This help identify where the popular public spaces in the neighborhood are. The usage of the public space will be mapped to be able to relate the behavior to space.

The technique of safety mapping will be based on physical traces that indicate a possibly unsafe environment, for example litter, graffiti, deterioration, and streetlights. The outcomes will be mapped and compared and merged with the outcomes of the surveys to eventually get a comprehensive insight into the potential (un) safe spaces in the neighborhood.

6. VR experiment

The main method that leads the project to its final outcome is the VR experiment. The VR experiment will be use in order to validate the effectiveness of the design principles with the condition to improve perceived safety. Research shows that visualized ideas helps participants in VR experiments to assess and reflect deeper on the spatial properties and qualities and it positively contributes to the engagement of the participants (Van Leeuwen, Hermans, Jylhä, Quanjer, & Nijman, 2018). There are different ways in which VR can be used to do research. Firstly, a decision needs to be made regarding whether or not the participants are selected from the actual location of the VR environment or to select random participants who are not from the project area. When deciding between these two option it should be taken into consideration that the perception of a safe environment tends to be perceived the same way for most people, except that it can depend on their demographic. However, residents of the project area are already familiarized with the context and are aware of different social and physical factors present in the area, which might corrupt the desired results. One option is to use the stated choice experiment, in which the participant is given two or more options in VR of which one is stable and the other ones differ per question. This, however, can create a level of familiarity for the option that remains the same, which could affect the decision making of the participant. The participant is asked to choose one of the given options based on a narrative. This

narrative sketches a situation to which the participant can relate (Van Dongen & Timmermans, 2019). The environment in which the participant is located within the VR environment contains changing attributes. The presence or absence of the attributes is used to assess the experienced environment of the participant. "Stated choice methodology assumes that when people have a choice between different alternatives, they will choose the alternative with the highest utility, which is defined as 'the level of happiness that an alternative yields to an individual'" (Van Dongen & Timmermans, 2019, p. 5).

A second option for using VR is by using static one perspective rendering. The participant is able to navigate between multiple static renderings similar to Google Street View. Based on research, on the difference between static renderings on a computer and experiencing the environment with a VR headset, it showed that the variables 'immersion', 'translocation', and 'concentration' were significantly performing better when using a VR headset (Van Leeuwen et al., 2018). Nevertheless, using static renderings on a computer does have an advantage regarding time efficiency, reaching participants and duration. Modeling static renderings takes less time than modeling a interactive VR environment. Reaching participant can be done by sending a questionnaire via email and often the duration of a VR experiment is often overestimated.

Method and techniques	What?	Aim	Outcome/Data
Literature study	<i>Perceived safety</i>	In order to understand the theories of perceived safety, social safe design (CPTED), human behavior, and environmental psychology	<i>Theoretical paper</i> <i>Body of knowledge</i>
<i>Theoretical review</i>	<i>Social safe design(CPTED)</i>		
	<i>Human behavior</i>		
<i>Context study</i>	<i>Environmental psychology</i>	In order to get context and knowledge on the history of the place	<i>Mappings</i> <i>Body of knowledge</i>
	<i>History</i>		
Documentary research	<i>Safety</i>	In order to obtain the goals of the municipality	<i>Qualitative data</i> <i>Quantitative data</i>
<i>Vision + ambitions</i>	<i>Densification</i>		
Socio-economic analysis	<i>Socio-economic characteristics and interrelations</i>	In order to obtain data on the socio-economic status of the project location	<i>Quantitative data</i> <i>Data visualizations</i> <i>Mappings</i>
<i>Descriptive analysis</i>			
Spatial analysis	<i>GIS</i>	In order to obtain data on the interconnection between physical environment and behavioral and social constructs	<i>Data visualizations</i> <i>Mappings</i>
<i>Mapping</i>	<i>Space Syntax</i>		
<i>Observing public life</i>	<i>Socio-spatial dynamics</i>	In order to understand the relation between people and the use of public space	
Fieldwork	<i>Questionnaire on neighborhood safety</i>	In order to obtain statistical data on perceived safety by the residents of the neighborhood	<i>Quantitative data</i> <i>Qualitative data</i> <i>Data visualizations</i> <i>Mappings</i> <i>Photos</i>
<i>Surveys</i>			
<i>Observing public life</i>	<i>Identify people flows</i>	In order to understand the dynamics of the neighborhood and the use of the public space	
<i>Safety mapping</i>	<i>Potential signs of (un)safe locations</i>	In order to identify potential (un)safe locations and areas in the neighborhoods	
VR experiment	<i>Design principles</i>	Generate VR models that are used for the VR experiment and simulate scenarios of (un)safe environments	<i>VR model</i>
<i>Modeling</i>			
<i>Narrative development</i>	<i>Compile a narrative</i>	In order to obtain relevant information from the participants a structured and concise narrative needs to be told	<i>Narrative</i> <i>Questions</i>
<i>Choice experiment</i>	<i>Experience-based questionnaire</i>	In order to validate preferences between different scenarios with regard to perceived safety	<i>Qualitative data</i> <i>Quantitative data</i>

Literature and general practical preference

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Reflection

Relation with other studios and Msc Program

This thesis touches upon different relevant topics within the urbanism research program. Dealing with the global issues of rapid urbanization, densification and intensification, this project looks at these issues in the Dutch context. Perceived safety relates to the social well-being and health of cities' residents and aims to improve overall safety. Sustainability is a broad subject in the research field of urbanism in which social sustainability is only one of the several aspects. It focuses on the social dynamic and social resilience of an area. Sense of belonging to a community and social interaction and cohesion play a big part in this. The final outcome, a neighborhood transformation design, will implement sustainability in the broader sense. The spatial implementation of design principles with the aim to improve safety bridges the gap between theory and design.

Scientific relevance

This research add to the body of knowledge on social safe design, perceived safety and the use of VR technology in empirical research. According to Romice et al. (2016) there is a lack of effective synthesis of the theory on connecting the form of cities with the social processes and implementation in mainstream practice. Despite the extensive knowledge on links between urban form and socio-economic processes, this is not sufficiently applied in practice. Furthermore, there is a lack of empirical research with the aim to measure the targeted changes in the individual physical and social environment (Bloeme, 2013).

The development of research on designing for people has caused an over-professionalized form of urban place-making, which makes people believe that everything related to shape and management of environmental form is a professional problem (Romice et al., 2016). This thesis will explore methods where the design outcome is tailored to the experience of the user. The results therefore will be determined by users of the public space, which is testing during the research by a VR experiment.

Societal relevance

Safety is one of the human needs and is included as second most important need in the pyramid of Maslow. This means people will seek to find safety before meeting their social needs, esteem needs, and self actualization. Safety, therefore, is a basic need in life. The social and physical environment are equally important to establish a safe environment. However, in cities, where the building density and population density is high, creating a safe environment has become more and more complex. The well-being of people is depending on feeling safe in the direct living environment. However, the safety performance of the neighborhoods that are being research in this project; Bloemhof and Pendrecht are considered a safe environment. The government has a budget of 130 million euros to increase the safety in Rotterdam-Zuid. The money must be invested in housing, education, work, safety, and culture. The neighborhoods also gained special attention in the safety vision of the municipality of Rotterdam. Their goal is to minimize the risks and tackle the challenges they foresee in regards to perceived safety in the neighborhood. When the safety in the neighborhood increases the quality of the living environment will also increase. This largely benefits the residents of the neighborhood and might take away the bad image the area has for a long time.

14.3 / Additional maps

The location of the front doors and shared entrances in Bloemhof and Pendrecht are used to calculate the front-door density per street. Each dot represents an entrance to a building. The data is generated in QGIS by author.



fig 71. Frontdoors Bloemhof



fig 72. Frontdoors Pendrecht

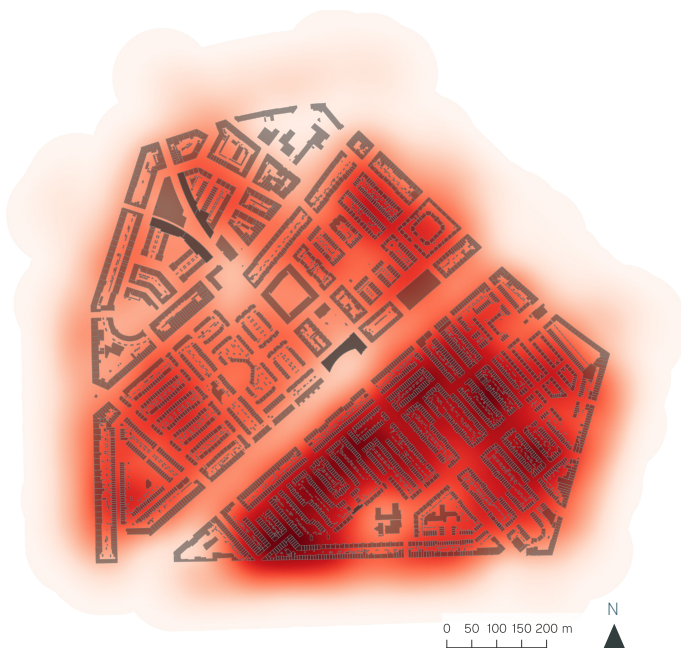


fig 74. Heatmap of the front-door density in Bloemhof

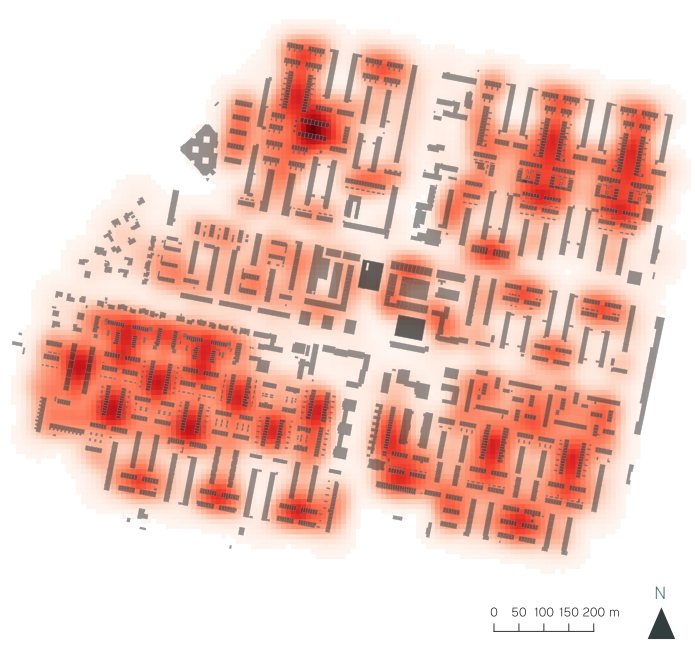


fig 73. Heatmap of the front-door density in Pendrecht

14.4 / Survey



Dear participant, thank you for taking part in this survey.

By completing this questionnaire you are helping me with my graduation research from TU Delft about the perceived safety in Pendrecht.

The results of this survey will only be used for my graduation research and your answers will be processed anonymously.

In this survey, some questions are asked about the safety perception and satisfaction of your neighborhood. If you don't have a judgment or don't want to answer a question, you can leave that question unanswered. Completing this survey will take about 5 minutes of your time.

Thank you in advance!

Lieke Marijnissen

***required**

1. What is your zip code? *

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2. How long have you been living in Pendrecht?

- ☐ Up to 1 year
- ☐ 1 to 2 years
- ☐ 2 to 5 years
- ☐ 5 to 10 year
- ☐ 10 to 20 years
- ☐ 20 years or more
- ☐ I live in another neighborhood

3. In what type of dwelling do you live?

- ☐ Single family home
- ☐ Detached house
- ☐ Upstairs or downstairs apartment (beneden- bovenwoning)
- ☐ Gallery apartment building (galerijflat)
- ☐ Porch access apartment
- ☐ Residential tower
- ☐ Other, namely

4. How many of your neighbors do you know?

- ☐ 0
- ☐ 1-2
- ☐ 3-4
- ☐ 5-6
- ☐ More than 6

5. How often do you talk with somebody you meet on the streets in your neighborhood?

- ☐ Never
- ☐ Sometimes
- ☐ Regularly
- ☐ Often

6. Do you ever consider to move to another neighborhood

- ☐ Yes
- ☐ No

Some statements now follow. State your opinion of the statement on the answer scale. All the statements relate to the neighborhood Pendrecht.

	Strongly disagree				Strongly agree
7. I live in a nice neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. I am satisfied with the green in my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. I am satisfied with the quality of the public space (parks, squares, playground, etc) in my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. I regularly use the public spaces in my neighborhood (parks, squares, playground, etc) in my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. My neighborhood is well maintained and clean	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I like the buildings in my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I experience my street as nice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. I experience my street as desolated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. I experience my street as too busy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. I rarely encounter people in my street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. The sense of community is high in my neighborhood	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. My neighborhood has sufficient amenities (shops, sports facilities, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. I feel safe when I walk alone in the streets during the day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. I feel safe when I walk alone in the streets during the night	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never				Often
21. I experience nuisance from loitering groups in my street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. I experience nuisance waste in my street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. I experience intimidation or threats in my street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. I experience drugs related nuisance in my street	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

25. How could the public space in your neighborhood be improved?

26. Are there places in the neighborhood you tend to avoid?

- ☐ Yes
- ☐ No

If you answered yes, could you explain here which places and why?

27. What do you like the most in your neighborhood?

28. What do you least like in your neighborhood?

29. Do you have any other comments or suggestions regarding questions asked?

Demographic question

This questionnaire contains some demographic questions, your answers will be processed anonymously and will only be used for this research.

30. What is your gender?

- ☐ Male
- ☐ Female
- ☐ I prefer not to say
- ☐ Other, namely

31. What is your year of birth?

.....

32. What is your migration background

- ☐ None, Dutch
- ☐ Suriname
- ☐ Antillean
- ☐ Turkish
- ☐ Moroccan
- ☐ Other, namely

33. What is your highest education level completed?

- ☐ None, unfinished primary education
- ☐ Primary education
- ☐ Highschool
- ☐ MBO
- ☐ HBO
- ☐ University
- ☐ Other, namely

34. What is your household composition?

- ☐ Single
- ☐ Multi-person
- ☐ Single-parent
- ☐ Two-parent

35. E-mail address

Would you be willing to share your email address to be contacted for further research within the next 4 months?

.....

Thank you for participating this survey!

