FORM *follows* MOTION

Designing public space derived from the understanding of pedestrian movement

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Designing public space derived from the understanding of pedestrian movement

CHALMERS
UNIVERSITY OF TECHNOLOGY

A Master's Thesis in Architecture by Teresia Maria Louise Forsman

Direction: Social Ecological Urbanism
Spring Term 2021

Chalmers School of Architecture
Department of Architecture and Civil Engineering

Master Program:
Architecture and Design for Sustainable Development

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Gothenburg, 2021

Abstract

55% of the world's population live in urban areas today. By 2050, that number is expected to be 68% (United Nations, 2018a). The terms and conditions of our cities are rapidly changing, and more and more people inhabit streets and public spaces. At the same time, the more cars continue to fill up our streets (Trafikanalys, 2019, p. 2), the more focused our politicians and traffic planners have become on making room for even more cars (Gehl, 2010a, p. 91). There is a global will to become more sustainable and fossil free, but a reluctance to leave the car and the infrastructure that comes with it behind.

The consensus is that we need to build for pedestrians, but often the actions taken to improve pedestrian life lack the deep understanding of their behaviors. There is a disconnect between the knowledge that we possess through research and the professions that are trying to make reality of it. The purpose of this master's thesis is to support architects and planners in making the right choices; to help them understand the complexities of pedestrians in our cities and how to proactively design for them.

The starting point is to develop an understanding of the pedestrian movements in our cities by uncovering the choices and behaviors that lie behind them, and to then develop strategies on how to design pedestrian-friendly public spaces, derived from that knowledge. By generating a set of design factors to assess the degree of pedestrian presence and quality of experience that a design provides or will provide, prior to its implementation, the aim is to enhance the practical skills of architects and planners in all stages of urban planning, further bridging the gap between research and practice.

The chosen method for this master's thesis was mainly research for design. The design factors were developed based on existing research and knowledge in different fields related to pedestrian movement, considering behaviors and preferences of pedestrians.

The project site of Korsvägen was chosen as the design project to test the design factors, based on it being a public space handling a lot of pedestrian movement at the same time as offering room to design. It was also chosen based on its relevance due to its ongoing development plans; Gothenburg's major infrastructure project "Västlänken".

Keywords:

built environment studies
cities for people
human scale
human dimension
mobility
pedestrian behavior
pedestrian freedom
pedestrian movement
pedestrianism
public life studies
space syntax studies
urban public space
walkability

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Thesis outline

Chapter 1 introduces the subject and aim of this master's thesis, and positions the work within the relevant discourses. The chapter is completed by presenting the thesis questions, delimitations and the methodology that has been used. A schematic illustration is used to show the process of the master's thesis, including the different investigation, definition and intervention steps as well as the final design, reflection and improvement steps.

Chapter 2 introduces the theoretical background that lays the foundation of the work of this master's thesis. It includes an investigation of the human dimension and the notion of walking, the importance of pedestrianism and how design can be used to support and influence it. The chapter concludes with a thorough review of different methods to analyse and understand pedestrian movement in relation to physical form and spatial design.

Chapter 3 presents a design toolbox that has been developed as a practical and analytical tool that can be used by architects and planners. It consists of 20 design factors, which have been extracted from literature, and have been found to be important for walking, pedestrian behaviour and pedestrian flows. It is an attempt to bridge the gap between research and practice by uncovering the behaviour that lies behind the pedestrian movement in our cities. The design toolbox also presents a workflow on how to support the use of the design factors with different methods and analyses in the design phase of a project. The purpose is to aid architects and planners to make proactive design choices that will influence beneficial pedestrian behaviors as well as highlight and enable the ones that are already there.

In chapter 4, the design factors are investigated further by looking at design examples from eight different case studies. Interesting scenarios and design choices are highlighted and used as inspiration for the thesis design project.

Chapter 5 introduces the public transport node of Korsvägen in central Gothenburg as the chosen site for the design project. The design proposal illustrates the application of the design toolbox and strives for a new and better pedestrian usage of the area. Throughout the design phase, reflections on the toolbox application will provide input for changes and adjustments that need to be made to the toolbox itself in an iterative process.

The finalizing parts of this master's thesis includes reflections of the process, as well as a discussion of potential applications and next steps.

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Image 1: (Gehl, 2010b)

Chapter 1

Introduction

[puh-**des**-tree-uh-niz-uhm]

noun

1. the act of walking
2. fondness for walking for exercise or recreation

Thesis background

The story of this master's thesis starts in the beginning of the summer in the year of 2020. I, personally, had not used the public transportation system for several months. Not since the breakout of covid-19 was declared to be a national matter and we were recommended to stay at home and meet as few people as we could. This was in the middle of March. During the first months I was quite okay with staying in my own neighborhood, only visiting the grocery store and maybe taking a walk in the nearby blocks. The fear of what covid-19 actually was, kept me from trying to experience the city further on foot.

As the months passed and the situation started to become normalized, I started to realize that it is completely possible to execute all my errands in the city on foot. Going to the public library takes me 45 minutes, and the same goes for the university. It was during these many walks that I started to get interested in the way our cities are designed for pedestrians. Or should I say, the way they are *not* designed for pedestrians. A city like Gothenburg is by no means difficult to move around in, but the question is whose movements are prioritized? Is the city planned around the buildings we want to erect and the cars that should be able to drive between them? Where in that equation do the pedestrians end up? Have we stopped designing for the public life in our cities? My personal opinion is that most public spaces are a result of the space that was left over, when the buildings and the roads had gotten their space. This is where I understood that this is the field I want to focus on.

So, this master's thesis is mainly driven by my personal desire to understand how to design better cities for people to move around in, as well as my dislike for the cars that have continued to deteriorate our cities over the course of my life. To me, there seems to be a global will to become more sustainable and fossil free, but at the same time without trying to leave the car and all the infrastructure that comes with it behind.

I am well aware of the fact that my perspective on this problem, this dilemma, is not groundbreaking. We all know what I am about to say with this mater's thesis. We need to build for our pedestrians. But if we already know it, why don't we do it? I believe that there is a disconnect between the research and knowledge that we possess and the professions that are trying to make reality of it.

The main background to this master's thesis is the fact that I wanted to make it easier for architects and planners to make the right choices. To help them understand the pedestrians in our cities better and to proactively design for them, instead of having to work with designs in hindsight, with whatever is left when all other planning decisions have been made. Hopefully, my contribution is somehow helpful and will improve future work in the field of architecture. Micro or macro improvements, everything is welcome.

Thesis questions, aim, delimitations & discourse

How can the understanding of the pedestrian movements in our cities support the design of architecture and public space in the strive for cities made for people?

How do we design architecture and public space that is shaped by the pedestrian movements in our cities rather than the other way around?

Can pedestrian movements shape architecture and public space?

Aim

The aim of this master's thesis is to develop an understanding of the pedestrian movement in our cities by uncovering the choices and behaviors that lie behind them, and to develop strategies on how to design pedestrian-friendly public space derived from that knowledge. By generating a set of design factors to assess the degree and quality of the pedestrian experience that a project or design provides or will provide, prior to its implementation, the aim is to enhance the practical skill of architects and planners in all stages of urban planning, further bridging the gap between research and practice.

The tools and design factors are to be developed based on existing research and knowledge in different fields related to pedestrian movement, considering behaviors and preferences of pedestrians. The aim is to base these tools and design factors on existing methods to analyse urban environments at the macro scale as well as the micro scale, with the purpose of the two different scales complementing and enriching each other. The proposition is that a double approach, consulting both the macro scale and the micro scale, would support a stronger understanding of the pedestrian behavior in all situations.

The master's thesis will strive towards contributing to changing the view on pedestrians in our cities, reinforcing their position in current and future design practice and highlighting the importance of data on pedestrian movement in terms of pedestrian environments and the related activities and behaviors.

Delimitations

When talking about pedestrians, one naturally brings up the topic of cars in our cities. This master's thesis will not focus on methods on how to get rid of the cars in our cities, it will focus on how to highlight and prioritize pedestrians. This is a giant discussion and one can never truly happen without the other, but as an achievable starting point, this master's thesis will begin by looking at the problem from the point of view of the pedestrian.

This master's thesis will not present any new and groundbreaking conclusions, there is already a great body of existing literature on the subject of pedestrian movement. The problem is that the existing knowledge is not transfered effectively enough to practice. There are also already existing design guidelines used in some cities to promote pedestrians, but they are all quite straight forward, their main focus are only on streets and they are almost solely concerned with safety. This master's thesis aims at enriching these questions, addressing public space in general and not streets specifically.

We know that there are a lot of factors influencing pedestrian behavior. This master's thesis will focus on the factors we as architects and planners can affect. This includes factors that deal with physical form and spatial design, both in relation to the location itself as well as its location relative the city it is a part of. The concentration on the architectural factors does not deny the importance of many other factors. In many cases, improvements done related to the architectural aspects can influence other aspects, but the focus here is not to investigate that further.

This is not a master's thesis about creating generally nice public spaces. It is a project focusing on creating pedestrian-friendly public spaces derived from the understanding of pedestrian movement. This means that all the theory and all the design factors that are presented will be investigated and developed from the point of view of the pedestrian and her experiences, behaviours and preferences in public space.

Lastly, this master's thesis will address the notion of pedestrians in general. Pedestrians are not a homogeneous group and they have different limitations and possibilities depending on different factors, for example age and mobility impairments. It is not possible to specifically address each type in this master's thesis, but the methods and strategies that are developed and presented aim at being inclusive, not excluding any of the different types of pedestrians.

Discourse

This master's thesis follows a long line of studies and research and the statement that pedestrians need to be better understood and accepted is nothing new. The interplay between humans and their environment is a question that has been pondered by humanity for centuries. The foci might have been slightly different but the aim has always been the same; to create cities that are made for the people who live in them. This is the first discourse that this master's thesis aims at contributing to.

The second relevant discourse is the one related to urban design. There are many ways in which cities can be created for people, but the focus in this master's thesis is on how this is done by taking care of and designing our urban public spaces.

The third relevant discourse is the one related to urban studies, focusing on the relation between urban design and pedestrian movement. The three fields of study that are to be investigated are the fields of public life studies, space syntax studies and built environment studies.

This master's thesis aims at contributing to all relevant discourses by combining the different fields of study and presenting the findings in a simple and synoptic way, easy for architects and planners to work with. Using the collected findings from the research, we can get closer to creating cities designed for and derived from the natural behavior of people, pedestrians, rather than the other way around.

As the world is facing great challenges in the field of sustainable development, there is a need to always check whether the work we present is in line with the 17 Sustainability Development Goals developed by the United Nations. When working with understanding, highlighting and prioritizing pedestrians, the work is in line with three of the Sustainability Development Goals. They are: striving for good health and well-being, sustainable cities and communities and climate action.

Walking is promoting these goals as it is proven to be good for physical and mental health, it is free, allowing for all groups of society to meet and get an understanding of each other, it is pollution, fossil and noise free and also the form of transport that imposes the least safety risks to other road users (Bird et al., 2018, pp. 1-13; Ewing & Handy, 2009, p. 65; Gehl, 2010a, p. 28; Litman, 2020, pp. 2-3, 26-27, 29 Middleton, 2011, p. 93; Netto et al., 2018, p. 4; Ribiero & Hoffimann, 2018, p. 1; Tibbalds, 2000, pp. 9, 57).

Figures 1, 2 and 3:

United Nations Sustainable Development Goals (UNSDGs), 3, 11 and 13.

(United Nations, 2021).

Overall methodology & process

The chosen method for this master's thesis was mainly *research for design*. The point of departure was to conduct a survey of the field of pedestrian movement, to further understand and define the challenge of supporting pedestrianism with design.
The next step was to collect, investigate and synthesize research and knowledge connected to urban design, focusing on public spaces, and urban studies, focusing on the relation between urban design and pedestrian movement. Specifically, the knowledge was drawn from three different fields of study:

- Public life studies, mostly represented by the direct observation works of Jan Gehl and his colleagues, but also other pioneers of the field,
- Space syntax studies, mostly represented by the empirically tested modeling and analyses of public space configurations in relation to pedestrian movement by Bill Hillier and his colleagues, and
- Built environment studies, mostly represented by different existing guidelines promoting pedestrian movement, based on empirical studies and statistical modeling.

The collected literature and references consisted of urban design books, theoretical books introducing concepts related to pedestrian movement, empirical studies on pedestrian movement, analytical urban studies on modeling and explaining pedestrian movement in cities, existing design guidelines and articles discussing the practice of pedestrian movement.

Methods on how to use this knowledge and how to present it in a way that bridges the gap between research and practice was investigated and developed. This resulted in a design toolbox consisting of 20 design factors, extracted from the literature. The design toolbox also presents a workflow on how to support the use of the design factors with different methods and analyses. The design toolbox can, in the initial design phases, be used as an evaluation system to highlight problems and potentials. It can then be further applied as a design support tool, using this knowledge to produce and test different designs, understanding the potential impacts of the design.

Besides literature studies of existing theories and ideas, eight existing projects and designs that showed potential in prioritizing pedestrians were studied. These case studies were used as inspiration for the upcoming design project and used to check the design relevance of the extracted design factors in real cases.

The design proposal part was used to put the theory part of the master's thesis to test, attempting to apply the design toolbox as well as re-developing and improving it during the process. Is the design toolbox and its proposed workflow useful and applicable? Is it helpful in the strive for a new and better pedestrian usage of the chosen project site? Reflections and ideas that arose during the iterative design process was used to revise the design toolbox, making sure that it was easily understood.

The project site of Korsvägen was chosen based on it being a public space handling a lot of pedestrian movement and offering room to design. It was also chosen based on its relevance due to its ongoing development plans; Gothenburg's major infrastructure project "Västlänken".

Figure 4 on the following page illustrates the process of the master's thesis, including the different investigation, definition and intervention steps as well as the final design, reflection and improvement steps.

Figure 4:

The process of the master's thesis

Identified challenges
Investigations
Definitions
New inventions
Architectural examples
Specific context

Theory
Contribution
Application
Represents a new chapter in the booklet

Chapter 2

A theoretical and methodological background to design that supports pedestrianism

"The terms and conditions of the movements of our cities need to be studied, understood and accepted in order for the spaces where these movements take place to be designed as rooms for people"

my own translation
(Halleman, 2019, p. 11)

The human dimension and the notion of walking

If we are to reinforce public life as an important part of the planning of our cities, we must begin with a thorough understanding of the human dimension and the way humans move about in our cities. The human dimension, or the human scale as it is also referred to, has been debated and discussed extensively over the last couple of decades and the recurring theme is that it is too abstract and hard to understand. To be able to understand what is meant by the human dimension, we need to divide the problem into several categories and explore them separately.

The physical possibilities and limitations of the human body

The natural starting point for understanding the human dimension is to understand the physical features of the human body. The human body has developed through millions of years of evolution, resulting in a movement pattern described as slow, on foot and linear in its orientation. Our feet can walk or run forward with ease, but backward and sideway movements are done with relatively great difficulty. Moving upward and downward are also done with difficulty, and the same goes for conversing. Pedestrians also typically bow their heads 10 degrees down while moving. Our arms are made for forward movement, for touching something or clearing the path along our route. In short, the human body is a linear, frontal, horizontal and upright object (Gibson, 1986).

The human body is also limited in relation to its visual fields, controlling what we are able to see depending on the angle from which we are observing it. The human visual fields can be divided into four different categories: the peripheral, central, effective and concentrated visual field (Hatada et al., 1980, pp. 560-569).

The peripheral visual field is constituted by the two visual fields on each sides of our view between the angle of 60 and 90 degrees. This is where we can understand movement but are not able to recognize objects or forms. What we see in the peripheral visual field is perceived as blurry.

The central visual field is constituted by the two visual fields between the angle of 30 and 60 degrees. In this visual field we can recognize colours but we lack details on forms and definitions. The central visual field provides the visual context.

The effective visual field is constituted by the visual field inside the angle of 30 degrees. This is the field where we can observe an object, understand all its forms and colours clearly, and see details without having to move our eyes or head.

The concentrated visual field is constituted by the visual field inside the angle of 3 degrees. This is the field of maximum visual acuity, the one we use for reading.

It is important to acknowledge that pedestrians are not a homogeneous group that responds similarly to all situations. Depending on aspects such as age or mobility impairments, these general definitions might differ. So, this is the client we are working with: a pedestrian with all her attributes and potentials, but also crucial limitations that might differ between different individuals.

The physical practice of human walking

As Jan Gehl beautifully puts it, "one of the most memorable moments in life is the day that a child stands upright and starts walking: now life is about to start in earnest" (2010a, p. 33). This short quote itself tells us how important the practice of walking actually is.

In urban planning, walking is most commonly referred to as a means of transportation, a way of getting from point A to point B. But there is a lot more to the practice of walking. Michel De Certeau argues that "the act of walking is to the urban system what the speech act is to language" (1988, p. 97). When we walk we experience and learn about the places we are in, and we develop feelings and thoughts for them. Walking is one of the most important ways of perceiving urban places (Wunderlich, 2008, p. 128).

The most basic attribute of the notion of walking is that it is executed in a slow pace that offers multiple possibilities to influence the way in which it is practiced. Humans practicing walking can effortlessly stop to change direction, maneuver, speed up or slow down or simply switch to a different type of activity if needed or wished for (Gehl, 2010a, p. 119).

Outdoor activities in public spaces are usually

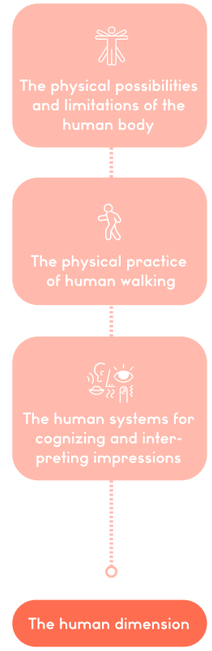


Figure 5:

Dividing the human dimension into several categories

divided into three different categories: necessary activities, optional activities and social activities. Pedestrian movement can be linked to all three categories, but mainly the first two. It is important to understand and acknowledge that the practices of human walking can be executed in different ways, have different incentives and be affected in different ways depending on its nature.

Necessary activities will be executed almost no matter what, for example in the form of walking to the bus station, to the school or running errands one inevitably has to do. Optional activities means the activities that are executed if there is a wish to do so and if the conditions are favorable. Important factors include weather conditions and physical quality of space. This category includes activities such as recreational walking, the exploratory walking or strolling of a tourist, or taking a walk to get a breath of fresh air. Social activities, also referred to as resultant activities, means all the activities that evolve from activities linked to the other two categories. These activities are not only related to pedestrian movement, but also to stationary activities and passive contacts, such as seeing and hearing other people. They are directly dependent on the presence of others, and are a consequence of people being in the same spaces. This category also includes, for example, children playing on the sidewalk and greetings and conversations between people bumping into each other (Gehl, 2010b, pp. 9-14).

5 km/h architecture:

Small spaces, small signals, many details and people close by

60 km/h architecture:

Large spaces, large signals and no details

The human systems for cognizing and interpreting impressions

Another important factor is how we cognize and interpret what we are exposed to during our pedestrian experiences. Our sensory apparatus and systems for cognizing and interpreting sensory impressions are exclusively adapted to the visual fields and pace connected to the human body and the practice of walking. This means that only when we walk, we are really given the opportunity to perceive, cognize and interpret the details presented around us (Gehl, 2010a, pp. 41-43).

We are able to see and perceive what is right in front of us, more or less clearly depending on which visual field the impressions are part of. But we are able to cognize, make sense of and interpret what we have seen before and what we currently see, making a coherent mental image of the combination of everything. The first issue is our perception, the ability to see, hear, or become aware of the impressions through our senses. The second issues are cognition, the mental process of acquiring knowledge and understanding the impressions through experience and the senses, and interpretation, the action of being able to mentally explain and understand the meaning of the impressions. Our perception changes as we move around but all the time we make cognitive models of the space we are in, in synchronic mental images. Architecture can be described as a presentational and not discursive form of meaning making. This means that our understanding of architecture and the built environment relies on capturing and recapturing the whole, and not proceeding successively from part to part. It can be described as seeing a painting where our eyes travel on it to capture the whole thing, as opposed to reading a text word by word (Langer, 1941, pp. 63-82).

Jan Gehl uses the notion of the *5 km/h architecture* and the *60 km/h architecture* to explain the difference of architecture that is related to the human dimension and architecture that is not. The 5 km/h architecture is characterized by small spaces, small signals, many details and people close by; the 60 km/h architecture by large spaces, large signals and no details. To a pedestrian, all information in the 60km/h architecture is presented in a grotesquely magnified way, and the result is an experience that is quickly interpreted as uninteresting and tiring. Many of our city environments of today are closer to the 60 km/h architecture, rather than the 5 km/h architecture (Ewing & Handy, 2009, pp. 76-77; Gehl, 2010a, p. 43-45).

A comfortable human scale environment

When we begin to understand all three parts of the human dimension, we can start to formulate what constitutes a comfortable human scale environment. Basically, a human scale environment is one that: provides city spaces that takes into account the possibilities and limitations of the human body, considers and allows for the human body to experience and execute the notion of walking in all ways possible and allows the human body to interpret the impressions in a scale and pace that is related to its sensory systems.

At the end of the day, it is human bodies that live and move about in our cities, and it is mostly from the perspective of our human bodies that we experience our cities.

The importance of pedestrianism, understanding pedestrianism and design that supports it

The previous section discussed the need for an understanding of how we, as humans, operate in and use our cities. Ole Jensen argues, however, that not only do people observe the city whilst moving through it, they are the city. That the meaning of places in the city is constituted by the movement that takes places there, just as much as the way they are formed, their morphological properties (2009, p. 140). Kevin Lynch also stated this fact decades earlier, saying that "moving elements in a city, and in particular the people and their activities, are as important as the stationary physical parts" (1960, p. 2).

It becomes more and more clear that walking is a lot more important than it just being a means of transportation. What would our cities even be without their pedestrians?

The importance of pedestrianism

There are many reasons why pedestrianism is important, not least in the aspect of giving life and meaning to our cities, but also in the aspect of the positive effects it has on our lives. Travel in the form of pedestrian movement could be a positive experience in the simple sense that it can bring us pleasure. However, we usually consider pedestrian travel as a cost, not taking into account all the benefits (Ascher, 2003, p. 23 as quoted in Jensen, 2009, p. 152; Lynch, 1981, p. 274 as quoted in Jensen, 2009, p. 152).

The public spaces in our cities are the spaces where pedestrians are provided the opportunity to meet, see, hear and bump into other people. This is where all groups of society, regardless of age, religion, income, status or ethnic background come together. The absence of well-functioning pedestrian landscapes in our cities can create a subtle but effective form of segregation (Gehl, 2010a, p. 28; Jacobs, 1961; Middleton, 2011, p. 93; Netto et al., 2018, p. 4; Tibbalds, 2000, p. 57). An important attribute of walking is the fact that it is free. In order for all groups of society to meet and get an understanding of each other, all groups need to be able to participate in the public life of our cities. There are plenty of examples of cities in the world where the inhabitants, almost exclusively, are dependent on owning a car to get around (Litman, 2020, p. 3).

The act of walking is by far the most common form of physical activity in the world today. Designing cities and communities in a way so that they offer possibilities to walk is an important factor contributing to increasing physical activity and health. A usable, well-functioning and attractive public realm is also important for the mental health, contributing to the inhabitants' feelings of well-being and comfort (Bird et al., 2018, pp. 1-13; Ewing & Handy, 2009, p. 65; Ribiero & Hoffimann, 2018, p. 1; Tibbalds, 2000, p. 9;).

Additional benefits of pedestrianism include that it is a climate-friendly, pollution, fossil and also noise free mode of transport. Walking is also the form of transport that imposes the least safety risks to other road users. The term "safety in numbers" is used to describe the correlation between the number of active mode users and the number of traffic fatalities, where active mode users means pedestrians, cyclists and non-drivers. When the active modes of travel increase, there tends to be a reduction of the traffic fatality rates per capita (Litman, 2020, pp. 2, 26-27, 29).

The importance of understanding pedestrianism

There is no doubt that the benefits of enabling pedestrianism are many, and this is why we need to understand pedestrianism and accept it as a vital layer to our cities. As of today, walking is still considered somewhat of an unquestioned form of movement through the city. It is taken for granted, often being unnoticed. All the research being done in the field of pedestrian movement tells us the same thing: there is still an obvious lack of data on pedestrian movement in terms of pedestrian environments and the related activities and behaviors. The data that does exist focuses on aspects such as pedestrian counts and movement patterns (Middleton, 2010, p. 577).

We can gather data and information of the frequency in walking as much as we want, these types of studies are also important, but they will never be truly useful to us in a design aspect if we do not uncover the choices and behaviors that lie behind the data. As Lars Gemzoe highlights in the context of research on the pedestrianization of the city of Copenhagen: "one of the key factors in understanding the complexity of areas for walking is that there is much more

to walking than walking... numbers alone are not an indication of the quality of a place" (2001, p. 20 quoted in Middleton, 2010, p. 577).

The importance of supporting pedestrianism with design

If we want meaningful cities offering free and sustainable transportation in the form of walking, with all its additional benefits, we need to make design choices that allow for it to happen. We know by now that pedestrianism is nothing that appears out of thin air (Hallemar, 2019, p. 11).

What is emphasized in this master's thesis is that by understanding the pedestrians in our cities, we can create pedestrian environments and designs that adapt to the existing pedestrian situation. One of the most fatal design choices to make is the one that does not respond to the existing situation, altering the inherent place-ballets. That is, when we design pedestrian environments, we need to understand the inherent place-ballets. The walking practices being executed in a place has an impact on the temporal character and identity of that very place. Hence, the walking practices that we design for need to be aligned to the place-ballet that already exists (Gehl, 2010a, p. 126; Wunderlich, 2008, pp. 137-138; Seamon, 1979, pp. 143-152; Seamon, 1980, p. 163; Tibbalds, 2000, p. 64) .

As we will see in the next section, physical form and spatial design choices can very much influence the behaviors of pedestrians. It is not that hard to design a public space or street section that does not take into account the life of pedestrians. What is hard is to make design choices that will influence beneficial behaviors, as well as highlight and enable the ones that are already there. This is what we want to aim for.

Place-ballet = A situation where some users come together regularly, creating hubs of synchronized patterns of human activity

(Seamon, 1979, p. 56-57)

Physical form and spatial design influence pedestrian behavior

Looking back at the history of cities and the cities that we develop today, we can see that everything from the urban structures and spatial design on a large scale to the physical form and design choices on a small scale influences the ways in which humans operate in them. First we shape our cities, and then they shape us (Gehl, 2010a, p. 9; Marcus, 2018, p. 3-4; Wunderlich, 2008, p. 136).

Local influences

There are many examples of how renovations of spaces can invite people to completely new patterns of uses. This can be done by simple design decisions that prioritize the pedestrians and go in line with their behavioral preferences (Gehl, 2010a, p. 16). Public life studies has shown that the character of walking environments in urban spaces impacts how we practice our walking. Walking environments that are social, calm or complex engender different reactions. For example, pedestrians tend to walk faster on streets that invite linear movement, but lower their pace when crossing open squares (Gehl, 2010a, p. 120; Wunderlich, 2008, p. 134).

A large share of literature in the field of built environment studies presents findings and conclusions on factors relating to how many people walk in an area and why they find an area attractive, or as it is defined as how "walkable" an area is. These factors have been tested and identified through empirical studies and statistical models. Local factors that have been found to be very significant are, for example, the presence of greenery and active street frontages. Other local qualitative factors related to the attractiveness to walk include visual diversity, for example diversity in building ages and styles, and aesthetics (Adkins et al., 2012; Ewing & Handy, 2009; Lefebvre-Ropars & Morency, 2018; Reisi et al., 2019).

Global influences

There are other, more large scale, properties of cities that affect the way pedestrians move in them. As introduced by Bill Hillier and his colleagues, there is a consistent correlation between pedestrian movement and the configuration of the urban grid in which it takes place. They argued that this phenomenon is so basic that it should be identified by a special term, which they chose to call *natural movement*. The natural movement in urban spaces may not always be the largest component of the total movement, but it is the most pervasive. The most important property of natural movement is that it depends on the global properties of the system. The pedestrian movement in each street, location or area will be influenced by how that street, location or area is connected to every other area in the system (Hillier et al., 1993, p. 32). A typical explanation to why specific places become underused, is that the design of that very place does not take into account the global properties of the system. The design becomes, as Bill Hillier and his colleagues expresses it, overlocalised (Hillier et al., 1993, p. 32). The theory of natural movement is part of the larger set of theories and techniques called *space syntax*. The theories and techniques of space syntax that will be used in this master's thesis, and how they are useful, will be discussed and explained in the following section.

Research belonging to the field of built environment studies has also provided knowledge on global factors that influence pedestrian behavior. Examples of global factors are street connectivity and the density of attractions, for example in the form of retail, restaurants and services (Ewing & Handy, 2009; Lefebvre-Ropars & Morency, 2018; Reisi et al., 2019; Saelens et al., 2003, Sundquist et al., 2011). The findings of these *walkability studies*, both on a local and a global scale, will also provide input for the compilation of design principles that support pedestrian movement.

Reversing the relationship between architecture and pedestrian behavior

Clearly, there are a lot of ways in which physical form and spatial design influence pedestrian behavior. This chapter has only highlighted some of the broad influences there are. It may seem as a very obvious statement to make, nevertheless it is many times overlooked. To be able to support pedestrianism with design, to make design choices that influence beneficial behaviors, we must look at the problem backwards. We must allow the relationship to work in the opposite direction and, to the extent that it is possible, use the pedestrian behavior as a starting point when making choices related to physical form and spatial design. Only when we can master that, we can fully enjoy our cities as pedestrians.

Space syntax:

A set of theories and techniques to analyse spatial configurations

Natural movement:

A theory within the scope of space syntax, identifying that a proportion of the pedestrian movements in our cities are determined by the configuration of the grid itself

Walkability studies:

A branch within the built environment studies, presenting findings on factors related to how "walkable" an area is

Methods for analysing pedestrian movement in relation to physical form and spatial design

Normative knowledge = aims at proposing how it should be done

Descriptive knowledge = based on analyses, aims at describing how it is

In the strive for understanding the pedestrian movements in our cities in relation to physical form and spatial design, several methods and approaches on how to do so have been developed. These methods and approaches belong to either the *normative* or the *descriptive* field, both relying on observing and studying how people move in space, in a more or less systematic way. This means that even though they are different in their execution, they are not completely separated from each other. Often the analytical approaches also result in proposing normative principles that have been empirically tested and are measurable. The other way around, the normative approaches also rely on analyses which are nevertheless more qualitative and intuitive, and less systematic. Both approaches can provide valuable inputs for the formation of design factors that support pedestrian movement and for their measurement and evaluation.

The knowledge used in this master's thesis is drawn from three different fields of study: public life studies, space syntax studies and built environment studies. The research field of public life studies was primarily formed during the 1960s as a response to the deteriorating public spaces of the time. This field of study is based on direct observations and mappings and provides normative principles on how public space could be designed better. A few decades later, in around the late 1970s and the early 1980s, another research field within the same theme was developed: space syntax. As space syntax research is conducted through mathematical models of our cities it takes a descriptive analytical approach. In the last two decades a discrete field within the built environment studies has been formed, focusing on pedestrian movement. This field of study could be described as a mix of both a normative and a descriptive approach, as it includes empirical studies and direct observations combined with statistical modeling to find correlations and to present concrete design guidelines and evaluation indices.

The statement of this master's thesis is that neither of the methods of these fields are sufficient on their own. We need to use all these fields, with their focus on different methods, qualities and scales, in a way so that they complement and amplify each other.

Public life studies

The research in the field of public life studies that is used in this master's thesis mainly belongs to the works of Jan Gehl and his colleagues, first conducted in the 1960s but continuously reworked and developed still today. However, the works and ideas of other pioneers have also been used, for example William Whyte, Kevin Lynch, Edward Hall and David Seamon.

Public life studies are mainly conducted by directly observing, studying and mapping they way people move in and use public space in our cities. These observations and mappings mainly represent an understanding of our cities from the perspective of the pedestrian, the small scale. The methods and tools that are used to study public life are developed, adapted and adjusted to the purpose of each individual study and its local context. The observations could include, for example, gathering information on where people prefer to sit and walk, how pedestrians walk, what kind of activities they engage in, with whom and for how long depending on the attributes of the spaces.

As the research foundation grew and few contradictions in the results were observed, more and more conclusions were drawn in relation to what properties of public space could be seen as successful or not. However, this way of working does not include a systematic approach where conclusions are tested and analysed. Conclusions are drawn from describing and through those descriptions, trying to understand the reasons behind the observed behaviours. The conclusions that are drawn are then used to produce guidelines on how to reinforce and favour public life in public space. This means that this research field contributes with normative knowledge, where the purpose is to provide information on what to do and how, on the basis of direct observations (Gehl & Svarre, 2013, pp. 83-121; Zacharias, 2001, p. 14).

Space syntax studies

As previously mentioned, space syntax is a set of theories and techniques used for analysing spatial configurations. This research field was developed by Bill Hillier and his colleagues, and the research in this field that is used in this master's thesis mainly belongs to their works (Hillier & Hanson, 1984; Hillier, 1996). They develop models to represent and analyse urban configurations and public space, and propose measures to describe them. These models and measures have been empirically tested in relation to how well they explain pedestrian flows. The findings are generalizable and the models can be used to describe urban space and predict pedestrian flows quite sufficiently without having to directly observe it. Space syntax studies, as opposed to public life studies, mainly represent an understanding of our cities from the larger scale. They do not separate different kinds of walking or pedestrian movement, they focus on overall pedestrian flows. As space syntax argues that configuration is the primary driver of pedestrian movement, its findings imply overall guidelines which are focusing solely on the configurational properties. It does not aim to propose specific design guidelines and principles.

From the explanation above, it might seem that the methods of space syntax are completely separated from the direct observations and mappings of pedestrian behavior. That is not the case. Space syntax models are programmed to integrate both human behavior and physical environment into the same description. This means that they represent what emerges in the *meeting between* properties of the physical environment and human abilities, both physical and cognitive (Gehl & Svarre, 2013, p. 75; Marcus, 2018, p. 2; Stavroulaki et al., 2017, p. 3). It has been proven that these models capture human behavior in the form of pedestrian movements (Hillier et al., 1993; Marcus, 2018, p. 2; Stavroulaki et al., 2019).

The rest of this space syntax section will introduce the specific space syntax analyses that will be used in this master's thesis and how they function, as well as how they can be used in a design process.

Angular integration centrality

The angular integration centrality analysis is currently one of the most typical analyses in the field of space syntax. Angular integration centrality analyses measure the angular distance of each line in the network in relation to every other line. Each line in the network is assigned an integration value and this value is a function of the total amount of angular degrees you have to turn in order to reach all other lines of the system. The integration values of each line are relativized according to the mathematically possible range of integration, and then standardized so that different systems can be directly compared to each other. The values can then be represented visually in a map, where the most integrated lines are shown as red lines, then orange, yellow and green lines, to the least integrated lines which are blue. Other colour ranges can of course be used based on preference, however these are the most usual ones. Integration highlights each location's centrality as a destination and is often referred to as "to-movement" centrality. Less central areas are spatially segregated, more disconnected from the rest of the network and associated with lower movement rates. Highly integrated areas are usually the city centers and local centers and are streets and areas which are associated with high volumes of pedestrian flows (Hillier & Iida, 2005).

Angular betweenness centrality

Another analysis which is commonly used is the one of angular betweenness centrality. It uses all the shortest paths between all the lines in the network and then calculates how many of these shortest paths pass through each and every line. The shortest path is defined as the one with the least angular changes, meaning the one that is the most direct. The result is a representation of each line's importance in all the trips between all the lines in the network. Practically speaking, this means that the analysis highlights which paths people tend to pass through when they go from place to place in the city. If angular integration is a measure of "to-movement", angular betweenness is instead a measure of "through-movement". These analyses can also be shown visually in a map. Usually, the lines are shown in a range of thicknesses, where the lines that are used the more are thicker and the lines that are used the less thinner (Hillier & Iida, 2005; Stavroulaki et al., 2019, p. 25; Turner, 2007).

Attraction betweenness centrality

The analysis of attraction betweenness centrality is an addition to the angular betweenness centrality analysis. It works in the same way, except that it also includes important origin and destination points in the network. These attraction points can be, for example, building entrances, park entrances or public transportation stations, depending on what the analysis is supposed to study and highlight. What the analysis does is that it calculates how many of the shortest paths in the network that connect these attraction points to each other, pass through every line. The result is a map showing which lines are most used for through-movement in the network based on the network itself, but also based on the attraction points (Stavroulaki et al., 2019, p. 25).

Visibility graph analyses

The visibility graph analysis is based on how much space pedestrians can see as they move around in their environment. It allows assessment of urban spaces on a much smaller scale compared to the previously

introduced analyses. It can even be used with a distinction between centimeters if required. The analysis divides the analysed area into small tiles and calculates all the visual connections between all tiles. Each tile is allocated a value depending on how visible or hidden it is from all other tiles. This can also be translated into the extent that each tile offers an overview of the rest of the environment. The result is represented in a map using a spectral colour range, where the most common colours range from red, to orange, yellow, green and blue. Red being the most visible parts of the map and blue the most hidden. There is a proven correlation between visibility and pedestrian flows, which is why these analyses are often used. So called isovists can be used to present the volume of space visible from a given point in an environment, showed with a coloured area covering the visible space together with a specification of the location of the point (Campos & Pinedo, 2017, p. 3, 8-9; Turner et al., 2001, pp. 108-109; Turner, 2004).

Axial maps and axial lines analyses

Axial lines are defined as the longest straight visibility lines for representing spaces in urban environments, and the least number of axial lines that cover the space constitute the least line axial map. As pedestrians prefer routes that are as straight as possible and that approximates the direction of their final destination as well as possible, axial maps and axial lines analyses give an indication of where "desire lines" are most likely to appear. These analyses can also be shown visually in a map. Usually, the lines are shown in a range of colours, from red, to orange, yellow, green and blue. The red lines represent the longest lines and the blue lines the shortest (Hillier & Hansson, 1984; Marcus, 2018; Stavroulaki et al., 2017; Turner et al., 2005; Vaughan & Geddes, 2009).

Why do we use angular distance instead of metric distance?

Many of the names of the analyses used in the field of space syntax include the word "angular". This means that the mathematical models used consider the angular distances of the network instead of the metric distances. The angular distance simply means the number of turns, and the degree of the directional change, that needs to be taken. It has already been mentioned in this section that space syntax models are programmed to integrate human behavior with the physical environment. This is exactly why the angular distance is used, instead of the metric distance mostly used in traffic modeling.

Research in cognitive science has suggested that humans' understanding of distance is compromised by the visual, geometrical and topological properties of the networks we move in, the legibility of the urban form. Our decisions are not primarily made in consideration to physical effort, but to mental effort. As a consequence, the route choices of pedestrians are to a greater extent affected by the frequency and the degree of directional change, rather than the metric distance. This is based on the premises that people tend to take the straightest route with the least angular deviation to go from place to place and that a big turn, the turn around a corner for example, constitutes a cognitively significant change because it brings in a lot of new information to a moving subject. We talk about a perceived distance that is not necessarily related to metric distance; where smoother routes are often perceived as shorter (Conroy Dalton, 2003, pp. 108, 126; Hillier & Iida, 2005, pp. 553-554; Marcus, 2018, p. 4; Ozbil et al., 2011, p. 139).

Analysis on different scales

When we conduct our analyses of angular integration centrality, angular betweenness centrality or attraction betweenness centrality, there might be a need to analyse the network in question on different scales. For example, we could be interested in the hierarchies of the lines on a local or a global scale. A local analysis uses a shorter radius and highlights the hierarchies of the lines in relation to their more local connections, meaning that these analyses reflect shorter pedestrian trips. A global analysis uses a longer radius and therefore highlights the larger connections of the lines to the surrounding urban context. That is, the global analysis reflects much longer trips. Regardless of which radius we choose, it is important to always include the surrounding urban context in the analysis. Mathematically, using a specific radius means that the analysis only includes trips shorter than or equal to the length of the radius in the calculations.

Space syntax as an evidence based design tool

The task that remains is to understand how to connect these analyses to design. What is important to understand is that space syntax analyses do not tell architects and planners what to do, but they can be useful in the design process. Mostly they are used as tools to help us understand and simulate the likely effects on the human behavior provoked by the design, to predict the movement patterns that will most likely appear (Gehl & Svarre, 2013, p. 75).

The workflow that is to be presented in this master's thesis, however, is based on the idea that the tools should be used before the design process even starts, to analyse the already existing spatial and functional logic of the area in question and its surroundings. In this way, the space syntax analyses can be used as design support tools, highlighting areas which are either problematic or which offer great design potential in relation to pedestrian movement. On the basis of the information that is revealed, more detailed design proposals can be developed and then inserted into the model to test and analyse how well they work with the existing situation. This method of using space syntax analyses has already been used, for example in the redesign of the Trafalgar Square in London between 1996 and 2003 (Hillier et al., 1993, p. 66; Hillier et al,. 1998).

Even though most space syntax analyses operate at quite large scales, the statement of this master's thesis is that they can still be used for developments in all scales. And together with the knowledge from the public life studies and the built environment studies, they will form a powerful design tool. This way of using research and analyses as the foundation of a design process is called *evidence based design*.

Built environment studies on "walkability"

A discrete field within the built environment studies is the one related to "walkability", focusing on pedestrian movement and the environmental factors influencing it. Their agenda is to produce empirical findings and propose guidelines for design, planning and policy that will support walking and create more walkable environments. The term "walkability" has been introduced as a measure to explain how friendly an area is to walking.

Built environment studies are mainly conduced by directly observing, studying and mapping they way people move in and use public space in our cities as well as interviewing them and surveying their preferences, just as the public life studies. However, they take a systematic approach, using strict statistical modeling to find correlations and draw conclusions. In addition their empirical data are much larger, often big data, and are gathered using strict protocols. This results in very specific guidelines telling architects and planners exactly what to do. These guidelines often lack the more qualitative assessment as they are quite straight-forward and usually discuss properties that are measurable or provisions of certain things, for example street width or frequency of crosswalks. Many of the qualities of experience that you get from public life studies, are overlooked and not emphasized here. Also, their main focus is on streets and sidewalks and not public space in general, meaning they do not capture all kinds of walking practices.

There are also other foci related to the built environment studies, variables that are not related to spatial design. Many studies consider factors such as income, segregation and demography, to name a few. These aspects of the built environment studies are not relevant for this master's thesis.

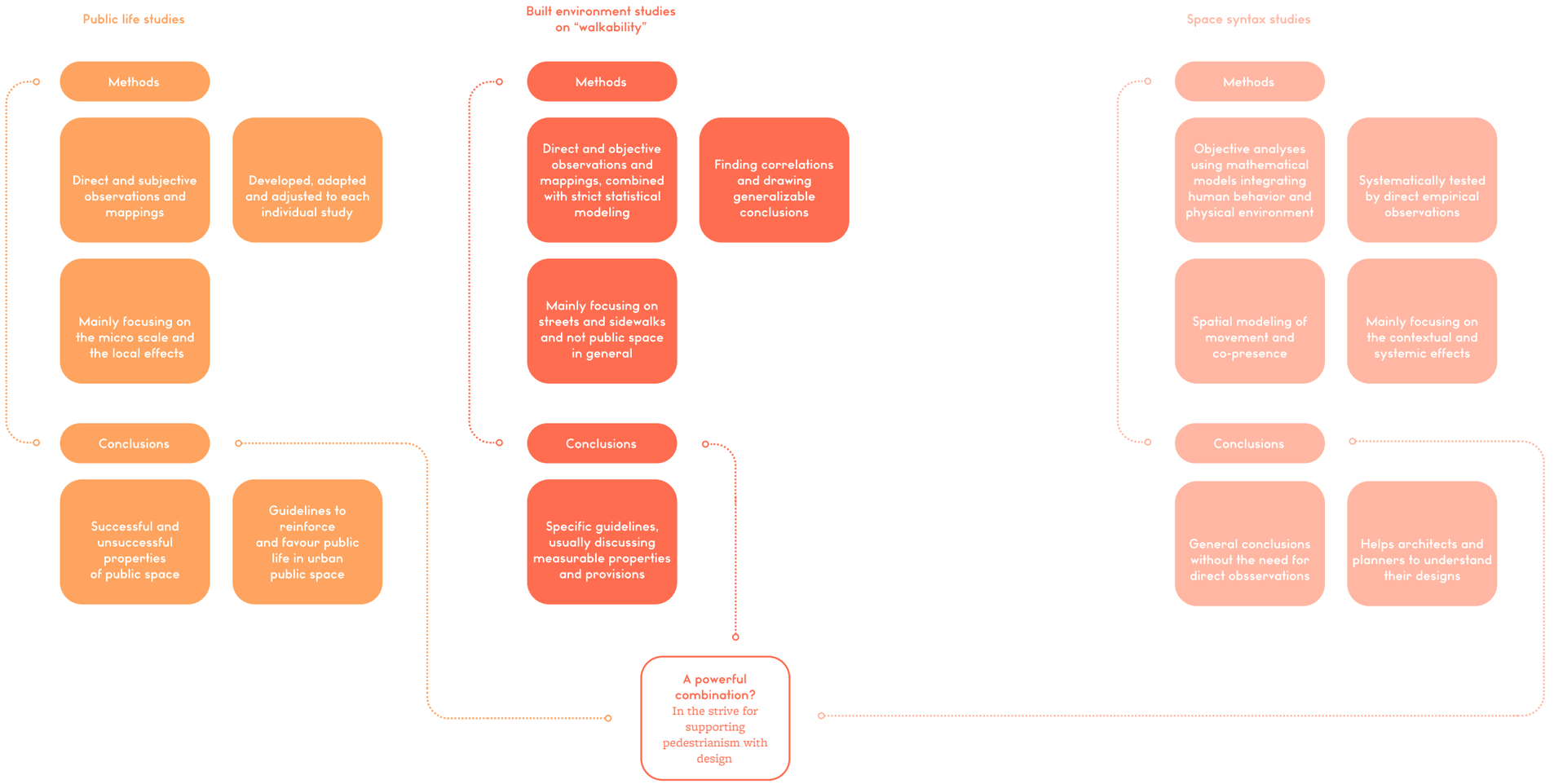


Figure 6:

Methods and conclusions of public life studies, built environment studies and space syntax studies, placed within the spectrum of normative and descriptive knowledge

Chapter 3

A design toolbox for creating pedestrian-friendly public space

Methods and analyses combined with theory-based design factors

One of the conclusions that can be drawn from chapter 2, is that there is a need to reinforce public life, the life of pedestrians, as an integrated part of the planning of our cities. Another conclusion is that the knowledge and information to achieve this is out there, scattered across several fields of research and many times generalized and hard to distill from a great body of information. The knowledge gathered from different fields would benefit from complementing each other.

Architects and planners need practical and analytical methods on how to make design choices that will influence beneficial behaviors as well as highlight and enable the ones that are already there. They need methods that are not just drawn from intuitions and assumptions. This design toolbox is an attempt to bridge the gap between research and practice by uncovering the spatial conditions and design principles that lie behind the pedestrian movements in our cities. It aims to making that knowledge easily accessible to architects and planners in a way that can be used *proactively* in design.

20 design factors

As mentioned in chapter 1, research for design is the main chosen methodology to carry out this master's thesis. The design factors in this design toolbox have been distilled based on existing theory and research belonging to the fields of public life studies, space syntax studies and built environment studies. The design toolbox consists of 20 different design factors which are meant to cover all situations in public space where pedestrians are present. Page 31-40 describes each design factor and the underlying theory and research in detail. Each design factor has a set of clear check-up questions that can easily be used to assess how well it has been executed. The summary of all design factors and their related check-up questions is referred to as the evaluation system.

When working with public space and pedestrians, it becomes natural to divide the design factors into two different scales: the macro scale and the micro scale.

The *macro scale* focuses on the larger context and network; the individual site as a part of a whole. It is important to understand that decisions made in city and regional planning, in site planning and at the small scale are very closely linked to each other. If good conditions are not created through decisions at the primary planning levels, good conditions rarely exist for working at the small scale either (Gehl, 2010b, p 83). The first 4 design factors in the design toolbox deal with the macro scale.

The *micro scale* focuses on the immediate environment that the individual person or pedestrian meets and uses every day. It is at the micro scale that we evaluate and experience all planning decisions made (Gehl, 2010b, p 83). The last 16 design factors in the design toolbox deal with the micro scale.

The 20 design factors are also divided into two different categories; principle factors and provision factors. The principle factors are more general and discuss properties that involve the design or project as a whole. The provision factors work on a more detailed level, discussing the providing or supplying of specific elements. The 4 macro scale factors are all principle, whereas the 16 micro scale factors are divided into 11 principle factors and 5 provision factors. Many of the factors are connected to each other, both directly and indirectly. See figure 8 on page 30 for an illustration of the connections between the different design factors.

Proactive actions = Actions taken to control a situation rather than just responding to it after it has happened

A combination of the design factors and different methods and analyses to assess them

The design toolbox does not only consist of the 20 design factors on how to support pedestrian movement with design and the connected check-up questions. It presents a workflow, a recommended process, on how to use different methods and analyses together with the design factors. The workflow chart on the next spread illustrates the recommended process, divided into 5 steps.

In the first step of the design toolbox, the larger context of the chosen design or project is analysed with the help of the macro scale principle design factors. The second step is to consult the micro scale principle design factors and the third step the micro scale provision design factors. In these different steps, different methods are needed to reflect on and answer the check-up questions. Some are more complex and systematic and need

Micro = Latin for "small"
Macro = Latin for "long"

the help of several precise space syntax analyses, while others do not have these kinds of methods and can be answered by direct observations, manual mapping, visual inspections or simple measurements.

The fourth and the fifth step is to generate a design proposal by consulting the results from the analyses and the evaluation and to test this design proposal in an iterative process. These two steps of the design toolbox can not be followed and described as detailed and linear as the three first steps. Each design process is different and depends on the project and the desires of the architect or planner. This means that step four and five are carried out simultaneously and irregularly and they are used together as a design support tool. Based on the findings from the first three steps, the initial phases of the design process includes identifying problems and potentials and formulating the aims and desires for the design proposal. The aims and desires also depend on the visions of the specific architect or planner using the workflow. The initial phases also include prioritizing which design factors are the most important and relevant, and finding a balance of what to focus on, as all of the design factors can not be fulfilled to the same extent in every project. In this sense, the design toolbox is made to be flexible as it offers different ways of realizing aims and desires, and can be applied in different ways with different foci.

Furthermore, step four and five includes producing and testing designs, as a way of understanding potential impacts of the designs prior to their implementations. Depending on potential results and inputs, the design proposal can be adapted and changed to the extent that is needed and strived for. Compromises will always be a part of the design process, as different design factors might be conflicting. The design toolbox and its workflow does not give answers on what decisions to make, but rather gives architects and planners the ability to take more informed choices. In the end, aims and desires of the project may push the design proposal in one or another direction and this is all part of the design process.

There is no definite description on how to execute step four and five of the design toolbox, but the aim is to provide a general way of structuring the design process so that the design choices are based on research and knowledge, however wrapped in a freedom of choice depending on design aims and desires, rather than just intuitions and assumptions.

How to use the design toolbox?

The design toolbox as a whole can be used for new designs and projects, but it can also work as a guide to assess and evaluate already existing designs. In a way, these two scenarios are the same thing, because no project is created without assessing an already existing context. If the toolbox is only consulted to assess and evaluate an existing design or project, use step 1 to step 3, otherwise use step 1 to step 5.

During the master's thesis, a more precise evaluation system was also developed and tested, directly based on the design factors and their check-up questions. This was carried out as an experiment on how to assess and evaluate designs in a more measurable way. This resulted in an index called *the pedestrian index*, where each design factor is given a score depending on how well it is executed. Each design factor is also weighted depending on its relevance, and the score is multiplied with the relevance weight. The total number of points is then divided with 20 to extract the pedestrian index of the project.

The pedestrian index does not have a set interval that will make it possible to use for comparisons between different projects. Different projects may have a different number of weights, depending on what design factors are more or less relevant. This means that the indices will differ between different projects, but when it is used for the same project the indices of the "before" and "after" will be comparable.

At the end of the chapter, on pages 41-45, the pedestrian index and the evaluation system with a summary of all the check-up questions for each design factor can be found. This system, together with the workflow chart, is what is meant to be practically used by architects and planners.

Net effects of the design toolbox

The 20 design factors of the design toolbox have been developed to be as literal and measurable as possible, so that they are as easy as possible to use. A lot of aspects will not be mentioned in the factors because they can not be literally and separately assessed, they are believed to be a direct net effect of the other factors. For example, adaptation, safety, comfort, attractiveness and liveability are features that will naturally be the indirect result of a design that is focusing on being pedestrian-friendly by considering the 20 design factors.

This means that whereas the design toolbox is focusing on literal design factors connected to improving pedestrian experiences, the design result may very well be a public space that is generally appreciated in several aspects beyond the aspect of the specific pedestrian experience.

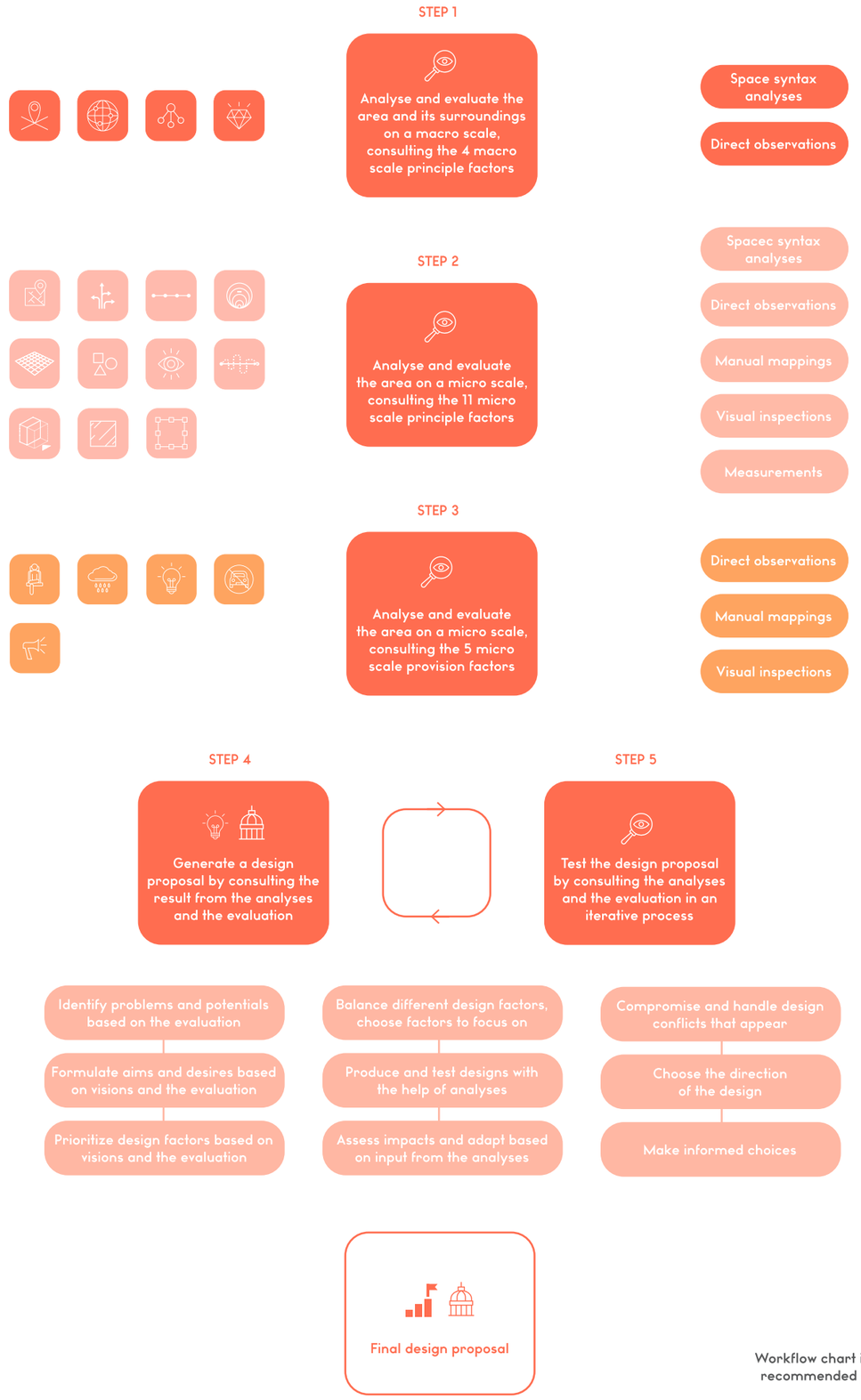


Figure 7:

Workflow chart illustrating the recommended process of the toolbox

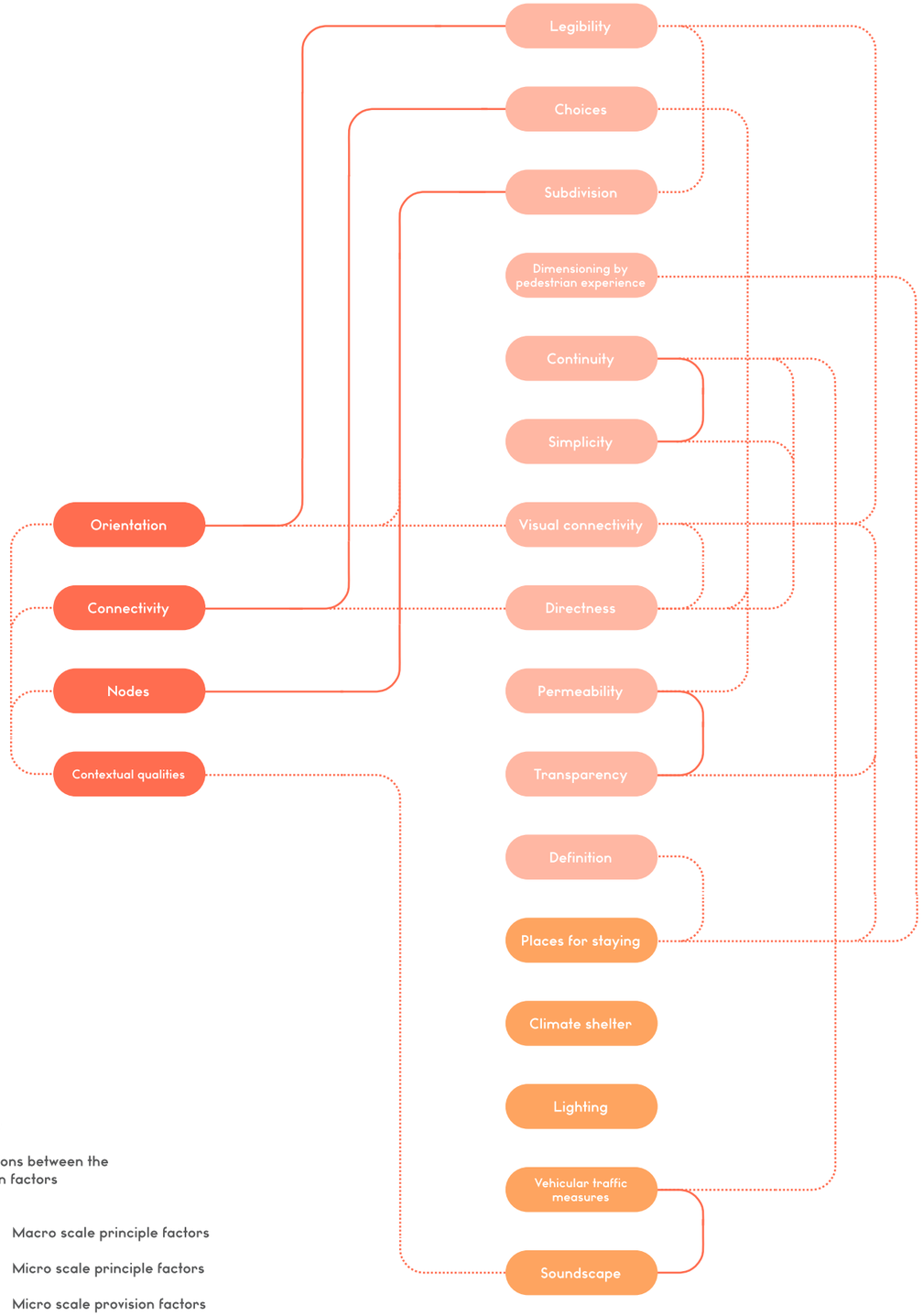


Figure 8:

Connections between the 20 design factors

The 20 design factors

Orientation

The design factor of orientation means working with the area in question in such a way that pedestrians are able to orient themselves relative to the urban network or urban context. Orientation focuses on enhancing important properties that makes pedestrians understand how the space they are in fits into the wider urban context. This can be done, for example, by highlighting and enabling views to important landmarks, attractions or qualities in the nearby surroundings. On the contrary, pedestrian environments that are totally enclosed, for example underpasses or bridges that offer no such views, have been found to be disorienting (Hillier et al,. 1998; Lynch, 1960, p. 83; Tibbalds, 2000, p. 49).

Check-up questions

Does the design help pedestrians to orient themselves relative to the urban context?

Does the design help pedestrians to know where they are and where to go next?

Connectivity

The design factor of connectivity means designing with the global connections in mind, providing more or less connections to the surrounding urban context depending on what the aim is. Regardless of what the intentions of the design are, the overall result of the design decisions made in any local context always depends on how that area is connected to every other area in the system. Usually, the problem is that the area in question is badly connected to the context, leading to an overlocalised design, but the problem can of course be the opposite as well. Research has concluded that the pedestrian flows of an area are directly related to the connectivity properties of the area, meaning that pedestrians tend to use well-connected areas rather than badly connected areas (Frank et al., 2010; Hillier et al., 1993, p. 32; Ozbil et al., 2011; Penn et al., 1998, p. 62; Saelens et al., 2003; Sundquist et al., 2011).

Check-up questions

Does the design consider and build on the potential of its global properties due to its global connections?

Does the design provide a satisfying amount of connections to the surrounding urban context?

Figure 9: Orientation

Figure 10: Connectivity

Orientation is connected to legibility (page 33), however they focus on slightly different properties and scales

Figure 11: Nodes

Figure 12: Contextual qualities

Subdivision and nodes are closely linked to each other, where the usage of nodes is one of the most important ways in which subdivision can be carried out

Nodes

A node is a point in a network at which paths intersect. Nodes are important because here pedestrians need to take decisions and thus heighten their attention. The design factor of nodes means working with the design of the node in a way so that it improves the understanding of the network it is a part of. It also means making use of the node to utilize and highlight the qualities and potentials of the systems it is part of (Lynch, 1960, p. 72).

Pedestrians perceive the elements at nodes with more clarity than other places, which means these places need to be designed carefully. A poorly designed node can contribute to a lesser understanding of the network, hence, if we are to put closer attention to the design choices, we should start with the nodes (Lynch, 1960, p. 97).

Pedestrians tend to prefer when nodes coincide with breaks in transportation and decision points on a path. Most naturally, these are the spaces where nodes usually are. When designing a node, the most important aspects to consider are that it should be clear as of where to enter the node, where the "break" occurs and how to get out of the node (Lynch, 1960, p. 102).

The design factor of nodes is closely related to the micro scale principle factor of subdivision (page 34). The usage of nodes is one of the ways in which subdivision can be carried out, however, nodes are too important not to be a design factor of its own.

Check-up questions

Does the design of the node contribute to a better understanding of the surrounding network?

Does the design of the node utilize the potentials of the systems it is a part of?

Does the design of the node highlight the inherent qualities of the systems it is a part of?

Contextual qualities

The design factor of contextual qualities means utilizing the existing nearby qualities in such a way that it enhances the pedestrian experience. If there is water nearby, use it in a favorable way. Do not turn the back of the development towards it. If there is a characteristic building or landmark nearby, incorporate it into the pedestrian experience. This is an easy way of creating more interesting and intriguing spaces for pedestrians (Tibbalds, 2000, p. 64).

The design factor of contextual qualities also means designing with consideration to the nearby attractions. Research has shown that the connectivity of an area affects the pedestrian flows to a higher degree than the land uses. However, the more an area is used for pedestrian movement, the more inviting it is for attractions such as shops, cafés and other meeting places. The more attractions an area gains, the more the pedestrian flows will increase. This effect is called the multiplier effect. This means that the design choices need to support the pedestrian movements caused by the attractions as well (Hillier et al., 1993, p. 48; Peponis et al., 1997, pp. 344-345: Penn et al., 1998, p. 82).

The design factor of contextual qualities is linked to the strategy of orientation, since working with contextual qualities is one way of improving orientation.

Check-up questions

Does the design incorporate potential nearby qualities and characteristics in a favorable way?

Does the design allow pedestrians to experience potential nearby qualities?

Does the design support the pedestrian movements caused by nearby attractions?

Legibility

The design factor of legibility means organizing the different parts of a network to such an extent that it can be easily recognized as a coherent pattern. However, the organization should not be too uniform. Uniformity and monotony of places tend to be experienced as confusing, which leads to people getting lost and having to rely on maps (Degen & Rose, 2012, p. 3277).

At the other end of the scale we find labyrinth-like networks. Pedestrians value the mystification and surprise of these networks, but only to the extent where there is no danger of losing the basic form or never coming out. The surprises should be kept small compared to the whole (Lynch, 1960, pp. 5-6).

The trick is to find a suitable mixture between the two. Pedestrians tend to perceive networks more easily when all paths are not the same but when, at the same time, there is a clear hierarchy where decisions have already been made about which routes and spaces are the most important (Gehl, 2010a, p. 67).

This is also related to the space syntax measure of intelligibility, which describes the relation and tuning between hierarchies in the local scale and hierarchies in the global scale, a property which has been found to positively effect way-finding and navigation (Hillier et al., 1987, p. 237). "High intelligibility" implies that the whole can be read from the parts.

Check-up questions

Does the design provide informative views through visual links through the area?

Does the design incorporate a balance between uniformity and mystification?

Does the design have a clear hierarchy of routes and spaces?

Choices

Closely related to the design factor of connectivity is the design factor of choices. The design factor of choices means providing several possible routes in a pedestrian network, avoiding over-reliance on single routes. Pedestrians tend to prefer variety and a redundancy of choices, as opposed to feeling forced to take an assigned path (Tibbalds, 2000, p. 55).

The design factor of choices is also related to the micro scale principle factor of directness (page 36). When the pedestrian network offers several possible routes, or when the space is open and broad, the possibilities for path minimization and directness also increase (Zacharias, 2001, p. 10).

Check-up questions

Does the design offer pedestrians several possible routes?

Does the design avoid over-reliance on single routes?

Figure 13: Legibility

Figure 14: Choices

Figure 15: Subdivision

Figure 16: Dimensioning by pedestrian experience

The four communication distances:

Intimate: 0 - 0,45 m
Personal: 0,45 - 1,2 m
Social: 1,2 - 3,7 m
Public: > 3,7 m

(Hall, 1966, pp. 113-129)

The distance at which we can start decoding emotions and facial expressions: 25 m

The distance at which we can start to see people in motion: 100 m

(Gehl, 2010a, p. 35)

Subdivision

The design factor of subdivision means dividing pedestrian routes into several manageable parts, in order for the walking distances to seem shorter and more interesting. This design factor is the natural next step after creating legible routes and spaces where we can orient ourselves. Subdivision is used to avoid the “tiring length perspective”, which describes the situation where the pedestrian can see the whole route before starting out, ending up with a feeling of fatigue before the walk has even begun (Gehl, 2010a, p. 127).

Positions along a pedestrian route can be subdivided by using different large design or spatial qualities that become check points, or in the simple way of using house numbering. Places that can be thought of as “before” or “after” something are usually preferred to improve definition (Lynch, 1960, p. 97).

This design factor can also be applied to stairs and ramps, as well as buildings and facades. Vertical facade articulation functions as a kind of subdivision, as opposed to facades designed with horizontal lines. When designing pedestrian environments, our main focus needs to be on keeping the ground floor facades, and possibly the second floor facades, rich in detail and variation, because these are the part of the environment that pedestrians most easily can take in and interpret (Gehl, 2010a, pp. 41, 77). The same way of working applies to stairs and ramps that are divided into several parts, where the pedestrian cannot see all the way to the top (Gehl, 2010a, p. 128).

Check-up questions

Does the design create manageable lengths of each section of the pedestrian routes?

Does the design create interesting parts of each section of the pedestrian routes?

Does the design create diversion, allowing for a rhythm of different and new impressions to occur?

Dimensioning by pedestrian experience

The design factor of dimensioning by pedestrian experience means designing with different important distances in mind. An important prerequisite for a comfortable pedestrian experience is room to walk relatively freely (Gehl, 2010a, p. 121).

Another important aspect to consider is how pedestrians use different distances to control the physical relationships with each other. The distances between pedestrians are used as signals to when they do or do not want contact and, depending on the design purpose, the four communication distances can be used.

Considering larger space dimensions, there exists two important thresholds. The distance at which we can start decoding emotions and facial expressions (25 m)and the distance at which we can start to see people (100 m). These thresholds are useful guidelines when dimensioning different parts of larger public spaces with pedestrians in mind (Gehl, 2010a, p. 35).

It is also possible to use dimensions to intensify the pedestrian experience. Pedestrians tend to prefer experiencing larger spaces from the perspective of smaller spaces. This design strategy offers detail and intensity on one hand, and a view of the whole on the other hand (Gehl, 2010b, p. 91).

Check-up questions

Does the design offer pedestrians room to walk relatively freely?

Does the design work with different distances and dimensions depending on the desired pedestrian experience?

Does the design work with an interplay of dimensions to intensify the pedestrian experience?

Continuity

The design factor of continuity means designing the pedestrian environment in such a way that it minimizes the frequent interruptions along the path. Both physical interruptions such as distinct curbs, railings and uncomfortable and unnatural level changes as well as mental interruptions in the form of waiting time at stop lights disturb and impoverish the pedestrian experience. Particularly the old, disabled and blind or partially sighted people become physically hindered by too large amounts of such obstructions. Most of the interruptions pedestrians face in our cities of today are the result of cars (Gehl, 2010a, p. 91).

The most fundamental requirement of continuity is that the actual bed of the pavement is consistent. Pedestrians perceive these paths to be the most dependable ones (Lynch, 1960, p. 52).

Another aspect of continuity is that pedestrians prefer to remain at ground level. This means that they do not prefer underpasses, tunnels, decks and bridges which separate them from the ground and potentially from the impressions of open air spaces. Where level changes are inevitable, ramps are preferred over stairs as they preserve the feeling of horizontality to a greater extent. However, in some cases, stairs can of course be the better choice (Tibbalds, 2000, pp. 49, 68; Gehl, 2010b, p. 145).

Continuity and physical access are two properties that are closely linked. For older people and those with mobility impairments, the physical access of the environment is the most crucial aspect. When designing with continuity in mind, good physical access will be naturally achieved (Zacharias, 2001, p. 11).

Check-up questions

Does the design minimize the frequent physical and mental interruptions along the pedestrian routes?

Does the design work with consistent beds of pavement?

Does the design allow pedestrians to remain at ground level?

Does the design handle level changes in a way that preserve the feeling of continuity?

Simplicity

Closely related to the design factor of continuity is the design factor of simplicity. The design factor of simplicity means sticking to the general rule of keeping it simple. The design of pedestrianized space tends to be more successful if it is free of too much clutter in the form of for example street furniture, bollards, planters, seats, kiosks and trees (Tibbalds, 2000, p. 44).

Simplicity is also an important aspect regarding the extent to which pedestrians tend to appreciate the aesthetic elements. Too ordered environments can appear monotonous and boring, while a too chaotic impression also repels. People consistently prefer moderate levels of both complexity and order, which is of course difficult to describe in detail since people perceive things differently (Ewing & Hardy, 2009, p. 81; Gehl, 2010a, p. 178; Zacharias, 2001, p. 11).

The design factor of simplicity can also be applied to other design choices, for example colours, materials, shapes and other details that may give the feeling of too many impressions at the same time.

When working towards simplicity, the key is to maintain the integrity and coherence of the space as a whole, regardless of the shapes and dimensions of it (Tibbalds, 2000, p. 47).

Check-up questions

Does the design strive towards keeping it simple and creating cohesion?

Does the design minimize the amount of visual clutter?

Does the design maintain the integrity and coherence of the space as a whole?

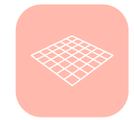


Figure 17: Continuity

Figure 18: Simplicity

Continuity and simplicity are closely linked to each other, as well as physical access. Good physical access is a natural result of continuity and simplicity

Figure 19: Visual connectivity

Figure 20: Directness

Visual connectivity

The design factor of visual connectivity means providing good visual overviews of and direct visual links through the environment of the design. This design factor is of course related to other design factors, mainly directness, legibility and orientation, where visual connectivity is an important element.

It has been showed that the area of usable space visible to a pedestrian at any point in the street grid is an important factor determining which route the pedestrian chooses. Pedestrians tend to prefer routes that offer direct visual links through the built environment, rather than complex routes where they cannot find a clear itinerary. This can also be translated into the fact that if pedestrians do not see a particular place, they will most likely not use it (Campos & Pinedo, 2017, p. 8; Gehl, 2010b, p. 97).

Visual connectivity also affects which locations pedestrians choose to pause or stop, gather, stand or sit. Some people feel more comfortable in places where they can have a visual overview of the space but where they are themselves protected from the gazes of others. Corners offer this type of visual properties. Other people choose to place themselves in the visual center where they are both visually exposed and have an overview of the area they are in. Visual connectivity describes the interplay between "'seeing" and "being seen" that takes place in public places (Guerreiro et al., 2015).

Check-up questions

Does the design offer the pedestrians a clear visual overview of the area?

Does the design avoid unwanted, obscure areas, providing pedestrians visibility of all parts of the design?

Does the design offer different choices of "seeing" and "being seen", different levels of visual overview and exposure?

Directness

The design factor of directness is related to several of the design factors that have already been mentioned. Directness is an important element of legibility, orientation, connectivity, choices, continuity, simplicity and visual connectivity. But directness is an important property to understand on its own as well.

Pedestrians tend to prefer routes that are as straight as possible and that approximates the direction of their final destination as well as possible, avoiding meandering routes. This is because it helps the sense of orientation if the direction of movement is in line with what we are moving towards. Especially, when pedestrians are allowed to see the destination of their walk, they tend to follow a course along the visual shortest line, the one with the least angular changes. There is no need for all routes to be completely straight for pedestrians to be able to orient themselves, but long successions of turnings or gradual curves which in the end produce large directional changes are not favored (Conroy Dalton, 2003, pp. 108, 126; Gehl & Svarre, 2013, p. 139; Lynch, 1960, pp. 96-97; Marcus, 2018).

Pedestrians' pleasure of direct walks can be seen in numerous tramped paths worn across lawns and landscapes all over the world, these are often called "desire lines" (Campos & Pinedo, 2017, p. 1). The same goes for many failed systems meant to separate vehicular traffic and pedestrian traffic where the pedestrian paths dictate many detours and indirect connections. The pedestrians simply choose the more direct routes without regard for the assigned safe pedestrian paths. Only where the conditions are very extreme, where the vehicular traffic is very heavy, the barriers are too large and complex or where the streets are very wide, pedestrians effectively use the existing crosswalks (Gehl, 2010a, p. 126; Gehl, 2010b, p. 137; Tibbalds, 2000, p. 55;).

It is safe to say that pedestrians rarely choose the path that is assigned for them unless it meets their desires to walk directly to their goal. Forced choice is rarely chosen (Whyte, 1980, p. 36).

Check-up questions

Does the design consider the existing "desire lines" of walking and incorporate them into the final result?

Does the design enable direct routes through and within the area?

Does the design avoid gradually turning movements that in the end produce large directional changes?

Permeability

On the macro scale we talk about choice, providing several possible routes in a pedestrian network. This can be translated into the micro scale, where the design factor of permeability means encouraging and allowing for a fine grain of movement through and between buildings and other design elements. Many new designs of today tend to be large and slab-like with flat and homogeneous facades, offering no possibilities to engage in them. Pedestrian environments offering no permeability tend to be underused and overlooked, simply because they provide no interesting elements. Design elements to consider can be arcades, passages and courtyards, depending on the possibilities at hand (Tibbalds, 2000, p. 41, 46).

Check-up questions

Does the design encourage and allow for a fine grain of movement through and between buildings?

Does the buildings of the design have pedestrian-friendly frontages which offer possibilities to engage in them?

Does the design offer uses for pedestrians to engage in?

Transparency

Closely related to the design factor of permeability is the design factor of transparency. Sometimes the design factor of permeability and direct movement through and between buildings and design elements may not be possible or aimed for. Another way of strengthening the contact between people in pedestrian environments as well as between pedestrians and buildings is to, instead, work with transparency between the outdoor and indoor environments. The design factor of transparency is most critical at street level, because this is where the most interaction between indoors and outdoors take place.

One common design mistake is to separate the street life too much from the indoor life that is potentially taking place just next to it. This can be avoided by having some facades transparent or partly open, so that pedestrians can see what the insides look like and what is happening there. However, what is displayed is of course also of importance. Pedestrians like to see other people engaging in various activities, rather than shops and their display windows showing things and products (Gehl, 2010a, p. 25; Tibbalds, 2000, p. 57; Zacharias, 2001, p. 11).

Transparency can also be a property much subtler than providing actual visual connections between the indoor and outdoor life. Sometimes what lies behind the street or sidewalk edge only needs to be imagined and not actually seen. For example, streets with many building entrances contribute to the perception of human activity nearby, as opposed to those with mostly blank walls (Ewing & Hardy, 2009, p. 78).

Check-up questions

Does the design allow pedestrians to see what the building insides look like and what is happening there?

Does the design allow pedestrians to understand function?

Does the design allow pedestrians to see other people engaging in various activities inside buildings?

Figure 21: Permeability

Figure 22: Transparency

Permeability and transparency are closely linked to each other. The best results are provided when the design factors are combined and allowed to complement each other

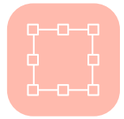


Figure 23: Definition

Figure 24: Places for staying

Definition

The design factor of definition means designing with the aim to create spaces that are intentional, clearly contained and defined. All pedestrian environments need to be easily recognizable and offer a sense of place, regardless of the character of them. Pedestrians tend to react favorably to fixed boundaries as something safe, defined and even memorable. In urban settings, definition is usually formed by lining the street or open space with unbroken building fronts, where the buildings become the “walls” and the street and sidewalks the “floor”. However, definition does not always have to be about physical volumes and shapes, as long as there is something to frame the activity. Pedestrians tend to avoid anonymous environments which feel as if they offer no physical or mental support. They are perceived as uncomfortable and ambiguous (Ewing & Handy, 2009, pp. 73-74; Gehl, 2010a, p. 75; Wunderlich, 2008, p. 138; Tibbalds, 2000, p. 40).

A useful tool is to work with the concept of edges, either physical or non-physical edges. Edges can be used as a vital contribution to the spatial experience and to the feeling of individual space as a place. A common problem in public space are the many urban squares with heavily trafficked roads on all sides, having no edges to offer definition and comfort (Gehl, 2010a, p. 75).

Check-up questions

Does the design aim to create spaces that are intentional, clearly contained and defined?

Does the design frame the existing activity in any way?

Places for staying

The design factor of places for staying simply means providing suitable and well-functioning places where pedestrians can take a pause from walking, without having to be in the way of the pedestrian traffic. These places should offer possibilities to sit, lean or stand, preferably rather discretely. Pedestrians tend to prefer to station themselves either along the edges of a space, or near objects such as bollards, statues, steps or, of course, benches and chairs. Research has shown that pedestrians tend to combine these two properties, meaning that objects placed along the edges of open spaces are used more frequently than objects in the middle. A lone object often does not offer enough mental support, they need to be anchored to something providing more comfort (Gehl, 2010a, p. 137, 139; Whyte, 1980, p. 21).

The design factor of places for staying is closely related to the design factor of visual connectivity, since visual connectivity affects which locations pedestrians choose to pause or stop, gather, stand or sit (Guerreiro et al., 2015). See “visual connectivity” on the previous spread for more information.

Check-up questions

Does the design offer pedestrians places to take a pause from walking, where they do not have to be in the way of the pedestrian traffic?

Does the design provide places for staying offering enough mental support in order for pedestrians to want to use them?

Climate shelter

The design factor of climate shelter means taking into account that the design should, when possible and at least to some degree, offer protection from the weather. There should mainly be protection from sun, rain and wind. The character of the micro climate determines whether it is more or less comfortable for pedestrians to remain in the space. This applies to the practice of walking, sitting, standing or any other activity. Research has found that presence in public places rises with temperature and sunlight until individuals begin to seek shade and more temperate conditions. Therefore, climate shelter is important also in public spaces where the micro climate might seem to always be satisfactory because of warm and comfortable temperatures (Tibbalds, 2000, p. 49; Zacharias, 2001, pp. 11, 15) .

Pedestrians tend to be affected by previously experienced and remembered climate conditions when they make decisions and plan their routes. This means that the micro climate in pedestrian environments do not only have an impact on the present movements, but also on future movements (Zacharias, 2001, p.11) .

Check-up questions

Does the development offer, if appropriate, some degree of protection from unwanted weather, such as sun, wind and rain?

Lighting

The design factor of lighting means working with the design so that it offers well lit areas at all times of the day. The quality of the artificial lighting in pedestrian environments is proven to have a significant effect on pedestrians’ behaviour in such environments after sunset, as well as their willingness to use the areas at all, because of how they are perceived. Pedestrian environments that are well lit are seen as more safe and friendly. If the artificial lighting is not sufficient everywhere, pedestrians tend to redirect their routes so that they coincide with the areas that offer the most light. Usually, public open spaces are well lit at the edges but not in the middle, resulting in them being underused as soon as the sun sets (Gehl & Svarre, 2013, p. 89; Painter, 1996, pp. 193-201; Zacharias, 2001, p. 11).

Check-up questions

Does the design offer well lit areas at all times of the day?

Does the well lit areas of the design coincide with the preferred pedestrian routes?

Figure 25: Climate shelter

Figure 26: Lighting

Micro climate = The climate of the immediate surroundings of the pedestrian, usually the area within a few meters

Figure 27: Vehicular traffic measures

Figure 28: Soundscape

Vehicular traffic measures

The design factor of vehicular traffic measures means taking into account other modes of transport and the way they affect the pedestrian experience. In the cities we live in today, there are hardly any public spaces that are completely free of vehicular traffic of any kind. Usually, pedestrians need to cross and pass several car roads and other facilities related to cars on their routes to wherever they are going.

Pedestrians prefer to use public spaces where their freedom is prioritized and where they feel safe. Vehicular speed is the number one factor of pedestrian unsafety, related to high numbers of serious injuries and fatalities. Reducing vehicular speed by speed limits or by traffic calming features are measures that improve pedestrian safety and the perception of safety. Separating pedestrians from vehicular traffic with buffers is another strategy used with both positive and negative effects. While these buffers physically distance pedestrians from vehicles, they also often hinder their mutual visibility which is a major source of crashes, especially when pedestrians cross informally or jaywalk (Stavroulaki & Berghauser Pont, 2020). An optimal strategy is one that promotes their safe interaction and mutual visibility, rather than their separation.

A strategy to prioritize pedestrians is to create an environment where vehicular traffic is allowed, but where the motorists feel like guests. This concept of integrating vehicular traffic on pedestrian terms also offers considerable advantages over methods that separate them from each other. Completely car-free areas are, of course, more safe and offer better design choices. However, these systems often involve long and disorienting detours for pedestrians. Systems that integrate both pedestrian and vehicular traffic can better fulfill the desired behaviors of pedestrians (Tibbalds, 2000, pp. 16, 55; Gehl, 2010b, p. 111).

Evidently, the reduction of vehicular traffic needs to be done in a manner that is best suitable to the individual case.

Check-up questions

Does the design, if appropriate, prioritize pedestrians over vehicles?

Is the design, if appropriate, adapted to the pedestrian movements rather than the vehicular movements?

Does the design allow other modes of transportation to affect the pedestrian experience to an adequate and appropriate level?

Soundscape

Closely related to the design factor of vehicular traffic measures is the design factor of soundscape, since noise is a natural result of vehicular traffic. Unwanted noise can be generated by other activities as well, but in our cities of today it is usually and foremost generated by the vehicular traffic. The design factor of soundscape means designing with consideration to potential existing noise. Noise is usually not something designers can change, but the design choices can influence the experienced noise levels and soundscape. Preferably, the most well-used pedestrian environments should be protected from and placed as far away as possible from the noise. Positive sounds, such as bird singing, tree rustling and running water have been found to increase “attractiveness to walk” and can be part of soundscape design (Vaeztavakoli et al., 2018).

An important property of noise, and any kind of ambient sound, is that it alters both the perception and behavior of pedestrians. Higher sound levels reduce their abilities to interpret and remember details in the environment, which might lead to a decreased level of satisfaction. Pedestrians also tend to walk faster and have more centrally fixed gazes in environments with high sound levels, another aspect that might lessen the positive experience and reduce the potential social aspects of pedestrianism (Zacharias, 2001, p. 11).

Check-up questions

Does the design, as much as possible, prevent and avert potential high noise levels?

Does the design, as much as possible, offer protection from potential high noise levels?

Does the design incorporate any positive sounds as part of the soundscape design?

The pedestrian index

Orientation
Weight = _____
Score = _____
Weight x Score = _____

Connectivity
Weight = _____
Score = _____
Weight x Score = _____

Nodes
Weight = _____
Score = _____
Weight x Score = _____

Contextual qualities
Weight = _____
Score = _____
Weight x Score = _____

Legibility
Weight = _____
Score = _____
Weight x Score = _____

Choices
Weight = _____
Score = _____
Weight x Score = _____

Subdivision
Weight = _____
Score = _____
Weight x Score = _____

Dimensioning by pedestrian experience
Weight = _____
Score = _____
Weight x Score = _____

Continuity
Weight = _____
Score = _____
Weight x Score = _____

Simplicity
Weight = _____
Score = _____
Weight x Score = _____

Visual connectivity
Weight = _____
Score = _____
Weight x Score = _____

Directness
Weight = _____
Score = _____
Weight x Score = _____

Permeability
Weight = _____
Score = _____
Weight x Score = _____

Transparency
Weight = _____
Score = _____
Weight x Score = _____

Definition
Weight = _____
Score = _____
Weight x Score = _____

Places for staying
Weight = _____
Score = _____
Weight x Score = _____

Climate shelter
Weight = _____
Score = _____
Weight x Score = _____

Lighting
Weight = _____
Score = _____
Weight x Score = _____

Vehicular traffic measures
Weight = _____
Score = _____
Weight x Score = _____

Soundscape
Weight = _____
Score = _____
Weight x Score = _____

An experiment on how to assess and evaluate designs in a more measurable way

Before consulting the evaluation system, the design factors and their related check-up questions, decide which design factors are the most relevant and important for the project in question. Give the most relevant design factors the heaviest weight (3), the second most relevant design factors the second heaviest weight (2) and the least relevant design factors the lightest weight (1).

Evaluate the project given all 20 design factors with the help of the check-up questions on the following two spreads, and give each design factor a score between 1 and 5 depending on how well it has been considered and executed. Summarize all weights and scores in the table on this page and calculate the total score when all design factors have been combined.

Finally, divide the total score by 20 to obtain the final pedestrian index assigned to the specific project. The pedestrian index will not be a number in a set interval and can therefore not be used to compare different projects. However, the index can be used to compare the “before” and the “after” of the same project. That is, before and after design interventions have been done.

Result
Total score = _____
Total score / 20 =
Pedestrian index = _____

Orientation*

Does the design help pedestrians to orient themselves relative to the urban context?

Does the design help pedestrians to know where they are and where to go next?

Connectivity*

Does the design consider and build on the potential of its global properties due to its global connections?

Does the design provide a satisfying amount of connections to the surrounding urban context?

Nodes

Does the design of the node contribute to a better understanding of the surrounding network?

Does the design of the node utilize the potentials of the systems it is a part of?

Does the design of the node highlight the inherent qualities of the systems it is a part of?

Contextual qualities*

Does the design incorporate potential nearby qualities and characteristics in a favorable way?

Does the design allow pedestrians to experience potential nearby qualities?

Does the design support the pedestrian movements caused by nearby attractions?

*This design factor is more easily evaluated with the help of space syntax tools

Legibility*

Does the design provide informative views through visual links through the area?

Does the design incorporate a balance between uniformity and mystification?

Does the design have a clear hierarchy of routes and spaces?

Choices

Does the design offer pedestrians several possible routes?

Does the design avoid over-reliance on single routes?

Subdivision

Does the design create manageable lengths of each section of the pedestrian routes?

Does the design create interesting parts of each section of the pedestrian routes?

Does the design create diversion, allowing for a rhythm of different and new impressions to occur?

Dimensioning by pedestrian experience

Does the design offer pedestrians room to walk relatively freely?

Does the design work with different distances and dimensions depending on the desired pedestrian experience?

Does the design work with an interplay of dimensions to intensify the pedestrian experience?

Continuity

Does the design minimize the frequent physical and mental interruptions along the pedestrian routes?

Does the design work with consistent beds of pavement?

Does the design allow pedestrians to remain at ground level?

Does the design handle level changes in a way that preserve the feeling of continuity?

Simplicity

Does the design strive towards keeping it simple and creating cohesion?

Does the design minimize the amount of visual clutter?

Does the design maintain the integrity and coherence of the space as a whole?

Visual connectivity*

Does the design offer the pedestrians a clear visual overview of the area?

Does the design avoid unwanted, obscure areas, providing pedestrians visibility of all parts of the design?

Does the design offer different choices of "seeing" and "being seen", different levels of visual overview and exposure?

Directness*

Does the design consider the existing "desire lines" of walking and incorporate them into the final result?

Does the design enable direct routes through and within the area?

Does the design avoid gradually turning movements that in the end produce large directional changes?

Permeability

Does the design encourage and allow for a fine grain of movement through and between buildings?

Does the buildings of the design have pedestrian-friendly frontages which offer possibilities to engage in them?

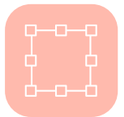
Does the design offer uses for pedestrians to engage in?

Transparency

Does the design allow pedestrians to see what the building insides look like and what is happening there?

Does the design allow pedestrians to understand function?

Does the design allow pedestrians to see other people engaging in various activities inside buildings?



Definition

Does the design aim to create spaces that are intentional, clearly contained and defined?

Does the design frame the existing activity in any way?

*This design factor is more easily evaluated with the help of space syntax tools

Places for staying

Does the design offer pedestrians places to take a pause from walking, where they do not have to be in the way of the pedestrian traffic?

Does the design provide places for staying offering enough mental support in order for pedestrians to want to use them?

Climate shelter

Does the development offer, if appropriate, some degree of protection from unwanted weather, such as sun, wind and rain?

Lighting

Does the design offer well lit areas at all times of the day?

Does the well lit areas of the design coincide with the preferred pedestrian routes?

Vehicular traffic measures

Does the design, if appropriate, prioritize pedestrians over vehicles?

Is the design, if appropriate, adapted to the pedestrian movements rather than the vehicular movements?

Does the design allow other modes of transportation to affect the pedestrian experience to an adequate and appropriate level?

Soundscape

Does the design, as much as possible, prevent and avert potential high noise levels?

Does the design, as much as possible, offer protection from potential high noise levels?

Does the design incorporate any positive sounds as part of the soundscape design?

Chapter 4

Case studies of eight projects and designs related to pedestrianism

Connecting the design factors to existing projects and designs

In this chapter, the design factors are investigated further by looking at design examples from eight different case studies from all over the world and connecting them to several relevant design factors. Interesting scenarios and design choices are highlighted and used as inspiration in the following parts of the master's thesis.

The character of the case studies varies between squares, pedestrian promenades, sidewalks, streets and other open public spaces for pedestrians in between of buildings. The scales of the case studies differ from very small to larger in scale, focusing on different important aspects.

A second purpose of this chapter is to attempt to loosely verify the 20 design factors that have been identified and defined, to see whether they can be found in already realized projects. If the design factors can be quite easily identified in several realized projects, that would indicate that they are relevant and also possible for architects and planners to work with. Both in an evaluation phase and in a design process.

Furthermore, the purpose is to see if the application and use of the design factors seem to coincide with *successful* realized projects. Successful in the way that they are well-used, considered to be well-functioning and liked by both people and communities. This means that the focus in this chapter is on the positive use of the design factors. However, not all projects apply the identified design factors in a successful way, and this will be addressed in a general discussion in the end of the chapter.

Image 2:

Zoom-in of Bailey Plaza, Ithaca, (more information on page 50).

Image 3 (Left):

Name: Parklet
Architect: Pgrydziak Prillinger Architects
Location: San Francisco, USA

Image 4 (Right):

Name: Nicholson Street Mall
Architect: Hassell
Location: Melbourne, Australia

Providing sidewalk seatings that are not in the way of the pedestrian traffic

- Continuity
- Definition
- Dimensioning by pedestrian experience
- Legibility
- Simplicity
- Subdivision
- Places for staying

This small sidewalk project demonstrates an easy way of providing places for staying that are not in the way of the pedestrian traffic. It uses a few car parkings instead of occupying parts of the existing sidewalk. The robust design of the urban furniture offers the pedestrians enough mental support to make them want to use it, more than a simple bench would have done. It also directs the gaze of the sitting people away from the traffic and towards the sidewalk pedestrians and the building frontages.

The design uses well chosen dimensions and distances to create a combination of personal and social spaces, while still maintaining the full width of the sidewalk so that pedestrians can walk freely.

Offering mental support in an open pedestrian environment

- Connectivity
- Nodes
- Choices
- Definition
- Dimensioning by pedestrian experience
- Legibility
- Simplicity
- Subdivision
- Visual connectivity
- Places for staying

This sidewalk project demonstrates another way of creating mental support to the places for staying. The choice of material and colour, differing from the rest of the sidewalk, creates a clear definition of the seating areas. This gives them a feeling of being anchored to something, even though they are placed in the middle of the space. The placement of the demarcated sitting area and the benches also considers the pedestrian flows from the surrounding area to and through the square connecting the square to the urban context. At the same time the shape of the sitting area allows for unobstructed movement and creates enclaves for standing.

The design also works with placing the benches in groups, where each bench has one or two other benches behind it so that they support each other which enhances the feeling of comfort. Also the two-side benches allow for freedom of choice, either sitting individually turning towards the square or sitting in groups facing each other.

Design factor categories:

- Macro scale principal factors
- Micro scale principal factors
- Micro scale provision factors

Image 5 (Left):

Name: Chicago Riverwalk
Architects: Sasaki & Ross Barney Architects
Location: Chicago, USA

Image 6 (Right):

Name: Vestre Fjordpark
Architect: Adept
Location: Aalborg, Denmark

Creating a first hand experience of nearby contextual qualities

- Contextual qualities
- Orientation
- Continuity
- Dimensioning by pedestrian experience
- Directness
- Simplicity
- Subdivision
- Visual connectivity
- Places for staying
- Soundscape

The placement of this pedestrian promenade just next to the water is an obvious way of allowing the pedestrians to experience the nearby qualities at first hand. Not only can they see the quality of the river, they can experience it up close. By extending the promenade on top of the river, the views of the surrounding areas are further increased which better help the pedestrians to orient themselves in relation to the city as a whole.

The “pockets” facing the river are designed with considerations to dimensions and distances, making them social spaces that different groups of people can use at the same time. They are placed in a similar manner as the first project, a bit to the side of the main pedestrian sidewalk, offering pedestrians an undisturbed forward motion along the promenade. Again the “places for staying” offer many choices of where to position oneself and where to look. One can sit gazing at the people walking on the promenade, or stand looking at the river, sit alone or in groups comfortably.

Encouraging a fine grain of movement between buildings and design elements

- Contextual qualities
- Choices
- Dimensioning by pedestrian experience
- Directness
- Permeability
- Transparency
- Visual connectivity
- Climate shelter
- Places for staying
- Soundscape

This recreational architecture project combines many outdoor facilities shattered across several building volumes, and is placed in the largest fjord landscape in Denmark. It demonstrates the use of the design factors of choices, visual connectivity and permeability to create an interesting landscape where a fine grain of movement between buildings and other design elements is encouraged and allowed for. The roofs of the buildings are connected to create a rooftop promenade accessible from ramps and flat stairs, however, the visitors can choose to stay at ground level. Climate shelter is created at some places as a net effect of the rooftop promenade. Places for staying are offered at several places, well integrated in the structure to create mental support and to avoid visual clutter.

The design works with dimensioning to create different experiences, where some areas are more sheltered and intimate, overlooking and framing the surroundings, and others are more open and wide.

Design factor categories:

- Macro scale principal factors
- Micro scale principal factors
- Micro scale provision factors

Image 7 (Left):

Name: Superkilen
Architects: BIG, Topotek1 & Superflex
Location: Copenhagen, Denmark

Image 8 (Right):

Name: Bailey Plaza
Architect: Mikael van Valkenburg Associates Inc
Location: Ithaca, USA

Reinforcing the pedestrian environment with colours, surfaces and edges

- Choices
- Continuity
- Definition
- Directness

This large public space project demonstrates the use of several design factors. Continuity and definition is achieved by a careful use of colours, materials and surfaces, where pedestrians can easily move across the space without interruptions in the form of level changes or without wondering if they are still in the assigned pedestrian area. All the area within the red lines in the picture is clearly differentiated from the rest of the space by using bright red and pink colours on the ground. The pedestrian freedom of the design allows for many possible routes and choices, which also allows for directness. It is easy for pedestrians to take the direct route to wherever they are heading.

The design choices also help reinforcing the public space by allowing the pedestrian area to reach all the way to the facades that are next to the area on one side. There are no trafficked roads here, separating the pedestrian area from the buildings. The result is that the public space is supported by the well-defined edges that are created, enhancing the feeling of comfort and organization.

Adapting the pedestrian environment to “desire lines” and the global network

- Connectivity
- Contextual qualities
- Nodes
- Choices
- Definition
- Directness
- Legibility
- Simplicity
- Visual connectivity

The design of this square, this nodal area, demonstrates the use of several design factors. The design of the square provides several direct connections to the surrounding urban context that preserves but also reinforces its position in the global network. This means that the design avoids becoming overlocalized, resulting in the area attaining the potential of becoming appropriately well used. The many connections, that are also very direct and in line with the destination, are also part of the design factors related to choices and directness.

This project also makes use of the design factor of definition by using greenery to define the loose edges of the area. Even though three of the four sides of the square is constituted by trafficked roads, the defined spots of greenery help framing and containing the area as a whole.

Design factor categories:

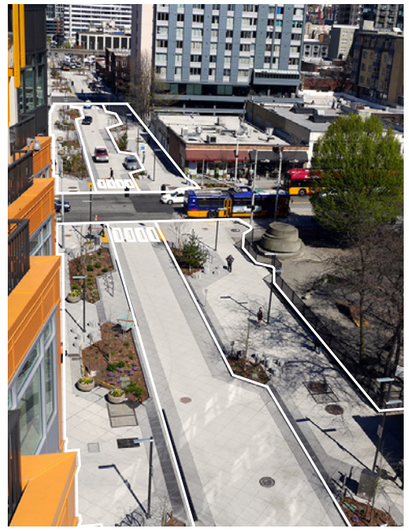
- Macro scale principal factors
- Micro scale principal factors
- Micro scale provision factors

Image 9 (Left):

Name: Bell Street Park
Architect: SvR
Location: Seattle, USA

Image 10 (Right):

Name: Teruel-zilla!
Architects: Mi5 Arquitectos & PKMN Architectures
Location: Teruel, Spain



Prioritizing pedestrians by making the motorists feel like guests

- Orientation
- Continuity
- Dimensioning by pedestrian experience
- Legibility
- Simplicity
- Subdivision
- Vehicular traffic measures

This street intervention project demonstrates one way of prioritizing the pedestrians by making the motorists feel like guests. The design works with colours, materials and surfaces to create a cohesive expression of both the car road and the pedestrian sidewalks. In this way, the car road looks just like the pedestrian sidewalks, making the motorists feel like they are using the street on the pedestrians’ terms. No traffic calming features are used in the sense of speed bumps or any other physical obstacles.

The design also works with continuity in the sense that the pavement of the pedestrian sidewalk is flat and consistent even when the sidewalk crosses the car road.

Combining architecture and open public space in a legible and continuous way

- Contextual qualities
- Continuity
- Legibility
- Permeability
- Simplicity
- Transparency
- Visual connectivity
- Lighting

This project is one of two case studies that incorporates buildings in the design and does not only relate to buildings in the surrounding area. It demonstrates the use of the continuity, legibility and simplicity design factors by partly placing the building underground, creating a surface that is still very free, simple and legible. The design maintains the scale, direction and integrity of the space as a whole while also creating a hierarchy of routes and spaces that makes the area interesting but also easy to understand.

The use of lighting along the walls next to the pedestrian routes enhances the edges and shapes of the design, working with light in a way that contributes to the design in more senses than just providing well lit areas where and when needed.

Design factor categories:

- Macro scale principal factors
- Micro scale principal factors
- Micro scale provision factors

General conclusions in relation to the investigated projects and designs

Based on the eight case studies from this chapter, it is clear that many of the design factors can be realized in different ways and with the help of different design solutions.

For example, definition can be created with the help of colours and materials, as in the Nicholson Street Mall project, but also with greenery or furniture elements, as in the parklet project from San Francisco or the Bailey Plaza project, or even with the help of surrounding buildings, seen in the Superkilen project.

Many of the case studies work with dimensioning by pedestrian experience in relation to places for staying, but also in relation to the areas for pedestrian movement. For example, in the Bell Street Park project, the sidewalks are made in the same width as the street to highlight and favor the pedestrians, whereas in the Chicago Riverside project they are adjusted to create the appropriate level of social and public areas.

A third design factor that is interesting to look at in relation to these case studies is directness. The easiest way to fulfill the property of directness is to have no buildings or elements that obstruct pedestrian movement at all, as in the public space project of Superkilen. However, directness can also be allowed for when there is an understanding of the routes pedestrians will prefer to take and when the design is adapted to those. This can be seen in the Chicago Riverwalk and Bailey Plaza projects. In the Vestre Fjordpark project, the project lacks a clear surrounding context as it is placed on the water. However, here the design factor of directness is fulfilled by allowing for many possible routes through and between the project, which is also in direct connection to the design factor of permeability.

Most of the case studies can easily be connected with the design factor of simplicity. For example by deliberate design choices in relation to materials, colours and building volumes and shapes, where the aim has been to minimize the number of elements and conflicting impressions.

Another aspect that is important to discuss is that many of the projects that have been highlighted here are also examples where some design factors have not been realized, or where they have an unsuccessful result.

In the parklet project from San Francisco, one can imagine that the design factor of soundscape is not well executed, as the people using the urban furniture are placed just next to the street with cars driving inches away from them. For the Superkilen project, there seems to be a need for signs and posts in the middle of the square, creating visual clutter, not fulfilling the design factor of simplicity. Also, there are not that many places for staying or gathering. When discussing the directness of the Bailey Plaza project, which seems to be well fulfilled, one can also see that people are still jaywalking at some places of the square. This means that even though the design factor has been used and executed, it might not have been to an extent that is enough to keep people from crossing the streets where they are not supposed to.

When overviewing all the eight projects of this chapter, it is clear that some design factors appear more often than others. This would indicate that some design factors are more general than others. For example, the design factors of nodes and vehicular traffic measures are not always applicable and relevant, whereas the design factors of simplicity and dimensioning by pedestrian experience are always possible to work with, no matter the design case. My opinion, however, is that all 20 design factors of the existing design toolbox need to remain as they are, since they are all important in their different ways.

When proceeding to the next chapter, these findings and conclusions will work as inspiration and will be further investigated, tested and used in the process of my own design project.

Chapter 5

Design proposal

The design proposal part is used to put the theory part of the master's thesis to test, attempting to apply the design toolbox as well re-developing and improving it during the process.

Is the design toolbox and its proposed workflow useful and applicable? Is it helpful in the strive for a new and better pedestrian usage of the chosen project site?

The project site of Korsvägen

The project site of Korsvägen is constituted and characterized by the meeting of four different roads; Skånegatan, Örgrytevägen, Eklandagatan and Södra vägen. Södra vägen is passing through the area, meaning that the total amount of road connections in the area sums up to five. Korsvägen is a very important and well-used public transportation node in the city of Gothenburg. As of today, six tram lines and fifteen bus lines frequently run through the station every day of the week (Göteborgs stad, 2017, pp. 10-11).

This results in a very complicated and complex spatiality of the area which is subordinate to everything else that takes place here, where the area is practically being forced to be defined by the voids that are left over between buildings and roads.

The area is surrounded by several both regionally and nationally important destinations, such as Gothia Towers, Liseberg, Universeum, Scandinavium, Världskulturmuseet, Götaplatsen and Göteborgs universitet (see the illustration on the following spread for more information). The area also houses a large number of dwellings as well as some schools. This results in a combination of large scale and small scale flows of visitors and users, present during all times of the day and year (Göteborgs stad, 2017, pp. 10-11).

Korsvägen is an area of great historical importance, it has been a part of the city of Gothenburg since it was first founded 400 years ago. During the 1700s, Örgrytevägen and Södra vägen was separated and the connection between them, Korsvägen, was created. The tram lines were added in 1881 and their positions, as well as the positions of the roads, have stayed the same ever since. The surrounding buildings represent different architectural eras, ranging from grand and exclusive buildings of the 1800s to the more reserved brick buildings of the early 1900s all the way to the relatively modern developments of the late 1900s (Göteborgs stad, 2016, p. 19).

The project site of Korsvägen is facing profound changes due to Gothenburg's major ongoing infrastructure project "Västlänken", a new construction of an underground railway extension that will result in three new underground stations. These three stations will be situated by the central station, in the region of Haga and in the area of Korsvägen. At the time of writing this master's thesis, Korsvägen is under construction with parts of it being closed off and temporarily changed. Several plans and decisions have been concluded about the future development of the area and the aim of this design proposal is to test and evaluate them as well as incorporating them into the final result to some extent. However, there are no limitations on what can be changed and how much the design choices have to go in line with what is already decided.

The project site of Korsvägen was chosen based on it being a public space handling a lot of pedestrian movements at the same time as offering room to design. It was also chosen based on its relevance due to its ongoing and future development plans.

Goals and strategies developed by the city of Gothenburg

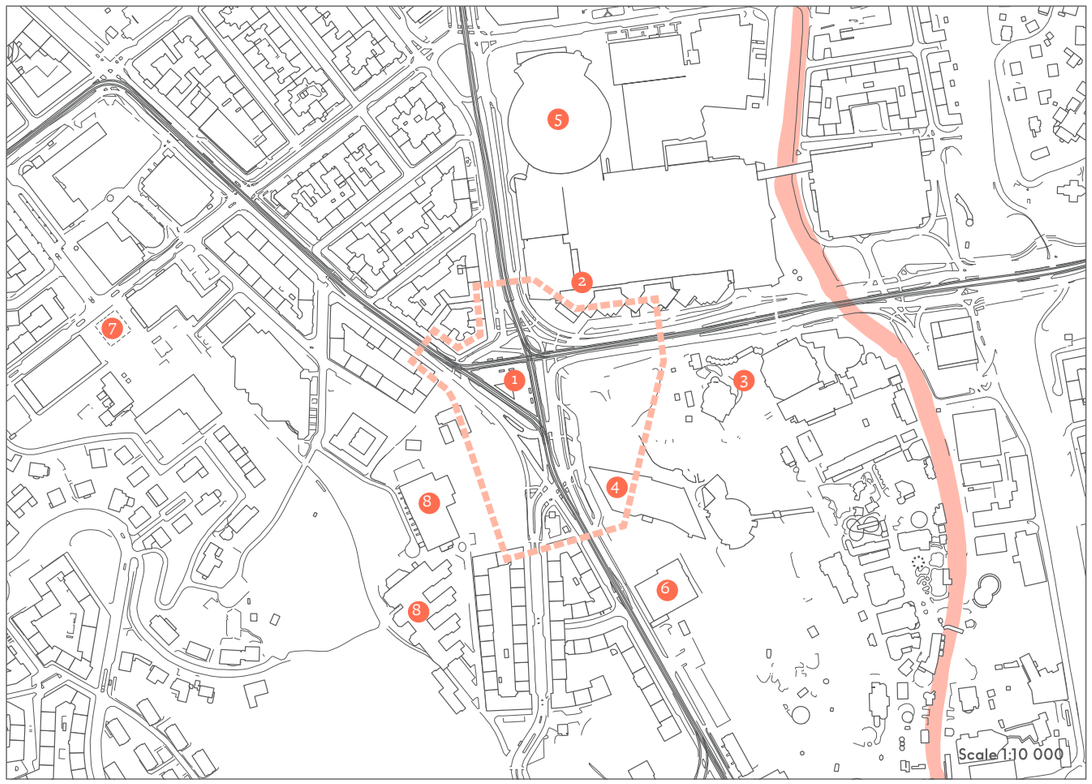
As part of the development program presented by Stadsbyggnadskontoret (from now on referenced to as the local building authority), some general goals and strategies have been developed. These goals and strategies are relevant for the whole project area of Korsvägen, including Örgrytevägen in the east and the area west of the tram station, called Johannebergs Lanteri (Göteborgs stad, 2017, pp. 17-18). The ones that are relevant and go in line with the aims and foci of this master's thesis are introduced below:

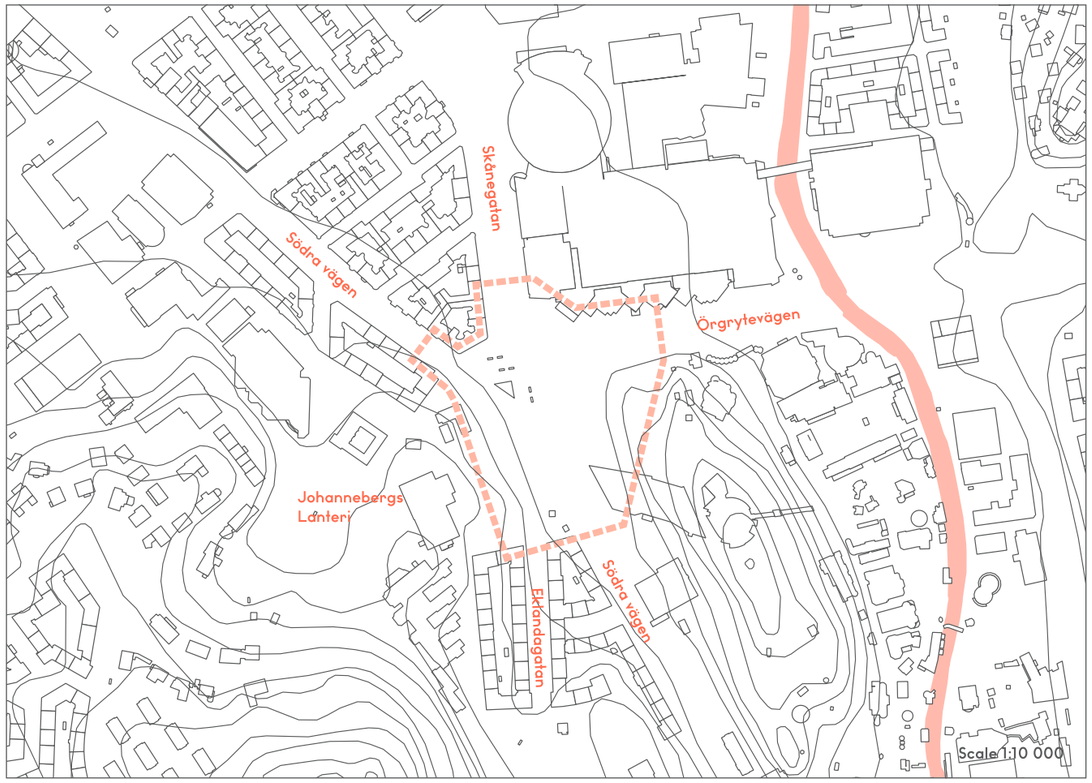
Inviting paths and logical connections:

- Korsvägen should be developed into an effective connection point, integrated with the existing paths of the city
- All paths of the city should run at ground level
- A fine grain of paths and consistent paths should be developed
- The exits of Västlänken should be safe to use and easy to find and locate

An inner city with room for everyday life:

- Buildings and parks around streets and places should be developed and given a variety of activities and destination points
- The urban space should be developed





in different scales and with different rhythms, suitable for everyday life as well as large happenings

Room for learning, experiences and meetings:

- The most important activities and businesses in the area should turn towards and address the city, creating a greater exchange with the surroundings and with each other
- Additional and converted development should take place in strategic places
- Experiences at eye level in the streetscape should be prioritized
- The history of the city should be present and visible through buildings, places and paths

Specifically for the area of Korsvägen, some more detailed goals and strategies have been distilled. They are:

- Continuous floors of pavement
- Distinct pedestrian paths
- Fewer “traffic islands”
- Green structure breaking off the traffic movements
- Bicycle parking in assembled zones that are not in the way of the assigned paths
- More places for staying
- The addition of water elements

A study has been carried out by Trafikkontoret (the traffic administration office) to examine whether the traffic situation should be solved with a traffic tunnel below ground or with a limitation of the traffic at ground level. The final assessment concluded that the development of the Korsvägen area should aim for a traffic solution where the traffic is kept at ground level, but where the flows are limited (Göteborgs stad, 2017, p. 18).

Opinions from the public

During the years of 2014 and 2015, the city of Gothenburg collaborated with citizens and visitors of the area of Korsvägen to gather knowledge about how the existing area was conceived. The main keywords used to describe the existing area by the representatives were: messy, chaotic, traffic, junction, central and nice (Göteborgs stad, 2016, p. 11). These are opinions and experiences that need to be considered and they will, of course, be an important part of the design process.

Figure 29 (Top Left):

Existing tram tracks and roads

Figure 30 (Bottom Left):

Existing topography

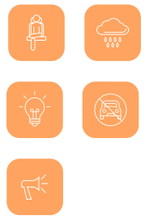
1. Station Korsvägen
2. Gothia Towers
3. Liseberg
4. Universeum
5. Scandinavium
6. Världskulturmuseet
7. Götaplatsen
8. Göteborgs universitet

Approximate project area

Analysing and evaluating the existing project site

Step 1: Macro scale principle factors

Step 2: Micro scale principle factors



Step 3: Micro scale provision factors

Before starting the process of creating a design proposal for the site, step 1, 2 and 3 of the design toolbox is consulted. This means, the three different categories of the design factors are analysed and evaluated. In this part of the booklet, only a discussion of a summary of the most important and representative results are presented. For a thorough review of all the different analyses and methods that are used, see Appendix 1.

On page 67, the conclusions that are drawn for each design factor are translated into the pedestrian index for the project site, representing the "before".

Step 1: Macro scale principle factors

Orientation

The project site is very open and broad and in that sense it offers pedestrians possibilities to orient themselves relatively well in the nearby urban context. Analyses of isovists taken from the five different entrance points show that most of the site can be overviewed when entering it (figures 31-35). What is interesting is that the isovist of the existing central area of the square shows that four of the connecting streets can be overviewed from here, but not the northern parts of Södra vägen (figure 36). Overviewing all five streets is only possible from the very southern part of the square, where the area accessible for pedestrians ends (figure 37).

Even though the site is open enough to offer possibilities for pedestrians to orient themselves, the design itself does not help orientation as the pedestrian routes are very complex, unnatural, narrow and not clearly defined. Pedestrians can understand the immediate next step, but making plans for their whole trip through and across the square takes more effort (figure 38).

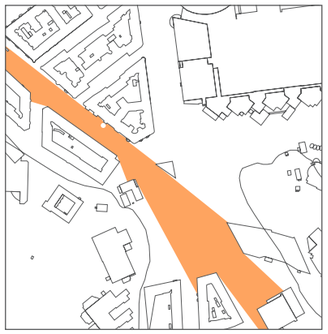


Figure 31: 360 degrees isovist from the northern parts of Södra vägen

Figure 32: 360 degrees isovist from Skånegatan

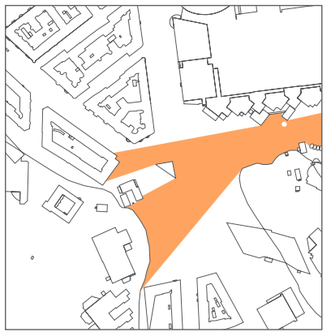


Figure 33: 360 degrees isovist from Örgrytevägen

Figure 34: 360 degrees isovist from the southern parts of Södra vägen

Figure 35: 360 degrees isovist from Eklandagatan

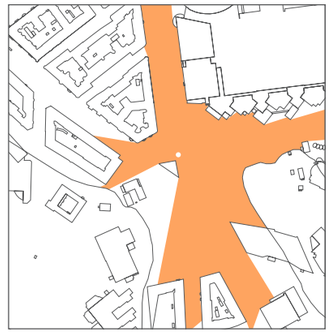


Figure 36: 360 degrees isovist from the existing central area of the square

Figure 37: 360 degrees isovist from the very southern end of the square

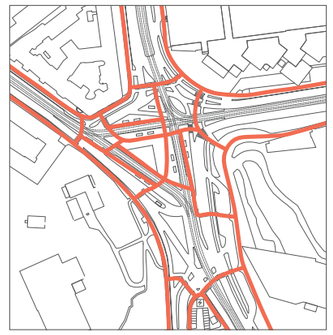


Figure 38: Existing project site, pedestrian paths

Connectivity

The design factor of connectivity is used to analyze both the general pedestrian network, where only the main pedestrian connections are represented, and the more detailed pedestrian network, representing all existing pedestrian paths within the project site to a very exact level. Angular integration centrality analyses of the general pedestrian network show that on a global scale it is well integrated into the surrounding urban network (figure 39 on page 60). This is achieved by many connections to the surrounding paths and the fact that the paths are constructed in the shape of a roundabout. However, analyses of the more detailed pedestrian network, show that these do not build on the potential of these global connections. The paths within the site are not direct and continuous and only the northern parts of Södra vägen are well-connected to the global network, at the same time as this street section is the only one not visible from the existing central area of the square (figure 40 on page 60).

The same pattern can be found in the angular betweenness centrality analyses, where the analyses of the general pedestrian network of the project site suggest a somewhat well-functioning through-movement (figure 41 on page 60), but where the analyses of the detailed pedestrian network indicate something else. These analyses show that the through-movement is cut off and does not reach across the square, because of too complicated routes and connections (figure 42 on page 60). Similar conclusions can be drawn for all radii used in the analyses, both on a local and a more global scale (Appendix 1, page 98).

Nodes

The conclusions that can be drawn considering the design factor of nodes are similar to the ones considering the design factor of connectivity. The project site clearly works as a node in the city, but lacks the contribution to the understanding of the surrounding network. When entering the site, the impression is chaotic and scattered and does not formulate the meeting of these five grand streets in a cohesive way. The design does not make use of the inherent qualities of the systems it is a part of.

Contextual qualities

The project site is surrounded by many important destinations that attract many visitors and users. It is also a very important destination in itself. There are no other considerably important contextual qualities nearby as the site is quite spatially enclosed by the two hills on each side of it.

Angular integration centrality

High
-
-
-
Low

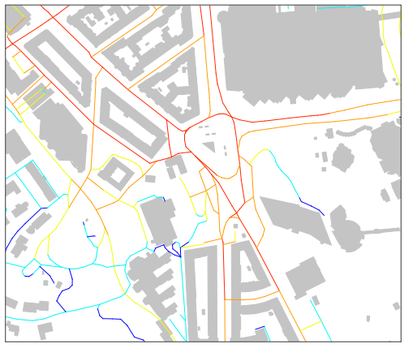


Figure 39: Angular integration centrality, 2 km, existing general pedestrian network

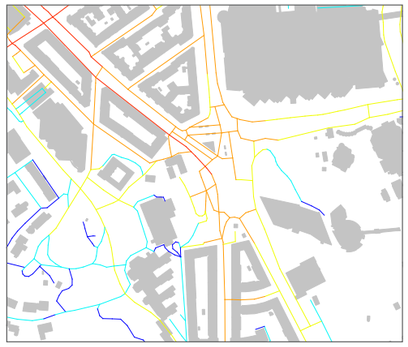


Figure 40: Angular integration centrality, 2 km, existing detailed pedestrian network

Angular betweenness centrality

High
-
-
-
Low

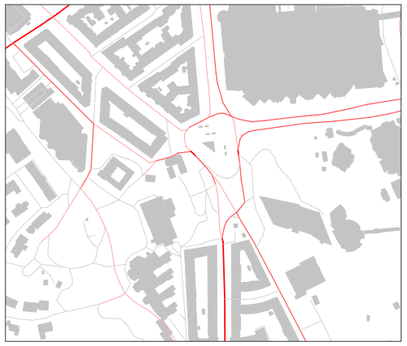


Figure 41: Angular betweenness centrality, 2 km, existing general pedestrian network

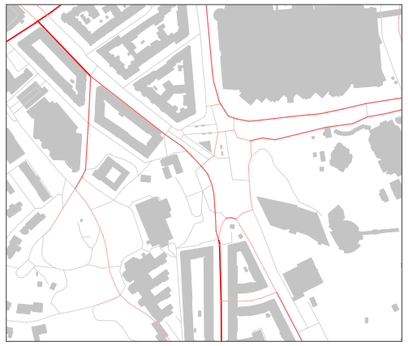


Figure 42: Angular betweenness centrality, 2 km, existing detailed pedestrian network

Attraction betweenness centrality

High
-
-
-
Low

Figure 43: Attraction betweenness centrality, 500 m, weighted, existing detailed pedestrian network

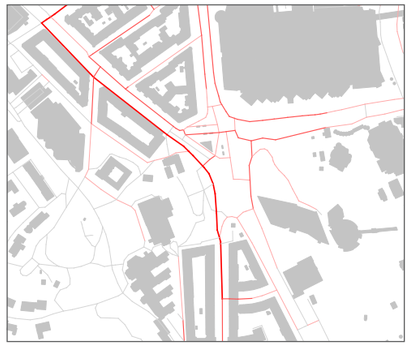


Figure 44: Attraction betweenness centrality, 2 km, weighted, existing detailed pedestrian network

Attraction betweenness centrality analyses that take into account the higher importance of the tram stations, the entrance to the station building and the entrances to nearby attractions compared to all other destination points in the area show, when looking at the detailed pedestrian network, that the site would benefit from having better "cross-connections" across the square. The analyses show that these are the connections that would potentially attain the highest through-movement, both on the very local scale but also on a more global scale (figures 43 and 44).

Whereas the angular betweenness centrality analyses show the potentials for general through-movement in the area, the attraction betweenness centrality analyses also take into account the important destination points that would potentially affect the movement patterns. This means that the angular betweenness centrality analyses discussed in connection to the design factor of connectivity are more relevant for pedestrian movements through the area, as opposed to the attraction betweenness centrality analyses discussed in connection to the design factor of contextual qualities

where the analyses have been adapted to the destination points inside of the project site. Both of these aspects are important and need to be considered in the new design proposal.

Step 2: Micro scale principle factors

Legibility

Concerning this project site, the design factors of orientation and legibility are quite similar since the site is not that large. What is concluded on the macro scale can also be found in the micro scale. There is no clear hierarchy between the routes and spaces of the square and the overall impression of the pedestrian routes is messy (figure 38 on page 59). This makes it hard for pedestrians to form a clear vision of how to make their way in and around it even though potential destination points can easily be identified through informative views. This is clearly a result of other transport modes being given higher priority, which is further discussed in the design factor of vehicular traffic measures.

Choices

The design factor of offering pedestrians several possible routes is definitely fulfilled in the project site. The problem is not that there is not enough choices, but that the different routes that exist are not legible.

Subdivision

The design factor of subdivision is one of the least relevant design factors in connection to this project site. The site is already too complex and fragmented and has a diversion of impressions that disturbs the experience. The challenge for this site is rather to find a calmness by softening the existing complexity, which is further discussed in the design factors of continuity and simplicity.

Dimensioning by pedestrian experience

The project site is, as already stated, a very open square, which means one would imagine that there is a lot of room for pedestrians to walk relatively freely. However, most of the pedestrian crosswalks and sidewalks are very strict and not very wide. This is an area where a lot of people gather from time to time, and the design does not allow for these kinds of flows. Considering different distances and dimensions creating different pedestrian experiences, and also different areas that are more or less private and social, this kind of spectrum can not be identified in the design. Most of the project site is completely open, and the dimensional impressions are very uniform.

Continuity

The design factor of continuity is one of the most relevant design factors in connection to this project site. This is a site where a lot of events and happenings take place, a lot of people move through and around the site each day and the design needs to minimize all the unnecessary interruptions and obstacles for the area to work as well as possible. This is not executed today. The project site is constituted by more than 50 traffic islands, creating almost unlimited amounts of physical and mental interruptions. It is hard to even walk a few meters without getting interrupted by passing cars, road signs, fences or curb sides (figures 45 and 46).

The only positive aspect in relation to this design factor is that the design allows pedestrians to remain at ground level, avoiding solutions incorporating bridges or tunnels that are disorienting or lacks human dimension.

Simplicity

The design factor of simplicity is also very relevant to this project site. In the same way that the design creates physical and mental interruptions, it also creates large amounts of visual clutter. As open and "simple" this project site may be, the design does not succeed at maintaining the integrity and coherence of the space as a whole. The site is broken up into too many details, parts and impressions (image 11 and 12 on page 62).

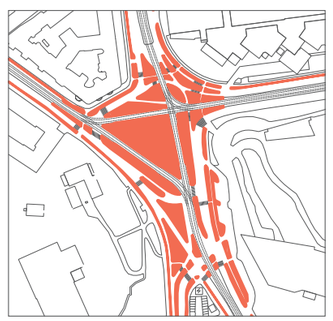


Figure 45: Existing project site, mental barriers (traffic islands)

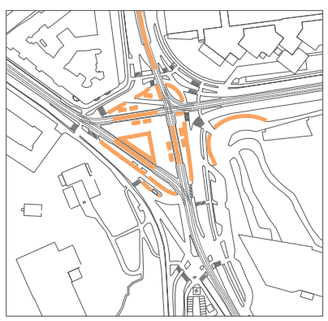


Figure 46: Existing project site, physical barriers (fences, walls and buildings)

Image 11: View from the north-east end of the square towards the entrance of Svenska Mässan (author's own photos)

Image 12: View from the north-east part of the project site (author's own photos)

Visual connectivity

The project site is open and broad and the station building in the middle of the square is the only part of the site functioning as a visibility boundary framing the pedestrians' fields of view on the eye level, apart from the obvious boundaries in the form of the surrounding building blocks and hills. Other smaller obstacles create visual clutter and disturb the views, but these obstacles can not be categorized as visibility boundaries. Analyses of isovists from the different entrance points to the site show that most of the site is always visible from these viewpoints (figures 31-35 on pages 58-59).

The visual connectivity analysis highlights which parts of the site are more or less visually connected to all other locations, meaning which parts are more visually prominent and offer a better overview and vice versa. As the site is designed today, the best overview is offered from the area south of the square showed in red, a part of the site assigned to trams and cars which is not accessible for pedestrians (figure 47).

The through vision analysis calculates how many lines of visibility pass through each location and highlights movement potentials in a design layout. This analysis indicates that the three areas having the best movement potentials can be found south, south-east and north-east of the station building (figure 48). Two of these locations are assigned to traffic and parking lots and the third is blocked by a low protection wall (figure 46 on page 61).

The conclusion that can be drawn in connection to the design factor of visual connectivity is that the existing design does not work with the design factor in a satisfying way. The areas with the best visibility and movement potentials are not offered to pedestrians but occupied by traffic.

Directness

In connection to this project site, the design factor of directness has already been discussed in several of the other design factors, mainly in connection to orientation, contextual qualities and legibility. There is also another type of space syntax analysis that gives clues about potential existing "desire lines" of the project site. That is, the axial map. Axial lines are defined as the

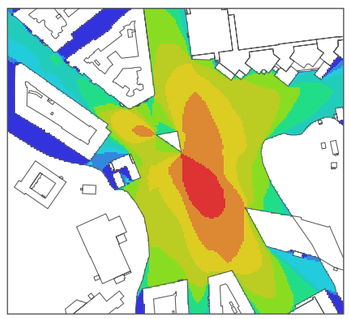


Figure 47: Visual connectivity analysis, existing project site

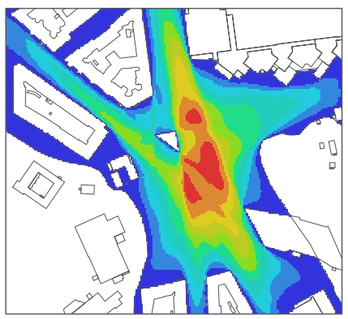


Figure 48: Through vision analysis, existing project site

Figure 49: Axial map with fewest lines, existing project site

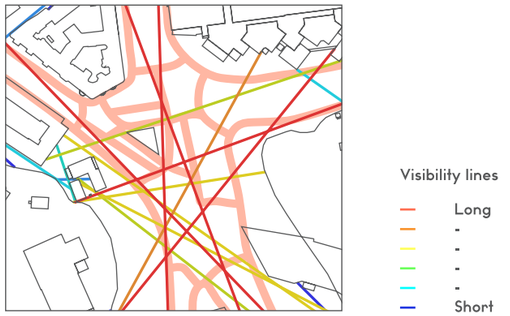


Figure 50: Existing pedestrian paths overlapped by axial map with fewest lines

longest visibility lines for representing spaces in urban environments, and the least number of axial lines that cover the space constitute the axial map. As pedestrians prefer routes that are as straight as possible and that approximates the direction of their final destination as well as possible, axial lines give an indication of where "desire lines" are most likely to appear.

Comparing the axial map of the existing situation with the mapping of the existing pedestrian paths, we can see that there is a clear contrast between the potential existing "desire lines" and the actual configuration of the pedestrian paths (figure 49 and 50). The center of the "star" that appears, as a result of the red axial lines intersecting, is the area of the project site that has the lowest density of pedestrian paths. However, some sections of the existing pedestrian paths coincide with the "desire lines". These are also the ones popping up in the angular network betweenness centrality analyses.

Permeability

In relation to the design factor of permeability, the design does not offer many uses for pedestrians to engage in, and the building frontages that do exist are not very pedestrian-friendly and does not invite much interaction. Right now the project site is mainly a site for through-movement, it is just a public transportation node with a simple and enclosed station building and some benches and bus shelters.

Transparency

The design factor of transparency is not very well executed in connection to this project site. The buildings that exist do not allow pedestrians to see what the insides look like and what is happening there. Mainly because the buildings that exist in the surrounding area are too far away and too introvert, and because the building on the square is not designed to offer transparency. Also, the existing station building is designed so that is has two front sides and one back side, where the back side is the one directed to the south-west. However, this part of the project site is in no way a back side and the building should address the surroundings equally on all sides.

Definition

Visual inspections of the project site clearly shows that the design does not work with the design factor of definition. This is even more evident when analyzing the site from simple aerial images from above. The only thing that the design is very successful at framing is the activity of the vehicular traffic that takes place at the site (image 13 on page 64). Furthermore, these traffic flows are the only perceptual barriers for the pedestrians.

The design does not give the impression of being intentional, the space is not defined and clearly contained for the pedestrians that are supposed to use it. The area that is most defined is the triangular square in the middle, however, this conceptual definition is weak as it is not defined as a perceptual enclosure (image 14 on page 64). The project site is defined by the void that is created between the surrounding buildings because of the streets passing, but the design does not build on and reinforce this spatiality in any way.

Step 3: Micro scale provision factors

Places for staying

The design factor of places for staying is partly fulfilled, there are benches along all sides of the station building and benches by the bus shelters (figure 51 on page 64). The benches along the station building offer more mental support than the individual benches by the bus shelters. However, the configuration of the places for staying as well as their connections to each other do not create potential for social interaction. The design does not work with beneficial distances between and placements of the places for staying. Also, the attempts to incorporate more places for staying, and of different types, into the overall design are weak.

Image 13: Aerial view of the existing project site

Image 14: Perspective of the existing project site

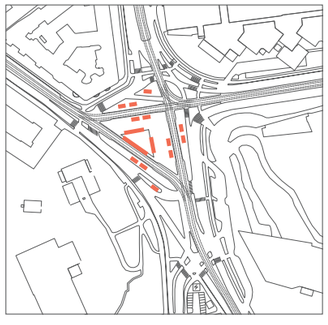


Figure 51: Existing project site, places for staying

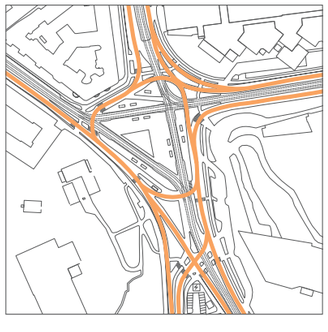


Figure 52: Existing project site, car routes

Figure 53: Existing project site, bicycle routes

Climate shelter

Similar to the design factor of places for staying, the design factor of climate shelter is partly fulfilled in the project site. There is protection from unwanted weather, but only along the edges of the station building and by the bus shelters. The attempts to further incorporate climate shelter into the overall design could be improved.

Lighting

Visual inspections of the site show that the area is well lit at all times of the day, mainly by several low lampposts scattered across the square and the surrounding paths, but also by three tall lampposts in each corner of the square. However, lighting is not used as a design tool to clarify and strengthen the pedestrian routes or to highlight the edges and shapes of the design.

Vehicular traffic measures

The design factor of vehicular traffic measures is one of the most important and relevant design factors in connection to this project site, and it is also one of the design factors that has been executed in the poorest way. Mappings, visual inspections and direct observations all show that the vehicular traffic modes and flows are clearly prioritized in the project site. The design is not in any way adapted to the pedestrian movement that takes place, or could take place, here. The car roads and the bicycle paths are extremely simple and direct compared to the pedestrian paths, which are forced to exist in the areas that are left over, strongly affecting the pedestrian experience (figure 38 on page 59, figure 52 and 53). The car roads are also constituted by several lanes on all sides of the square, allowing for high flows of traffic.

Both angular integration centrality and angular betweenness centrality analyses of the motorized network show that the project site is central both on a local and a global scale, causing a lot of to-movement and through-movement in the area (figure 54-57). The more local angular betweenness centrality analysis shows that the street section just north of the station building is very central for through-movement (figure 56) and the more global analysis shows the same usage for the street section to the east of the station building, directly connecting the southern parts of Södra vägen to Skånegatan (figure 57). This is a natural result of the project site being designed as a roundabout for vehicular traffic. Both sets of analyses also indicate that all roads passing on each side of the square are central, even as they are not making use of the street sections belonging to the actual roundabout.

The direct result of this is that all existing pedestrian crossings in the area are heavily trafficked and hard for pedestrians to cross. The vehicular traffic is predominant and pedestrians are most likely left with the feeling of having to adapt to its rhythm and existence. Changes being made to the motorized network can alter both the angular integration centrality values and the angular betweenness centrality values, redirecting some of the vehicular traffic to other adjacent parts of the network where it has a decreased impact on the direct pedestrian experience.

Soundscape

The project site is naturally a very noisy area of the city, as a lot of tram traffic and vehicular traffic travels through here today. The design factor of soundscape is therefore very important, but also very hard to work with. The design is clearly facing towards the noise, rather than aiming at creating spaces that escape from it, creating an overall unsuccessful and noisy soundscape. Also, there are no positive sounds incorporated into the design.

One way of working with the design factor of soundscape is naturally to decrease the vehicular traffic in the nearby area, as discussed in the vehicular traffic measures. Not only will the pedestrians be better prioritized, but the soundscape will also be directly affected in a positive way.

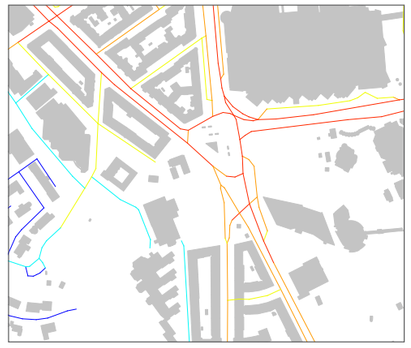


Figure 54: Angular integration centrality, 2 km, existing motorized network

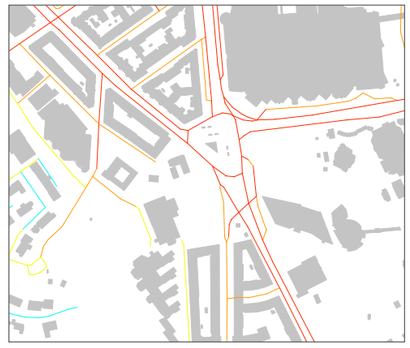


Figure 55: Angular integration centrality, 10 km, existing motorized network

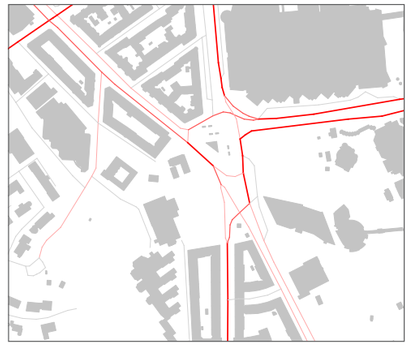


Figure 56: Angular betweenness centrality, 2 km, existing motorized network

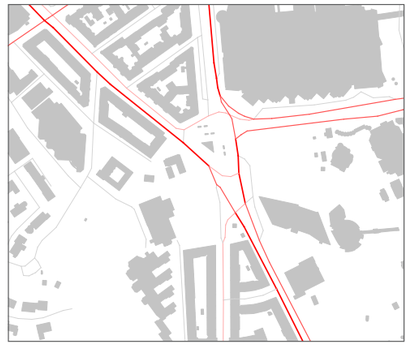
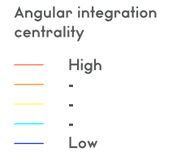
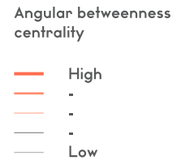


Figure 57: Angular betweenness centrality, 10 km, existing motorized network





The six main goals for the design proposal

Six main goals for the design proposal are developed based on the findings from the evaluation, but also based on my personal aims and desires for the project site. However, the two always influence each other. The evaluation steps do not provide a clear answer of what changes can and need to be done, the result of the evaluation process is of course affected by the aims and desires of the specific architect or planner and vice versa.

Prioritize the pedestrian freedom and the pedestrian activity

The design proposal for the project site should be shaped by the pedestrian movements in the area and the first priority should be the pedestrian experience. The design should aim at reducing the to-movement and through-movement of the vehicular traffic, creating a safer, quieter and calmer area. Design choices, both on a general and detailed level, should aim at framing and reinforcing the pedestrian activity, making the motorists feel like guests when entering the project site.

Create a feeling of coherence and calm

The design proposal for the project site should heavily reduce the amount of mental and physical barriers, creating a more coherent and calm impression. The design should be connected to and suit the surrounding city, becoming a part of the city that makes sense and does not feel like too much of a break.

Better incorporated and connected pedestrian paths, both locally and globally

The design proposal for the project site should create pedestrian paths that are well-functioning and well-connected both on a local and a global scale. That is, the pedestrian paths should support both the local movements to and from destinations within the project site, such as the tram stations, the underground train stations and the entrances to the important building complexes, but also allow for more global movements to pass through the area in a smooth and effortless manner. The local pedestrian paths incorporated into the design should also build on the potentials of the existing global pedestrian connections.

Pedestrian paths that are readable and clear

The design proposal for the project site should create simple, natural and clearly defined pedestrian paths, routes that make sense and are easy to read. The pedestrian paths should further aim at coinciding with the presumable “desire lines”. The design should offer a clearer hierarchy between paths and spaces and the pedestrian paths should offer more freedom and be able to handle larger flows.

Better interplay between placement of buildings, design elements and pedestrian paths

The design proposal for the project site should offer and consider different levels of visual overview and exposure and these visual properties should be translated into the design choices and the placement of buildings, design elements and pedestrian paths. The design of the project site should offer more dimensional variety, creating different pedestrian experiences and it should also, to some extent, work with dimensioning to create a wider diversity of more open and social areas as well as more enclosed and private areas. More places for staying of different types should also be incorporated.

Better usage of the inherent qualities of the project site

The last and most important goal for the design proposal is that it should take better advantage of and use the inherent qualities of the project site, in relation to all possible design factors. The design should, for example, derive from the contextual qualities of the site and its location in the city, the overall street network and existing patterns of centrality and the geometry and spatiality of the open space. This means, using the analyses and design factors in such a way so that we better understand the site itself and can better adapt the design choices to its nature and the nature of its location in relation to the city as a whole.

The pedestrian index

Orientation

Weight = 3
Score = 3
Weight x Score = 9

Connectivity

Weight = 3
Score = 3
Weight x Score = 9

Nodes

Weight = 3
Score = 1
Weight x Score = 3

Contextual qualities

Weight = 2
Score = 2
Weight x Score = 4

Legibility

Weight = 2
Score = 2
Weight x Score = 4

Choices

Weight = 2
Score = 5
Weight x Score = 10

Subdivision

Weight = 1
Score = 4
Weight x Score = 4

Dimensioning by pedestrian experience

Weight = 3
Score = 2
Weight x Score = 6

Continuity

Weight = 3
Score = 2
Weight x Score = 6

Simplicity

Weight = 3
Score = 1
Weight x Score = 3

Visual connectivity

Weight = 3
Score = 2
Weight x Score = 6

Directness

Weight = 3
Score = 2
Weight x Score = 6

Permeability

Weight = 1
Score = 2
Weight x Score = 2

Transparency

Weight = 1
Score = 3
Weight x Score = 3

Definition

Weight = 3
Score = 1
Weight x Score = 3

Places for staying

Weight = 2
Score = 3
Weight x Score = 6

Climate shelter

Weight = 2
Score = 4
Weight x Score = 8

Lighting

Weight = 2
Score = 3
Weight x Score = 6

Vehicular traffic measures

Weight = 3
Score = 1
Weight x Score = 3

Soundscape

Weight = 3
Score = 2
Weight x Score = 6

Chosen weight for each design factor

The decisions concerning which design factors are the most important are done mainly based on the six chosen main goals for the design proposal, but also based on the character of the project site. Since the chosen project site is a trafficked square, quite open and large, some of the design factors are not as relevant as they would be if the project site was a street, a network of streets or a site where more buildings were incorporated. The importance of the site relative the urban context and the placement of potential surrounding contextual qualities also determines whether some design factors are more or less important.

The most relevant design factors are: Orientation, connectivity, nodes, dimensioning by pedestrian experience, continuity, simplicity, visual connectivity, directness, definition, vehicular traffic measures and soundscape.

The second most relevant design factors are: Contextual qualities, legibility, choices, places for staying, climate shelter and lighting.

The least relevant design factors are: Subdivision, permeability and transparency.

Scoring of each design factor

The scoring is based on the result of the analyses and evaluation of the project area.

Result

Total score = 107
Total score / 20 =
Pedestrian index = 5,35

Design process of the new design proposal

In this section, step 4 and 5 of the design toolbox is consulted. This means that a design proposal is generated by consulting the results from the analyses and the evaluation and this design is tested by using the analyses and the evaluation once again in an iterative process. The design process is broken down into the several main steps that are taken and each step is discussed and explained through illustrations and analyses. The final plan is used throughout the section to highlight the different steps. The final plan with a detailed legend can be found on page 86-87.

Naturally, the design process has not been as linear and systematized as it might seem from the explanations, the different parts of step 4 and 5 have been utilized in the order that fit this very design process. Several decisions have been taken simultaneously based on the way that they affect each other. For clarity, in this section the process is presented in a linear manner.

As the local building authority already has developed a design proposal for the project site, my design process relates to both that design proposal (figures 58-60) and the existing situation. However, the main approach is to look at the project site itself and to adapt the design choices to its nature.

In this part of the booklet, only a discussion of a summary of the most important and representative results are presented. For a thorough review of all the different analyses and methods that are used, see Appendix 2.

On page 85, the conclusions that are drawn for each design factor are translated into the pedestrian index for the project site, representing the “after”.

Figure 58: Design proposal developed by the local building authority, car routes

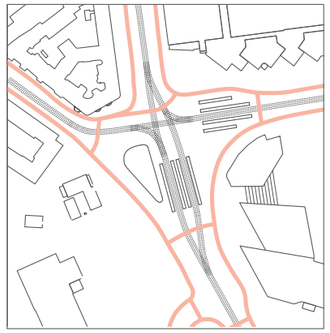


Figure 59: Design proposal developed by the local building authority, bicycle routes

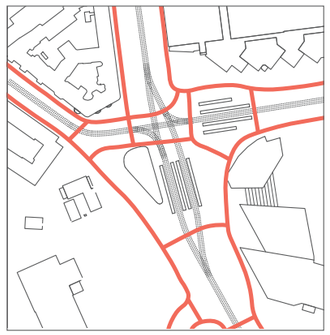


Figure 60: Design proposal developed by the local building authority, pedestrian paths

Change of the traffic situation

The predominant traffic roundabout is removed completely, redirecting some of the traffic to adjacent streets and connections. This results in potentially changed and reduced traffic flows, both considering to-movement and through-movement (figures 62-73 on pages 70-71). A new and smaller roundabout is created in the very south part of the area to keep some of the previous movement possibilities. This roundabout is much more anonymous and will not steal as much of the attention as the previous one did. The design proposal developed by the local building authority includes a roundabout that is located in a north-south direction. This is changed to a roundabout located in a west-east direction. The angular network betweenness analyses with a radius of 10 km indicate that a roundabout in the west-east direction will potentially lead to higher through-movement in the eastern parts of the project site, compared to a roundabout in the north-south direction. The difference compared to the existing situation is still evident though. This effect is permitted as a west-east direction of the roundabout has several other advantages that are more important for the design of the project site, both the extension of the pedestrian space but also the possibility for one of the tram stations to be moved further south. Apart from the change of the direction of the roundabout, the main intentions from the proposal of the local building authority is kept. The street section to the east of the project site is moved further east to extend the middle of the square even more.

As this modification of the traffic situation results in an extension of the area accessible to pedestrians, it increases the possibilities to convert the area into a public space rather than a traffic junction or a public transportation node. Also, all roads surrounding the square now consist of one lane which further extends the pedestrian area and also reduces the traffic flows.

Bicycle routes are added next to the car routes, with a buffer zone of one meter in between to keep cyclists away from the immediate traffic. The bicycle lanes themselves also work as buffer zones between the pedestrian paths and the motorized traffic.

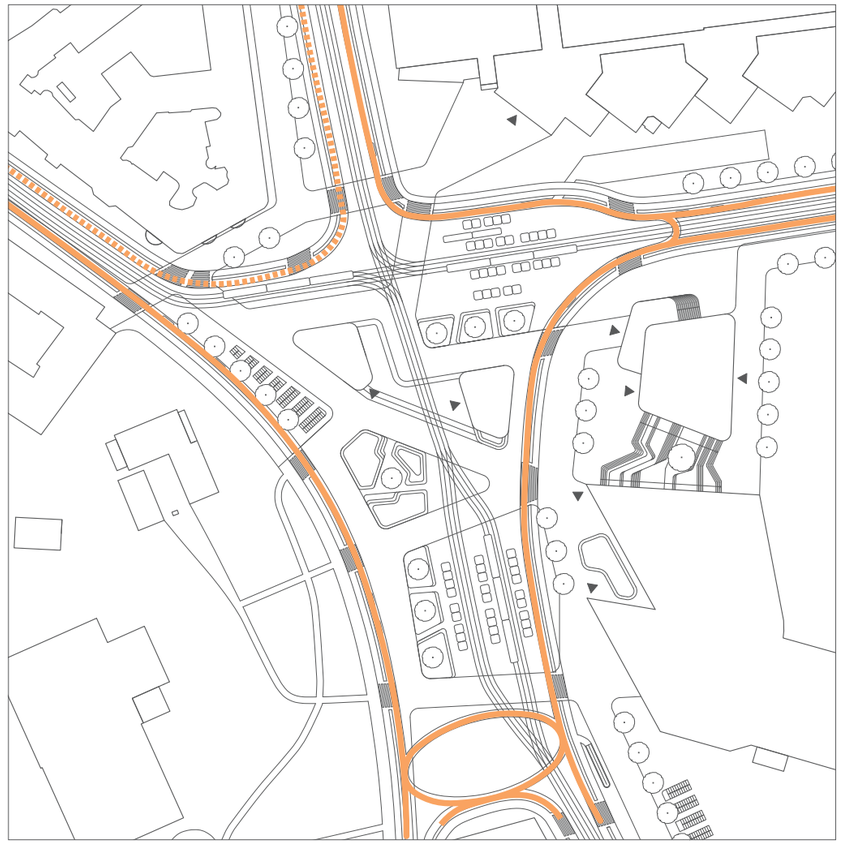
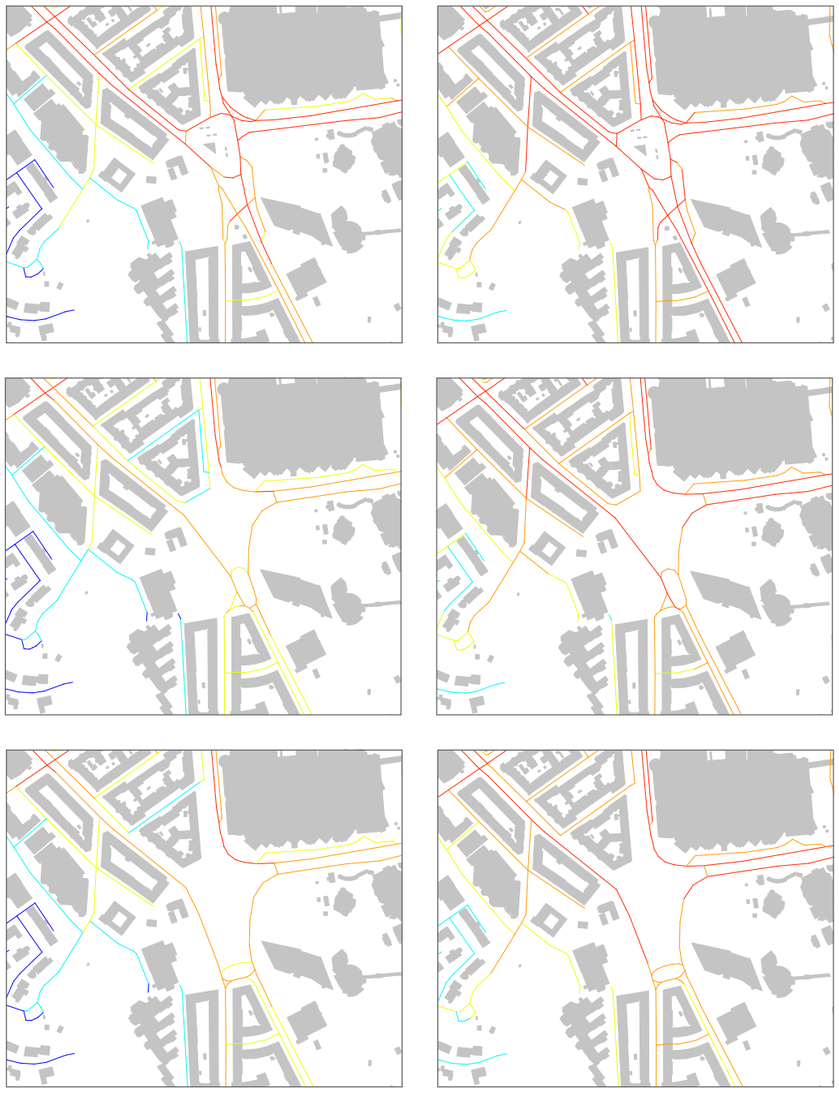


Figure 61: Change of the traffic situation, my final proposal



Angular integration centrality

- High
- -
- -
- Low

Figure 62-64: Angular integration centrality, 2 km, motorized network, existing situation (figure 62, top), proposal by the local building authority (figure 63, middle) and my proposal (figure 64, bottom)

Figure 65-67: Angular integration centrality, 10 km, motorized network, existing situation (figure 65, top), proposal by the local building authority (figure 66, middle) and my proposal (figure 67, bottom)

Figure 68-70: Angular betweenness centrality, 2 km, motorized network, existing situation (figure 68, top), proposal by the local building authority (figure 69, middle) and my proposal (figure 70, bottom)

Figure 71-73: Angular betweenness centrality, 10 km, motorized network, existing situation (figure 71, top), proposal by the local building authority (figure 72, middle) and my proposal (figure 73, bottom)

Angular betweenness centrality

- High
- -
- -
- Low

Creation of a new central area

The next step is to consult the isovist analyses of the empty area to find the most suitable placement of the central parts of the square. To allow for good orientation and legibility, the central area is placed and designed somewhere around the point where the overview and exposure is the highest and where all five connecting streets have the best potential of being overviewed clearly. This very point is further south than the previous central area of the square (figure 75) and the design proposal will have to adapt to this new placement of the central area from the initial design stages.

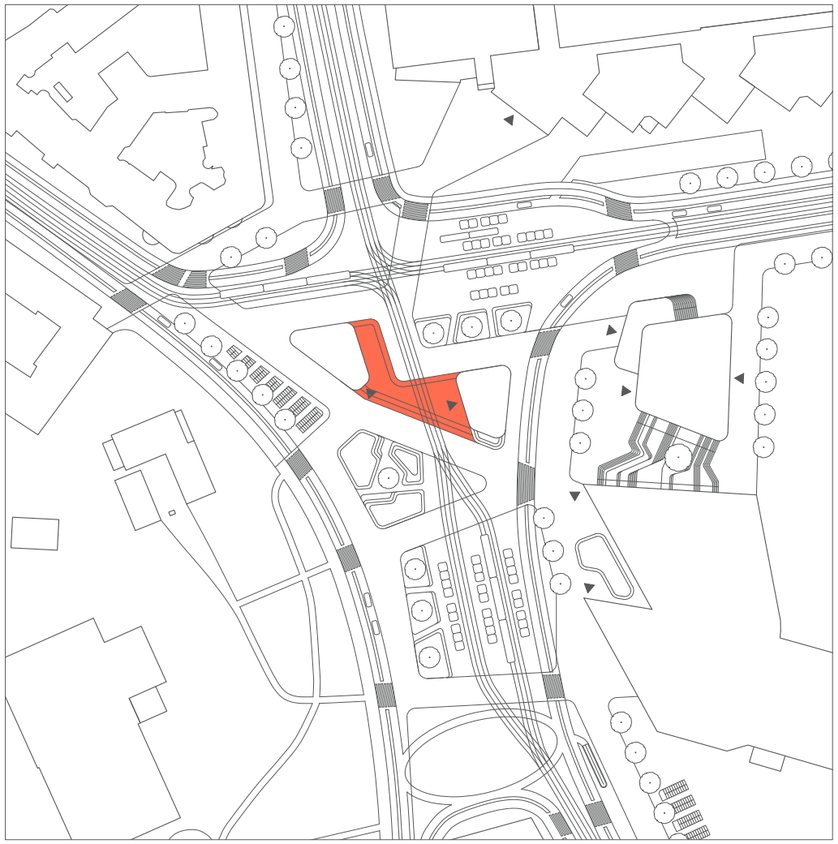


Figure 74: Creation of a new central area, my final proposal

Figure 75: 360 degrees isovist from the point with the best overview, empty project site

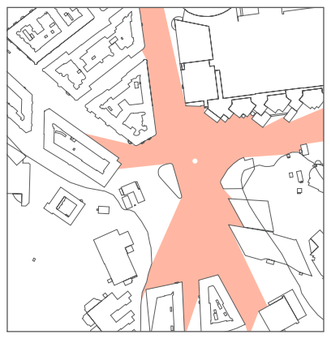


Figure 76: 360 degrees isovist from the central area of the square of the proposal by the local building authority

Incorporation of new pedestrian paths

The first simple iterations of the pedestrian paths are developed from the axial map of the empty area, where the aim is to capture the main movement directions of the most important axial lines as they give an indication of where the natural "desire lines" are most likely to appear (figures 78-79 on page 74). The through vision analysis is also used as it shows which parts of the empty site have the best potentials for pedestrian movement, based on the existing spatial layout of the site (figure 80 on page 74). These main movement directions are then slightly adapted so that they pass through the central area of the square, creating a natural connection point. Looking at the main movement directions added to the visual connectivity analysis, it is clear that they are concentrated around the area of the empty site that offers the best overview, which goes hand in hand with the analyses done to find the most suitable central area of the square (figure 81 on page 74). The result is three main movement directions forming the shape of a cross with six arms. The aim of the design proposal is to preserve these main movement directions as well as possible, going further in the process.

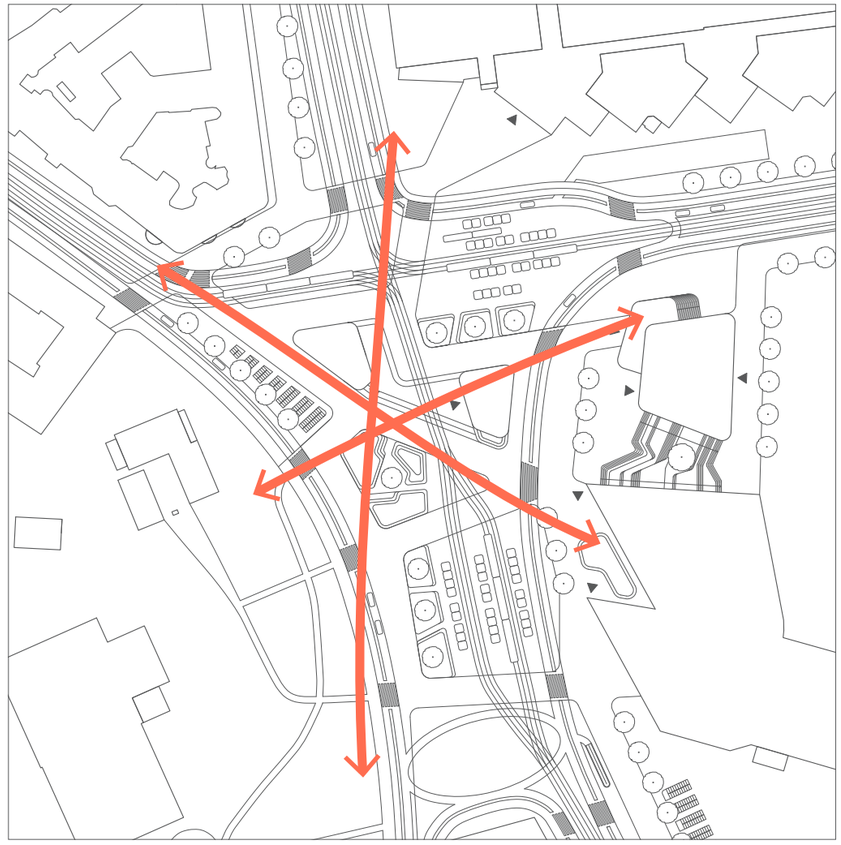


Figure 77: Incorporation of new pedestrian paths, my final proposal

Visibility lines

Long
-
-
-
Short

Figure 78: Axial map with fewest lines, empty project site

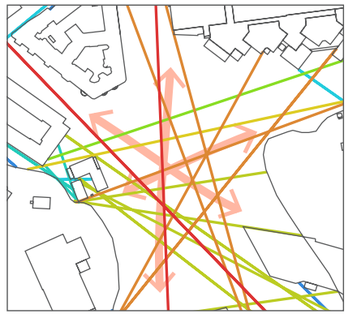


Figure 79: Axial map with fewest lines, empty project site, main movement directions added

Exposure and visual connectivity

High
-
-
-
Low

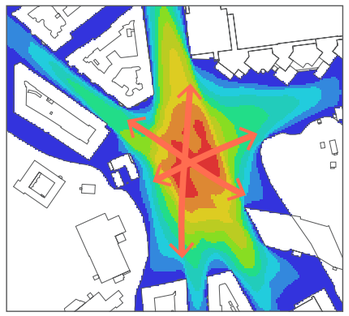


Figure 80: Through vision analysis, empty project site, main movement directions added

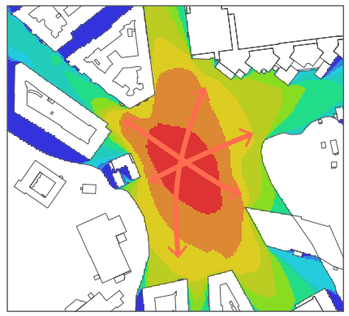


Figure 81: Visual connectivity analysis, empty project site, main movement directions added

Addition of the tram lines and the new tram stations

Included in the plans of the local building authority is a new placement of the tram tracks at the site (figures 58-60 on page 68). The tracks to the west of the existing station building are to be removed, so that the existing triangle of tracks disappears and the new tram tracks create a single cross instead. The new design proposal will include two tram stations instead of three, but where one of them allows for two trams going in the same direction to stop next to each other at the same time. The new tram stations are also longer than the previous ones, allowing for the use of new trams that are 45 meters long compared to the existing trams of 30 meters.

The main idea presented by the local building authority considering the tram tracks and the stations is preserved. The single tram station is kept in the north-east parts of the square, just outside the main entrance to Gothia Towers, and this station is also surrounded by bus stops on both sides. However, the double tram station is placed further south, just outside the entrance to Universeum. This allows for more freedom in the middle of the square as important pedestrian paths can cross this area without the interruption of a large tram station.

The pedestrian paths aim at crossing the tram tracks with an angle as close to 90 degrees as possible. In that sense the crossing time is shorter and the tram tracks are also easier to spot and notice as they clearly formulate a break.

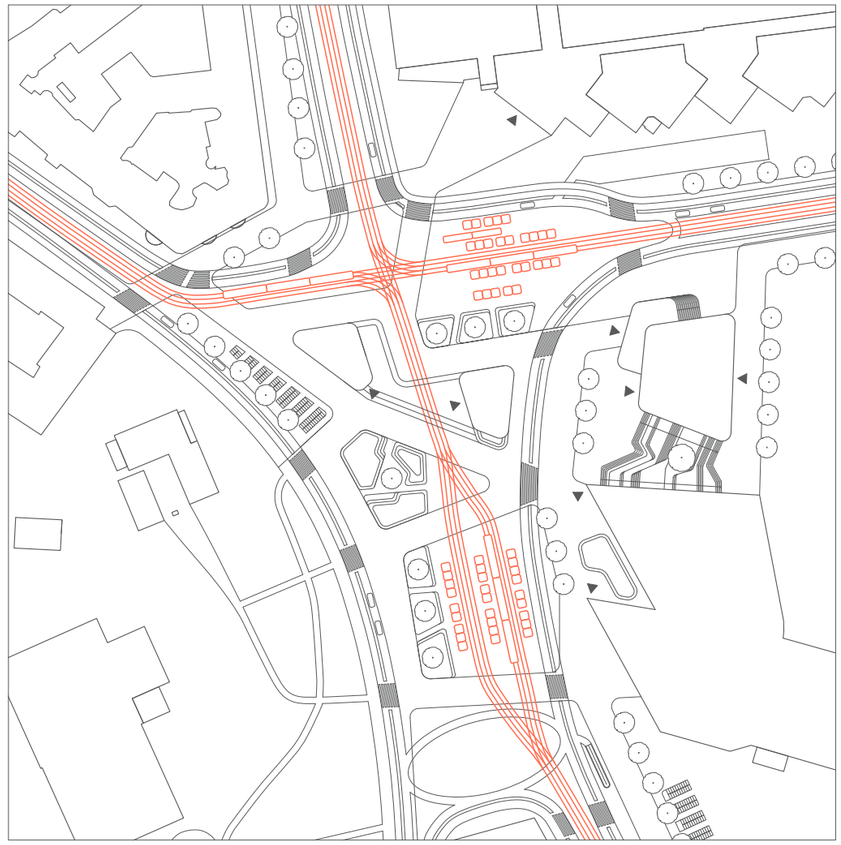


Figure 82: Addition of the tram lines and the new tram stations, my final proposal

Addition of new buildings and other larger stationary design elements

When the main movement directions are decided, it is time to place buildings and other larger stationary design elements, for example seating areas and areas assigned for bicycle parking. The visual connectivity analysis is used to make sure that, when placing buildings, the areas attaining the highest exposure are areas that are accessible to pedestrians (figure 88 on page 77). The through vision analysis is also used to make sure that the areas attaining the highest potential for through-movement coincide with the actual areas assigned for pedestrian movement (figure 89 on page 77).

Several different iterations were tested to attain the best option considering where to place buildings (Appendix 2, pages 124-127). Quite early in the design process, it became clear that two smaller buildings would benefit the area more than just one large building. Two smaller buildings allow for a better general exposure of the project site and for a more open central area, where the buildings can face each other and frame the central area without blocking any important pedestrian paths or views. Another advantage of two buildings is the better overview of surrounding contextual qualities, for example the view over the hill to the west of the project site. This view is much more blocked in the proposal of the local building authority.

The isovist from the central area of the design proposal shows that four of the five connecting streets can still be overviewed from this point (figure 90 on page 77). Örgrytevägen is only partly visible, but that is mainly due to the new building that is planned in the eastern parts of the area which is part of the plans of the local building authority, however slightly redesigned in my design proposal. Different building placements resulted in different exact positions of the central area, where the aim was to provide a central area not being too close to the tram tracks (figure 91 on page 77).

Depending on what kind of activity present, the design elements are placed differently. For example, the building that houses the entrance to the underground train is placed very near the central area of the square where many pedestrian paths meet to create easy access (the western building), but the building with the very best overview nearby

is assigned to a café or a restaurant (the eastern building). Outdoor seating areas are placed in areas with different levels of overview but in areas that can not be occupied by buildings as they would block the visual connectivity across the square too much. Larger areas for bicycle parking are placed in the edges of the square where the pedestrian movement is low and the access to the bicycle paths are easy, in order not to block any important pedestrian movements.

The process of placing pedestrian paths, tram tracks, tram stations, buildings and other larger design elements is naturally something that goes hand in hand and needs to be done somewhat simultaneously. Visual connectivity, through vision and axial lines analyses are used together with angular integration centrality, angular betweenness centrality and attraction betweenness centrality analyses throughout the process to see which placements of the different design elements are the most beneficial in combination with the tram tracks, tram stations and pedestrian paths.

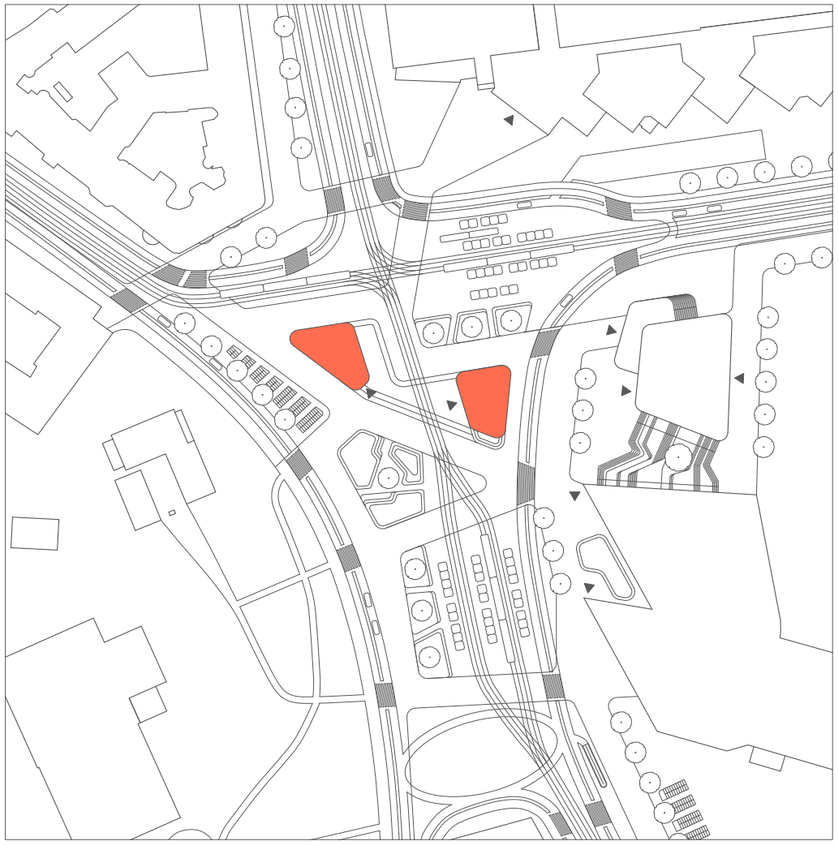


Figure 83: Addition of buildings and other larger stationary design elements, my final proposal

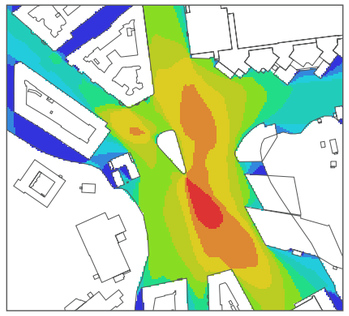


Figure 84: Visual connectivity analysis, added buildings, proposal by the local building authority

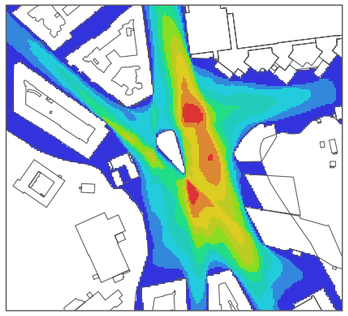


Figure 85: Through vision analysis, added buildings, proposal by the local building authority

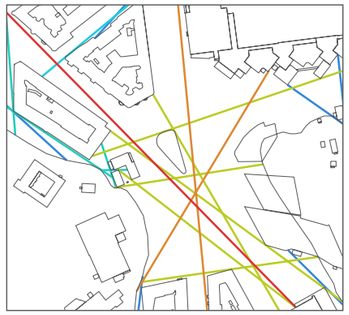


Figure 86: Axial map with fewest lines, added buildings, proposal by the local building authority

Figure 87: Axial map with fewest lines, added buildings and pedestrian paths, proposal by the local building authority

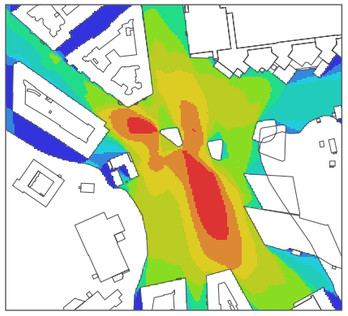


Figure 88: Visual connectivity analysis, added buildings, my proposal

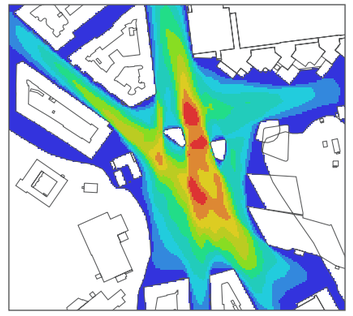


Figure 89: Through vision analysis, added buildings, my proposal

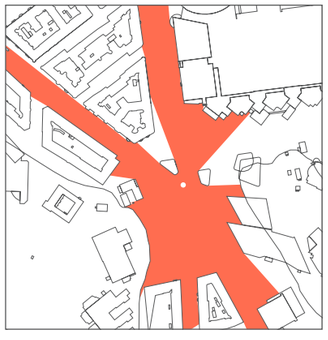


Figure 90: 360 degrees isovist from my proposed central area of the square, added buildings

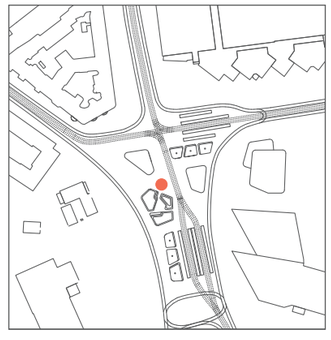


Figure 91: Position of the central area in relation to the tram tracks

Adaptation of the pedestrian paths to the local design and attractions

As this is a site which houses a lot of important destination points, the pedestrian paths also need to be adapted to those and not only to the global movements. Apart from the station building in the western parts of the square and the two tram stations, other new important destination points are created such as the building housing the second entrance to the underground train station to the east of the square and a new public stair created in between that building and the extension of Universeum. The entrances to Gothia Towers and Liseberg stay the same and have the same importance.

Axial map analyses with the buildings added are used to see where new “desire lines” appear in relation to the buildings and the pedestrian paths are adapted so that they, once again, capture the main directions of the most important axial lines (figures 97-98). Some pedestrian paths are headed directly towards the important destination points, others are passing just next to the destination points. This creates a variety of different views where some are long and almost uninterrupted and others are shorter and showcase important elements, where the ending points are chosen carefully so that they help orientation and legibility. Ending points are for example interesting buildings, entrances and important attractions within the area but also other important surroundings views.

Angular integration centrality, angular betweenness centrality and attraction betweenness centrality analyses are used to evaluate the potential effects of the new pedestrian network. The analyses of my design proposal are showed together with analyses of the existing situation to allow for easy comparisons.

The angular integration centrality analyses of my design proposal show that the three main movement directions discussed earlier attain the highest centrality values, both on a local and global scale, indicating that these will be the most central paths. As these paths are central in both scales, they will be important for orientation and legibility as, on them, pedestrians understand where they are in relation to the context but also in relation to the surroundings. They are important for the understanding of how to move within the square but also through. The

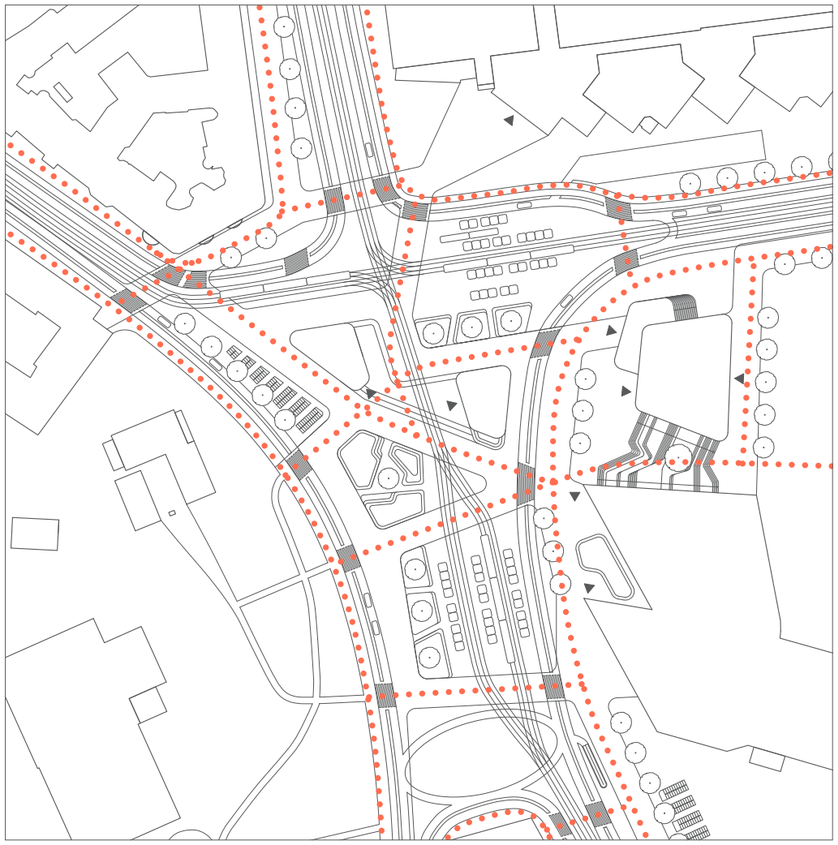


Figure 92: Adaptation of the pedestrian paths to the local design and attractions, my final proposal

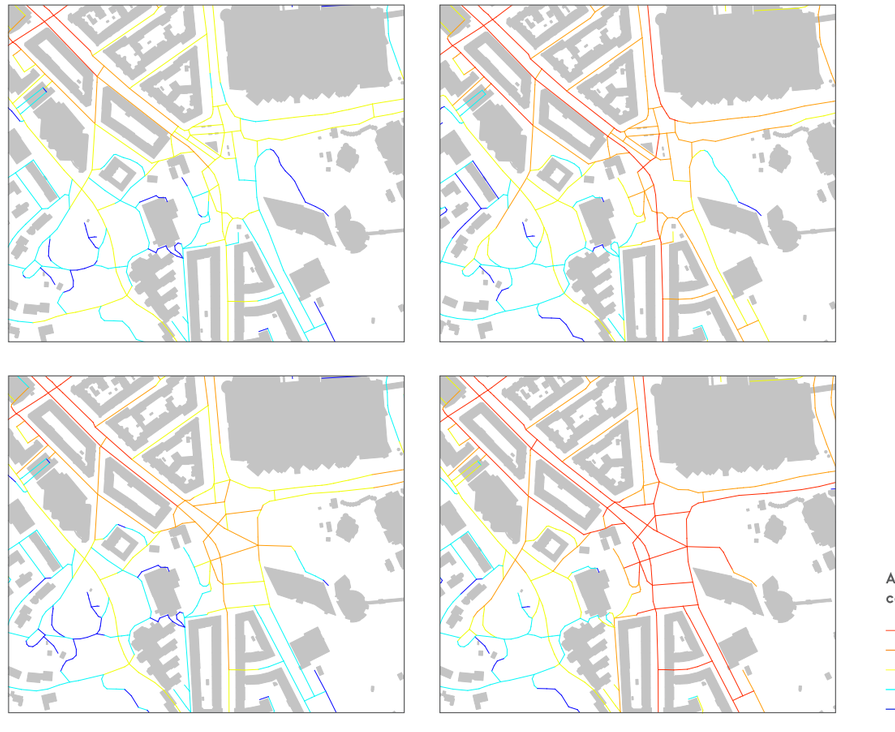


Figure 93-94: Angular integration centrality, 1 km, detailed pedestrian network, existing situation (figure 93, top) and my proposal (figure 94, bottom)

Figure 95-96: Angular integration centrality, 5 km, detailed pedestrian network, existing situation (figure 95, top) and my proposal (figure 96, bottom)

Figure 97: Axial map with fewest lines, added buildings, my proposal

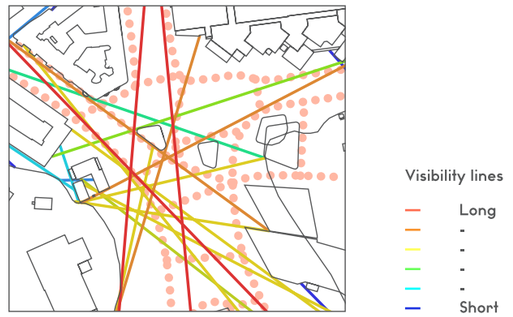


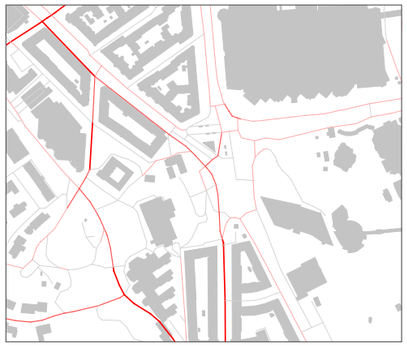
Figure 98: Axial map with fewest lines, added buildings and pedestrian paths, my proposal

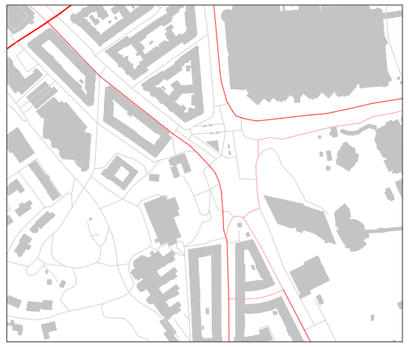
analyses also show that all five connecting streets gain higher centrality compared to the existing situation, indicating that the new pedestrian paths do not only build on the global potentials, but also reinforce the global network (figures 93-96).

The angular betweenness centrality and the attraction betweenness centrality analyses tell the same story, where the main movement directions get higher values in both scales as well (figures 99-106 on pages 80-81). This indicates that the pedestrian paths also support through-movement, both general through-movements through the area and through-movements within the area, having the project site as a destination point.

Angular betweenness centrality

High
-
-
-
Low





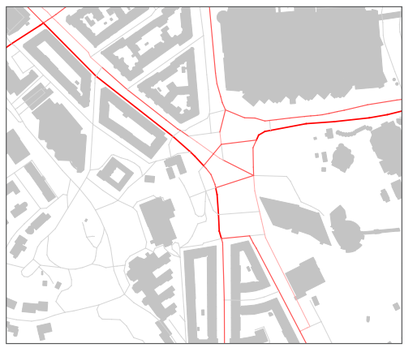
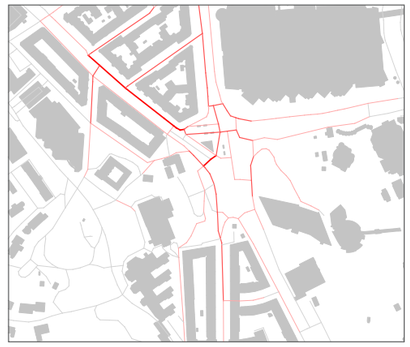
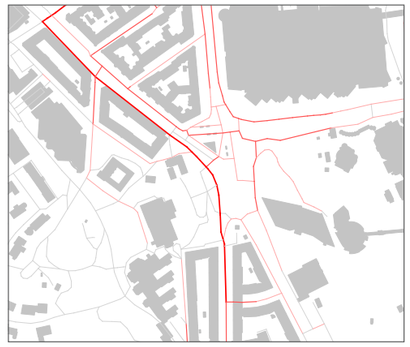
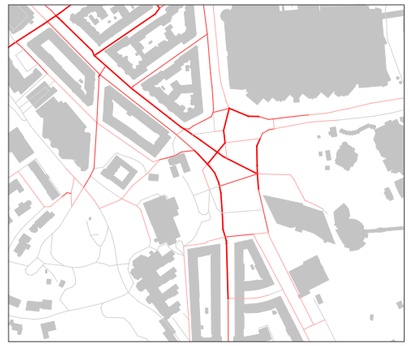


Figure 99-100: Angular betweenness centrality, 1 km, detailed pedestrian network, existing situation (figure 99, top) and my proposal (figure 100, bottom)

Figure 101-102: Angular betweenness centrality, 5 km, detailed pedestrian network, existing situation (figure 101, top) and my proposal (figure 102, bottom)







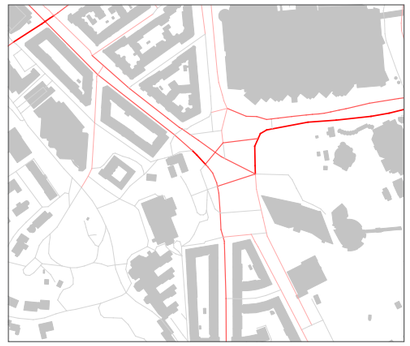


Figure 103-104: Attraction betweenness centrality, 500 m, detailed pedestrian network, existing situation (figure 103, above) and my proposal (figure 104, below)

Figure 105-106: Attraction betweenness centrality, 2 km, detailed pedestrian network, existing situation (figure 105, above) and my proposal (figure 106, below)

Attraction betweenness centrality

High
-
-
-
Low

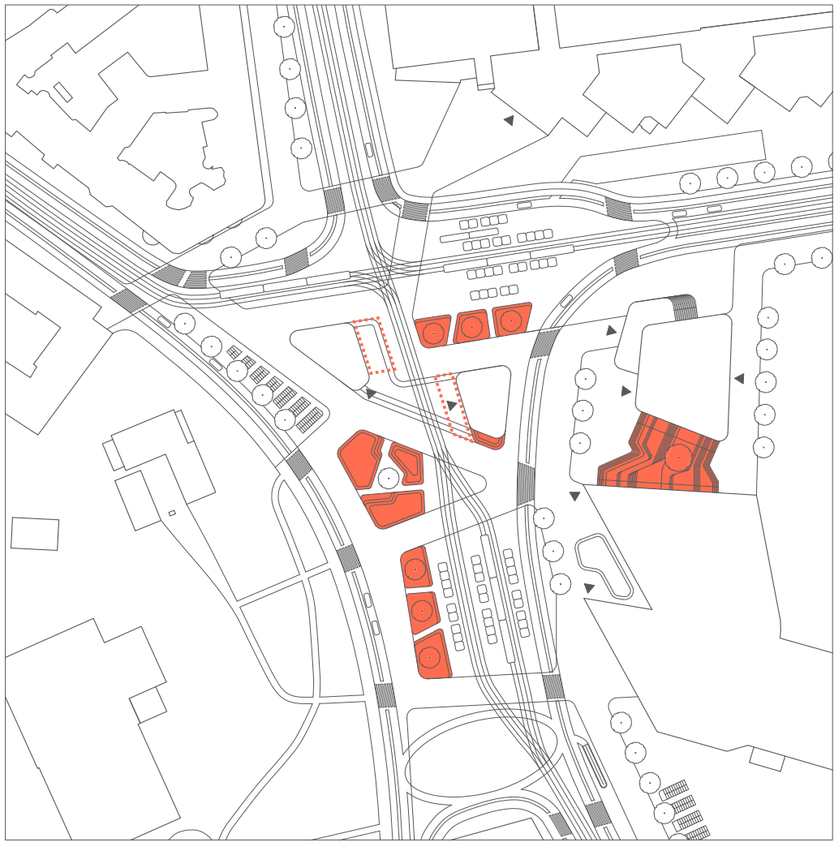


Figure 107: Adaptation of the uses and level of engagement of the buildings and design elements, my final proposal

Adaptation of the uses and level of engagement of the buildings and design elements

When the placements of the buildings and the other larger stationary design elements are decided, visual connectivity and through vision analyses are used once again to make the more detailed design choices (figures 88-89 on page 77).

The large seating area in the middle of the square is situated in the area with the very best overview and exposure, and because of that it is designed to be extrovert as you can be seated on all sides around the edges of the area, facing the surroundings. However, it is also designed to be introvert, as the area in the middle is partly enclosed and with places for staying facing each other. This means that pedestrians can choose to be more or less exposed to others, at the same time as always having a relatively good overview of the surroundings themselves.

Seating areas are also assigned to the eastern side of the western building and to the western side of the eastern building, as these are the edges of the buildings having the best overview of the surroundings. These seating areas are not permanent and part of the building design, but rather an extension of the shop, café or restaurant to be found in the buildings. This means that the buildings are designed to be more inviting, social and open in connection to these areas. The increase of activity here in the form of the seating areas also add to the framing of the central area, with the two buildings and their seating areas facing each other.

Other seating areas can be found along the tram stations and in the form of a large stair in the east parts of the project site. The stairs are placed at the end of pedestrian paths and axial lines, and they connect to the entrance to Liseberg which is an important attraction. Because of the elevation of the stairs, the area also offers a different type of visual overview compared to the rest of the project site. Each edge of the stairs are designed with normal steps to be able to handle moderate pedestrian flows whereas the middle steps are deeper and wider to provide places for staying.

The detailed design of the different buildings of the design proposal is not the main

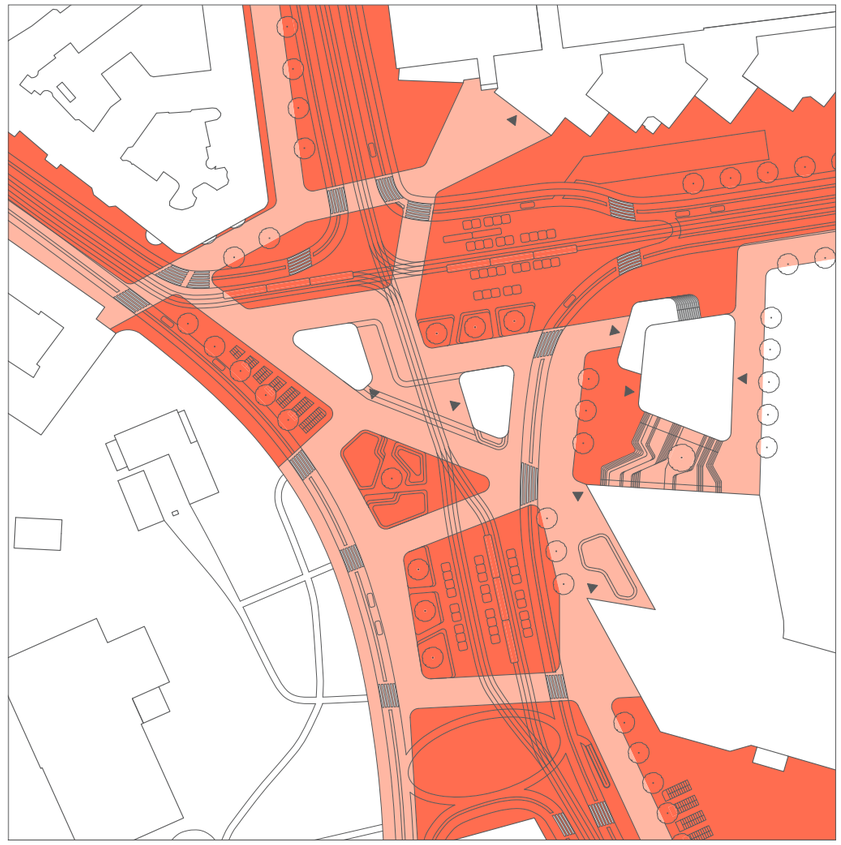


Figure 108: Adaptation of the design of the pavement to highlight the pedestrian paths, my final proposal

focus of this master's thesis but the aim is always to strive towards permeability and transparency, allowing pedestrians to understand function and to be able to see and engage in the activities that take place inside and nearby the buildings.

Adaptation of the design of the pavement to highlight the pedestrian paths

One of the main issues of the existing design of the project site is that the pedestrian activity is not in any way defined or framed. A pattern of the pavement is used in the design proposal to highlight the pedestrian movement. The pattern does not consider any of the vehicular roads or the tram tracks and the pavement covers the entire project site from edge to edge.

The aim is partly to make motorists aware of the fact that this is an area where pedestrians are prioritized, but also to create more readable and clear paths for pedestrians. However, to avoid a too complicated and mentally exhausting pattern, only the main connections are highlighted. Most likely, the pattern is not *too* clear from eye level, meaning that pedestrians will feel that they do not have to follow the main paths if they do not approximate the direction of their final destination well enough. As this is a large and free open space for pedestrians, shortcuts can naturally be taken freely.

Incorporation of smaller details such as greenery, water elements and lighting

In the final stages of the design process, smaller details are added to complete the design proposal. However, this part of the design process has not been the main focus of this master's thesis and therefore these design choices are not anchored with analyses to the same extent as the larger design choices.

Greenery is added in the form of rows of trees along some parts of the car roads where they are not disturbing the pedestrian movement. The intention is that the greenery will absorb some of the noise from the surrounding traffic but also work as a visual barrier, disconnecting the traffic from the public space of the square. Trees are also added in connection to the different seating areas, to provide mental shelter and shadow. A water element in the form of a pond are

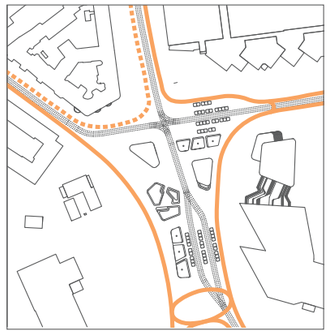


Figure 109: My proposal, car routes

Figure 110: My proposal, bicycle routes

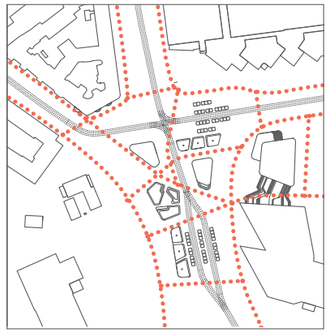


Figure 111: My proposal, pedestrian paths

Figure 112: The pattern of the pavement

added in front of the new extension of Universeum, as water elements are proven to contribute to more positive soundscapes. The edges of the pond also work as an additional seating area.

The design choices in relation to lighting are not applied in this design proposal as they would need more time and attention. However, the envisioned solution is that the lighting features should be integrated into all design elements. For example, that lighting is provided through stripes of light integrated in every other level of the social stair. Also, lighting can be integrated into important parts of the pavement. However at some places, lighting in the form of lampposts will have to be used, to provide some light from above where needed.

The pedestrian index

Orientation

Weight =	3
Score =	4
Weight x Score =	12

Connectivity

Weight =	3
Score =	5
Weight x Score =	15

Nodes

Weight =	3
Score =	3
Weight x Score =	9

Contextual qualities

Weight =	2
Score =	4
Weight x Score =	8

Legibility

Weight =	2
Score =	3
Weight x Score =	6

Choices

Weight =	2
Score =	5
Weight x Score =	10

Subdivisions

Weight =	1
Score =	4
Weight x Score =	4

Dimensioning by pedestrian experience

Weight =	3
Score =	3
Weight x Score =	9

Continuity

Weight =	3
Score =	5
Weight x Score =	15

Simplicity

Weight =	3
Score =	4
Weight x Score =	12

Visual connectivity

Weight =	3
Score =	4
Weight x Score =	12

Directness

Weight =	3
Score =	4
Weight x Score =	12

Permeability

Weight =	1
Score =	3
Weight x Score =	3

Transparency

Weight =	1
Score =	4
Weight x Score =	4

Definition

Weight =	3
Score =	4
Weight x Score =	12

Places for staying

Weight =	2
Score =	4
Weight x Score =	8

Climate shelter

Weight =	2
Score =	4
Weight x Score =	8

Lighting

Weight =	2
Score =	3
Weight x Score =	6

Vehicular traffic measures

Weight =	3
Score =	4
Weight x Score =	12

Soundscape

Weight =	3
Score =	3
Weight x Score =	9

Chosen weight for each design factor

The weights for the design factors are kept the same as before in order to do a comparison of the "before" and the "after" pedestrian index.

Scoring of each design factor

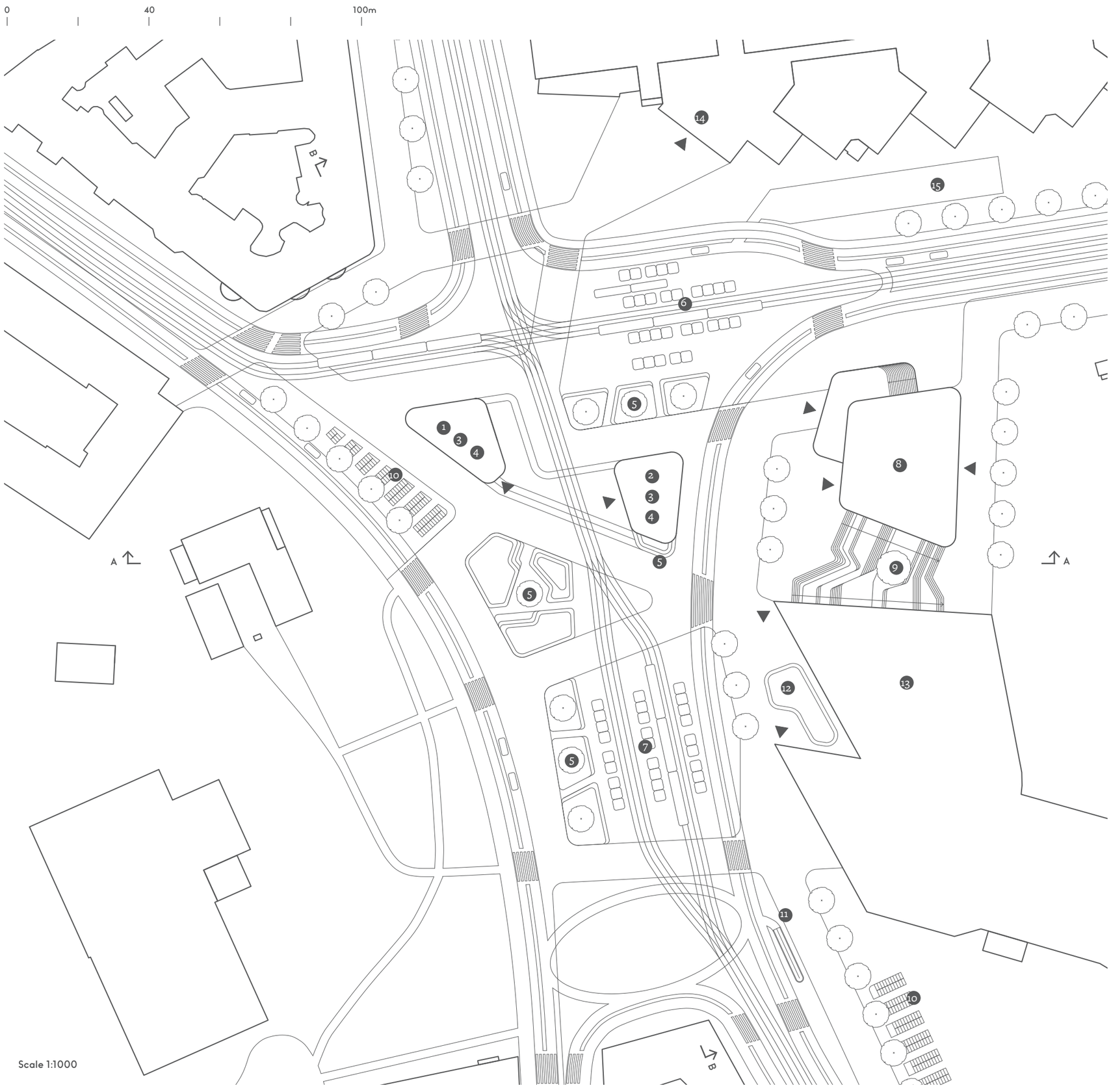
The scoring is based on the analyses and evaluations connected to the design process of the design proposal.

Result of the "after"

Total score =	186
Total score / 20 = Pedestrian index =	9,30

Result of the "before"

Total score =	107
Total score / 20 = Pedestrian index =	5,35



Scale 1:1000

Figure 113:

The final plan

1. Station buildings, entrances to the underground train
2. Café and restaurant
3. Shops
4. Toilets
5. Seating areas
6. Tram and bus station
7. Double tram station
8. Public building and offices
9. Social stairs
10. Bicycle areas
11. Entrance to underground bicycle garage
12. Pond and seating area
13. Extension of Universeum
14. Gothia Towers
15. Taxi parking


Vehicular traffic movement patterns
Bicycle movement patterns
Pedestrian movement patterns

Figure 114:

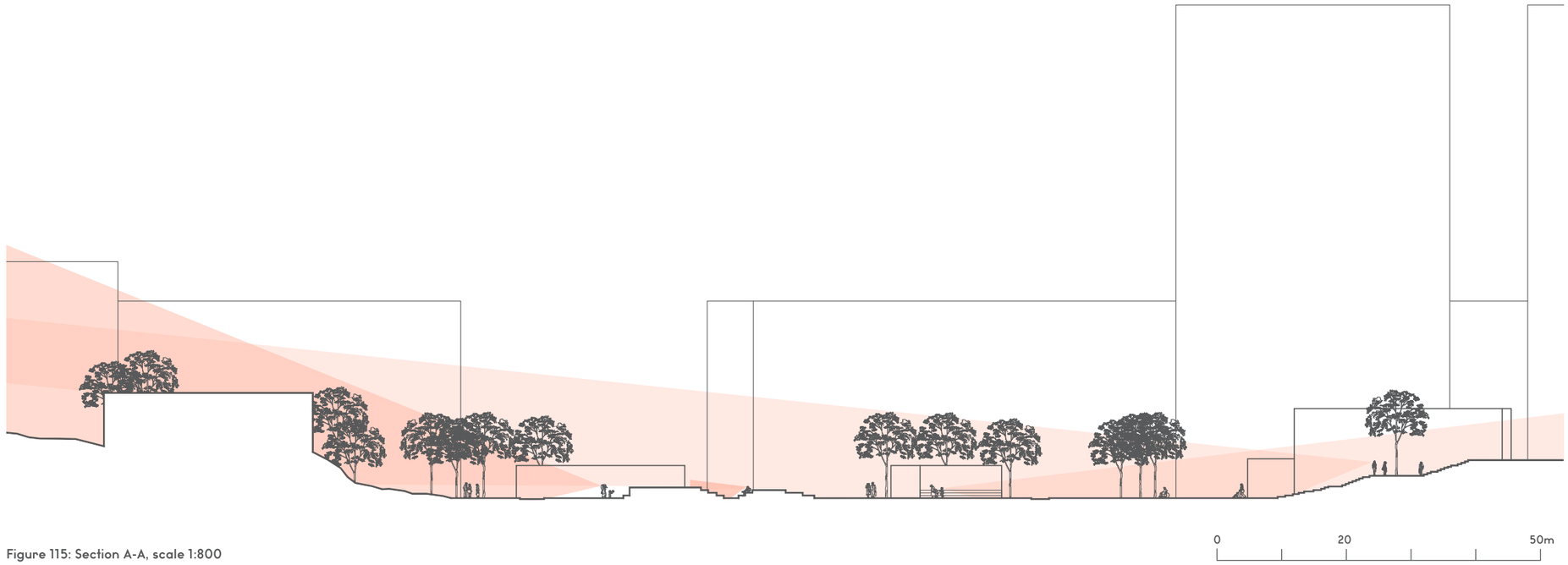


Figure 115: Section A-A, scale 1:800

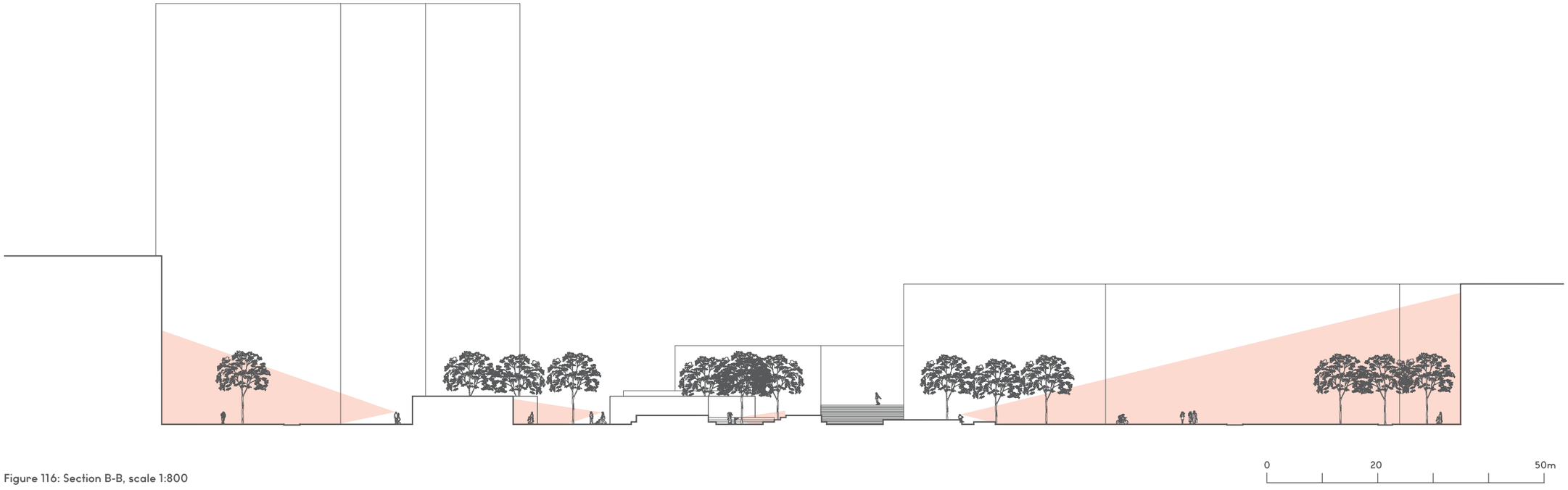


Figure 116: Section B-B, scale 1:800

Figure 117: View of the north-western parts of the project site, facing the arcade on the west side of the new station building and the facade of the pompous building where Södra vägen meets Skånegatan

Figure 118: View of the central and south-western parts of the project site, facing the central seating area and the buildings framing Eklandagatan

Summary

This master's thesis has been conducted in seven different steps where the main method was *research for design*. The first two steps was about theory, conducting a survey of the field of pedestrian movement and collecting, investigating and synthesizing theory on pedestrian movement from different fields of research. The third and fourth step was about contributing with something new by extracting design factors of my own from the theoretical body and then combining these design factors into a design toolbox. The fifth, sixth and seventh step was about applying this design toolbox, first by identifying and testing the relevance of the design toolbox through real case studies, then by testing it through my own design proposal and lastly, by using this knowledge and experience to revise and potentially improve the design toolbox.

This is not a master's thesis where the final design proposal is the main end product. All parts of the process, from the initial investigations of theory and research to the final application of the design factors in the exemplified design proposal, have been equally important in the strive for developing a design toolbox and a workflow. This is the main end product; the design toolbox with its workflow, applicable to many different situations, not just one.

The main focus of this master's thesis has been to test if public space can be designed derived from the understanding of pedestrian movement and how this can be done with the use of the design factors that have been distilled based on research. The question has always been; how can this knowledge based on research be translated into practical work? The approach has been to look at design of public space from another perspective, to have another starting point to design than what might be the usual. In addition to this, to find out if good design can follow from this approach.

The design proposal that was developed to test the design toolbox is still at an early stage. The focus has been to conceptually design the project area, to test the theories that have been developed. The design should be seen as a proposal, not a finished project. The design does not go into very fine details, but rather gives an example of what the area could look like when designing from the perspective of pedestrian movement.

Referring back to the research questions, whether public space can be designed derived from the understanding of pedestrian movement and if this understanding would support the design of architecture and public space in the strive for cities made for people, the findings from this master's thesis would suggest that the answer is *positive*. The design proposal executed in this master's thesis is only one of many possible applications and the idea of a public space being designed from this approach can be scaled and applied into any other context.

Reflections & next steps

Reflections

As previously mentioned, the end product of this master's thesis is not mainly the final design proposal, but rather the final design toolbox and its workflow. The design proposal and its related design process is used as a way of testing the relevance and usability of the design toolbox. If there would have been more time, I would gladly have developed the design proposal further so that it is more than a conceptual idea, incorporating all finished design elements. However, that would be outside of the main aim of this master's thesis. This section will discuss whether I believe that the design toolbox and its workflow contributed with something new or not. It will also reflect on the previously mentioned questions "is the design toolbox and its proposed workflow useful and applicable?" and "is it helpful in the strive for a better pedestrian usage of the chosen project site?".

Firstly, using these design factors, on different scales and with different foci, gives a very thorough review and analysis of the area, to an extent that I have never achieved in a project before. When analyzing and discussing all 20 design factors in one go, some things will naturally be highlighted several times as they might be connected to several factors. However, I believe that all 20 design factors are needed in order not to miss any aspects in any project site. In relation to the project site analysed and evaluated in this master's thesis, for example the design factors of orientation, legibility and directness discussed similar matters. If the site analysed would have been of a different type, most likely the result would not have been the same. Maybe some other design factors would have been overlapping instead.

Throughout the process of the master's thesis, the number of design factors have been reduced and some of them have been combined with each other in different ways. However, reducing them even more would not give any further benefits as that would possibly mean that some aspects would be missed. The workflow of the design toolbox has also been developed and clarified throughout the process. It was not until after my own design process, using the design factors and the check-up questions, that I was really able to reflect on and formulate the two last steps of the workflow completely. As previously mentioned, these two steps are not as linear and easy to describe as the three first steps. They depend on the architect or planner, and on the nature of the site. But the workflow gives an indication of what these steps include, and how the results from the evaluation can be further used in combination with personal design aims and desires.

My opinion is that the design toolbox helped me in the process of understanding the site, both understanding its potentials but also understanding the underlying reasons to why some aspects of the existing design were not successful. Often it is easy to pinpoint things and details that are not working, but without fully understanding why it is hard to propose something better and improved. Also, some of the analyses that were used highlighted problems and potentials that I would never have been able to figure out myself, simply because the relationships and connections were too complicated and complex to see when manually analysing space.

In relation to the design process of the new design proposal, I believe that the design toolbox made the process easier. After evaluating and analysing the site, I already had an idea of what the site needed and what changes could be done as problems and potentials were already highlighted. The different design factors were also helpful in the sense that they could be used to make sure that no important aspects had been forgotten. However, in this design proposal, there was not enough time to focus and build on every single one of the design factors.

The chosen project site of Korsvägen is not a simple site, it is one of the most complex public transportation hubs and traffic junctions in the city of Gothenburg. Eventuating the analyses, it is clear that the pedestrian experience could be *even* better prioritized and designed with even better results, but as the process of designing this square does not only include the pedestrian paths, several compromises had to be done in order to get the best overall result in the end. This is an area for pedestrians, but also for cyclists, cars, trams and buses. Nevertheless, I believe that the result is quite pleasing and well-functioning. Space for pedestrians has been freed up and the project site has become more accessible and inviting. The

area now becomes more of a public space than just a public transportation node. The aim in general has been to strive for multi-functionality and to create synergies, where all aspects of the area are taken into account, but where the starting point is to design from the pedestrian experience. It is about exploring a design process where the pedestrians are highlighted and supported, it is not about forgetting about everything else.

The *pedestrian index* was an experiment and an idea I believed in a lot in the beginning of the process. It was a good idea but unfortunately too ambitious and complex for a project of this size. Creating an index of this kind would need much more time and research. The fact that the index would be much more useful if it was easily comparable is what hindered me in the process of working with it. It was a fun addition to use it in this project site, but I do not think that it added something to my design process and the quality of the final result.

Throughout the whole process, I have been trying to be clear to myself about what the aim of a master's thesis is in general and to me and my own master's thesis in particular. It has never been about finding a sole solution of how to bridge the gap between research and practice in connection to pedestrian-friendly urban design, and it has never been about presenting a finished design project on the theme that *has it all*. It is a chance to explore beyond the field of architecture, pushing the boundaries of what we have done throughout our five years of education, and asking new questions. Is it possible to create a connection between research and practice, to synthesize different approaches from different fields of study? Is it possible to use this knowledge available through research to build a design method that actually helps architects and planners in their work?

I believe that developing an understanding of the pedestrian movements in our cities and uncovering the choices and behaviors that lie behind them are crucial to be able to design pedestrian-friendly public space. This knowledge exists, but it is scattered across different fields of study with different foci. I look forward to contributing to the field of architecture and urban space design by showing that there is a possibility to systematically bridge the gap between research and practice and that the design toolbox and the workflow developed in this master's thesis is one way of doing that.

Next steps

When imagining the potentials for development in relation to this master's thesis and the work that has been done, I can see several possible next steps. A finished master's thesis is not equal to the work and the ideas presented being finished.

One possible next step could be to continue the work with the pedestrian index, however, I think that the design factors and their check-up questions together with the workflow of different methods and analyses are enough to reach the goal of designing with pedestrian movements as a starting point. I believe that it is too hard to create measurable variables in relation to the design of public space, and that it is better to stick to the more open and soft approach of the design factors and their check-up questions. However, sometimes even the check-up questions might be too quantitative and would need the complement of the background theory to fully be able to utilize and understand the design factor.

Other next steps are to test the design toolbox and its workflow on many other project sites, ranging from sidewalks and squares to streets and larger networks. This might give a deeper understanding of how useful and applicable the design toolbox and its workflow is, and give more input on how to develop it further.

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Image credits

Image 1: Geh, J. (2010b). *Life Between Buildings.* (6th ed.). The Danish Architectural Press.

Image 2: Bailey Plaza [Online image]. (2007). Michael van Valkenburgh Associates Inc. https://www.mvvainc.com/project.php?id=25&c=campuses

Image 3: Griffith, T. (2016). Geometric and Grass-covered Parklet [Online image]. Contemporist. https://www.contemporist.com/11-parklets-you-wish-your-city-had/

Image 4: Snape, D. (2013). Nicholson Street Mall [Online image]. Landezine. http://landezine.com/index.php/2013/01/nicholson-street-mall-by-hassell/

Image 5: The Jetty [Online image]. (2016). Sasaki. https://www.sasaki.com/projects/chicago-riverwalk/

Image 6: Hjortshøj, R. (2017). Vestre Fjordpark [Online image]. https://www.adept.dk/project/vestre-fjordpark

Image 7: Baan, I. (2013). Superkilen [Online image]. Landezine. http://landezine.com/index.php/2013/02/urban-revitalization-superkilen-by-topotek1-big-superflex/

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Image 10: Teruel-zilla! [Online image]. (2012). Dezeen. https://www.dezeen.com/2012/06/12/teruel-zilla-by-mi5-arquitectos-and-pkmn-architectures/

Image 11-12: Author's own photos.

Image 13: Korsvägen [Online image]. (2021). Google Maps. https://www.google.se/maps/@57.6963558,11.9881403,535m/data=!3m1!1e3

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Appendix 1: Analysing and evaluating the existing project site







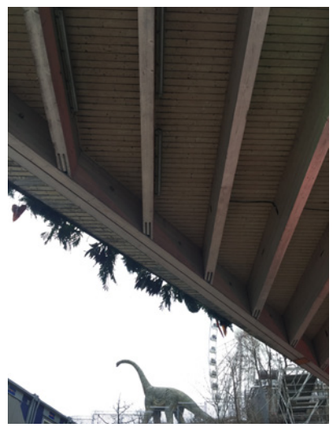


Photos from the project site (at the time of the master's thesis when the site is partially closed off). Author's own photos.





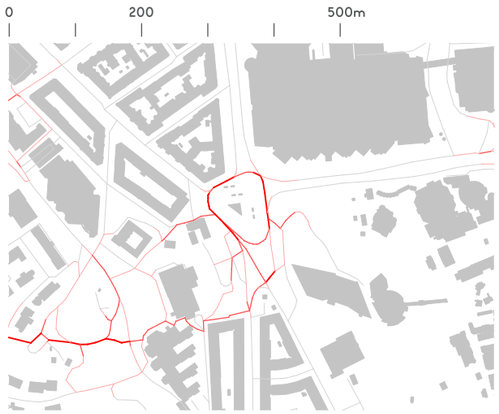




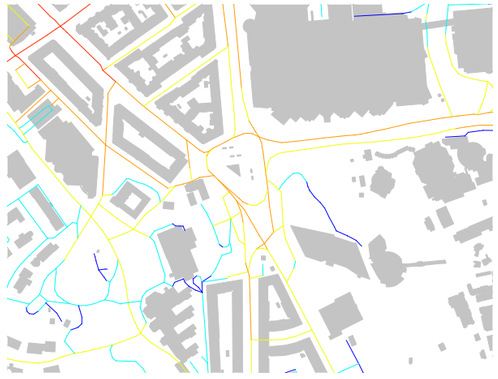
Space syntax analyses: Existing general pedestrian network

Analyses have been done for 200 m, 500 m, 1 km and 2 km and the three most representative radii have been chosen.

Angular integration centrality, 200 m

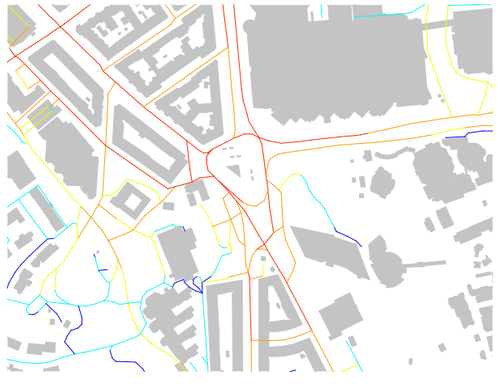


Angular betweenness centrality, 200 m



Angular integration centrality, 1 km

Angular betweenness centrality, 1 km

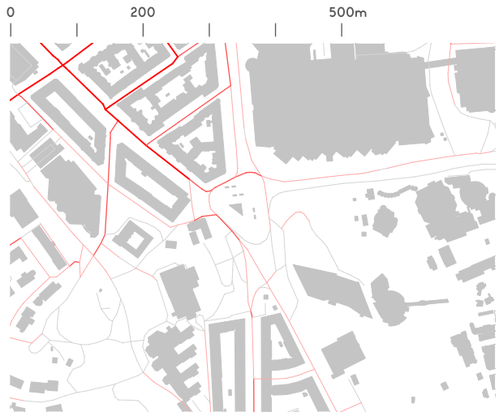


Angular integration centrality, 2 km

Angular betweenness centrality, 2 km

High
-
-
-
Low

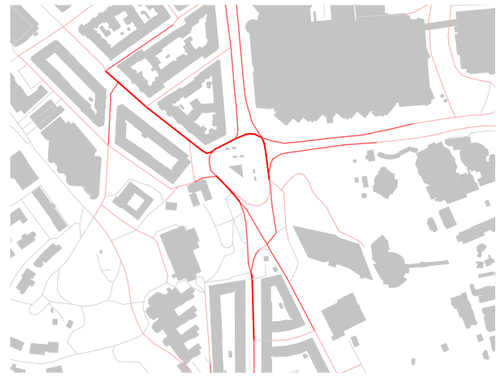
High
-
-
-
Low



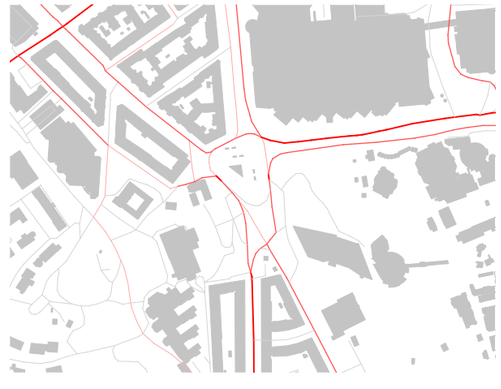
Attraction betweenness centrality, no weights, 500 m

Attraction betweenness centrality, weights, 500 m

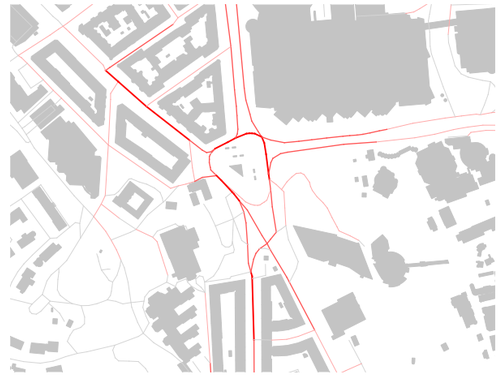
Attraction betweenness centrality, no weights, 1 km



Attraction betweenness centrality, weights, 1 km



Attraction betweenness centrality, no weights, 2 km



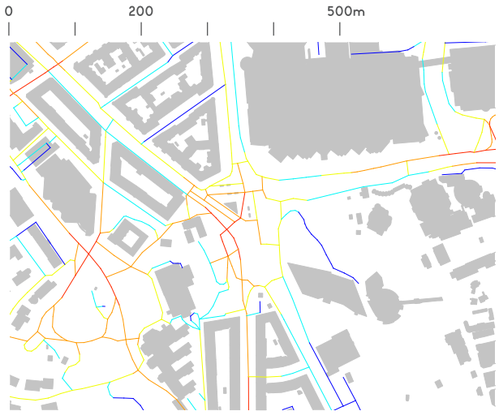
Attraction betweenness centrality, weights, 2 km

High
-
-
-
Low

Five times heavier weights have been given to important addresses, such as the tram stops and the entrances to important buildings.

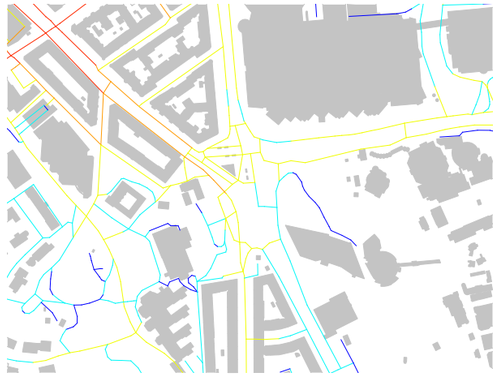
Space syntax analyses: Existing pedestrian network with more precise details added to the project site

Analyses have been done for 200 m, 500 m, 1 km and 2 km and the three most representative radii have been chosen.

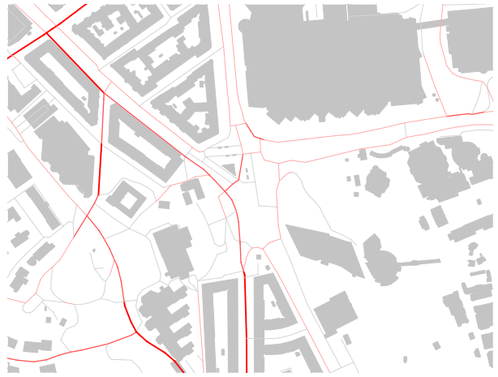


Angular integration centrality, 200 m

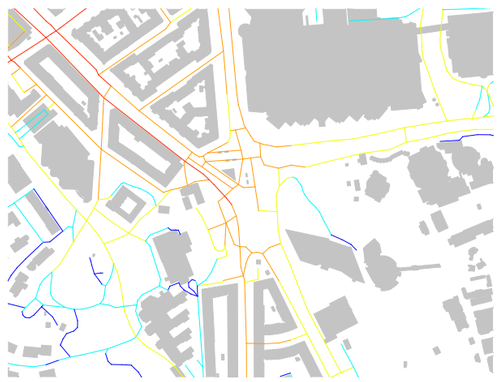
Angular betweenness centrality, 200 m



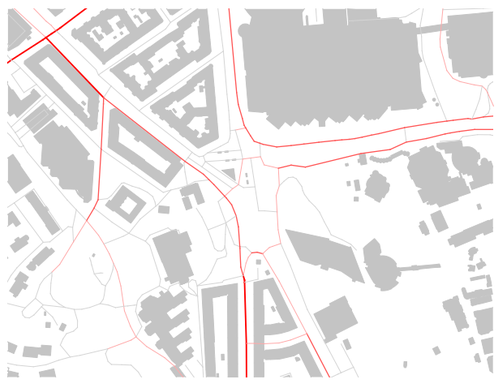
Angular integration centrality, 1 km



Angular betweenness centrality, 1 km



Angular integration centrality, 2 km



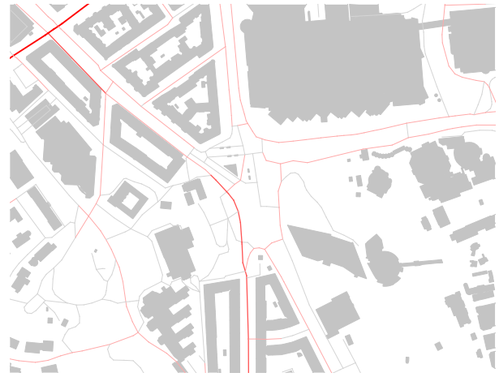
Angular betweenness centrality, 2 km

High
-
-
-
Low

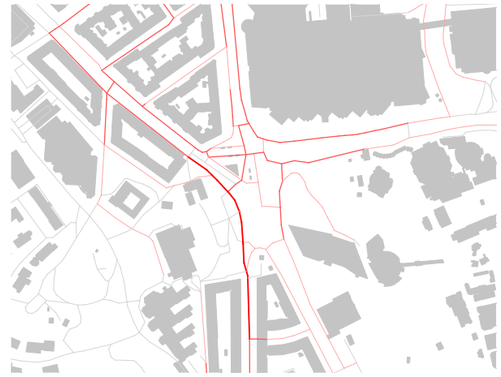
High
-
-
-
Low

Attraction betweenness centrality, no weights, 500 m

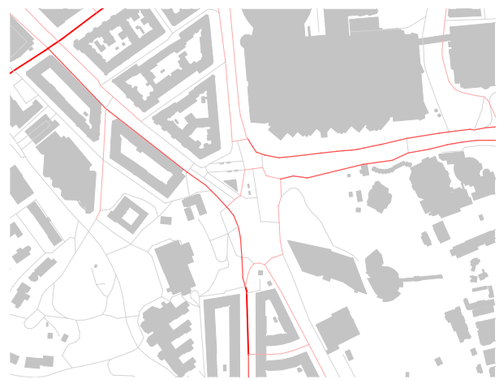
Attraction betweenness centrality, weights, 500 m



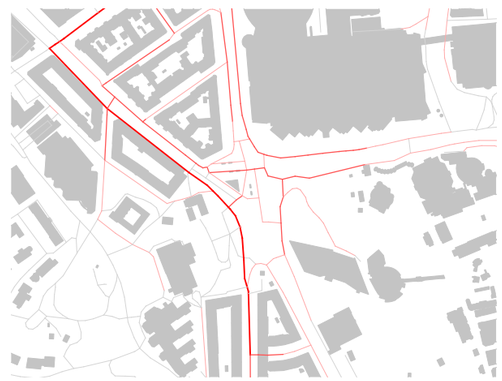
Attraction betweenness centrality, no weights, 1 km



Attraction betweenness centrality, weights, 1 km



Attraction betweenness centrality, no weights, 2 km



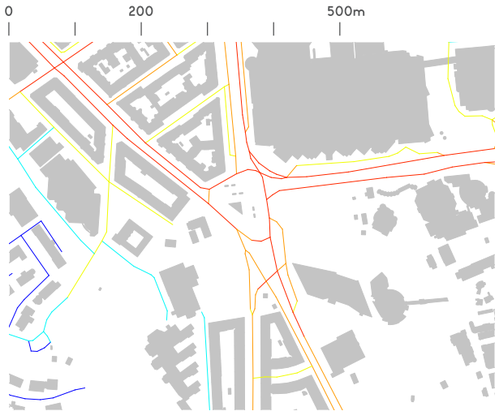
Attraction betweenness centrality, weights, 2 km

High
-
-
-
Low

Five times heavier weights have been given to important addresses, such as the tram stops and the entrances to important buildings.

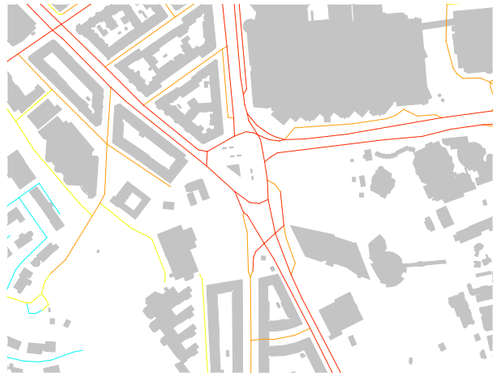
Space syntax analyses: Motorized network

Analyses have been done for 1 km, 2 km, 5 km and 10 km and the three most representative radii have been chosen.

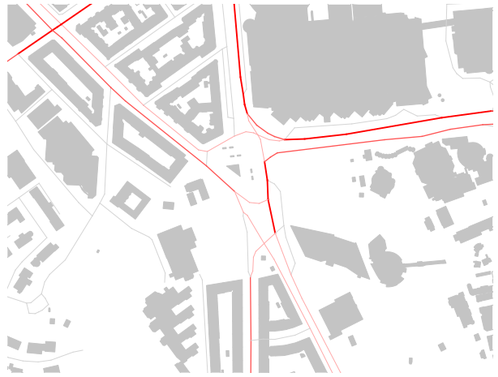


Angular integration centrality, 2 km

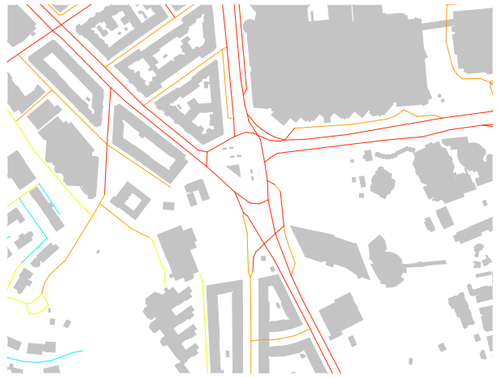
Angular betweenness centrality, 2 km



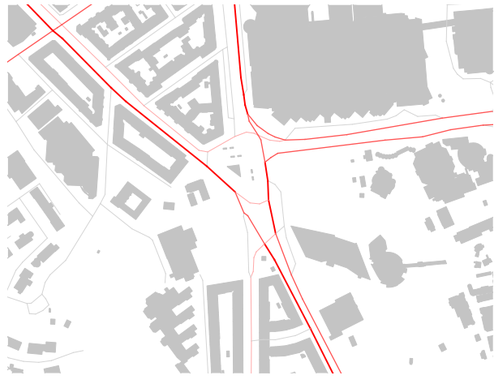
Angular integration centrality, 5 km



Angular betweenness centrality, 5 km

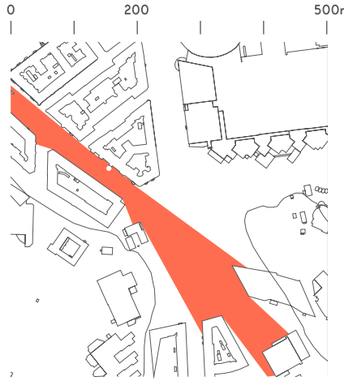


Angular integration centrality, 10 km



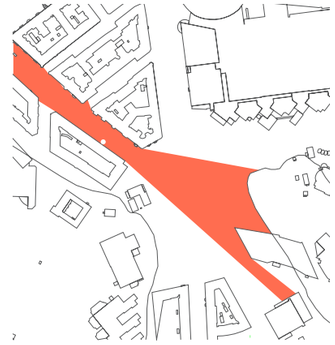
Angular betweenness centrality, 10 km

Space syntax analyses: Isovist visual field analyses of the empty project site, 360 degrees



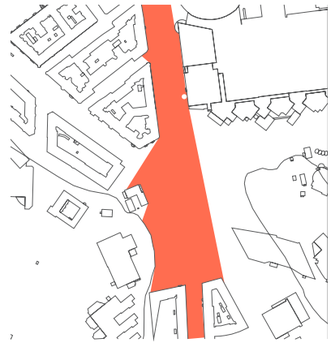
Entering from Södra vägen, north parts

Entering from Södra vägen, north parts

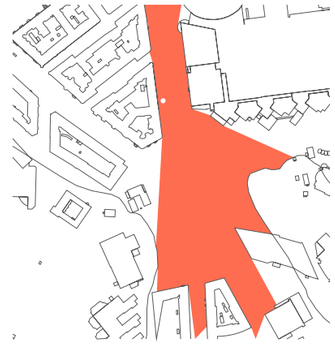


Entering from Södra vägen, north parts

Entering from Södra vägen, north parts

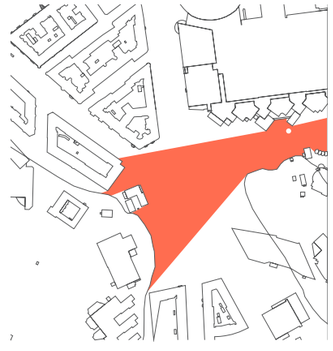


Entering from Skånegatan



Entering from Skånegatan

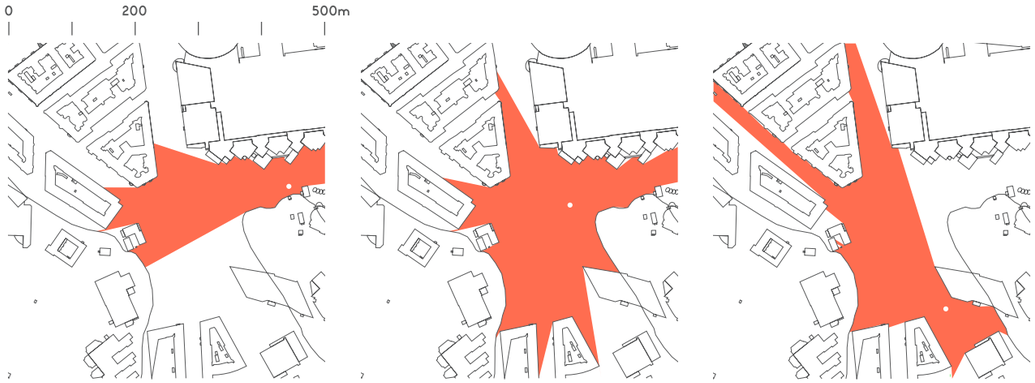
Entering from Skånegatan



Entering from Örgrytevägen

Entering from Örgrytevägen

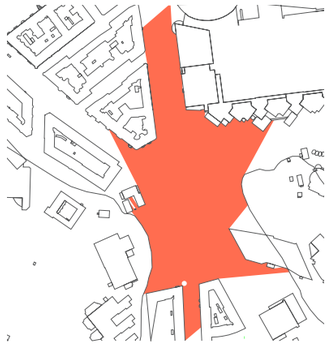
Space syntax analyses: Isovist visual field analyses of the empty project site, 360 degrees



Entering from Örgrytevägen

Entering from Örgrytevägen

Entering from Södra vägen, south parts

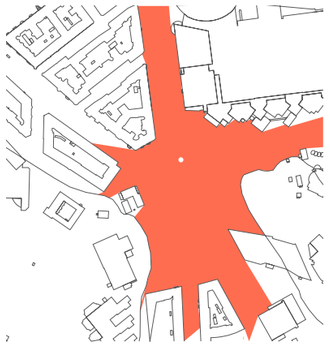


Entering from Eklandagatan

Entering from Johannebergs Lanteri

Gothia Towers main entrance

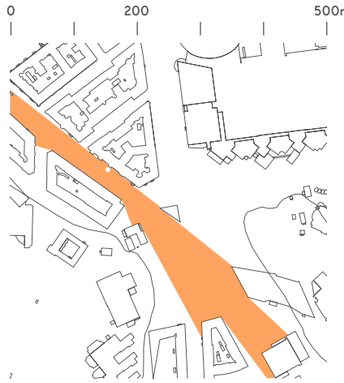
Universeum main entrance



Existing center of the square

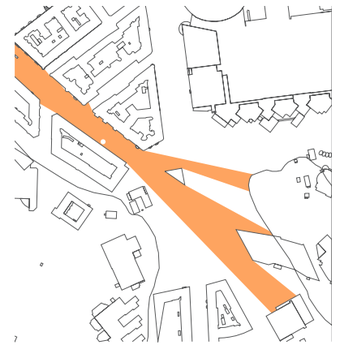
Existing very southern end of the square

Space syntax analyses: Isovist visual field analyses of the project site with the existing station building, 360 degrees



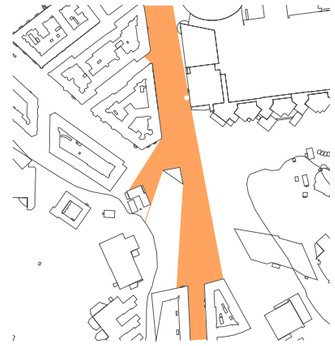
Entering from Södra vägen, north parts

Entering from Södra vägen, north parts



Entering from Södra vägen, north parts

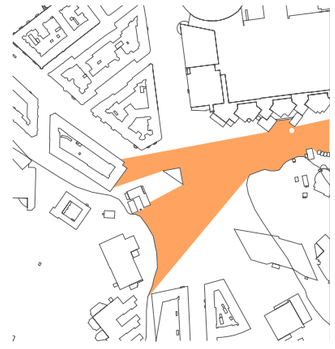
Entering from Södra vägen, north parts



Entering from Skånegatan

Entering from Skånegatan

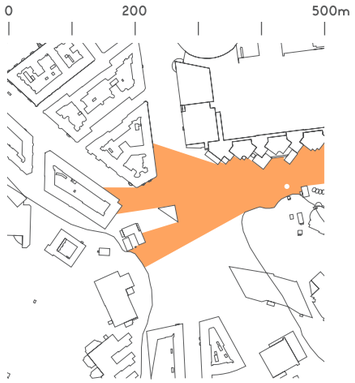
Entering from Skånegatan



Entering from Örgrytevägen

Entering from Örgrytevägen

Space syntax analyses: Isovist visual field analyses of the project site with the existing station building, 360 degrees



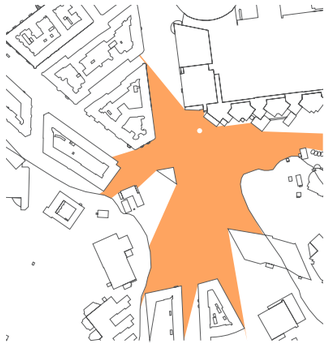
Entering from Örgrytevägen

Entering from Örgrytevägen

Entering from Södra vägen, south parts

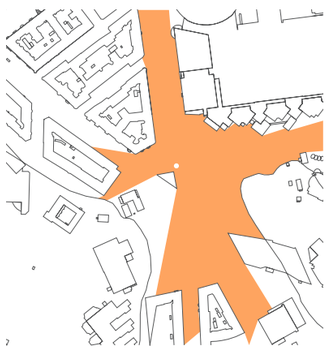
Entering from Eklandagatan

Entering from Johannebergs Lanteri



Gothia Towers main entrance

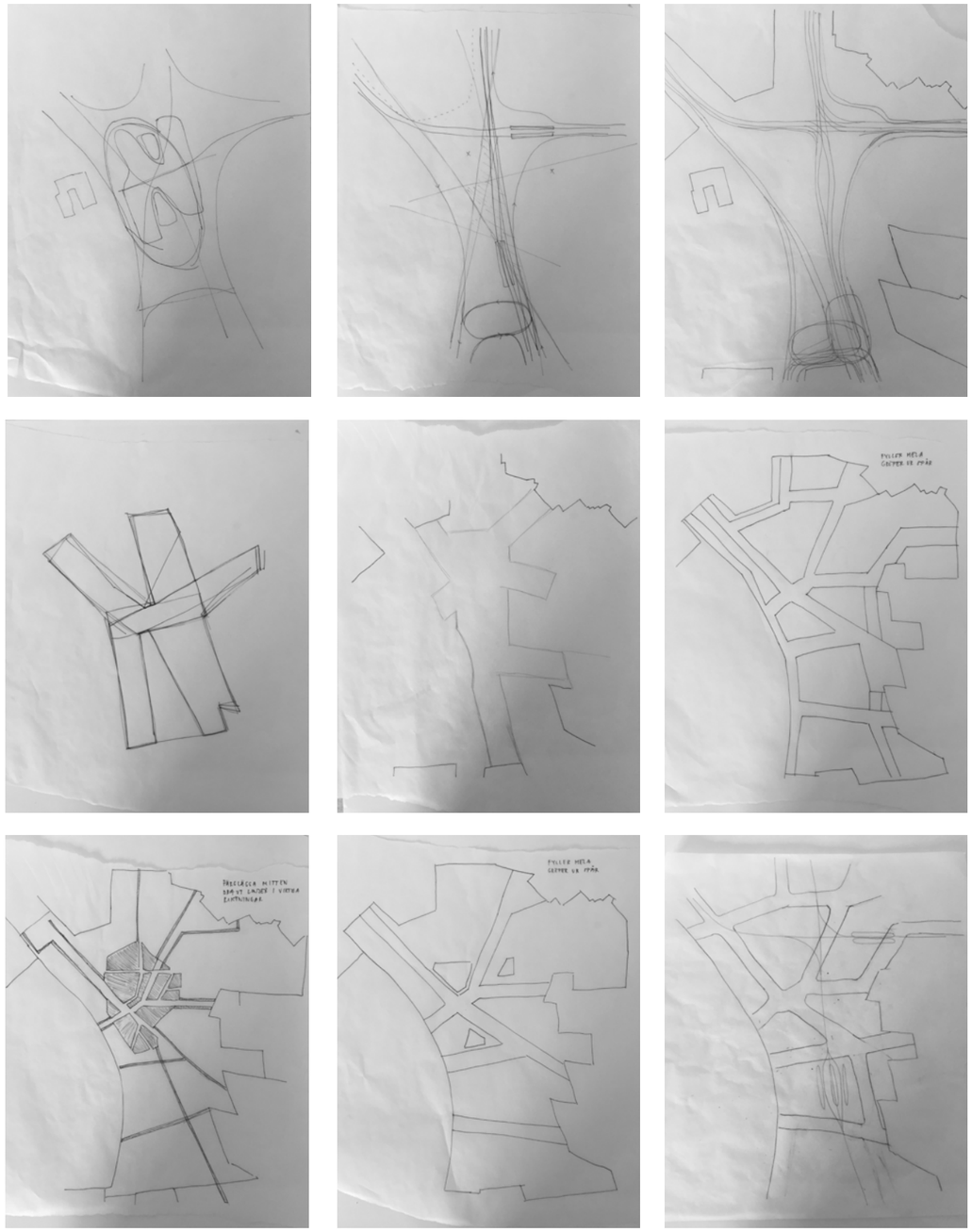
Universeum main entrance

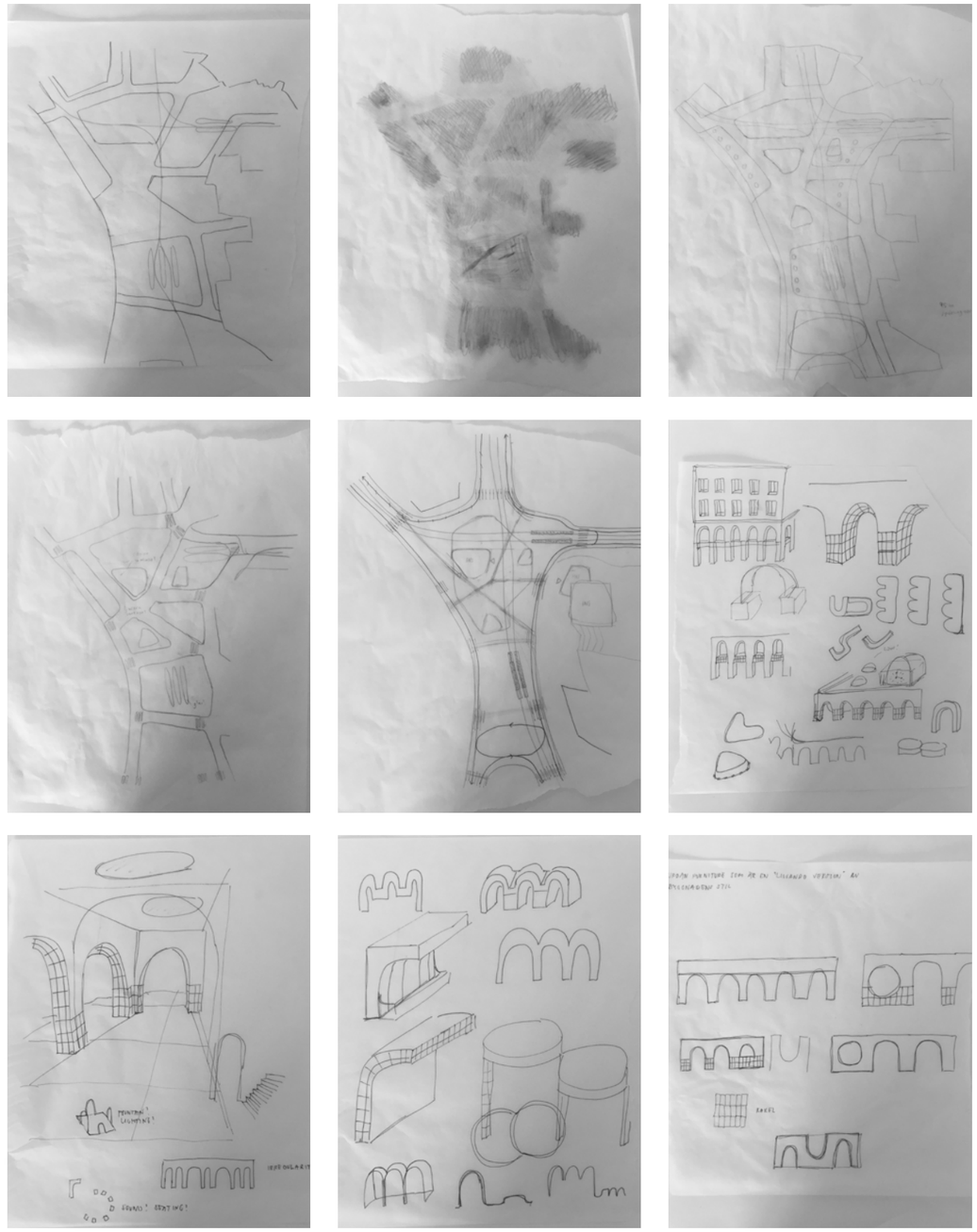


Existing center of the square

Existing very southern end of the square

Appendix 2: Design process of the new design proposal



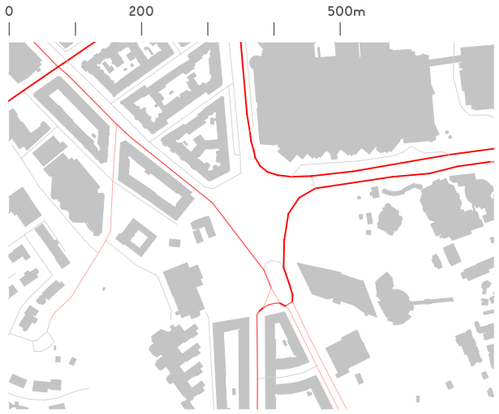


Hand sketches from the initial phases of the design process. Author's own photos.

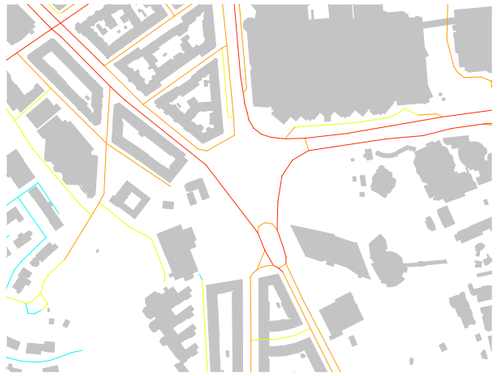
Space syntax analyses: Motorized network, proposal by the local building authority

Analyses have been done for 1 km, 2 km, 5 km and 10 km and the three most representative radii have been chosen. The values for each interval are the same as the ones for the existing motorized network (page 108). A comparison will show a direct increase or decrease in integration and betweenness centrality values.

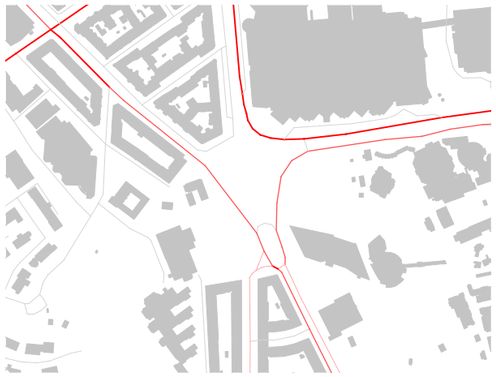
Angular integration centrality, 2 km



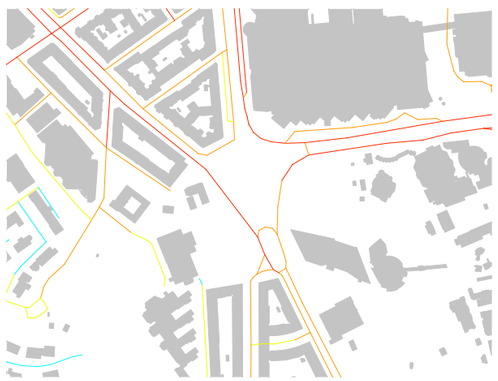
Angular betweenness centrality, 2 km



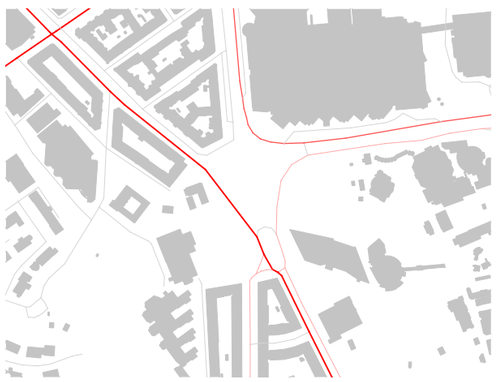
Angular integration centrality, 5 km



Angular betweenness centrality, 5 km



Angular integration centrality, 10 km

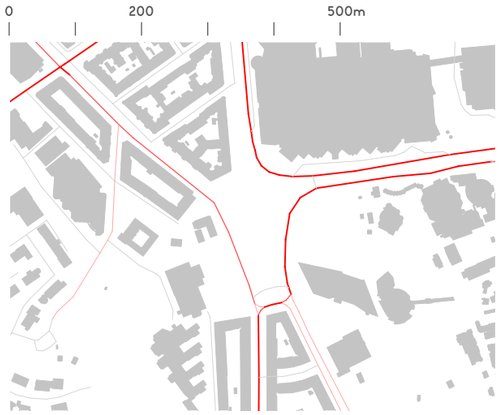


Angular betweenness centrality, 10 km

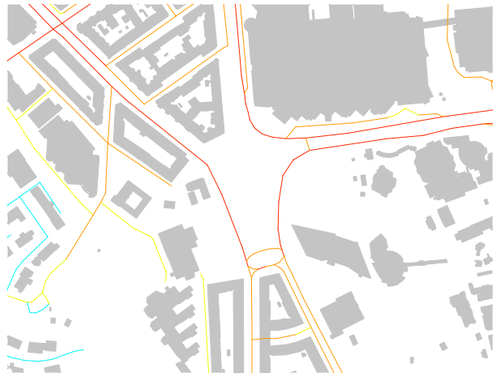
Space syntax analyses: Motorized network, my proposal

Analyses have been done for 1 km, 2 km, 5 km and 10 km and the three most representative radii have been chosen. The values for each interval are the same as the ones for the existing motorized network (page 108). A comparison will show a direct increase or decrease in integration and betweenness centrality values.

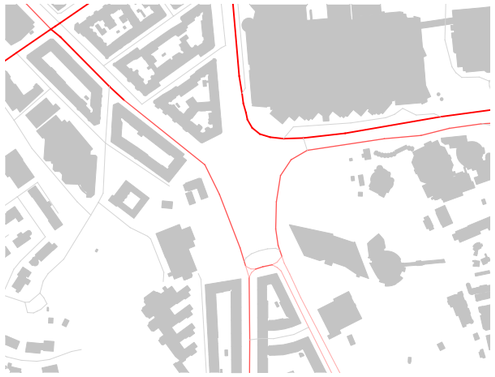
Angular integration centrality, 2 km



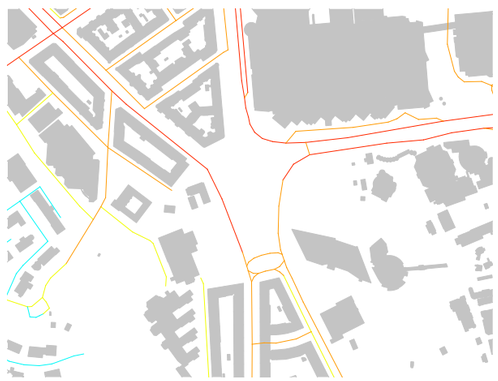
Angular betweenness centrality, 2 km



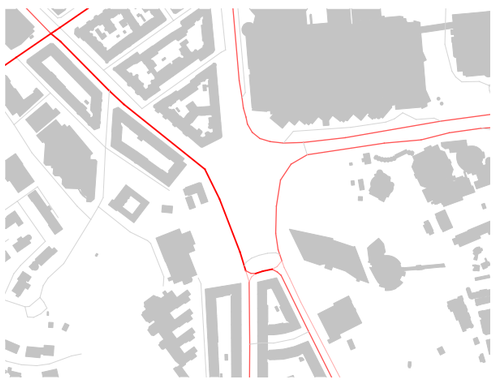
Angular integration centrality, 5 km



Angular betweenness centrality, 5 km



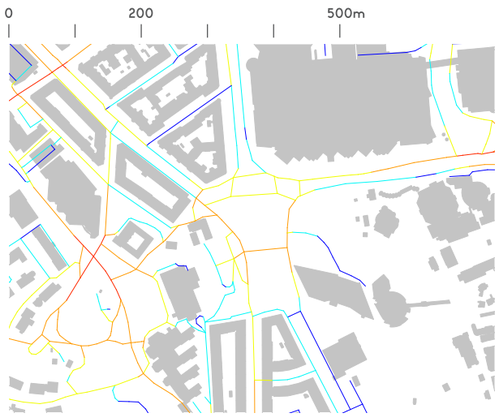
Angular integration centrality, 10 km



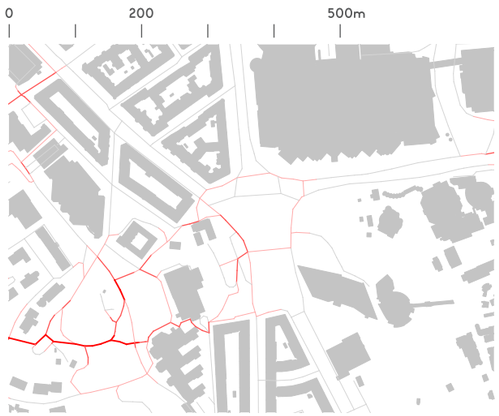
Angular betweenness centrality, 10 km

Space syntax analyses: Pedestrian network, proposal by the local building authority

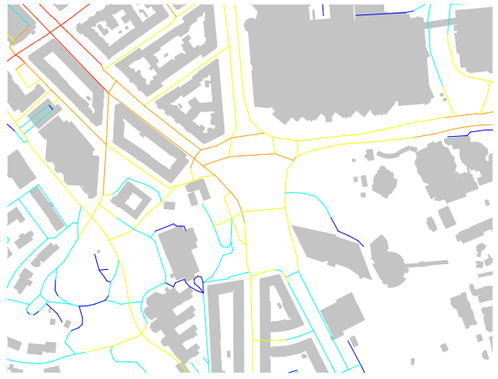
Analyses have been done for 200, 500 m, 1, 2 and 5 km and the three most representative radii have been chosen. The values for each interval are not the same as the ones for the existing pedestrian networks (pages 104-107). A comparison between the different networks will show the change of hierarchy of the different lines.



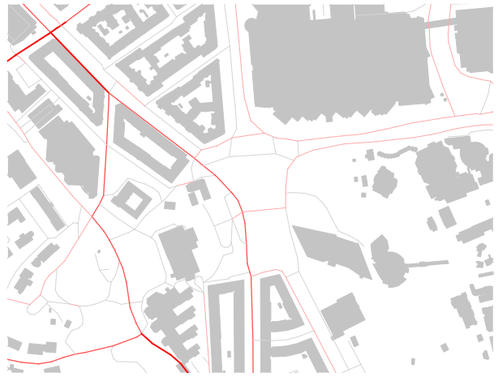
Angular integration centrality, 200 m



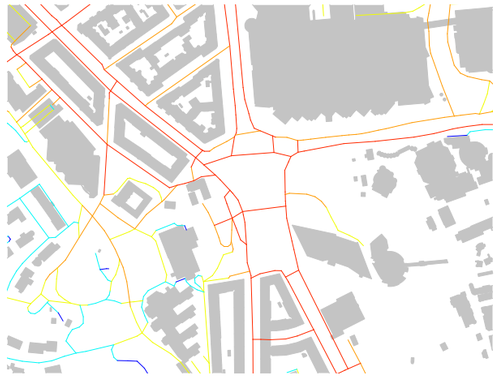
Angular betweenness centrality, 200 m



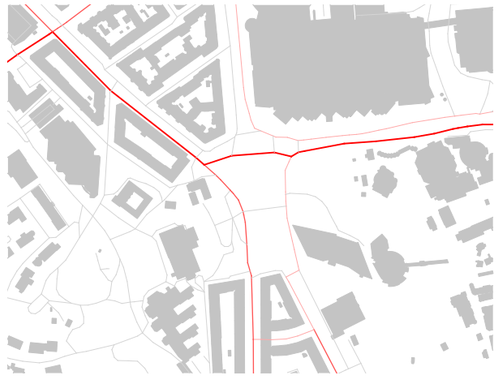
Angular integration centrality, 1 km



Angular betweenness centrality, 1 km



Angular integration centrality, 5 km



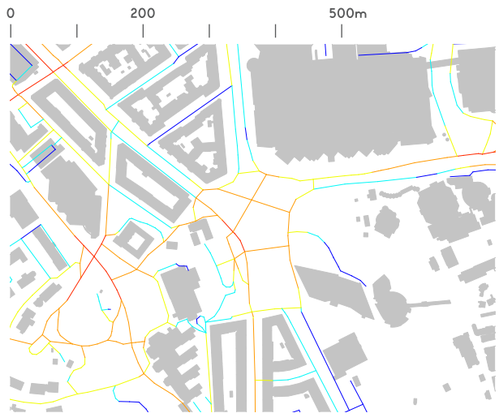
Angular betweenness centrality, 5 km

High
-
-
-
Low

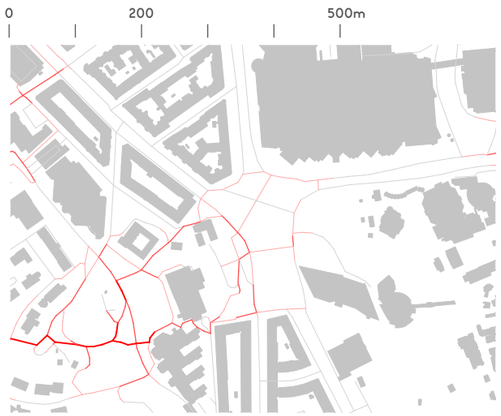
High
-
-
-
Low

Space syntax analyses: First simple iteration of the pedestrian network, my proposal

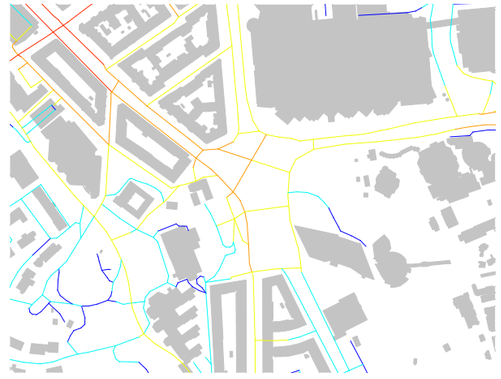
Analyses have been done for 200 m, 500 m, 1 km and 2 km and the three most representative radii have been chosen. The values for each interval are not the same as the ones for the existing pedestrian networks (pages 104-107). A comparison between the different networks will show the change of hierarchy of the different lines.



Angular integration centrality, 200 m

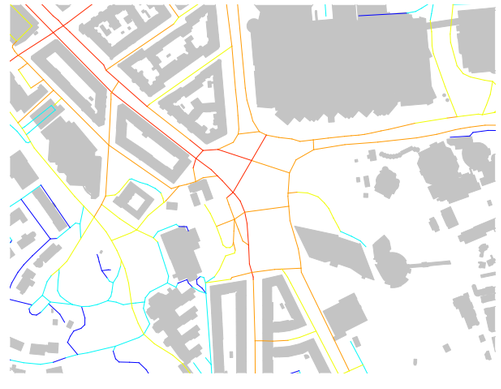


Angular betweenness centrality, 200 m

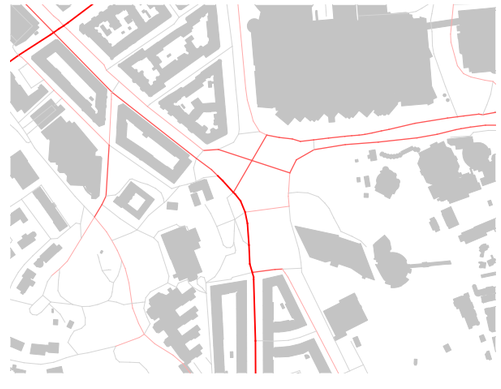


Angular integration centrality, 1 km

Angular betweenness centrality, 1 km



Angular integration centrality, 2 km



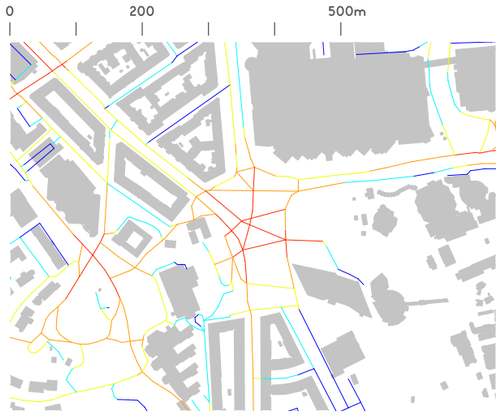
Angular betweenness centrality, 2 km

High
-
-
-
Low

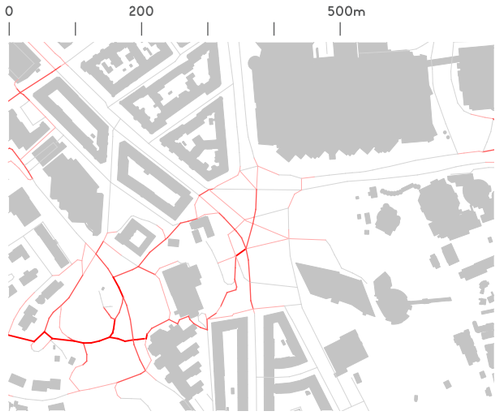
High
-
-
-
Low

Space syntax analyses: Further development of the pedestrian network, my proposal

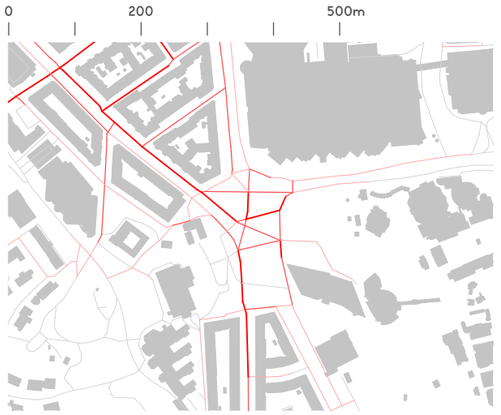
Analyses have been done for 200 m, 500 m, 1 km and 2 km and the three most representative radii have been chosen. The values for each interval are not the same as the ones for the existing pedestrian networks (pages 104-107). A comparison between the different networks will show the change of hierarchy of the different lines.



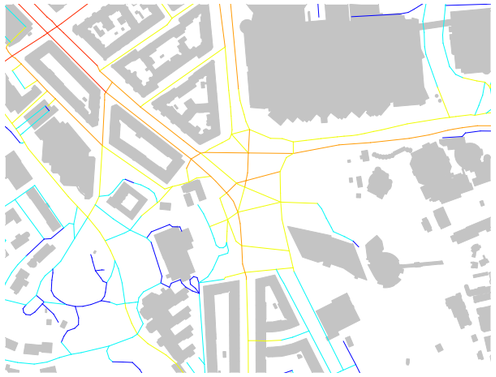
Angular integration centrality, 200 m



Angular betweenness centrality, 200 m

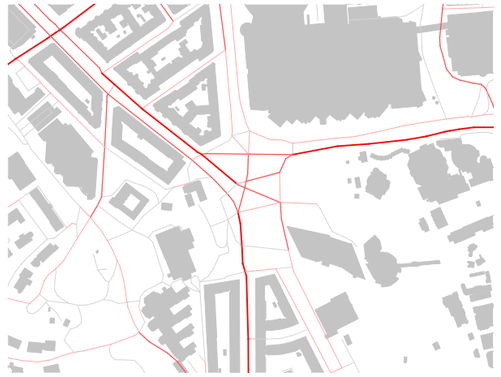


Attraction betweenness centrality, weights, 500 m

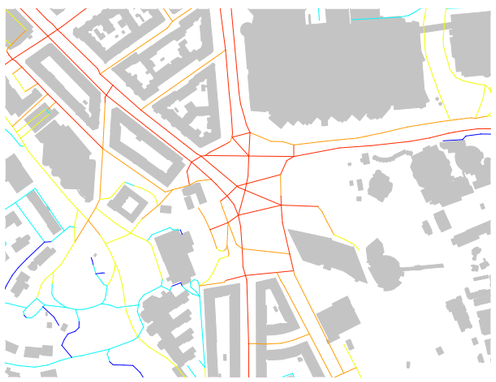


Angular integration centrality, 1 km

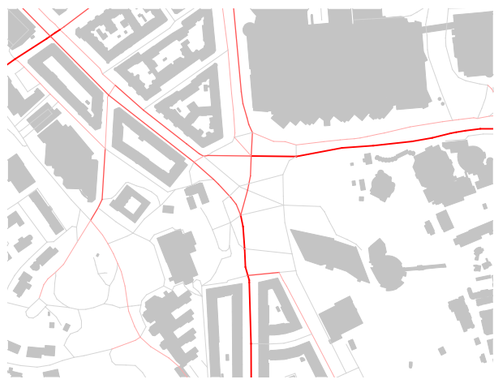
Angular betweenness centrality, 1 km



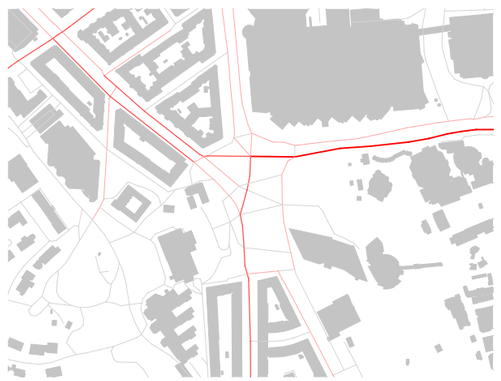
Attraction betweenness centrality, weights, 1 km



Angular integration centrality, 2 km



Angular betweenness centrality, 2 km



Attraction betweenness centrality, weights, 2 km

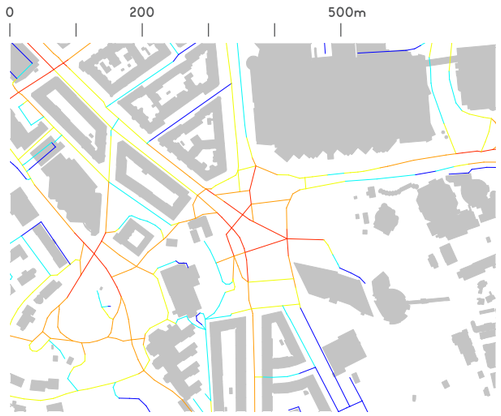
High
-
-
-
Low

High
-
-
-
Low

High
-
-
-
Low

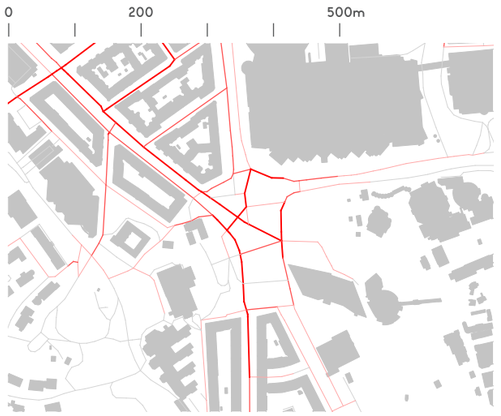
Space syntax analyses: Final pedestrian network, my proposal

Analyses have been done for 200, 500 m, 1, 2 and 5 km and the three most representative radii have been chosen. The values for each interval are not the same as the ones for the existing pedestrian networks (pages 104-107). A comparison between the different networks will show the change of hierarchy of the different lines.

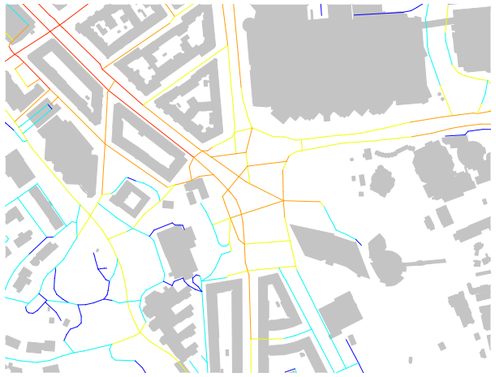


Angular integration centrality, 200 m

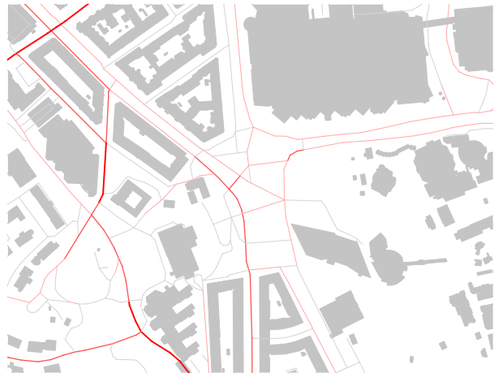
Angular betweenness centrality, 200 m



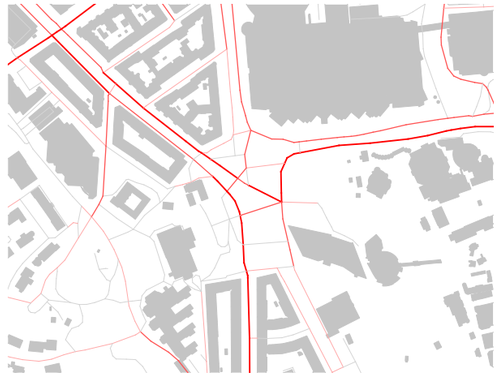
Attraction betweenness centrality, weights, 500 m



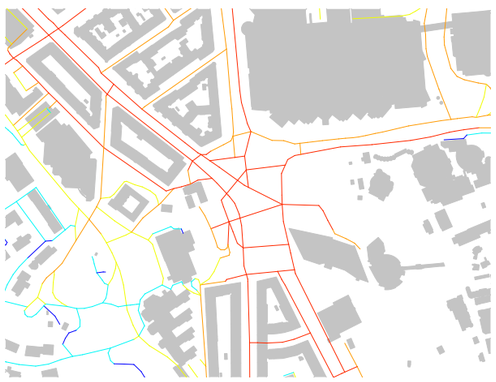
Angular integration centrality, 1 km



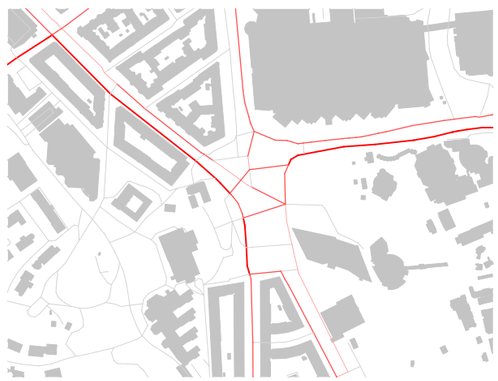
Angular betweenness centrality, 1 km



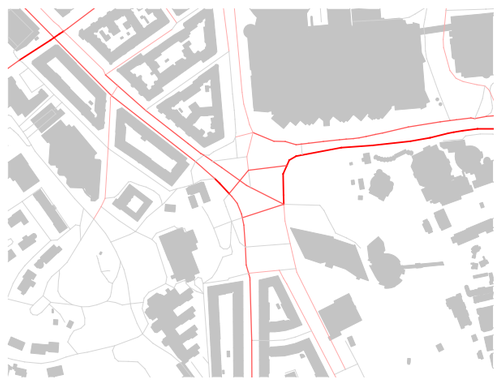
Attraction betweenness centrality, weights, 1 km



Angular integration centrality, 5 km



Angular betweenness centrality, 5 km



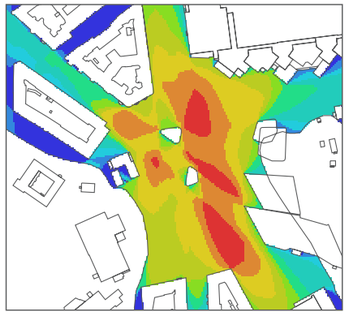
Attraction betweenness centrality, weights, 2 km

High
-
-
-
Low

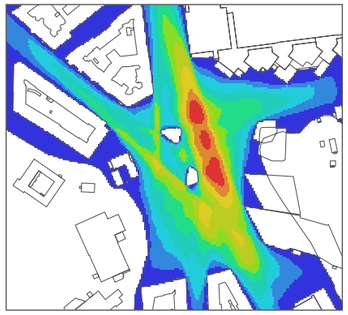
High
-
-
-
Low

High
-
-
-
Low

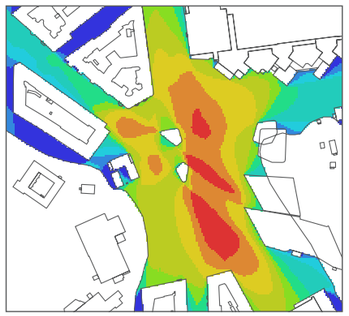
Space syntax analyses: Visual graph analyses, axial map analyses and 360 degrees isovist visual field analyses, different iterations of my proposal with added buildings



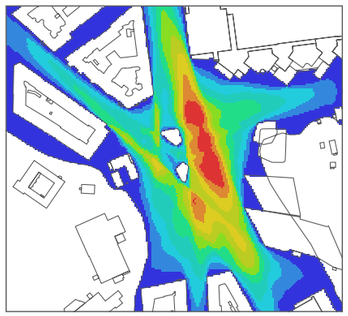
Visual connectivity analysis, iteration 1



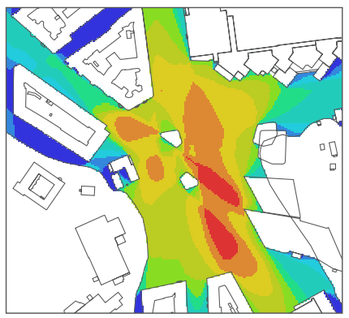
Through vision analysis, iteration 1



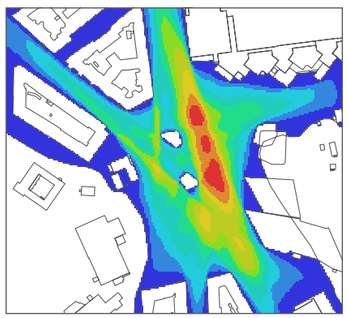
Visual connectivity analysis, iteration 2



Through vision analysis, iteration 2

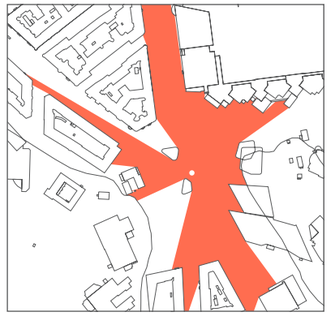


Visual connectivity analysis, iteration 3

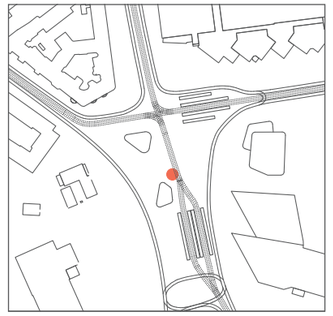


Through vision analysis, iteration 3

Axial map with fewest lines, iteration 1

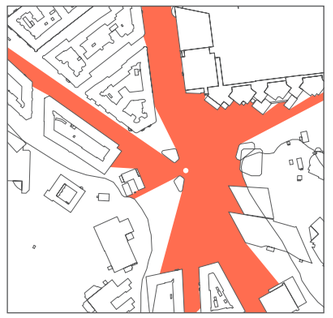


Isovist visual field from the point with the best overview, 360 degrees

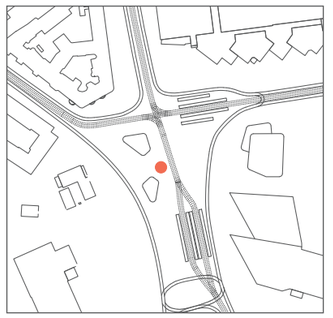


Position of the point in relation to the tram tracks

Axial map with fewest lines, iteration 2



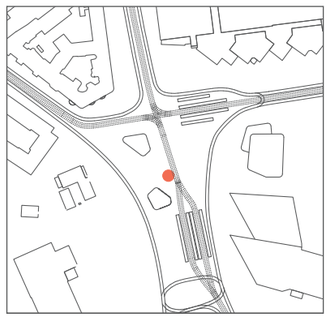
Isovist visual field from the point with the best overview, 360 degrees



Position of the point in relation to the tram tracks

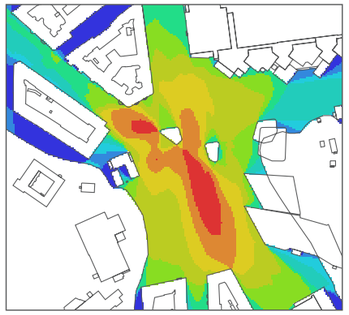
Axial map with fewest lines, iteration 3

Isovist visual field from the point with the best overview, 360 degrees

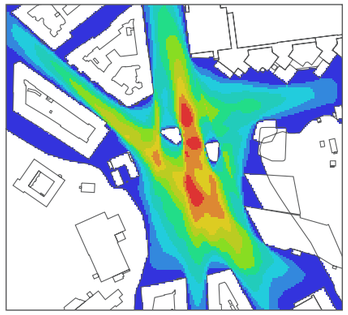


Position of the point in relation to the tram tracks

Space syntax analyses: Visual graph analyses, axial map analyses and 360 degrees isovist visual field analyses, different iterations of my proposal with added buildings

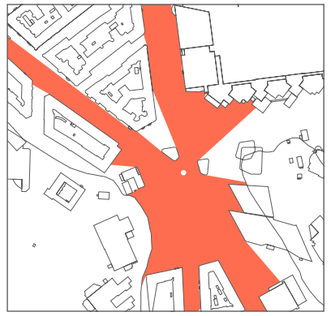


Visual connectivity analysis, iteration 4

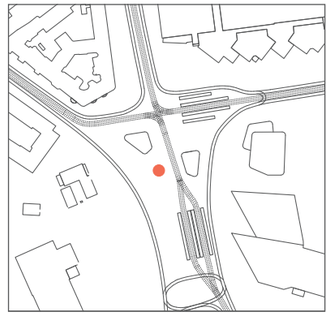


Through vision analysis, iteration 4

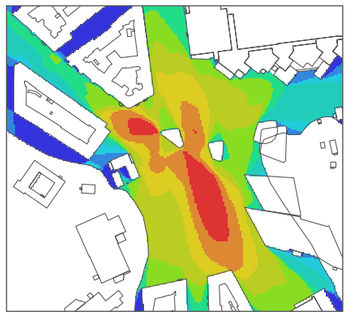
Axial map with fewest lines, iteration 4



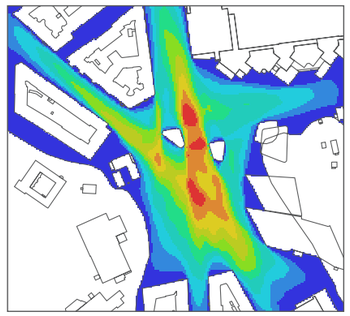
Isovist visual field from the point with the best overview, 360 degrees



Position of the point in relation to the tram tracks

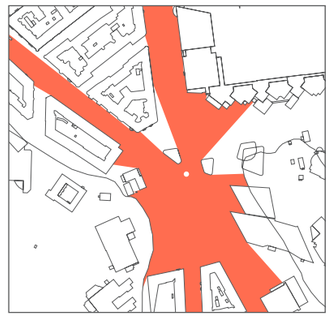


Visual connectivity analysis, final iteration

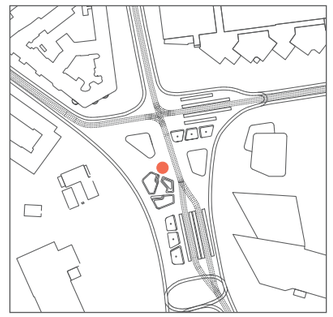


Through vision analysis, final iteration

Axial map with fewest lines, final iteration

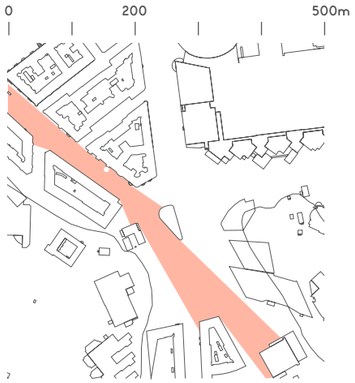


Isovist visual field from the point with the best overview, 360 degrees

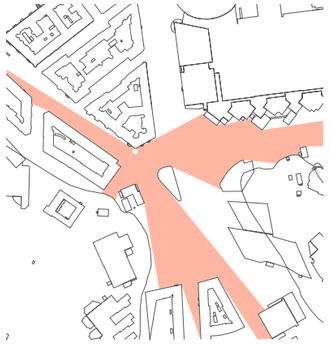


Position of the point in relation to the tram tracks

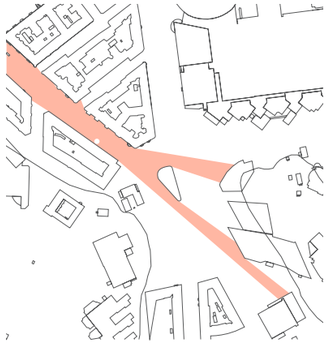
Space syntax analyses: Isovist visual field analyses of the project site with the proposal from the local building authority, 360 degrees



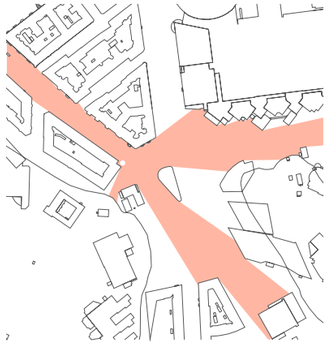
Entering from Södra vägen, north parts



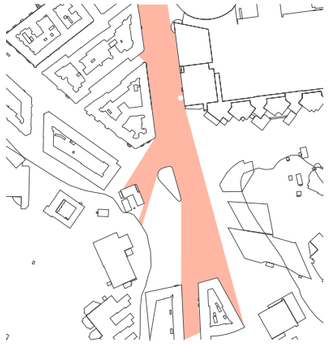
Entering from Södra vägen, north parts



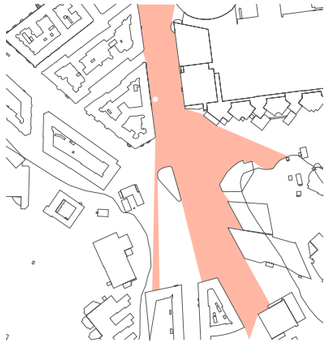
Entering from Södra vägen, north parts



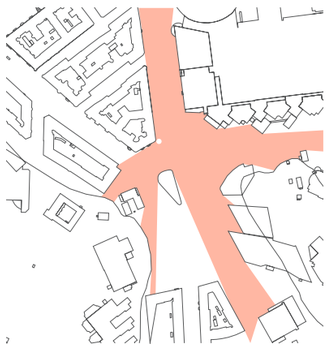
Entering from Södra vägen, north parts



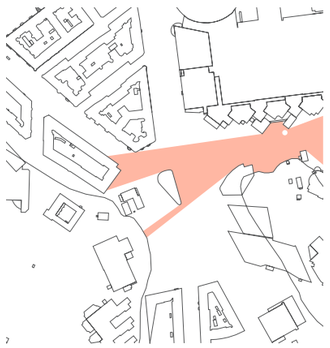
Entering from Skånegatan



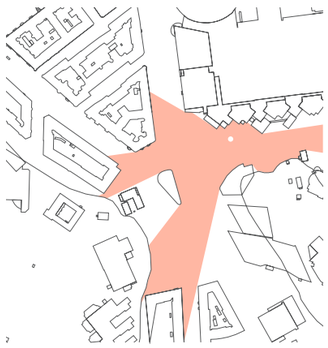
Entering from Skånegatan



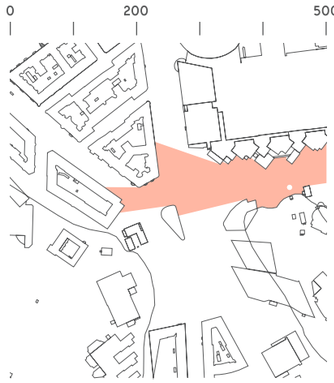
Entering from Skånegatan



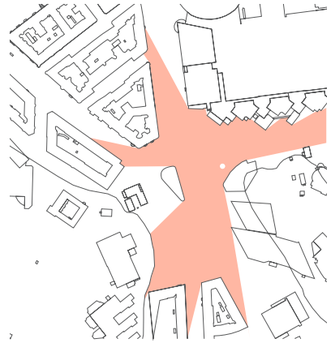
Entering from Örgrytevägen



Entering from Örgrytevägen

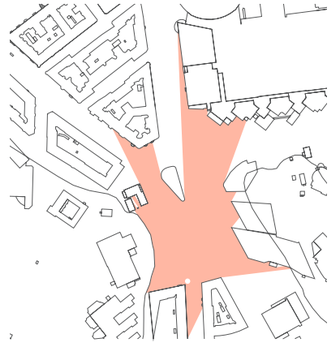


Entering from Örgrytevägen

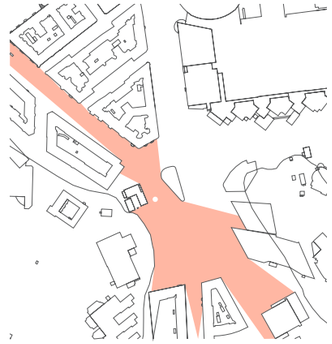


Entering from Örgrytevägen

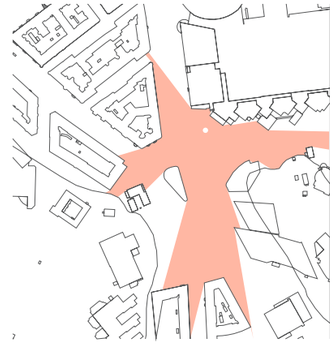
Entering from Södra vägen, south parts



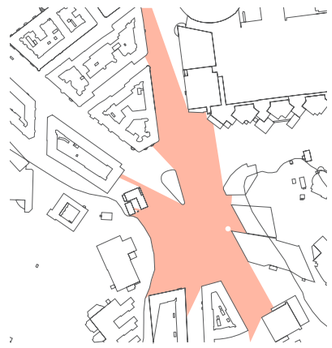
Entering from Eklandagatan



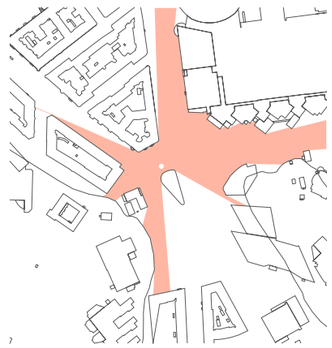
Entering from Johannebergs Lanteri



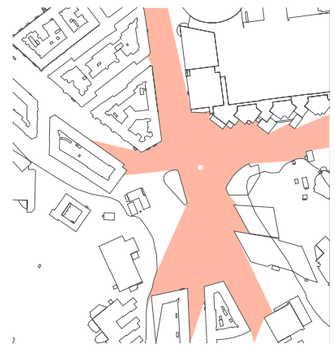
Gothia Towers main entrance



Universeum main entrance

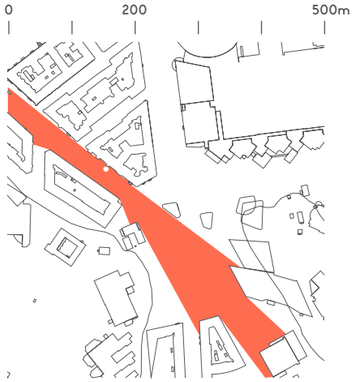


Center of the square, 1

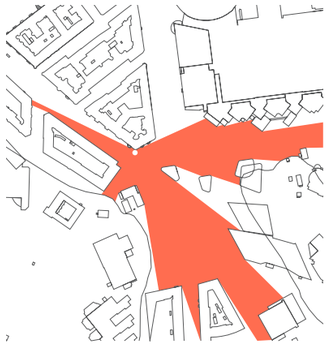


Center of the square, 2

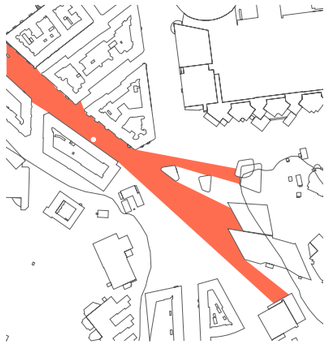
Space syntax analyses: Isovist visual field analyses of the project site with my proposal, 360 degrees



Entering from Södra vägen, north parts

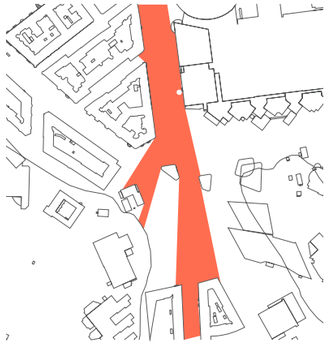


Entering from Södra vägen, north parts

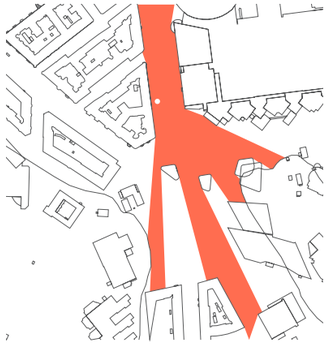


Entering from Södra vägen, north parts

Entering from Södra vägen, north parts

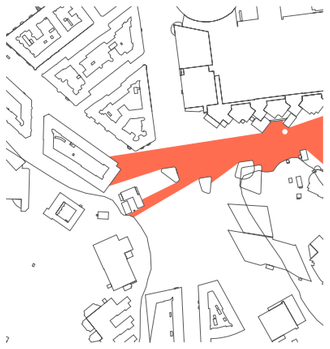


Entering from Skånegatan

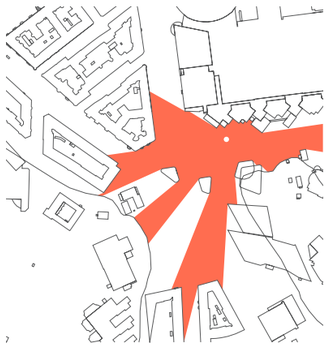


Entering from Skånegatan

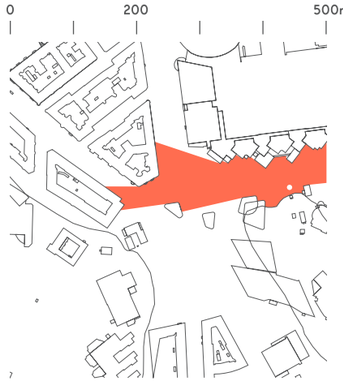
Entering from Skånegatan



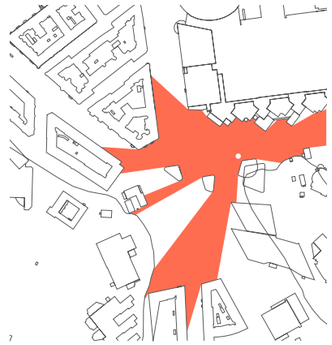
Entering from Örgrytevägen



Entering from Örgrytevägen

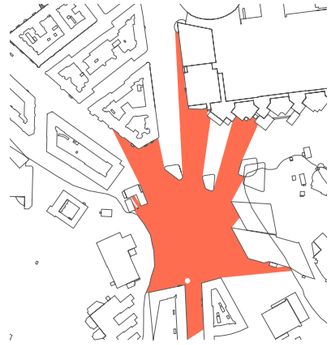


Entering from Örgrytevägen



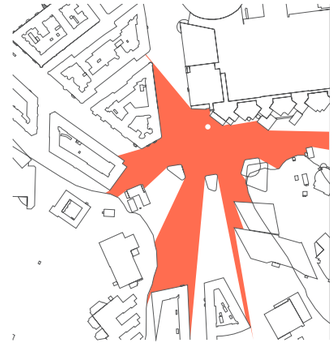
Entering from Örgrytevägen

Entering from Södra vägen, south parts



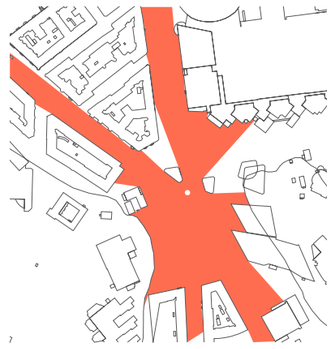
Entering from Eklandagatan

Entering from Johannebergs Lanteri

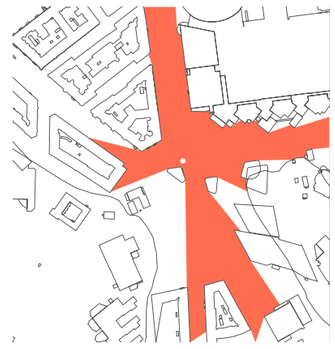


Gothia Towers main entrance

Universeum main entrance



Center of the square, 1



Center of the square, 2

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