# Gåsebäck Market Tower

Master Thesis in Architecture
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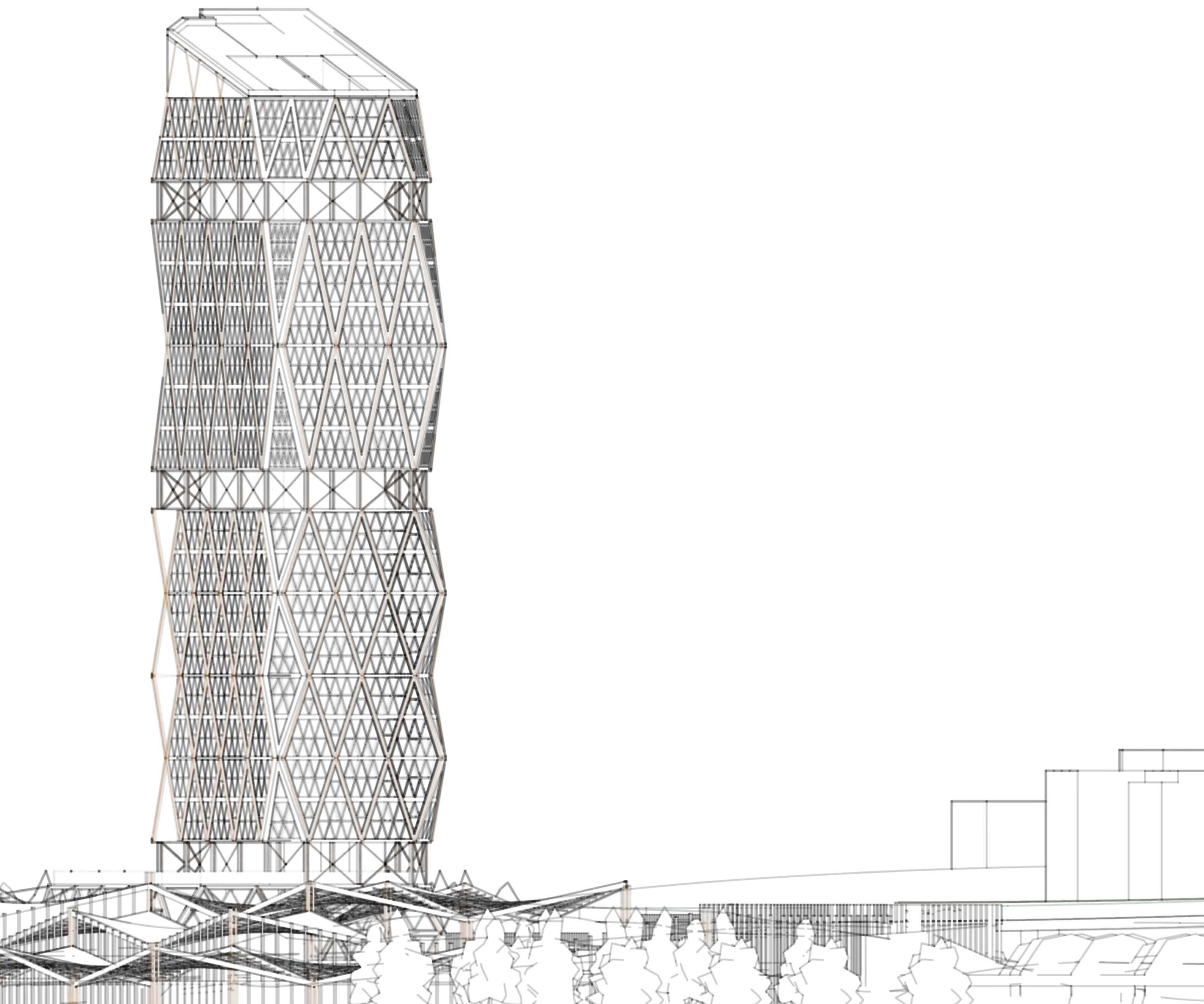

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**Aknowledgement**

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**Reader Guide**
The master thesis is separated into three overall main sections; 01. Theory and Analysis, 02. Process and 03. Presentation. The sections have constituent elements following the symbolic representation of a construction; Ground, Foundation, Columns, Elevation, Joints and in the end The Roof. In the beginning of the thesis, there is a glossary page with our interpretation of the definitions used throughout the text. In each chapter there is a conclusion box summarising the results gathered from the different investigations.

# Abstract

This thesis explores the concept of building a timber skyscraper to address the challenge of the growing population in Helsingborg, particularly for students and people above sixty years old. The aim of the project is to create a landmark and node that provides a better infrastructure to the neighbourhood, creates a cultural gathering point and promotes social interaction between inhabitants.

The thesis discusses the potential of using timber construction instead of traditional materials for a skyscraper, reducing the environmental impact of construction and helping to promote the use of bio-based materials in building design. Using timber also has a close relation to the area, as Sweden is one of the biggest exports of timber and has a tradition of building in wood.

The emphasis on the structure and how it can frame the social aspects wanted for the project has been a design development tool for the construction of the skyscraper. A grid was introduced to comply with the different requirements of sizes for the public and private areas, by using multiples of the grid area of 15 x 15 m throughout the design.
This thesis's research and design process involves a thorough analysis of the site and the target population, by desktop and phenomenological analysis including a site visit and workshop weeks.

This thesis aims to demonstrate the possibility of constructing a timber skyscraper in Helsingborg as a response to the increasing population demands. By combining a socially sustainable approach with an inviting and community-focused design, the project aspires to create a high-rise structure that not only addresses housing needs but also enhances the overall quality of life for residents and the surrounding area, by creating a combination of a node and a landmark, it both attracts and guide people through their daily flow, while also creating a hub of ideas and possibilities.

# Table of Content

## The Process

*[ Cultural hub; a gathering point of several activities related to culture, which is defined in this project as being a combination of spaces for the creation and exhibition of art, library and auditoriums. ]*

*[ Economic sustainability; relies on the public functions in this building, meant to support the development of creative activities into flourishing businesses, creating a focused cultural hub in the city. ]*

*[ Environmental sustainability; will be reflected in our strategy to reuse the waste material from the area and creating a building that can adjust to current and future uses, with a structure that can be a long lasting built platform for the community. ]*

*[ Emptynesters; People who do not have children living at home anymore, often couples in the age span of mid age to higher age. ]*

*[ Gesture; Element of the tectonic approach to the design process. Describes the envisioned, and in practice perceived, experience of the architectural space. ]*

*[ High-rise; Tall buildings, with six stories or higher. A skyscraper can be considered a high-rise building, but a high-rise is not necessarily a skyscraper.]*

*[ Landmark; Can be understood as a space, object or building that has a role in defining the identity of a culture, country or city and its inhabitants. ]*

*[ Node; Defined as a connective moment, of streets, of uses or activities. It can be a landmark in itself. It can also be the platform for a landmark to stand alone or for several to coexist and interact. ]*

*[ Public users; People from the neighbourhood area using the building as a transit area or public interaction space.]*

*[ Quality of Life: Including parameters such as visual connections, outdoor spaces, areas to interact and the feeling of security in the design ]*

*[ Stereotomic approach: Volumetric approach of the design. ]*

*[ Stereotomics: The heavier materials such as earth and stone in relation to the mound. ]*

*[ Skyscraper; A significant tall building that has a vertical construction showcasing the achievements in structure and creating a landmark for its respective city. ]*

*[ Student; person who is studying in a further education institution, often in the age span of 19-26.]*

*[ Tectonics; A combination between design and construction, which creates a symbiosis of the intersection appealing to the viewer's experiential understanding of the building. ]*

*[ Tectonic approach; An analysis of gesture and principles. ]*

*[ Vertical Expansion; Contrary to horizontal expansion. It is a strategy that allows releasing space at the ground level by concentrating the construction density in height, creating the possibility to introduce green and blue structures. ]*

*[ Personalisation; Opportunity to personalise a shared space outside private areas. ]*

*[ Principle; Enunciation and description of tools used in the tectonic design process. ]*

*[ Social sustainability; in this project, is about integrating the different needs for the users of the skyscraper and the community it has an impact on, minimising inequality and promoting personal and professional development. ]*

# Glossary

Ground 1.0

# Why?

## Introduction


Gåsebäck: View of site

# Why?

## SKYHIVE
## Timber Skyscraper Competition

### Our motivation to participate in the Buildner Competition

Buildner Architecture issues an annual competition challenging the way a state-of-the-art skyscraper would function - but this year another layer has been added as the skyscraper should consist primarily of timber.

Issuing the competition with this twist, they wish to see a structure that can tackle economic, social, and cultural problems by examining the relationship between the city and the skyscraper on an optional site of 130 x 80 m. (Skyhive Timber Skyscraper, n.d)

The competition requirements are seen as a guideline and are open for improvements, but it gave the project a starting point, where it was possible to further develop and investigate what is important for this project.
The reason for participation in the competition was an interest in accommodating the need of housing seen worldwide and still having in consideration to develop a sustainable proposal.

Since the competition was set to work with one of the most architectural iconic typologies, and transforming it into a sustainable building with biobased materials, it triggered our interest.

Not only could we explore how to build a skyscraper environmentally sustainable, but also how the impact a big building has on the individual, the neighbourhood and the city scale.

## Suggested Building Programme

| | |
|---|---|
| Retail component | 15.000 m2 |
| Grand lobby | |
| Food and beverages outlet | 5.000 m2 |
| Office spaces | 60.000 m2 |
| Executive offices | 10.000 m2 |
| Ancillary facilities | 10.000 m2 |
| Basement/parking | |
| Podium parking | |

## Competition Site

| | |
|---|---|
| 130 x 80 m | 100 % |
| Roads on two sides | No height limits |
| Allowed density | No distance limits |
| Building height | None |
| Distance requirements | |
| Underground restrictions | |

# How?

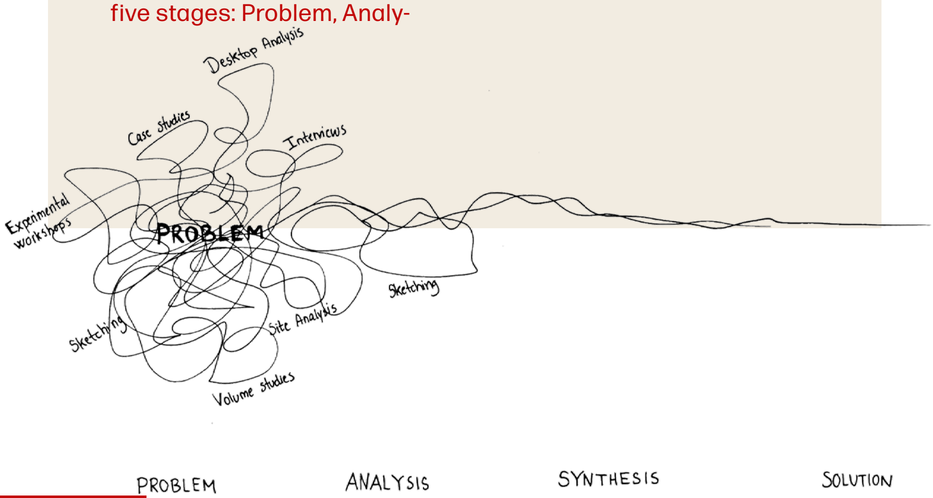
## METHODOLOGY

## How was the project developed?

The methodology for this project is an iterative design process, that can be illustrated as a curlicue for the initial part, but is later on straightened out, as seen on the illustration. This process has been described by Rowe in an architectural context, based on the observation of how several architects worked. He created the method called Design Thinking Method (Rowe, P.G., 1998).
From another perspective, Lawson bases his investigation on a Hegelianistic theory of the design triad Thesis - Antithesis - Synthesis (Lawson, B., 2005). Knudstrup later interpreted that research and based her theory on observations from an architectural school context (Botin, L. et al, 2005).

The process diagram from Mary-Ann Knudstrup contains five stages: Problem, Analysis, Sketching, Synthesis and Presentation phase.The work process goes back and forth from problem and analysis phase, analysis and sketching phase, sketching and synthesis phase, synthesis and analysis phase and lastly synthesis and presentation phase.

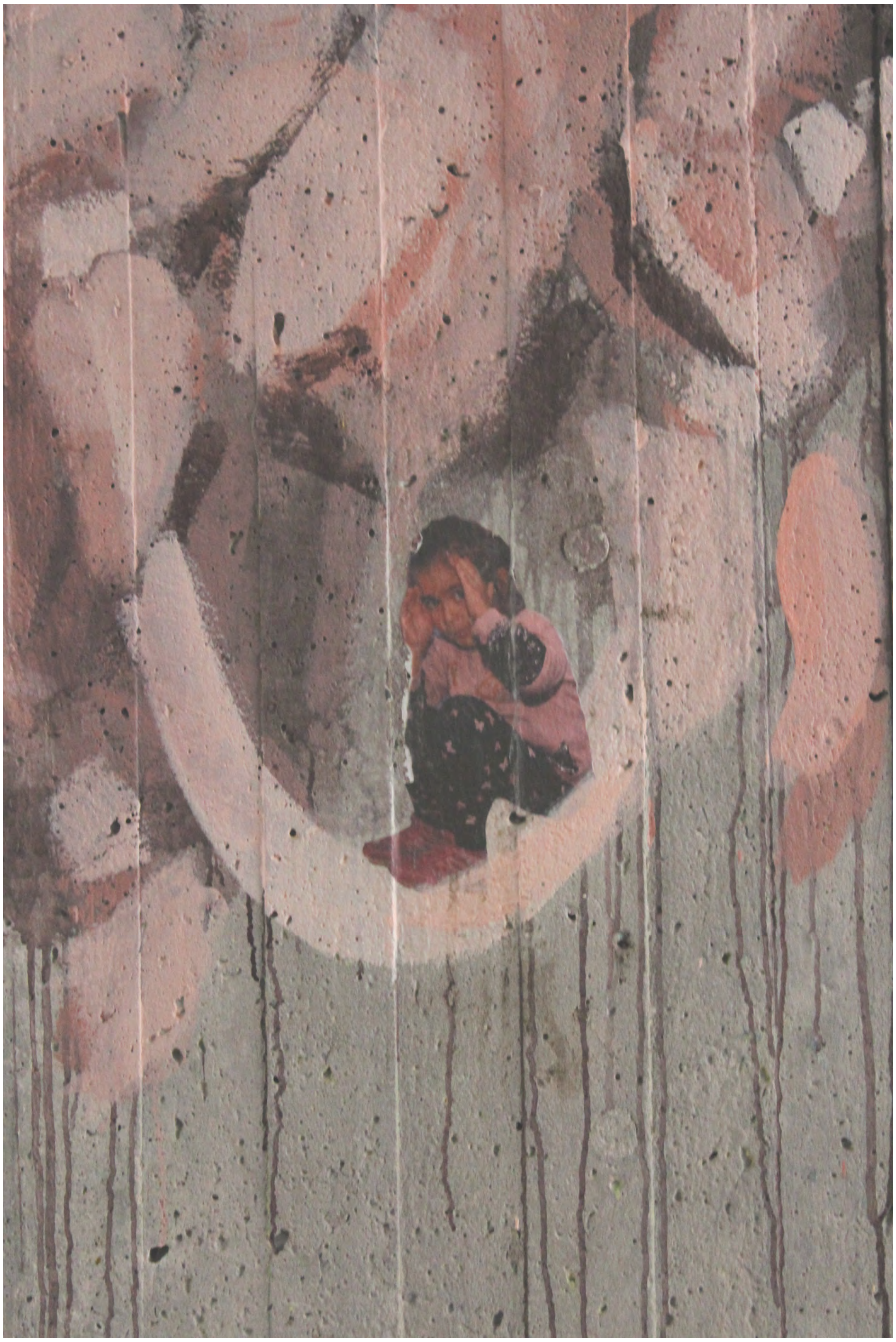
In the illustration of the process curlicue it still contains the phases from the process diagram from Mary-Ann Knudstrup, just illustrating the design process as how it in reality felt. The problem phase acts as the background for the rest of the analysis phase, where the sketching phase is part of the tools used during the analysis phase.
The synthesis phase still allows for reevaluation where the solution phase is the final stage.



| Tools | How did we use it? | What came out of it? | Phase | |
|---|---|---|---|---|
| Urban mapping | Developing a base map to be able to work with the different analysis on the same base, giving a clear understanding of the layers of the urban environment. | The results were used to find the site location, and develop the space programme.It gave an overview and understanding of Helsingborg in the urban environments. | Analysis and sketching phase | Desktop analysis |
| Case study | The case studies were used in close relation to theory text examining the plan, structure and tectonics by redrawing by pencil. | Examining an example gave a deeper understanding of the content in the theory, and was an inspiration for the design process. | Analysis and sketching phase | |
| Literature search | The literature search was wide to begin with, exploring different paths of e.g. how to build or implement different sustainability strategies. | It helped narrow the focus for the project, as there was a screening process of literature. | Analysis phase | |
| Tectonic approach | Based on a theoretical base, during model making, sketching and evaluating. | During the process it shaped the frames for the different functions, and guided towards a phenomenological approach to construct. | Analysis and sketching phase. During the design process. | Phenomenological analysis |
| Photography | During site visits it was used to document materials, atmospheres in different locations and during model making workshops. | It gave a general impression of the city by capturing a life frame, the angles in a physical model by placing the camera at human scale. | Analysis and sketching phase | |
| Sketching | Used in the initial design process, case studies to interpret the shape/ plan/sections n e.g.<br>Sketching on the computer was an important communication tool when having meetings online. | When not being able to capture the focus in a photograph a sketch can simplify the viewpoint. It was also used as a tool to connect what we see and read with our thoughts and visions. | Analysis and sketching phase | |
| Physical model and 3D model | The literature search was wide to begin with, exploring different paths of e.g. how to build or implement different sustainability strategies. | The physical models challenged the expression of the design and highlighted the problem areas. The 3D model also had the same results, but on a higher detailed level - the disadvantage was not being able to sense the scale. | Analysis phase | |
| Enscape | During meetings it worked great to see the design actively and make decisions based on the walk-through. | Gave a better impression of how it feels walking around in the building in terms of dimensions, materials etc. | Analysis phase | |
| Observation | Used during site visits by being in different locations towards our site and by photographing. | Supported the results from some of our urban analysis, and gave them an extra layer of atmosphere. | Analysis phase | |
| Interviews | Used with prepared background knowledge at the municipality of Helsingborg and for user analysis. | It either confirmed or enlightened us even more, and supported our decisions during the design process. | Analysis and sketching phase | |

*“Design is not something that is tacked on after analysis, or solving the spaceplanning puzzle; nor is it purely aesthetic.*
*The unsung element is the set of intangibles or cognitive processes that arise from passionate and deeply personal involvement...”*

- Andrew Pressmann (p. xxvi, Schwartz and Ford, 2017)



# Where?

LOCATION

## Why Sweden?

**Sweden has a long lasting tradition of building in wood, and is one of the leading producers and exporters of wood worldwide. Building in wood is part of the Swedish Parliament's strategy to reach net-zero emissions by 2045.**

### Building in wood in Sweden

Sweden has been building in wood for centuries, with the longest standing structures dating from the 13th century. Given to fire safety concerns, the use of wood was limited to two story buildings in 1874.

This meant that most individual houses kept being built in wood, especially timber frame, while for large apartment buildings and institutional facilities the industry had to resort to other solutions (Swedish wood, n.d).

In 1994, Sweden entered the EU. This affected the entire building regulations system and, together with the development of technology, new solutions were implemented, merging wood and other materials that fulfilled fire safety, indoor noise, and load bearing standards (Sharing Sweden, 2017).

Today, Sweden is one of the five world leaders in wood export (85% of its production), after Canada, Russia, the US, and slightly above Germany (Swedish Forest Industries Federation, 2020).

This information reveals the importance of the Swedish wood industry and its dominance in the nordic context.

Kärnan: a 35 m high medieval tower with wooden construction in Helsingborg first mentioned in year 1070.

## SITE
# Why Helsingborg?

### Choosing county

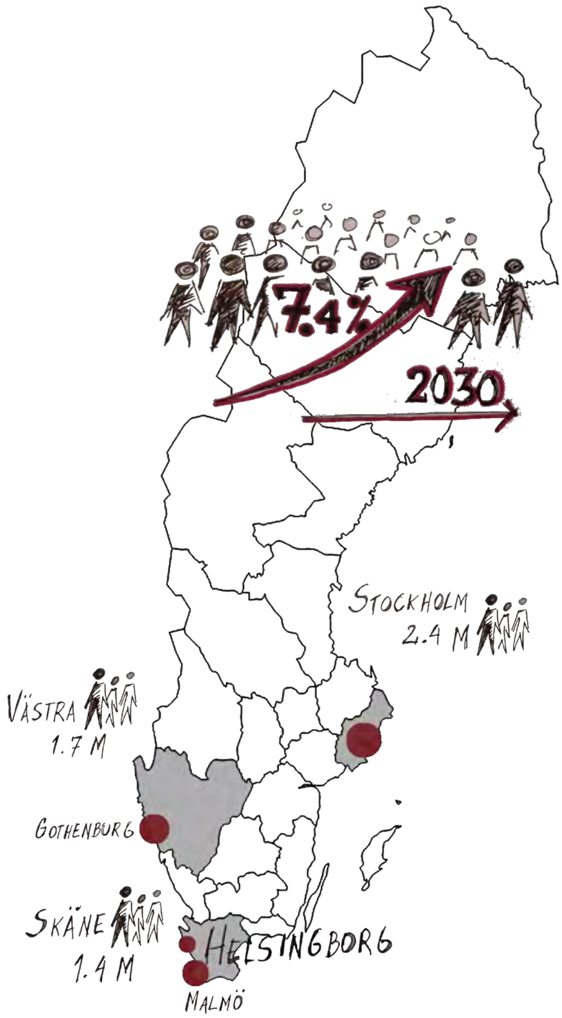
Research regarding the demographic situation shows that the Swedish population is expected to experience rapid growth around the entire country. The national statistics database refers to a 7.4 percent increase from 2020 to 2030, mainly thanks to international migration and citizens moving from the country to the main cities. The total population will then reach over 11 million inhabitants (Sweden Statistics, 2020).
To better understand the impact of the demographic statistical data, three counties with the largest populations (numerically) were analysed. The focus was set on their current state and expected development.

Stockholm county is the region of the capital and currently has 2.4 million inhabitants. The expected demographic growth is 10.8% until 2030 (Sweden Statistics, 2022). The city is a blend between the best-preserved mediaeval city and the modern city. It houses several skyscrapers, throughout different districts. The tallest is Kista Science Tower with 124 m (Stockholm, 2023).

Västra Götaland county currently has 1.7 million inhabitants. The expected demographic growth is 6.1% until 2030 (Sweden Statistics, 2022). This county is the region of Gothenburg, the second largest city in the country. In fact, the city is currently undergoing the largest urban development plan in Scandinavia, predicted to have 25000 new homes and 45000 new workplaces by 2035 (Smart City Sweden, 2020). Karlatornet - under construction - is predicted to become the tallest skyscraper in the Nordic region with 246 m height (Serneke, n.d).

Skåne county currently has 1.4 million inhabitants. The expected demographic growth is 9.2% until 2030 (Sweden Statistics, 2022). Malmö is the third largest city in Sweden and the one presenting the fastest growing. The majority of the population is under the age of 35 (Malmö Stad, n.d). The municipality commissioned the spanish architect Santiago Calatrava to design a building based on his sculpture Twisting Torso which is currently the highest northern building with 190 m height (Nikel, 2022).

Helsingborg is the second largest municipality of Skåne county, with 150 000 inhabitants and also expected to experience rapid growth (Sweden Statistics, 2022). The municipality is developing a comprehensive master plan which sets the guidelines for the regeneration of the city and new construction in the long term. The city's development is based on the H+ masterplan by the architecture firm ADEPT, approved in the context of a public competition (Helsingborg, n.d; ADEPT, n.d).




| Helsingborg municipality (Statistics Sweden, 2022) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age group | 2022 | | 2030 | | Growth 2022-2030 | | 2040 | | Growth 2022-2040 | | 2050 | | Growth 2022-2050 | |
| | nr | % | nr | % | nr | % | nr | % | nr | % | nr | % | nr | % |
| 0-14 | 26988 | 17,8 | 26344 | 16,4 | -644 | -2,4 | 27153 | 15,9 | 165 | 0,6 | 28634 | 16,0 | 1646 | 6,1 |
| 15-24 | 17468 | 11,5 | 20142 | 12,5 | 2674 | 15,3 | 19903 | 11,7 | 2435 | 13,9 | 20119 | 11,3 | 2651 | 15,2 |
| 25-44 | 40884 | 27,0 | 42082 | 26,2 | 1198 | 2,9 | 42816 | 25,1 | 1932 | 4,7 | 44218 | 24,8 | 3334 | 8,2 |
| 45-64 | 37446 | 24,7 | 39514 | 24,6 | 2068 | 5,5 | 42598 | 25,0 | 5152 | 13,8 | 43729 | 24,5 | 6283 | 16,8 |
| 65-84 | 25055 | 16,5 | 27688 | 17,2 | 2633 | 10,5 | 31490 | 18,5 | 6435 | 25,7 | 33889 | 19,0 | 8834 | 35,3 |
| 85+ | 3655 | 2,4 | 5025 | 3,1 | 1370 | 37,5 | 6356 | 3,7 | 2701 | 73,9 | 7912 | 4,4 | 4257 | 116,5 |
| **Total** | **151496** | 100 | **160795** | 100 | **9299** | 6,1 | **170316** | 100 | **18820** | **12,4** | **178501** | 100 | **27005** | **17,8** |

**Stockholm, Gothenburg and Malmö, as the largest cities in the country, are already far ahead in the development of their respective long-term plans, answering and preparing for further demographic growth. In Helsingborg, it is clear that we have the opportunity to introduce a skyscraper exploring vertical expansion as a strategy to address the demographic growth, as will be addressed in the following chapters**

## Helsingborg in Development

The city of Helsingborg claims to be a climate-neutral city in 2030 (Helsingborg Municipality, 2023). At the same time, the current population of about 150 000 inhabitants is expected to increase by about 6% until the same year and 18% by 2050 (Sweden Statistics, 2022). This means there is a need for a great investment in construction and infrastructure, with a realistic sustainability strategy.

International migration, a higher rate of immigration than emigration, contributes to the largest part of the projected population increase in the county. Though the population growth is expected to affect all age groups, it is mainly young adults 16-24 and 80+ that are expected to increase in the percentage of the population by 2030, when compared to the previous decade (Sweden Statistics, 2020).

## The inspirational H+ masterplan ADEPT masterplan

H+ is the city's renewal project for Helsingborg and has been developed by ADEPT architects including an area of 100 ha, which stretches from the harbour, and towards the south district of Gåsebäck, connected by a canal.
The vision is to create a flexible urban plan with focus on all aspects of sustainable development, including physical, social and financial dimensions, creating a "Tolerant City" (ADEPT, n.d).

Three main areas are referred to as the intervention areas, with particular characteristics, but that should be articulated among each other; Oceanhamnen - the harbour area, Söder - the University area and Gåsebäck - the industrial area. The general ambition is to connect the different districts.
To understand Helsingborg's approach to the H+ plan in detail, a meeting with the municipality was conducted (appendix 01).
Representatives for the municipality were Helena Taps, project leader and architect for the Gåsebäck area, Oscar Hall, planner for the whole area of Helsingborg municipality and Jessica Jönsson, an antiquity assessor, who conducts analysis regarding which buildings are worth preserving.

**Growing city and a new plan**
The demographic growth is happening mostly in the students and elderly age groups. On the other hand, the city's office has found that a lot of families are moving out of the city.
The reason is that families typically prefer to live in individual houses instead of apartments, for which there are currently not enough options.

The city also wishes to attract creative people.
In the last few years, this group has been moving to either Malmö or Copenhagen, where there is more access to art and cultural options. To create attractiveness in Helsingborg, a new cultural platform must be created.
As the H+ plan from Adept was developed in 2009-2013, there has been a need to make changes to adjust to today's problems.

The most impactful fact in the masterplan is that there is currently no funding to alter the railway to an underground route. Without this alteration, it will not be possible to create the lake that ADEPT proposed.
Nevertheless, there is a historic connection to the water that is important to restore. A new strategy, less invasive in regard to infrastructure, is being developed.
The green promenade to the city centre is being considered on a more local scale.
Existing pine forests and new parks will be connected in a green corridor. One of the new parks will be located next to the train wagon garages as seen in the illustration.
The representatives from the municipality explained how the materials for new buildings should reflect the surroundings. Extra precautions should be taken when placed close to historical buildings in the city centre. When placed further from the centre, there is more freedom and less concern about the contrast that might be created.


Illustration 1: H+ Masterplan made by Adept Architects

# Our intention

Our intention in designing a skyscraper is to create a landmark for the city, acting as a poetic focal point throughout the city, symbolic as a lighthouse guiding its surroundings.
The skyscraper should not act in a solitary manner, distancing itself from the city. Instead, it should promote a physical connection, by allowing the inhabitants of the city to interact and use it actively in their daily lives.
The building should become an integrated part of the surrounding environment and the existing infrastructure. Through the implemented functions and its own atmosphere, it will add value to the neighbourhood.

How can we create a wooden skyscraper that becomes a landmark in Helsingborg, supporting the expansion of the city set by the municipal masterplan?
How can this iconic structure generate a socially inclusive environment by having a flexible interior and allowing for an adaptive mixed-use programme?

# Initial problem statement

# 1.1

# What?

## What is the State of the Art?

Helsingborg townhall built in 1897, and was at first a policestation and a fire station.

HISTORY OF SKYSCRAPERS

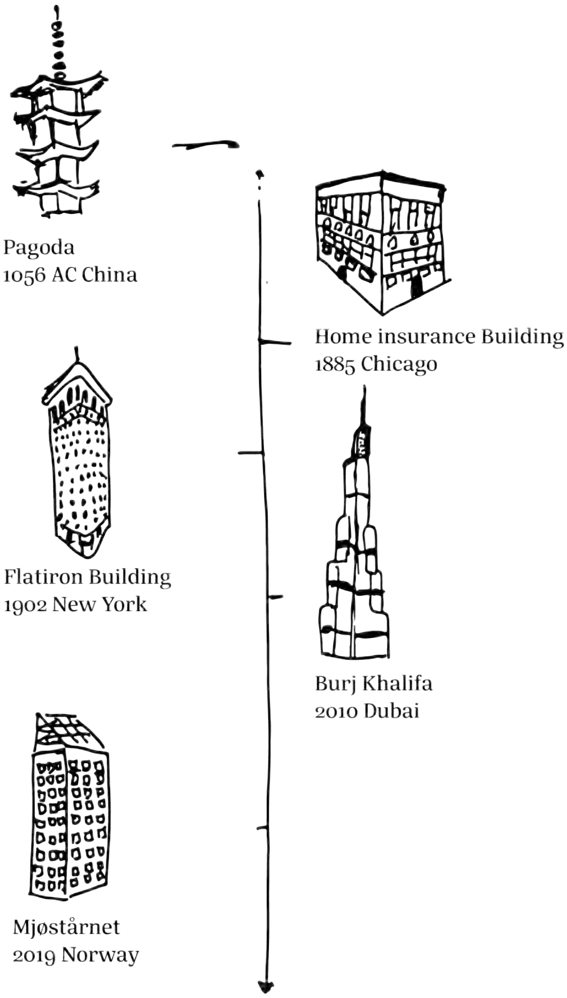
# What defines a Skyscraper?

## The Rise of Skyscrapers

In 1888 an American architect called Leroy S. Buffington designed a twenty-eight-floor building that he named "Cloudscraper".
From that moment on, it was considered a competition between cities to build the tallest building (Lepik, 2004).
Cities, much like people, want to have a recognisable feature and skyscrapers are a significant architectural achievement (Maslovskaya et al, 2018).

Skyscrapers were, in the beginning, built as office spaces but the structure was later used for housing.
The reason for this was a combination of people moving to the cities and space becoming scarce with prices for land rapidly increasing (Lepik, 2004).

But the wooden high rises had already been standing tall. Mainly in Asian architecture, where Pagodas, religious temples were made out of wooden construction and stand 67.31 m tall, and were built in 1056 AC (B. Orta, 2020).




Today the same which-is-the-tallest-building race is happening once again. This time, with timber structure skyscrapers. Cases such as the 'Mjøstårnet' in Norway, with its 19 stories were seen as the largest constructed timber building, but already being overhauled by 'The Ascent MKE Building' in Wisconsin USA, with its 25 stories in 2022. New visions for creating taller buildings are ongoing.

But the skyscraper is also a highly debated typology, since its very beginning. In Europe, it wasn't accepted by the conservative building regulators, as it would possibly ruin the advantages of the old buildings in their surroundings (Lepik, 2004).
It can also be seen in fiction, with novels and movies like The High Rise and Judge Dreed, where the skyscrapers have a negative connotation (Ballard, 1975)(Cannon, 1995).
In these fictional stories, the inhabitants of the skyscrapers lose touch with civilised reality because of their distance from the outside world and the hierarchy created inside the building.
Even if the examples are fiction, it is a reflection of how skyscrapers are seen and should be carefully considered on how to avoid distancing the users from the rest of the neighbourhood.
People have perceived skyscrapers as a stable architectural achievement; it is buildings that are standing tall as opposed to lying low (Troelsen, 2020). Just by its stature, it is a remarkable structure.
The skyscraper is part of the static image of the city skyline. When up close, it is a part of the act.
The skyscraper is also creating a viewpoint in the city, where people inside and outside both act as the actors and the audience of the play (Troelsen, 2020).

**Skyscrapers are a symbol of architectural and city achievements since the beginning of skyscrapers; it has been a competitive typology, in structural accomplishment.**
**First, it was constructed in iron and later steel, and today the race is beginning to occur in timber structures. However, timber high-rise buildings were already built tall before the Chicago skyscrapers arose. The bad connotation that comes from the fictional representation of the skyscraper should be lessened by trying not to create an economical hierarchy in the building and give back the attractive area to the public.**

TO BUILD IN WOOD

# What is the discussion today?

## Wooden buildings?

Building in wood has become a large topic of discussion. As 38 % of the $CO_2$ emissions come from the built environment (United Nations, 2020), the UN 17 goals include 11, 12 and 13, climate action, sustainable cities and responsible construction and production. This shows a need to find alternative materials, to what has been used until today, with a low carbon footprint.


Illustration 2: United Nations, "INVERTED SDG ICONS" 17 goals

Skyscrapers in wood have risen and large architectural/engineering firms are beginning to specialise in wood construction (Sweco, n.d.) (Henning Larsen Architects, 2022).

DTU, Denmark's Technical University, has made a report called "CO2 emissions from building life-cycles" explaining the emissions from different material use. In the report, they discussed the use of CLT slabs versus concrete sandwich slabs for sound insulation in floor decks. The concrete slabs show a smaller CO2 emission than the CLT slabs, where the reason was a larger CO2 emission per kilo CLT than per kilo concrete. As their study showed, the effect of sound reduction is related to kilograms of material used, therefore the concrete had a lower CO2 impact (Hertz, K. D., & Halding, P. S., 2020).

This small experiment showed that timber is not always the solution for a lower carbon footprint. But in buildings with less need for sound reduction, a CLT slab floor can still potentially be a better solution as it requires less material for construction than concrete.

A combination of different construction materials could be a possible solution as described by the report from DTU. But the study is not conclusive on what material has the best potential for sound reduction, it describes how materials are still being developed and there could potentially be created a solution where CLT would have a smaller CO2 emission than concrete.

The study also does not consider wood's ability to store CO2 as it takes at the end of the life of the material. And it does not take into account how wood is easier to reuse afterwards.

Talks and conferences have emerged, with architects, engineers and researchers promoting the use of wood in high-rise buildings, showing the benefits of using this material (building green, 2023) (Micheal Green, 2013).
Wood can store 1 ton of CO2 per m3, which makes the material carbon-reducing (Orta, B. et. al, 2020), and renewable material. In comparison with today's widely used material; concrete.
Concrete consists of sand/gravel which is a scarce material being extracted and predictions show that we are globally going to run out of sand because of high demand (Mette Bendixen, 2019).

**It is still widely discussed if building in wood is the future of decarbonizing the planet. Some studies show that building multi storey constructions with timber, does not necessarily have a lower carbon footprint in elements than the standard concrete construction (Hertz, K. D., & Halding, P. S., 2020).**
**Other people discuss the benefits of wood storing CO2 and potentially helping decrease the pollution from the building industry.**
**Exploring the potential of building in wood as a more bio-based renewable material can help push the boundaries in the building industry and stand as a statement for more sustainable exploration.**

INVESTIGATING TECTONICS

# What are Tectonics?

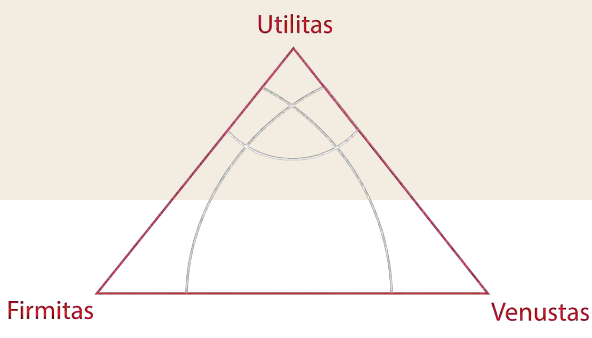
## What is the perception of tectonics?

Tectonics derives from the Greek word tekton, meaning builder or carpenter. But the word has been used in relation to several poetries where they speak of the art of carpentry (Sekler, 1965).

Structure and construction are generic elements and tectonics is a transformative element creating experiential architecture (Foged and Hvejsel, 2018).

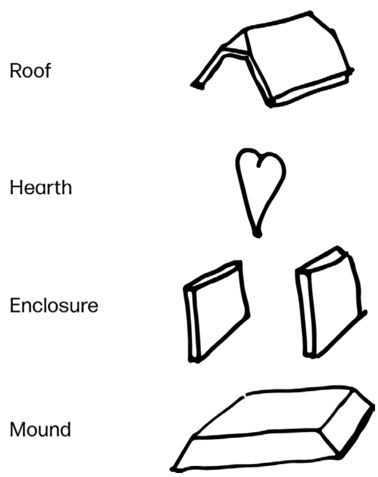
Vitruvius proposed that architecture could be assessed as an element of three; utilitas (function), firmitas (durability) and venustas (beauty), and this definition was the baseline for many years to come (Den Klassiske Vurdering af Arkitektur, 2023).

The Vitruvian triad is illustrated to show how the three aspects are intertwined - For example: if a building has a high durability or beauty aspect it has no function and consists merely of art, but if it only has function and durability and no beauty it is just a building.



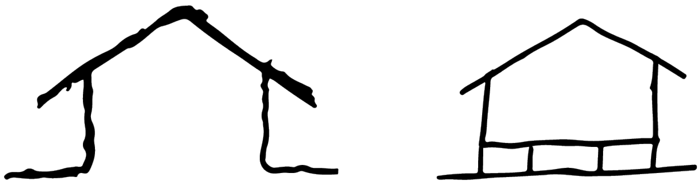
Gottfried Semper (1803-1879), a German architect, also felt the need to divide architecture into elements, such as Vitruvius did, and named the four elements the hearth, roof, mound and enclosure.
The four elements have materials assigned to each, where the hearth has ceramics, roof has carpentry, the mound has masonry and the enclosure has textile.

According to Semper the material has an important role when developing architecture, as the purity in the craftsmanship of the material creates art and expression and thereby beauty (Semper, 1989).




Semper's four elements of architecture can be further divided into two construction principles; stereotomics and tectonic. Stereotomic construction is the heavier materials such as earth and stone which, as mentioned before, are the materials for mound and hearth. The tectonics are the lightweight structures, which are the roof and the enclosure (Schwartz and Ford, 2017). From Sempers point of view, the materials of the elements are predefined in their categories and should not be enhanced or substituted by other materials to be able to carry more loads or have a wider span. In other words, he did not agree with the technological achievements that conflicted with his spatial definition (Schwartz and Ford, 2017).
Disagreeing on the technological achievements and continuing separating materials between stereotomics and tectonics can in many cases create a rigidness in the design in terms of materiality and construction. But the syntactical transition between the stereotomics and tectonics implies a poetic division from mound and hearth to walls and roof, which contributes with storytelling in the construction.
Eduard Franz Sekler (1920-2017), an Austrian architect, combines the theory from both Semper and previous theorists, but makes a distinction between construction, structure and tectonics. He explains it by substituting words in following sentence:

***"... if we substitute ´construction of society´ or ´construction of thought´ in a statement where previously we had ´structure of society´ we recognize a drastic difference. (...) The real difference between these two words is that ´construction´ carries a connotation of something put together consciously while ´structure´ refers to an ordered arrangement of constituent parts in a much wider sense."*** **- Eduard Sekler (Sekler, p. 2, 1965).**



Tectonics in the interpretation of Sekler is the space where the manifestation of the artist, the architect, can be expressed. Tectonics is a visible element of forces, loads and columns evoking empathetic emotions from the viewers (Sekler, 1965).

Another aspect is the theory from Kenneth Frampton (b. 1930), a British architect, who discusses the importance of evaluating projects individually, the consideration of building type, technique, topography, and temporal circumstances and cultural conditions.

An example he mentions to support his statement is comparing the way the gogo houses from Tanzania are built and how different the Japanese houses are construction wise.
There is a difference just looking at how the house meets the mound, as the gogo houses are built in a stereotomic way, almost as an extension of the mound, whereas the japanese houses are built on stilts meeting the mound on point foundation showing a tectonic approach (Frampton, 1995).

Marco Frascari (1945-2013) was an Italian architect who highlighted the importance of the role of detail in architecture.
The detail is the generator of design, architecture is not only elements of the construction, but is an art of the elements joined together in a meaningful manner creating spaces, where he stressed the importance of the joint (Frascari, 1981).

Today the definition of tectonics also concerns the impact it can have socially in a context, on an individual human being and on the environment. Edward R. Ford, an architect based in Virginia, congregated the elements to define tectonics in one sentence:

***"Tectonics is still an integrative philosophy; it is still an examination of the interwoven relationship between space, function, structure, context, symbolism, representation, and construction."***
**- Edward R. Ford (Schwartz and Ford, p. lxv, 2017).**

Tectonics is not only how architecture is interpreted, but is also a method where it can be divided into two elements: one that describes the envisioned experience of the architectural space (gesture), and the other describing which tools have been used and the effect these tools had (principle) (Foged and Hvejsel, 2018).
The structure can also be characterised as a holistic analysis, as the logic of the elements comes in a certain order, such as material, the joining of these and the joining of the primary structure and so forth (Beim, 2004)
Going back to the Vitruvian triangle, it can still be used as a tool to evaluate architecture today, but has to consider elements other than the ones mentioned in the triad in some cases.
The quality of architecture does not only lie in the readability of the joints and structure, but is defined by how the architecture also encompasses empathy, curiosity and poetry (Foged and Hvejsel, 2018).

Our tectonic position is taking offset from the knowledge of great theorists, intertwining their theories to create a definition used for the project.

Architecture is a combination between design and construction, and when in symbiosis the intersection can appeal to the viewer's understanding of the building creating an experiential architecture.

Meaning that not only should the building meet the basic requirements of what is needed to live in it, but rather enhance the quality of living by thinking about how the different elements in a building are expressed and joined together as a piece of art.
A tectonic approach of gesture and principles are seeked to be implemented in the design process.

LANDMARK AND NODE

# What is the definition?

## On the intersection of Landmark and Node

Our definition:
A landmark can be understood as a space, object or building that has a role in defining the identity of a culture, country or city and its inhabitants. It can be representative of a cultural context, circulation dynamic or simply by contrasting with its surroundings.
It does so, in a manner that allows it to recover a memory and possibly start a conversation.
The interaction of the landmark with the environment can also have a generative character, boosting the development of other dynamics, interpersonal relations, cultural or economic activities or infrastructural connections.
Can often be used as a reference point or a navigation aid.

The node is a place of conversion, generated by the intersection of paths or overlap of locations. It is an area that attracts concentration of activities, people or traffic, depending on its character. In practice, a node can be, for instance, a building, a square or a large road intersection.

Because of their distinctive character, standing out from the urban fabric, the concepts of landmarks and nodes can interact with each other.
This interaction generates a union that enhances their individual role and creates a powerful moment where referential uses and activities can take place.

## Defining the Elements of the City with Kevin Lynch

In one of his defining works, The Image of the City, Lynch described five element types. These have been the base of contemporary knowledge when discussing the composition of cities.

**Path**
The main element that composes the infrastructural grid of the city. In general, the channels through which we navigate in the city, establishing the connection between one location and another.

**District**
Areas of the city that mentally present to the observer as a unit, given to a representative building typology, activities, topography, textures and materials.

**Edge**
Element that establishes boundaries or breaks between other elements. The limit where land meets water, the disruption provoked by a highway between two neighbourhoods et cetera.

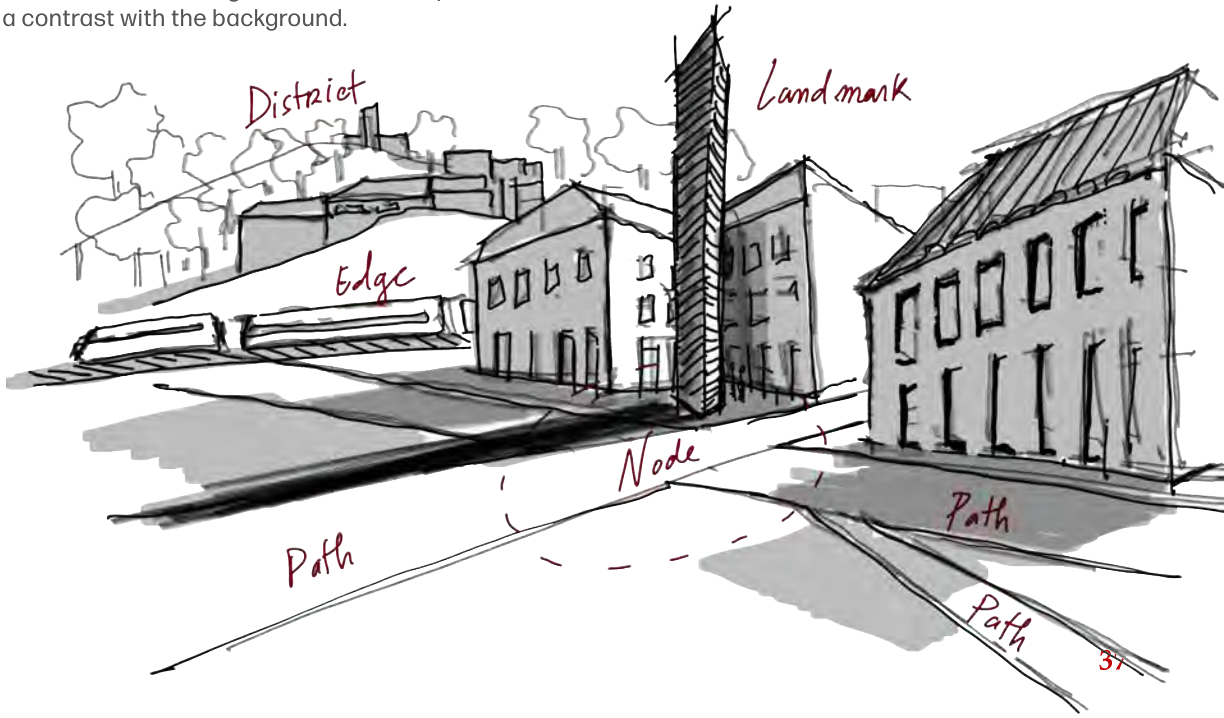
**Node**
Strategic intersections of paths or locations that generate a type of concentration. They are usually related to the mobility infrastructure of the city, meaning that the node is where combinations of systems happen. For example, nodes can be train or railroad stations or squares.

**Landmark**
Reference points that are recognised as such by establishing a contrast with the background.

Yet, it is worth noting that Lynch was the first one to point out that:

***"... there is a tendency to skim over the interrelation of the parts into a whole. (...) It is the total orchestration of these units which would knit together a dense and vivid image, and sustain it over areas of metropolitan scale."*** (Lynch, 1964, p.108)

It is the combination of such elements that creates a variety of cities' identities and has the power to enhance their individual identity or create a new combined one.



## Other Perspectives

For the study of the landmark, in particular, Kalin and Yilmaz, researchers at Karadeniz Technical University, developed a study in 2012 regarding the visual perception of Hagia Sophia in Trabzon, Turkey, while in motion through the city.
The building has carried its importance since the 13th century, surviving many changes of use; mosque, military storage, cholera hospital, mosque again and currently a museum. This suggests not only the cultural impact of a landmark but also the importance of adjustment to new uses, and adapting to the evolving surrounding city.

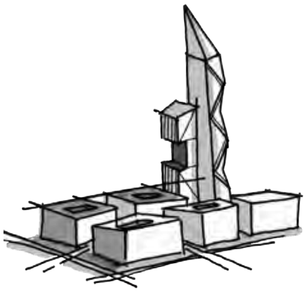
In 2004, Hasanuddin Lamit, researcher at the Malaysia Technical University, produces a study entitled "Redefining Landmarks" where he presents the landmark as a discernible figure from its surroundings, raising the possibility of it being, beyond a building, any object or space suggestive of a memorable event, standing out from a homogenous background. The author proposes a categorization of landmarks:

**Towers**
Symbols of power, design and height only limited by the technological knowledge available at the time. Have the ability to respond to "dense population concentration, high land costs and scarcity of land" (Lamit, 2004). Their dimension implies the possibility of interaction for a large variety of uses and systems.

**Buildings**
Built elements that are determinant to the image of the city, standing out through aesthetic attributes, implying "dominance" over their surroundings. Better perceived from a close distance.

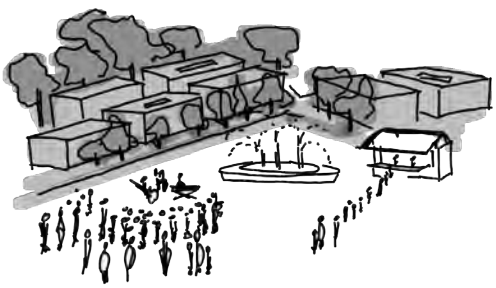
**Open spaces**
Characterised by their key location in the city, have the power to create concentration or stage a certain activity. Can be perceived as a reference point but not as an orientation aid.

**Special Urban features**
Not characterised by their size - in relation to the other categories - these should be understood as of artistic character, a sculpture or an installation possibly a starting point of conversation or critical debate.

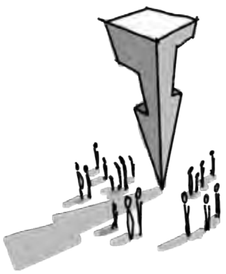


Towers

Buildings



Open Spaces



Special Urban Features

In this paper, the landmark role intertwines with the concept of symbol, by establishing the definition of a landmark in relation to its importance in the city's dynamics and relations, both physical and metaphysical.

From the categorization of landmarks, the definition of open spaces can be directly related to the early description of node, developed by Lynch.
This correlation leads us to believe that nodes can be, under certain circumstances, perceived as landmarks (using Lynch's terminology).
A famous case is the Piazza San Marco.
The main square in Venice is a landmark in itself but also represents the urban space where several landmarks coexist. Among them, the San Marco campanile tower in the south-eastern corner punctuates the connection with the Grand Canal (Lynch, 1964).

In 2016, Bala refers to landmarks as "urban symbolism" and how the perception of signs can be different depending on the individual's cultural background and previous experiences. Landmark, in the context of urbanism, refers to an easily recognizable figure, possibly representing a country, its culture or a certain historic period.
A landmark is often chosen by its significance, cultural representation, function or associated activity or visibility, possibly recognized as a navigation tool.
Their powerful presence means they have the ability to stand alone, creating a contrast with the surrounding environment.
When located at an important site, e.g., at a junction of important paths, they become even more relevant. (Bala, 2016).

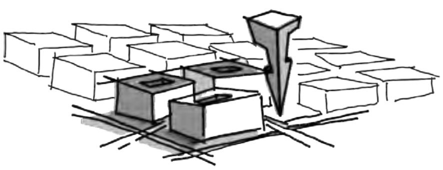
Landmarks can vary in typology, from buildings with a particular historical and cultural significance - a church, a museum or a skyrise - to structures such as bridges, which can also withhold a particular significance. (Lamit, 2004)

Wang and Sun, 2019, noted that most often the landmark quality of a structure is given by exterior visual observation and not by the experience of the interior space.
Therefore, it is relevant to understand the qualities of the space between the observer and the landmark. The authors refer to this as "Urban landmark space" and develop a set of conceptual guidelines to design it in an effective manner, considering the impact of the pre-existing urban dynamics. Some of the most important concepts are the following:

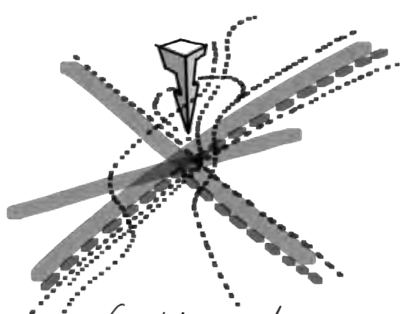
**Activate through contrast**
The landmark only exists by comparison with its surroundings.

**Combine and domain**
When combined with the road network, the landmark becomes a referential point and part of the cognitive recognition of space.

**Become a symbol**
Historic, political or local aesthetic symbolism provides a mechanism for an object to be perceived in a dynamic manner by creating an affinity with its surroundings and the observer.



Activate through contrast



Combine and domain

Become a symbol

Urban space itself can be generally described as all space between buildings, as mentioned by Rob Krier (2011) in the report “Typological and Morphological Elements of the Concept of Urban Space”. He also defines the two main elements as being: the street and the square.
These are distinguished by the functions and types of circulations that happen within their differentiated limits. The square was one of the first ways in which men started defining urban space, by placing several houses around one open area.
The courtyard typology became representative of a symbolic, and many times religious, value. The Agora is an example of one of the first dedicated social spaces.

Krier also describes the appropriate activities to be developed in a square area, primarily commercial and cultural, with the possibility to have residential use (Krier, 2011).

**The interaction of the landmark with the environment can also have a generative character, boosting the development of other dynamics, interpersonal relations, cultural or economic activities or infrastructural connections.**
**Landmark and node can exist in close proximity or paired in such a way that the observer will perceive them as one unit. This can be possible by placing a building with a significant typology at a crossing point. The design must be developed in a way that incorporates how the users and surrounding will perceive and use it.**


Knutpunktet: A multifunctional building containing bus-, metro-, and ferry traffic, and SWECO Architects office on top.

INVESTIGATING USERS

# Life in the Heights

## Living in the Heights

As history shows, the skyscraper typology has been used for several decades, and during modernism it was strived to make better high-rise residential buildings, allowing everyone to have access to light, view, and fresh air. But even if this ideology strived for better living conditions, the criticism arose discussing the negative impacts it especially could have on children.

The report developed by BUILD (Mechlenborg, M. and Hauxner, K., 2021) shows a new worldwide view on living in a skyscraper as it has shifted from something negative to being something that only a few can afford - it is a luxury.

This can be seen in the documentary of Oscar Niemeyer about Copan, which is the largest residential building in Latin America, where people invested in several apartments as a leasing business.
Even if the building has issues such as no meeting areas, most residents state that they are proud to live in the building, simply because it is  a landmark of the city of São Paulo (Copan: Cidade Vertical, 2019).

**The Representative User Group**
The biggest representative group living in skyscrapers, according to the report from BUILD, are what is described as emptynesters, which are couples who do not have children living at home anymore and do not wish to keep a house with a garden (Mechlenborg, M. and Hauxner, K., 2021).

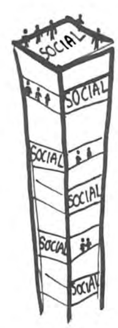
Another group are students, given the opportunity to have an active community in the building. This user group does not have the same opportunity to choose their preferred building typology, their choice depends mostly on the rental price and location.

**Well-Being**
The quality of living in the heights can be affected by the negative outcomes that have been examined during the years. The topic of loneliness has been widely discussed, as several investigations have shown that occupants in high-rise buildings have reported psychological concerns such as being afraid of crime and feeling lonely (Gifford, R., 2007).

Another research by Barr & Johnson distinguishes between the building typologies; skyscraper and a high-rise and the impacts they have on the occupants. It suggests that a skyscraper has a more positive impact on the occupants than a high-rise as the skyscraper often seeks to enhance the city image by its aesthetics, thereby giving the occupants a sense of pride in their home and a high-rise is often a quick solution to housing-demands (Barr, J. & Johnson, J., 2020).
The research concludes that there are several physical factors that have an impact on the level of satisfaction and quality of life:

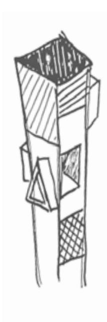
Visual connections
Undisturbed view, enhanced by the quality of having floor-to-ceiling windows, giving opportunity for the occupants to follow the seasons and life in the city.

Outdoor spaces
Choosing different outdoor spaces gives opportunities to find shelter from wind, different view orientations, and creates different levels of socialisation opportunities. Rooftop outdoor spaces are used less because of the strong winds.



Community
Having several communal spaces pr. 30 persons enhances contact between occupants drastically, while the necessary communal spaces are the allocation area, stairwell, and the entry hall area.

Security
Having clear instructions of what to do during an emergency should be part of the development of the building.



User group
Defining the user group to target their needs and behaviour patterns.

Not too tall
Skyscrapers with stories between 15-20 have a higher potential for creating social life, minimising troubles with wind and the feeling of being less safe.

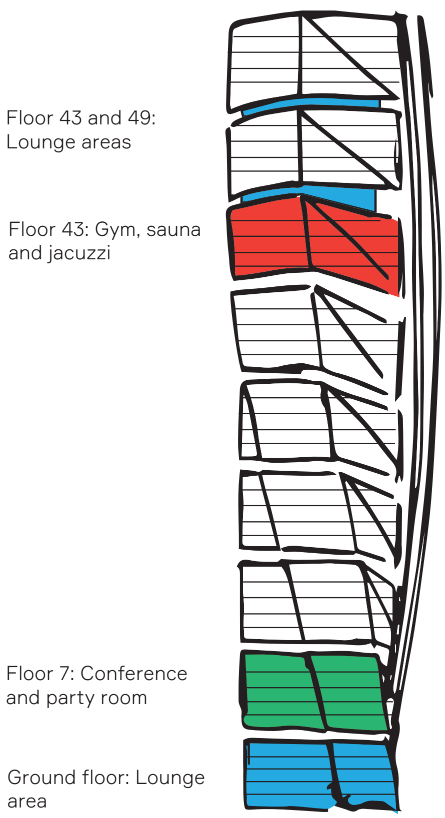
## Turning Torso

**This case study is chosen because of the building typology, the variety in apartment sizes welcoming a broader user group, and the focus the design has on the occupants comfort. But even when comfort was the goal there are still some faults in the design that go against the comfort and well-being of the occupants.**

The Turning Torso was designed by the artist, sculptor and engineer Santiago Calatrava, which depicts the movement of a body in a turning 90 degrees movement, and was meant to transform the new harbour and be the landmark for Malmö. The surrounding neighbourhood is composed of low-rise apartment buildings, an area designed as a village by the sea (Lepik, 2004).
The poetic symbolism of the human body depiction continues in the construction of the skyscraper. It consists of nine blocks that are a reference to the spine, where each block consists of five stories.
Some of the comfort focal points integrated in the building are:

**Security**
There is no entry for people who do not have an appointment in the building, as every area demands access through a key tag system. At the ground floor lounge there is a 24/7 reception just by the elevators. Turning torso has five elevators, three for the apartments assuring that there is always an elevator available, and two for the offices on the top floors. The building is cautiously planned with fire safe compartments, which creates the feeling of safety for the occupants.

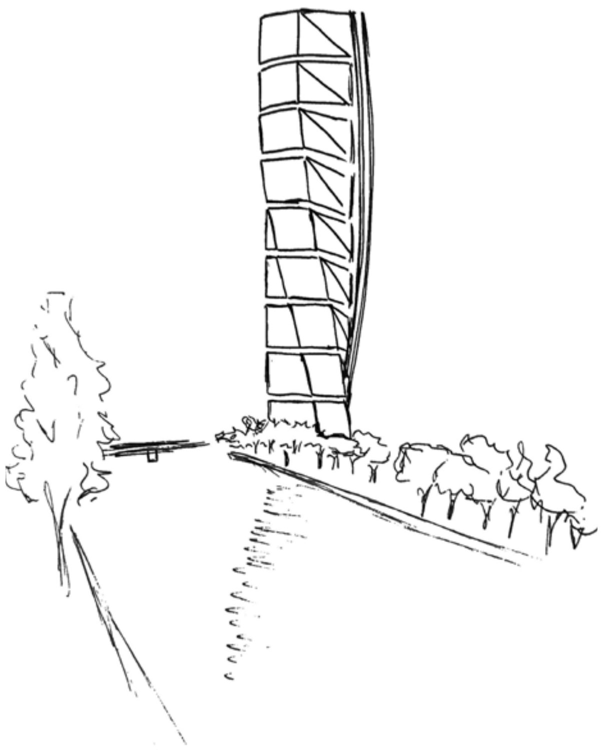
**Social areas**
On floor seven, the party area is often in use by the residents when they are having an event, but is never used as a casual meeting point in between neighbours. On floor forty-three the facilities do not create a meeting point between the users, as the gym is often empty, and the sauna and jacuzzi facilities are intimate events as they are booked per apartment.
A general observation of the social areas are the sizes of the rooms, which seem too small and the shape is impractical, resulting from a compromise with the design and shape of the structure.
The social areas are minimal and placed too far away for many of the occupants, creating a physical and psychological barrier, which reduces the chance of being used . The entire building does not have shared or private outdoor spaces, which minimises the feeling of well-being as an occupant.

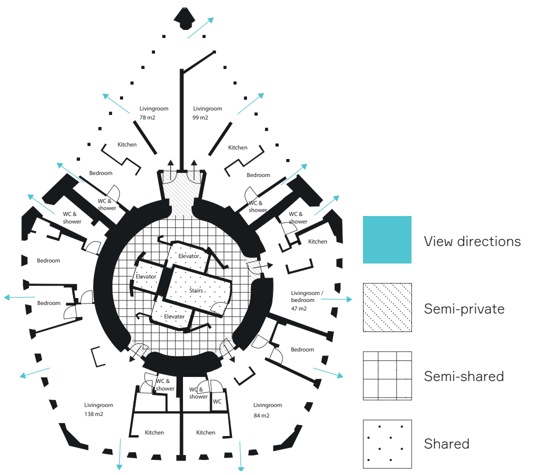


**The design of the apartments**

There are six different apartment types in the building stretching from 1, 1½, 2, 3, 3½ and 4 room apartments. For each apartment type there are several different layouts of the plan, as seen in the illustration. Including different apartment types in the building, is an invitation to a broad user group. This factor contributes to promote inclusion and more possibilities of interaction with the  surrounding neighbourhood.

Four of the five apartments in each floor also have several view orientations with windows from floor-to-ceiling which enhances the well-being for the occupants, and even includes, in some of the apartments, a view from the shower. Giving the apartments a different view orientation allows the occupants to interact with the city's skyline at different levels and follow the storytelling of the everyday city dynamics.






**Important factors to enhance well-being when designing a skyscraper are: visual connections, outdoor spaces with different degrees of privacy, community spaces pr. each 30 people, design for a specified user group, security considerations in case of emergencies and not making it too tall.**

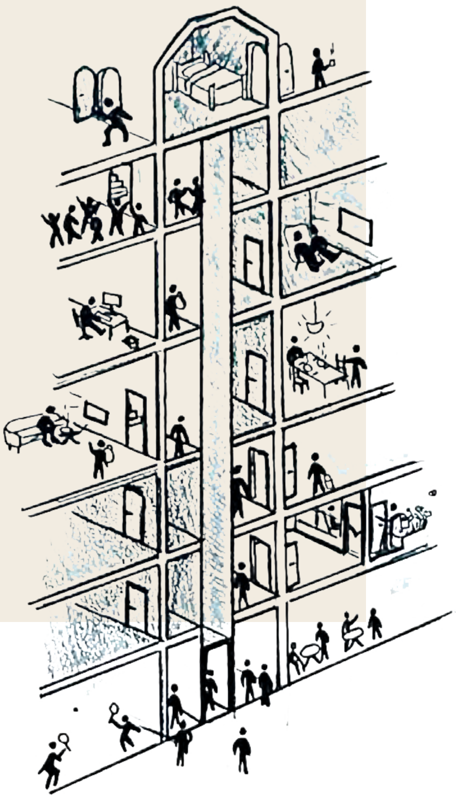
## INVESTIGATING USERS

# Users of a Skyscraper

### The flying occupants

The conducted research on the demographic development of Helsingborg has allowed us to define the user group for the residents.
The data suggest that there is an increasing population of Helsingborg consisting mainly of students in the age group of 16-24 and middle age to elderly people, in the age groups of 45 and above.

The two user groups have different needs and behavioural patterns, but also share some similarities of needs such as the wish of having a sense of community in the building.



**Students**
A study from Trondheim, Norway investigated which aspects are important to secure housing satisfaction for students. A student is defined to be between 19-26 years old, who are in a phase that is called "young-adult phase", where they are in pursuit of their own ideals, new friendships and experiences. The students want to participate in the city's social and cultural life as to why the location is important.
Another student group which also exists are the people between 30-49 years, who often are in a relationship or/and have kids. This group represents a small percentage of the student type. (Thomsen and Eikemo, 2010).

The results from the quantitative survey indicated that the most important variables for a student was the type of housing - if it was a tenancy or an ownership, and next the quality of the housing and the location. The first variable was important for the students as the survey investigated between communal student accommodations and private tenancies of family apartments or ownerships.
The lack of experiencing the student accommodations as homes underlines the importance of how the different typologies are designed, if there is place for personalisation and which kind of materials are being used to avoid an institutional feeling (Thomsen and Eikemo, 2010).
The survey also included questions about individual facilities, such as the kitchen. Results showed that it did not matter how satisfied the students were with the quality of the accommodation if those facilities were shared. They also underlined that it is a highly subjective topic, as each person is influenced by their course throughout life, their culture and social circumstances and by their personal abilities and choices (Thomsen and Eikemo, 2010).
Thomsen also found in an earlier study showing that students thrived, no matter the housing type, when the design considered these aspects (Thomsen, 2008):

Variety in relation to the design of dwelling types.

Considerations in the choice of exterior/interior materials to avoid the feeling of an institution.

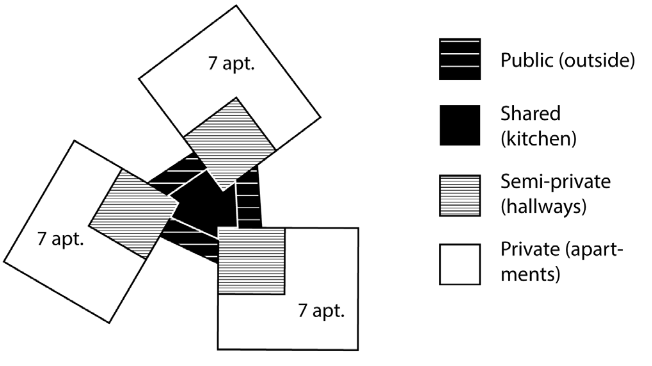
Differentiation of functions for spaces.

Consideration of graduating the private, semi-private and public areas.

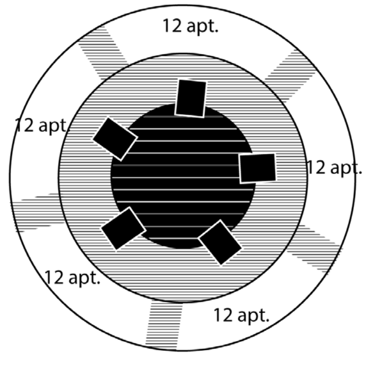
Share common facilities with a smaller group enhancing the feeling of belonging.

A project which shows these considerations is the Campus College in Odense from 2015 (Campus Kollegiet, no date).

A project which shows these considerations is the Campus College in Odense from 2015 (Campus Kollegiet, no date). It consists of three towers connected with each other by a volume containing the communal areas; kitchen and living room.
Each tower has seven apartments, meaning that twenty-one apartments are sharing the communal areas. On the top floors there are study rooms and a party room.
Another project focusing on the social aspect is Tietgenkollegiet in Copenhagen from 2006 (Tietgenkollegiet, no date).
The idea was to avoid the end of the hall plan layout by creating a circular building.
The circle is a symbol of communal feel, and is where the concept arose from. Every shared facility is towards the inside of the circle giving visual connections to every floor, and the private rooms are faced outwards towards the city.
On each floor there are sixty rooms, divided into five groups of twelve sharing a kitchen and living room. On the ground floor a party room, workshops, and laundry is placed.



Campus College in Odense



Tietgenkollegiet in Copenhagen

These examples have a clear graduation in zone division from private to social areas, which underlines the behavioural pattern of students needing the combination of both. In the illustration it is seen that the graduation of zones also creates boundaries, separating the functions such as the hallways and the kitchen.
The concept of having shared facilities, such as kitchen and living area, has a sustainable approach both socially, economically and environmentally, which is strived for in this project. The conclusions for student needs are:

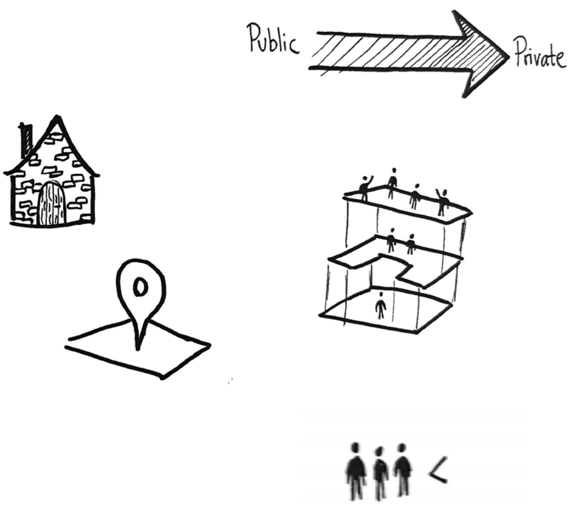
**Graduation between private, semi-private and public functions.**

**Functions with different social interaction levels. Space for personalisation.**

**Materials in the interior and exterior should enhance the feeling of home.**

**Smaller group divisions for shared facilities.**

**Near university and the city centre.**




**Emptynesters**
From the chapter Life in the Heights, it was concluded that the persons who wanted to live in a skyscraper were mostly emtpynesters. They are often defined as a couple or single person and are in the stage where their children have moved out, and they do not want the troubles of having a house with a garden, as they want something care-free.
As the statistic concludes from the chapter Helsingborg in Development, the age for the emptynesters suggests that they are from mid age and above (45+) but are still in the category of being capable of self-care.

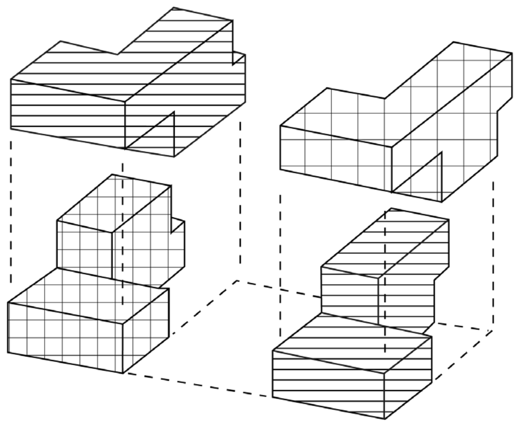
As mentioned, this user group is called emptynesters, but this is also a syndrome which can have negative effects on their mental health as they can experience the feeling of emptiness, loneliness, depression and reduction in social activities which all highly reduces their quality of life (Zhang, C. et al., 2021).
There was also a difference in socioeconomic status, people who had a lower income did not have the behavioural resources to turn their lifestyle to the better, comparing it with the emptynesters with higher socioeconomic status who demanded a healthier lifestyle and was able to improve their quality of life significantly by themselves (Zhang, C. et al., 2021).

The kind of house preference for emptynesters depends on a series of factors such as lifestyle, values, stage in life and economics and social class. The two last factors are dependent on demographic characteristics, while the factors lifestyle, values and stage of life depend on a broader series of interwoven characteristics, such as age, education, socio-economic status, income, wealth, family-status, location, hobbies etc. (Beamish et al,, 2015).
How much space is needed for the user group depends on where they are in their stage of life.
For instance, people who are close to retirement do not consider space as a critical aspect of home preference, but are more interested in the amenities that enhance their quality of life such as; having a kitchen with all appliances or a location that allows them to take part of the different activities in the neighbourhood (Beamish et al, 2015).

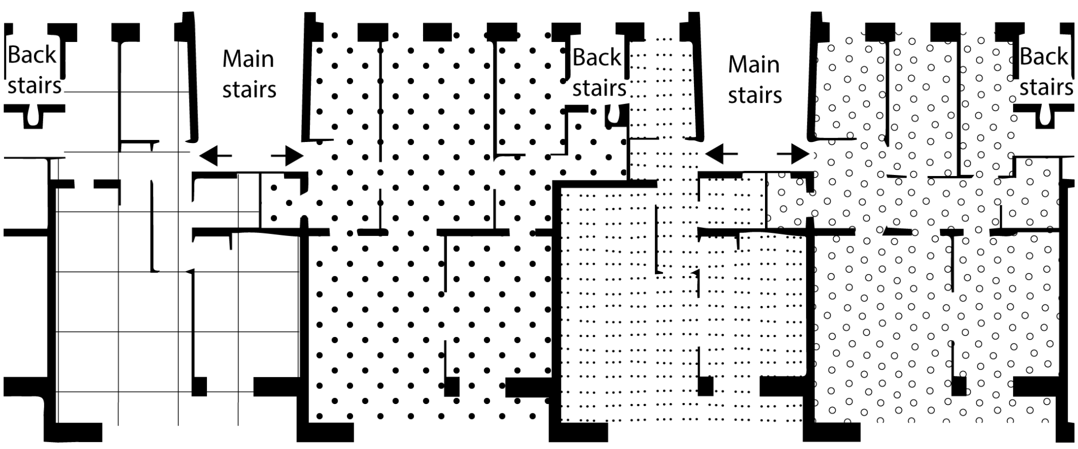
Creating house typologies for emptynesters should make a difference in dealing with the negative effects of having an empty nest, by promoting social interaction in the design. Neighbourhood socialisation can be beneficial for the well-being, creating emotional support and casual interactions (Yuan and Ngai 2012).

In Scandinavian countries apartments were often planned towards having a broad user group, varying the apartments in size and price to create diversity. This can be seen in two examples that are built 66 years apart, but still have the same values: Vestersøhus by Kay Fisker and C.F. Møller in 1939 , and the VM Houses by BIG in 2005.

In both examples the apartment sizes are varied, appealing to a broader user group, but differ in a vertical and a horizontal movement as some of the apartments in VM houses have two floors and create variation vertically.



VM Houses in Copenhagen




Vestersøhus in Copenhagen

**Needs of an emptynester:**

**Private kitchens with all the appliances.**

**Being close to activities in the neighbourhood.**

**Accessibility**

**Spaces that promote casual interaction.**

**Private outdoor area.**

Another user group that the municipality wishes to attract to the city is the families. This was revealed during the interview (see appendix 01) where the leading architect for the project, Helena Taps, expressed the concerns of not being a city that was welcoming for families.
The tendency for families is that they move out of the city or even to bigger cities than Helsingborg,such as Gothenburg, Malmö or to Elsinore as they offer better opportunities of finding family friendly houses or apartments.
The spaces designed for this user group should take departure from the programming of the emptynester apartments, but be more flexible. These homes should have the possibility to accommodate extra resting spaces and have the possibility to extend into shared living areas, where children can play.

**Public users**
The intent of the skyscraper is to create a building that is engaging with the surroundings, this means that there will be a user group that is very broad. The theory from the architect Jan Gehl from "Byer for Mennesker" (Gehl, 2010) is used to help define the needs of the broader public user group, as his theory is extensive in understanding the intertwined relationship between urban public spaces and society.

**Human scale dimensions**

**The visual perception is not meant to look up in a vertical direction, but is made for a horizontal direction.**

**The dimensions of streets and buildings should adapt to the boundaries of the human senses.**

**Safety**

**Soft edges between inside and outside create an overview.**

**Plaza**

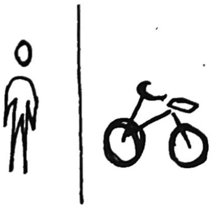
**Defined edges for people to stop and stand.**

**Sitting arrangements in a good microclimate zone. View to movement.**

**Art installations.**

**Clear paths and zone divisions for different traffic tempo.**

**Bicycle parking.**



**Each user group has specific needs depending on their stage in life. The results from this research use the bullet points from each category to develop design parameters to guide the design during the process.**

SUMMARY

# Theory: What can we Sum Up?

Skyscrapers are a symbol of architectural and city achievements, since the beginning of skyscrapers it has been a competitive typology, in structural accomplishment. The bad connotation that comes from the fictional representation of the skyscraper should be lessened by trying not to create an economical hierarchy in the building and give back attractive areas to the public.

The discussion of how building in wood is the future of decarbonizing the planet is equivocal. It shows a need for a change in material assessment strategies, as the benefits of wood storing $CO_2$ is currently not included in the assessments. Exploring the potential of building in wood as a more bio-based renewable material can help push the boundaries in the building industry and stand as a statement for more sustainable exploration.

Architecture is not only the science behind how to build but it is a combination between design and construction that should intersect creating a symbiosis. Meaning that not only should the building meet the basic requirements of what is needed to live in it, but also enhance the quality of living by considering how the different elements in a building are expressed and joined together as a piece of art.

When creating a skyscraper it is important to take into consideration how the building is expressed and shapes its surroundings as it is seen from several areas of the city and can have an impact on site. For this project it is wished to investigate how landmarks and nodes can exist in close proximity or paired in such a way that the observer will perceive them as one unit.

When placing a building with a significant typology at a crossing point, the design must be developed in a way that incorporates how the users and surrounding will perceive and use it.

Important factors to enhance the users satisfaction of home and well-being are: visual connections, outdoor spaces with different degrees of privacy, community, design for a specified user group, security considerations in case of emergencies and minimising the building height.

In a skyscraper there are several users, and each group has specific needs depending on their stage in life.

The results from the theoretical research are used to develop design parameters to guide the design during the process.

Columns

# 1.2

# Where?

## Investigating the Urban Environment

## IMAGE OF THE CITY

# Analysing the city

**Even if Helsingborg consists of several landmarks and nodes, they each impact their surroundings individually. This can be seen in Kärnan Tower as being a historical landmark reflecting the age of the city centre, the tall Söder skyscraper reflecting the commercial area it is placed within. For the site location the new tower should reflect its surroundings such.**

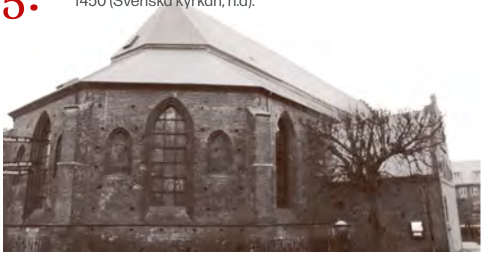
9. Helsingborgs Stadsteater, from 1921 designed by Erik Magnusson (Helsingborgs Stadsteater, 2021).

10. Scandic Oceanhamnen Hotel located at the far end of the pier, as part of the development of the new harbour area.

1. Kärnan tower, 35 m high built in 1681 (Guidebook Sweden, 2023).

4. Dunkers kulturhus, designed by Kim Utzon and built in 1997. Generates a link between the city centre and the promenade along the marina (Kim Utzon, n.d).

5. Sankta Maria kyrka, a gothic styled church completed in 1450 (Svenska kyrkan, n.d).

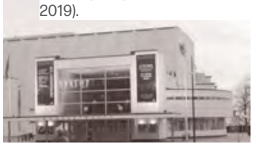


11. Söder skyscraper: Residential tower placed in the corner of a large commercial building.

2. Helsingborg city hall designed by Alfred Hellerström in 1897 (Länsstyrelsen Skåne, n.d).

7. Statue of Magnus Stenbock, representing the last battle between Denmark and Sweden in Skåne (Equestrian statues, n.d)

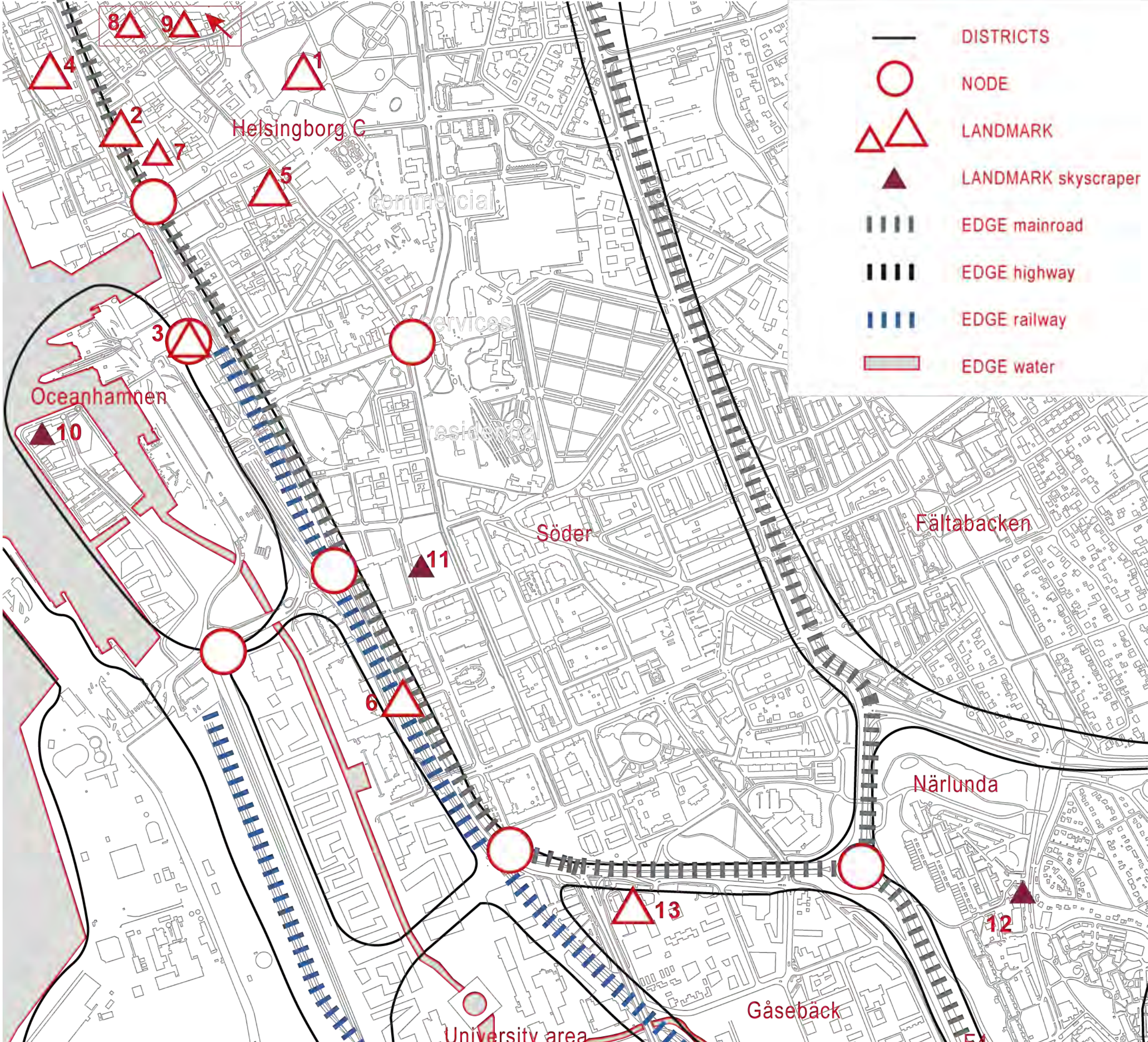
8. Helsingborgs Konserthus designed Sven Markelius in 1932 and referred to as "Sweden's first functionalist monumental building" (Helsingborgs Konserthus, 2019).



12. Närlunda skyscraper : Residential tower and healthcare facilities on the base volume.

3. Helsingborg central station, renovation, finished in 2020, creating new meeting opportunities. Besides being a transport interface - combining bus, train and ferry, the building has restaurants, offices and parking (Wihlborgs n.d).

6. Gustav Adolfs kyrka, designed by Gustaf Hermansson and completed in 1897 (Svenska kyrkan, n.d).


DISTRICTS
NODE
LANDMARK
LANDMARK skyscraper
EDGE mainroad
EDGE highway
EDGE railway
EDGE water
Helsingborg C
commercial
services
residential
Oceanhamnen
Söder
Fältabacken
Närlunda
University area
Gåsebäck
E4 Malmö
Industrial harbour
Site
Planteringen
Ramlösa
North
1:12000

## CHOOSING SITE

# Site locations in Helsingborg

**Oceanhamnen - harbour area**
To implement a landmark in the harbour, three locations have been considered. The harbour is meant to be composed of 4-6 story high buildings that culminate in a tower in the north western end of the harbour. Occasionally, higher buildings arise within the blocks, increasing the density and contrasting with the surroundings.

1. On the front pier
Entrance to the harbour
Visual connection between different functions

2. Between the harbour and the old town
connecting the traditional and the modern city
reinterpretation of a traditional material - wood

3. On the water as an island
connecting the new harbour neighbourhood at east and the park on the ocean side at west (as predicted in the municipal detail plan)
symbol of connection between built environment and nature

Most of the predicted locations for high rise buildings and skyscrapers tend to cast a shadow over the surrounding area, generating problematic conditions for its neighbours.

Although considering the previous possibilities for the placement of our building, the context seemed to not require a new landmark, given the existence of the new hotel. With a denser construction than predicted in the masterplan, the harbour has its particular ongoing strategy to answer the city's intention for development.

**University area**
This area represents the connection between the harbour and Gåsebäck. As the name suggests, its character mainly comes from the existence of the Helsingborg campus, which is part of Lund University.

A suggestive central area defines the crossing point for the entire H+ plan - "a pivot where green meets blue" (ADEPT, n.d) - the connection between the water stream that develops from the harbour with the park that extends from the northern side of the city, connecting the surrounding neighbourhoods to the urban nucleus. This is meant to be a new node for pedestrians and potentially light infrastructure.

4. Placing a landmark in the new node could be an interesting possibility. But in this particular case, with the landmark taking the shape of a high-rise building, it would create shadowing problems in the surroundings and have a negative impact on the use of the public space.
It was therefore considered that it would not be a viable option to place the skyscraper in this area of the city.

It was therefore considered that it would not be a viable option to place the skyscraper in this area of the city.

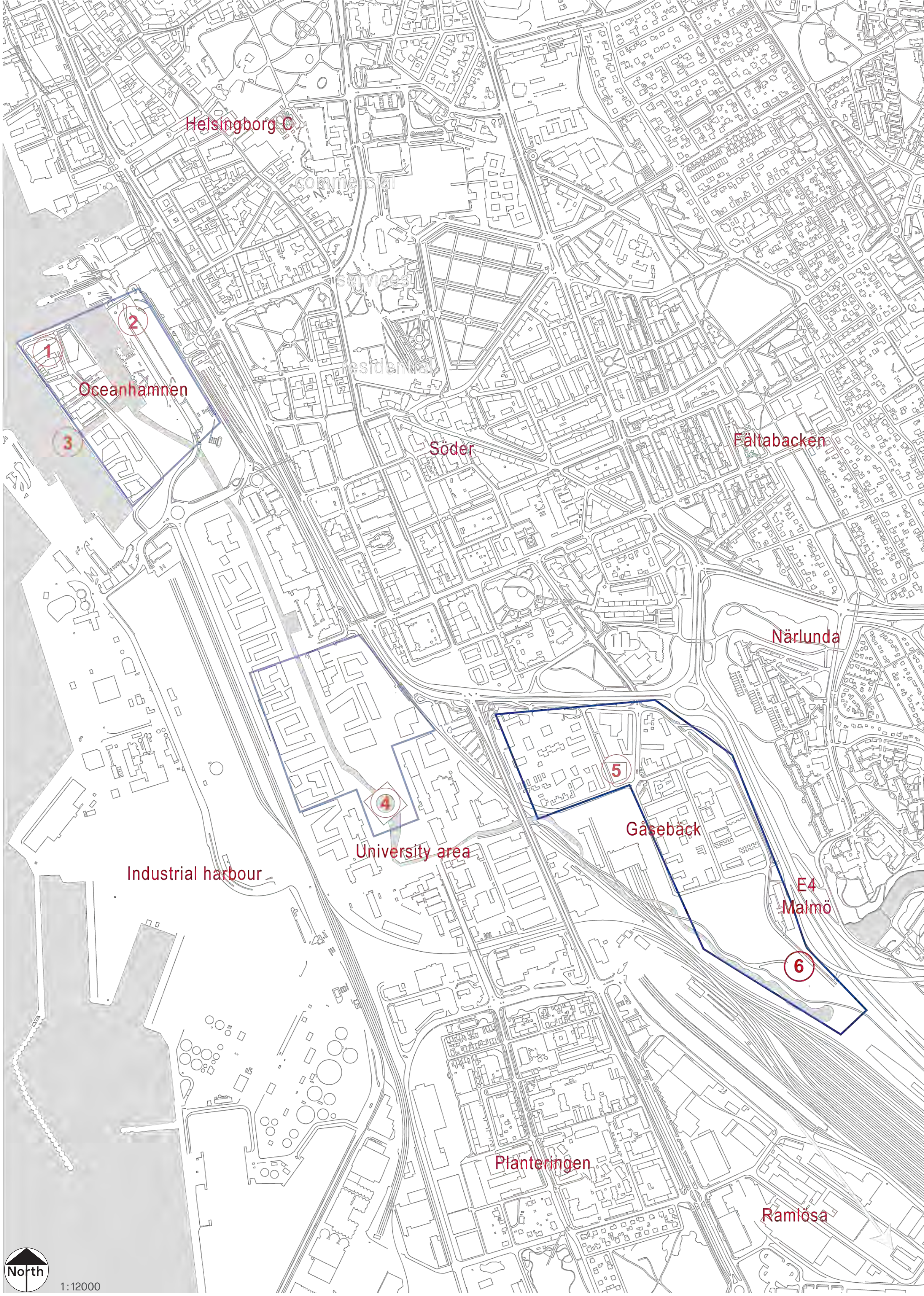
**Gåsebäck area - creative district**
Today this area is mostly used for industry in connection with the harbour and the railways, but in the future, it will be the creative hub of Helsingborg with residential areas. Following the intention of the H+ plan, some of the existing buildings are being repurposed to house artists, create meeting places and events. (Gåsebäck Stadsdel, 2017).

The masterplan indicates an intention to extend the Gåsebäck river separated by the highway E4, extending the water stream to the harbour. This will represent a new axis for light mobility in the city.

5. The site has been chosen by the H+ master plan to include a high-rise. But it does not give the surroundings good conditions as the high-rise will cast a shadow on the residential buildings, especially after work hours and worse during winter months.

6. At the beginning of the river on the west side of highway E4, and will be an iconic statement when entering Helsingborg Furthermore it will not be a disturbance when casting a shadow as it will mainly cover the main road.

**Our final choice was location 6 in the Gåsebäck area. This site gives us the opportunity to develop the design for a new landmark and node, as it is placed in a location where it should act as a connection point between east and west. This can offer qualities to the city by becoming a new entrance, and also to this specific area, by developing a particular identity as a cultural hub.**


Helsingborg C
commercial
services
residential
Oceanhamnen
1
2
3
Söder
Fältabacken
Närlunda
4
University area
5
Gåsebäck
E4
Malmö
6
Industrial harbour
Planteringen
Ramlösa
North
1:12000

Columns

# 1.3

# Gåsebäck

## Getting to Know the District

## FUNCTIONS

# Industrial district?

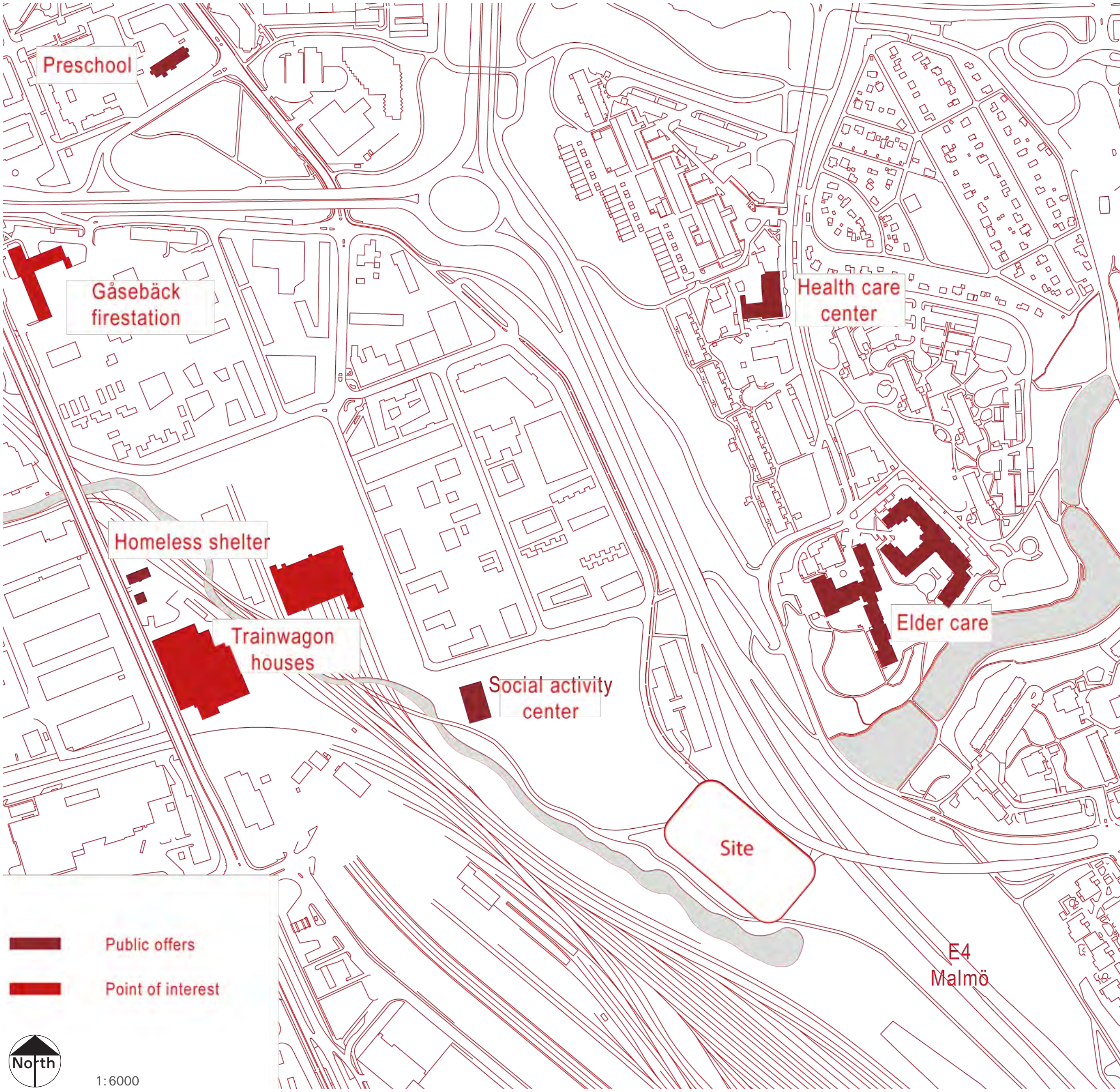
*"Gåsebäck? Is that where you change the tires on the car?"* - The question that often popped up when asked about the district (Gåsebäck Stadsdel, 2017) .

Today the area is considered an industrial area, where buildings hold functions such as car repair, used car shops, offices for the industrial area and a welding shop. It also has attracted street-art facilities, a church and a social activity centre because of the cheap rent. It has an industrial area on the west side and a housing area to the east. The main city centre is located to the north from this site.
In Gåsebäck there are currently no green areas that are pleasant to use, but the municipal strategy proposes to implement a green strategy, creating the connection between east and west Helsingborg as a promenade with parks and trees.

The people of Gåsebäck are people working in the industrial sector, artists, and economically challenged people - as it is seen that there are several offers in the area such as homeless shelter and social services department. There are also several offices and retail shops, such as secondhand shops.

**The intentions**
The plan for Gåsebäck is to turn it into a creative district; this can be seen in the conserved buildings of interest that have been repurposed. One of the conserved buildings is the train wagon garages which are transformed into a sports facility and an active space for young people and adults. The fire station is another conserved building that is turned into a creative hub, where functions like 'maker space' is implemented and people can come and express themselves and a street food area to create a relaxed eating environment.

Collage of the atmosphere in Gåsebäck.




**As of now, there are several industrial offices in the area, but it is the intention of having more residential functions in the future, but with no strategy of having retail in the area.**
**Having retail would complement the area of Gåsebäck as it will become a new residential area in a creative hub. The transformation of the area should still be able to include the existing users.**

MOBILITY

# How is the infrastructure around the site?

1.


2.


3.

4.

5.

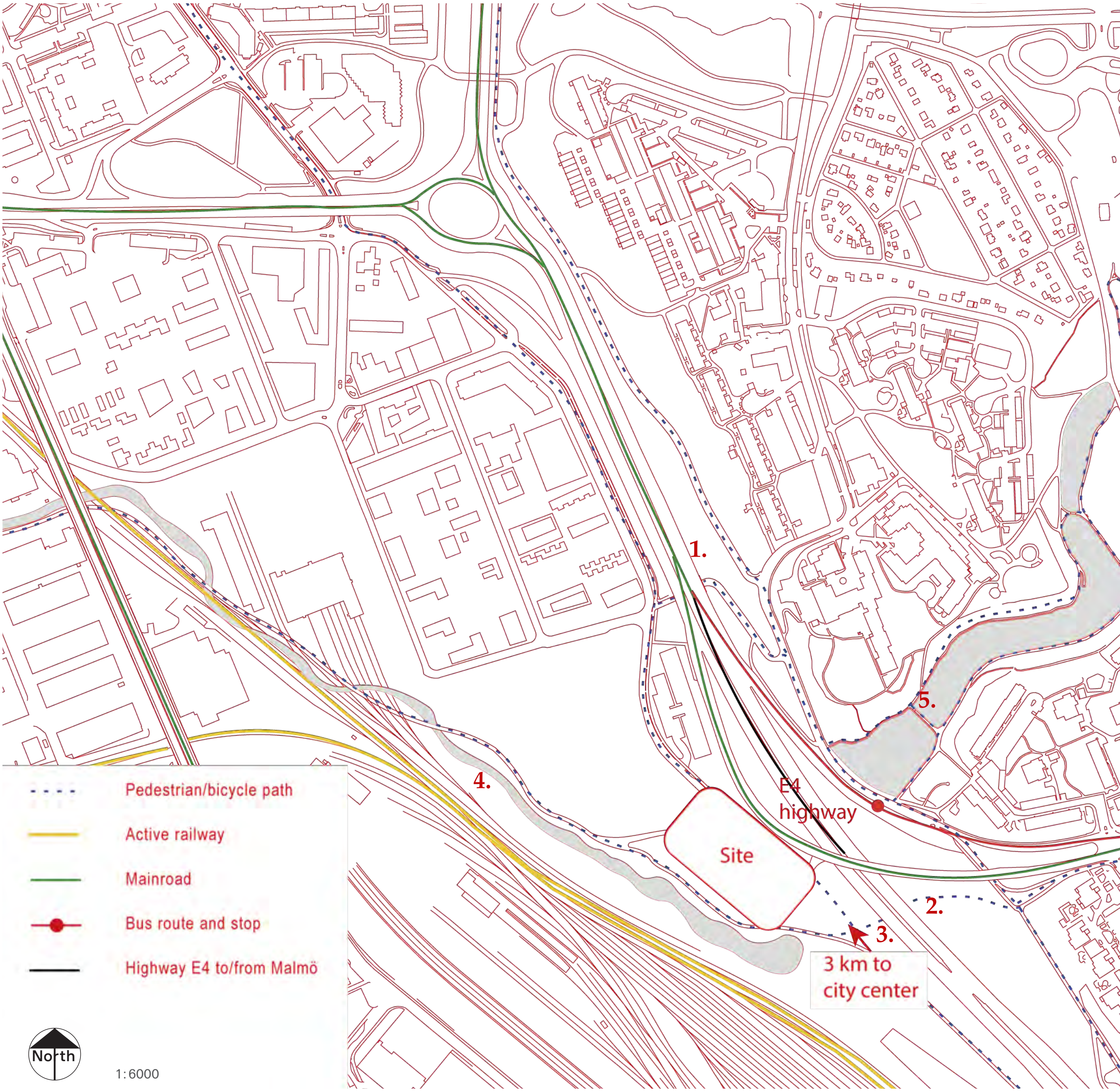
Gåsebäck is the southern entry point in Helsingborg from the E4 highway, directly connecting to Malmö. Helsingborg is currently characterised by a large residential area at east and an industrial landscape at west, where the site is located.

From the site, the city centre is only 3 km away. As seen from the analysis “Image of the City” the highway represents a heavy boundary that keeps the residents of the eastern side living a separate reality. To access the centre it is possible to take the bus or cycle. Reaching the cycle lane from the east side of E4 is possible through two tunnels that connect to the industrial district, on each side of the ending point of the Gåsebäck river. Nevertheless, the connection is not pleasant, or sufficiently illuminated.

Before the H+ plan it was not possible to safely walk to the centre, since there are no sidewalks along the cycle lane or in any other area of this district, except for direct and mostly private accesses to the buildings. The whole area suggests exclusive road use.

On both sides of the river, a green promenade extends for 1.5 km, and has on both sides connections to sports fields and leisure areas. This is the most important green extension for the community of Närlunda, also one of the largest in the city and a natural protected area.

The already existing tunnels, bus stops at the end of the river promenade and cycle lane on the industrial area demonstrate that this area is the main connection of the residential area to the city centre.




**Gåsebäck is an industrial area, limited at west and south by the railroad and at east and north by the highway.**
**Currently, it is not cyclist or pedestrian friendly, even though it is used as one of the main trajectories to access the city centre, by the surrounding residential neighbourhoods.**

## TYPOLOGY AND MATERIALITY

# How is the atmosphere in Gåsebäck?

The typology of Gåsebäck was examined by a phenomenological approach on site, observing and capturing the different types of buildings in the surrounding area on camera.
When walking around the area, there was a feeling of abandonment in the industrial-looking buildings, most of which seemed unpreserved. There was however a sign of life, by the cars parked around the buildings, but shutters and curtains were shut and the streets were nearly empty.

The buildings are old industrial buildings and few of them have been marked as preservable, shown on the map below. These buildings have a very strict composition with windows in the same dimensions spread with the same proportion. There is little to no ornamentation on the buildings, it extrudes functionalistic brick architecture.

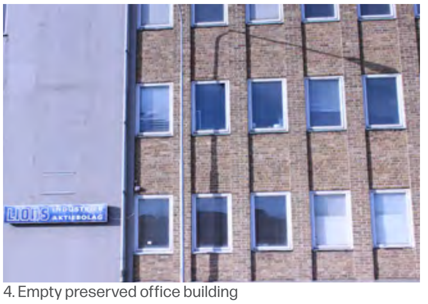
To understand the materiality of the surroundings of the building, a tomographic study on site helped understand the textuality and atmosphere.
Gåsebäck consists of a diverse use of materials but the facades exhibit brick as the main material.
This is a reflection of the city's history in brick manufacturing, as was mentioned during the meeting with the municipality. They are mainly yellow and displayed in a "normal" joint pattern.

The area also has a lot of graffiti, which is in principle an effect of the abandonment. Nowadays, it has been embraced by the city and represents an encouragement by the city to express creativity, through the promotion of an annual creative festival called Gåsebäcksfesten (Gåsebäck Stadsdel, 2017).
When trying to fit into the area, there should be a relation between materiality around and in the building and there should be an acknowledgement of the typology, to integrate into the community and create a socially inclusive environment in and around the building.


1. Point of interest: Train wagon houses


3. Social activity center


4. Preserved office building


4. Empty preserved office building


5. Point of interest: Old fire station


6. Homeless shelter


The quirkiness and lopsidedness represented in the typology of the area, should expand into the building design, for it to relate to the area and encourage creativity. It can incorporate reused materials from the demolition of several buildings from Gåsebäck.

TOPOGRAPHY AND SIGHT

# How is the topography and the sightlines?

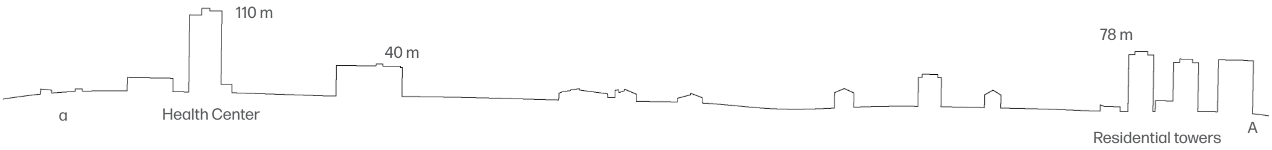
The topographical level of Gåsebäck is lower than the neighbouring levels to the east and north with a 20 m difference.
Section Bb shows this height difference in topography levels between east and west, where it is seen that the residential towers are placed on the higher points overlooking the E4 highway.
Towards the site, the topography levels are lower and there is a minimal height difference in the Gåsebäck district.
Section Aa is used to investigate the heights of the buildings to the northeast, which helps understand how the surrounding skyline is when walking around in Gåsebäck.
The buildings have a height between 110 m - 17 m, and some of the highest can be seen from different angles around the district as seen in picture 1 and 3.

1. View towards the residential towers

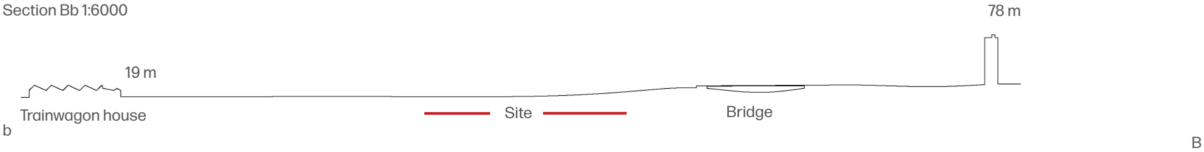
2. View towards city center

3. View towards Health Center

Section Aa 1:6000




Section Bb 1:6000




The topography levels and building height of the surrounding buildings vary in different orientations as seen in the sections. Therefore, when placing a skyscraper on the site it will be much higher than the existing buildings towards west, but will be in connection with the skyline of the neighbourhoods across the highway towards east. This must be taken into account as it will not be in human scale in Gåsebäck district.

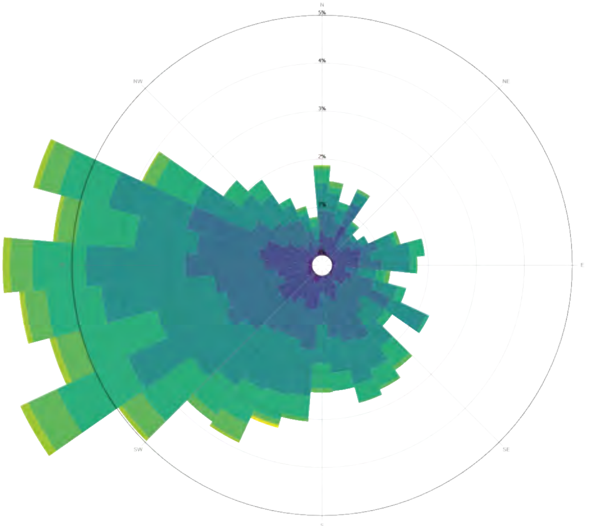
WIND, NOISE AND SOIL

# Elements Affecting Helsingborg

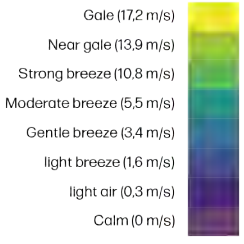
The wind analysis showed that the dominant direction is from a west orientation in Helsingborg. The analysis was carried out by using the Climatestudio component for rhino/grasshopper.

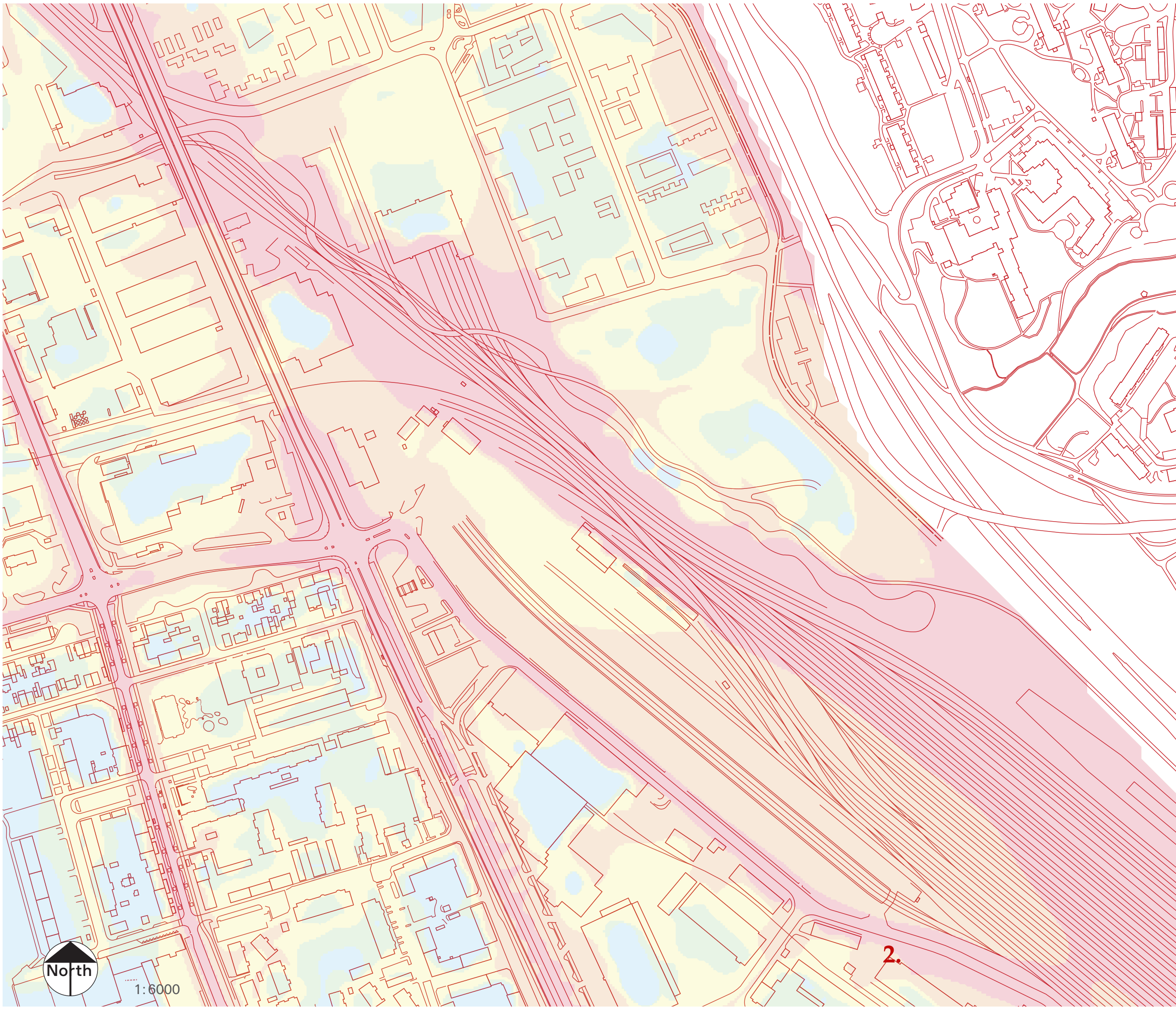
The noise level for Helsingborg has an average sound level between 55-60 dB, and is mostly an effect from road traffic on the E4 highway (Helsingborg Stad, 2023).

The soil-type in Helsingborg consists of sediment from the Jurassic Cretaceous Period and the Triassic Period from around 210-190 million years ago, which is a mixture of coarse sand, clay, mud and limestone of a depth of 200 m. This mixture was covered with post-glacial material with a depth of around 5 m (SGI, 2009).
This mix of soil types can create problems when there is a lot of water, as the soil can not absorb the amount of water that comes from a flood or from heavy rain, and deeper foundations are needed (Soil Types in Construction - Pros & Cons, 2021).

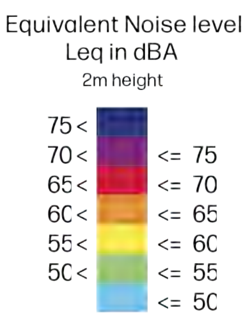


Wind Rose






**Considerations for a good microclimate around the skyscraper are focused on the wind conditions on the tower, especially on the ground floor.**
**Being close to the coast and having a softer soil type, it is necessary to have a deep foundation.**



SUMMARY

# Analysis: What can we sum up?

The analysis of site location resulted in finding the best option possible, giving us the opportunity to develop the design for a new landmark and node, as it is placed in a location where it should act as a connection point between east and west.

The site location also presents as a start or end point for the development plan of H+, like an exclamation point at the end of an assertive statement.

Gåsebäck is a mixture of creative, industrial, and social spaces. All of this is located between a net of mobility infrastructure. At west and south by the railroad and at east and north by the highway, where the noise nuisance is the highest.

Currently, it is not cyclist or pedestrian friendly, even though it is used as one of the main trajectories to access the city centre, by the surrounding residential neighbourhoods.
The existence of the skyscraper can impact the neighbourhood by minimising the amount of build footprint and release area for public green space.
The quirkiness and lopsidedness represented in the typology of the area, should expand into the building design, for it to relate to the area and encourage creativity.

The new building and its surrounding area should encourage creativity in the area while respecting the history. The building height of the tower should take into consideration how to be in coherence with the higher buildings towards east, and the heights of the human scale.

Considerations for a good microclimate around the skyscraper should be focal points during the process.

# 1.4

# Building Program

## What to include

REGULATIONS

# Safety and Accessibility Measures

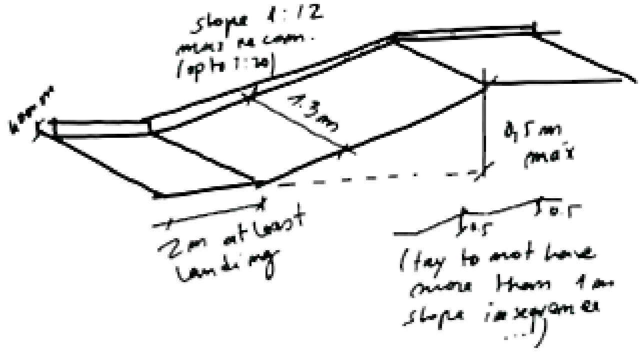
An analysis of the Swedish Building Code - BBR, Boverket's mandatory provisions and general recommendations was conducted.
Based on this information several guidelines were highlighted, which were relevant for the project and evaluated. The intention was to ensure that all fire safety rules and recommendations were complied with, and create inclusive and accessible environments.

Pathways in outdoor areas should have a minimum width of 1.5m or 1.0m with 1.5m width turning points every 10m length.
*In a building prone to have a heavy pedestrian circulation, the requirements are enhanced to ensure a min. width of 2.0m in every outdoor circulation type, pathway, ramp for staircase. This way, it is possible to ensure a turning point at any moment.*

Ramps should reach only a maximum slope of 1:12 or up to 1:20 in exceptional cases and preferably not exceed a height of 0.5m per each ramp stretch, but possible up to 1.0m length.
*Ensuring that the maximum slope is 1:12 in every ramp typology, indoor and outdoor. Nevertheless, the ramps will possibly reach a 1.0m difference height. To provide easier navigation and landing, all outdoor ramps will have a minimum of 2.0m width.*

Lifts' dimensions should be at least 1.1 x 1.4m or 1.4 x 2.0m. At least one elevator should fulfil these dimensions criteria.
*In the main vertical core of the building, connecting public functions and residential, there will be three lifts. One with 1.7 x 2.0m and two with 1.7 x 1.275m.*
*With this measure it is intended to minimise the number of circulation cores and routes, concentrating vertical movement in one core that is proportionate to the large number of occupants.*

Dwellings in general should have
Accessible front door, minimum 0.9m width
At least one bathroom, cooking area and resting area should be accessible.
All outdoor areas, terraces and balconies should be accessible.
Dwellings with multiple storeys
Should accommodate a toilet with the minimum dimensions of 2.2 x 2.2m on the ground floor.
Student apartments with a maximum of 35 m2
Everyday social contact, resting, and cooking areas can be located in the same room, overlapping partially or completely.
Dwellings with common spaces
Can share rooms for cooking and everyday social contact. The space should be large enough to compensate for the limitations of the individual dwellings.
*The goal is to ensure that all functions are completely accessible, including the residential areas. The apartments will have different typologies:*
*Student apartments*
*Include resting area, bathroom and, in some cases, work area;*
*All have an accessible bathroom, with a minimum width of 1.3m, ensuring that it is possible to fully rotate a small wheelchair, reaching 1.5m whenever possible.*
*The minimum 1.3m rotation area will also be ensured in the resting area, reaching 1.5m whenever possible;*
*Shared facilities including cooking and social areas will provide a minimum of 10 m2 per resident in the same floor where the apartment is located;*
*Laundry and clothes hanging rack will be located in a room shared by three residential floors.*
*Emptynesters and family apartments*
*Full equipped homes, with resting area, bathroom, kitchen and living room in a shared space;*
*Same minimum requirements for the bathrooms as for the student apartments.*
*There will be shared living areas, meant for everyday social and leisure activities.*
*Having in consideration not only accessibility but also access to the escape route in case of emergency, all doors will have opening direction outwards of main compartments. Only inside the apartments, bathroom and bedroom doors will open inwards in order to facilitate circulation inside the units.*




**Fire safety measures**
Escape routes for high populated areas should have at least a clear 1.0m width for up to 150 people and 1.2m clear width for more than 150 people.
*Considering different types and number of users for each function, all escape routes will have a minimum of 1.2m width in all circumstances.*

Maximum walking distance to nearest escape route:
(* if only in 1 direction)
- Class 1 – Offices / Warehouses – 30m / *10m
- Class 2A, 2B – Places of assembly – 30m / *10m
- Class 3 – Dwelling – 45m / *10m
- Class 6 – Workshops – 15m / *30m

Specifics
Class 2 – places of assembly for under 150 people:
With one escape route – max. 10 seats per row.
Circulation between rows – min. 0.45m.
Seats in auditoriums / cinemas / theatres should be attached to the floor.

FUNCTIONS IN THE BUILDING

# Space Program

The space program includes the three topics of sustainability, which are social, environmental and economic sustainability. These three topics should be a reflection of the conclusions drawn from the theory and analysis.
Our user group and their needs and well-being, the functions, mobility and infrastructure of the nearby environment are all elements merged into the space program.

Regarding the conditions of the built environment, the space program takes in relevant information from the Swedish building regulations.
Knowing that the regulation sets mostly minimum and recommended values, we considered, whenever possible, an upgrade of the standards, in order to achieve better well-being conditions and comfort for the occupants.
The topics which information is drawn from are accessibility, dwelling, workplaces, light, indoor climate and safety.

Social sustainability was a neglected factor for years, where economic and environmental sustainability was in focus. Today, it has been shown that including the factor during design of a building has several advantages for the occupants, as it includes minimising the feeling of isolation, creating opportunities of meeting the neighbours, creating a community, not only for the residents but also the surrounding neighbourhood (Maleki, Casanovas-Rubio, Fuente Antequera, 2022).

Another research defines social sustainability as “a life-enhancing condition within communities, and a process within communities that can achieve that condition” where equity between generations, health and sense of community are the main features that allow to achieve a sustainable state. Mckenzie underlines the importance of not generalising the definition of social sustainability, which should be defined for each project, depending on the framework. (McKenzie , S., 2004).

From the meeting with the urbanism department in Helsingborg municipality and the analysis of the masterplan H+, it was also possible to conclude the intention to develop the Gåsebäck area as a creative and cultural hub, in the repurposed industrial buildings.

The previously presented user groups and their interaction in the particular environment of Gåsebäck is the focus of our social sustainability strategy. We will create both spaces for private use and meeting places that allow different groups to interact, generating connections and a community feeling. E.g., study rooms integrated in the residential common areas will generate interaction between different floors. Workshops, coworking and fitness sharing functional areas will generate purposeful and occasional meeting moments between office workers, local artists, residents and external users of the building.

Environmental sustainability is not a new topic in the construction industry, because it is one of the major sources of waste production worldwide. Regenerative paradigm is the new vision that intends to develop design solutions with renewable resources, generating a positive environmental impact. This paradigm considers an optimization in the reuse of renewable materials, going beyond the carbon neutral approach (Attia, 2018).

Our environmental sustainability strategy is based on the functional analysis of Gåseback and a survey of the existing buildings, their current condition, cultural and historic value. Knowing that the municipal strategy considers the demolition of structures in poor condition and no potential future use, we will consider the reuse of waste materials from the area. In particular, the reuse of brick, which is culturally representative of this area’s industrial history.

The building itself should have a flexible functional organisation, so that future use and repurposing of spaces can be a possibility. E.g., the parking area considers the current need in this area, based on statistical data. But we also have information that the number of new registered personal vehicles has just dropped by about 25% compared to last year (Sweden statistics, 2022). In just a few years, the parking area can be overtaken by a new activity, depending on the circumstances at the time.

A reversibility strategy, designing for a long lifespan of the building (Attia, 2018) is particularly important in this context, where the development of the area constitutes only a projection at this point. The development of the industrial area into a creative platform is intentional, but no absolute certainties exist regarding the attractiveness of the area for some functions. (Helsingborg municipality, 2023)

The economic criteria is often the main factor for private developers and investors, and there are different indicators used to understand the validity of a building as an investment. But during the life cycle of the building, there are many other stakeholders affected by its economic sustainability. Management and monitoring is required, in order to assure a continuous overview of the economic performance of the building. (Eklova, 2020)

One important impact factor is the commercial viability, “an empty building is not economically sustainable, nor it is environmentally sustainable because the resources (...) are not used effectively” (Eklova, 2020)

Considering the already existing cultural activities in the area, and the intention to support their development, our program intends to host complementary functions, such as creating coworking and workshop areas for local artists. These functions mean to generate a building that is useful for the residents and the community, generating relationships, based on cultural values, personal and professional growth. The building must also enclose other functions, in order to support the daily life of the community, such as a fitness centre and a supermarket.

The implementation of these functions reflects our economic sustainability strategy, focused on assuring the introduction of new and complementary services, therefore stimulating the development of all activities in the area. We will also have a space where a pop-up market and temporary exhibitions can be assembled. This and other spaces, predicted to have a flexible use, are meant to stimulate the curiosity of the city for this new area.

## Space program

| Room | | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of users | Net area (m2/user) | Net area (m2) | | Number of users | Number of apts | Net area (m2) | Gross area (m2) |
| Apartments | | | | | 112 | 56 | 4387 | 5572 |
| Emptynesters | 2 | 25 | 49 | | 16 | 8 | 392 | 3184 |
| Emptynesters / families | 2 - 3 | 18 | 55 | | 24 | 8 | 440 | |
| Emptynesters / families | 2 - 3 | 19 | 58 | | 24 | 8 | 464 | |
| Shared living room | 8 | 14 | 111,5 | | 64 | 8 | 892 | |
| Extra storage | 8 | 1,4 | 11 | | 64 | 8 | 88 | |
| Technical facilities | | | | | | | 96 | |
| Staicase emergency route | | | | | | | 78 | |
| Students single | 1 | 16 | 16 | | 20 | 20 | 320 | 2388 |
| Students single / couple | 1 - 2 | 12 | 23,5 | | 16 | 8 | 188 | |
| Students shared | 2 - 3 | 13 | 38,25 | | 12 | 4 | 153 | |
| Shared kitchen | 8 | 14 | 110 | | 8 | 6 | 660 | |
| Shared living / TV room | 8 | 5,75 | 46 | | 8 | 6 | 276 | |
| Laundry | 24 | 0,75 | 18 | | 48 | 2 | 36 | |
| Study room | 4 | 5 | 18 | | 16 | 4 | 72 | |
| Technical facilities | | | | | | | 128 | |
| Staicase emergency route | | | | | | | 104 | |
| Work space | | | | | | | 1701 | 1187 |
| Coworking | | | | | | | 418 | |
| Cantine & Lounge | | | | | | | 200 | |
| Indoor workshops | | | | | | | 645 | |
| Outdoor workshops | | | | | | | 438 | |
| Indoor market | | | | | | | 675 | 736 |
| Supermaket | | | | | | | 450 | |
| Restaurant | | | | | | | 225 | |
| Culture | | | | | | | 832 | 1053 |
| Library & auditorium | | | | | | | 528 | 784 |
| Winter market | | | | | | | 188 | 269 |
| Technical facilities | | | | | | | 64 | |
| Staicase emergency route | | | | | | | 52 | |
| Outdoor Market | | | | | | | | 3874 |
| Utility | | | | | | | 883 | 1321,5 |
| Fitness | | | | | | | 664 | 1092 |
| Café | | | | | | | 219 | 229,5 |
| Parking | | | | | | | 938 | 957 |
| Car parking | | | | | | | 510 | 727 |
| Bicycle parking | | | | | | | 116 | |
| Storage | | | | | | | 93 | |
| Bicycle parking residents | | | | | | | 219 | 229,5 |
| | | | | | | | | |
| Project Overview | Area (m2) | | | | | | | |
| Plot size | 7420 | | | | | | | |
| Total construction | 12600 | | | | | | | |
| Total building footprint | 3546 | | | | | | | |
| Tower footprint - fitness | 676 | | | | | | | |
| Tower footprint - residential | 398 | | | | | | | |
| | | | | | | | | |
| Construction index | 1,70 | | | | | | | |
| Land use index | 0,48 | | | | | | | |
| | | | | | | | | |

| | Indoor Environment | | | | | | Content | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Light (DF) | Temperature (C°) | Air quality | View | Accessi-bility priority | | Users | Activities | Equipment | Notes |
| | | | | | | | | | | |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | High | | Emptynesters | rest, cook, work | full kitchen & bathroom, office area (extra) | 1 bedroom apt, including living area |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | Medium | | Emptynesters / families | rest, cook | full kitchen & bathroom | 1-2 bedroom apt, including living area |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | Medium | | Emptynesters / families | rest, cook | full kitchen & bathroom | 1-2 bedroom apt, including living area |
| | 2% | 19 - 22 | | Green spaces | High | | Emptynesters / families | socialize, play | living room furniture | |
| | | | | | Medium | | Emptynesters / families | | | |
| | | | | | Low | | Maintenance personal | | ventilation system | maintenance access |
| | | | | | Medium | | All building users | | | |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | Medium | | Students | rest, work | | |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | Medium | | Students | rest, work | | |
| | 2% | 19 - 22 | 0,5 - 1h | Public spaces | Medium | | Students | rest, work | | |
| | 2% | 19 - 22 | 0,5 - 1h | | High | | Students | cook, socialize, party | full kitchen and tables | |
| | 2% | 19 - 22 | 0,5 - 1h | Green spaces | High | | Students | rest, socialize, party | living room furniture | |
| | | | | | High | | Students | | washing and drying machines, clothes rack | |
| | 4% | 19 - 22 | 0,5 - 1h | Public spaces | High | | Students | individual study | office furniture, individual work stations | |
| | | | | | Low | | Maintenance personal | | ventilation system | maintenance access |
| | | | | | Medium | | All building users | | | |
| | | | | | | | | | | |
| | 4% | 19 - 22 | 0,5 - 1h | Green spaces | High | | Workers | individual and group work | variety of work stations & levels of privacy | |
| | 2% | 19 - 22 | 0,5 - 1h | | High | | Workers | food preparation & coffe, socialize | simple kitchen, tables | |
| | 4% | 19 - 22 | 0,5 - 1h | Green spaces | High | | Workers & public | adaptable according to use | adaptable according to use | flexible, allowing to change user and install a variety of equipment |
| | 4% | unheated area | unheated area | Public spaces | High | | Workers & public | wood and metal work | activity specific ma-chinery | |
| | | | | | | | | | | |
| | | 19 - 22 | | | High | | Residents, public, pas-sers-by | | | access to load/unload area |
| | 1% | 19 - 22 | | Public spaces | High | | Residents, public, pas-sers-by | | | |
| | | | | | | | | | | |
| | 2% | 19 - 22 | 0,5 - 1h | | High | | Residents, public, pas-sers-by | reading, researching, lectures, workshops | image & sound system | |
| | 2% | | | | High | | Residents, public, pas-sers-by | | | |
| | | | | | Low | | Maintenance personal | | | |
| | | | | | Medium | | All building users | | | |
| | | | | | | | Residents, public, pas-sers-by | | | flexible outdoor with shel-tered areas, establishes connection between all other activities |
| | | | | | | | | | | |
| | 1% | 19 - 22 | 0,5 - 1h | Public spaces | High | | Residents and public | physical activity, individual training and group classes | gym equipment | |
| | 1% | 19 - 22 | 0,5 - 1h | public spaces | High | | Residents, public, pas-sers-by | | kitchen and tables | |
| | | | | | | | | | | |
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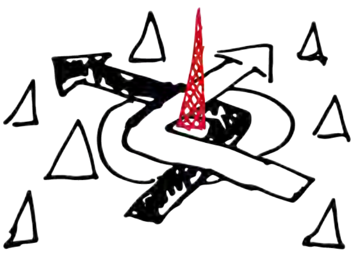
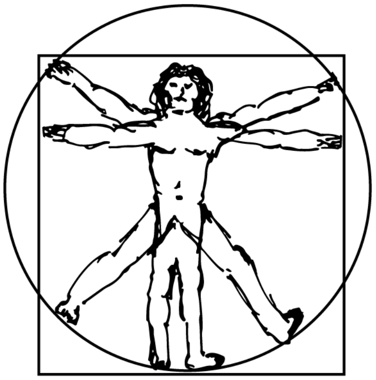
DESIGN PARAMETERS

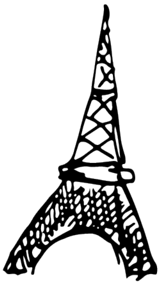
# What are our focal points?



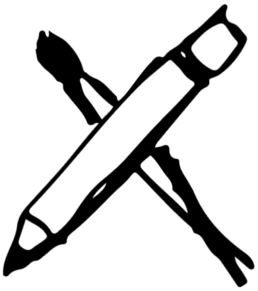
Creating a Node and Landmark



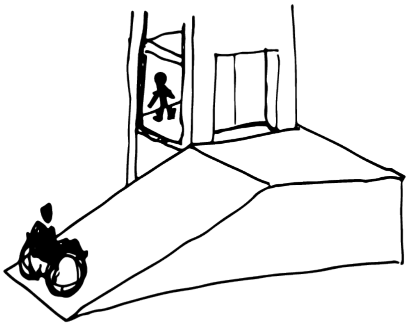
Relating to the human scale and needs



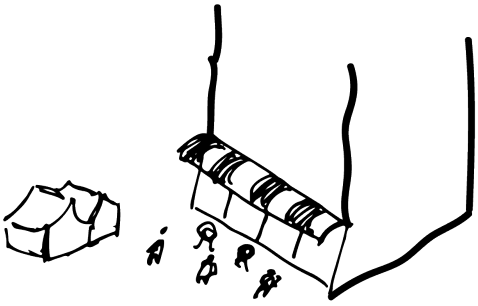
Iconic shape



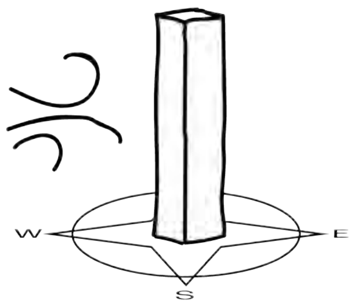
Encouraging creativity



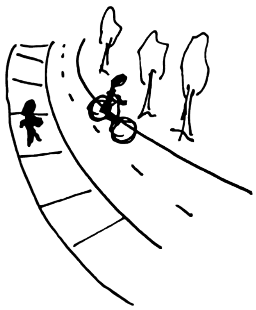
Accessable inside and outside



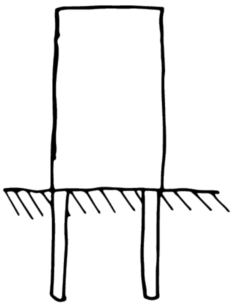
Groundfloor functions for users of the area



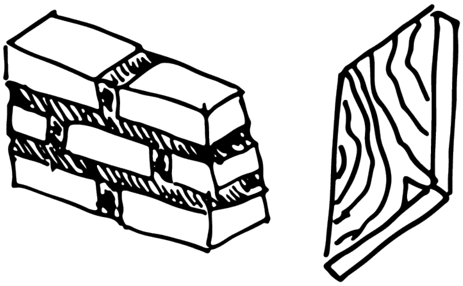

protect against wind from west



Improved infrastructure for bikes and pedestrians



Deep foundations



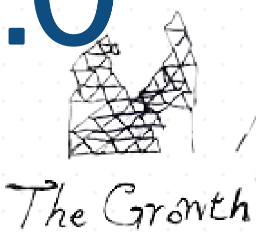
Materials relating to history and the future

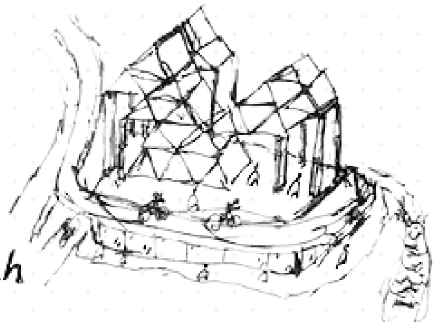
Our vision is to create a skyscraper that is the connection point between Gåsebäck and the southern neighbourhood of Närlunda. Creating an infrastructural enhancement between the district invites to have a gathering point in the design and connects a broad mix of users. By doing so it should create a new platform for a cultural hub in an iconic structural framework.

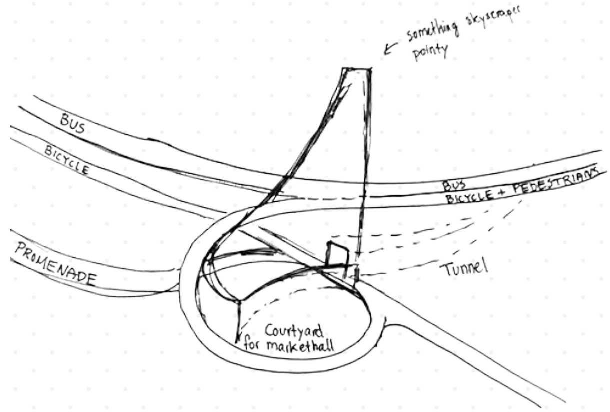
How to design a wooden skyscraper that supports the demographic growth and transformation of the city, creating a socially inclusive environment for both its users and neighbourhood and contribute to the city's mobility in an iconic structure?

# Problem statement

# 2.0






# How?

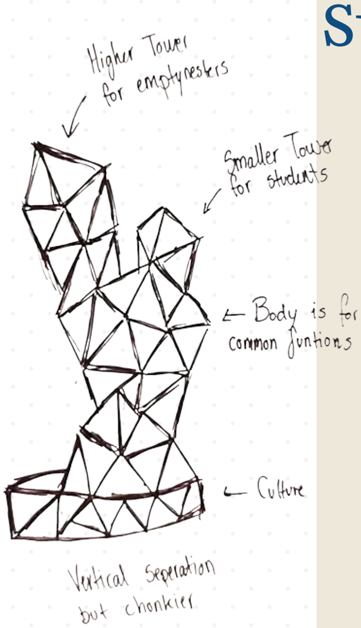
THE PROCESS

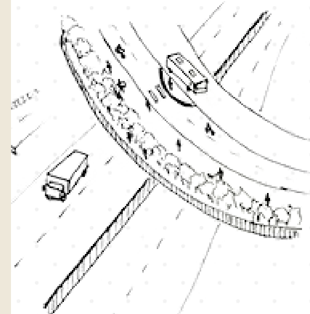
## Starting the Designprocess

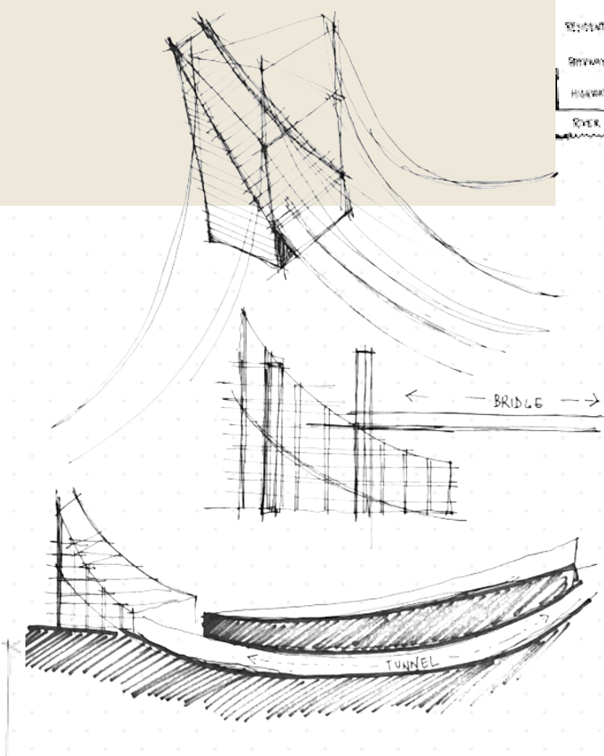
The layout of this chapter starts with an illustrative overview of the design process in an chronological order, showcasing the development of the different elements of the building. After the chronological overview the chapter is separated into themes, highlighting the focus areas that were especially worked on.

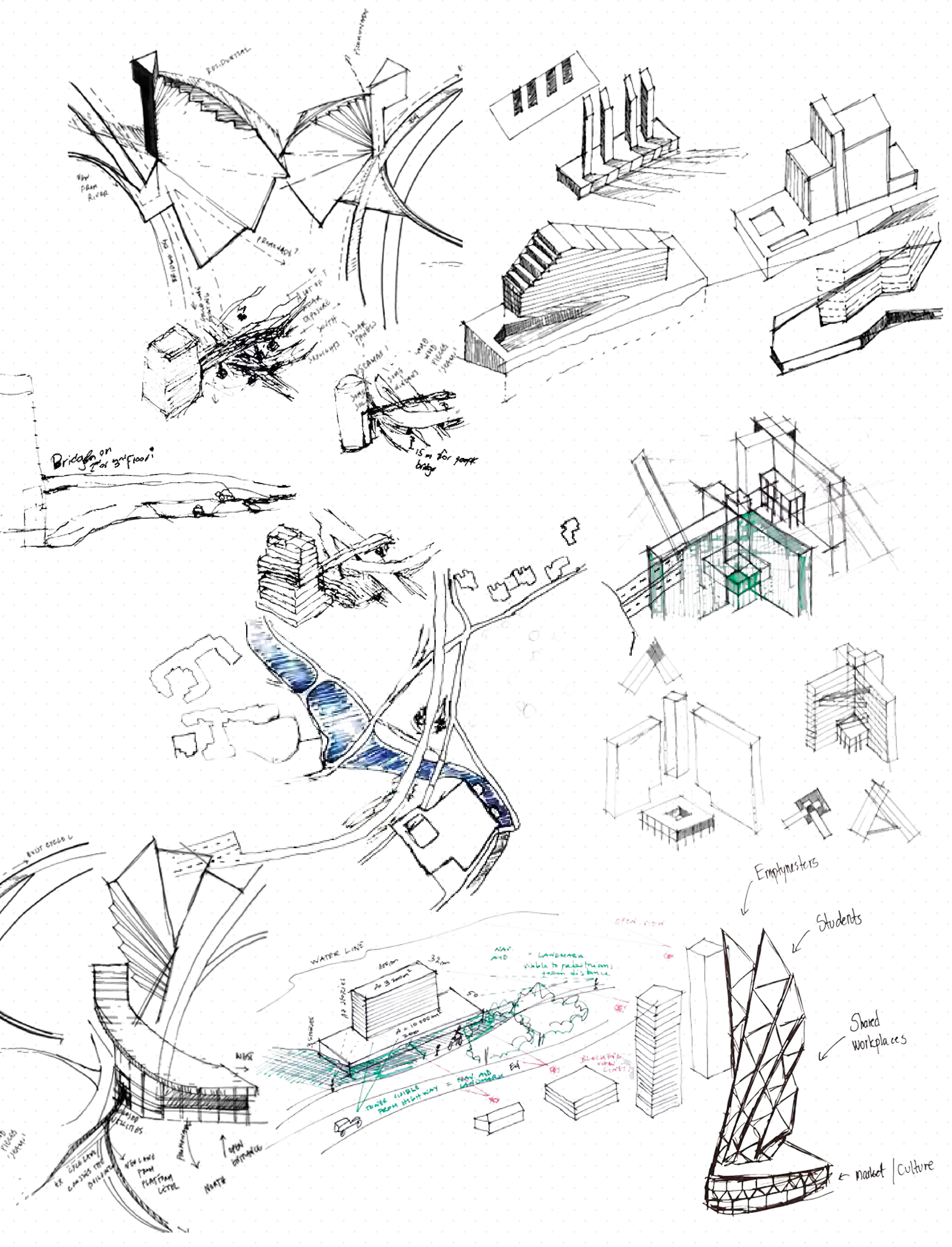
The process was based upon the knowledge gained from the previous chapter with analysis and theory search, and a site visit.

The visit to Helsingborg, helped select the site placement.
It was possible to see how the highway physically separated the city into a west and eastern part, creating problems for pedestrians and bicyclists. The pedestrian/bicyclist connection between Gåsebäck and eastern Helsingborg was done through two dark and long tunnels under the highway, giving the impression that the soft traffic was merely a practical necessity but not as relevant as the heavy road traffic.

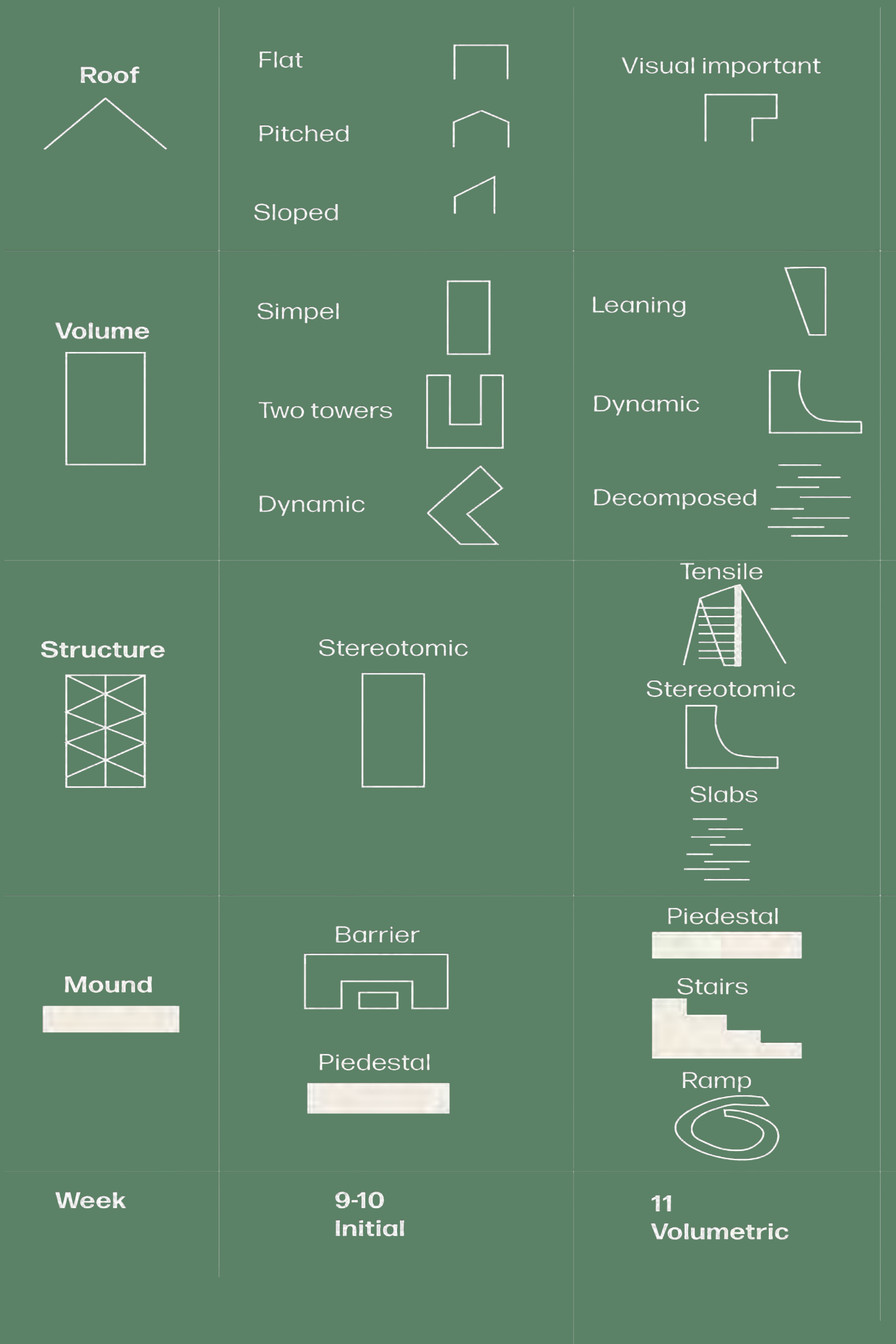



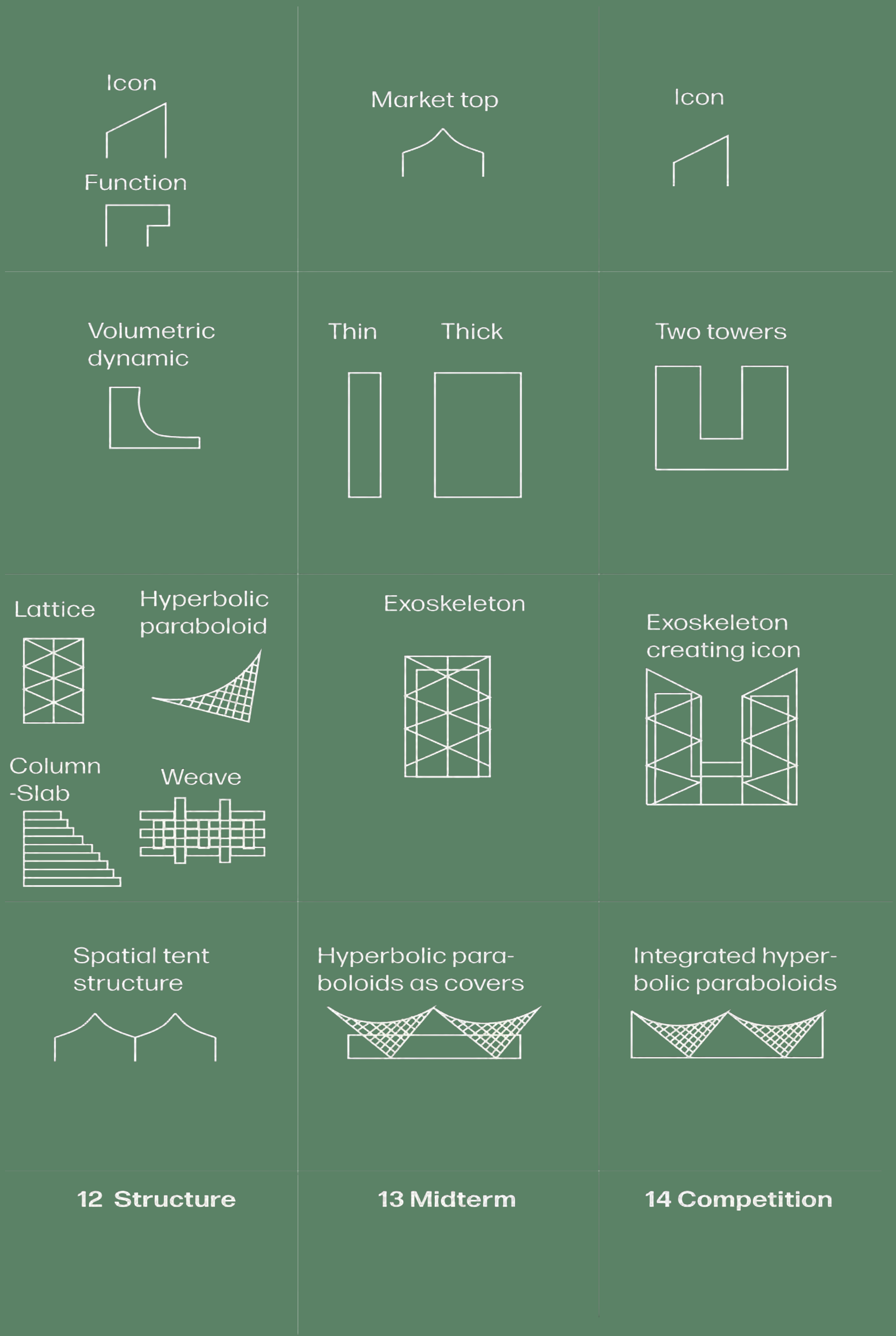





RESIDENTIAL
VIEW FROM RIVER
PROMENADE?
Bridge on 2nd or 3rd Floor
15 m for people bridge
WATER LINE
Emptynesters
Students
Shared workplaces
Market | Culture
NORTH

## 2.1 Chronological overview of initial designprocess

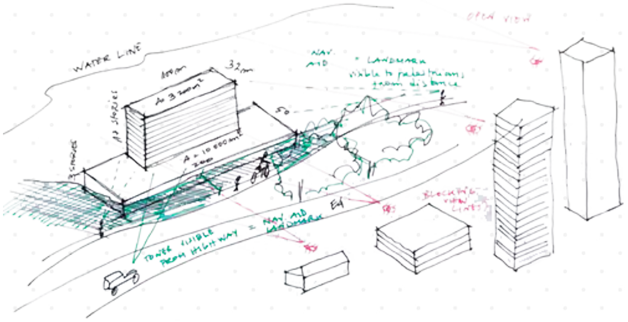


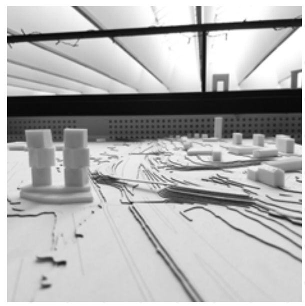

Icon
Function
Market top
Icon
Volumetric dynamic
Thin
Thick
Two towers
Lattice
Hyperbolic paraboloid
Column -Slab
Weave
Exoskeleton
Exoskeleton creating icon
Spatial tent structure
Hyperbolic para-boloids as covers
Integrated hyper-bolic paraboloids
12 Structure
13 Midterm
14 Competition

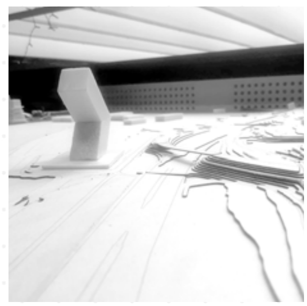
# Initial Sketches and Volume Studies

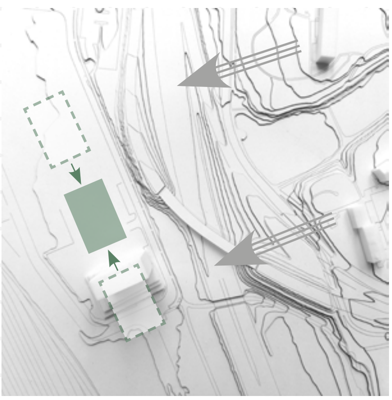
The design process was initiated by a sketching phase and a volume study workshop. The processes did not have any confinements, as this was the moment to try out extravagant ideas, even though it was based on the knowledge gained from the analysis.

At this stage, the focal points were view-lines and the contrast between an iconic shape and the human scale.

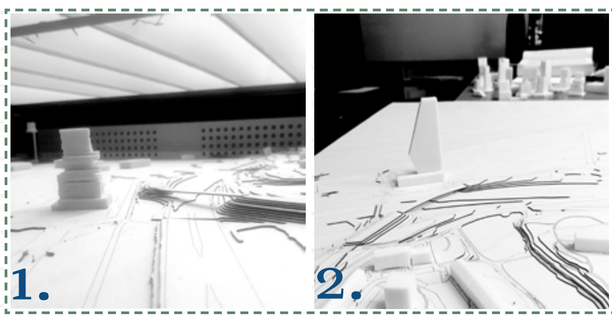








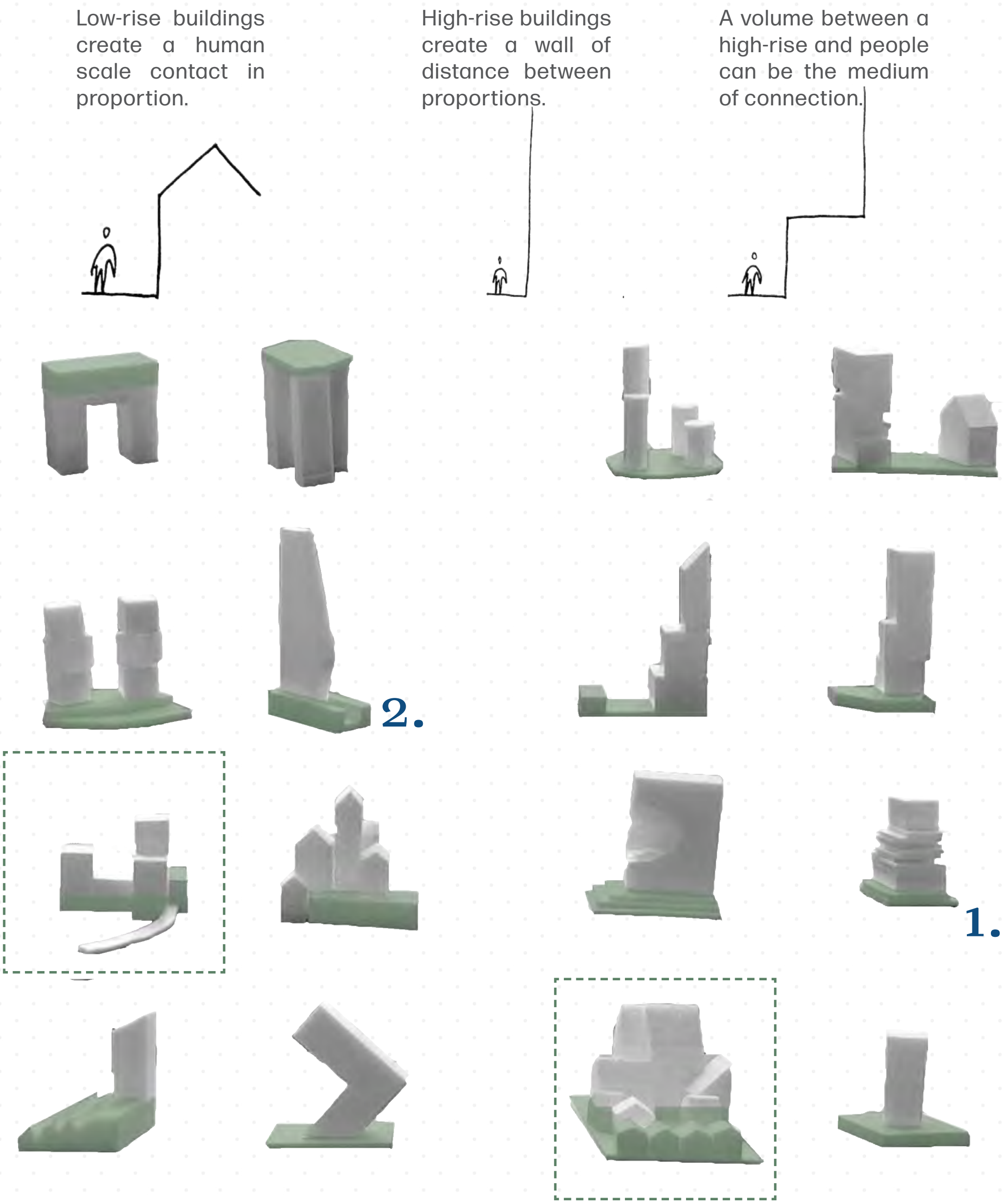
View lines obstructed by tower




View lines from E4 highway and Gåsebäck river and iconic shape

**Viewlines**
A tower can often be seen from many orientations, but can also obstruct the view for others.
In the initial process it was considered how to minimise the obstruction by how the tower was placed on site. A wide tower construction on site would obstruct the view from the residential towers in east Helsingborg.
The optimal placement for the building was therefore, in the end of an extending line from the river - placing itself where it couldn't obstruct visual connections.

**Icon**
Based on the theoretical research, it was concluded that creating a landmark derives by establishing contrast with the background and designing an iconic structure, thus giving the volumetric shape of the tower an individualised character.
Even so, it was important for the project to have in consideration the different uses and their functionality.
For these reasons, two main proposals were chosen for further development; a dynamic shape and a vertically divided volumetric mass.




**Human Scale**

An important factor for the relation between the tower and the human scale was the proportion created by different volumes.
This could be done by lowering the height of the tower towards pedestrian access (Gehl, 2010), and extending it in the different directions, connecting to Gåsebåck and east Helsingborg.
Several iterations of the foam models included a lowerpublic volume which had a different shape than the rest of the structure, creating a podium for the tower and an approachable element for the human. The highlighted iterations show what options were further developed.

**The tower should be placed in the extension line of the river, to prevent obstruction.**

**Iconic shape should be merged with a layered volume.**

**The building should be composed of, at least, two different parts; a lower volume, appealing to the human scale and creating a buffer in relation with the skyscraper.**

**Iteration 1 and 2 were chosen for further development.**

# 3 Concept Studies with 3 Connection Strategies

+

Not in close relation to the highway

Incorporate art

Integrate the tunnel concept in the design

–

Longer and darker tunnel than the existing ones.

It would raise the feeling of being unsafe, being in the tunnel and in the entrance/exit points.

How to get daylight/ light and air in the tunnel?

+

Not in close relation to the highway

Securing a better infrastructure route for buses in the future

The landmark and node is one/stands stronger in the concept

Less construction - use existing bridge connection

–

The highway is still a big factor dominating the atmosphere

Different levels for the bridge and for the ground floor - less accessibility

+

Not constrained as a pedestrian to one pathway

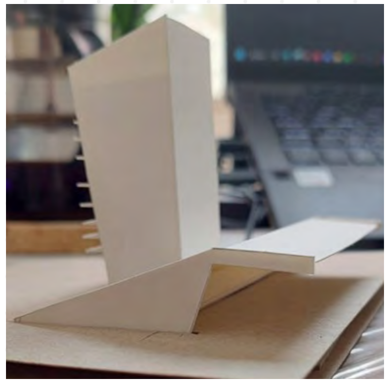
Sound reduction from the highway in green and blue surroundings.

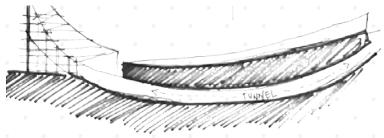
–

Not a sustainable choice when having the river extend above the highway

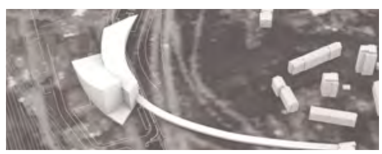
Node and landmark are not one entity

## The Sailboat





## The Slope



## The Pancake

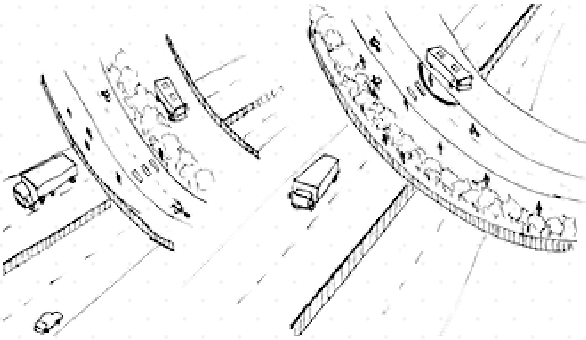
From the initial design workshop the two chosen concepts were further developed, and a third concept appeared. The three iterations are: The Sailboat, The Pancake and The Slope. The slope emerged from the intention of merging the building with the existing bridge.

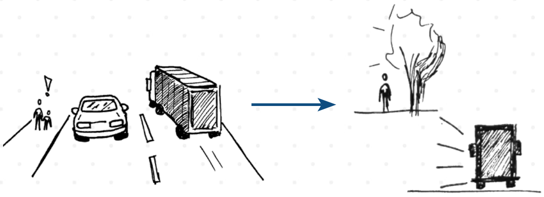
It was further investigated how to connect east and west Helsingborg by having three connection strategies:

Tunnel under highway
Bridge over highway
On ground with highway in tunnel

The three strategies were tried out and implemented on the three volumetric concepts through several iterations.

**The bridge-connection was chosen, revealing to be the one with the most advantages, such as:**
**Repurposing the existing bridge as a bus, cycling and pedestrian lanes - as seen on the sketch, which also was the most environmentally sustainable iteration.**
**Enhanced the feeling of safety by having an overview and being further away from the cars.**





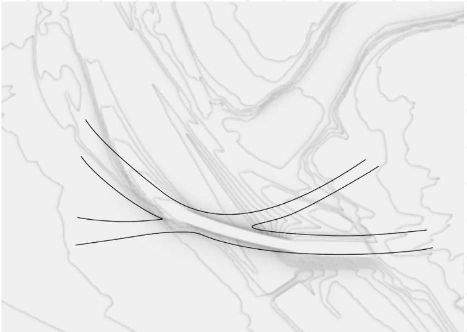
Further investigations included the implementation of parameters such as; incorporating areas for standing, sitting, walking and bicycling amongst green structures.

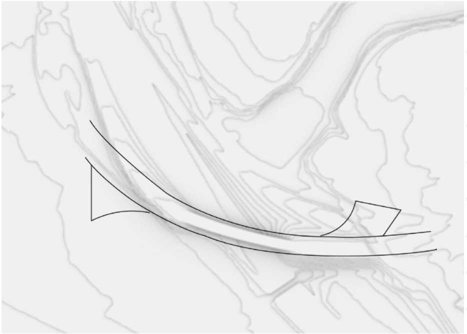
## Two bridge concepts

**Two bridges in one:**
Using the existing bridge to extend the new pedestrian- bicycle bridge, and connect directly in front of Gåsebäck river.

**Existing bridge with platform:**
Using the existing bridge with two platforms in the endpoints, minimising the amount of new construction material for the connection to the ground towards the river.

The existing bridge was a one direction road connecting the harbour area with east Helsingborg. At first the intention was to connect the river from the existing bridge with a new pedestrian/bicycle bridge extension, but this solution raised several questions, such as;
Why create a new bridge besides an existing one?





**The existing bridge was used as the connector above the highway as it had several advantages such as enhancing the feeling of safety when crossing near the highway.**

**The bridge iteration with the smaller platforms in the endpoints was chosen, as it created the same infrastructural connection as the extension from bridge solution, but with less amount of material usage for construction.**

# Focal Points in the 3 Concepts

The three concept iterations were evaluated from three focal points; wind, noise and shadow. This analysis helped define the area where the optimal placement of the tower was in terms of:
1. not casting a shadow on the neighbourhood areas.
2. how the design of the volume could help reduce higher wind speeds.
3. have the best position in terms of noise levels when placing the tower.

The shadow investigation showed that there were long casted shadows with a building with over 20 stories height onto the neighbourhood area. In terms of minimising noise nuisance, the noise map was used to take advantage of the best area with lower noise. The best placement was near the bridge as the construction worked as a noise reduction.

The wind analysis had a velocity of 10 m/s, and reveals the effect it has on the different volumes:

In The Pancake it is seen that on the top of the skyscraper, there is an impact increasing the wind velocity when going just above the roof, and creating turbulence on the top. On the darker side of the tower it creates more turbulence and in some areas it creates vortex shedding where the wind is swirling around as a consequence of the building shape.

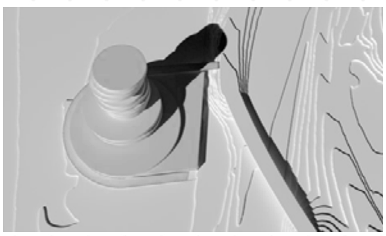
On The Sailboat the roof design minimises the wind turbulence on the darker side of the tower compared to the wind analysis of The Pancake. The different heights and corners of the roofs break the velocity and deflect it, making it more aerodynamic.

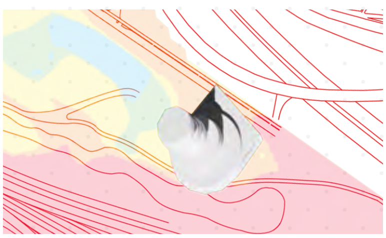
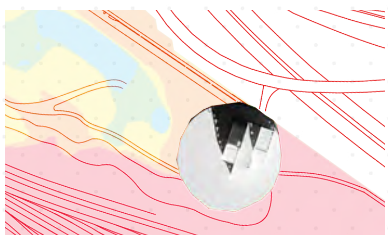
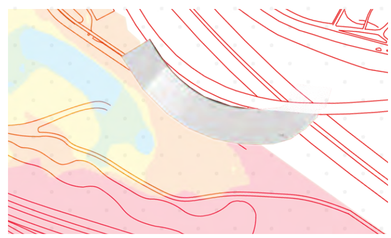
The Slope has the best result in terms of minimising the wind velocity on the overall volume of the tower. It has some of the same advantages as the Pancake with soft edges and a better aerodynamic shape. The velocity is minimised at the bottom of the tower and on the rooftop as the roof has an overhang which stops the wind and traps it underneath it.

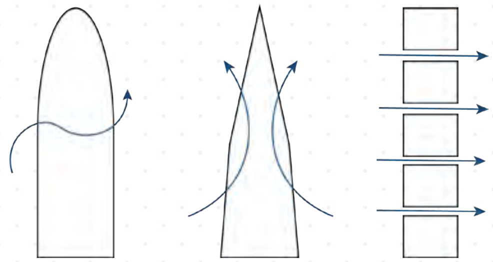
### The Pancake

### The Sailboat

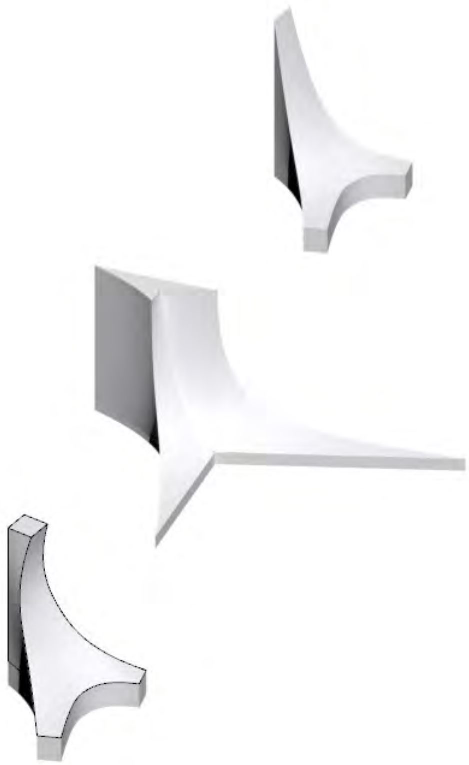
### The Slope



Some wind velocity reduction strategies used in the further development of the design are (Mills, F. and Smisek, P., 2018):
Softening the corners to have a better aerodynamic shape.
Tapering of the building at the top letting as the wind velocity is greater.
Increase the porosity of the building by creating gaps letting air pass through.



**Place the tower towards the highway as it gives less amount of shadowing onto the new housing area in Gåsebäck and in eastern Helsingborg, and would instead cast it onto the highway.**
**Another aspect was to move it further behind the bridge connection as the mound underneath the bridge gave some shelter from the traffic noise.**

**The design of the tower should incorporate soft edges, tapering of the building and porosity as wind velocity reduction strategies.**

# Structural Strategies

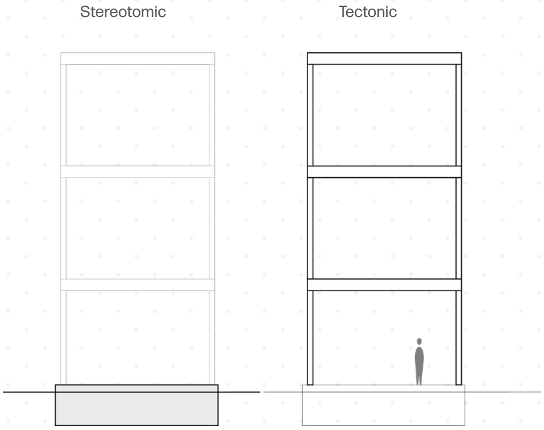
The structural workshop had the focus of finding a structural stability strategy for the tower. This would include both the technical aspect of how to construct with wood, and how it is experienced as a user and passersby.

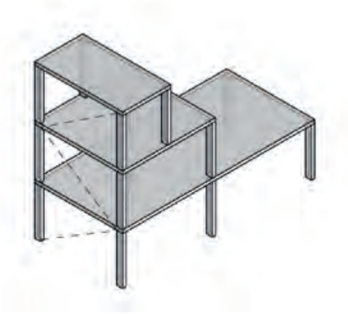
With its low self-weight and resistance characteristics, wood makes for an interesting option for multi-story buildings. This can reflect on easier and cheaper transport and assembly of elements. The main obstacles lie on fire and moist resistance (Swedish wood, n.d).

To deal with the fire resistance performance, the strategy can be to increase the structural elements cross section up to the dimension that allows it to withstand fire for the required time. For smaller elements, the solution might be to apply protective covers or cladding layers with non-flammable materials (Markström et al., 2019).

Fluctuation in moisture levels can lead to pathologies caused by microorganisms or alterations in density. This is a concern that applies mostly for exterior exposed structures or facade elements (Markström et al., 2019).

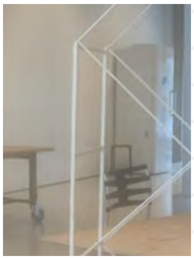
## Structural Stability Workshop

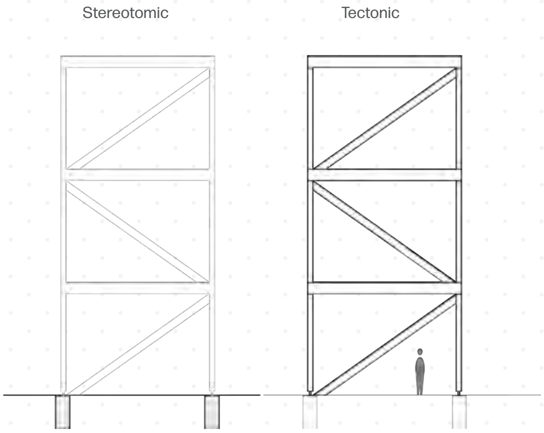


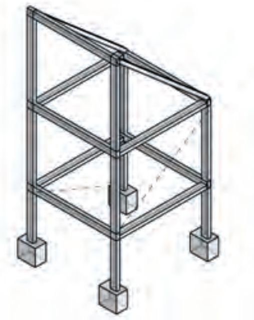



Principle:
The construction consisted of columns that were separated by the slabs of each floor. It was investigated how to achieve structural stability when there were no lattice structures. To gain structural stability there had to be two sides with a lattice structure. The wooden structure meets the floor slab on the ground floor on several points where it is the slab that distributes the forces.

Gesture:
The structure assimilates the simple constructive logic achieved during modernism. The wide span of area without columns gives the impression of the tower floating above the head level. It can be seen either as a positive or a negative experience of space.





Principle:
The construction consisted of four continuous columns in each corner of the tower with lattice structure in between. With this model it was investigated how many lattice structures were required to achieve structural stability. By having a pattern of one diagonal per second box frame on two sides the structure performed better.

Gesture:
By having structures diagonally it breaks with the vertical and horizontal movement of columns and slabs. It interacts visually with the user creating a wrapping around the building.

## Structural Stability Workshop

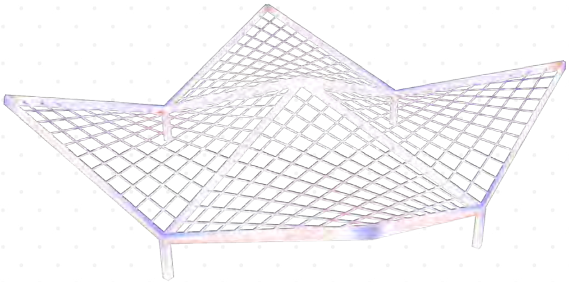
**Hyperbolic Paraboloid**
The structure appeared during a desktop investigation of finding strong structures which could withstand loads with slimmer structures.
It was investigated how the hyperbolic paraboloid could have different expressions, especially focusing on the tent structure as seen in the pictures.

How could the hyperbolic paraboloid be implemented in the tower?
A conceptual idea emerged of having the tower connected to a tent of paraboloids in a structure.

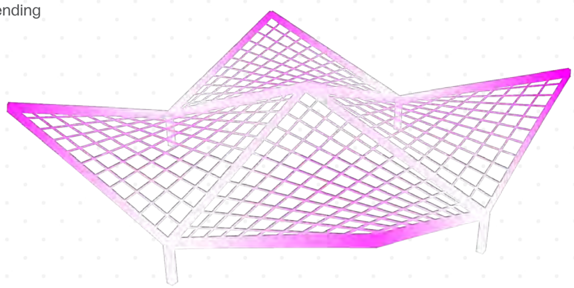
Principle:
The construction consisted of four columns in each corner connected by beams and lattice elements on top. The lattice elements are not bent, but are straight beam elements which form a doubly curved surface. It is used when wanting to create large areas without columns interfering, as it is a strong structure.
With this in mind the 15m x15 m grid was developed in the design, adding or removing paraboloids forming a net on the ground floor. The size of one paraboloid could be used to determine the area needed for the public ground floor functions.

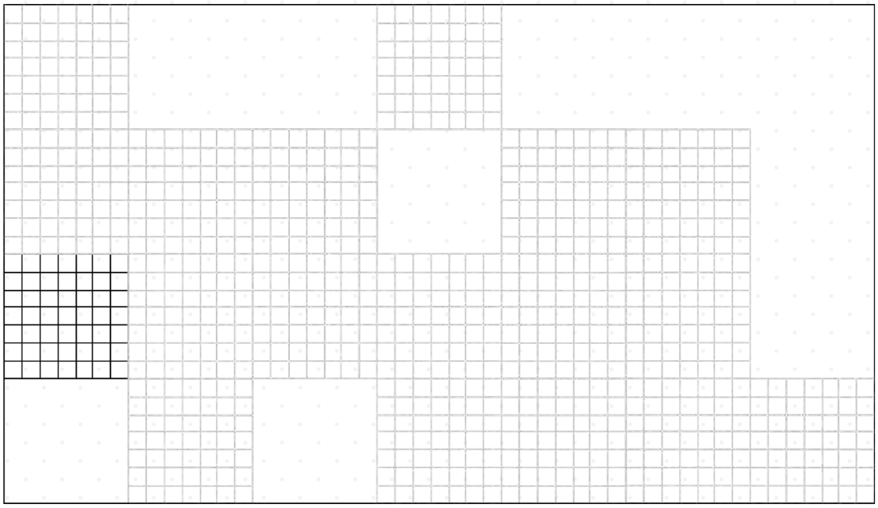
Gesture:
The hyperbolic paraboloid consists of a doubly curved surface, meaning that when being underneath it, it will create the illusion of being under bent elements, as if the roof structure has the same textuality as a tent material.
The structure creates curiosity from the viewer as the height differs in each corner creating a spatial experience. Adding to the architectural experience, the paraboloid roof structure can create vivid shadow play underneath.

Axial stress



Bending





Expanding the grid

Merging the paraboloid and the tower created a new iteration

Connections to the tower

**Because of the workshop, the design of the tower developed from being a simple volume to an exoskeleton tower design, with a lattice structure to gain structural stability.**

**The hyperbolic paraboloid was used to accommodate the ground floor functions. Merging the tower and paraboloid created a new design iteration which developed further to the proposal for the competition.**

Weaving patterns for the top part of the paraboloid

# Midterm Review and Competition Poster

**The proposal for the competition was too large for the proportions of the site.**

**Two towers did not have the advantages that were wished for in the project in terms of social sustainability.**

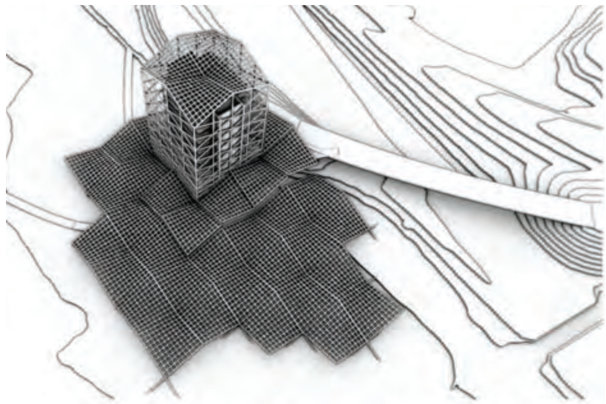
**The exoskeleton structure would need a strategy for replacements in the future minising how environmentally sustainable it was.**

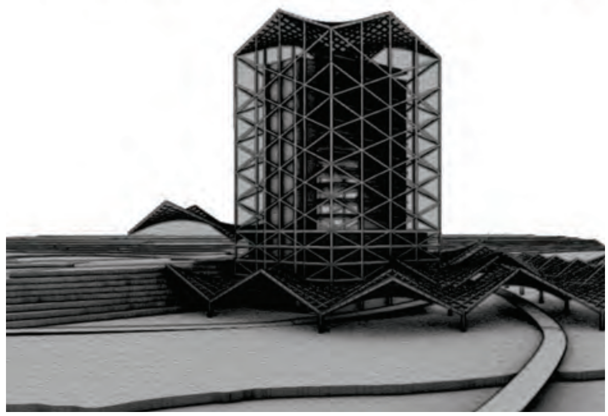
During the two weeks, there was a fast development of the design proposal. For the midterm review the proposal consisted of the marketplace concept, where one of the tents extrudes vertically as seen in the concept diagram. This concept idea was further used during the week of competition for delivery of the A2 presentation poster.

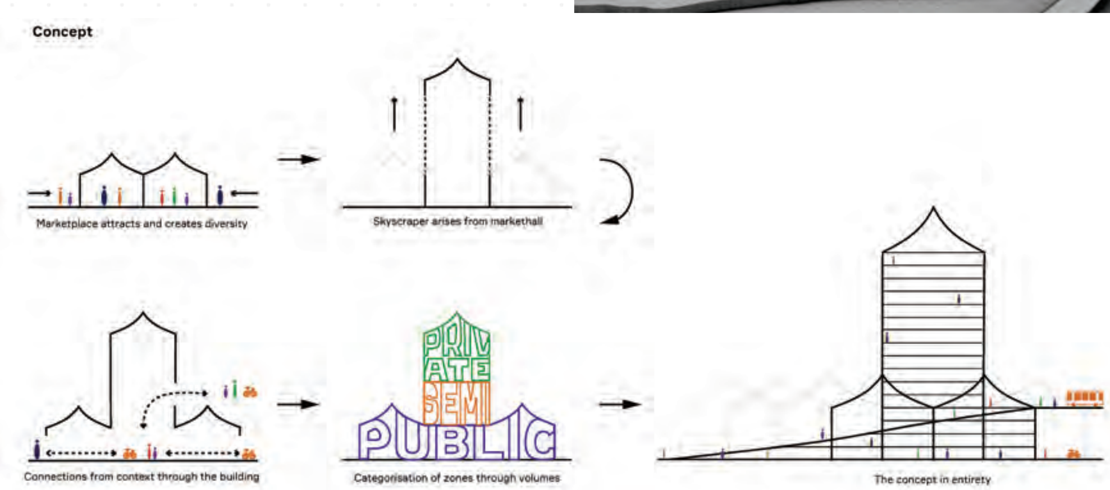
The concept of having a tower emerging from the paraboloid tents was physically visible in the midterm review design proposal, as the roof had the same structure as the tents.
For the competition proposal there were two towers that imitated the tents, but instead integrating the curve of a tent in the structure and in the roof design.
The complications of having two towers:

Difficulties to obtain a circulation that benefited the occupants and the public users on two towers.
- Difficulties in complying with fire regulations as the fire escape cores on the ground floor would obstruct, in case of fire emergency.
- Some apartments struggled to have enough daylight.
- What are on the top floors of the towers?

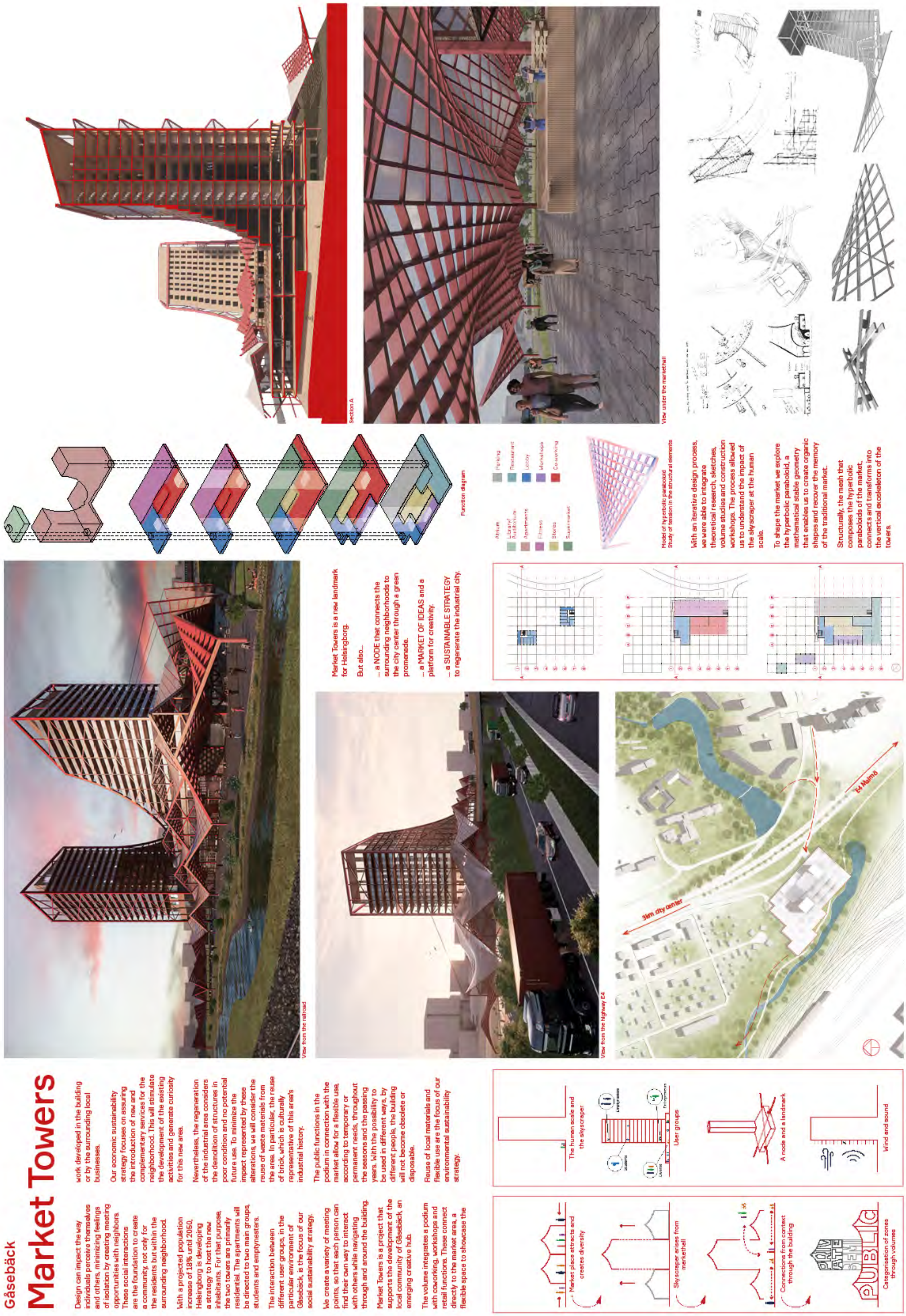
Both proposals had an exoskeleton, which meant that the wood had to be weather protected. The impregnation of wood was tried out with a red colour, giving it a distinctive expression, but even so having an exoskeleton would reduce the lifespan of the wood.
From this phase we could also evaluate the impact of the building program that was being implemented, which derived from the competition framework.
The program was revealed to be too large - in construction volume - for the site where it was being implemented. Therefore, it was minimised during the following weeks.







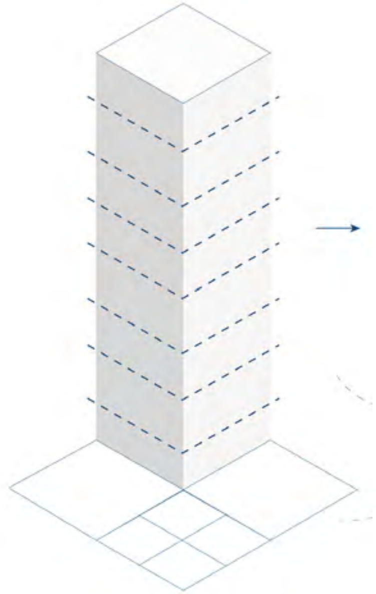
Illu. 03: Competition poster by Magnus R., Marques M., Rasmussen D. (2023)



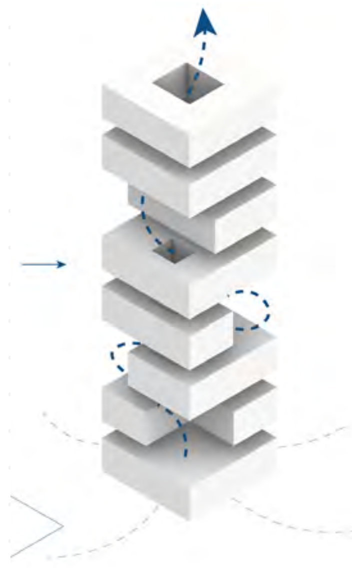
# Order of Functions and Relations

Two strategies were used to find the order of functions and relations, a vertical and a horizontal. At first the focus was mainly on the horizontal cut, as the ground floor plans were developed first with the functions in stacked layers, which evolved around the 15 m x 15 m grid from the wood workshop.
The size of the grid was defined during the further development of the space program after the competition. While navigating to find the optimal sizes for both the smaller public functions and the larger one, the simulations showing the strength abilities of the hyperbolic paraboloid helped define the span width that could be reached between columns. The grid could either be doubled or sized down depending on the functions.

Horizontal cut of tower from the grid structure

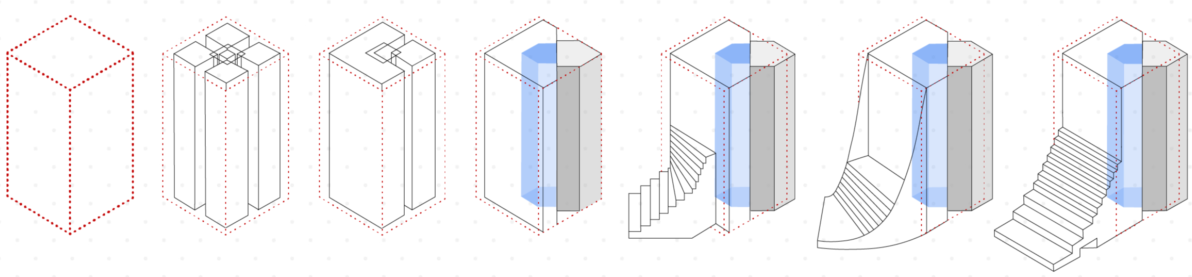


Vertical cut in further development of the plans working with the relations inside the building and the sourrundings

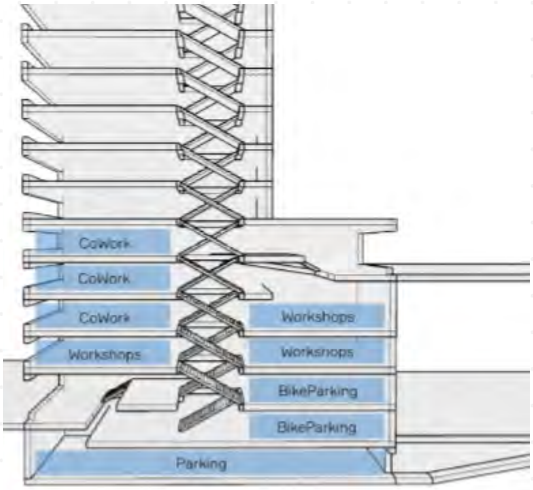


By working with a vertical relation between levels, interesting connections were created in the design of the plans. The concept of continuing the promenade from the ground floor and up to the top floor blossomed in this phase.
As seen in the illustration below of the initial development of the vertical promenade (grey) and the communal rooms (blue), it is seen how the elevator is being pushed out from the volume, making it important that it is visible from Gåsebäck.

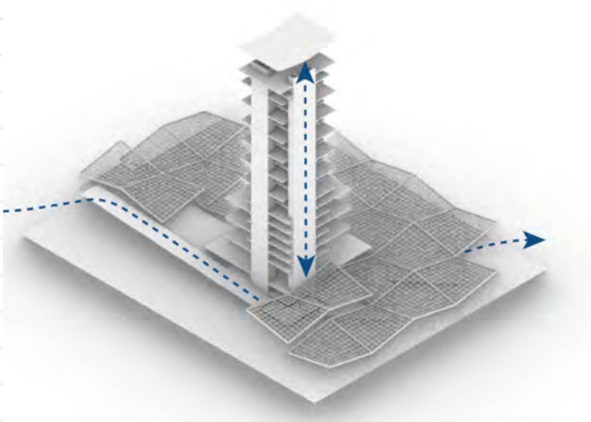
Development of the vertical promenade



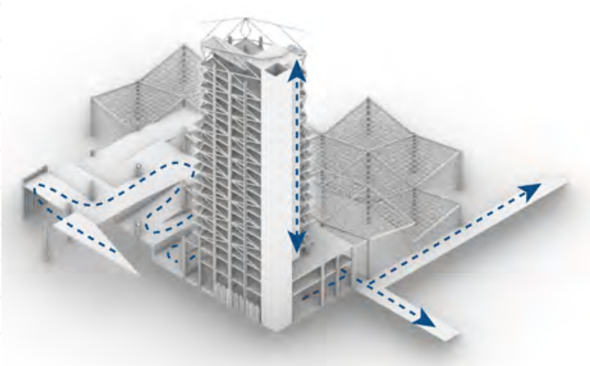
Vertical order of functions and relations in inital process



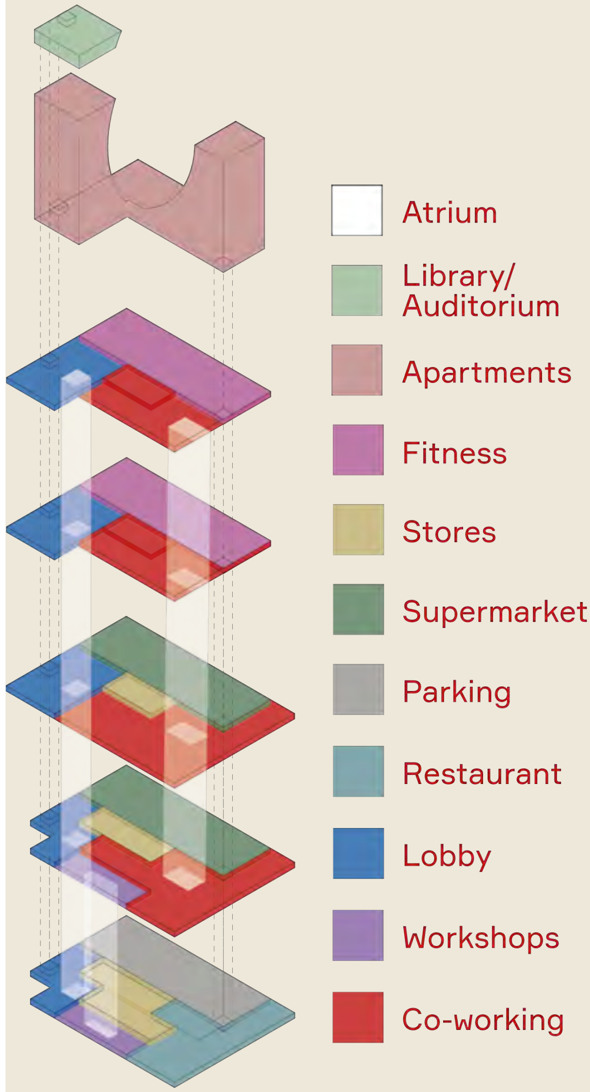

Development of the vertical promenade showing the elevator core towards Gåsebäck



Further development of the entity of the vertical promenade, where the elevators are behind the technical shaft



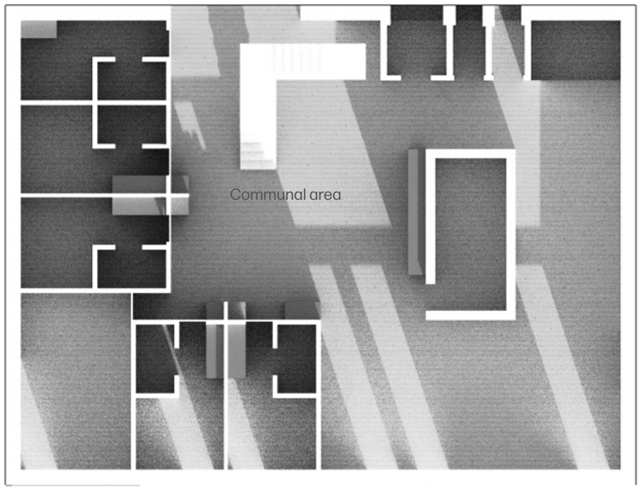
Horizontal order of functions initial process



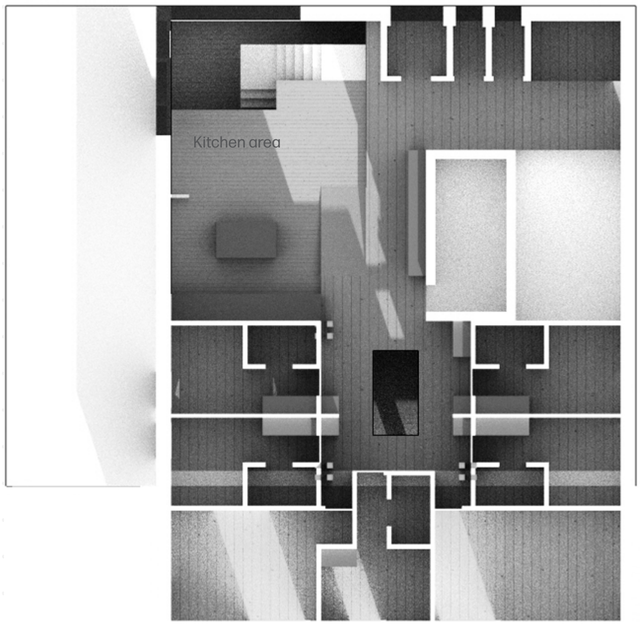

The functions from the ground were chosen based on the results from the analysis and the space program.
They were placed in relation to their surroundings, having noise producing functions that had less requirements in terms of daylight, such as the fitness.

This function was located towards the highway, as it was possible to establish a visual relation with the road dynamic and the use itself would not be affected by the noise.

# Order of Functions and Relations


The floor plans intended to investigate how to create casual social interactions complying with the user need results found in the theory.
The intention was to have different social interaction levels depending on the user, such as varying between visual or physical meeting points and how much shared facilities they would share.
Vertical openings in the floor plans were investigated at this point.

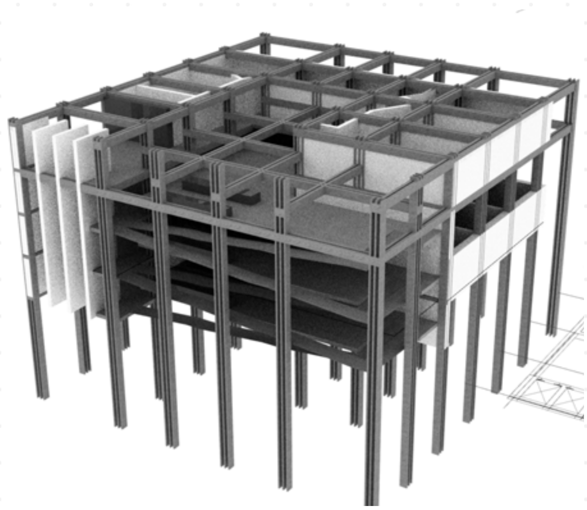



During the plan developments it was intended to create graduations between the private, semi-private and public areas.
A principle of organising the apartment floors was placing the apartments in a south and west orientation, giving them good daylight, having the technical and fire core towards the darker orientation towards north, and having the communal in the west.

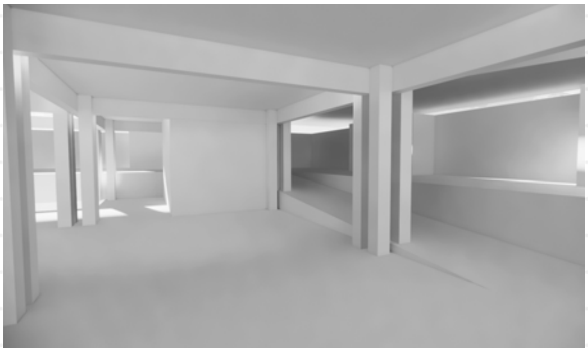
By having the private and semi-public functions in each corner the communal areas became the gradient between them.
The fire core had a major influence on the development of the plans as considerations of how to have a maximum walking distance of 10m, or if there should be two cores would impact the overall design.

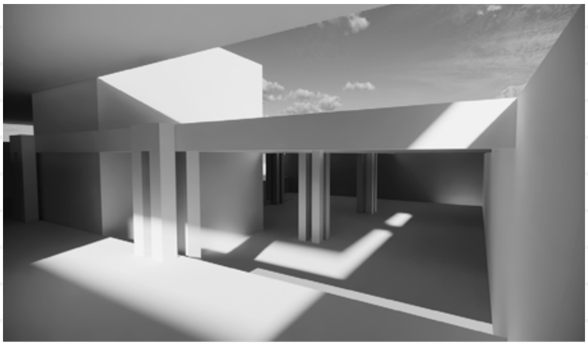
Physical and visual connection

2.5 Structural Strategy



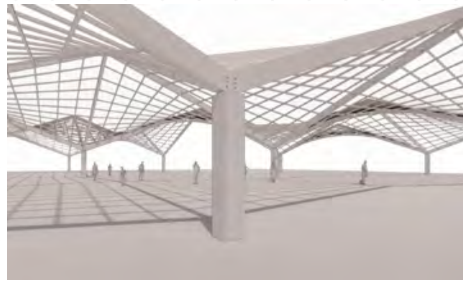
The iteration with the ramp tower - finding how much is too much

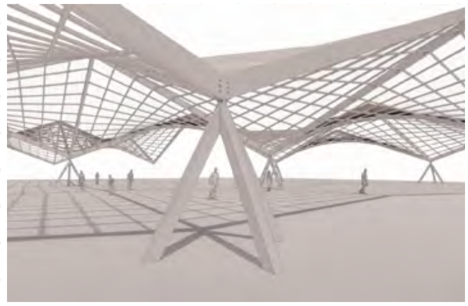


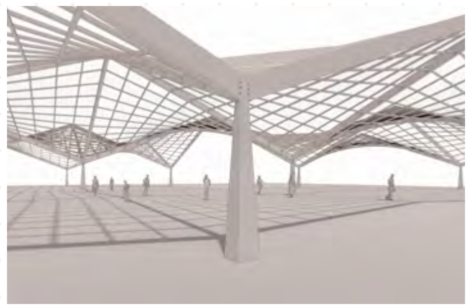


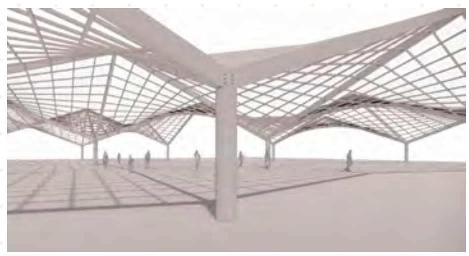
**The grid creates a baseline that can be either sized up or down to follow the area needed for the functions.**
**Horizontal order creates little connection between levels.**
**Vertical connections create physical and visual interactions between floors.**
**Have communal areas as a gradient between private and semi-public functions.**
**For each user group there should be a difference in shared facilities.**

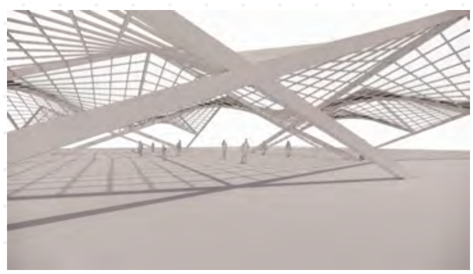
# Column and Beam Expression and Joints



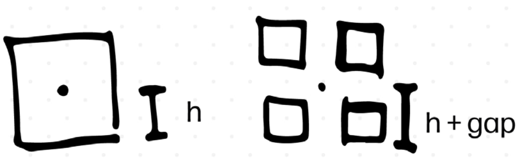


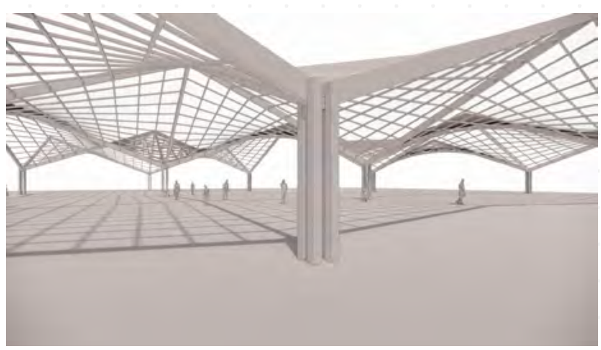


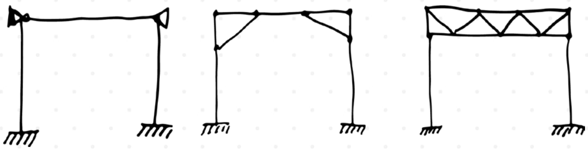




As the structure is made from wood, it has a large impact on how the skyscraper is designed. It was important to design the expression of the different columns in the build.
Different iterations were made to create an expression for a large number of columns on the ground floor. Shows differences in how the column would be interpreted in the market area
To test it, some virtual renditions from a human perspective were assessed. And to determine the sizes of the columns, there was made a hand calculation of the columns throughout the building (Appendix 02)
The assessment was dependent on how the columns' expressions were correlated with the other structure, how the columns were carrying the loads and which design option would use the least amount of material. The square, the pyramid and the four columns were further considered.
The 4 columns with the beam in between would be able to carry as much as a single square beam with the same mass. Spreading out the column into 4 would change the moment of inertia, potentially helping the beam's strength. Dividing the column would also make the column grab the beams and create a simple joint.



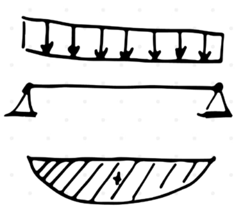


The pyramid column would have a larger mass in the bottom, which would potentially create an overuse of material. Where it would have made more sense to place the mass in the middle, but that expression would create too many shapes in the already complex structure.

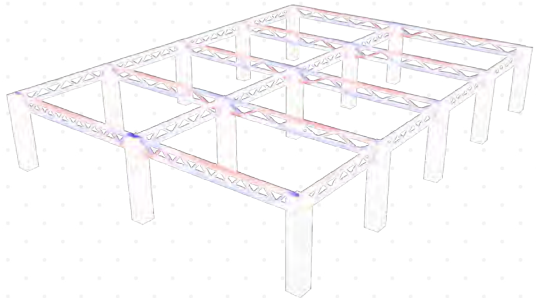
The square is a regular expression which would help make the apartments more simple.
When choosing a beam, the section height was important to consider, given the presence of the ventilation system in the ceiling and the requirement for a minimum height of 2.4m. Therefore different beam types were explored in Karamba, to find the one with a low bending low height and a simple expression as it needed to be in the residential areas.

First, the basic rectangular beam was explored.
A simulation showed that a height of 500 mm was required in order to reach an acceptable bending of a maximum of 1,7 mm. This would create a problem when placing the ventilation below the beam, which created areas that went below an acceptable ceiling height. It would also require a large amount of material usage which would be preferable if prevented.

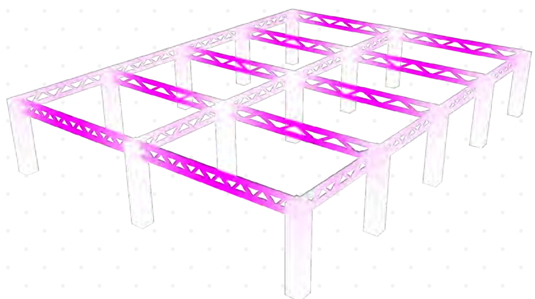
Therefore, a truss beam was explored. With this design, it was possible to create openings in the beam. The diagonal trusses minimised bending and it was possible to reduce the amount of material used. It did however need a height of 600 mm to not exceed the bending of 1,7 mm.
A diagonal beam going from the column and closer to the middle of the beam was explored to create a smaller section and prevent bending. That would create a beam height of 300 mm, which was deemed acceptable, and it created a traditional wooden expression, as it was used in old Swedish wooden buildings.



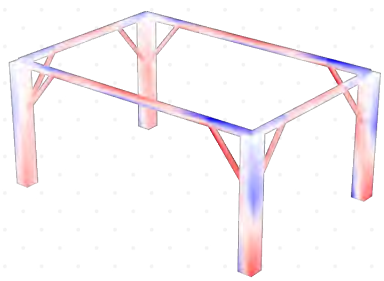
Having the beam column joint with a fixed simpel support, the moment curve looked like the above. This meant that there where it is highest the bending stress of a beam is worst.



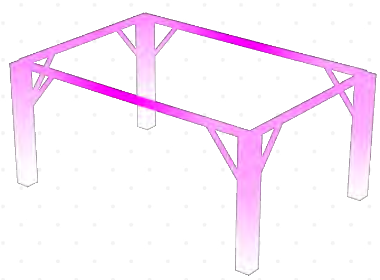
Ground floor structure investigation: Axial stress



Ground floor structure investigation: Bending



Ground floor structure investigation: Axial stress



Ground floor structure investigation: Bending

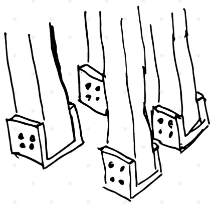
# Column and Beam Expression and Joints

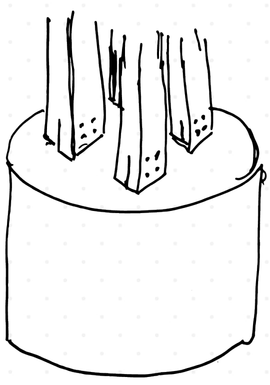
**The joints**
The joints of the building had to have a clean and honest expression, showing the structural system and creating meetings between the elements. Meeting with the mound was important as it is where the building transfers the forces to the ground.
An iteration was made where the column seemed as if it grew from the ground, with a metal "shoe" to keep them fixed.
But an iteration where the joint lifted the column above the ground, creating air and a lighter expression was chosen to make the building lift and show the transferring of forces to the foundation pillars.

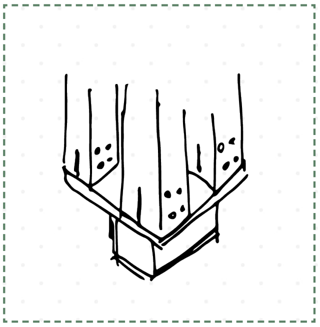
**The stitching**
The relationship between the tower and the "market" is an important merging moment. The "stitching" was the strategy defined to connect the two elements.
The tower and marketplace fit into a grid system of 15 m x 15 m where the tower's lower volume spans 25 m x 25 m which means it creates a gap of 5 m. This gap was there for the building to release from, but still be a part of, the hyperbolic paraboloid structure.
Some of the earlier sketches showed a direct connection between the hyperbolic paraboloids and the tower, where the tower would seem like growing from the marketplace.

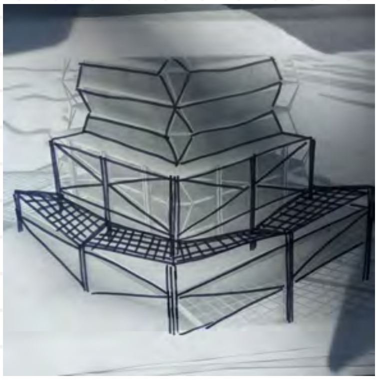
There were also iterations where, instead of the stitching, there was only a gap between the tower and the marketplace, to express a breathing space between the vertical structure and the horizontal plane.

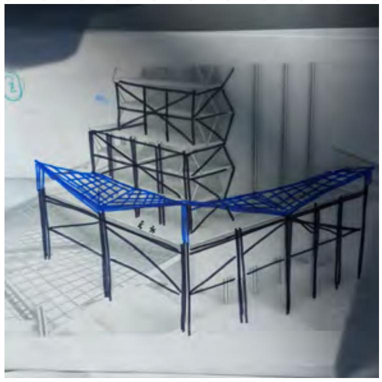
The last iterations explored a connective element that allowed to show the inter-relations between the two structures, the tower and the market, while still allowing them to assume their individual character.

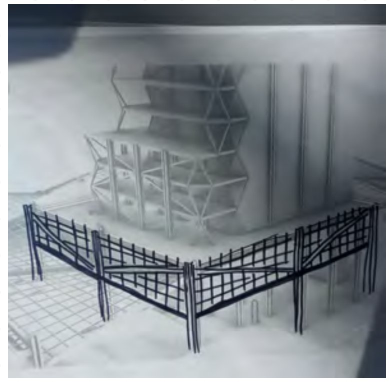


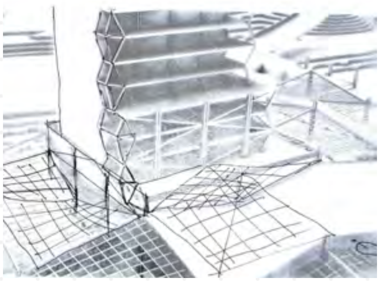


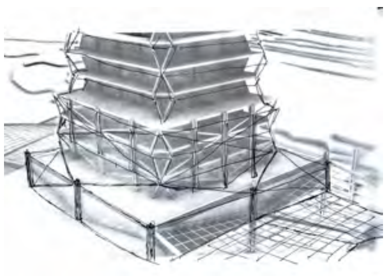


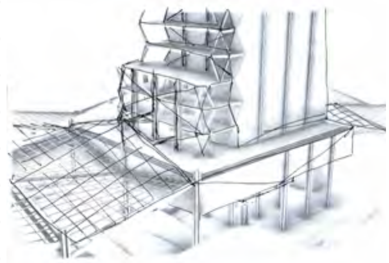


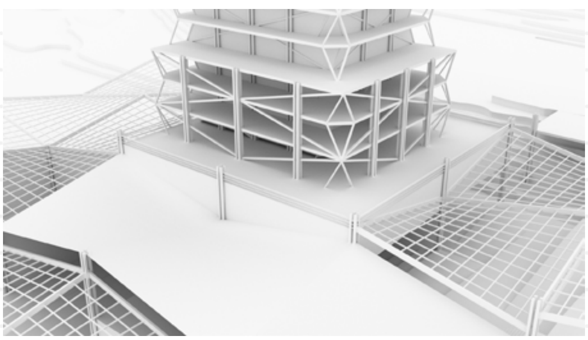






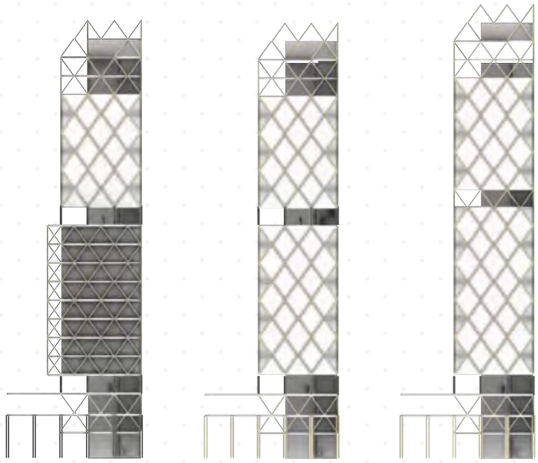


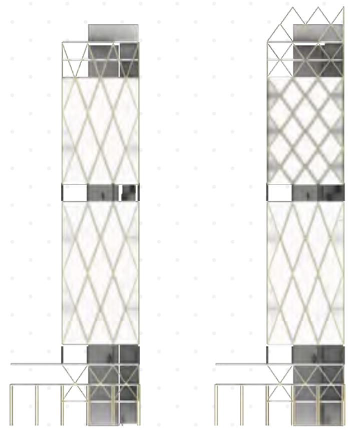


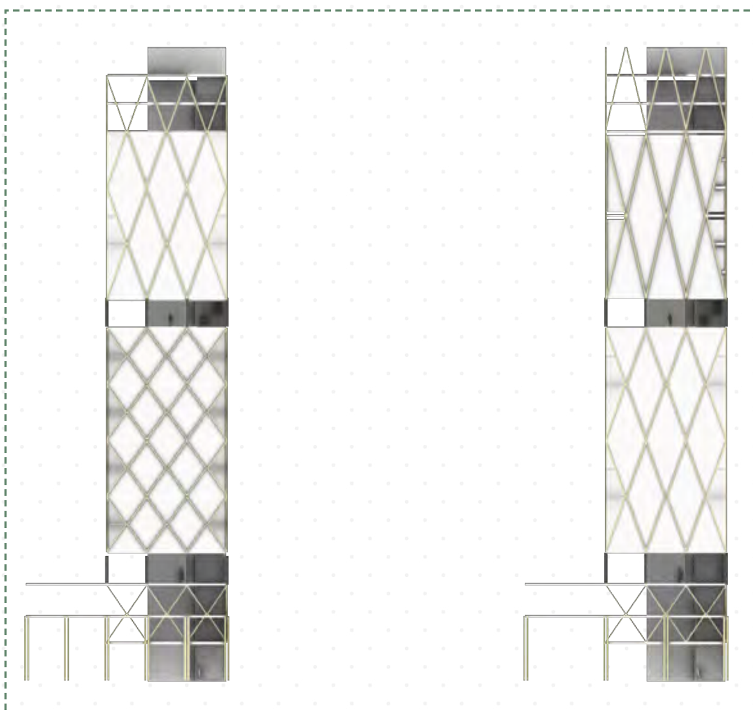


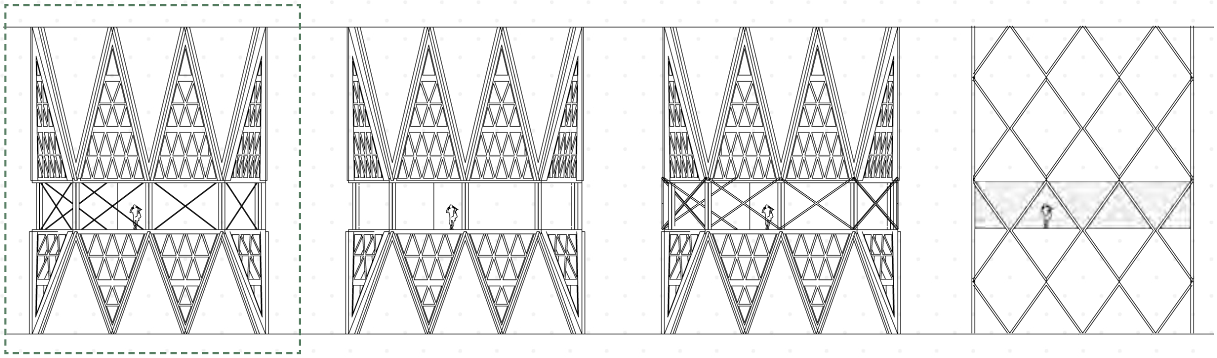
# Facade Expression

The expression of the facade is a major component, as it establishes a direct link with the structural strategy and supports the iconic aspect. It is expressed through the amount of transparency, size, spacing and materiality.
Throughout the design process, the overall shape would create a specific facade which would need to align with the shape and the concept.
When trying to shape the building, it was important to have a distinction between the different functions, which could be accommodated by how the facade was expressed. There were several iterations showing this distinction in the facade.
With the final shape, it was possible to show this functional distinction integrated with the structural system. The cross beams were pulled as tall as the number of floors that were connected in the functions. And as the different functions had different connections, it made a distinction between them. The corners of the building follow the diamond shape, to decrease the perceived dimensions of the tower.

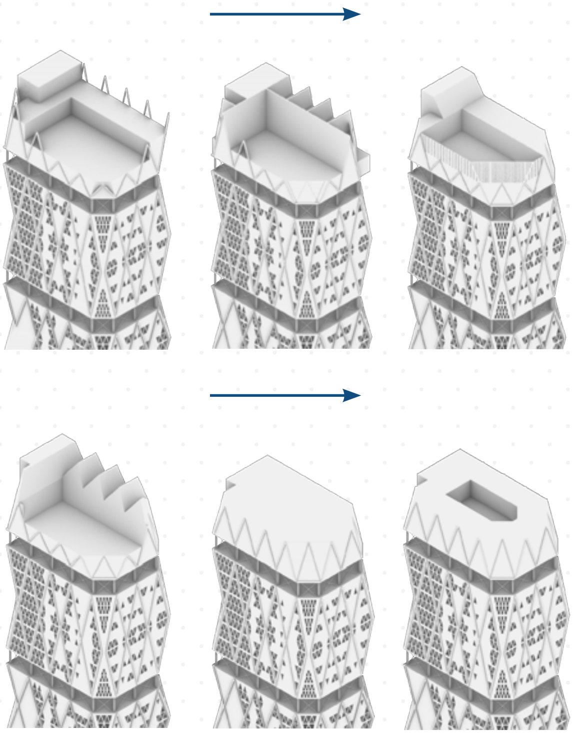




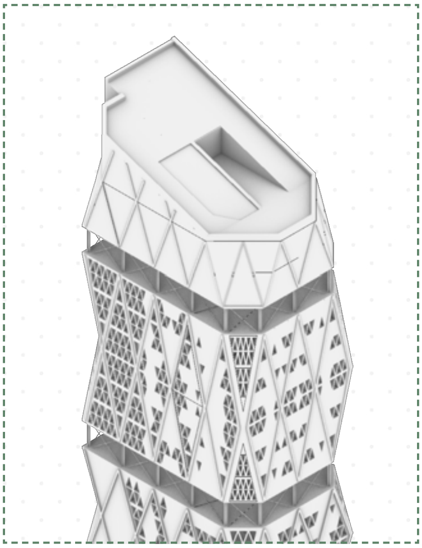




**The Gaps**
As the different functions were separated, the volume was also separated. This happened as a reflection of the different noise levels produced by different users and their variety of routines.A separation in the volume would create less direct contact and less noise transfer. The gaps, being an opening in the volume, exposed the internal system of the building and created the opportunity for outdoor areas where the different users could meet.
To reach this vision, the gaps needed to be designed in a transparent way, showing even the existence of technical installations. But they should also become an area where people can meet outdoors, protected from high wind speed.

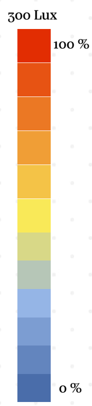


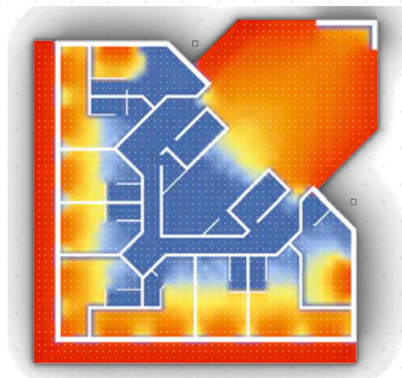
**The Crown**
As skyscrapers have historically had a significant top, it was also the goal for this project to create an iconic shape with a significant culmination moment. This intention was reinforced by placing a public function on top of the building. It was considered how to shape the “hat” of the building.
The top would consist of a library and auditorium, giving back to the city and allowing the public to be a part of not only the ground floor but also the tower.
The shape then took into consideration how to create an auditorium and relate to the tower shape.
The top had two floors and also needed room for the elevator motor.
It was always drawn to be higher towards the north, supporting the expression of the vertical promenade, with the elevator and technical “backbone” of the building being the tallest part.
Orient to the south, framing a view of the sea.An iteration where the shape transferred to the top but still created a sign that made it stand out was chosen.



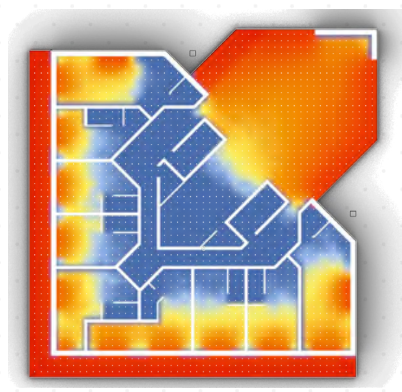
# Daylight in the Building

Throughout the design process, a daylight simulation of different plan solutions with different window sizes was made.
When trying to shape the plan, it was essential to include a demand of how much daylight there should be in the different rooms.
The demands were based on the European regulations of at least 300 lux in half of the room half of the day. The program ClimateStudio was used to calculate the amount of daylight intake in the building at Helsingborg.
Rooms that did not need as much light were placed in the deeper area of the building and the northern facades. While the more used rooms were placed towards the facade in the solar path.
The windows' sizes and shapes were also explored to generate a facade that shows differences in public and private functions/areas. When trying to create the window expression the inside view and aesthetic and the outside expression were explored with a virtual rendition of the room and how it would look from a human perspective.
However as the daylight wants as many window facades as possible, the energy model and the thermal environment in the building don't want as much glazing in specific areas.

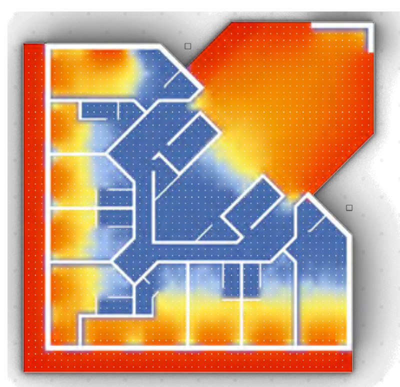


3 x 2,1 m window size, 0,8 m above ground



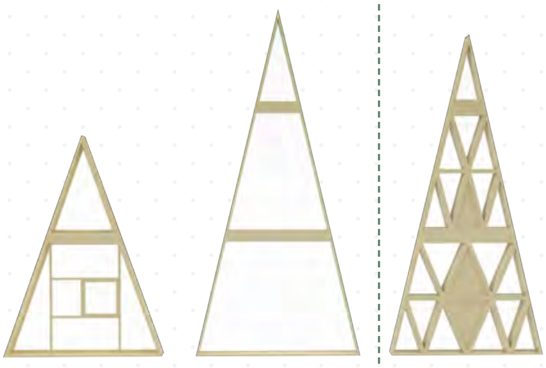
3 x 1,5 m window size, 0,8 m above ground

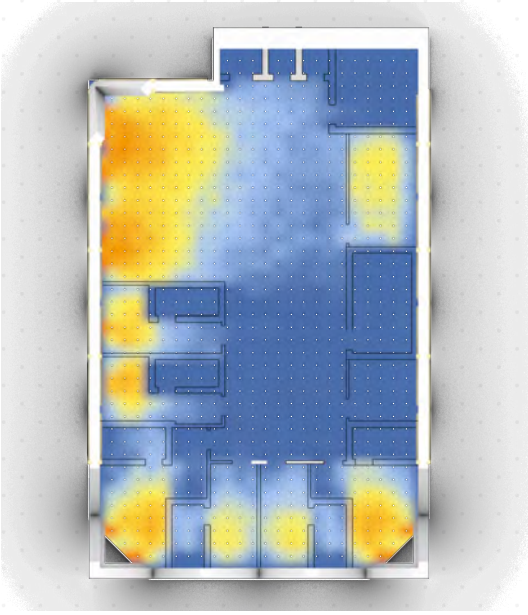


More windows of 3 x 2,1 m, 0,8 m above ground

# 2.6 Daylight Analysis

Window iterations

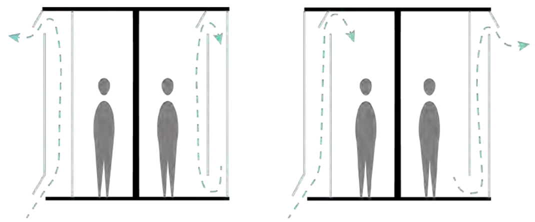




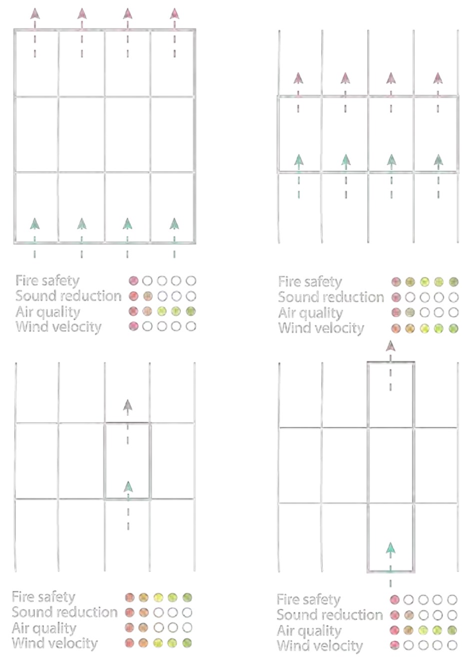
Therefore a system was created, where the big triangular structure is divided into smaller triangles, and it is possible to turn some opaque and some transparent, according to the need for daylight but not overheating. In the common rooms of the student apartments, the number of windows became smaller as there was overheating. But still, at an amount with an acceptable daylight factor.

# Assesing the Comfort in Common Areas

The thermal analysis was conducted for the later design iterations, and focused on the communal rooms in the study levels. The communal area had the biggest amount of glazing, and had glazing in a south-west and north orientation.
The process consisted of working with the software ClimateStudios which is set to comply with the regulations of EN17037. The upper and lower temperature limits were set to be 26 and 18 degrees, meaning that if either were exceeded the heating or cooling demand would show on the graphs.
The glazed facade in the common room gives sufficient amount of daylight in the common room, but produces a cooling need starting from May and ends in September.
As it is not necessary to need a cooling demand in a nordic country, it is wished to keep the demand lowest as possible. Several iterations was applied to get results in ClimateStudios, all with mechanical ventilation and shading devices to comply with minimum requirements for air change (see appendix XX for input data):

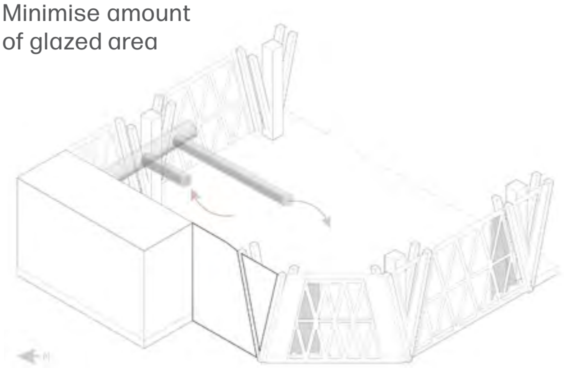


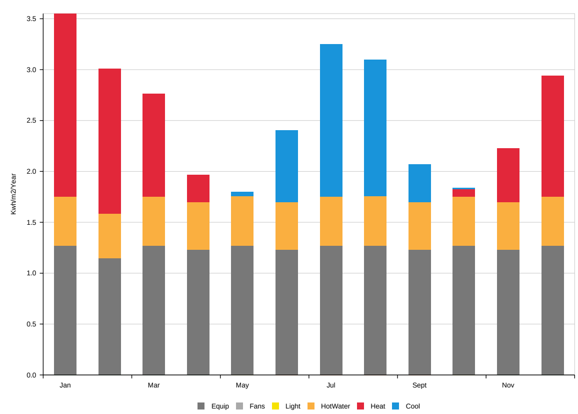
Ventilation modes for DFS




Types of DFS

Minimise amount of glazed area



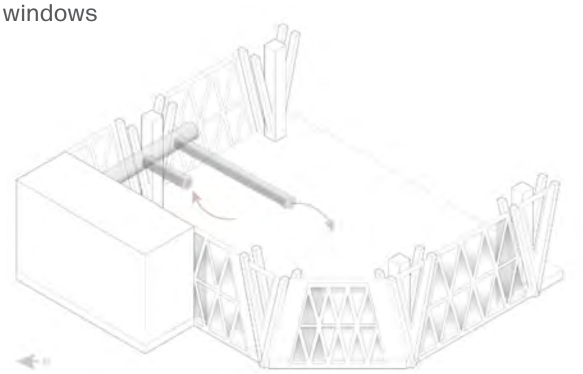


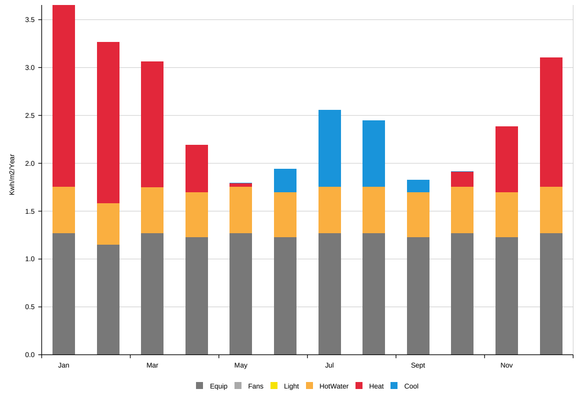

Another option to try out was implementing a double skin facade (DSF). This option was not a calculation option in ClimateStudios and in general difficult to model (Kalyanova, 2008) (Khoshbakht, et al., 2017), as why a theoretical investigation would support the process.

Pros
- Being able to open windows even when being on higher floors, and have natural ventilation enhances user comfort (Alemdağ and Beyhan, 2017)
- Energy demands can decrease significantly in temperate climates when designed properly (Khoshbakht, et al., 2017).

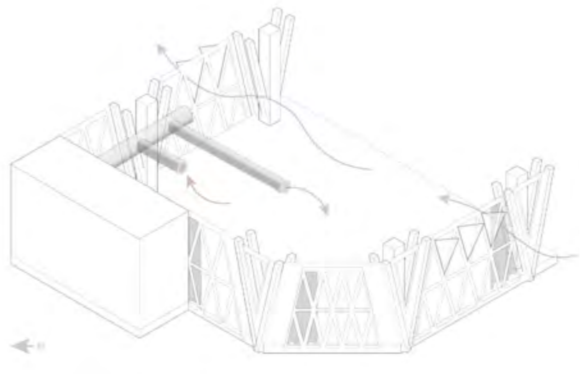
Cons
- Energy demands can increase significantly as the need for cooling arises even at very low solar radiation intensity (Kalyanova, 2008).
- Maintenance requirements are very high (Alemdağ and Beyhan, 2017).
- The transparency of DFS is compromised as it is needed to have a proper shading device (Kalyanova, 2008).
- Some types of DSF can increase the risk of fire spreading (Alemdağ and Beyhan, 2017).
- Very high air flow speed in ventilated space, creating noise nuisance (Alemdağ and Beyhan, 2017).

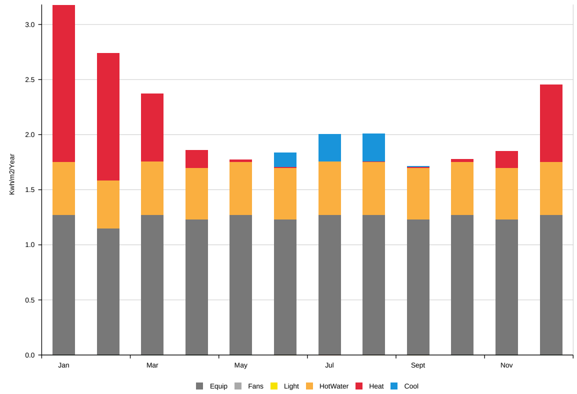
Lower G-value for windows



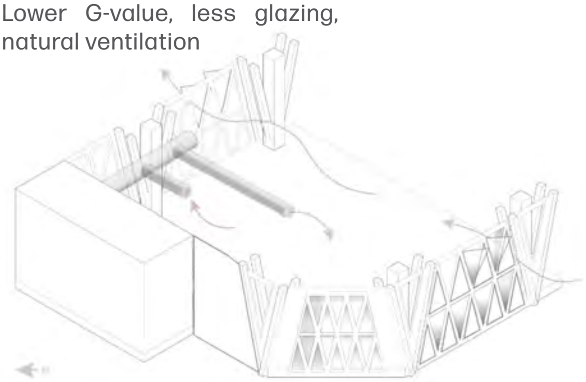


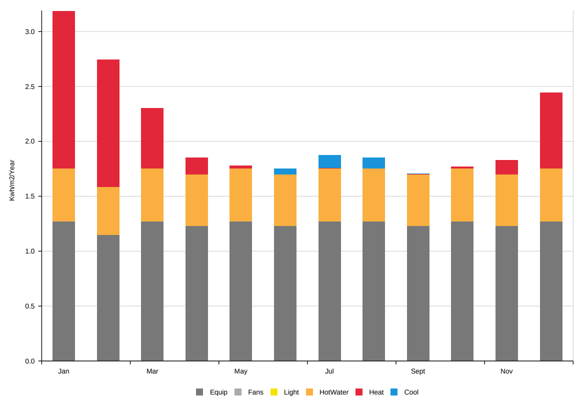

Natural ventilation






Lower G-value, less glazing, natural ventilation






**Passive strategies**
- Natural ventilation
- Minimise the size of windows
- Low g-value for windows
- Low U-value for walls
- DSF

**Active strategies**
- Automatic shading
- Mechanical ventilation
- DSF

**Implement a hybrid solution strategy for a reduction of cooling demand.**

**The uncertainty of data for implementing DSF is too high, with minimal options to test the effect.**

# Materiality

The materiality should reflect the history of the area while also introducing new bio-based materials for the structures. For an assessment of materials, different iterations were shown in a virtual rendition. These were based on the different materiality around Gåsebäck, found in the typology analysis.
First, there were the materials used for the structure of the tower. As the competition brief was to design a timber skyscraper, a research of current developed wood-based products was investigated. Each product has different characteristics, purpose and behaviour, which allows for consideration of different applications. E.g., GLT (glue-laminated timber) is mostly indicated for structural elements, for its strength and flexibility in one direction, while CLT (cross-laminated timber) is mostly used for walls, flooring and roofing, for its composition of 90 degree overlapping layers that gives it strength in both directions (Markström et al., 2019; Hyne Timber, 2019).
The coating of the wood was also to be settled:
The red colour had functional properties, such as withstanding the weather. It also has a strong visual expression highlighting the construction, and being a red focal point throughout the city.
The impregnation with the neutral colour has a more subtle approach of setting a focal point in the city. The neutral impregnation will over time also have a change in colour, giving it a grey look.

**The neutral colour impregnation was chosen as it related more to the context by having the textuality of wood showing naturally, as a contribution to the wood industry in Sweden.**

## 2.8 Materiality

The ground is the mound of the building and needs to have more massive materiality. The different iterations were therefore based more on stone-like materials. These materials need to relate to the area, but also the building standing on top of it.
Asphalt was a major part of the industrial area, creating a dark ground. But the asphalt expression created a car-favoured expression, where the new plans want to incorporate soft traffic.
Cobblestone pavement was an expression of a marketplace/plaza, there is however a lot happening because of the sizing of this material. It is also a less accessible ground material as it makes it more difficult to operate a wheelchair in that environment.


Asphalt

**Bricks are a big part of the Gåsebäck buildings, and as some of them are going to be torn down in the plan, reusing the bricks for the pavement would create a relation to the area and a more sustainable material choice. Helsingborg has also been known for its production of bricks.**


Brick


Cobblestone

# 3.0

## Presentation

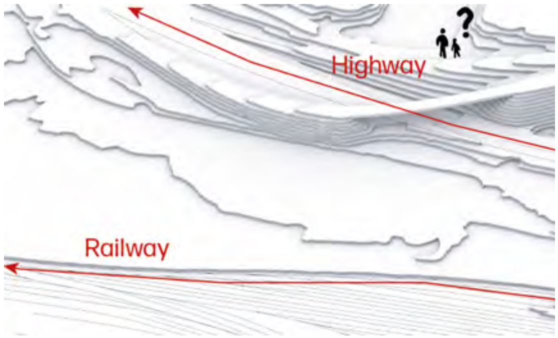
# GÅSEBÄCK MARKET TOWER

# Table of Content

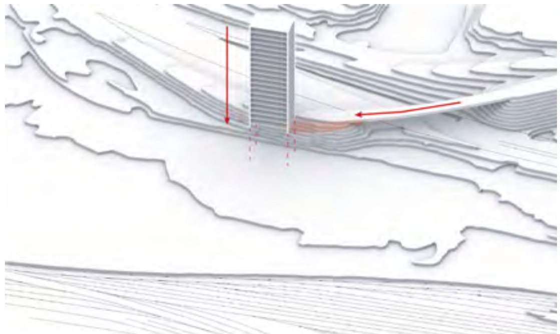



Helsingborg International

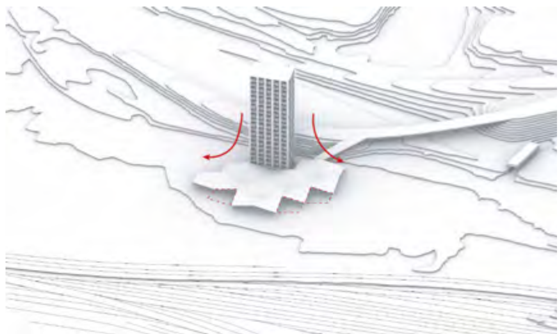
# Concept Diagram



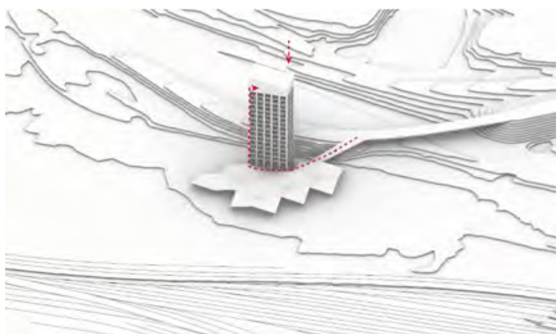

The two districts are separated physically by the highway, making it difficult for pedestrians and bicyclists to cross.



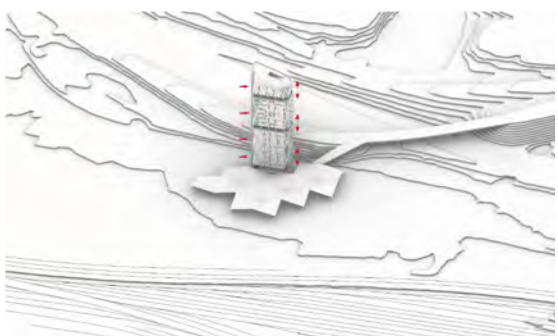
Gåsebäck Market Tower creates a connection to the other side of the highway, and a node for the area.



The structure spreads out becoming a market space for the node, to encourage creativity and community

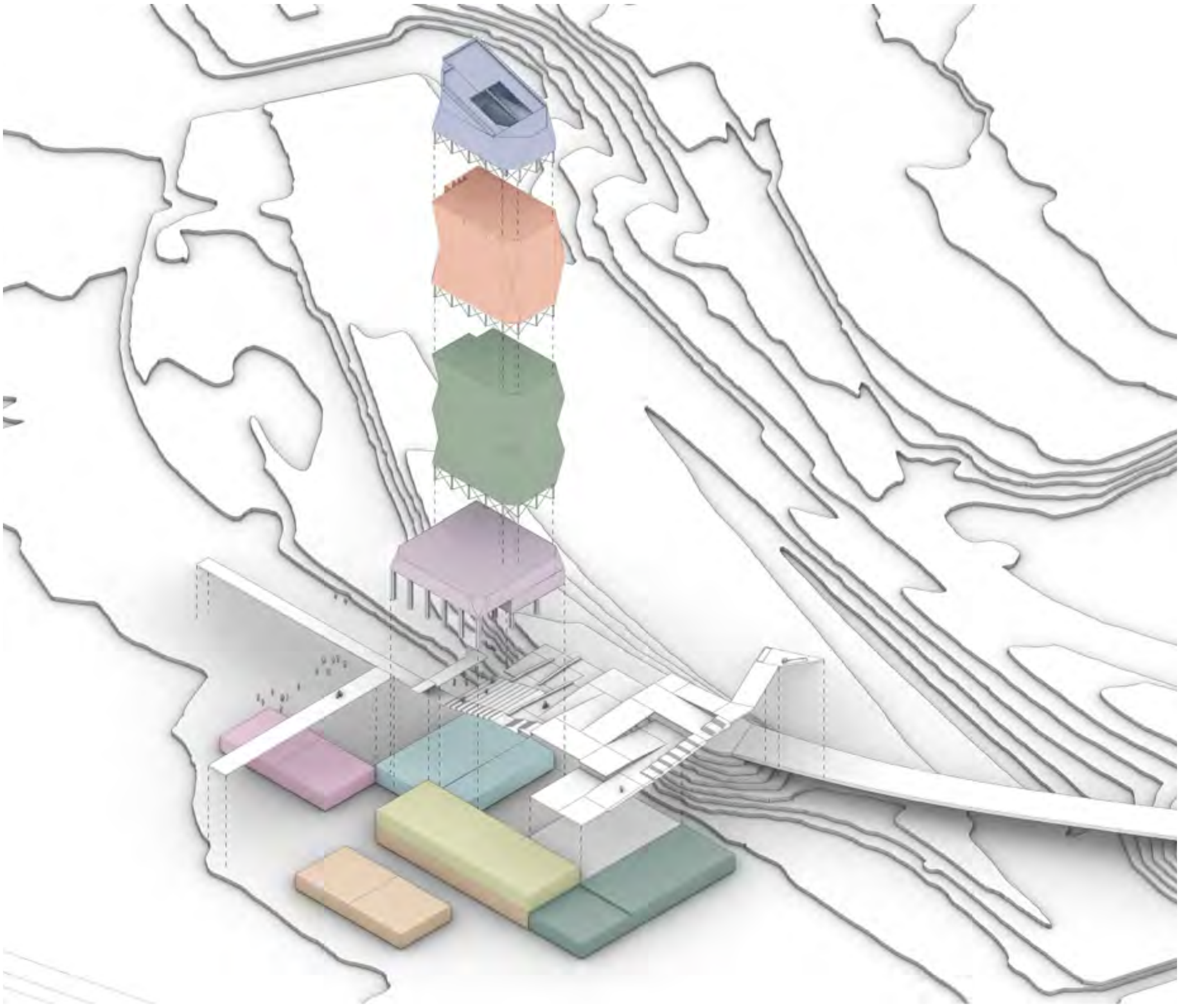


A vertical promenade is created to encourage the public to use the tower, therefore making them feel a sense of belonging.



Corners of the tower are pushed in and gaps are created to help reduce the wind velocity created by the tower.

# Function Diagram

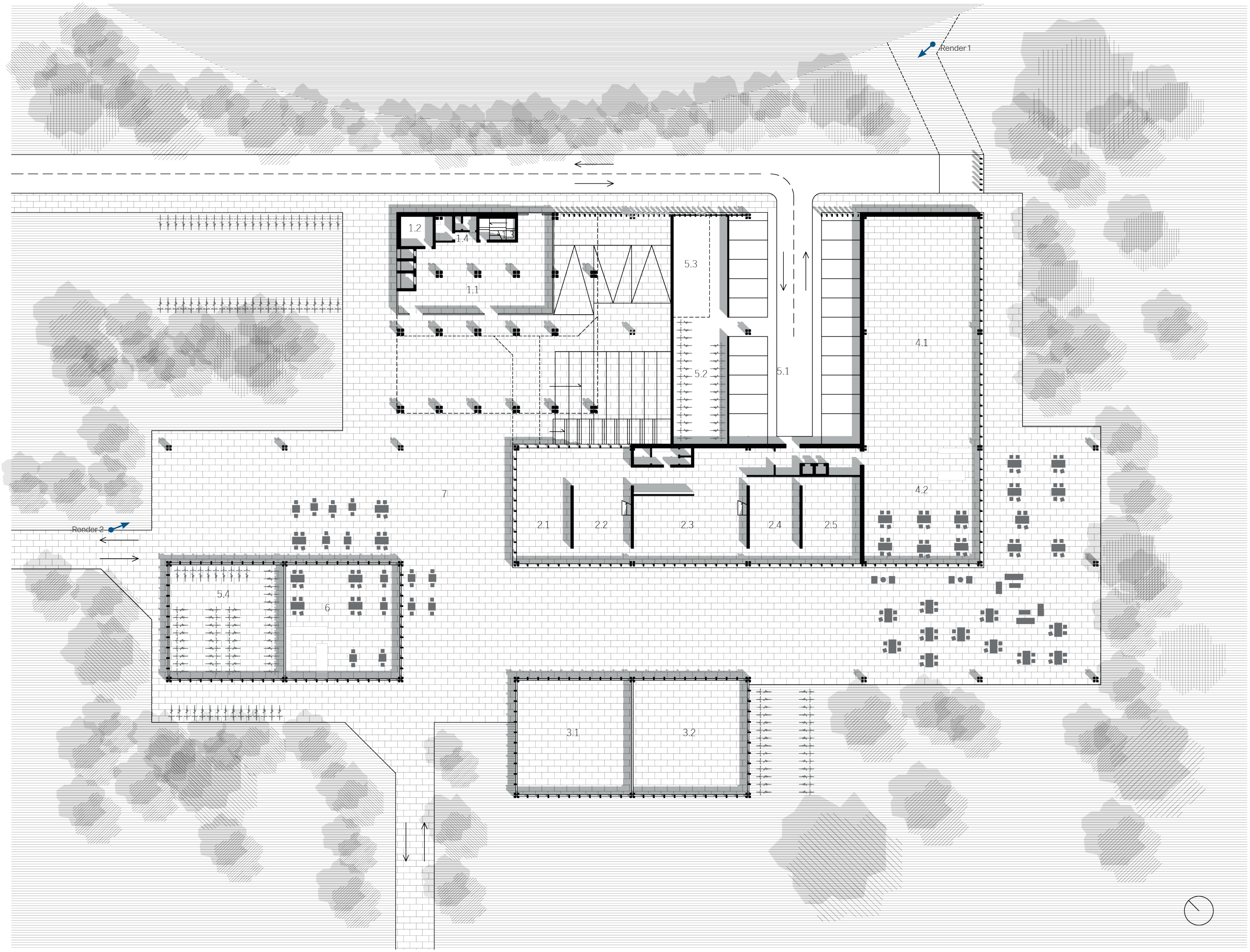


- Auditorium/Library
- Student apartments
- Emptynesters apartments
- Fitness centre
- Café
- Workshop areas
- Co-working spaces
- Restaurant and supermarket
- Winter market

The Gåsebäck Market Tower aims to connect Närlunda, on the other side of the E4 highway, and is one of the reasons why it is placed in the southern corner of Gåsebäck.

The placement of the building acts as a portal of the city, welcoming drivers from the highway, people on the train and now also pedestrians and bicyclists on the bridge. It connects with the Gåsebäck river and the green promenade acting as the end or start point for the promenade.


Scale:
1:5000



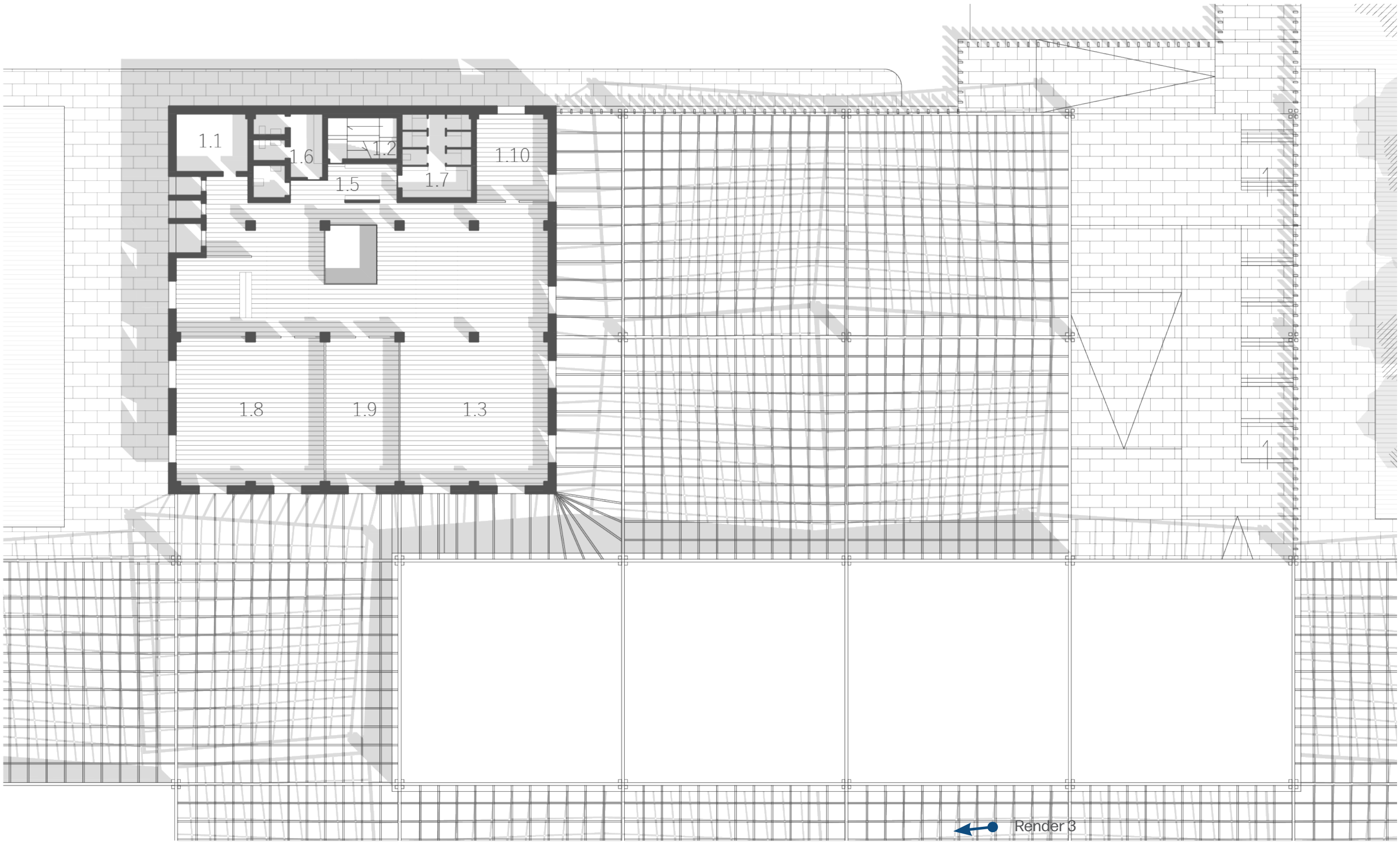

Plan Ground floor . Scale 1.500

1.1 Lobby & winter market; 1.2 Technical room; 1.3 Emergency route staircase; 1.4 Toilets; 2.1 Photography workshop; 2.2 Sewing workshop; 2.3 3d printing & laser cut workshop; 2.4 Leather workshop; 2.5 Painting workshop; 2.6 Storage & washing; 2.7 Storage & access coworking; 2.8 Toilets; 2.9 Toilets; 2.10 Access to parking; 3.1 Wood and metal workshop; 3.2 Ceramics & hobby store; 4.1 Supermarket & local products; 4.2 Restaurant; 5.1 Car parking; 5.2 Bicycle parking; 5.3 Storage; 5.4 Residents bicycle parking; 6 Café; 7 Market

Render 1: View towards west standing on the existing bridge at the busstop

The ground floor is divided into several areas creating different types of market spaces. The "entrance/lobby" underneath the tower, is a space for exhibitions where people can express their different art skills or sell products. West of it is a workshop area for people with different hobbies to gather and create while meeting people with the same or similar interests The stuff created in the workshops can then be sold in the lobby area. To the south, a restaurant and indoor market is placed for people to buy local products and eat.

Render 2: View towards south

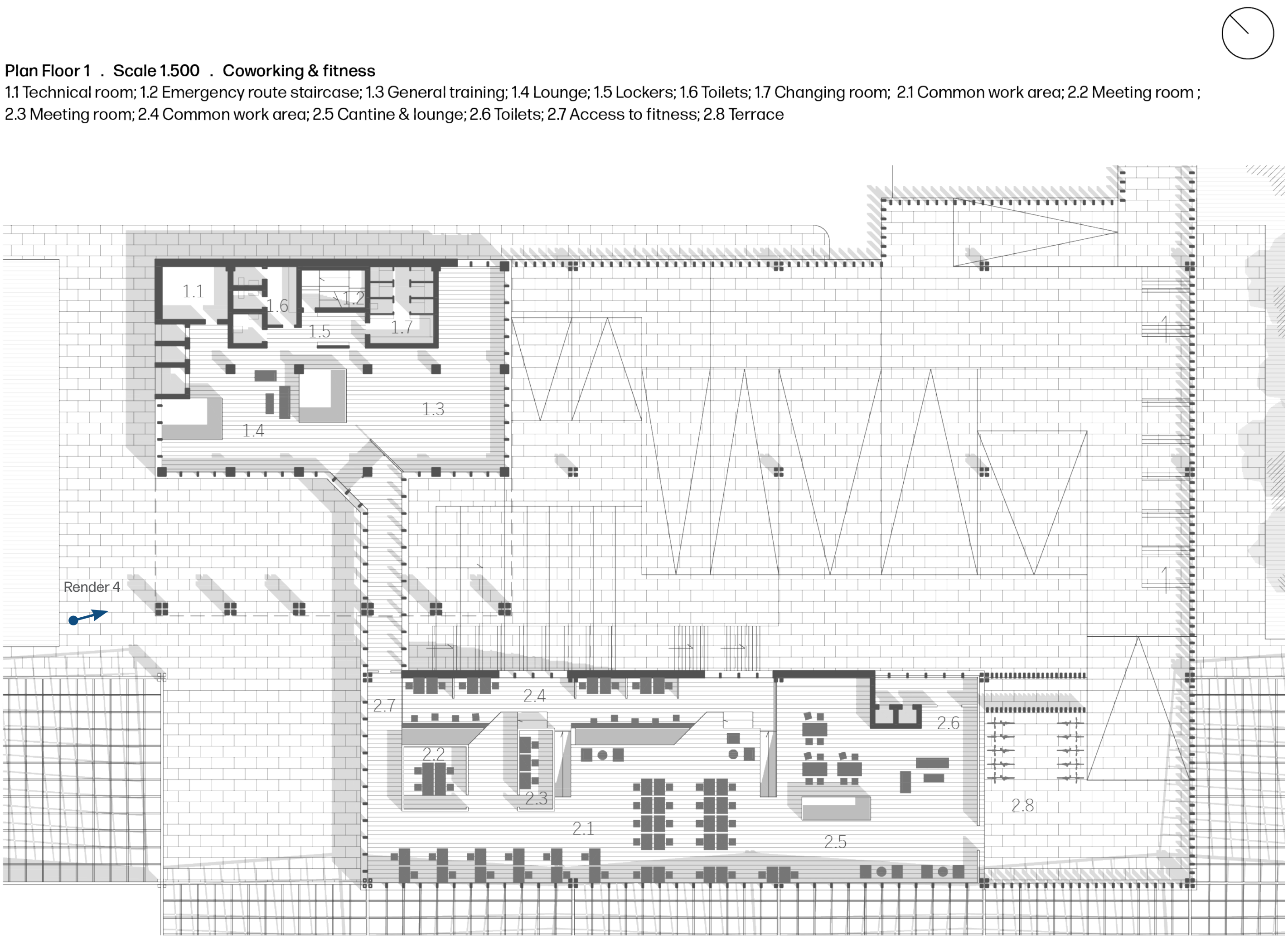



**Plan Floor 2 . Scale 1.500 . Fitness**

1.1 Technical room; 1.2 Emergency route staircase; 1.3 General training & machines; 1.4 Reception; 1.5 Lockers; 1.6 Toilets; 1.7 Changing room; 1.8 Group training; 1.9 Group training; 1.10 Office & storage

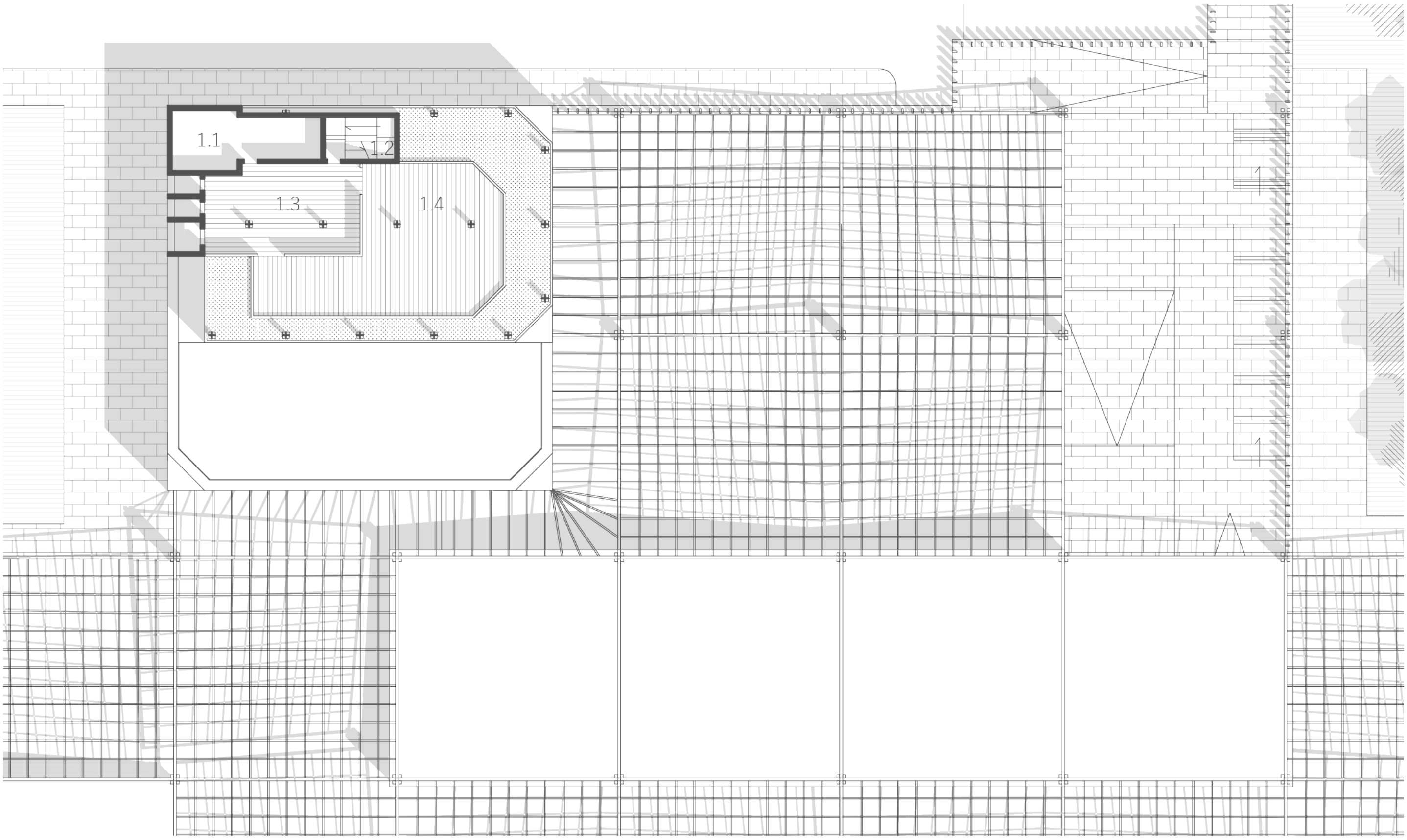
**Plan Floor 1 . Scale 1.500 . Coworking & fitness**

1.1 Technical room; 1.2 Emergency route staircase; 1.3 General training; 1.4 Lounge; 1.5 Lockers; 1.6 Toilets; 1.7 Changing room; 2.1 Common work area; 2.2 Meeting room ; 2.3 Meeting room; 2.4 Common work area; 2.5 Cantine & lounge; 2.6 Toilets; 2.7 Access to fitness; 2.8 Terrace



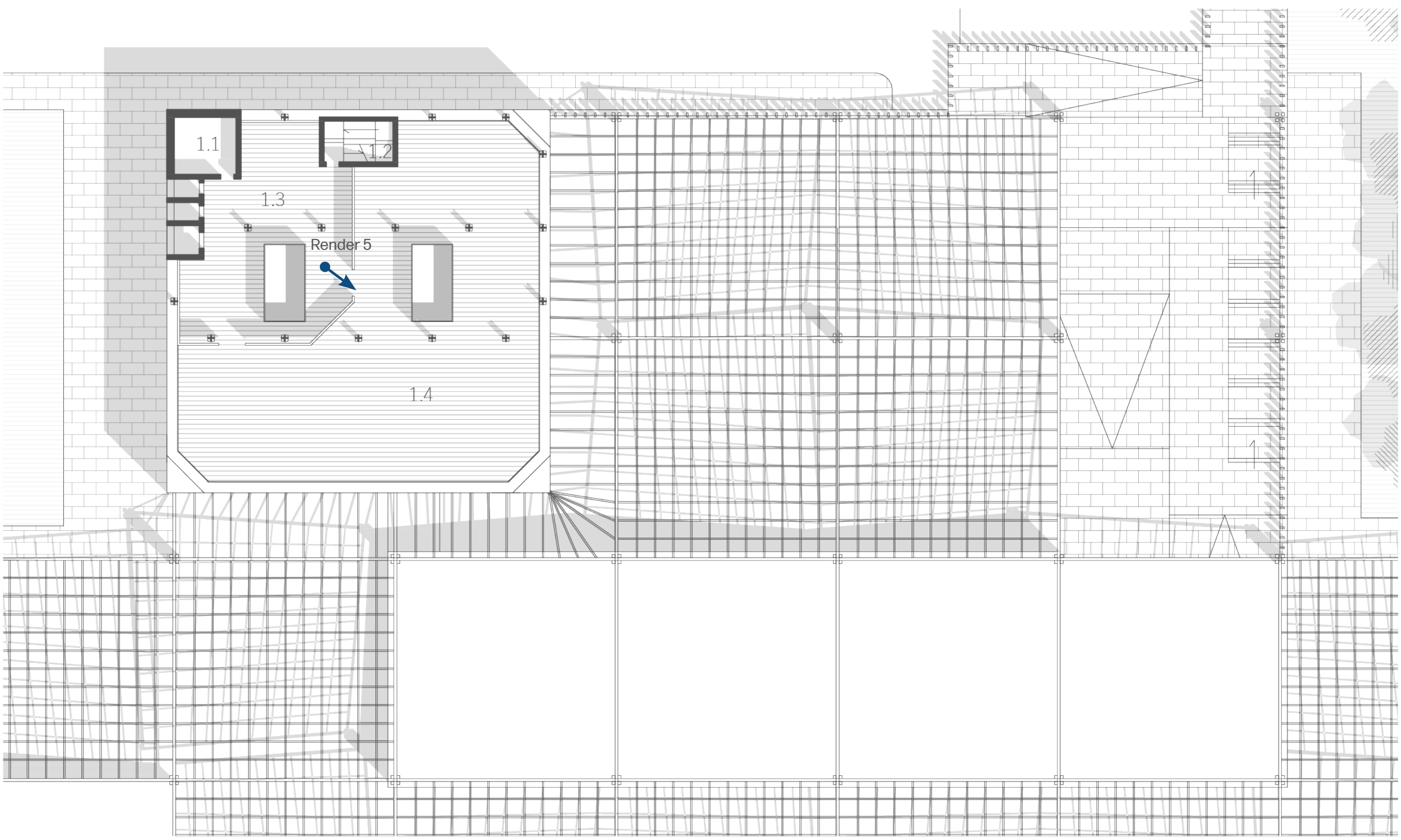
Render 3: Outdoor workshop market place

Render 4: Grand staircase meeting the wintermarket




Plan Floor 12 . Scale 1.500 . **Shared terrace & technical facilities**
1.1 Technical room; 1.2 Emergency route staircase; 1.3 Indoor social area; 1.4 Outdoor social area

**Plan Floor 3 . Scale 1.500 . Fitness terrace**
1.1 Technical room; 1.2 Emergency route staircase; 1.3 Indoor training; 1.4 Outdoor training



Render 5: Gap between emptynesters and students


**Plan Floor 11 . Scale 1.200 . Emptynesters & family apartments**
1 Shared living & play room; 2 Technical room; 3 Staircase emergency exit; 4 Common hallway; 5 Storage; 6 Emptynesters apartment; 6.1 Living room & kitchen; 6.2 Bathroom; 6.3 Bedroom; 7 Emptynesters / family apartment; 7.1 Living room & kitchen; 7.2 Bathroom; 7.3 Bedroom; 7.4 Extra sleeping area; 10 Emptynesters apartment; 10.1 Living room & kitchen 10.2 Bathroom; 10.3 Bedroom; 10.4 Bedroom

**Plan Floor 5 . Scale 1.200 . Emptynesters apartments**
1 Shared lounge / café & bar; 2 Winter terrace; 3 Technical room; 4 Storage; 5 Staircase emergency exit; 6 Common hallway; 7 Storage; 8 Emptynesters apartment; 8.1 Living room & kitchen; 8.2 Bathroom; 8.3 Bedroom; 9 Emptynesters apartment; 9.1 Living room & kitchen; 9.2 Bathroom; 9.3 Bedroom 10 Emptynesters apartment; 10.1 Living room & kitchen; 10.2 Bathroom; 10.3 Bedroom; 10.4 Office / sleeping area

Render 6: Emptynester apartment with view towards Närlunda


**Plan Floor 14 . Scale 1.200 . Students apartment . Single & Couple**
1 Shared kitchen; 2 Living / TV room; 3 Technical room; 4 Study room; 5 Staircase emergency exit; 6 Storage; 7 Students apartment; 7.1 Room; 7.2 Bathroom; 8 Students apartment; 8.1 Room; 8.2 Bathroom; 9Couple students apt 9.1 Room ; 9.2 Bathroom; 10 Students apartment; 10.1 Room; 10.2 Bathroom; 11 Students apartment; 11.1 Room; 11.2 Bathroom; 12 Couple students apt; 12.1 Room; 12.2 Bathroom

**Plan Floor 13 . Scale 1.200 . Students apartment . Single & Shared**
1 Shared kitchen; 2 Living / TV room; 3 Technical room; 4 Study room; 5 Staircase emergency exit; 6 Storage; 7 Students apartment; 7.1 Room; 7.2 Bathroom; 8 Students apartment; 8.1 Room; 8.2 Bathroom; 9Shared students apt; 9.1Hallway; 9.2 Bathroom; 9.3 Bedroom; 9.4 Bedroom; 9.5 Living area/extra bedroom; 10 Shared students apt; 10.1 Hallway; 10.2 Bathroom; 10.3 Bedroom; 10.4 Bedroom; 10.5 Living area/extra bedroom

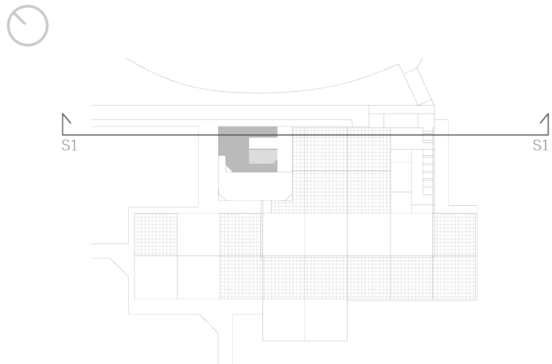
Render 7: Student apartment

Render 8: Common room

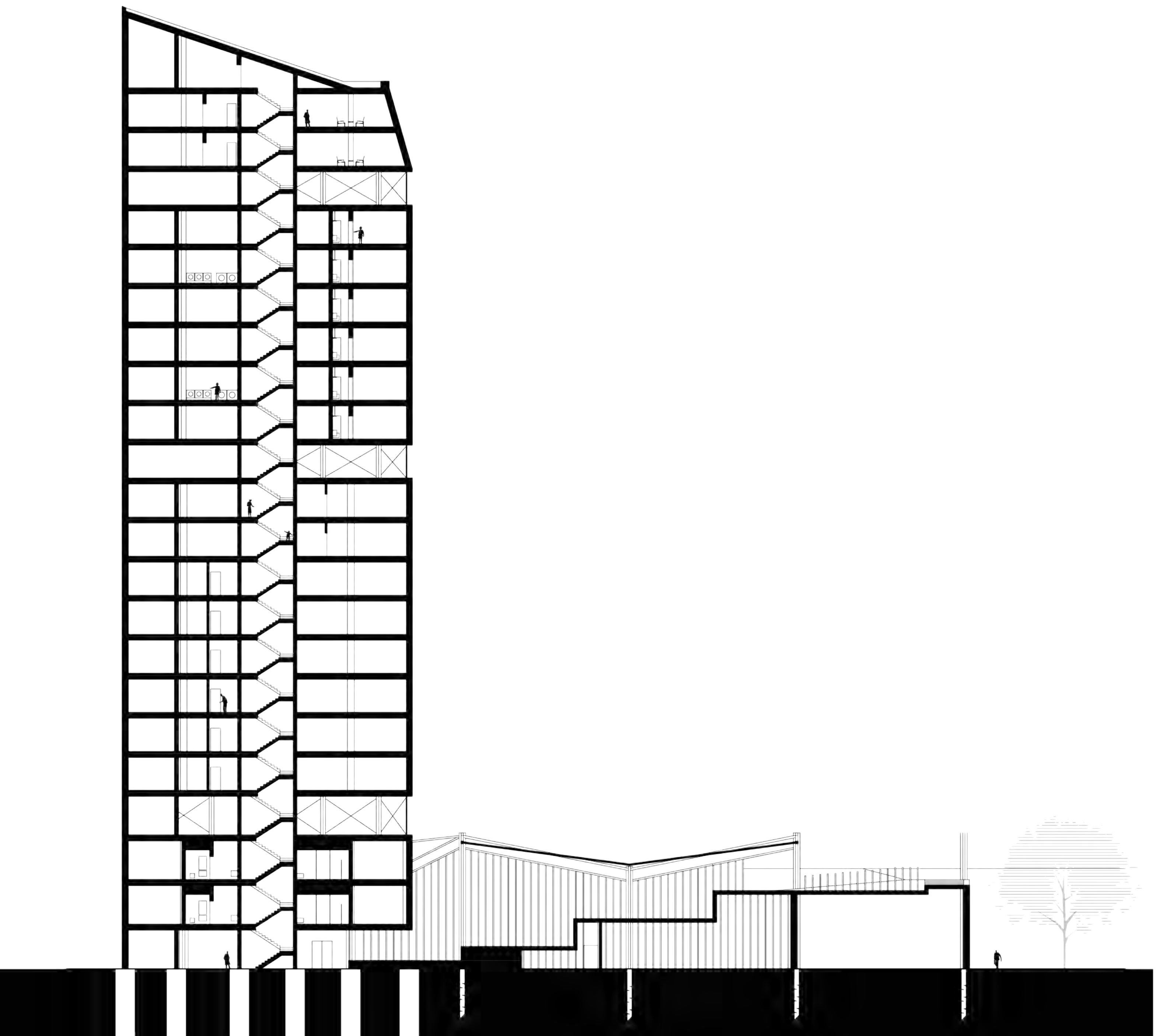

**Plan Floor 14 . Scale 1.200 . Students apartment . Single & Couple**
1 Reception area; 2 Storage; 3 Technical room; 4 Staircase emergency exit; 5 Terrace

**Plan Floor 21 . Scale 1.200 . Library & auditorium**
1 Library; 2 Toilets; 3 Technical room; 4 Staircase emergency exit; 5 Auditorim access

Render 9: Library with w view towrads the auditorium




Section 1, 1:500



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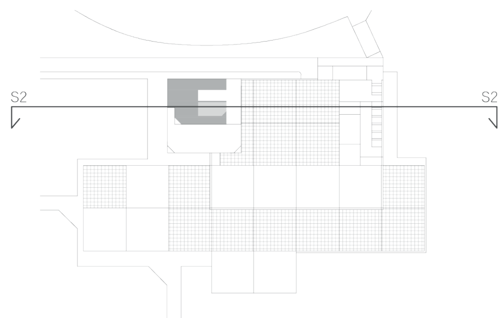
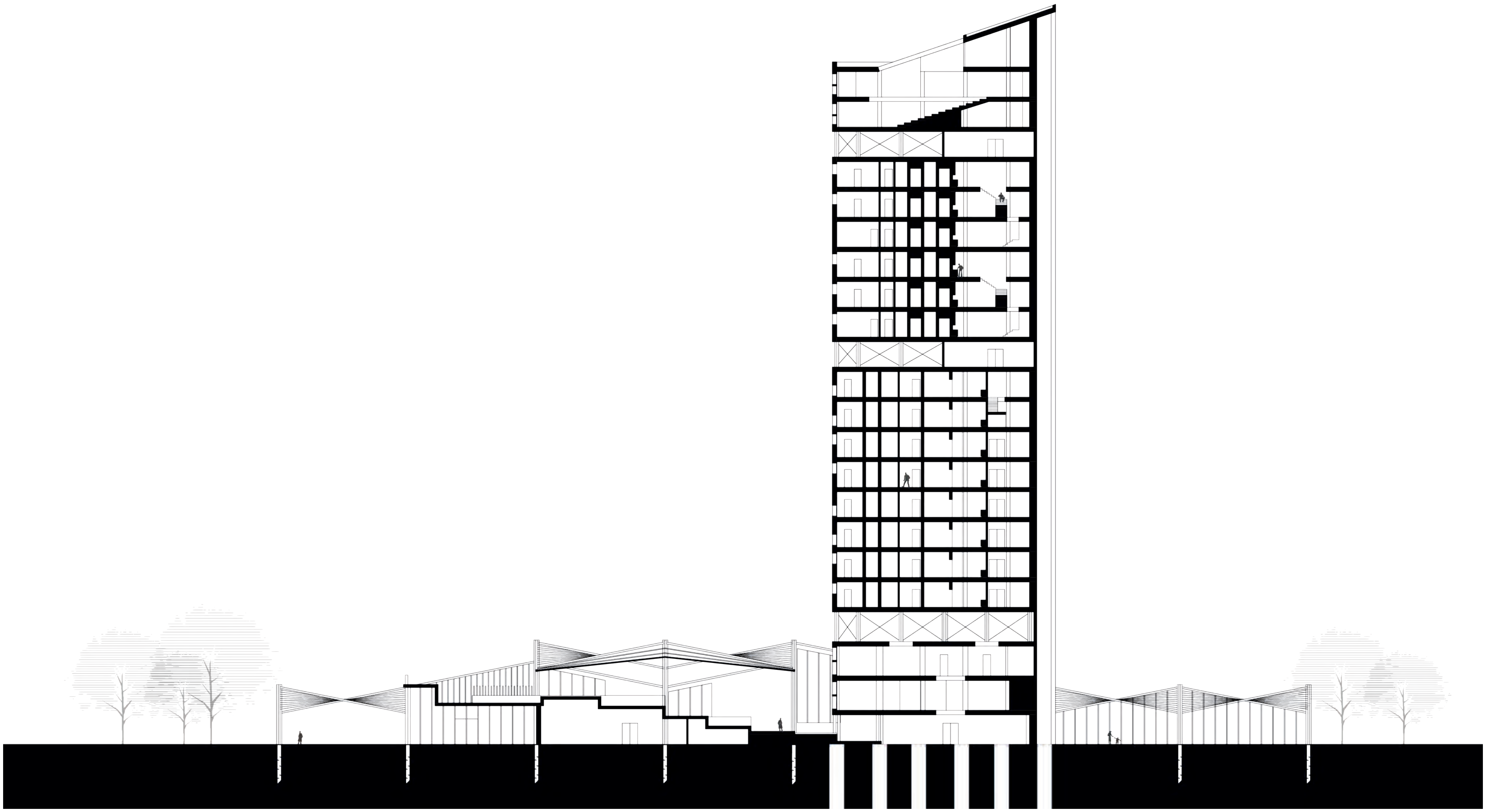
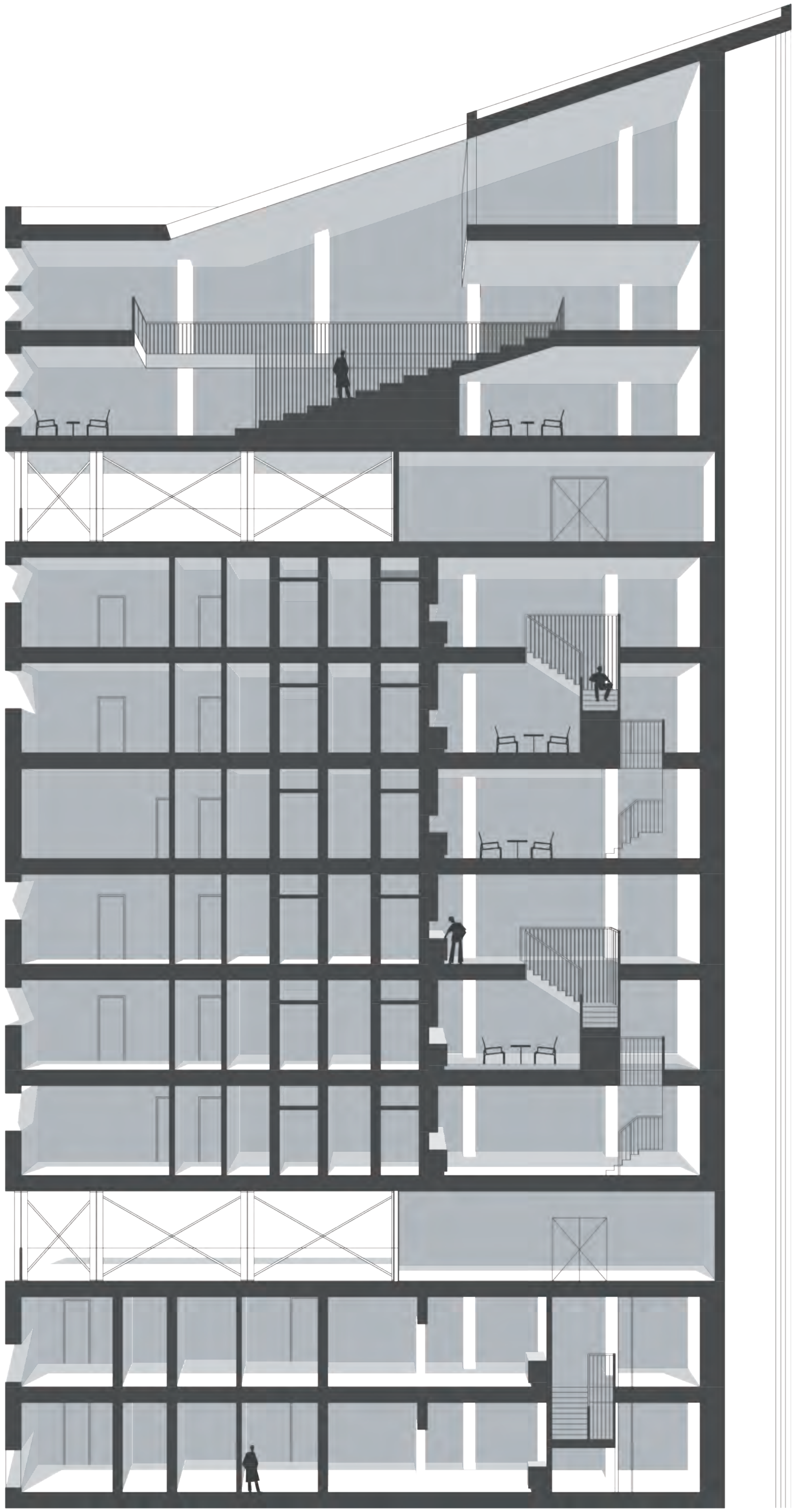
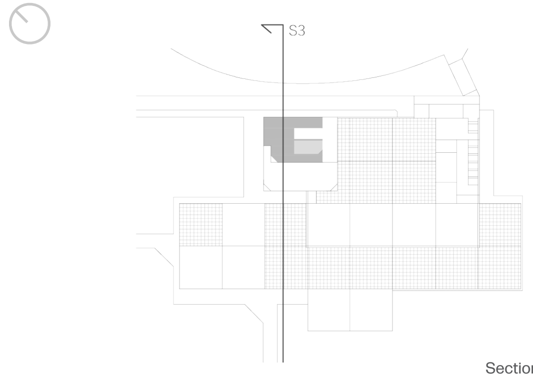


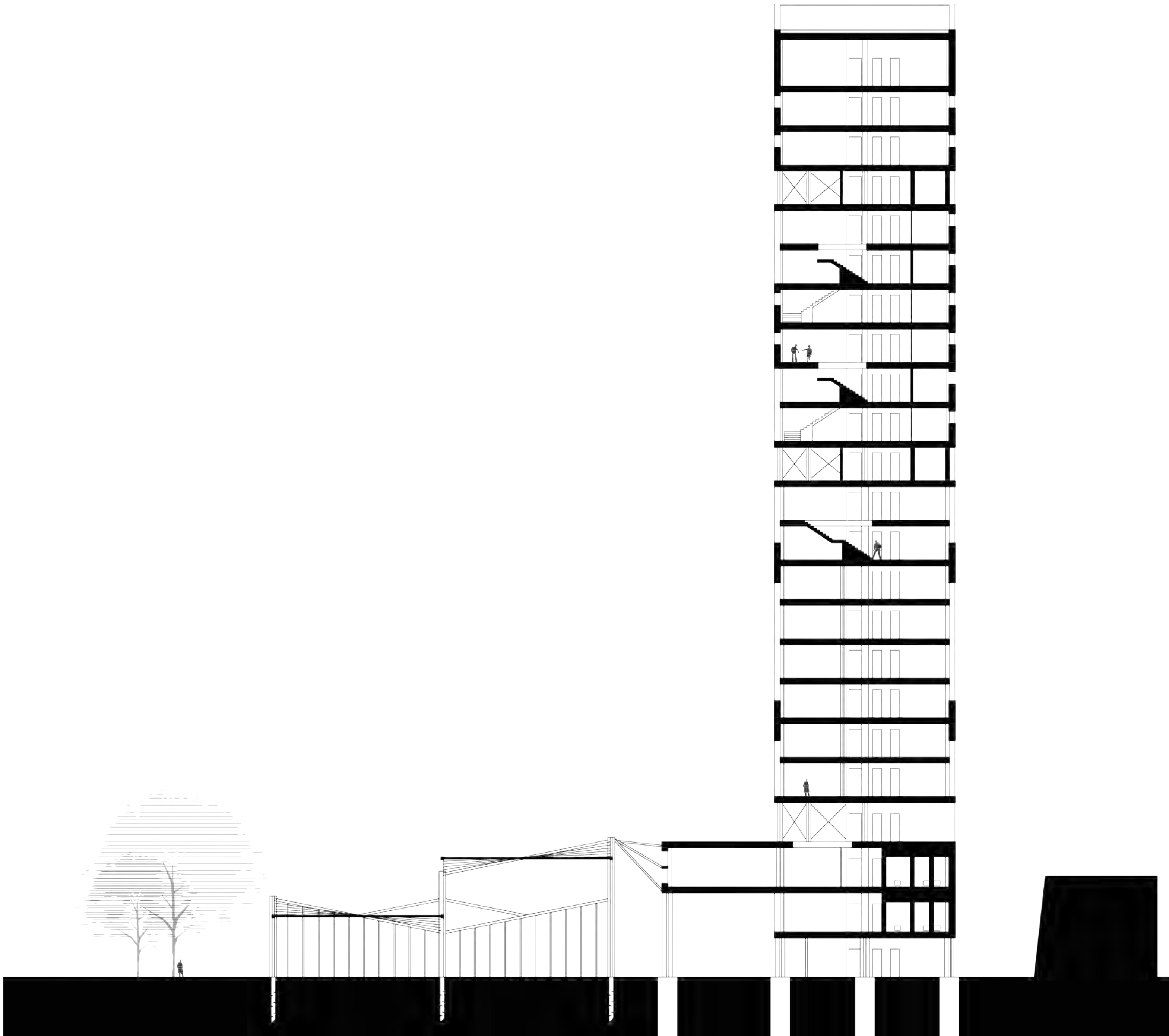
**"a proper building grows naturally logically and poetically out of all its conditions"**

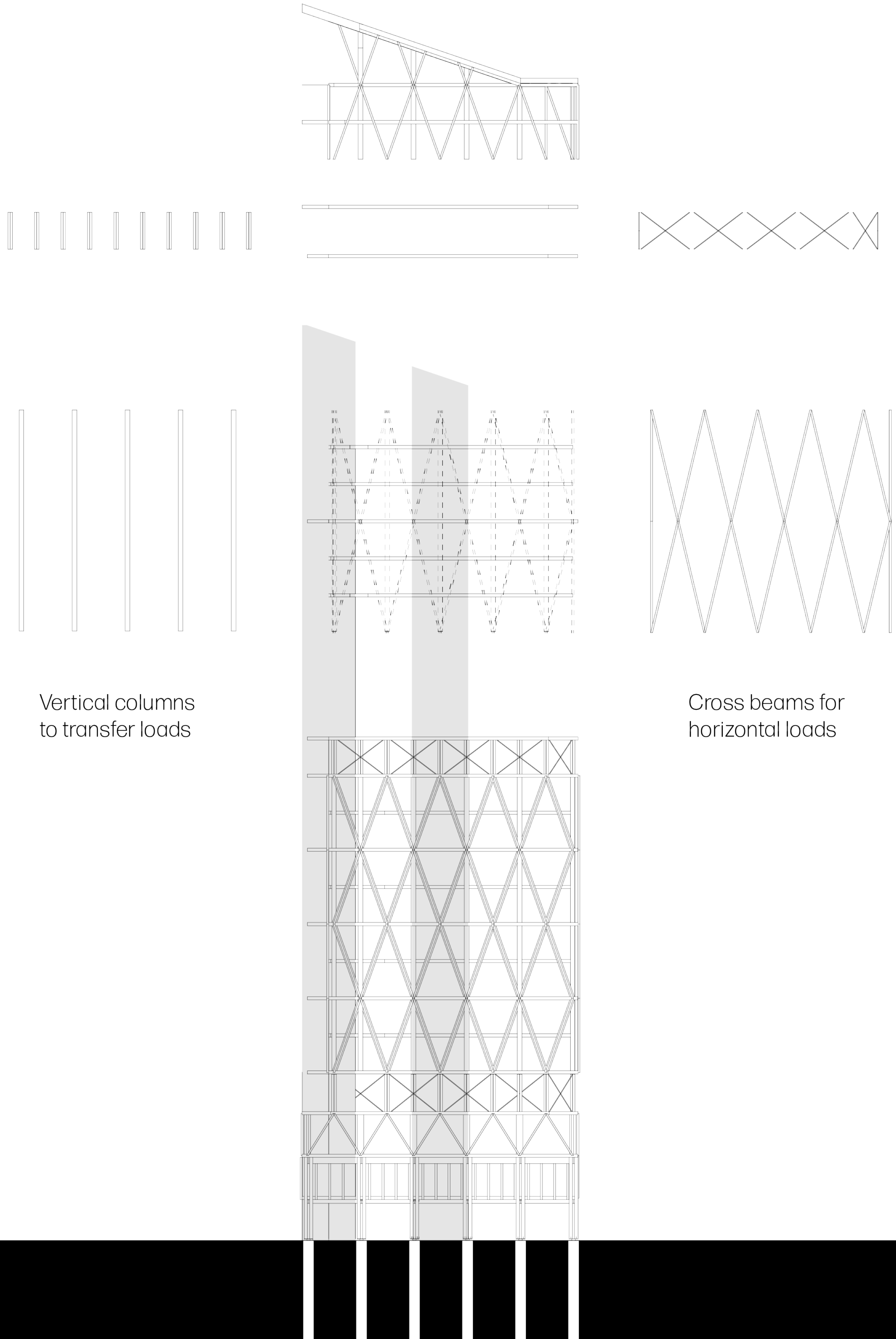
**-** Louis Sullivan, 1856-1924



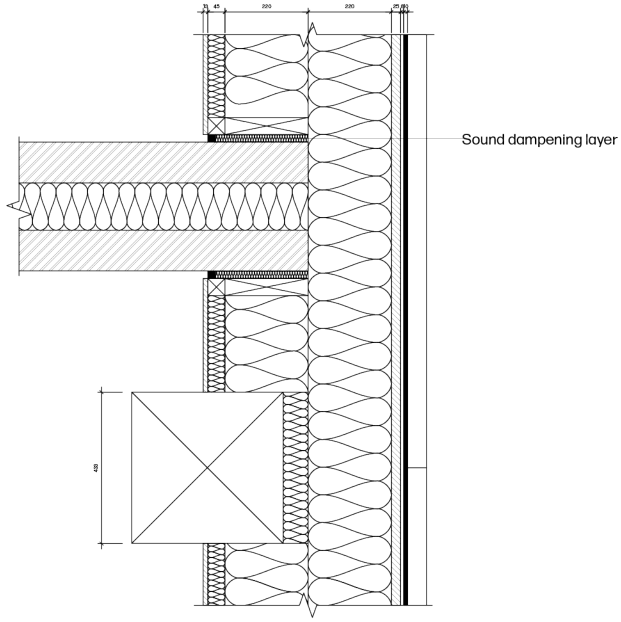



Section 3, 1:500




Vertical columns
to transfer loads
Cross beams for
horizontal loads

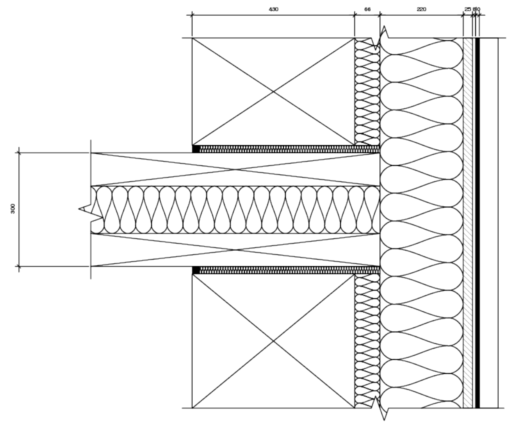
Detail: Horisontal section of exterior- and interior wall




1:20

Exterior wall:
13 mm plywood
485 mm woodfiber insulation
25 mm plywood
(windbreak)
8 mm air gap
10 mm weaved timber facade
50 mm timber moullion

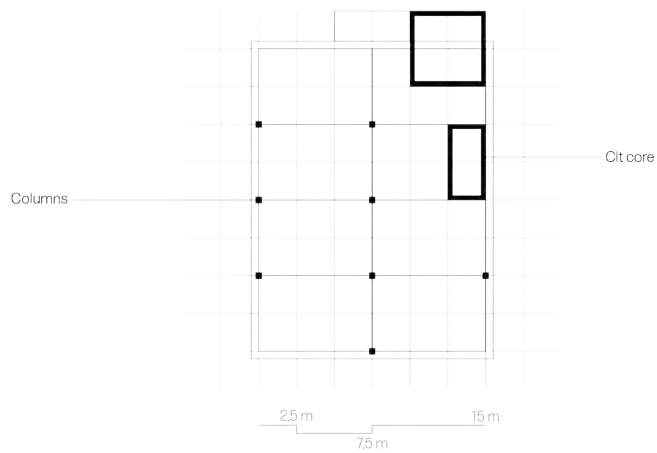
Detail: Vertical section of floor seperation

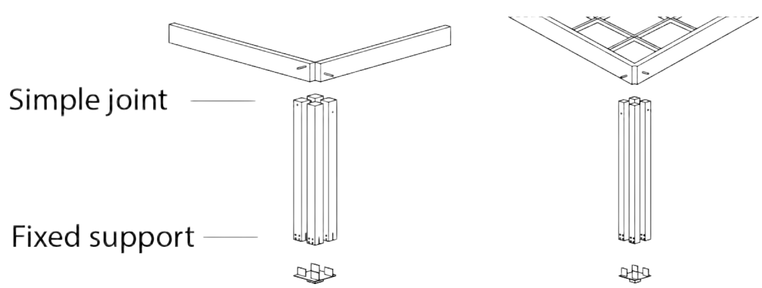


1:20

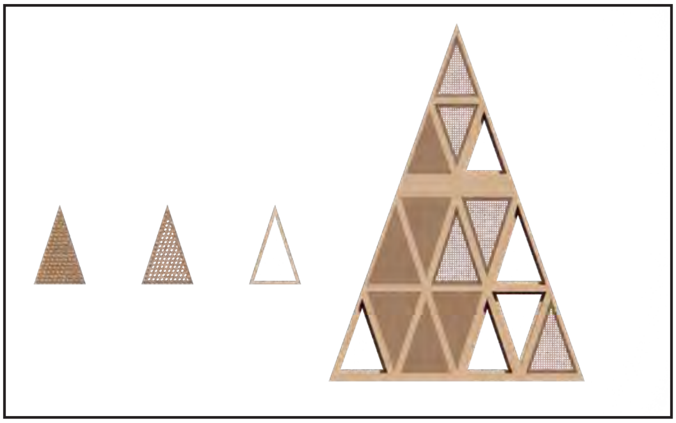
Clt floor:
100 mm CLT
100 mm Insulation and beams
100 mm CLT

The structural system is based on a grid structure, creating spaces for different functions throughout the building. It is a column-slab structure carrying the building while having big cross beams to take the horizontal forces. The cross beams are a big part of the tower expression, while creating a wind velocity-reducing strategy, also takes wind forces, and creates an iconic shape.
The columns in The Gap are outside, therefore metal is used to withstand the environmental conditions and the possibility of having a more slim column, expressing an “airspace”. This also creates another expression from the rest, showing a shift in the tower and exposing the technical core.
The forces are transferred into the ground through pillar foundation, because of the soil type in the area, which shows a continuation of the columns into the ground.



North-East elevation 1:500



South-West elevation 1:500

# Conclusion

The design process developed over the last four months culminated in the proposal for Gåsebäck Market Tower. This project began with the brief for the competition Timber Skyscraper, issued by Buildner, which proposed to challenge the concept of a wooden skyscraper while exploring the impact it could have on its surrounding environment.
On this premise, ongoing investigations and studies were conducted, creating a focused perspective on the chosen intervention site - the Gåsebäck neighbourhood in Helsingborg.
The resulting skyscraper represents the integration of the concepts of landmark and node in one unit.

The tower itself answers to the rapid demographic growth of the city, offering new residential options for the existing and future citizens, with solutions for flexible and adaptable use. In the case of the student apartments, the private resting space was reduced to a minimal solution, while shared areas are reinforced in size and use potential. The emptynester and family apartments present a solution that contains all the domestic functions while allowing for alterations of use.
Special attention was given to creating a variety of connection moments between the different levels of the skyscraper. Staircases and atriums connect the different levels, not only physically, but also through lines of sight. The shared areas were integrated with the circulation, elevating the possibilities for recurrent interaction between neighbours.
The market hall, placed around the southern and western sides of the tower, creates a protective shelter for the urban scale interactions. The market invites the local community to make use of the space, complementing the emerging creative dynamics of Gåsebäck with workspaces that can also be used for exhibitions and commercial purposes.
The metric of the hyperbolic paraboloid roof creates a space composition that functions as a mediator between functions and eliminates formal circulation areas, i.e., in the common areas of the apartments. This node is the arrival gate from the eastern side of Helsingborg, which has the opportunity to connect to the city centre through the decommissioned highway bridge, now at the service of pedestrians, cyclists and public transport.
The connection between the tower and the market happens through functional uses. The very base of the tower is the centre of the nodal area, which communicates with all other functions, assuring that residents, public daily users or the occasional passer-by share the same areas, even when making use of the building in different ways. Also important to mention is that each use has different access possibilities. For example, to reach the coworking space it is possible to enter through the workshops, through the ground floor parking or use the main core of the tower and travel through the fitness. This redundancy of access enables not only more navigation options but also the possibility of the attractiveness of the different functions - the users get to know the building, explore it and may take advantage of all areas.

Finally, to reinforce the public use of the building, the tower culminates in a library and auditorium on the top floors. This gesture transforms the building into a vertical promenade that is accessible to everyone.
In sum, landmark and node support, generate and contribute to each other's identity, through function, use, purpose and impact in the ongoing development of the city.
The Market Tower is a statement of the possibilities of regeneration of an industrial district, a market of ideas, knowledge and interactions. This is a building that wishes to be at the service of the community, to be nothing more than a clean canvas.

# Reflection

This master thesis allowed a deep dive into questions raised throughout previous academic projects. By visiting the intervention site and meeting with representatives of the municipality, it was possible to understand the complexity of implementing an urban masterplan and the role each building can have in the process.

**For a long term economic sustainable solution**
Going from a visionary plan, like the H+ by Adept, to the practical implementation is a complex process that takes long running communication between various actors, and stakeholders; such as municipality, developers, designer teams, clients and final users.
After gaining insight into this process, it was possible to create a predicted scenario of development for the city, grounded in social and economic availability. This allowed to base this project in a realistic context to the current and future needs of the Gåsebäck neighbourhood in Helsingborg.
Further, we came to understand that no detail plans were being developed in this neighbourhood currently. The reason being that the land is divided between several private owners - reflecting on long negotiation processes. In contrast, in the harbour area, originally belonging in large percentage to the municipality, new construction is already being implemented.
Therefore, it would be an interesting investigation to develop a more in-depth analysis of the existing industries, their proprietary status and the role they have in the community. This could help define a strategy for medium and long term development of the area. And while developing a building that intends to be supportive of community activities, this information could reflect on the design of the building, justifying current intended use and possibilities for adaptation and appropriations of the building in the long term.

**Materiality options considering resources circularity**
From the Site Analysis and the Materiality chapters, it is also relevant to remember that there is a large amount of abandoned industrial buildings in Gåsebäck, some of which are planned to be demolished. Some of these buildings are composed mainly of red brick, characteristic of the area. To generate a connection with the local history and tomographic character, this project intends to integrate the red brick, recovered from the demolished buildings, in the paved area of the market and ground floor areas of the building, which is more than seven thousand square metres. However, this solution was implemented in the project with no further investigation on how it could be achieved in practice. An interesting investigation could have been to develop a strategic plan for the collection, treatment and active use of the material, for both indoor and outdoor environments. Another possibility could have been to investigate the possibilities of repurposing other materials from the area, creating a waste management strategy for reuse in new construction or rehabilitation of existing buildings.
Focusing on the building structure, the timber elements represent a challenge in itself. Some of the most important features being the fire resistance properties and the long term exposure. This has been taken in consideration during the design process, in particular during the structural workshops.
Different options were investigated, including the possibility of using an exoskeleton entirely made of wood. This possibility raised several questions related to; fire resistant coating applications and possibility to change structural elements in case of damage derived from exposure. The final solution is a hybrid composition, with the structure mostly enclosed inside the envelope of the building, showing its “legs” on the ground floor levels. The exposed elements are relatively protected under the building and accessible to maintenance purposes. Further studies could have been

developed regarding the fire resistant properties of wood construction, and the way in which the most extreme cases - like the exoskeleton - could define the design and use of the building.

For the facade, the expression is achieved by mirroring the structural logic of the interior lattice, to the outside. Even though being in wood, these elements are not structural and therefore, their replacement does not compromise the stability of the building. The openings between the diagonal elements compose the windows by creating triangular subdivisions that become opaque, semi-opaque or transparent depending on the relation with interior use in each moment - glass for windows, and a more or less tight weaved structure for the enclosed triangles. The pattern allows for a filtered entrance of daylight, functioning as a shading device.

This structure derives from practical investigations during the structural workshops, where it was explored what structural entities and materials could be used to shape the hyperbolic paraboloid of the market roof structure. As a consequence, the weaved pattern is used both for the facade of the tower and for the cover of the paraboloids, becoming the “wrap” that protects both structures. In terms of materiality, bamboo was the mainly discussed option. It would be relevant to conduct further investigation regarding this material and its behaviour in creating the weaved structure, as well as the possibilities of fixation to the supportive structure.

In the case of the tower, the use as a shading device could also be an object of investigation, exploring the possibilities of mechanical control - possibly functioning as a moveable blind instead of a fixed element. The results could have an interesting result, not only in the practical use but also in the expression of the facade, making it more dynamic - becoming an organism that changes shape according to the will of the users. But in this regard, it would also need to be considered the effects of the level of control given to the users in the thermal behaviour of the building, which was not included in the scope of this thesis.

In a general manner, the choice of materials for this building was influenced and inspired by the competition requirements and the local use of red brick, as mentioned before. As a consecutive step of the current project, an iterative process of material investigations would be of importance.

**Expanding the knowledge regarding the user groups**

The functional aspect of the Gåsebäck Market Tower takes on the need to respond to the demographic growth of the city as well as the regeneration of an industrial area, creating a platform for creative industries and individuals.

In this aspect, theoretical investigation using literary sources and case studies wes conducted to understand the needs of the tower residents. The results allowed us to create a design that is intentionally promoting social interactions in the shared and common areas of the building.

The integration between all functions of the tower and the market area was a key factor throughout the design process. The intention was to assure the creation of one large unit, where uses can intertwin and promote interaction, learning and cooperative activities

For further development of these studies, it would be interesting to investigate the public functions and its users, their specific needs and requirements - in particular question users of the coworking space and workshops. Even if this can be a wide user group - it is also intentional that the use of the space can be adjusted to different activities - there are already several case studies of coworking offices and shared workshop places that could be taken as a starting point. In this way, it could be possible to implement specific design features related to predicted uses. For example, understand the challenges of an open workspace vs enclosed offices or the safety requirements related to public access between the different spaces.

**Creating a landmark not for Helsingborg, but for Gåsebäck**

When approaching this project the intention was to create a landmark for the city of Helsingborg. But upon further research and analysis, it became a landmark of the area Gåsebäck. The height of the building does not exceed other projects nearby, because of the limitations in timber construction. But the outstanding structure and a new way of construction in Helsingborg still hold significance to the area.

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**Illustrations**
Illustration 1: ADEPT masterplan H+
Illustration 2: United Nations, "INVERTED SDG ICONS" 17 goals, SDG Permissions,
New York, https://www.un.org/sustainabledevelopment/news/communications-material/
Illustration 3: Magnus R., Marques M., Rasmussen D. (2023) Gåsebäck Market Towers. Buildner Architecture Competitions

# Appendix 01

**Meeting with Municipality**

To understand Helsingborg's approach to the H+ plan in detail, a meeting with the municipality was conducted on the 21st of February 2023.
The participants were Helena Taps, project leader and architect for the Gåsebäck area, Oscar Hall, planner for the whole area of Helsingborg municipality and Jessica Jönsson, an antiquity assessor, who conducts analysis regarding which buildings are worth preserving.
From the beginning, it was possible to understand that the H+ plan was a visionary proposal, which was at the moment being taken under consideration to develop a comprehensive master plan.
In this context, Oscar and Helena gave a presentation showing the most relevant aspects related to the ongoing growth of the population and the challenges that were being faced, which were summarised as the following:

The population is growing from 150 000 inhabitants to a projection of 190 000 until 2050;
Increasing demand for residential options;
The north area of the city has been more expensive;
Southern area has a lot of problematic neighbourhoods;
The city has difficulty attracting families since they often prefer individual row houses and not apartments;
The city department wishes to create attractiveness for creative people;
This group currently has no platform to develop and end up migrating to Malmö or Copenhagen.

On the interpretation of the H+ by ADEPT:
The proposed tunnel for the train is non-economically possible to put in practice;
The proposed blue-green corridor won't play the "backbone" role predicted in the plan;
Instead, there is a strategy to connect existing pine forests in the south with new parks, creating a north-south connection through the city.

Future developments:
Predicted tunnel between Helsingor and Helsingborg;
The Harbour detail plan will be finished in the next two years.

General considerations regarding interventions in the city:
Connection with the water is historically important to recover;
Existing industry is currently interfering with view lines;
Outside of the centre the use of materials is more flexible because it doesn't create contrast challenges with historic buildings;
Study Jen Gehl;
Existing skyscraper in Söder area - in theory is in the right spot but in practice has a lot of issues with the wind and creates a questionable contrast with the historic buildings;

Regarding Gåsebäck and, in general, the industrial area:
Container yard will be moved further south when there is a practical solution to move the cranes while the port is working;
Predicted social areas in the current container yard area;
Predicted park around the maintenance train building that is going to be preserved;
Train lines will likely be moved to west instead of the implementation of the tunnel;
Intention to create new view lines to the water - visual connections east-west;
Importance of understanding the value of the buildings that will be preserved;
Local history connected with brick factories;
Thecipality is developing a strategy to deal with waste resulting from demolitions;
important to keep the activities that already exist, since it is the only area in the city where it is possible to afford large spaces for a low rent;
Religious organisations, thrift shops, social security departments, car mechanics
Important to create co-creative places and opportunities, since it is becoming part of the identity of this area;
There is currently no definitive masterplan or detail plans for the area - the development depends on what is possible to achieve by negotiating private land ownership and individual plots;
Possibility of negotiation with private owners to develop large projects together;
Beware noise from the highway;

General comments and open questions:
It is important to make this area easier to read;
What would make people want to live in this area? (Helena);
With a new development, the prices in the area will inevitably raise - what can be done about the existing activities and their circumstances?

# Appendix 02

## Calculation of groundfloor + student column

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Column groundfloor | | | W_y = 1/6*x^2*y | mm3 | | | | | | | |
| Material | GL 32h | | M_y = -1/2 * q * l^2 | N | | | | | | | |
| f_m_k (buckling) | MPa | 32 | | | | | | | | | |
| f_c_0_k (compression) | MPa | 29 | F_q = 1 m2 * 1,229 kg/m3 * air speed^2 | N | | | | | | | |
| E i fiberretning | MPa | 11100 | Running mean windspeed in Helsingborg 2021 (https://www.smhi.se/en/climate/climate-indicators/climate-indicators-geostrophic-wind-1.91478) F_q = 1 m2 * 10229 kg/m3 * air speed^2 | 1,39576301 | | | | | | | |
| Section i_y | mm2 | | | | | | | | | | |
| Height | mm | 4000 | | | | | | | | | |
| Modstandsmoment W_y | mm3 | 37200000 | | | | | | | | | |
| Fd (force) | N | *1000 | | | | | | | | | |
| Deadload (P-load) | N | 1425144,6 | | | | | | | | | |
| Windload (Ø-load) M_y | Nmm | 11166104,08 | | | | | | | | | |
| Use load (M-load) | N | 3678147 | | | | | | | | | |
| BGT dominant live load with variabel wind load | N | 3639090 | | | | Standard size: | | | | | |
| BGT dominant wind load with variabel live load | N | 3648040 | | | | | 620 | | | | |
| BGT dominant snow load with variabel live load | N | 1675620 | | | | | 600 | | | | |
| 1 Regningsmæssige trykstyrke (compression) | f_d = (f_k * k_mod) / Ym | | 2. Regningmæssige bøjningsstyrke (buckling) | f_m_d = (f_m_k * k_mod) / Ym | | 3. Effective area | A_eff = l * w | 4.Regningsmæssige trykspænding | sigma_c_d = F_c_d / A_eff | 5. Regningsmæssige momentspænding | sigma_m_d = M_d / W_y |
| Ym for GL | | 1,3 | | | | i_y | 600 | | | | |
| For P-load | MPa | 11,15384615 | | | | w | 620 | | | | |
| For combined load | MPa | 20,07692308 | For combined load | MPa | 17,23076923 | mm2 | 372000 | MPa | 9,7825 | MPa | 0,097825 |
| 6. Relative slankhedsforhold | lambda_rel_y > 0,3 | | 7. k_y and k_c_y | | | 8. Kontrol af bæreevne P-load | sigma_c_d / k_c * f_c_0_d | 9. Kontrol af bæreevne for Ø-last | $\frac{\sigma_{c,0,d}}{k_{c,y} f_{c,0,d}} + \frac{\sigma_{m,y,d}}{f_{m,y,d}} + k_m \frac{\sigma_{m,z,d}}{f_{m,z,d}} \leq 1$ | | |
| Lambda_y | Lambda_rel_y = L_s / i_y * squareroot (12) | 23,09401077 | k_y | 0,5 * (1+ b_c * (lambda_rel_y - 0,3) + lambda_rel_y^2 | 0,5743771153 | Should be 1> | 0,88 | Should be 1> | 0,89 | | |
| Lambda_rel_y | Lambda_rel_y = lambda_y / pi * squareroot (f_c_0_k / E) | 0,3757396278 | k_c_y | 1 / k_y + squareroot (k_y^2 - lambda_rel_y^2) | 0,9912704764 | | | | | | |
| | | | b_c is a factor taking imperfections into account. For GL it is 0,1 | | | | | | | | |

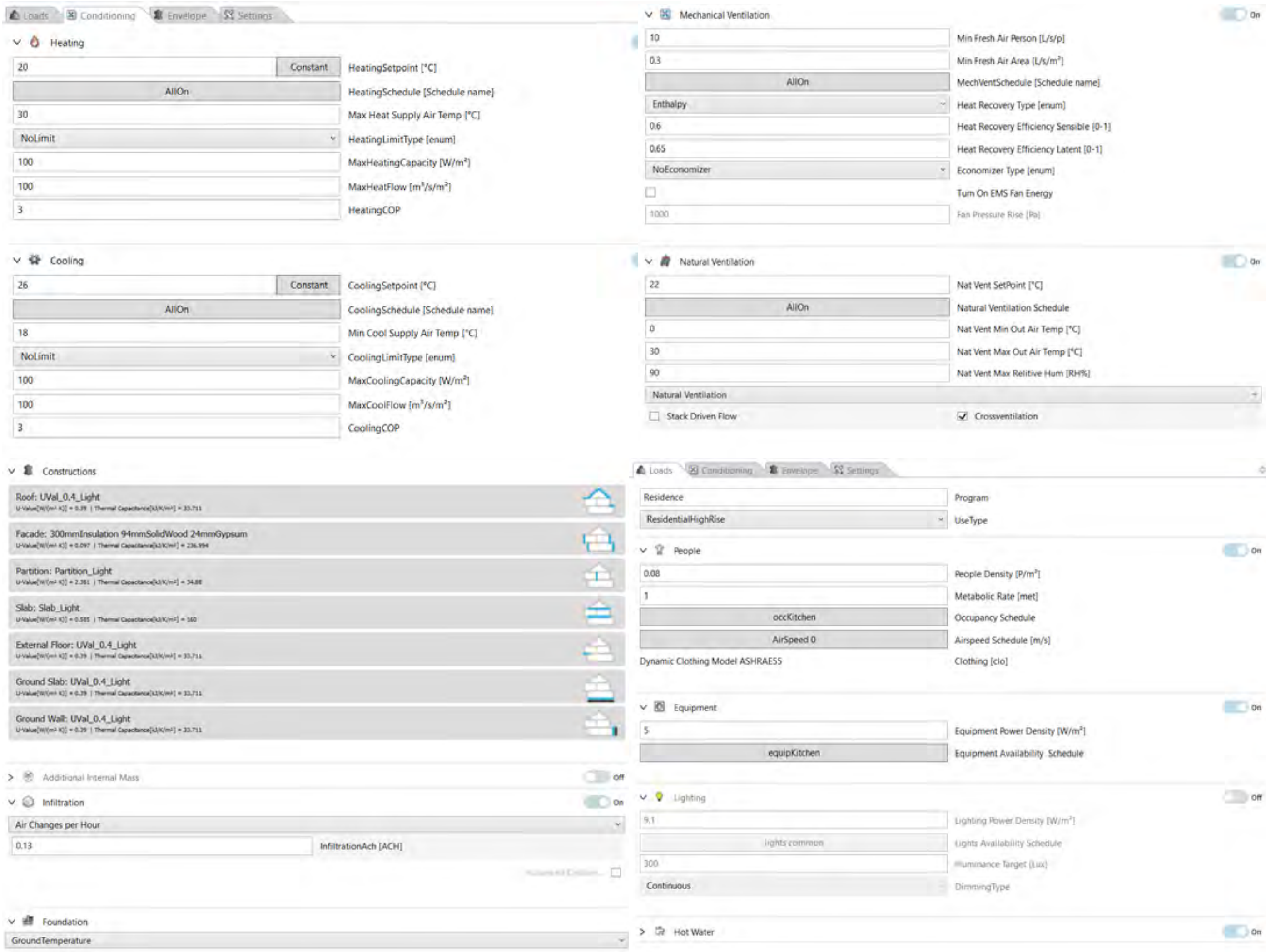
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Column fitness floor | | | W_y = 1/6*x^2*y | mm3 | | | | | | | |
| Material | GL 32h | | M_y = -1/2 * q * l^2 | N | | | | | | | |
| f_m_k (buckling) | MPa | 32 | | | | | | | | | |
| f_c_0_k (compression) | MPa | 29 | F_q = 1 m2 * 1,229 kg/m3 * air speed^2 | N | | | | | | | |
| E i fiberretning | MPa | 11100 | Running mean windspeed in Helsingborg 2021 (https://www.smhi.se/en/climate/climate-indicators/climate-indicators-geostrophic-wind-1.91478) F_q = 1 m2 * 10229 kg/m3 * air speed^2 | 1,39576301 | | | | | | | |
| Section i_y | mm2 | | | | | | | | | | |
| Height | mm | 4000 | | | | | | | | | |
| Modstandsmoment W_y | mm3 | 13592952,5 | | | | | | | | | |
| Fd (force) | N | *1000 | | | | | | | | | |
| Deadload (P-load) | N | 1425144,6 | | | | | | | | | |
| Windload (Ø-load) M_y | Nmm | 11166104,08 | | | | | | | | | |
| Use load (M-load) | N | 3678147 | | | | | | | | | |
| BGT dominant live load with variabel wind load | N | 1718772,908 | | | | Standard size: | | | | | |
| BGT dominant wind load with variabel live load | N | 1743192,99 | | | | | 435 | | | | |
| BGT dominant live load with variabel snow load | N | 1581306,458 | | | | | 433 | | | | |
| 1 Regningsmæssige trykstyrke (compression) | f_d = (f_k * k_mod) / Ym | | 2. Regningmæssige bøjningsstyrke (buckling) | f_m_d = (f_m_k * k_mod) / Ym | | 3. Effective area | A_eff = l * w | 4.Regningsmæssige trykspænding | sigma_c_d = F_c_d / A_eff | 5. Regningsmæssige momentspænding | sigma_m_d = M_d / W_y |
| Ym for GL | | 1,3 | | | | i_y | 433 | | | | |
| For P-load | MPa | 11,15384615 | | | | w | 435 | | | | |
| For combined load | MPa | 20,07692308 | For combined load | MPa | 17,23076923 | mm2 | 188355 | MPa | 9,254827268 | MPa | 0,1282424102 |
| 6. Relative slankhedsforhold | lambda_rel_y > 0,3 | | 7. k_y and k_c_y | | | 8. Kontrol af bæreevne P-load | sigma_c_d / k_c * f_c_0_d | 9. Kontrol af bæreevne for Ø-last | | | |
| Lambda_y | Lambda_rel_y = L_s / i_y * squareroot (12) | 32,00093871 | k_y | 0,5 * (1+ b_c * (lambda_rel_y - 0,3) + lambda_rel_y^2 | 0,6465737776 | Should be 1> | 0,85 | Should be 1> | 0,86 | | |
| Lambda_rel_y | Lambda_rel_y = lambda_y / pi * squareroot (f_c_0_k / E) | 0,5206553734 | k_c_y | 1 / k_y + squareroot (k_y^2 - lambda_rel_y^2) | 0,9709230035 | | | | | | |
| | | | b_c is a factor taking imperfections into account. For GL it is 0,1 | | | | | | | | |

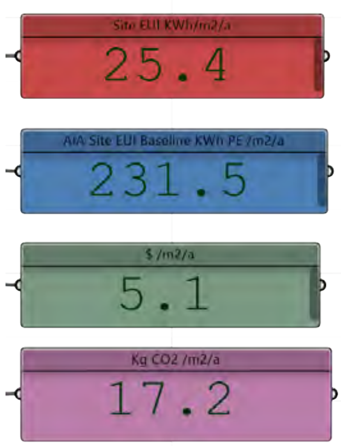
## Loadcombination calculation for groundfloor column

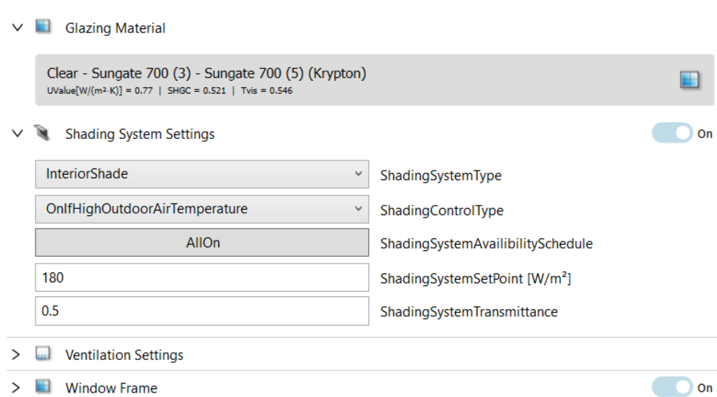
| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| For one column | | | | | | | | | | | |
| Library + auditorium | Levels | 2 | Consequence class: KFI | High CC3 | 1,1 | Snow load, data from https://www.smhi.se/klimat/klimatet-da-och-nu/klimatindikatorer/klimatindikator-sno-1.91052 | average fro 2022 in cm | 51,2 | | | |
| Student | Levels | 6 | | | 1,2 | | | | | | |
| Emptynesters + shared | Levels | 8 | | | | | | | | | |
| Fitness | Levels | 2 | Etagereduktions faktor | a | 0,5238095238 | | | | | | |
| Gaps with technical rooms | Levels | 2 | | | | | | | | | |
| Lifted from ground floor | Levels | 1 | | | | | | | | | |
| Total | Levels | 21 | | | | | | | | | |
| One floor apartment area | m2 | 375 | | | | | | | | | |
| Roof area | m2 | 385 | | | | | | | | | |
| Area for library+auditorium | m2 | 518 | | | | | | | | | |
| Area for student apartments | m2 | 2250 | | | | | | | | | |
| Area for emptynesters + shared | m2 | 3000 | | | | | | | | | |
| Area for fitness | m2 | 1000 | | | | | | | | | |
| Area for gaps | m2 | 750 | | | | | | | | | |
| Total | m2 | 7903 | | | | | | | | | |
| Superimposed Dead Load (G) | | | Live load (Q) | | | Snow load (Q) | | | Wind load (Q) | | |
| Roof load | kN/m2 | 1,6 | For housing in kN/m2 (DS/EN 01) | | | For housing in kN/m2 (DS/EN 01) | | | For housing in kN/m2 (DS/EN 01) | | |
| Level load | kN/m2 | 2,4 | Dominating | factor | 1,5 | Dominating | factor | 1,5 | Dominating | factor | 1,5 |
| Wall and facade load | kN/m2 | 2,4 | Variabel | factor | 0,5 | Variabel | factor | 1,5 | Variabel | factor | 1,5 |
| | | | | | | DS/EN 1991-1-3 | | | DS/EN 1991-1-4 | | |
| Meters of wall | m | 63,5 | Loads total students + library | kN/m2 | 6653 | snow load: s = u_i * C_e * C_t * s_k | kN/m2 | 0,64 | http://www.statikeren.dk/sub_pages/loads/wind/wind.php | kN/m2 | 2,05 |
| Total of wall in library+student block | kN | 1219,2 | Loads total for emptynesters + family | kN/m2 | 25500 | u_i = formfaktor | faktor | 0,8 | | | |
| Total of wall in emptynester + shared | kN | 1219,2 | Loads total for fitness (category C4) | kN/m2 | 5000 | Exposure factor : C_s* C_top | C_e | 0,8 | West facade area minus gaps | m2 | 2378 |
| Total of wall in fitness | kN | 432 | Total | kN/m2 | 37153 | Size factor (depends on the height of building and area of roof) | C_s | 1 | West facade area with gaps | m2 | 2553 |
| Total | kN | 2933,9 | | | | Factor for topopghraphy (windy) | C_top | 0,8 | | | |
| | | | | | | Thermal factor | C_t | 1 | | | |
| Load area for student + librabry floor | kN | 6643,2 | | | | Charateristics topoghraphy value | kN/m2 | 1 | | | |
| Load area for emptynesters + shared floor + 1 gap | kN | 8100 | | | | | | | | | |
| Load area for fitness floor + 1 gap | kN | 3300 | | | | | | | | | |
| Total | kN | 18043,2 | | | | | | | | | |
| Load area for roof | kN | 616 | | | | | | | | | |
| Total load area ground floor kN/m2 | kN/m2 | 34,54896 | Total use load area ground | kN/m2 | 59,4448 | Total use load area ground floor | kN/m2 | 1,16224 | Total wind load area | kN/m2 | 7,79984 |
| Area of one column load | m2 | 37,5 | Area of one column load | m2 | 37,5 | Area of one column load | m2 | 37,5 | Area of one column load | m2 | 37,5 |
| One column total dead load | kN | 1295,586 | One column total live load | kN | 2229,18 | One column dominant total snow load | kN | 43,584 | One column dominant total wind load | kN | 292,494 |
| BGT | | | | | | | | | | | |
| Dominant live load with variabel wind load | kN | 3639,092019 | | | | | | | | | |
| BGT | | | | | | | | | | | |

# Appendix 03

## Thermal analysis input



Thank you for reading!