HIGH-RISE CITY?

A critical re-thinking of large scale urban developments in Copenhagen

Andi Kiriakos Youssef, Dylan Chau Huynh & Rasmus Nyborg Andersen

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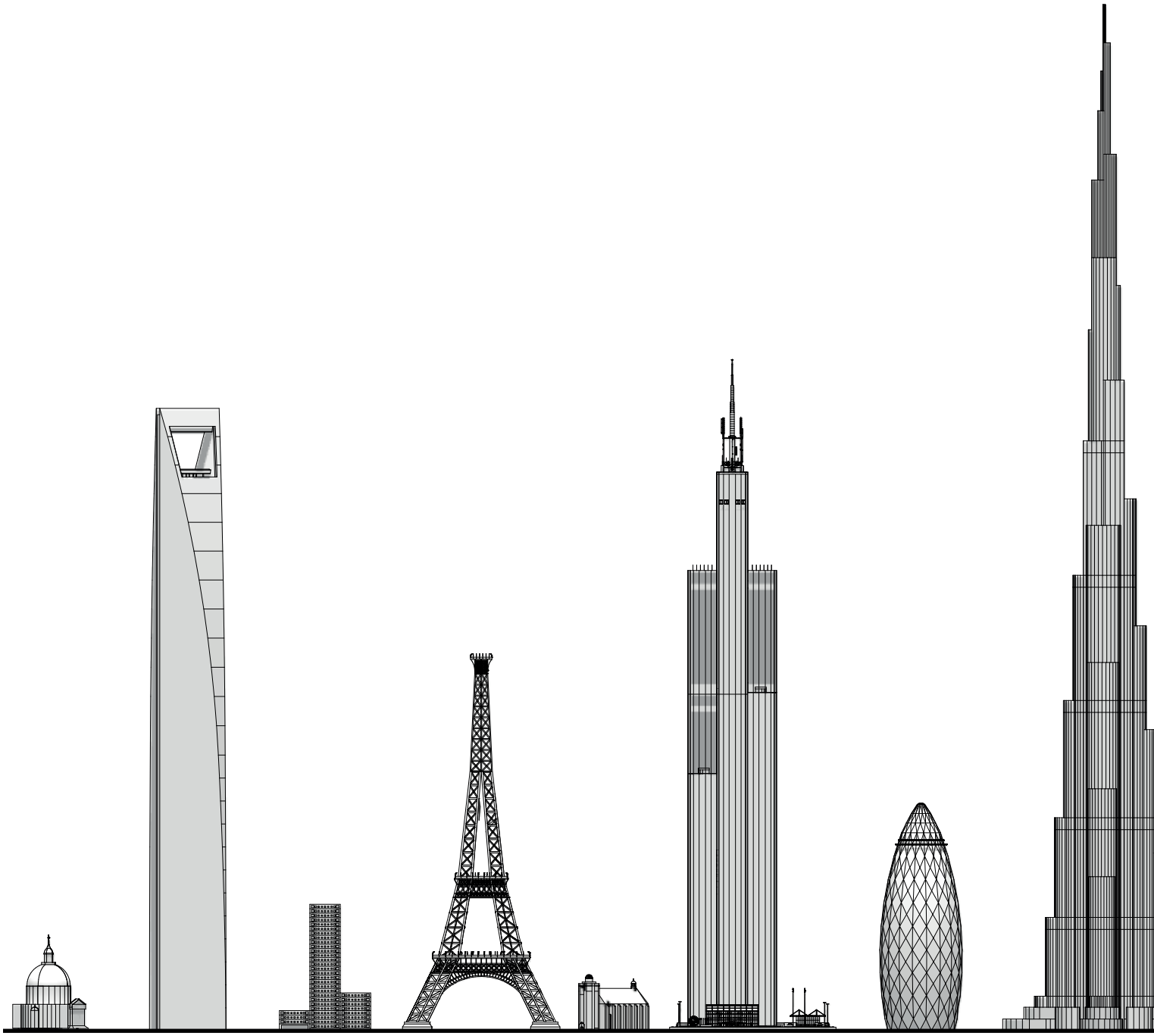
01. Copenhagen

Foreword

This thesis is a cross-disciplinary between the master's studies in architectural design engineering and urban design engineering at Aalborg University. The thesis will through a cross disciplinary methodology and process attempt to explore the boundaries of the high-rise and its relation to the city. Questioning its consideration related to sustainability, resilience, identity, and the human scale concerning social and sensorial experiences. In addition, critiques the high-rise and its contemporary paradigm in which it is all about verticality by exploring other large-scale forms that can subsidize the floor area ratio which the high-rise excels at. The high-rise will be located at the historic environment of Jernbanebyen on a site that is currently functioning as a warehouse that has previously been workshops and facilities concerning railway services. The result is a form that is permeable through it forms rather than impenetrable. The form and expression provoke social interaction through the notions of collective and community rather than separating through vertical hierarchy. In addition, the functions and architectural expression relates to the history and identity of its location in which it also merges in with the existing city.

The thesis could not have been possible without the help and work from friends and peers. We would firstly like to thank the study board for their work that allowed for a cross-disciplinary master's thesis. Our supervisors Marie Frier Hvejsel and Ole B. Jensen for their commitment, hard work and guidance that allowed for a critical reflective thesis. The many architectural firms and professionals that gave us permission to use their pictures, here mentioning Luca Girardini, Morten Bang from LOKAL, DSB, Freja Ejendomme, Jesper Larsen and Luftfotodanmark. Kåre Stig Nielsen from Banedanmark with his knowledge and dedication into showcasing the qualities of the Jernbanebyen. Andrea Dynnes with her expertise concerning to work with the human scale. Schønherr Landscape Architects and Gjørtz/Andersen/Arkitekter for their critical assessments and reflections related to designing high-rises in our historic urban environments.

The thesis is divided into nine parts that is described in the list of content. In addition, no appendix is available for this thesis. Every diagram, illustration, figure, and picture are described through an illustration description. The rightfully photo credits for the not self-produced illustrations are given in the list of illustrations.



Fredericks Church
79 m

Shanghai world financial center
492 m

Bohr's Tower
100 m

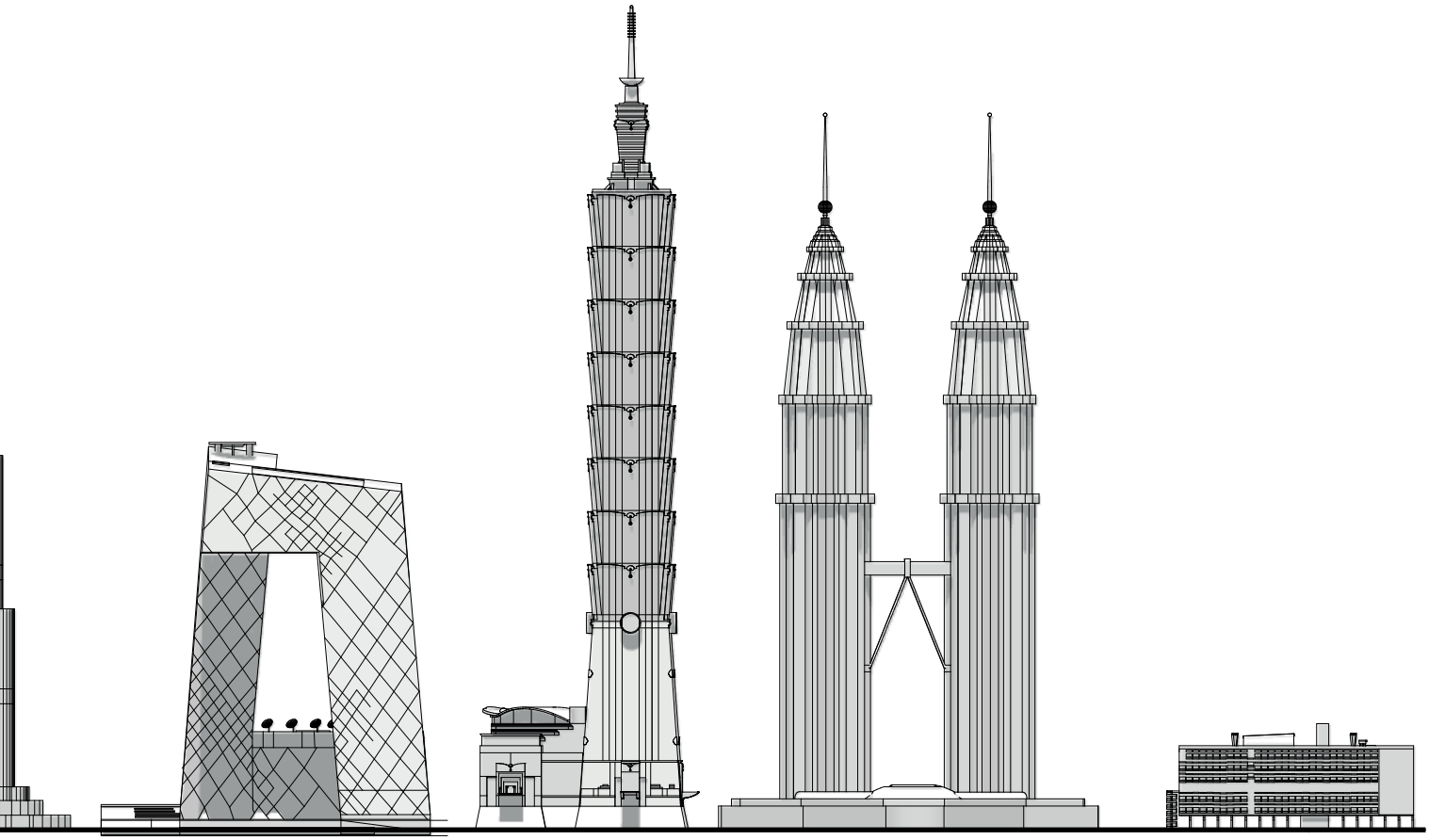
Eiffel Tower
300 m

Rundetårn
42 m

Willis Tower
527 m

The Gurken
180 m

Burj Khalifa
830 m



CCTV Headquarters
238 m

Taipei 101
508 m

Petronas Towers
452 m

Unite D'Habitation
56 m

02. The scale of the high-rise

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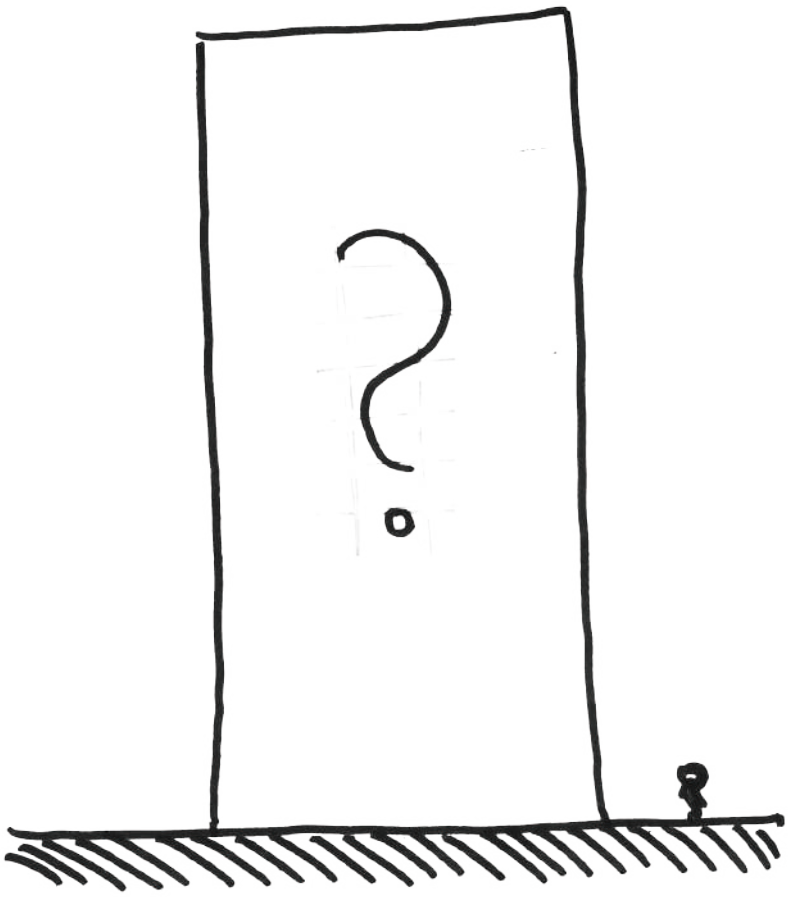
01 Prologue

This chapter will present the introducery part of the thesis. Firstly, an motivation based on the groups interest in the subject. Secondly, an introduction that describes the overall themes and challenges of the thesis project. Thirdly, an elaboration of the theme 'high-rise city' and an describtion of high-rise policies in Denmark related to the development of dense urban areas. At last, an introduction to the chosen site of the thesis that is based on a competition.



Motivation

The human scale?
As architects and urban designers, we design for humans, therefore it is important to know what the aspects are for the human being. We know based on our own experience, that the human being is connected to nature, even though it is individually desired or not. We also know that the human being is most comfortable when being close to or completely on ground level. We build our surroundings in relation to ourselves and our own human scale and we use this scale to measure and relate to. Therefore, it is important that the objects and elements in the built environment are in an appropriate proportion compared to the human body. These principles go directly against the large-scale structures. They are in their inevitable shape, distant from nature and the human scale in their height and structure.

In design, it does not matter if it is furniture as they always must appeal to the human – its proportions and scale. In addition, it is important that the product is customized to a local and cultural environment, so it can interplay with the socio-cultural norms within a specific society. Moving up the scale to houses and buildings the same principles and methods apply, as there are also a targeted audience within a local and cultural society, and a design that should appeal to the human scale.

Continuing further up the scale to the high-rise. The high-rise with its scale and complexity contains more than one specific audience. The vertical tower can almost feel scaleless in relation to the human understanding of its surroundings. In addition, it is no longer the local context and society that it needs to relate to, but also in an international context. The design automatically requires a different approach that breaks the relation with the human scale. Furthermore, meaning that the high-rise goes directly beyond the understanding of design.

This thesis aims to critically explore the high-rise its potentials, challenges and its limits related to the design of a dense urban environment. The thesis investigates the concepts of sustainability and resilience, the notion of societal identity and cultural heritage, and the life experienced at the human scale through social and embodied experiences at the high-rise. In addition, questions the verticality of the high-rise and instead attempts to generate form aiming at a better quality of everyday life. This is explored through the lenses of urban tectonics and mobilities to understand the human scale, covering both the urban, architectural, sociological, and engineering aspects. The high-rise being able to create better living environments whilst handling increasing societal issues related to material scarcity, social segregation, migration, climate change and population growth with architecture as a driver for social and sensorial experiences in the built environment.

Introduction

The human scale?
After 70 years of initial discussions of high-rises in Copenhagen as a part of the "Finger Plan" growing human population has pushed the legitimate construction of high-rise buildings. In 2018, seven new high-rises are being constructed and 31 more approved to accommodate the 10.000 new resident in Copenhagen each year (Eliasen, 2020). In perspective, only a few high-rises had been built up until the past 20 years, e.g. the SAS hotel by Arne Jacobsen in 1955-1960 or Bellahøj around the 1950. The reasons are described such as economical, structural, and ideological barriers (Christensen, 2010).

The manifestation of the high-rise in the European cultural historical cities has been an ongoing debate. Started as a part of the birth of the modern skyscrapers in the cities of Chicago and New York (Christensen, 2010). Le Corbusier admired the lines of architectural building and urban grid of New York but found the street to be to narrow and small. As a part of his research on "Urbanism", he discussed the human relation to geometry. In short, the curve is the past human. It represents a cultural development of the equipment disposal at the time, exemplified in the evolution of the cathedral that departed from the roman's abilities with construction.

The line is the modern human. The technological advancements have provided us with new equipment and thus allowed us to construct in a sense the same way as human walks and thinks. Straight. Straight with an end goal in mind and the determination to overcome the obstacles on the way (Le Corbusier, 1979). This is exemplified in his vision for the redevelopment of Paris: The Plan Voisin with its geometric grid structure, box like architectural volumes and big open urban surfaces.

In Copenhagen, "spires" referred to old Copenhagen and "boxes" referred to the high-rise is often the used notion to describe the cultural relation towards the buildings. The high-rise is argued as a "non-danish" building typology that goes against the cultural appreciated dense low building tradition. Yet both sides of the conflict emphasize the city as a unique trademark and the influence of the individuals' sensibility to recognize themselves as a part of the city (Christensen, 2010). The old Copenhagen, in its charming tangled public streets, its unique spires, crooked facades, ornamented details and historical expression versus the large plain surfaces and box like figures that rises above the current city roofs resulting in a new identity of the city towards an international language. Rising above and replacing buildings on their plots, thereby destroying existing cultural urban environments.

The high-rise is inevitable, thus large-scale structure must be considered if we are to meet the increase demand for housing, recreation, work, etc. The development of the city of Copenhagen have been criticized for not considering the historic and cultural conditions in the city related to both style and care for the existing historic layer of the city, designing the city like archipelagos. The complexity of the large-scale high-rise seems hard to interpret and understand related to its 'bigness' (Koolhaas & Mau, 1995).

The generic and mass-produced plan drawings result in a lack of social interaction in the vertical hierarchy which can lead towards the increased notion of loneliness within the population. Contemporary high-rises in Copenhagen were met with critic such as “unambitious” “a boring expression” “low on details”, “rejecting” and is nominated to become the ugliest building in Copenhagen (Ostrynski, 2019), hinting towards an influence of old Copenhagen style. These critiques have also led to the implementation of high-rise policies in different municipalities, in an aim to create better urban environments. Despite the critic, residents enjoy living in the high-rises - the views, the feelings of safety and in general observing the city from a distance. It displays a difference of sensibility towards the tower from a person’s experience of the inside varying of a person’s experience of the outside of the high-rise.

“...the human scale must always be the ultimate factor in the mind of the architect who has to design the immense blocks of buildings which are necessitated by practical and financial considerations. There must never come a time when people can be bored in our city.” (Le Corbusier, 1979, p. 238)

As artefacts in the cityscape, a symbol of power, an indication of booming economic prosperity and city development, and unique tall landmarks attractions in the city (Graham, 2016). However, does it leave no space back to public as it offers no pleasant streets or squares adjacent to it (Sim, 2019). In addition, as turbulent wind thrives in narrow spaces and vertical surfaces (City of London, 2019), results in the life on the street with an unpleasurable microclimate which furthers downgrades the walkability and accessibility in the city (Gehl, 2010). In addition, climate change and city resilience, does the high-rise development with its huge facades and lack of permeable surfaces collect huge amounts of rainwater and thereby creating areas for flooding (Wiberg, 2018).

If we are to accommodate the increasing population of Copenhagen in a sustainable manner, then the environmental, sociological, and cultural aspects of the high-rise must be understood in the relations between the ordinary user, sustainable goals, and the impact of the large-scale international building typology across scales in relation to the human scale. To understand the citizen’s everyday life, practical usage, local cultural- and environmental ecology of the high-rise in a resilient manner. To better the lives for all in the city through generous and sympathetic spaces. Thus, this thesis asks:

*How can we **transform the historic environment** of Jernbanebyen into a dense, but **generous and pleasant living environment** for people, by exploring the **boundaries of the high-rise** through the study and design of its **social, cultural, and environmental** challenges and potentials?*

The large scale

The high-rise typology can be defined through many factors related to the contextual cityscape; however, it takes its point of departure in the notion of the large scale. In the field of architecture and urban design, the typology of the high-rise has become a staple in city development. A mega form in the urban landscape (Frampton, 2009), however, also an urban structure that contains hybrid programming (Maki, 1964; Fenton, 1985). These buildings are considered complex and the requirements for them are comprehensive. For what should the building be able to do, not just in terms to its own introverted and closed system but also as part of the remaining city. The typology does not only relate to itself but also to its surroundings.

Rem Koolhaas describes the notion of the mega form in his own definition as 'bigness' (Koolhaas & Mau 1995). Koolhaas believes that technological developments have brought a new type of architecture: "The combined effects of these inventions were structures taller and deeper - Bigger - than ever before conceived, with a parallel potential for reorganization of the social world - a vastly richer programming." (Koolhaas & Mau 1995, p. 498-499). The huge buildings provide several square meters, which are too big for a simple function, therefore a hybrid programming is often found in large-scale architecture which means different features and intersections are contemplated in the building. The programming also has the potential to gather many people at the same place and tell the many stories that unfolds throughout the complex gathering of functions.

The city is one part of the hybrid building, as the building due to its scale is being forced to relate to the urban context and society (Koolhaas & Mau, 1995). The structures can even facilitate urban space, infrastructure, and perhaps even landscape (Maki, 1964; Frampton, 2009). The building cannot be controlled by a single architectural gesture, which means that there will be places where architecture does not define the function (Koolhaas & Mau, 1995), as the complexity of the program challenges the aesthetics of the architecture in which the understanding of space and tactility is forgotten (Wall, 2012). Due to the scale, the buildings will never be experienced as a whole – the need for technical clusters, necessary infrastructure, building regulations and safety regulations creates a new aesthetic that is usually not defined as 'good' architecture.

The complexity of the high-rise related to the programming and form concerning both architectural volumes and urban surfaces requires an inter-disciplinary approach to understand the many challenges that concerns the cultural identity of the architecture, the social life related to space, and the individual embodiment. This calls for an understanding which can unfolded through the notions of urban tectonics and mobilities.

The human scale between the high-rise buildings. Newly constructed high-rise districts can be found in almost every new big city. In Aalborg, it can be experienced at the harbourfront. The spaces in-between the high-rises leaves no gestures to the public.

04. Østerbro Harbour, Aalborg


Vognværksted
Ud
Ind

Site introduction

Jernbanebyen
This thesis takes its point of departure in the city district of Jernbanebyen. Jernbanebyen can be translated to the railway town thereby hinting the site's historic character as a former railway district in which the area was used as workshops and factories for train repairs and construction. The site is located in the district of Vesterbro/Kongens Enghave. The total area constitutes to approx. 555,000 sqm, of which a small area is laid out for the historic 'Den gule by' (The Yellow city) here hinting the architectural character of the area. Furthermore, 175,000 sqm is laid out for the Metro's preparation center which means the area is restricted and will not be available for development. The area around Jernbanebyen is under strong development with the establishment of housing up to 9 floors combined with business and a new metro line that will also service the needs for public transport at Jernbanebyen.

Jernbanebyen will be transitioning from a worker neighborhood related to the train industry into a green lively neighborhood that accommodates the different aspects related to everyday life in terms of work, recreation and living. The work functions should however also be in the spirit of the place. Jernbanebyen has been envisioned by the developers as an area which will accommodate all the best of Copenhagen: squares and green areas where people can meet, streets where you can bicycle in groups, small and large businesses side by side, a world of old and new that grows together. Community-driven neighborhoods with their own character. Cultural environments and car-free streets that intertwine with a unique mix of preserved buildings and modern sustainable architecture (Freja Ejendomme, DSB & Grandville, 2020). Furthermore, the identity of space and place is essential as the new development must maintain its red brick character which most of the buildings feature on site and the pragmatic structures of the factories and workshops.

The new development at Jernbanebyen is envisioned as a dense city area which will feature a floor area ratio of 100%-175%. This sets the areas ambition as to being able to consider aspects which will enhance the quality of life whilst attempting to house the growing population through densification. Meaning that many tall buildings will be placed in the area. This thesis will set up the overall structural lines for the masterplan and then detail design one chosen high-rise. The high-rise will be located on the southern part of Jernbanebyen in an area that will feature 70% residential and 30% business and have a floor area ratio of 175%. Whereas the northern part will feature cultural, shopping, and public functions. The northern and southern part of Jernbanebyen should be connected through greenery and recreational functions.

05. Pictures of Jernbanebyen

06. The site of Jernbanebyen and the city of Copenhagen in the horizon

02 Theory

This chapter will elaborate on the theoretical themes and framework of the project. Firstly, the strategic framework related to an sustainable development and transition to a resilient society is described. Secondly, a description of the themes in the project which revolves around the notions of transformation, architectural style, social and sensorial architecture. Lastly, a summary of the discovered challenges and potentials related to high-rise city development.

Sustainability and resilience

Sustainability has become a rising topic based on the increase and attention on environmental issues such as global warming, CO2 discharge, air pollution and shortage of raw materials (Vind & Lendager, 2019). The sector related to the built environment accounts for 30% of the overall CO2 discharge in Denmark. Furthermore, 35% of all waste products in Denmark (Folketinget, 2019). Drastic changes and innovations in the building sector are necessary if we are to reach the environmental goals of becoming CO2 neutral by 2050 (Klima-, Energi- og Forsyningsministeriet, 2021). Sustainability can be divided into three themes: environmental, social and economical. The concept of sustainable architecture can be associated to the original definition of sustainability in the Brundtland Report, in which they define sustainability as:"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987).

Related to climate change comes concerns related to several extreme weather events, increased precipitation, rising temperatures and sea level rise which are threatening our urban areas (DMI, 2018; Wiberg, 2018). Furthermore, there is an increasing challenge related to loss of biodiversity (Ojala & Cmapbell, 2020). This means in future development, there is a need to consider climate adaptation as an integrated part of the design. Continuing these thoughts, it is our belief for a sustainable high-rise development to be a long-term design, the local cultural aspects must be addressed to accommodate the ordinary users' adaptation towards a sustainable development.

The indication of cultural sustainability
The indication of the cultural aspect can be seen in the continues urbanization of Copenhagen that has pushed the transformation of city center. While it has been transformed throughout the city's lifespan, buildings and urban spaces of the past is still present. Including the mid- and late 1800s apartments and urban spaces of old Europe. The past 200 years these buildings have been transformed in its flexible/simple layout, that accommodates various lifestyles and habit patterns (Harlang IN Petersen, Andersen & Harlang, 2017). These spaces represent a cultural identity within its context, that ordinary user wants to care for. Further its robust materials, and the test of time, has proven them to be sturdy and durable. The buildings lifespans have extended for over 200 years, and will continuously do so, because of the cultural embedment.

"The adaptive reuse of historic structures, while particular to their context and time, are evidence that buildings with these same attributes can sit nearly abandoned for decades until changing environmental, economic and cultural conditions invited a reconsideration of their value as a cultural asset and integral to a place."
(Laboy in Cruz, 2019, p. 1034)

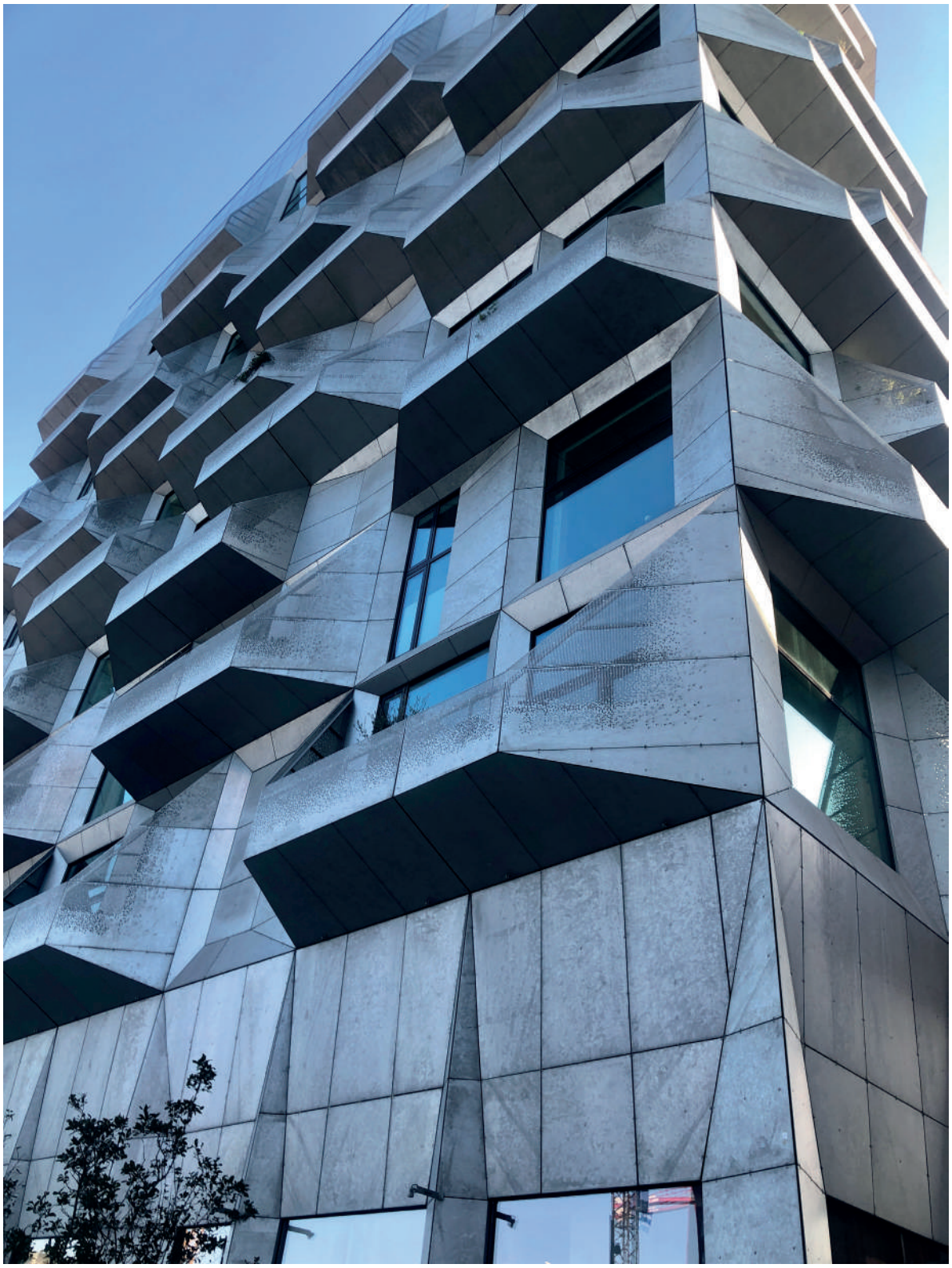
At Jernbanebyen, its primary function as office spaces, storage and various train workshops has been relocated. What remains is the heritage. Several buildings have been decided from the Copenhagen municipality “save-value” to represent the site historical expression. The resources of the buildings have been extended, because of its cultural and historical relation to the city. The resources of the space are needed to create this relation. This expression in its, fashioned, arranged, and detailed manner must be recognized in addition to new fashioned, arrangement and details. The resilience of a space, exist in the environmental, and cultural conditions, expressed in the processed, fashioned, arranged and detail of the space.

Environmental and social sustainability
When it comes to sustainability in high-rises, its vertical element naturally brings issues to the design. The general tall building is perceived with “high operating energy requirements, reliance on artificial lightning and condition, increased material needs, unsuitability for families with children and the negative impact they can have on the surrounding urban realm.“ These designs are, just like most sustainable architecture, variating depended on the local climate and urban context (Oldfield, 2019 p. 28).

In addition, high-rise areas result in the presence of impervious surfaces that leads to massive water collective areas through rainfall events. This results in flooding of the urban spaces as the water infrastructure capacity is not designed to withstand massive amounts of water in case of extreme rainfall events (Wiberg, 2018). There is a need for spaces that can withstand large amounts of water and delay it, thereby not overflowing the existing infrastructure (Bentzen, 2014; Nielsen, 2017). Nature and water does also contain a enjoyable and recreational dimension to it (Wiberg, 2018).

While previous studies have concluded that tall buildings have been less suitable, for families with children, in generating social and helping behavior as well as increase crime and fear of crime (Oldfield, 2019). Recent research indicates that the mentioned social issues are less recognize in newer high-rise in Denmark in which social gathering spaces have been planned (Mechlenborg and Hauxner, 2021). Further the tall building provides more people for the vitality of public spaces, with easier access to local community, services, and facilities (Oldfield, 2019).

This thesis believes in the cultural identity to being an essential notion in relation to unfolding the aspects related to environmental and social sustainability. Thus, culture being an essential relation in to the other aspects of sustainability, thereby gaining an more holistic understanding of what makes a building sustainable. To do this, we must further explore the notion of culture and identity related to architectural style and transformation of unused structures.



Transformation of silo into a high-rise structure. Done by re-using existing structures and adding new layers.

07. The Silo by COBE, Copenhagen (2017)

Sustainable principles and building techniques that are based on the understanding of material outsourcing concerning environmental sensibility.

08. Ressourcerækkerne by Lendager Group, Copenhagen (2019)

Culture and identity

Heritage and high-rise developments?
As new constructed high-rises dominate the skyline, the historic elements of the built environment are no longer emphasized, even though it is still desirable in creating pleasant environments. New buildings need space, resulting in a lot of the old historic elements get torn down or downgraded. Leading to an identity crisis in the built environment, as we no longer can experience and understand the history or sense of place which will worsen the relation to the space.

Architecture as a process
According to Hertzberger, change in architecture should be a process rather than objects in space. It should be understood and evaluated in relation to how it interacts and adapts to the environment and temporal context. Instead of setting up barriers to future uses by limiting the scope of programmatic capacity, the architect must engage in encouraging uses and reuse qualities in the buildings spatial and tectonic nature (Hertzberger, 2015). This means attempting to draw matters of concern related to future use and being able to uncover historic narratives in the buildings.

"The relationship between interventional design and architecture is as the relationship between temporality and timelessness, while one takes note in passing that temporal is different from temporary [...] If a building is to be altered, chances are it will be altered again. The designer therefore has responsibility for a building's past, its present and indirectly its future. The interventionist makes a contribution to a continuum, which is the life of the host building." (Scott, 2008, p. 152 - 153).

Heritage or technique?
It is believed in this thesis that preservation of the historic elements is essential for society to maintains the sense of belonging and cultural identity for the residents. However, there is also a need to build new and regenerate old areas to accommodate future population growth which means there is a need to work with existing historic elements in relation to new building structures. The new building structures must translate the historic, cultural, and social dimensions of the existing conditions to narrate the journeys from past to present - For us to understand where we were and where we are now.

This also means that the existing buildings will be intervened in some degree and extent. The group believes that by transforming an old structure into a high-rise, the high-rise will therefore be located into an existing historic environment which could benefit it in terms of creating welcoming and pleasant spaces around the high-rise. At Jernbanebyen, some of the old structures are huge and does already function as a landmark according to the perception of the site. It would therefore be obvious to use one of those structures as a base because the perception of landmarks on site will be maintained. Furthermore, exploiting the properties of the low structure to create a welcoming high-rise. This also requires the new structures to understand the existing local and cultural conditions when concerning the materiality and style of the new structure.

The question of style
In the high-rise development in the city districts, the critique related to style becomes obvious. The newly constructed high-rises seem to not be related to the style and identity of the place. Thereby creating identical spaces all around the danish context, even though all the areas represent different local contextual opportunities and constraints. Furthermore, challenges the identity and heritage understanding of the environment which is necessary to maintain cultural identity of space and place, and the aim of creating an welcoming high-rise.

This movement relates to an international stylish approach based on the “new wave in Danish architecture”. It emphasizes a pragmatic and diagrammatic approach (Weiss & Vindum, 2012). This type of architecture seems to follow an approach related innovative re-thinking of typologies and their synergies. The conceptual development in the new wave seems almost utopian and without boundaries (BIG, 2009; 2020). At the same time, it seems to be an architecture that does not seem particularly preoccupied with the aesthetics, the sense of place, the local, with the context, with the topography and does not emphasize the craft and detail of architecture (Louisiana, 2012; Kallesø, 2020).

The nordic tradition
Alongisde the breakthroughs in Danish architecture, it also seems that another kind of architecture has risen (Kallesø, 2020), an architecture that is based on the site-specific, the contextual, on the topography, on the building culture, and sustainability (Frampton, 1980; Louisiana, 2012). The contextual emphasis relates to critical regionalism which was driven by architects such as Sverre Fehn and Jørn Utzon in the post-war period (Frampton, 1980; Lund, 2001). This style attempts to exploit local and existing limitations and conditions to ensure cultural narratives in the urban environment. In addition, there also a cultural identity related to the social in perspective in which the collective generosity and caring is emphasized related to the public buildings in society. A Nordic tradition taking its point of departure in the values of the welfare state (Louisiana, 2012).

This thesis believes in a contextual based approach. It represents a danish contextualism which is necessary in maintaining the rich architectural identity and culture in our building traditions, local context, social tradition, and values. The new high-rise development should be able to maintain and convey the narratives of culture, identity, and tradition of the place and city, whilst also being able to narrate present day society. In addition, the openness of the high-rise is however also a key factor related to a Nordic cultural tradition and understanding of society. All this will be deployed through architectural intention, materials, and form of spaces.

In addition to the cultural aspect, we must also create embodied experiences and social interactions through the architecture of the high-rise. To do that, we must further explore and understand how the presence of these qualities can occur.

Living environments

The living environments is challenged along the high-rises concerning the experiences of microclimate, neglection of the human scale, and lack of priority in the creation of decent public streets and squares. Related to the good urban life and pleasant living environments, the notion of sense of community and sensory spaces becomes essential into creating quality spaces.

In the book Soft City by David Sim arguments that good urban quality in dense cities can occur by having different various building types and functions. He believes that even conflicting functions and citizens can live together as good neighbors if they are in city environments that lets them (Sim, D. 2019). Jan Gehl has studied functions in the public realm by dividing the different activities in three categories: The necessary activities, optional activities, and social activities. The optional activities can be sitting on a bench or the enjoyment of the local conditions, these can only occur if the qualities of the built environment can live up to the demands of the people in terms of pleasant public spaces. If optional activities occur in public spaces, then social activities could possibly occur (Gehl, 2010).

Designing a neighborhood
When designing pleasant neighborhoods, the presence of niches and dedicated public gathering spaces are essential for social interactions and embodied experiences ensures possibilities for life in the neighborhoods (Gehl, 2010; Sim, 2019).

The danish building traditions related to the city block structure relates to this kind of thinking. The surrounding building blocks shields for rain and wind making them comfortable for staying and moving. The characteristic of this building typology relates to inner courtyard area which is an encircled space that safe and comfortable area for outdoor activities. The block structure has also been criticized for being to private and not allowing the public inside these small, pleasant areas which is why there is a need for more open-minded blocks. The principle of this typology can be key into unlocking potentials and spaces for people in the dense environment as its scale, openings, form, and height can be varied related to the context (Sim, D. 2019).

Life on the streets
The ground floor includes a range of benefits that promotes activity, diversity, and life in dense environment. Having different functions provides interesting insight into the backstage and life inside the buildings. Using the potentials of active frontages and pleasant streets ensures that more people spend time outdoors on street level, creating safety and creates a more exciting and interesting walk (Sim, 2019). The materials should also afford walkability and accessibility, to experience the mixed variety of life in the buildings (Gehl, 2010).

To conclude, it is important to create a diversity in buildings to make different and interesting urban spaces. The division between courtyards and public spaces brings a needed demand for green areas that are important in dense cities. Furthermore, the placement of public function in the city or dense environment promotes diversity and activity on the site. This thesis believes in by considering the life on the streets and squares related to pleasant conditions can contribute to better high-rise districts.

However, high-rise has always been subject to a sense of privacy and closedness concerning its relation to the city. When subsidizing high-rise building area for public streets and squares, we also need to be aware of the relation between the building and the spaces in the city. If the transition spaces from building to public space do not correlate and offer experiences, the public would still perceive a negative relation to the high-rises.

There can be many potentials in large-scale architecture and its diversity in the mixed program. Jane Jacobs describes among other things, that by programming several functions into a district in which diversity and mixed use are ensured. In the book ”The death and life of great American cities” Jacobs describes how programming a district with many functions ensures activity for many hours of the day. This creates security, as well as connection to a building by several population groups, where you can thereby experience the diversity in the city and the building (Jacobs, 1992). Many of the principles concerning quality urban environments can also relate to high-rise life when moving up on the private floors, notions of neighborhood and community, and social spaces are still desirable. However, some of the residents experiencing the vertical lifestyle emphasize other qualities which also could be translated into qualities to the public realm.

As stated earlier, the local Copenhagen culture has persisted towards the adaption of the high-rise in their everyday environment. The recently finished (2017) Bohrs Tower at Vesterbro in Copenhagen, has already been met with critique by the locals. However recent research on the living environment and social life in danish high-rises by M. Mechlenborg and K. Hauxner indicates that the resident of Bohrs Tower do enjoy some part of the vertical lifestyle. Furthermore, their research indicates what could be missing In Bohrs Tower, that the resident themselves does not communicate.

The visual sensation is highly present in the apartments, while minor of sound has been described. Materials and forms and other bodies sensation have not been described. To continue, the photography of site, circulation, and the apartments, can provide a better understanding of the multisensory of the space. By exploring the variation and correlation of the spaces form and material. In conclusion, the desired qualities of indoor high-rise spaces could also relate to qualities needed in the public realm. Visual sensations, the experience of everyday urban life, multisensorial experiences, safety, and comfort are all criteria which could improve the quality of the public realm at the high-rise and inside the high-rise.

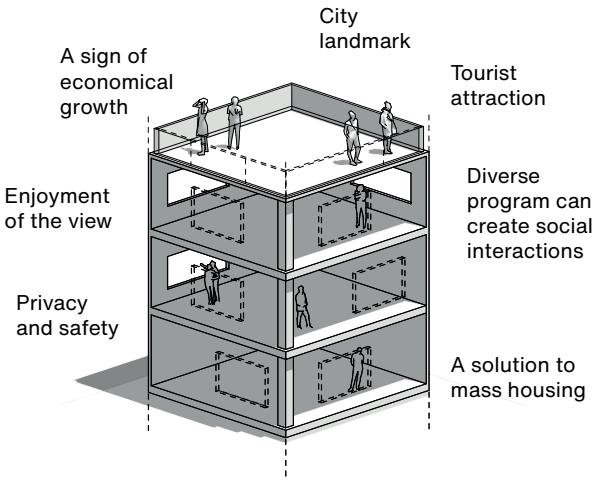
This thesis proposes a fluid use of urban theory and sensorial architectural theory in which we must take point of departure in desired quality for inside and translate them to outdoor qualities – and vice versa. This interdisciplinary line of thinking can hopefully be able to improve the life around and inside the high-rise for the better, thereby creating a relation between the building, the city, and the people.

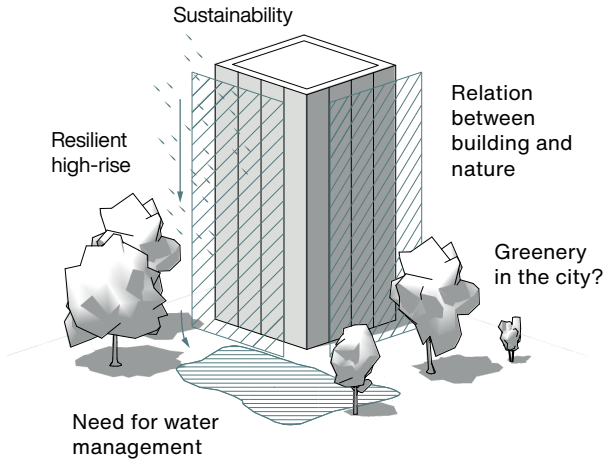
09. Social spaces at hallway - Ørsted Gardens by LOKAL, Copenhagen (2020)

10. Amaryllis House by LOKAL, Copenhagen (2018)

Theoretical summary

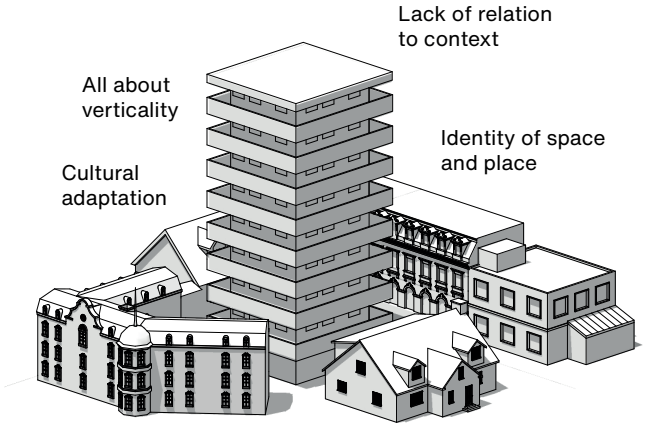
The high-rise potentials and challenges can be summed up in four points. The four points attempts to give a nuanced intepretation of the high-rise by considering both benefits and challenges.

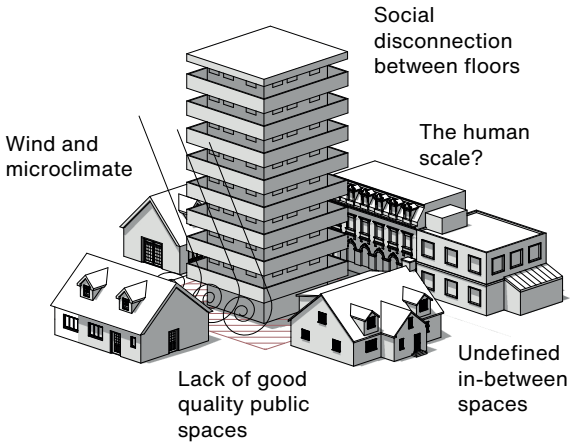




The benefits of the high-rise
Although the thesis has described the high-rise through its many problems and challenges, the theory also gave some glimpses into the benefits of the high-rise. In a strategic points it provides major benefits for the city branding related to the city identity and to providing landmarks and tourist attractions in the city. When working with a high floor area ratio also means that the structures should be able to accommodate many people which could be the mass housing solution. In addition, gathering the program and functions in one complete structure has the potential to create interactions and encounters between users and residents of the high-rise. Ofcourse, these benefits also contain a dark side.

Resilience and sustainability
The notion of sustainability is in this thesis divided into three sub themes: environmental which is related to emissions which means the design of the high-rise must attempt to reduce emissions, social which is related to the social interaction through the vertical hierarchies of the high-rise and the life around, and the cultural agenda which is addressed by the group to be essential when concerning a sustainable development of society. Furthermore, the resilience towards climate change gets greatly reduced when designing dense areas as they are filled with impervious surfaces. This also calls for an nature based approach to climate adaptation that will also provide nature to an dense city district.





Culture and identity

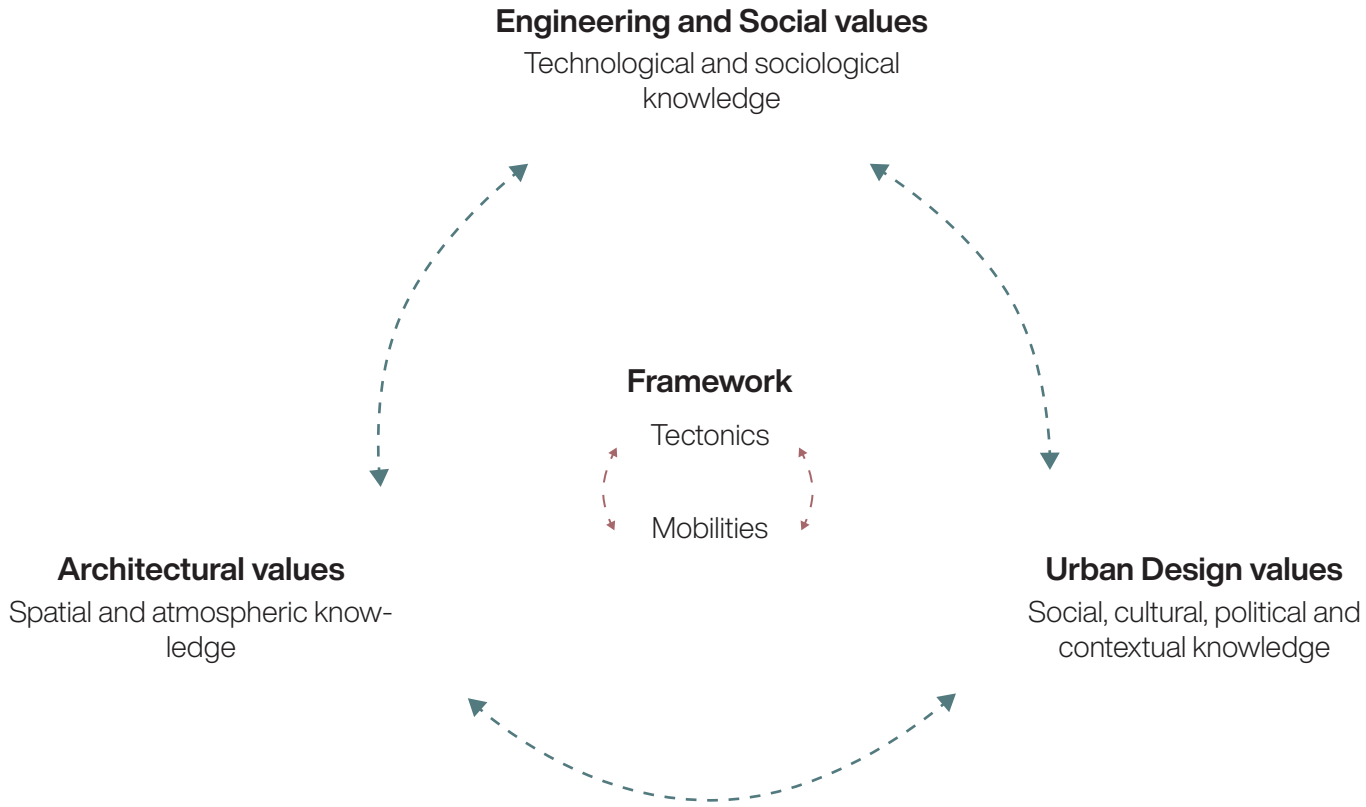
The cultural understanding of society can be traced back to the design of the built environment. The buildings are always a product of the time and in recent time, a kind of international style has arisen through the design of large-scale structures such as the high-rise. The high-rise will always be a dominant landmark in the area because of the enormous scale which means the generic design does not contribute to the understanding of culture and society. Furthermore, when new dense areas are being designed, the old historic buildings often get neglected. This group believes in the power of architectural style and transformation to narrate the thoughts and idea of the present culture in society.

Living environments and the human scale

The life around the high-rise structures has already been criticized in relation to microclimate, water management, lack of safety, and pleasant spaces. The challenges related to the living environments inside the buildings does differ a little bit as it emphasizes other architectural qualities concerning to live. This is among others the visual sensation to be one of the most important aspects in vertical living. However, many of the challenges outside and inside does resemble. Pleasant views to nature and life in the city is also key aspects for life around the buildings. In addition, important aspect in life around the buildings such as sense of community, social interaction and sensorial experiences are equally as important for the inside living environment.

03 Method

This chapter will present the methodology and approach of the project. Firstly, an elaboration of the methodology of the thesis and afterwards a description of the thesis approach which is based on an combined cross-disciplinary approach. At last, three different case study themes will be adressed: Alvar Aalto and his visions related to the use of materials towards creating welcoming buildings, Le Corbusier and his explorations with mixed programs, Elbphilharmonie and James Simon Gallert related to its transformation strategy.


Engineering and Social values
Technological and sociological knowledge
Framework
Tectonics
Mobilities
Architectural values
Spatial and atmospheric knowledge
Urban Design values
Social, cultural, political and contextual knowledge

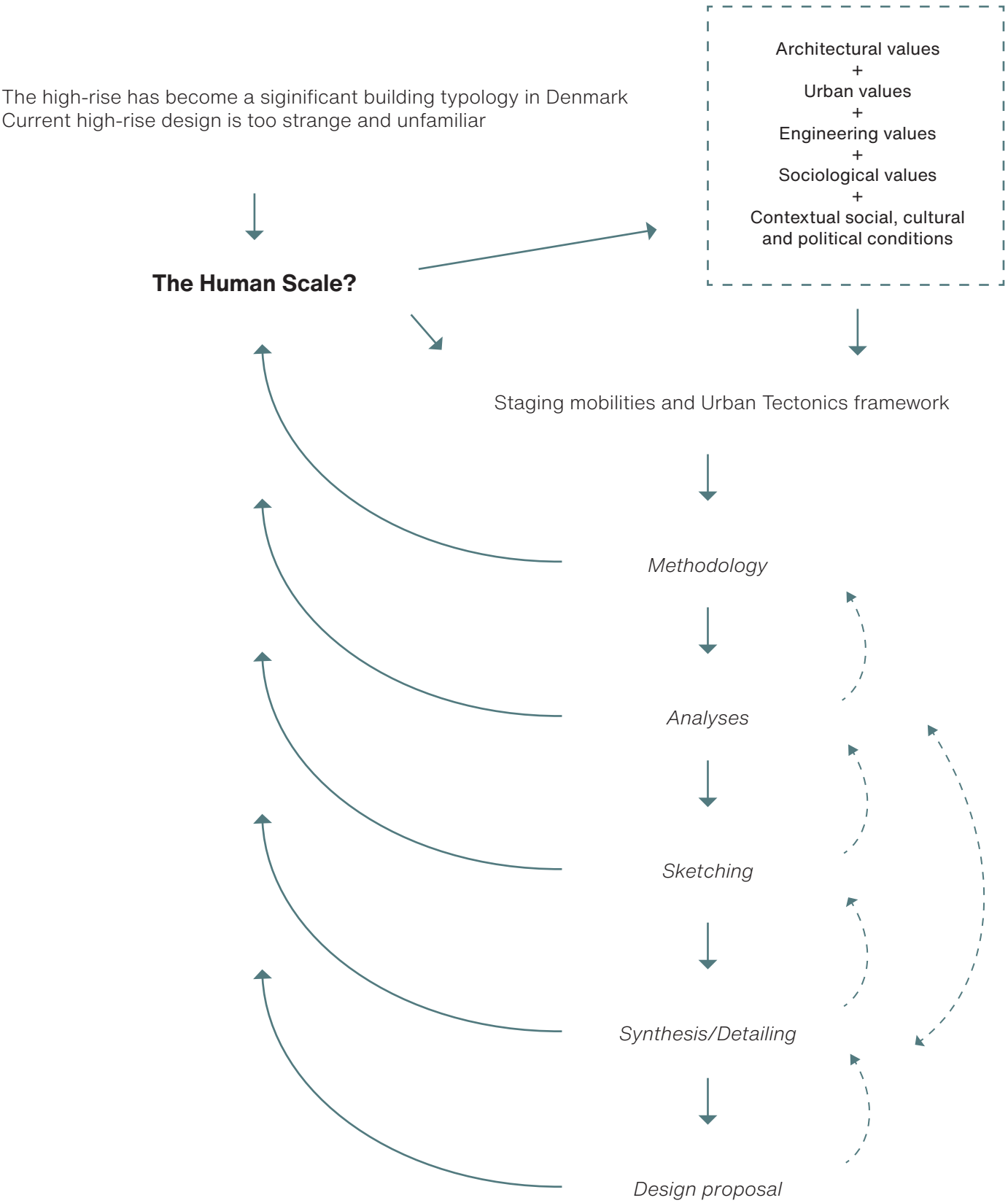
12. Approach

Approach

“Grounding a building structurally means transferring loads to the ground to anchor the building on the site – its structural configuration and load path. It also means establishing a long lasting imprint on the urban situation—an irreversible reconfiguration of patterns and flows of people and resources that connects the spaces of the building to cultural, economic, and social conditions— which can either prevent or enable buildings to persist and adapt when conditions change.“
(Laboy in Cruz, 2019 p. 1033)

Tectonics and mobilities approach
The notion of urban tectonics attempts to understand the city through multi-scalar assemblies in which the principle of assembly is described to result in a spatial quality based on the relations between different volumes in the city. This thesis proposes another kind of understanding of how the experienced spatial quality based on assemblies affects the life in the city spaces. This understanding will be used as a critical framework for the design, always reminding the group how the built environment has effect for the life in the city related to the spatial construction. This understanding will take its point of departure in the staging mobilities framework as it describes how a mobile situation is influenced by the built environment, social relations, and embodied performance. The principle that describes how the structural build-up in the city will still be the main point of departure. In addition, the mobile situation will in this framework be translated into the perceived gesture. The explained gesture based on the spatial relationship will be deconstructed into three different themes to provide a kaleidoscopic understanding of what the spatial build-up does for the life in the city. The three thematic gestures are here described as the embodied gesture, the social gesture, and the cultural gesture.

The theoretical framework will be deployed for addressing qualities of the urban realm related to integrating urban volumes and architectural structures. However, it is also important for this framework to be translated into an architectural perspective related to the indoor areas. As the notion of tectonics is mostly known for its use related to the synergy between construction, structure, and architecture, it seems to be a collaborative translation into the architectural perspective. Thus, the staging mobilities framework takes its point of departure based on the concept of people moving which also occurs in the indoor spaces of the high-rise. In this, the principle will describe what the structural buildup of the architectural form in terms of spatial quality and the gesture will describe what the space does for the individual, the social and the cultural.



13. Methodological framework

Methodology

The call of interdisciplinary methodology is more relevant than ever if we are to solve the climate change and better our living environment in the complexity of the contemporary built environment.

Our approach shows the important and the possibility to understand an integration of architectural, urban, engineering, and sociological aspects as a part of the design process. While our approach is an arc-urb-eng, the sociological have been a huge variable in our understanding of the social aspect of the sustainable development and transition into climate resilience. That is why we utilize a combination of tectonic and mobilities as both theories covers a broader perspective on design of space. In previous projects, is it our experience that the integrated design process has favored engineering over others science, such as sociological, anthropological etc. that we believe too also have an important impact on the design.

In practice it is our experience that an integrated design process is already present in the built environment. What differs, is that we challenge the current ways of approaching the variables and correlations in each party of practices. The problem, theories, analysis and sketching of the architect is now affected by the urban and engineering aspects and vice versa. This also means that variables and synergies need to be investigated and reflected upon in relation to alternative variables and synergies in the state of the art, resulting in a back-and-forth motion of iterative design. Thus, a mix of pragmatic reflection and innovation, hermeneutic cultural interpretation, phenomenological sensory and general philosophical questioning is explored depended on what is found suitable to the topics that addresses the arc-urb-eng of tectonic and mobilities integration. The qualitative methods: Mappings, pictures, hand drawings, sections, rendering, diagrams, sensing of space, interviews and literature screening will be the main tools.

Initially the method is used as a specific site analysis to understand the local context and to discover critical focal points on site that needs in depth sketching and detailing. Such as transformation, resilience and living environment are topic that are found critical to understand to better the design proposal in an environmental, social, cultural manner. The following case studies will be reference projects that represent how the methodology and the approach can be seen in the project.

Reference projects

Saynatsalo Town Hall
The Saynatsalo town hall is a town hall in the finnish city of Saynatsalo. It was designed by the architect Alvar Aalto. The town hall has been a major influence in the city related to blurring the relationship between the state and the individual through its tranparency and public courtyard space.

The town hall is an critique of modern perceptions of town halls in terms of it being closed and not open for public. This town hall that also follows nordic principles related to the welfare state in which there is a clear connection between state and individual. The result is a building that through its details and small scale gestures actually allows for a closer relationship between state and individual. The buildings heart is located in the inner courtyard that has two entrances. The two entrances are formed in a way that it allows for passing and the public using it does not feel unwanted. In addition, the courtyard allows for peeks into what is happening inside the building.

The building shows how a public building can be done in a way that it opens to the community and thereby a sense of transparency between city and people. His work on the form of building emphasizes small openings into the central courtyard that is characterized as the heart of the area. The small opening the generates curiosity and encourages people to discover the building. Stairs are located at both ends of the courtyard, thereby inviting and encouraging people to use the inner town hall courtyard as a circulatory space and gathering space that benefits the whole city.

MIT Baker house dormitory
The MIT baker house dormitory is a dormitory for the students of MIT. The house is also designed by the finnish architect Alvar Aalto and is one of his only buildings constructed in the United States.

The building is an dormitory that features housing units for individual students. All the housing units are located through one single long corridor that allows for social interaction between all the residents in the house. The building is located at a stunning landscape that required an approach in which the building should be an anonymous entity instead of seeking all of the attention in the urban environment. Instead, the curved brick facade towards the street and landscape attempts to run along with the river right in front of the building. Thereby, the public path between the building and river would be thrilling and exciting throughout the variety in shape and expression.

The dormitory shows how a building can become welcoming and enhance the adjacent spaces through the detailed work in the brick façade structure. The buildings emphasizes a curved organic expression that ensured pleasant views for everybody. A gesture that he carried out through gently turning the red bricks. The gesture that enhances the qualities for the residents also influenced the outdoor spaces, as the slithering façade generates curiosity for the public in its playful form and expression. In addition, attempts to down scale the large architectural structure into something that is related to the human scale through the playful and tactile facade.

14. Saynatsalo Town Hall, Finland (1951)
15. MIT Baker Dormitory, Massachussets (1948)

Unite D'Habitation
The Unite D'Habitation was completed in 1952 and was the first part of the new housing project series by Le Corbusier. The project series emphasized communal living in terms of being able to shop, play, live, and come together in the same building. The large-scale building complex was sought out to accommodate roughly 1600 residents. The building idea is derived from russia in their attempts to solve mass housing challenges due to population growth.

The building is a community and collective in itself. A neighborhood in which the residents would be able to come together through different activities, but would also be able to escape in their private two storey apartments within the building. This way, the residents would have their own private space, but outside of that private space they would shop, eat, exercise, and gather. A higher degree of community in a building that is able to accommodate almost all aspects of everyday life.

The building is despite its large form shows a form that is able to accommodate many people and their lifestyle. This is done through the smart spatial organization of the apartments. The apartments are large for the family but a small slice in the large building. The apartments are linked together through a dark narrow corridor that is located in the middle of the building. The apartments are a huge contrast to the corridor in which daylight flows th-rough the building from both ends. The spatial flow of the apartments also relies on different levels and floor heights in which the gathering spaces would be in double height.

Sainte Marie de la Tourette
The Convent of La Tourette is also designed by architect Le Corbusier and it would end up being his final building completed in Europe. The building is also described as a very unique program in which the monastery was built to be a self-contained world for a community of silent monks. In addition, to accommodate the specific and unique lifestyle of the monks. The monastery features individual living spaces also called cells, a communal library, a refe-ctory, a rooftop cloister, a church, and classrooms.

The building features one hundred individual cells with outward-facing balconies. Furthermore, with communal areas underneath and the cloister which was located around the roof. The building is unique in terms of that all the monks had one common point of departure in their lifestyle. That shared life root was in the spiritual and in their beliefs. The aim for the building was then that the monks would be able to be individual in their cells and together through the spiritual.

The building locates the gathering spaces in a way that the individual living cells would be seperated, but there would still be a degree and spiritual. The buildings shows how the structure and architecture is able to divide the different aspects of life into the individual, the collective and the spiritual. Thereby offering spaces for the individual and spaces which would allow them to be an collective with their sha-red common goal. The spiritual is the key aspect in which the spaces should be able to hold their shared goal and would be able to gather the monks towards enhancing the notion of community.

16. Unite D'Habitation, Marseilles (1952)
17. Sainte Marie de La Tourette, Eveux-sur-Abresle (1960)

Elbphilharmonie
Elbphilharmonie is a concert hall in Hamburg completed in 2017 by architectural firm Herzog & de Meuron. The result is an addition of an existing building that creates a new cultural center and landmark for the city. The extension provides a clear transition between old and new, thereby respecting the existing historical layer of the environment.

In a critique of the cultural institutions being too private, the building attempts to address this through the implementation of mixed functions and public activities. The building thinks about infrastructure and circulation in an experiential way that seeks to narrate the journey from past to present. This is then a proof that a building can become more public and welcoming by re-thinking the infrastructure to become more open-minded towards all. The staircases starts of in an geometric flow, however, when moving closing to the new addition, it suddenly becomes organic and fluent to mark the new beginning.

The expressive languague of the new addition results in a big constrast between the existing structure and the newer addition. The new addition exploits the technological advancement and techniques in contemporary society to form the organic wave shaped roof with its related windows. A constrast to the existing geometric form that was essential in the pragmatic order and effective planning of the warehouse typology. The new addition shows an approach to create an contrast between the new and old, and thereby narrating an journey from the different times both in interior and exterior.

James Simon Gallery
The James Simon Gallery designed by David Chipperfield serves as a new entrance for the museum and gateway for visitors. The structure is adapted into the city environment and gestures the everyday life with a sense of cover and security in an intimate promenade. The transparent column walkways provide glimpses of life and light from the outside. Furthermore, from the outside perspective, it also allows small glimpses of the historic architectural elements. Its expressive exterior attempts to continue the narrative and intentions of the existing historic surrounding structures. The simple and homogenous use of materials attempts to gesture the historic elements by not turning the focus onto the new, but rather on the old ornamented and tactile facades. The building attempts to create a great diversity of spaces and experiences on different levels for inhabitant and people visiting the museum. The many walkways, stairs and platforms allows for a diversity of experiences through the architecture.

The building is an example of how you can create relations in city by looking at the relationship between the building and the surrounding city space. In addition, how the style of the architecture attempts to not overtake the area but rather stage the historic identity. Thereby, creating pleasant new spaces and experiences for the people in the city and not just the people visiting the museum or gallery. Thus, attempting to improve the everyday life in the city with the experience and gestures of the architecture. The building latches out to the by passers and residents in the city and invites them into using the spaces outdoor spaces of the building.

18. Elbphilharmonie, Hamburg (2017)
19. James Simon Gallery, Berlin (2018)


JAMES
SIMON
GALERIE

04 Site

The case of Jernbanebyen has already been presented in the prologue part of the thesis. This chapter will present the site from an strategic point of view related to the development of the finger plan, the development of the capital Copenhagen, a timeline of the Jernbanebyen, the demographics of the site, and an description of the user groups presence in the area. Furthermore, the microclimate of the area will also be explored in relation to how new dense urban district will affect these conditions.

The Fingerplan

'Fingerplanen'
To be able to understand the strategic development and expansion of Copenhagen, where the site is located, it is important to know the strategic considerations in relation to the development of Sjælland (Zealand). With this knowledge the site can be developed in relation to the common goal and strategy of Copenhagen.

After years of war, the "Egnsplankontoret" led by Steen Eiler Rasmussen created a sketching proposal on how Copenhagen should grow in the future to accommodate rapid expansion related to population growth and urbanization. This plan ensured that the city expands in five horizontals directions, stretched from the center of Copenhagen and concentrating future building development along those axes. These axes would help create a solid transport network between the city center and the suburbs, making it attractive to settle outside the city while still working in the center. At the same time, the space between axes should remain as green landscape with open fields, parks or other recreative areas to ensure access to nature for everybody living on the fingers (Jensen, 1990).

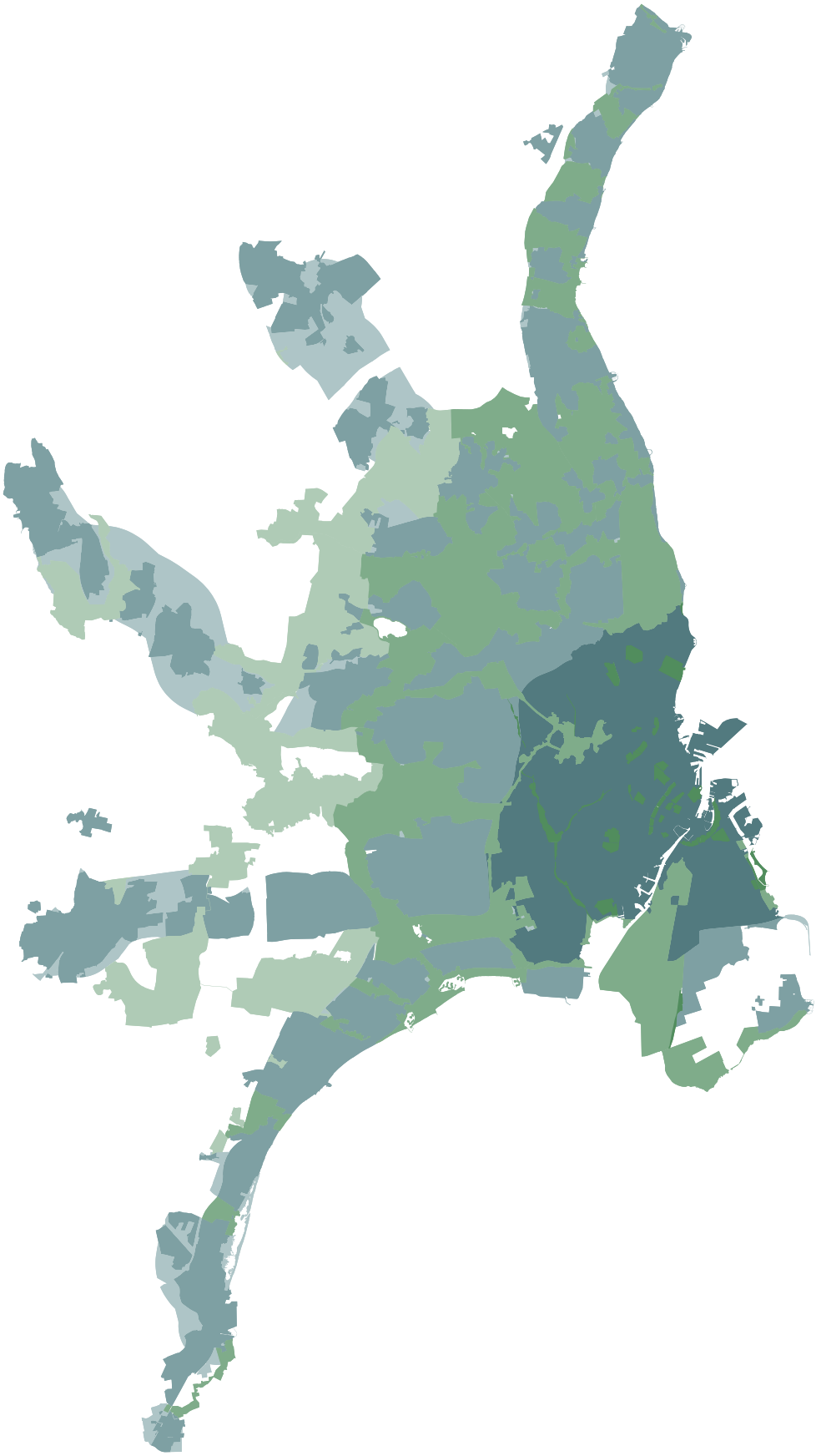
The plan has become essential in the danish planning history and is seen as a principle more than a detailed plan. It has since its invention had a big influence on the development of the capitol as it has regulated the build pattern and transportation strategy (Jensen, 1990).

The fingerplan model provided a strong strategic growth, but during the 90's the axes were growing out of proportion, resulting in many problems such as heavy traffic and land use. Therefore, a strategic change needed to happen and in the 90's instead of expanding along the "fingers" the focus changed toward the older buildings in the center of Copenhagen. The plan was to transform many of these buildings and convince citizens to stay in the center (Erhvervsstyrelsen, 2019). This leads to large attractive architectural projects within the center raising the popularity of the city as well as the population.

The capital of Copenhagen grows in its five fingers. All the road and infrastructural systems are planned to ensure accessibility towards the City of Copenhagen. The green and recreational areas are kept in between the fingers to ensure accessibility to everyone living on the fingers. The green spots start in the inner city of Copenhagen, moves through the site of Jernbanebyen and outwards.

Areas for urban development

Areas for nature



20. The Fingerplan

Strategic context of Copenhagen

To reach a contextual based design proposal it is important to know what kind of city Copenhagen is and what it wants to be in the future, as the site need to reflect the Identity and culture that the city has.

High-rises in Copenhagen
Just like many other European cities, Copenhagen have grown around its historical and culturally important city center, where the building and street structure are well maintained including the cultural environment and urban architectural values that follows. It is a great example of European city building with a mix of baroque, renaissance and medieval buildings. It mostly consists of 5 levels block housings and the only high-rises are the old towers and church spires that break the skyline. It is possible to divide Copenhagen into sections starting with the historical city core and moving outwards. The area outside the ramparts ranges between 5 to 6 levels but mostly also consists of block housings but on the southern part, east from the site, 5 of the 9 high-rise structures, seen in Copenhagen, are placed. Moving further outwards to the suburbs the main height is lowered to 3 levels and only very few high rises is seen (København kommune, 2006).

Municipality goals
As the city of Copenhagen grows in population the concerns seen in the municipality plan contains issues regarding high housing prices, more traffic and schools reaching their capacity, therefore a long-sighted plan have been laid out for the next 10 years. Some of the focus points are that the city should have room for everyone regarding their income so that living costs should be low while there also are green and recreative areas. Furthermore, it is important for the city that its qualities are cared for, as their historical buildings and environments. Another focus point is biking, and Copenhagen is known to be the city of bicycles, therefore there is a large demand for better cycling conditions as well as better public transportations.

Green Copenhagen
On sustainability Copenhagen wants to be CO2 neutral by 2025 and any sustainable transportation should be promoted so that the city's air pollution gets lowered. There is a wish for smaller and bigger green recreative areas. Copenhagen wants to be a green and blue city that will help create a climate adapted city and promote a healthier and active lifestyle were every citizen has close and easy access to the green and blue recreative areas. Not only will these areas be good for the dense urban environment, but it is also envisioned that they will contribute to floods, rainfall events and sea level rise as well as lower the temperatures in the city. The general strategy is to plant more trees and encourage green roofs and recreative areas. All these wishes, plans and strategies mentioned are topics that the site and final design must submit to (København kommune, 2019).

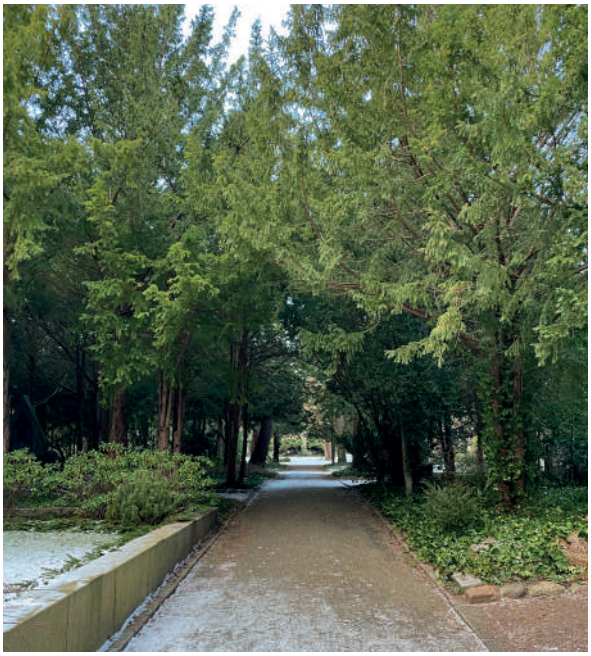
21. Strategic Context of Copenhagen

Contextual reference works

The City Dune is is the start of a potential green axis going from the SEB bank all the way through Jernbanebyen to Valbyparken and further out west. This empoweres the green finger in the fingerplan and also promotes more green spaces in the city.

H.C. Ørstedværket is a natural gas power plant. The location of the power plant challenges the density on the southern area of the site, as the pollution lowers the building height demands. This plant will some day be surrendered based on newer paradigms related to heat and energy production. But for now, it needs to be considered.

22. City Dune by SLA Landscape Architects
23. H.C. Ørstedværket



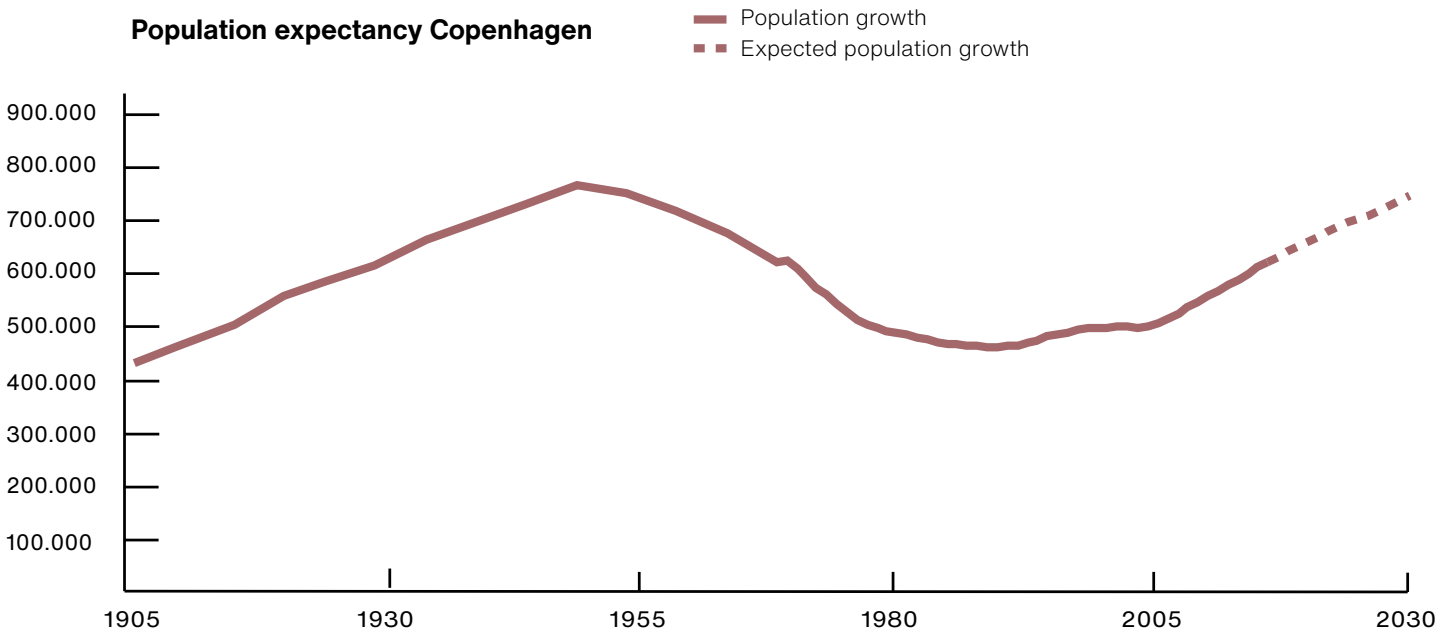
The green character is strong around Jernbanebyen. Because of major rain and flooding evetns there is also a need for recreational spaces that consideres climate adaptation. The adjacent areas features green recreational qualities and spaces for climate adaptation. Vestre Kirkegård is the central recreational area of this district and Enghave Parken is located at the main infrastructural node at Carlsbergbyen.

24. Enghave Parken by Third Nature
25. Vestre Kirkegård - Climate adaptation by Schønherr Landscape

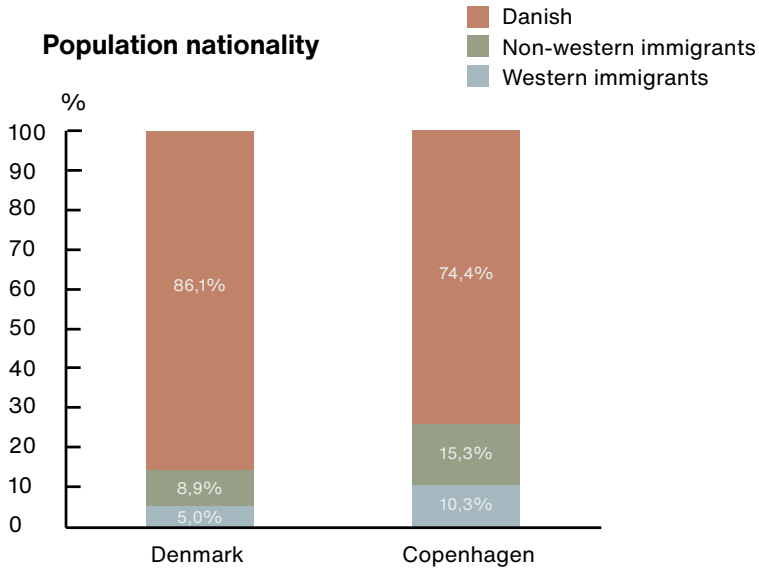
Demographics

The city of Copenhagen is experiencing rapid growth. Young people want to move to the bigger cities with its related opportunities for education, jobs and social life. In addition, the city of Copenhagen also attracts a lot of highly specialized workforce with its high rates of liveability. This also means the city is experiencing rapid city development to accomodate the population which is pressuring the major districts in the city.

Population expectancy Copenhagen



Population nationality



Average age Vesterbro/ Kongens Enghave in 2020

34,5

Average age in Denmark: 41,8
Average age in Copenhagen: 36,1

Population growth in Vesterbro/ Kongens Enghave from 2004-2020

43%

21.817 people

Life expectancy in 2019

79,3

77,7 in Vesterbro/ Kongens Enghave

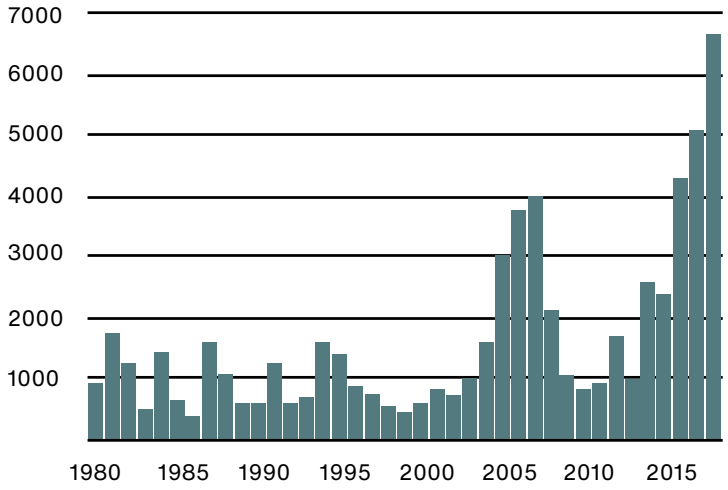
Population density in Vesterbro/ Kongens Enghave

6987

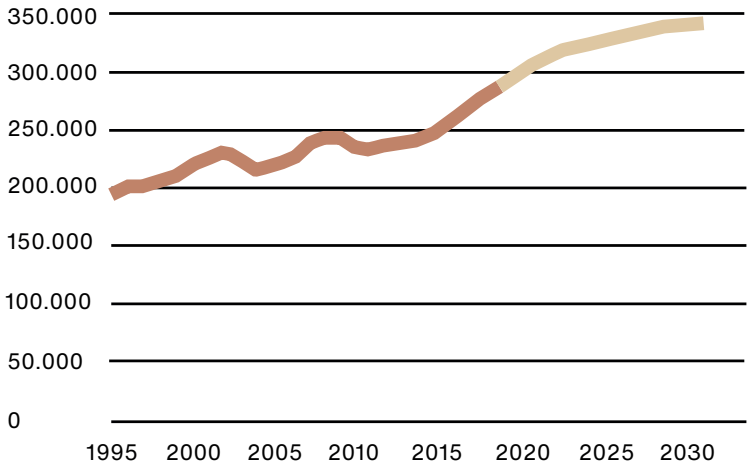
People per square kilometer

2800 in captial region

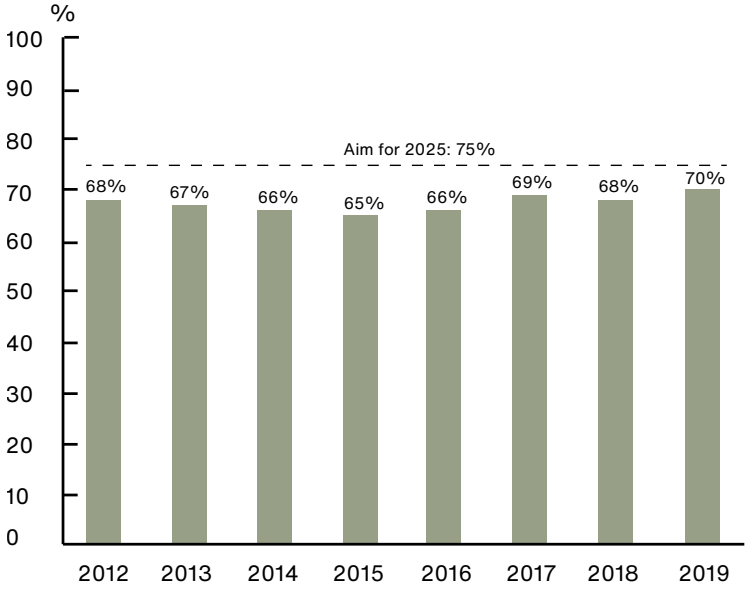
Newly built homes in Copenhagen



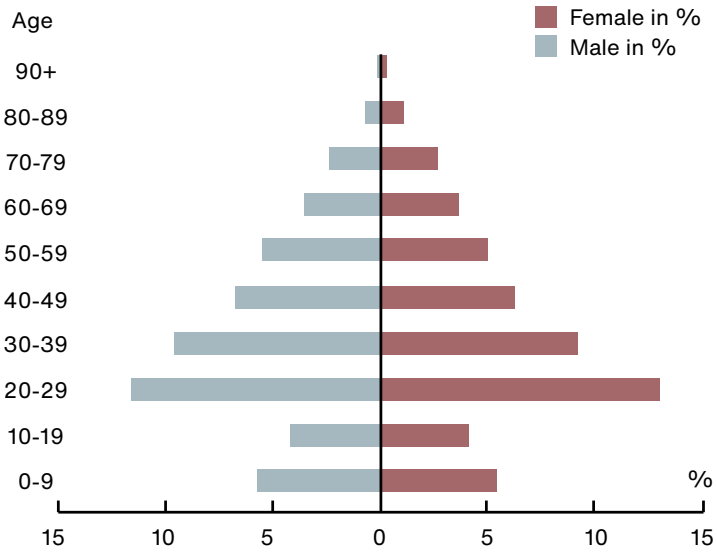
Private workplaces in Copenhagen



Trips in Copenhagen by foot, bike or public transport



Population composition in Copenhagen



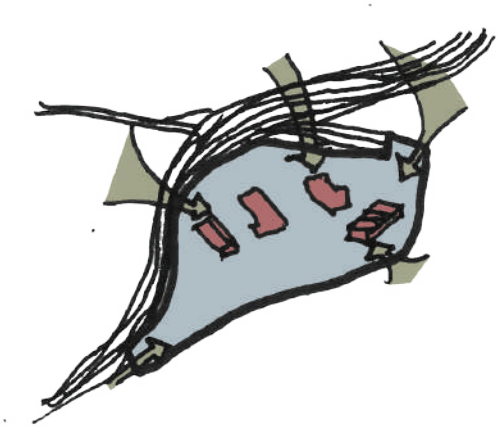
26. Stats of Copenhagen (Københavns Kommune, 2020)

User groups

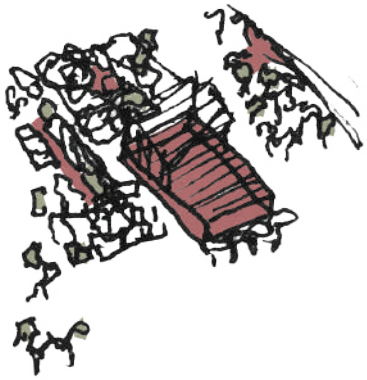
Hybrid narratives
Because of the size of the high-rise and the spaces it influences, a wide variety of users are described taking point of departure in the demographic's analysis. The aim for the thesis is also to touch on a broad spectrum of user groups to create a high-rise that is open and welcoming towards much of the population. It is also envisioned that if the high-rise can become a part of the city and enhance the quality of the specific environment, it should contain a diverse program to provide a diverse frame of functions and activities for all. One of the major problems related to the general social issues are related to loneliness and sense of community. In that sense, the building should be able to create social interactions. This can be done through the architecture, by giving glimpses of the life inside the building and provoking informal meetings. These methods allow for the users, residents and visitors to experience the different narratives that unfold throughout everyday life of the building, and sometimes they overlap.

The age groups
The high-rise should be able to accommodate all kinds of age groups, but as users, visitors, and residents of the buildings. The youth have a hard time finding housing because of the high prices in Copenhagen. In addition, the students also have problems related to needing space for studying, working and recreational use. The elderly population also want to live in the city, but the city has been criticized a lot for not being friendly for the elderly, and for the living units to not accommodate their needs. The elderly has in common with the youth, that they space for social interactions and recreation. The elderly has a hard time walking long distances which is why public transport options and closeness to necessary living functions are essential. In comparison, the youth enjoy biking to their different activities. Both kinds of transport promote a green mobility perspective of the city. Through the development of contemporary society, many different family patterns do also appear, this means that one kind of plan cannot accommodate every kind of family. In addition, collective living and generational housing that suggest a more social agenda has been moving forward.

Communities across scales
All the user groups across ages – the residents, visitors and users are in a need for a sense of community. This will result in a better quality of living. For this to occur, the architecture and urban design of the spaces must provide the frames for meetings and social interaction that allows for a sense of community. This thesis proposes to divide the sense of community into different scales in which the high-rise must accommodate to create a sense of community for all.



Community for the city
The large scale community is achieved through inviting the residents and visitors of Copenhagen to explore and enjoy the newly developed areas of Jernbanebyen. This reqiures some main attractions that will make people want to visit which will be the repurposing of the old workshops and train facilities.



Community for the district
In the area of Jernbanebyen, each district will in itself emerge into a community in which the new development is able to support everyday life. In this case, the new high-rise development blends in with existing city, thereby creating new connections and activites that allows for meetings in the district.

Community for the high-rise
The high-rise contains smaller communities within the structure. In this case, the residents that life and work within the building have to share different aspects of everyday life. This means each persons gets a limited amount of squaremeters, but nevertheless, larger areas that encourages social interaction.

05 Analysis

This chapter will illustrate the analyses that has been laid out on the site of Jernbanebyen. Different types of analyses have been conducted to gain an holistic understanding of different opportunities and constraints of Jernbanebyen. From mappings concerning the functions, connections and preservable buildings to phenomenological descriptions of the materials, facades and spaces. Furthermore, the argumentation for the chosen zoom in area for the detailed design of the high-rise is here elaborated through the notion of critical points of contact. This area is also analyzed through different methods. Lastly, an summary that describes the opportunities and constraints.

Connections and infrastructure

Jernbanebyen is encircled at major infrastructural nodes that creates an urban island effect. Because of the closeness to the train station, means that all train connections from the train station must go through the northern edge of the site. The southern part of the site features the ring road the connect the periphery of Copenhagen with the city center which also means the road can be defined as a major road. Furthermore, the metro preparation area divides Jernbanebyen into two area.

The area does not connect to the existing city grid because of the large barriers that divides the site with the rest of the city. In addition, the infrastructure also presents the site with major noise pollutions that should be addressed. The new planned metro line and bus terminal means that there is a nearness to major public transportation nodes from Jernbanebyen.

There are opportunities for creating new direct and attractive connections across the city for, especially cyclists. Three axes across southern Copenhagen are desired particularly strengthened by the development of Jernbanebyen. One is the east-west connection from Kongens Enghave towards Kødbyen and the central Copenhagen. The other important axis is the connection between the western part of Vesterbro and Bavnehøj from the current tunnel at the western part of the site and towards Fisketorvet and further along the water. Thus, also connecting the district on the port's green cycle route network.

Two new connections are proposed by the developers in relation to the regeneration of Jernbanebyen. A future connection over the metro area at Jernbanebyen will become part of the north-south connection, while a possible future bridge connection over the rails towards the northern part of the site will also strengthen - the north-southbound connection between Vesterbro and Jernbanebyen as well as further over towards the harbor and Enghave Brygge. The routes must be connected through activities and experiences in Jernbanebyen.

The area of Jernbanebyen is located on a green connection that runs from SEB Bank to The Danish Building Authority. This green feature in a previously hard-to-reach part of the city, is a desirable quality of the area in which Jernbanebyen will be an essential part of being able to continue the connection into the area.

Public transport nodes

Green connection

Existing connections

Bicycle paths

Metro

Existing tunnel

Potential bridge/tunnel

28. Connections mapping

Spatial qualities of green axis

This section will address the spatial qualities of the green axis from SEB bank along Kalvebod Brygge to the site of Jernbanebyen. The whole path is not finished yet, as the construction of the cactus towers are ongoing, and the new IKEA building has not started its construction phase. However, in the plan for the area, it is envisioned green sloping roofs that connects all the buildings on the axis. In addition, there is also an emphasis on climate adaptation measures in rainwater management solutions. The site of Jernbanebyen needs to adapt to the existing plan for a new connection in the area which is why it is essential to understand the spatial qualities of the path.

The area starts at the SEB bank which features a recreational urban landscape between the buildings. Steps and sloping surfaces create a connection between the urban space and the different levels and allow for both play and stay. The use of white concrete combined with natural elements affords a bright lush area in a very dense context with huge shadows.

Moving into the area of Stadsarkivet's roof which features a long homogenous path containing small green niches on the sides. The small niches contain benches and are in the summer covered with creepers and covered pavilions that affords the niches a sense of privacy. At the end of the road on the Stadsarkiv roof, a new area presents itself from the superimposition line of sight. The Tivoli hotel courtyard is the next space which is a green courtyard area that is covered by tall buildings. The courtyard block features sculptures and green elements as tools for recreation. The tree in the courtyard decreases the notion of the large-scale building blocks and creates intimate environments in a dense area.

A bridge over a major road connects the Tivoli buildings with the new Hotel CABINN roofscape that features a lush green nature that gradually moves upwards towards a high viewing point. The envisioned plan for the area is that the roofscape on Hotel CABINN will continue top of the roof of the planned IKEA building and further on move onto the area of the Cactus towers. Arriving to the NEXUS CPH, the roof slowly moves downwards into ground level. The space between the NEXUS CPH buildings features a down sloping path that features open channels for water management and benches to experience the water and for social interactions. In addition, crossing walkways to connects the buildings covers up the space. The path continues in a hilly grass field landscape at the traffic tower on ground level. The path ends roughly at the entrance of the area of Jernbanebyen.

29. SEB Bank and City Dune

30. Rigsarkivet

31. Tivoli Hotel

32. Hotel CABINN

33. Nexus CPH

34. Traffic tower

Site characteristics

The huge site of Jernbanebyen features many different characteristics that are derived from the pragmatic planning and architecture of the railway-oriented spaces. The characteristics are divided into three different categories.

Facades
The diversity in the facade expressions varies a lot. Many of the facades are based on a pragmatic approach based on maximized daylight and entrances through big openings. The facades on the warehouses are characterized by the red brick structure that is to find almost anywhere on site. The redness of the facades varies from very dark brown red to a light pink red. Furthermore, the facades contain a rich tactility in the use of red bricks and different ornaments that are based on the buildings being from different times. Many of the facades seem to not be maintained that has led to nature slowly intervening and the presence of patina on the materials. In addition, many of the openings has been replaced with newer windows and doors that accommodates the demand for energy efficiency and indoor climate.

Buildings and spaces
The special character of the massive site lies within its use the red brown brick on the historic buildings. The red identity is clear when moving through the site. They are supplemented by the involvement of green elements. The buildings are huge in horizontal size, but not in verticality. Only a few towers, large factories and warehouses are in the area to provide landmark orientational functions to the site. The scale therefore relates to the human scale and provides the opportunity to experience the life in the buildings with the huge openings in the facade. The small intimate niches between the buildings are perceived as pleasant through the climate – as sun is given the opportunity to shine through. In addition, the black wooden barn buildings and yellow bricks buildings provides different dimensions the character of the site and offers clear contrast to red bricks buildings.

Landscape and pavement
The site is planned through a pragmatic approach based on principles related to the effectiveness and movement through different workshop areas. The planning of the site does not follow ordinary principles related to city planning, but however, provide a unique historic glimpse into industrial pragmatic planning. Trees are located almost everywhere in the area which at the time was a necessity for the workers to experience nature. The green area also provides pleasant environments and soft materials to contrast the moving efficient asphalt pavement. Most of the trees on the site are old which means they are tall and huge in size and varies from space to space related to the type, crown and base. In addition, the presence of old unused railway tracks is all around the site which are insights to what the areas used to be. These small stamps convey the narrative of the workers and residents of the area.













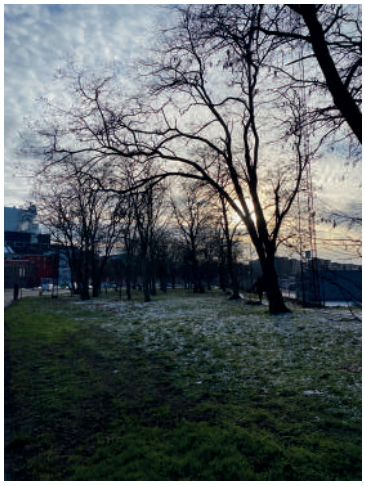











Preservable buildings and spaces

The buildings at Jernbanebyen dates back to 1903, over 120 years ago. It started as a maintenance/repairing workspace for train units, as well as a smaller railway station and water storage. New train technologies expanded the need for services and maintenance for trains and the need for general storage. The latest building was the new train workshop area in 1982. The new plans for the site, has moved the current functions of the site, such as the administration to the Traffic Tower just North-East and upcoming workshops facilities will be built in 2023-2027 north of the site which will locate them close to the current running train tracks.

According to the plans of Copenhagen, none of these buildings at Jernbanebyen are bound by law in relation to be preserved. The buildings are registered through the SAVE-method which is set out by the ministry of culture in which they are described to not have enough value to be preserved. However, it is described in the competition brief that some buildings must be preserved in some way or form. These demands are based on the wishes from the developers and landowners to attempt to rediscover the historic environments.

In addition, many of the remaining buildings are in this thesis defined as preservable in some way of form which is based on a vision to maintain much of the original structure and identity of the site. These buildings have been classified by the group as to be preservable because of the unique character and its affiliation to the historic environment. The interpretation of the buildings defined to be must preserved and buildings assessed to be preservable related to different interventions strategies can be studied throughout the following map. The notion of the special principles relates to experimental approach to exploit remaining elements, as these buildings are presented to feature very specific characteristics.

As a part of Copenhagen green vision, trees on site may be preservable if found qualified (Københavns Kommune, n.d.). On site, some of these trees have already been specified in the program for Jernbanebyen, but also parts that has been identified to be preservable that has been marked on the mapping. This is based on the character of the specific tree and its affiliation and potential into creating pleasant spaces.

Preserved in original form

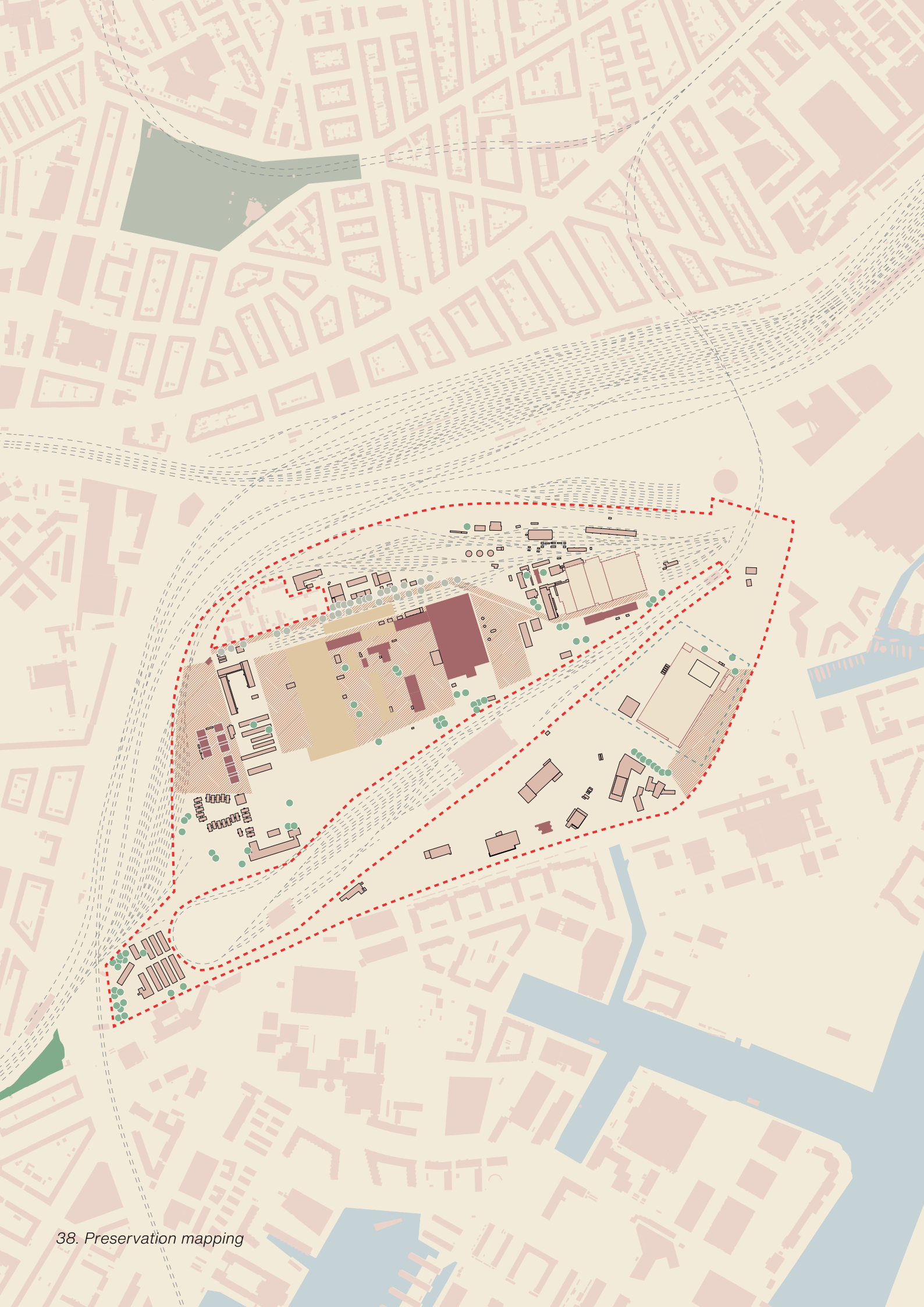
Structure and expression can be transformed

Special principles

City and landscape spaces

Trees worth preserving

Trees with preservable value



38. Preservation mapping

Timeline of Jernbanebyen

The Water Tower

”Skydebrohal”

Locomotive workshop

”Kedelsmedjen”

”Blanketlager”

1903

Extension by material feeding at Kalvebod Strand

1907

New established freight station

Electrical and saddler workshops

Train workshop

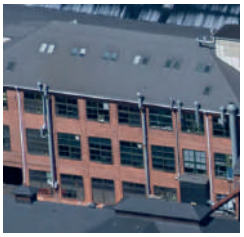
”Træladerne”

Old cooling workshop

1910

1915

1924



Electrical workshop

Workshop

Inspection hall

Storage and office facility

New train workshop

1949

1958

1982

39. Functions through a timeline of Jernbanebyen

Administration building

Boiler- and machine-house

”Jernmagasinet”

”Portnerboligen”

”De gule huse”

1908

New established central workshop

1909

Housing for civil servants

Trackmaster’s office

Lightrail train workshop

Pneumatic workshop

Main storage

1930

1933

1940

Allotment gardens provided safety and food during the war (1939)

Storage house

Technical plant

Alley trees

School

CPH Village

Unknown

Areas sold to the metro company (2005)

2018

Rental of the old buildings for offices (2009)

2020

Streetfood opens at ”Træladerne” (2009)

Functions and typologies

The site features a variety of functions. Most of the historic red brick buildings are currently used for workshop and maintenance related to train and railway activities. These buildings are occupied by DSB which is the national railway company. However, will some of the buildings in the future be free for other purposes. The buildings at “Den Gule By” are also still occupied by residents.

Some of the old structures in Jernbanebyen have been transformed into other purposes. The old wooden buildings currently house small shops and cafes, and some of the buildings used for railway services are now being used for offices. Temporary built structures have been placed on the western part of Jernbanebyen, they currently function as student housing and for education. These structures will be removed but is an indication of what is envisioned for the functions of the area.

The large halls have a unique typology and the other smaller buildings at Jernbanebyen can be characterized by either single family homes of point houses because of their free-standing location. The large halls were necessary to fulfill the different envisioned activities and are presented on this site as large-scale architecture. The large-scale buildings are currently functioning as landmark on the urban perception of Jernbanebyen and it is also the groups vision to maintain this perception.

The northern context of Jernbanebyen mostly features housing with other functions on the ground floor. The older apartments are located urban block structures that was between 3-6 floors which was characteristic in the old Copenhagen and its low dense style. The large courtyard inside the block offers greenery and outdoor spaces for the residents. The southern context mostly features fragmented pieces of point houses, row houses and blocks structures in an enormous scale up to 10 floors. The buildings on the other side of the ring road provides a wall for the noisy road and green spaces on the back. The southern part is mostly new development that is also based on the addition of land to create more habitable spaces.

It can therefore be concluded that Jernbanebyen is located at the intersection between the old north and the newer south. The site of Jernbanebyen in its context and building tradition should therefore be the transitional space between new and old which should be done by combining both.

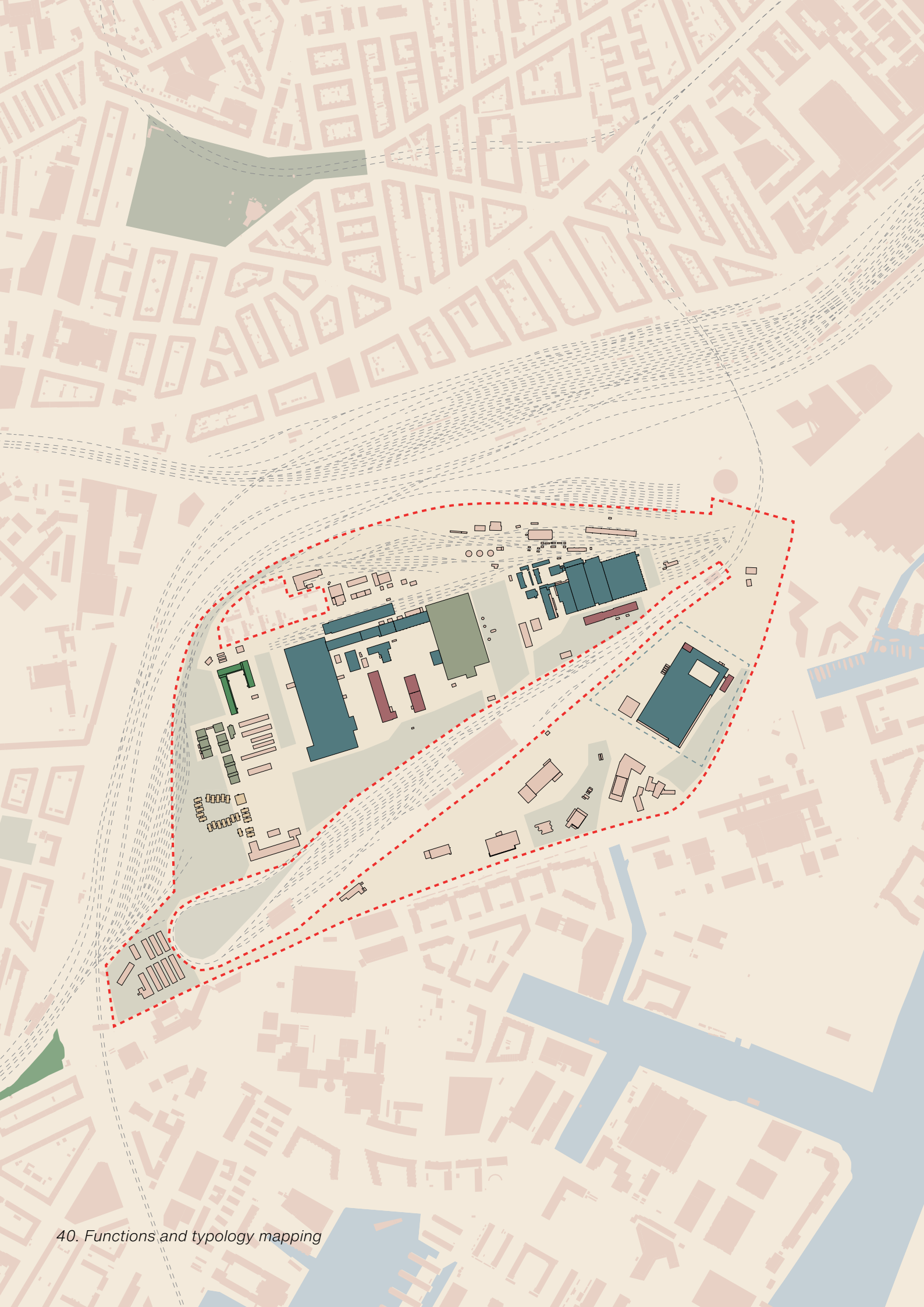
Workshop and warehouse

Culture and dining

Education

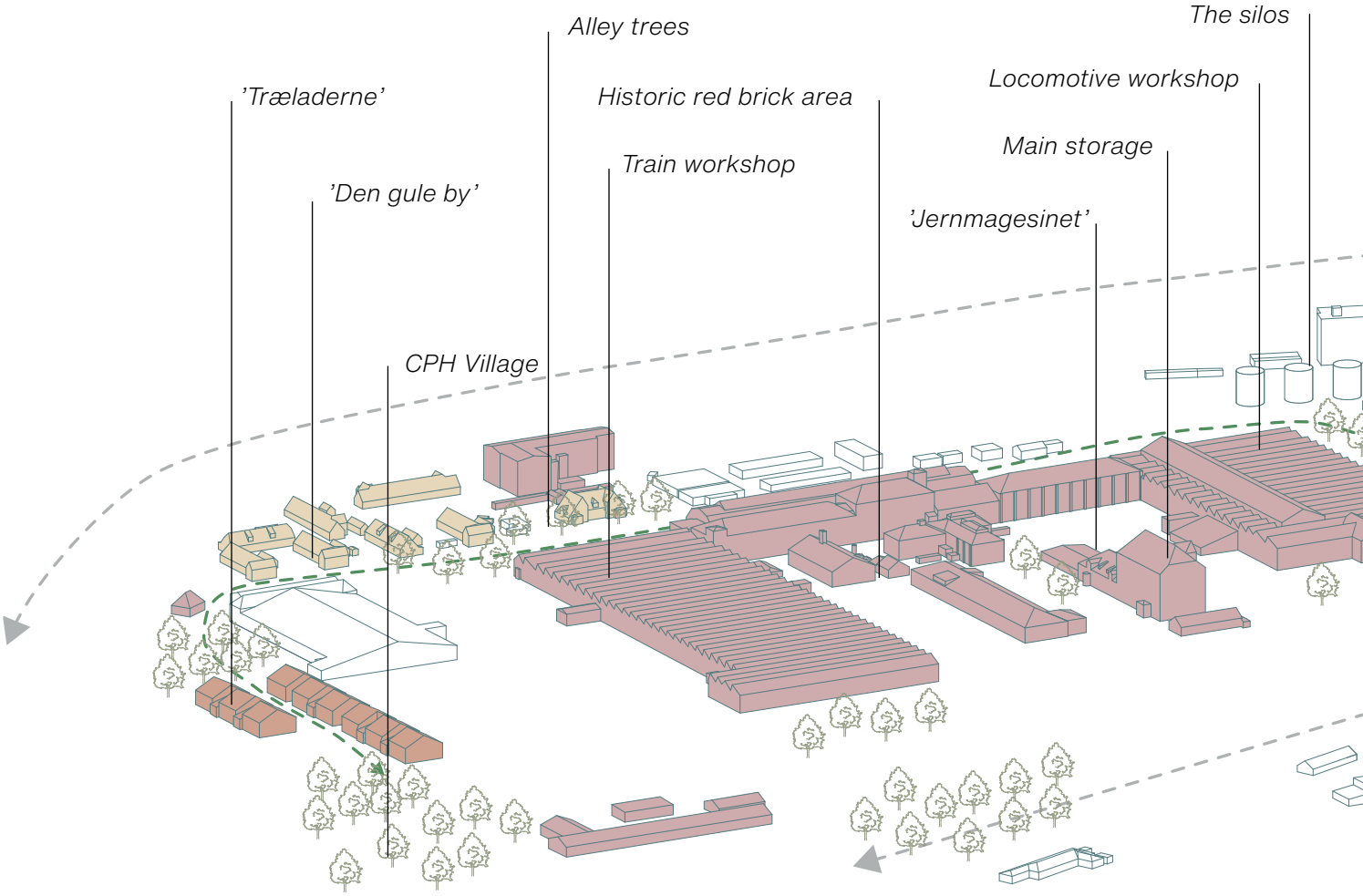
Student housing

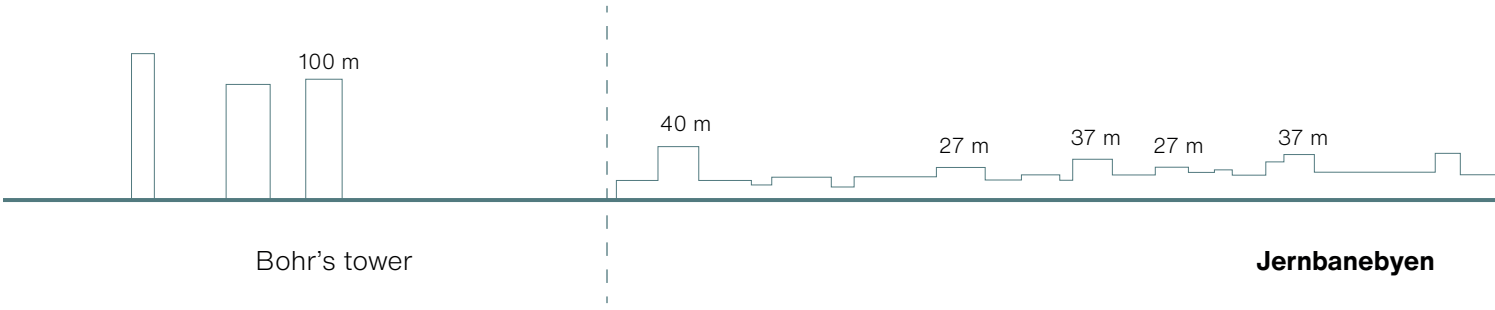
Offices

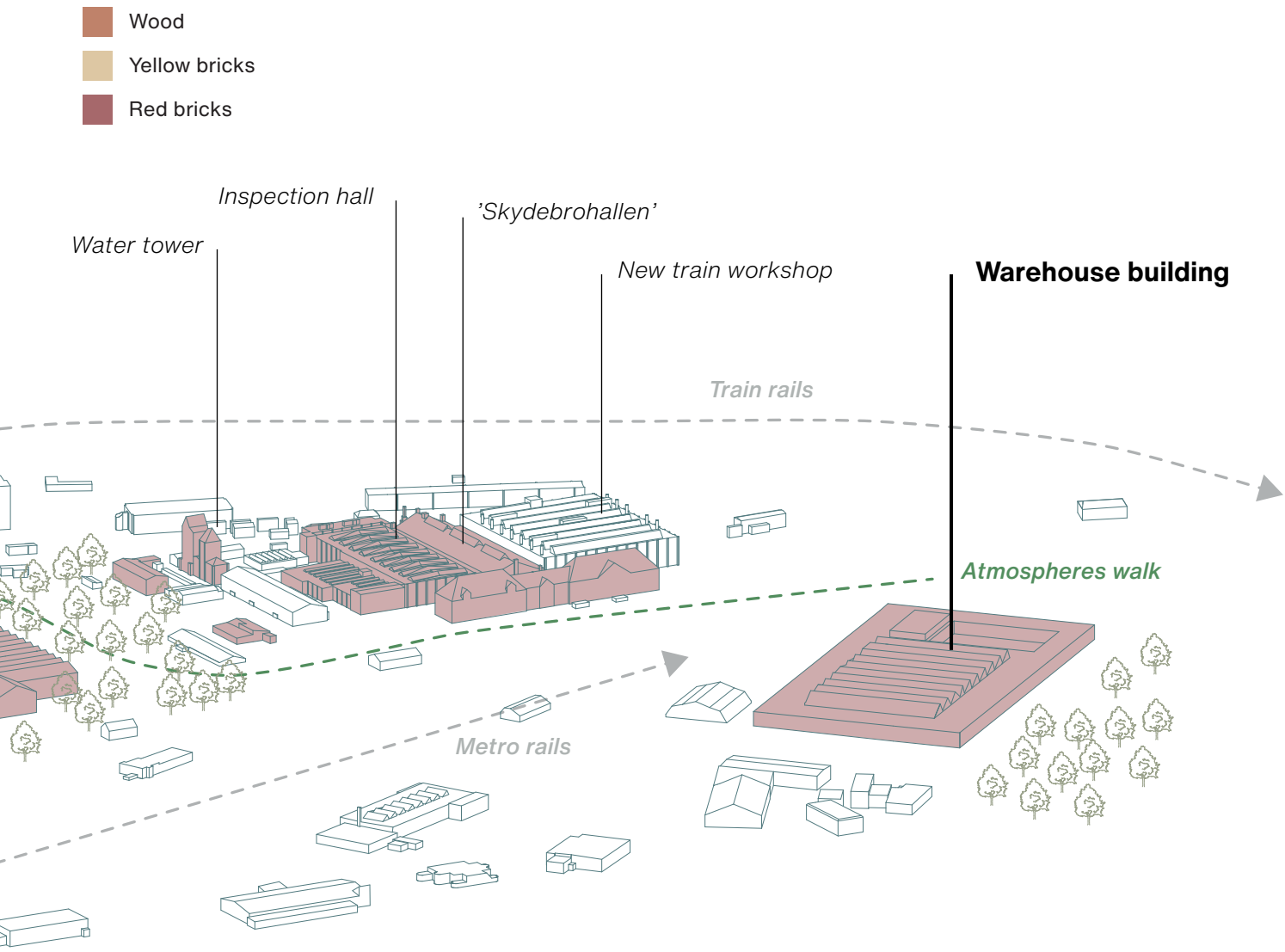


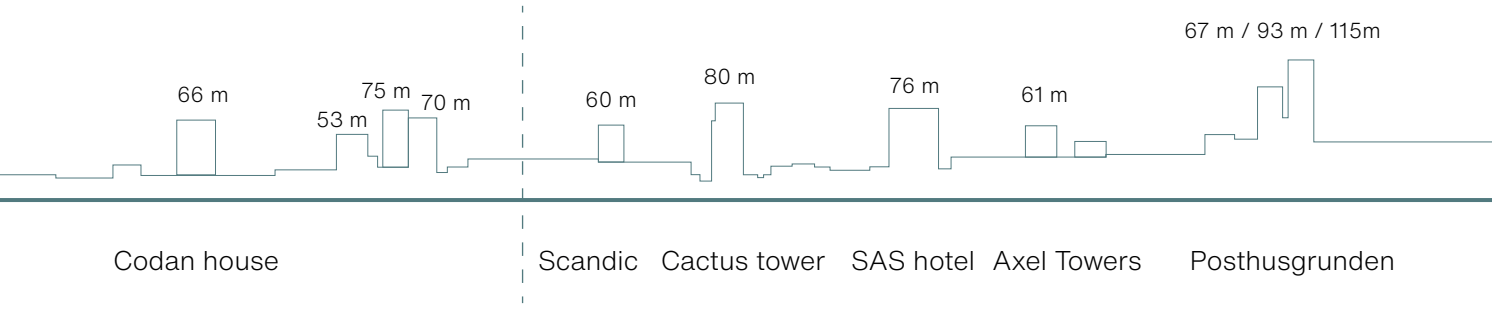
40. Functions and typology mapping

Materials and heights









41. Materiality at Jernbanebyen
42. Section of heights

Atmospheres

I peek through the fence. I see an aged red brick-façade staring at me. Its industrial glazed eyes indicate its tired and worn down. It is an early Thursday morning in February, the temperature is below zero making it hard to maintain the balance on the freezing grass terrain.

I take a step back on the pavement and continue down the street, its cold and my gaze again fall on another red brick building as if its color provided me with warmth and comfort - it draws me closer. For every step I take more details appear, the building has a gable roof but yet without a straight line.

The glazing on the windows were grey due to dust, as I move closer, I see every individual brick and not all of them are red, actually no brick piece is alike. It feels like this building is talking to me. Telling me stories, from each perspective, from each brick, each detail. It is as if the building has a soul, a spirit.

As I move deeper into the site, train tracks appear by my side as if the spirit is following me – I see the tracks slowly turn and obstruct the hard asphalt beneath me. I now have the story and the spirit right by my feet, the rusty cobber rail shows me its every wear and tear created by its many years of use. Now a new chapter is unfolding as the tracks, just like the brick building, is surrendering to natures inevitable touch.

As I look up, I find myself surrounded by nature and on a straight long street encircled by large trees. Even in winter it seemed clear that the nature is given time and space to unfold. The trees are grown out of proportion, the fence that was used as a divider is now the strong backbone of nature. Here I suddenly hear chatter and laughter – what seemed dead was alive. Surrounded by nature and life I wonder; what if it was summer?

While walking in the cold I noticed a color I haven't seen before. Between the green, grey and red colors bright yellow houses appear. It feels like entering a village, a hidden village.

As I pass one of the houses, I see their exposed entrances towards the street, yet the door is guarded by a small plant and a gnome facing me. This made me feel like I was trespassing. The houses are placed next to each other creating intimacy, intimacy that wasn't for me.

Continuing down the road I realize silence and peacefulness only broken by the train passing in the distance reminding me that I am still within a large city. I look around to see if there are others who noticed the train, but I only spotted a few elderly people, walking towards the same direction. Is it the same people who lived in these yellow houses? And where are they going?

I follow them entering a passage between two old wooden building and I suddenly find myself on a street with the old wooden building on each side, as if I were in a classical American western movie. It feels like I am entering a different era and now disconnected from the world.

The dark wood around me provides warmth and their two-story height provides safety and shelter from the cold February wind. Looking around I see clues of an eventful December. The pine tree is still standing, and lights are still dangling above me.

I find a wooden bench just like the wooden building it invites me to sit. As I sit, I start to think – this is a very different site visit. It was an experience that got me though different scenes as if they were taken out from different places and eras of the word, giving me a lot to process. What did I just go through?

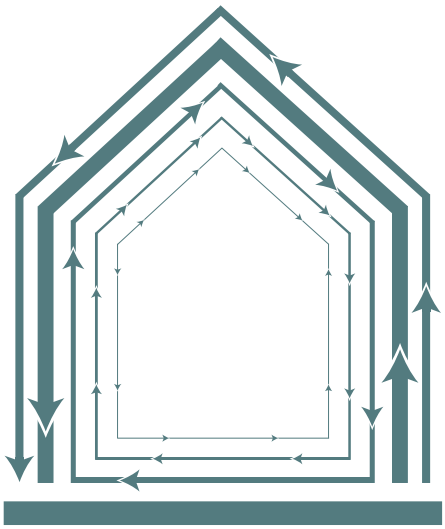
43. Atmospheres, February 4 14:32. Jernbanebyen, Copenhagen

Warehouse at Vasbygade

The warehouse at Vasbygade 10 has been chosen as the building that will be transformed into a high-rise. The most essential quality of the building is its low height and large wide structure. These features can be essentials tools in downscaling the high-rise into human scale. The SAVE-value of the building is low, and it is not protected as a preservable building. In addition, there are no demands to how it should be intervened and transformed which is why it is placed under the category of transformed with special principles. This allows the group to deploy many different approaches to the building whilst still attempting to maintain its identity. The warehouse has the potential to be reused through its flexible plan layout into other contemporary functions that does also require flexibility which can enhance everyday life activities.

Most of the building's interior are outdated, however does the structural system consisting of concrete still stand. When adding layers on the existing structure, there will also be a need to strengthen the existing structure or just create a new structure that merges in with the existing grid. The unique triangular roof structure allows for daylight into the middle of the large building. The wall of the building features a unique red brick that is smaller than the usual brick. The walls are used as stabilizing elements; however, it can also be interpreted that the many openings in the wall for ports did not weaken the stability of the system which is why the wall can be intervened in some way.

The warehouse did once provide the framework for work life. The new development should also be able to accommodate that notion to maintain the social spirit of the place. The functions in the high ceiling warehouse should be functions that require the same properties. In addition, also accommodate the nuances of everyday life and emphasize social interaction and public spaces that should be in the atmosphere of the place.



SITE - permanent

STRUCTURE - remains (almost) unchanged during a buildings lifetime -> 50-100 years

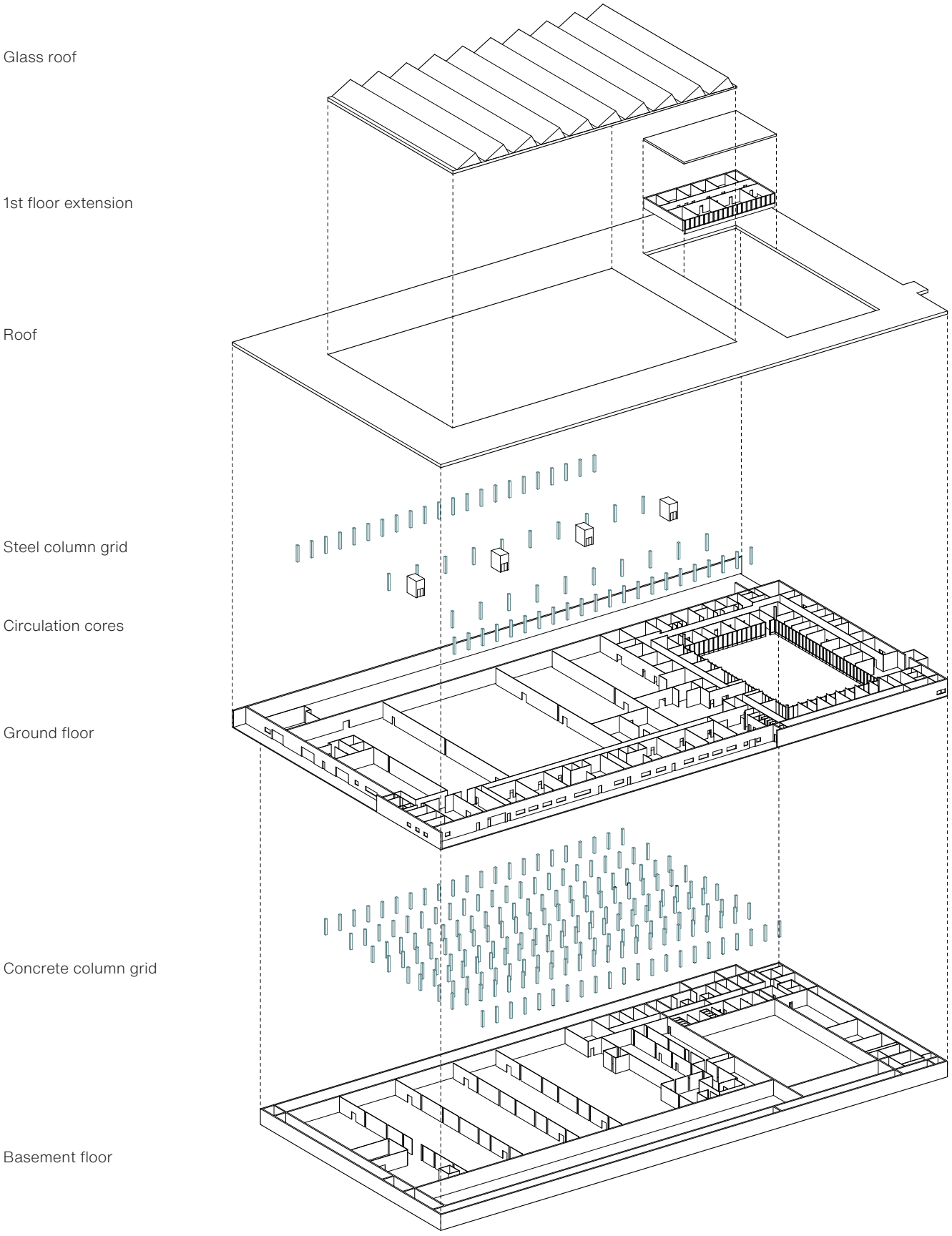
SKIN - the components of the facade has a lifespand of 20-50 years

SERVICES - the technical installations changes after 10-30 years

SPACE PLAN - the plan layout can be changed after 5-10 years

STUFF - surfaces, furniture and other 'stuff' are replaced after 1-5 years

44. The lifespand of a building



45. Exploded view of the warehouse

Registration and existing drawings



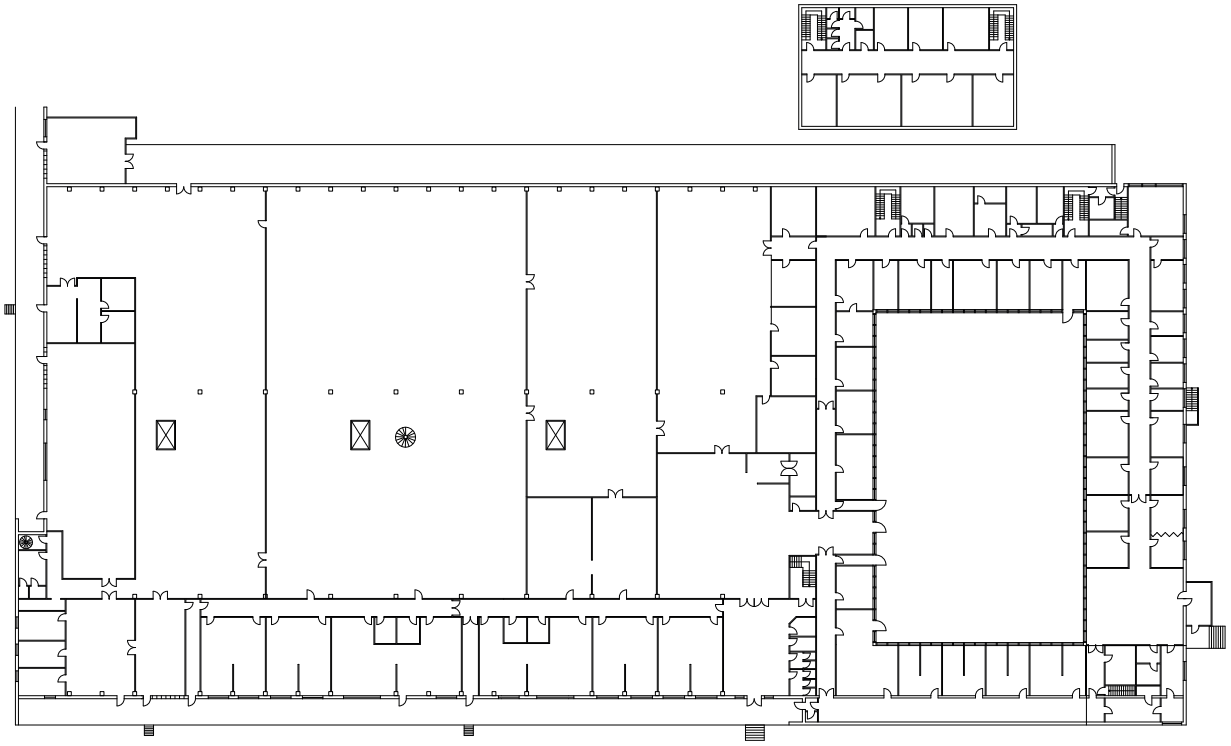




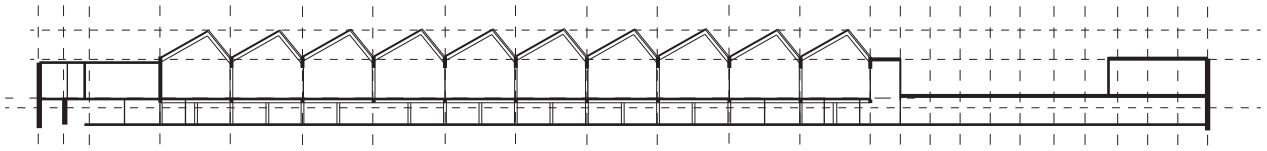


On the site visit, the different qualities of the building appeared. The large courtyard, the triangular roof structure, the red bricks, and also the railway tracks that appears to be both inside and outside of the building. These qualities considered when transforming the warehouse into a high-rise.

46. Photo registration of warehouse



47. Ground floor

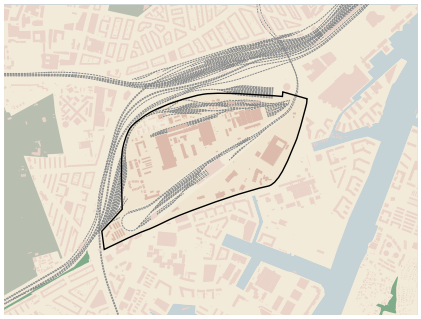


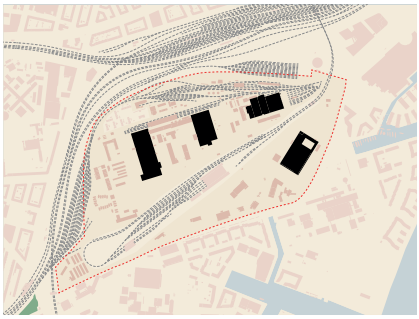
48. Section

The ground floor of the building can be divided into two main area; the offices around the courtyard and the bigger storage areas that are now divided into sub areas because of fire safety regulations. The unique triangular roof structure can be seen in the section as the most defining characteristic of the area.

Analysis summary

The analysis is summed up through six main points that are divided into two main themes. The first theme being structures that concerns how the unique structure and forms at Jernbanebyen shapes the future developments. The second theme concerns the character of the place, the spatial environment and layers of time that unfolds on the site. All the points are used as indicators and guidelines to how the high-rise will merge in with Jernbanebyen.





Urban island
Jernbanebyen is isolated as an island surrounded by roads and rails. Historically, the isolation has made good sense in which DSB's workshops required special safety measures. The isolation is today is a challenge because access conditions should be improved to ensure a better connection with the adjacent neighborhoods and the rest of the city. However, also an opportunity to create a oasis in the city.

Tracks as structure
The rational and pragmatic logic of the workshop characterizes the area. Halls, rails and shooting ranges form straight angles with each other that ensured efficient workflows. The historical remains form the structures of the area. The tracks of the past sets out directions for new structures and intertwines with new layers of the city. Therefore, also a potential that also sets the framework for new development.

Large scale architecture
The work on the train carts required a lot of space. Huge halls therefore characterizes Jernbanebyen. The large volumes of the halls are unique feature of Jernbanebyen, which should be continued and strengthened in the new development. The scale gives identity to the area and traces back to the industrial history. The large space of the halls provides space for many people that can meet and interact.

49. Structures






The green identity
Today, the area is characterized by large trees and many spontaneous green elements in the former railway areas, gaps, cracks and curbs. The vegetation has the potential to continue to be a valuable contribution to the overall green plan for the area. In addition, the green identity of the area could benefit the continuation of the green axis in Copenhagen, thereby enhancing the Fingerplan.

Spatial traces of time
Utility architecture is rich in details, materials and tactility. The buildings dates back to different times that have made Jernbanebyen a complex and diverse place. The interior features advanced constructions and special daylight conditions that creates unique spatial experiences. The buildings offers a look back in time that will benefit the identity of the place related to the new developments.

Work and community
One of Denmark's largest workplaces was right here once. It is now creative forces and companies that create life. The area should be able to accommodate every aspects of life. It should generate architecture that gathers worklife, homelife and a sense of community to enhance social interactions. In addition, the facilities on site should be in the spirit of the production history.

50. Character, environment and layers of time

06 Program

This chapter presents the program part of the thesis related to the problem statement and vision of the design proposal. Furthermore, an in-depth description of the master-plan of Jernbanebyen and the program for the high-rise that will be detail designed. An argumentation for the chosen proportions of the high-rise is here also explored. At last, design criteria based on all the knowledge gathered that will guide the design process.

Problem statement

How do we create a new typology of the high-rise that is welcoming and inviting through its understanding of the human scale. A high-rise that seeks to merge and connect with the existing urban fabric and local cultural identity of Jernbanebyen to form new narratives. A high-rise that gathers and connects all people across cultures, classes and backgrounds to enhance the quality life for all. A high-rise that aims to become a social organism through collaboration, social coherence, sense of community and interaction by rethinking the current hierarchy of people, functions, circulatory systems, and technical clusters?

Vision

The high-rise is envisioned as a social organism that allows for collectives, communities, and collaborations to thrive. It emphasizes the social design in its private, semiprivate, semipublic, and public functions, places, and interactions, providing the opportunities for social and individual company across several user groups. It should gather people across all aspects of life and the building should be able to provide glimpses into each other's lives through the different spatial experiences.

To be a part of a community and share your life through an exciting and active everyday life – a community and neighborhood across scales. In addition, in its materiality and form create the notion of an open high-rise that invites all in to use it. Being able to accommodate and enhance the dynamic everyday life activities. The functions in the high-rise should reflect upon the production and workshop history of Jernbanebyen. With the human scale at the main point, the high-rise has to accommodate the balance between relaxing and dynamic city life and offer both.

The preservable building in its urban and architectural principles, gestures the people of its historical past. Creating a cultural heritage that can make the high-rise culturally adapted into the existing urban environment. These principles will have to be respected as a part of its own, and less interfered as the transformation of the site takes place. Through the transformation of the existing warehouse building, should the high-rise be able to narrate the journey from old to new and show the historic traces - through its functions and spatiality.

The form should generate curiosity and be welcoming in a way that the high-rise can be perceived to enhance the life of the neighborhood for residents, users, and visitors. An strive for generous and pleasant architecture, as the urban spaces should respond to architectural volumes in a way that satisfies both spaces. The facades and roof, and urban environments must implement water strategies to prevent overflooding and engage urban ecosystems.

The high-rise should merge into the newer development plans of Jernbanebyen and enhance the notion of the green axis throughout Copenhagen. In addition, join into the existing visions for the city concerning green mobility, a green city and car free zones. The noises from the different infrastructural elements must be reduced to comply the pedestrians, cyclists and habitants using the site in their everyday life. However, the infrastructures must not completely disappear in a visual manner, as it enhances the experience of the site, opens, and possibly joins the site to the rest of the city. The vision for the masterplan will be presented on the following pages.

High-rise program

Functions	Sqm per units	Units	Total floor area
Living			**11405 m2**
Singles unit	79 m2	25	1975 m2
Couples unit	108 m2	29	3132 m2
Family unit	82 m2	25	2050 m2
Washing/Laundry room	15-50 m2	9	292 m2
Common rooms	15-430 m2	38	3956 m2
Working			**19103 m2**
Office space	250-900 m2	17	8500 m2
Workshop space	1300 m2	1	1300 m2
Startup office space	70-600 m2	8	2110 m2
Creative office	450-900 m2	2	1350 m2
Food production	150-300 m2	5	1050 m2
Brewery	800 m2	1	800 m2
Eatery	61-500 m2	11	2843 m2
Supermarket	1150 m2	1	1150 m2
Recreation and activity			**3227 m2**
Fitness	150-480 m2	3	980 m2
Observation deck	182 m2	3	546 m2
Rooftop terrasses	165-900 m2	5	1701 m2
Culture			**3650 m2**
Exhibition spaces	500-650 m2	3	1650 m2
Gallery/Showroom	500 m2	4	2000 m2
Knowledge			**2240 m2**
Study rooms	70-230 m2	11	1740 m2
Library	500 m2	1	500 m2
Necessary			**5265 m2**
Recycling areas	20-50 m2	11	340 m2
Circulation	4480 m2	--	4480 m2
Post office	445 m2	1	445 m2
Total			*~45000 m2*

Tactility Scale 1-5	**Acoustic**	**Height**	**Social generater** Scale 1-5	**Daylight** Scale 1-5	**Feeling**
5	*Quiet to*	2,5 m	3	4	*Intimate*
5	*medium*	2,5 m	3	4	
5		2,5 m	3	4	
4		3,2 m	4	2	
3		3 m	5	4	
3	*Medium*	3,5 m	3	5	*Concentration*
3	*Loud*	4,5 m	4	2	
3	*Medium*	3,5 m	4	5	
2		3,5 m	4	4	
3		3,5 m	4	4	
2	*Medium to*	4,5 m	4	1	
2-4	*loud*	3,5 m	2	2-4	
2		3,5 m	3	2	
					Energetic and
3	*Loud*	4,5 m	2	2	*emotional*
2	*Quiet*	3,5 m	2	5	
4		--	3	--	
1	*Quiet*	3,5 m	1	1	*Reflective*
1		3,5 m	1	1	
4	*Quiet to*	3,5 m	3	5	*Concentration*
3	*medium*	3,5 m	2	1	*and collabora-*
					tion
4	*Medium*	3,2 m	4	1	*Including and*
--	*--*	3 - 4,5 m	5	--	*social*
2	*Quiet*	4,5 m	1	2	

Function synergies

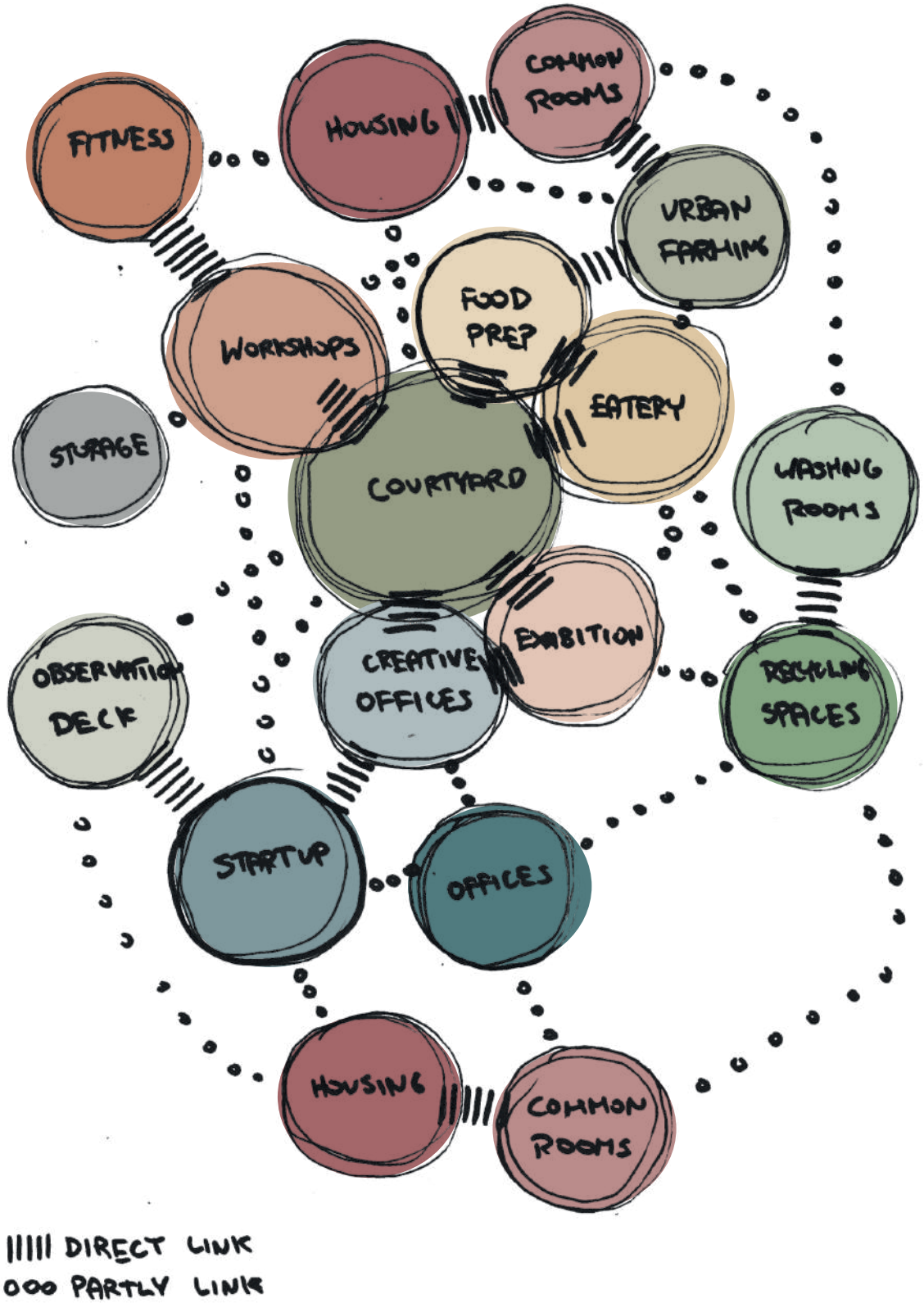
A high-rise tower (either for dwellings or offices) provides us with little integrated experience of its form, or of excitement of rising through its many layers. Somehow, each deck of a tower or slab must be transparent to us, and each level of activity must be unique. Then, and only then, will we sense three-dimensional linkage. This type of linkage is necessary because we will be building more high buildings as land in our cities becomes scarcer. It is possible because our building techniques and our love of communication makes it so. - (Maki, 1964)

This sets the tone for how the functions should be merged. The high-rise functions should be combined and merged based on their ability to create synergies. The linkage between the functions will be spatial glue that can be formed in many ways. The necessary spaces are key spaces that connects the high-rise. The flow of people represents the diversity of the program and people in the building. The circulation points are where functions merges, and people interact with each other. The necessary spaces mark the transition to between all the different spaces. The functions should in their individual qualities improve life for the residents and users, however, the functions in relation to each other could create even greater spaces and gesture the everyday life. Spaces that break down differences between the different users and residents to ensure diversity and social relations. Spaces that allow for people to observe and experience the different narratives and lives that unfold in the building, and sometimes also engage and interact in other narratives.

Living
The living areas contains the most intimate and personal secrets. However, it can also be criticized for being to individual and private which is why the high-rise will emphasize collective and social living. Being able to live together and share your life and know you neighbor and the people using and working in the building.

Work and knowledge
The workspaces represent an introvert and private sector that does not allow for much transparency. Workspaces emphasize concentration and productivity. It is believed that the spaces could offer quality to the public sphere by offering glimpses into the work and for workers to engage with the public. In addition, to also emphasize collective workspaces to create better opportunities for collaboration, interaction, and knowledge sharing.

Culture and recreation
The cultural and recreational spaces of the high-rise are spaces for self-expression and social development. They represent visions and critiques of society in which the spaces are for discussion through social gatherings and individual experience. The spaces also represent areas for dynamic activities and offers a break from the mind. These spaces could synergize well with other more necessary daily functions to expand the mind and enhance the quality of everyday life.



51. The five linking acts or operations (Maki, 1964)

Design criteria

The form should be generated by social interactions rather than the need for verticality in the city

Enhance the strategy throughout Copenhagen related to continuing the green axis along Kalvebod Brygge, thereby strengthening the fingerplan

Merge into the new visions for Jernbanbyen concerning creating an oasis in the city, prioritze soft mobilities and, nature, and an emphasis green public spaces

Accommodate the needs for everyday life related to living and working, furthermore be able to enhance the quality of life in all those aspects

The materials and structural principle should be in an tranparent character that allows for residents, users and visitors to discover, explore and get glimpses into the different narratives that unfolds in the high-rise, but also creates small intimate spaces for reflection

Ensure diversity and create social interactions and informal meetings between residents, users and visitors through the merger of everyday functions and quality necessary spaces

Exploit the qualities of the existing building and adjacent areas to ensure a cultural narrative and identity of the existing spaces. In addition, the functions of the high-rise should also correspond with the site's production tradition

Enhance historical identity and nordic tradition of the site through the high-rise concerning materials and form while also using sustainable building strategies

Open up to the street through a diverse use of active facades and functions on all floors. In addition, an emphasis on public, cultural and recreational functions that attracts people

Exploit the high-rise to provide solutions for handling climate change events. In this case, provide local water management interventions that will also enhance the recreational character of the high-rise

07 Presentation

The following chapther will present the design proposal through drawings and diagrams. Firstly, the concept is presented and then it dives deeper into the concept in all its aspects and dimensions starting from the site plan to detailed drawings. Secondly, the four chosen critical points for detailing are presented and lastly the technical considerations that have been integrated into the high-rise.

Concept presentation

The theoretical, analytic, and programmatic explorations in combination with the design process has led to the design concept of the new high-rise at Jernbanebyen. A concept that aims explore the boundaries of the high-rise and thereby re-thinking the structure in terms of all its potentials and challenges. A project that promotes a new type of social sustainability within the high-rise by re-thinking the programming of functions, spaces, and clusters. In addition, a project that positions the high-rise at an emphasis on cultural appreciation of existing structures in our historic environments by construction the high-rise as an addition to an existing railway warehouse.

Urban island and a part of the city
The notion of the island is still intact in terms of its unique functions and facilities concerning its historic identity. In addition, it now offers connections through the city emphasizing how the high-rise is now a part of the green axis running throughout Copenhagen.

Tracks and identity
The existing tracks that run throughout and along the high-rise provides a narrative that the newly transformed high-rise was once another kind of place. The existing traces provides a look back in time that ensures that the high-rise maintains an identity in the historic environment that is recognizable for the specific context it is located in.

Large scale architecture and the human scale
The large-scale red brick warehouse building is used as a tool to create a welcoming structure that is more related to the human scale. The warehouse is wide and low in height, thereby providing an excellent base for a new building addition that emphasizes the human scale.

The green identity and resilience
Jernbanebyen has always been an area that features a green identity. It is further envisioned that the high-rise should be able to maintain and enhance the green identity in the area. Another layer has been added to it by considering climate adaptation measures.

Spatial traces of time and sensorial experiences
The new high-rise addition collaborates with the existing structure to create dynamic and exciting spaces. The old spatial potentials with its tactile red brick façade and unique roof structure combined with the new structural principle that invades spaces allows for a spatial journey from past to present.

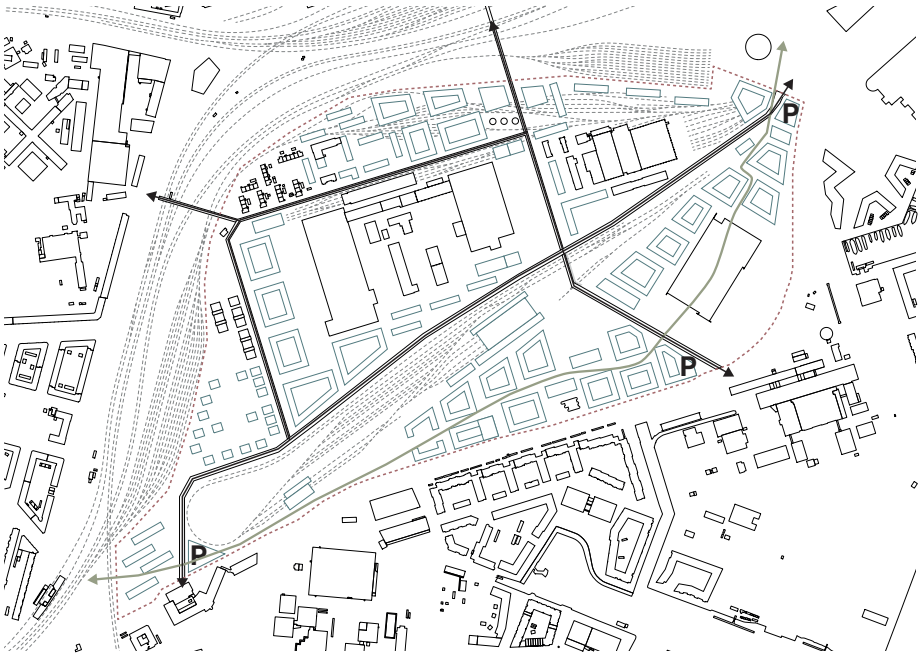
Work, community and the social
The functions of the high-rise are derived from the production tradition of the area. It also emphasizes the notion of community and the collective by merging different functions and creating social spaces throughout age, diversity, social status etc. In addition, exploits notions such a collective living, collective working, and gathering spaces to promote a higher degree of social living.

52. Presentation

The masterplan

Mobility
Jernbanebyen is emphasized as a car free area which means that there will only be cars for necessary uses. Parking facilities are located at the outskirts of the site and all the roads are made to accommodate walking and biking. The areas between all the built structures will be pedestrian friendly intimate streets.

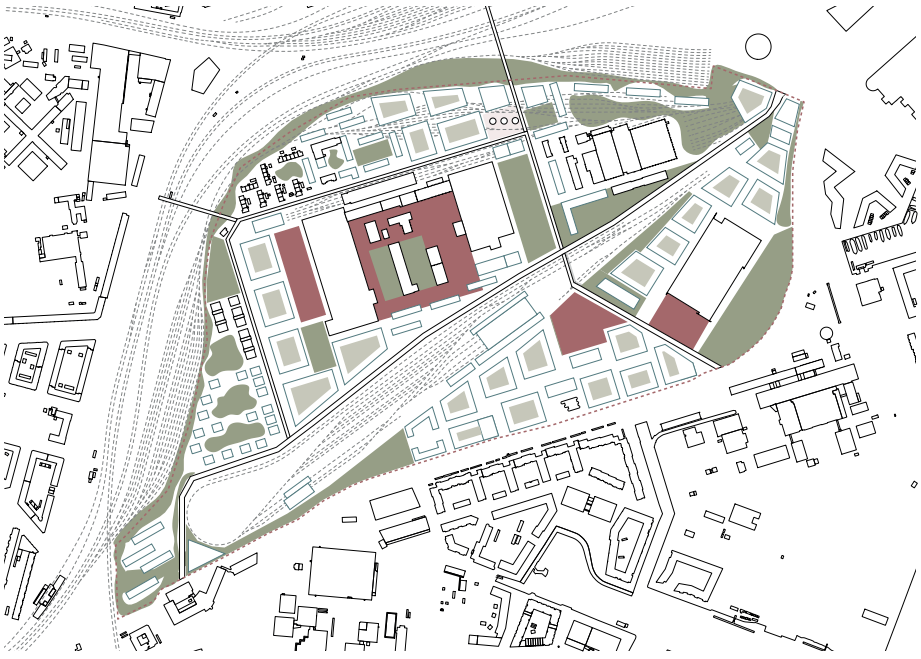
Major parking areas P
Main connections
Green axis



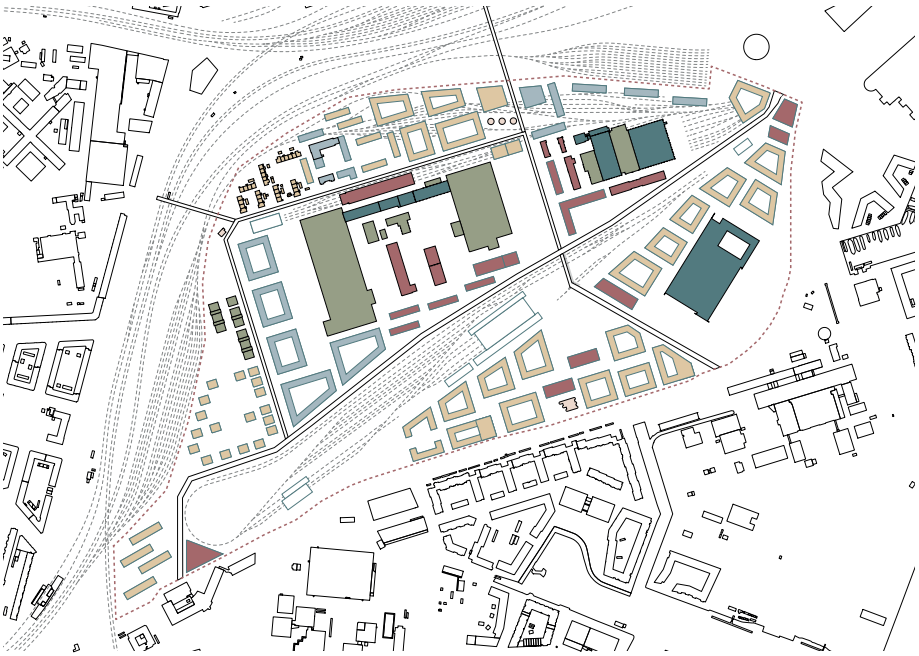
53. Mobility

Green spaces and squares
The green identity is the tissue the binds Jernbanebyen together. The masterplan emphasizes many green spaces and public squares that also functions as noise reduction for the larger infrastructure elements. In addition, the courtyards does also feature a green character. The green traces also continues the green axis through Jernbanebyen.

Green character
Green spaces
Squares



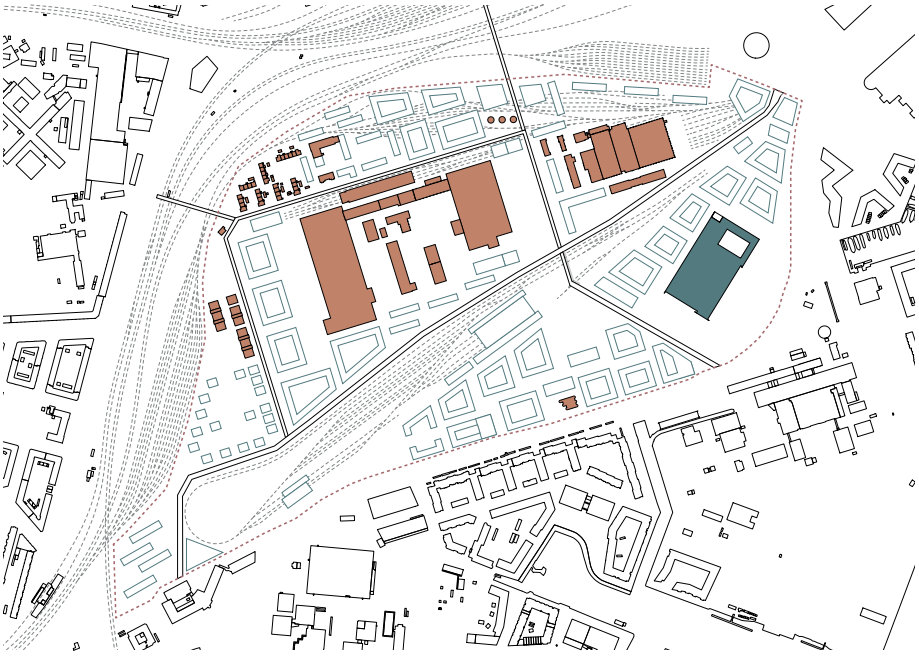
54. Green spaces and squares



Functions
The northern part of the site will mostly hold the cultural and public institutions, whereas the southern part consists mostly of housing and in smaller percentage of other functions.

Mixed
Culture and dining
Public institutions
Housing
Offices and shops

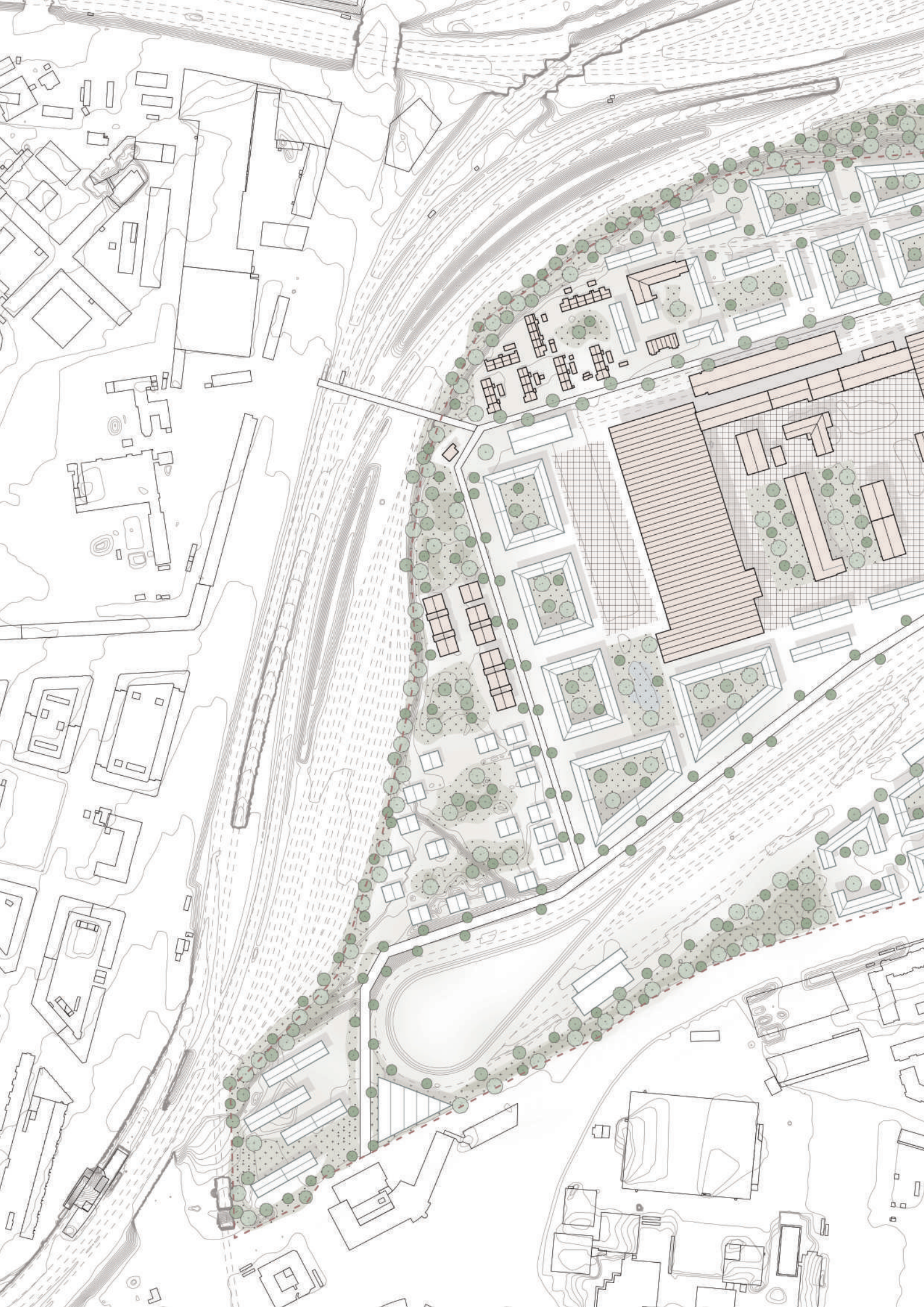
55. Functions

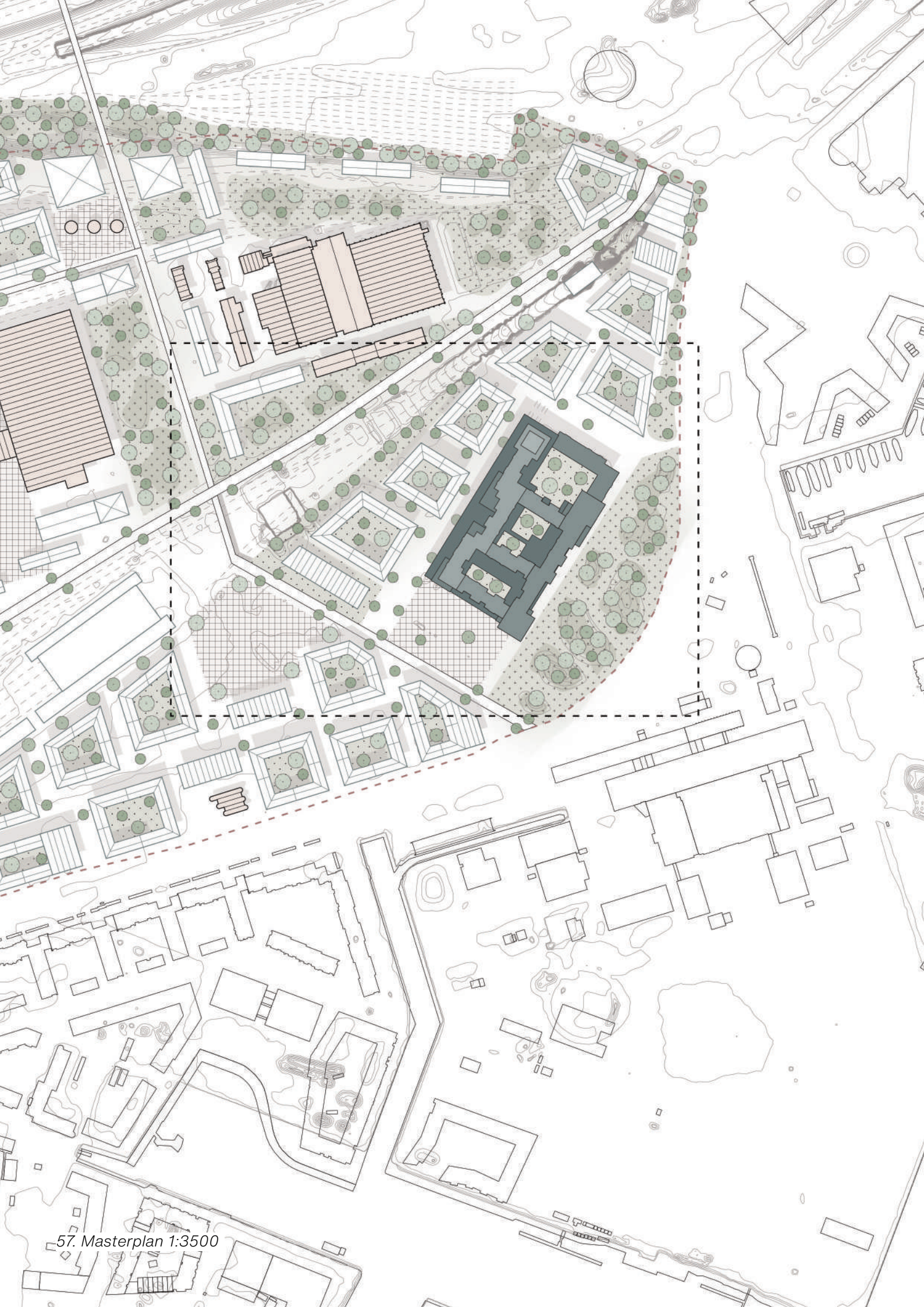


Preserved buildings
Jernbanebyen is filled with building with preservable characteristics in terms of maintaining the historic environments. All the large scale structures and unique small buildings have been preserved. The larger structure will still maintain its landmark trades at Jernbanebyen through is preservation and transformation.

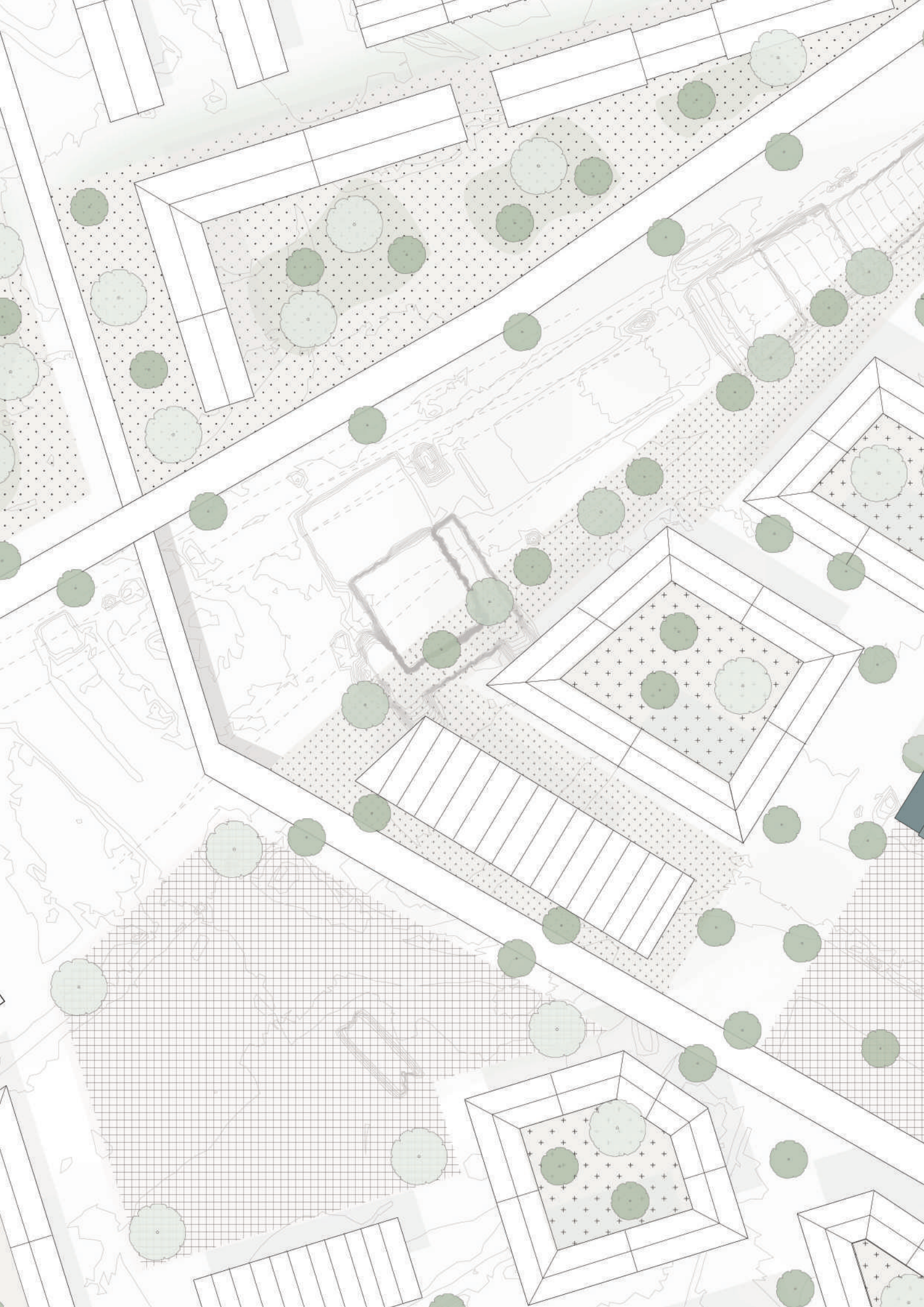
Transformed into high-rise
Preserved

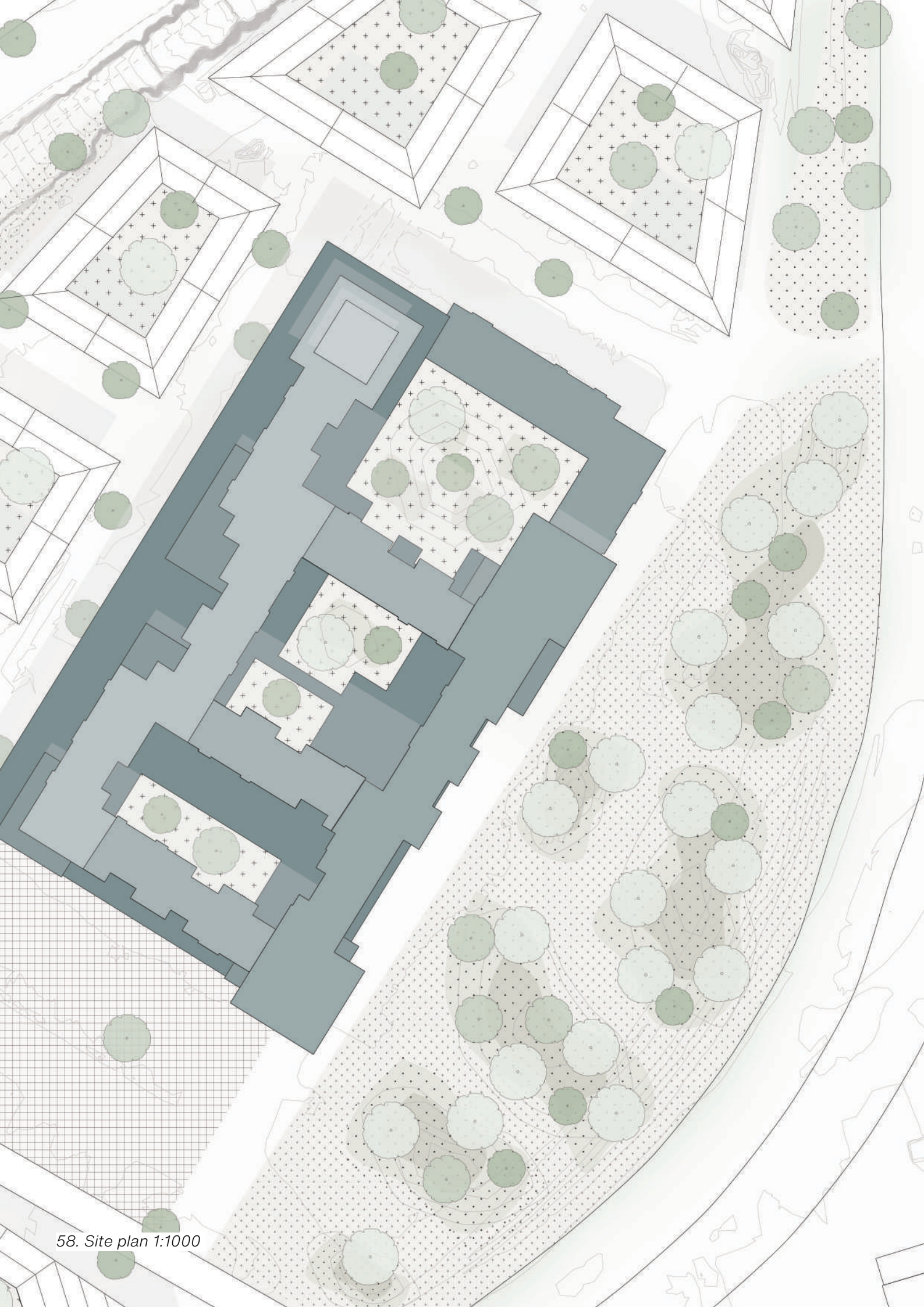
56. Preserved buildings



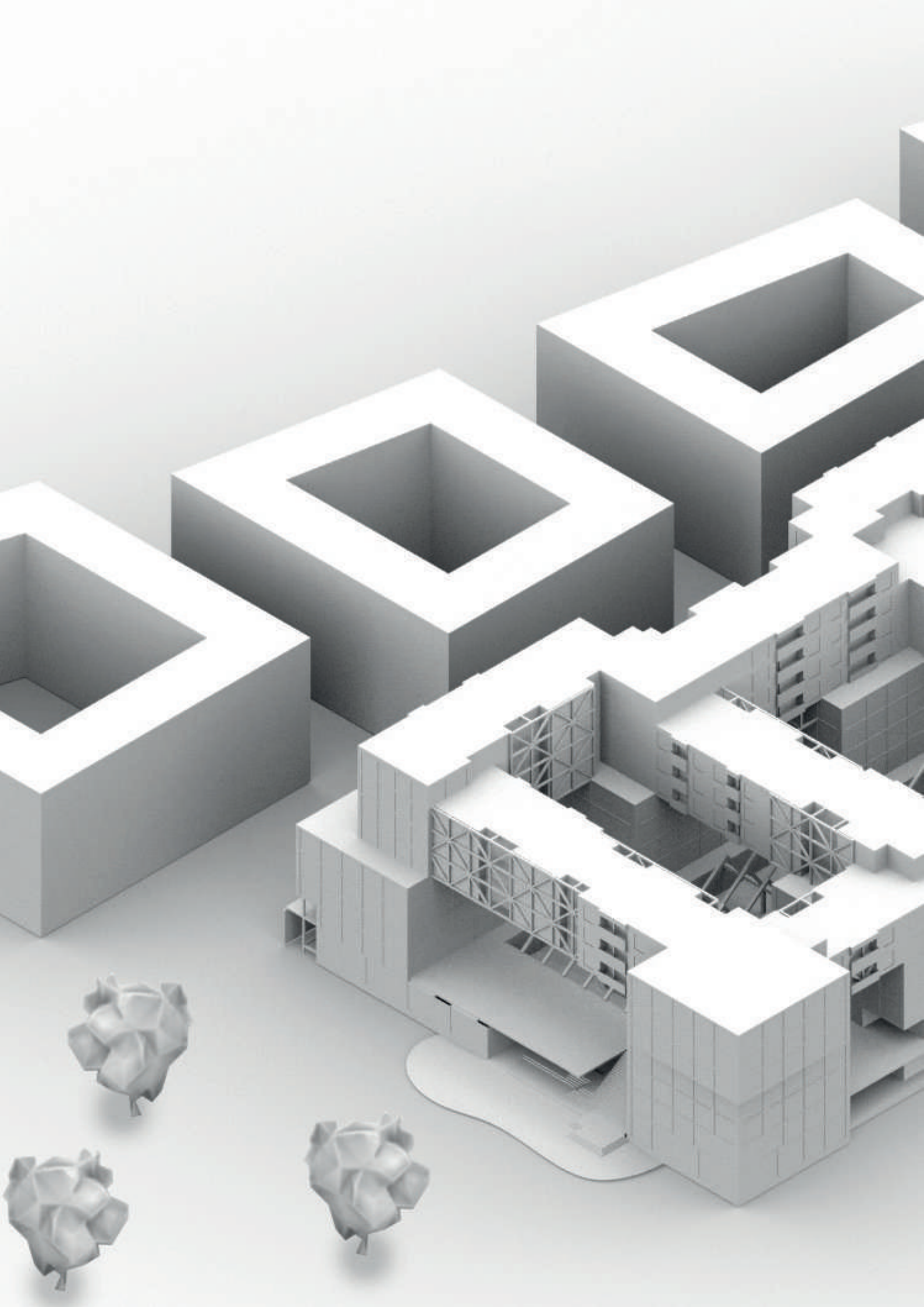


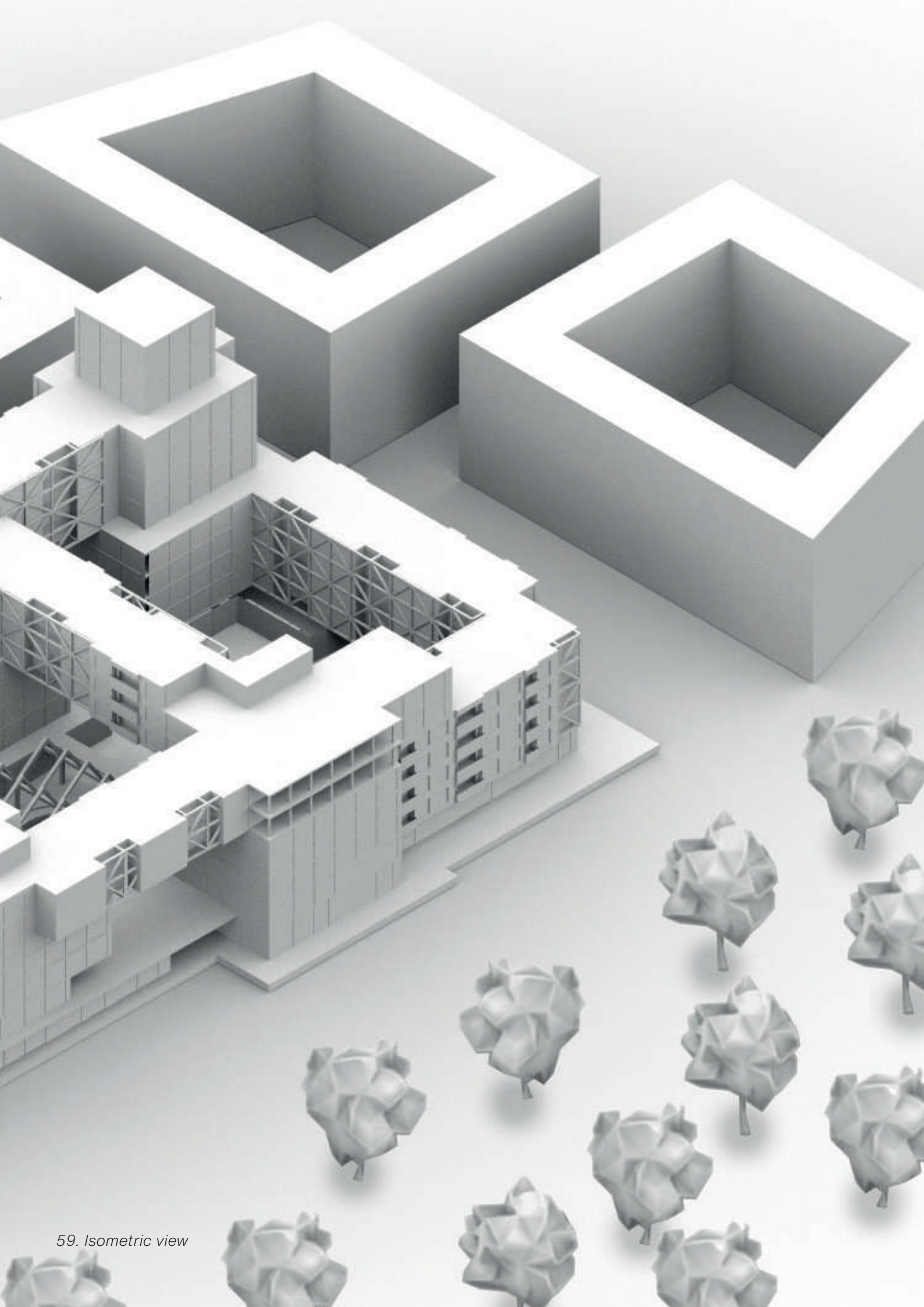
57. Masterplan 1:3500



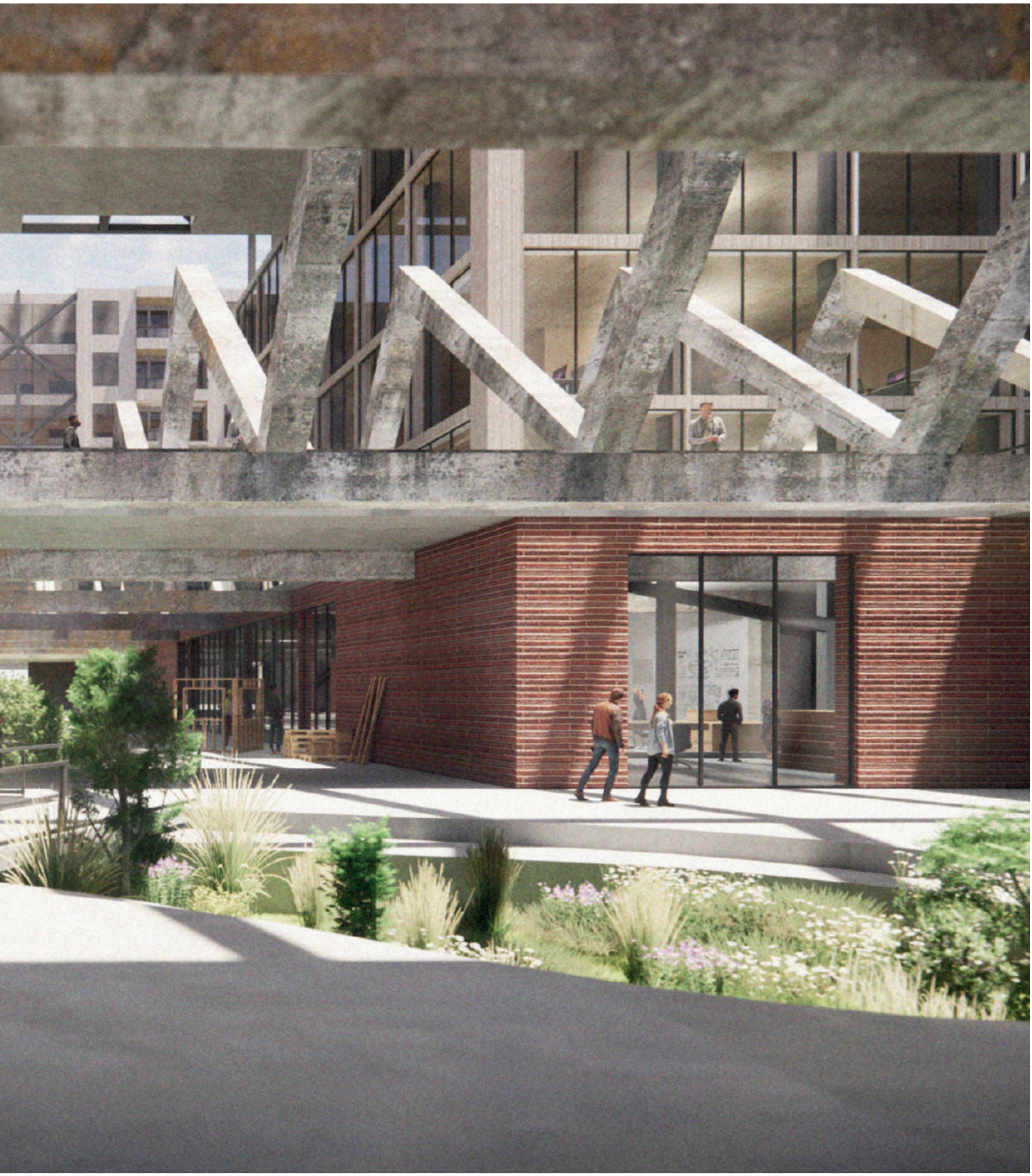


58. Site plan 1:1000

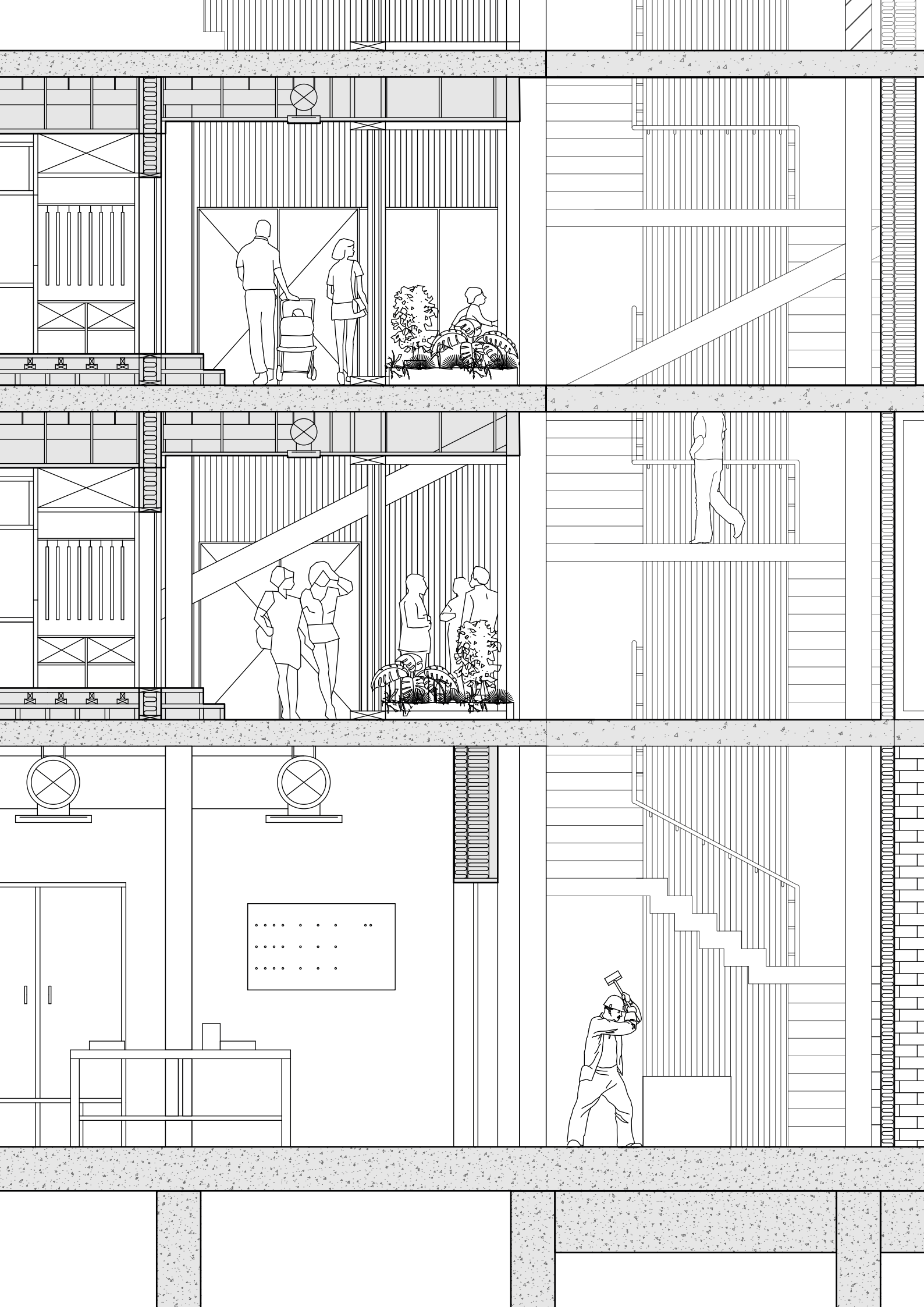


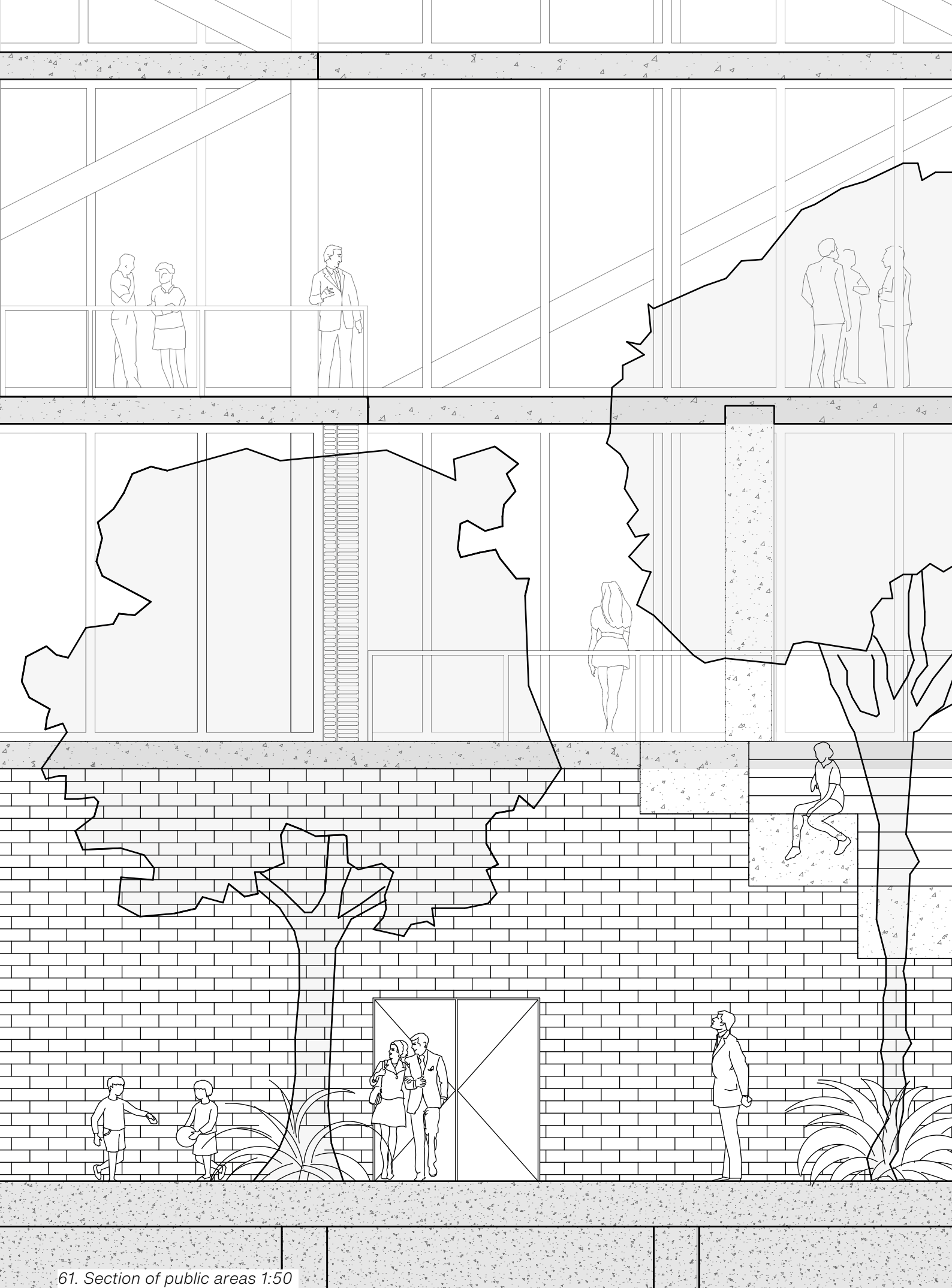


59. Isometric view

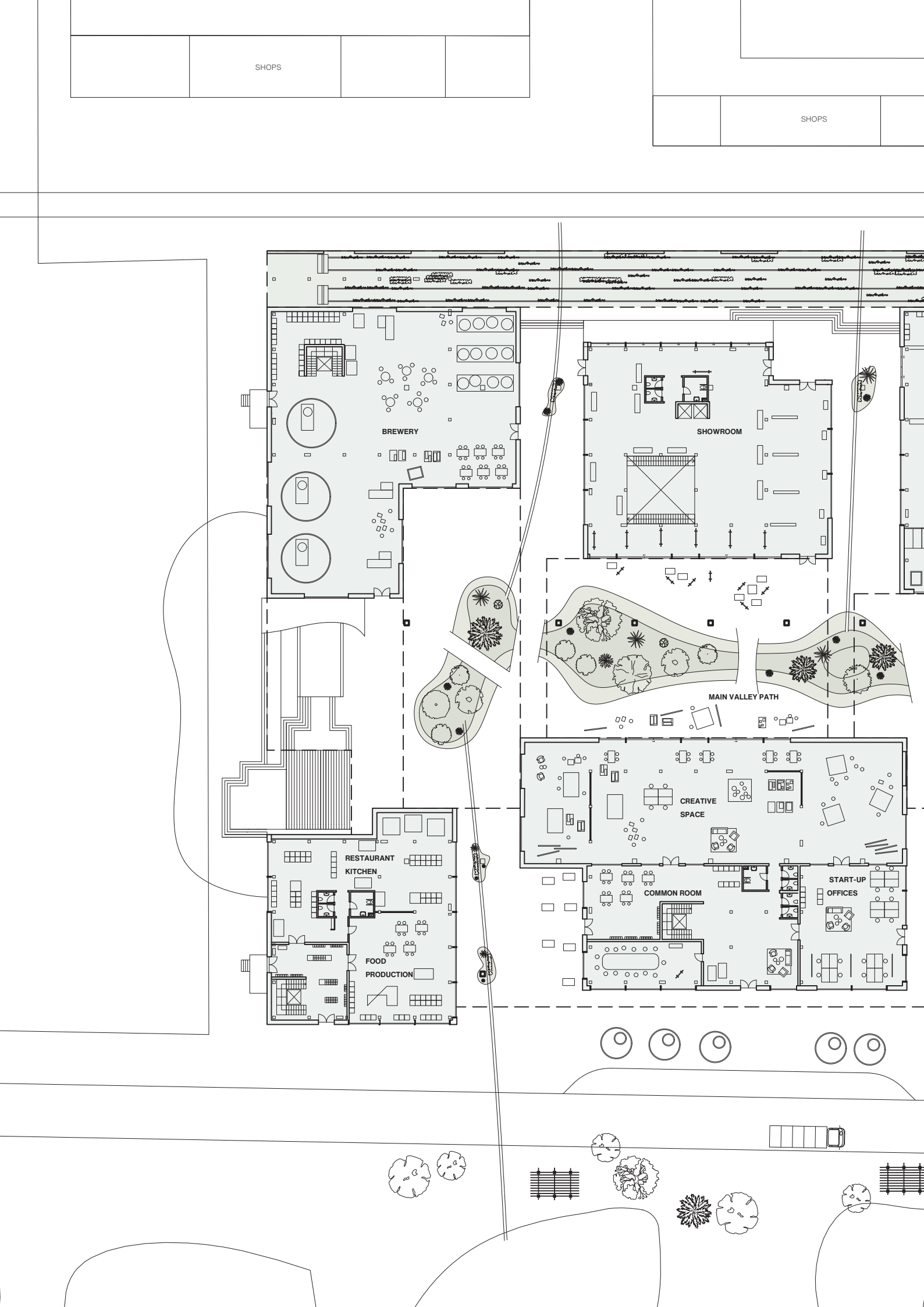


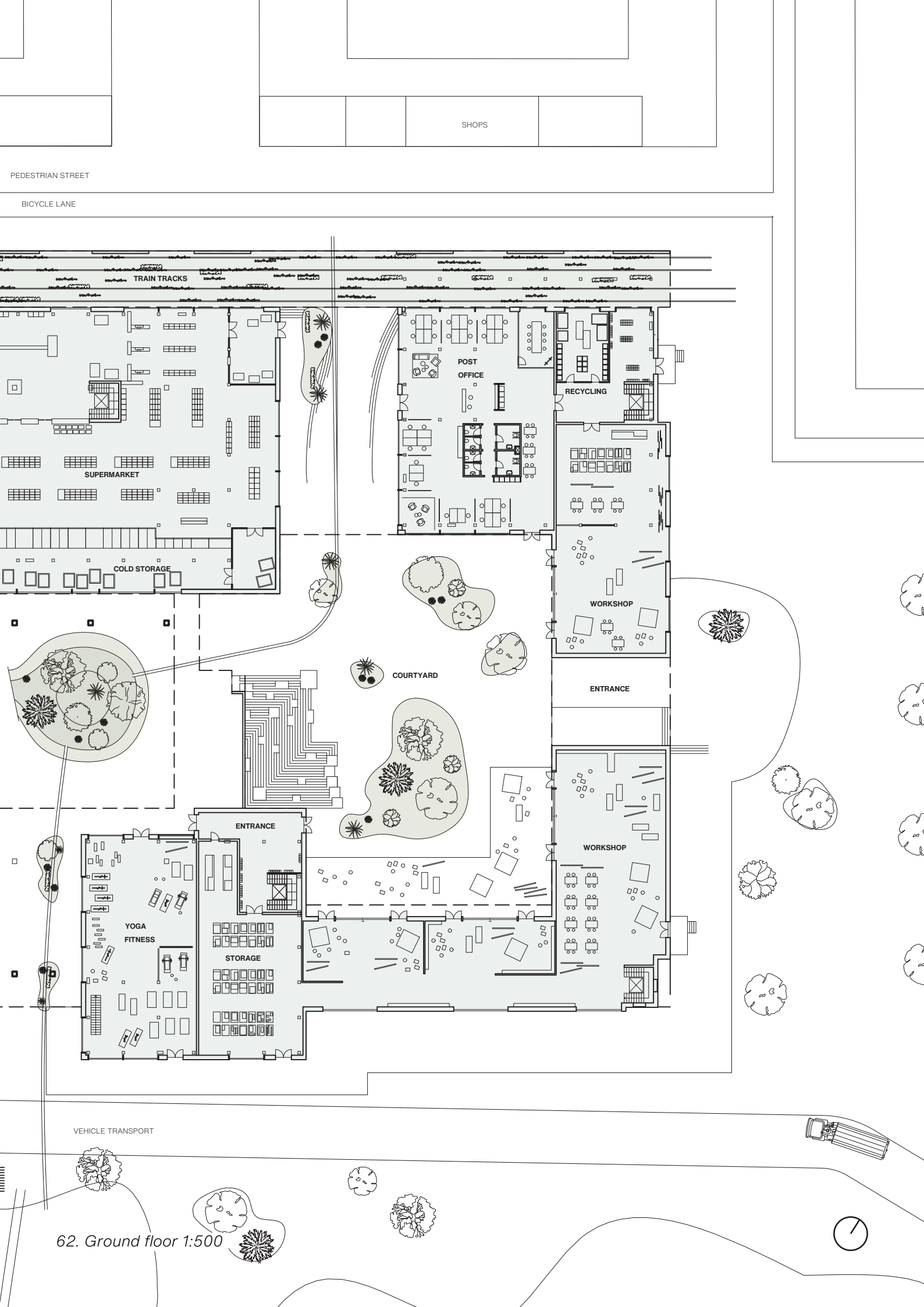
60. The high-rise



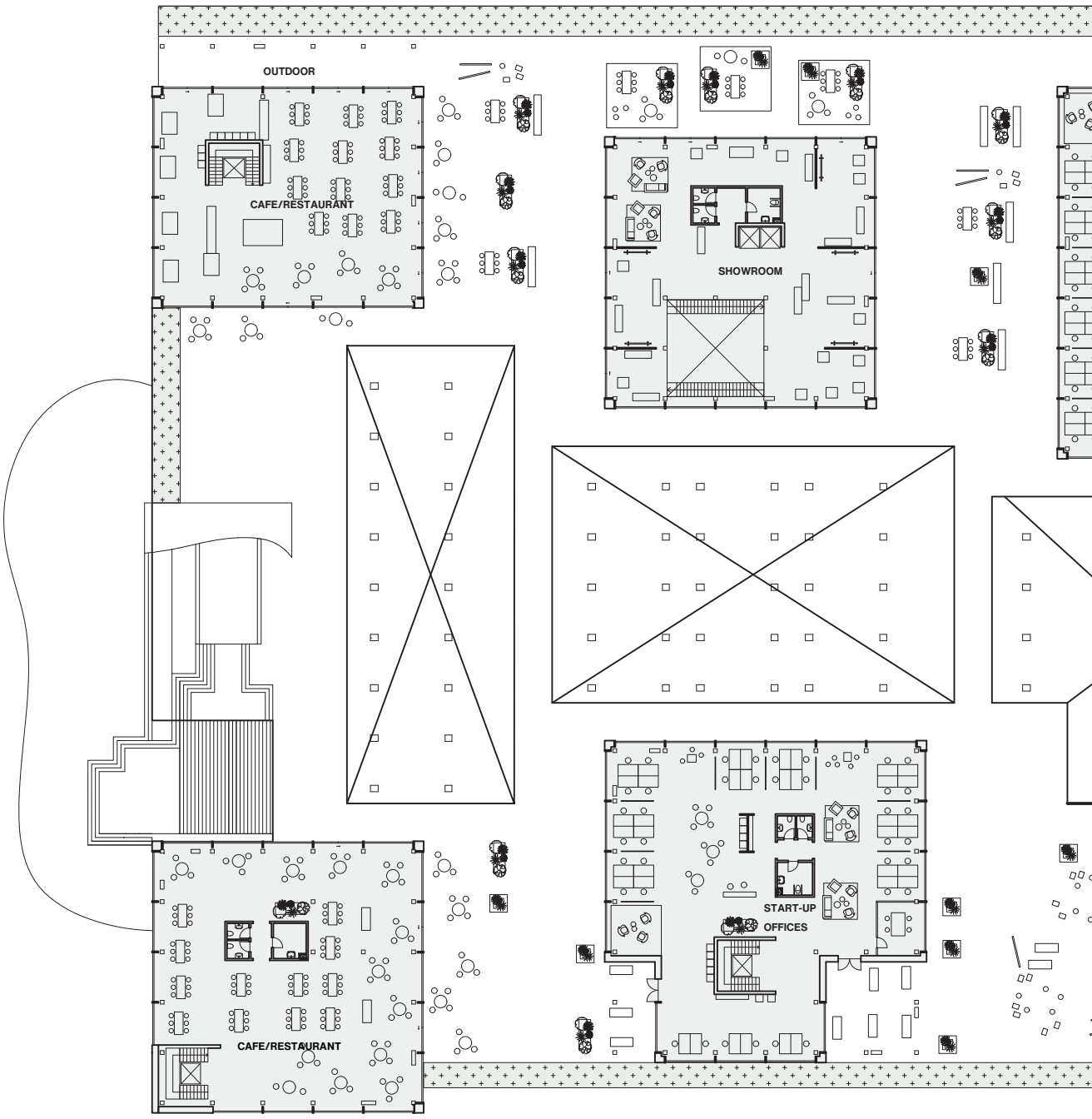


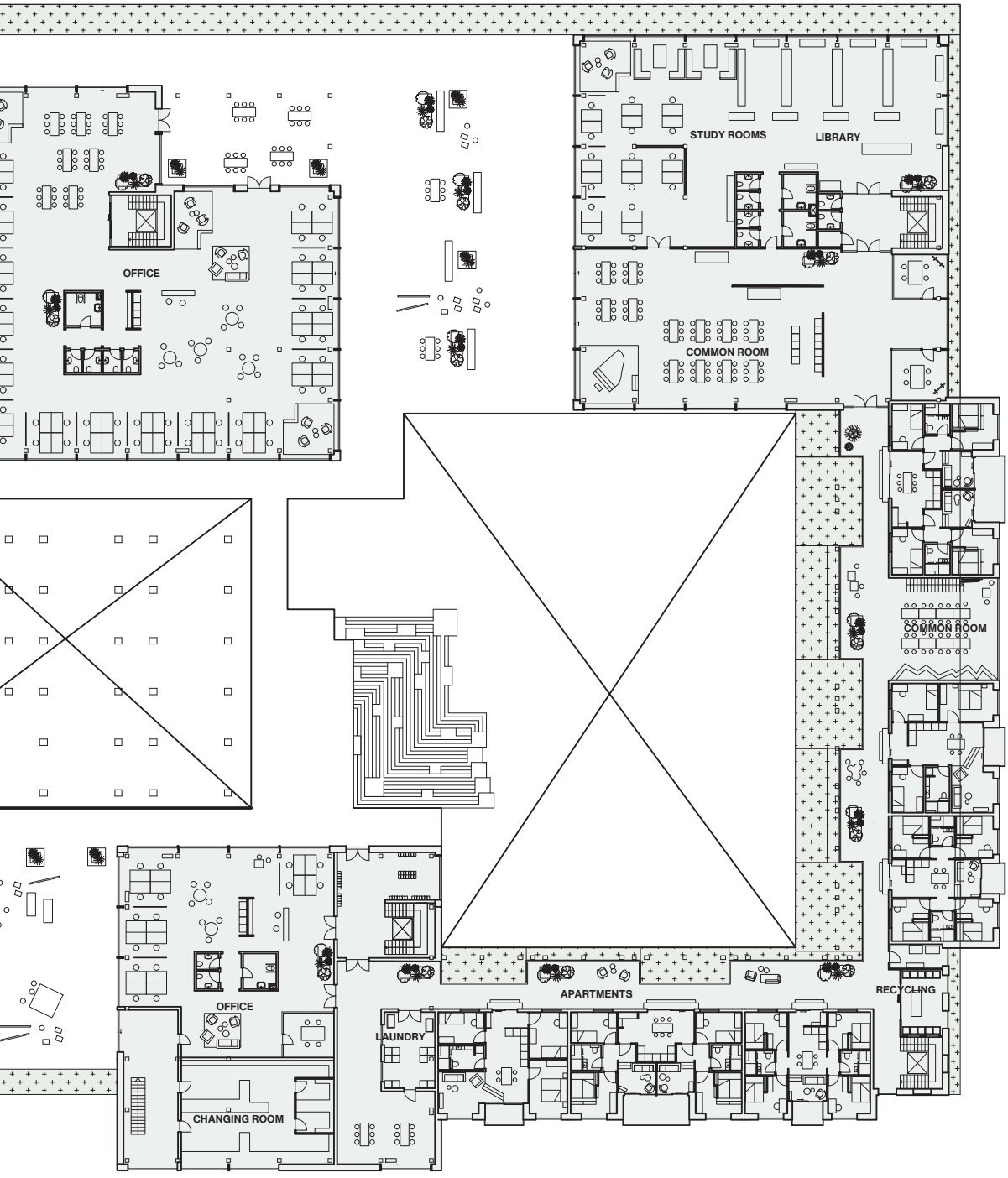
61. Section of public areas 1:50


SHOPS
SHOPS
BREWERY
SHOWROOM
MAIN VALLEY PATH
CREATIVE
SPACE
RESTAURANT
KITCHEN
COMMON ROOM
START-UP
OFFICES
FOOD
PRODUCTION

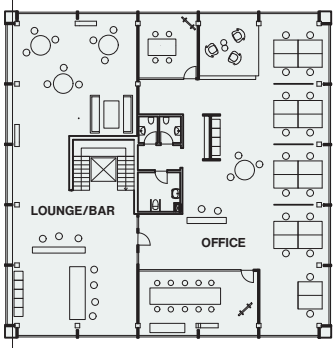


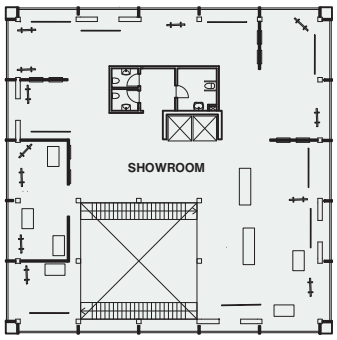
62. Ground floor 1:500

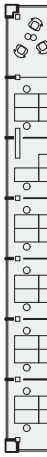

OUTDOOR
CAFE/RESTAURANT
SHOWROOM
START-UP
OFFICES
CAFE/RESTAURANT

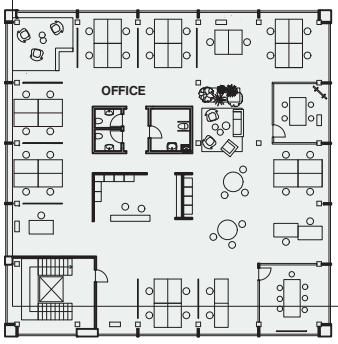


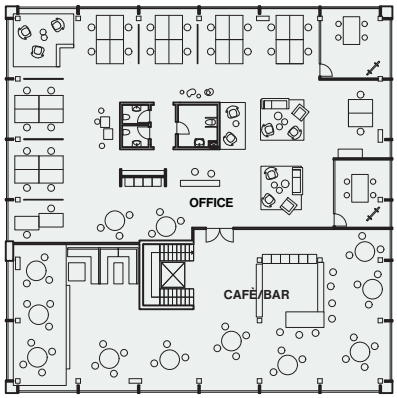
63. 1st floor 1:500

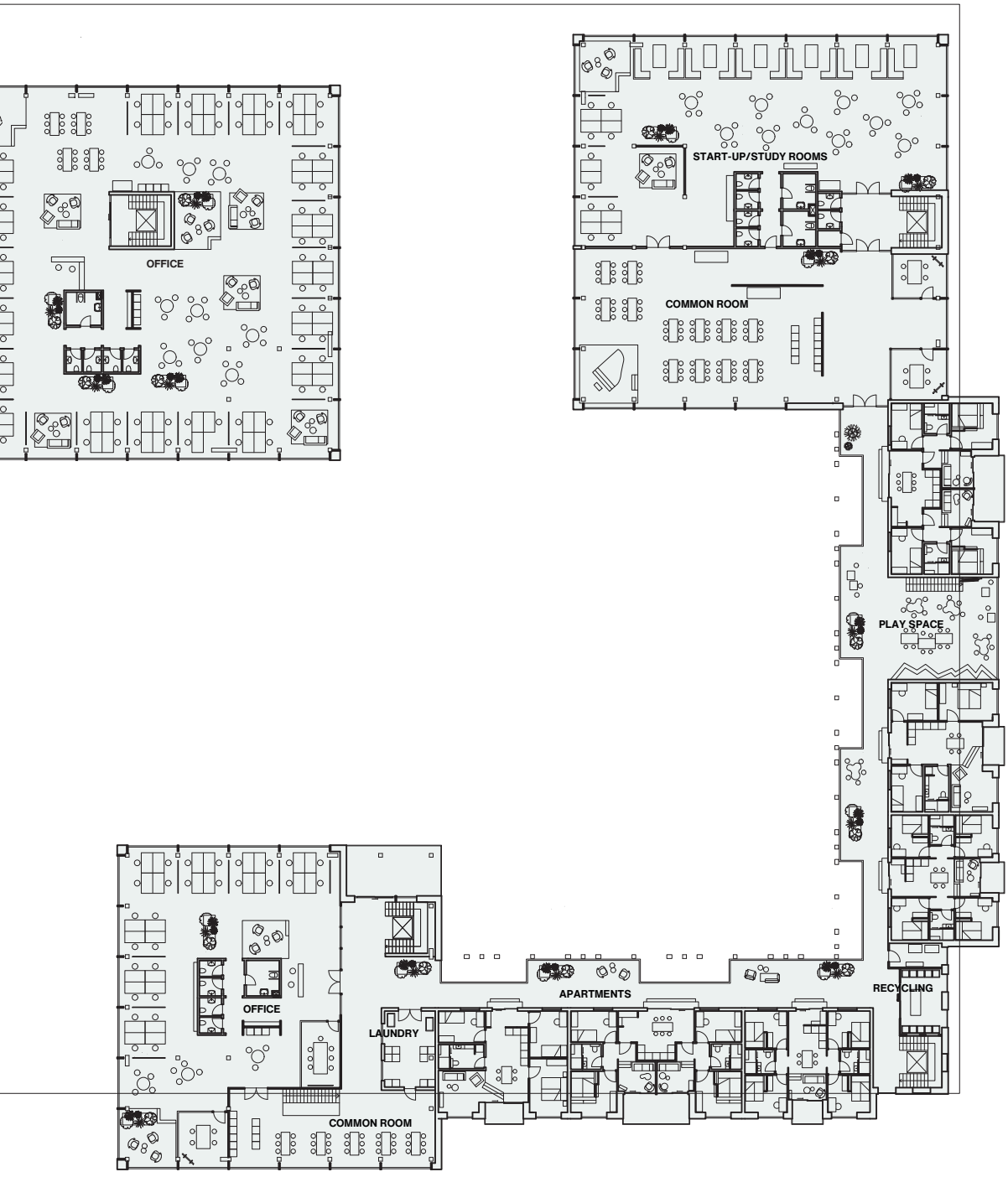

LOUNGE/BAR
OFFICE


SHOWROOM

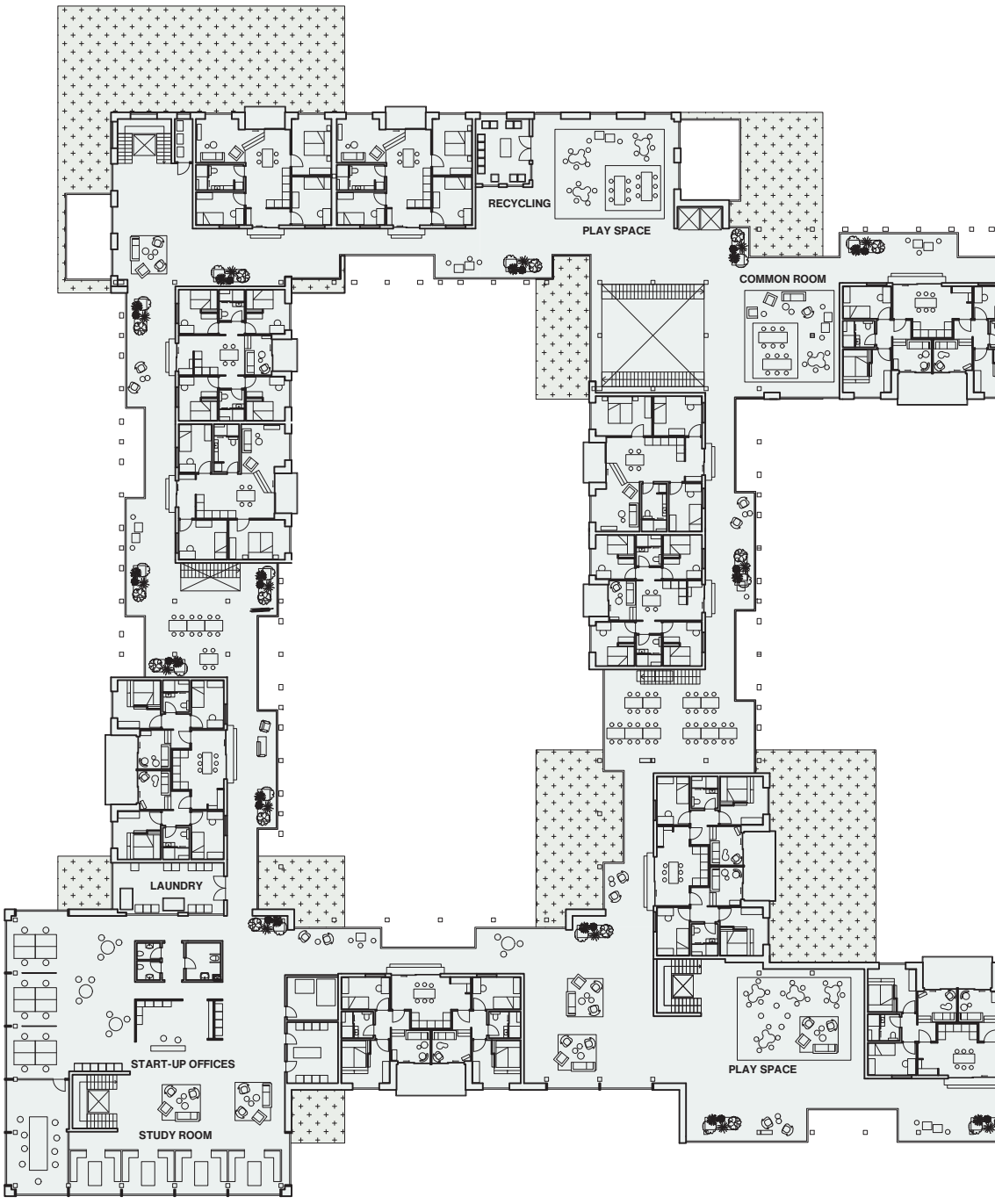


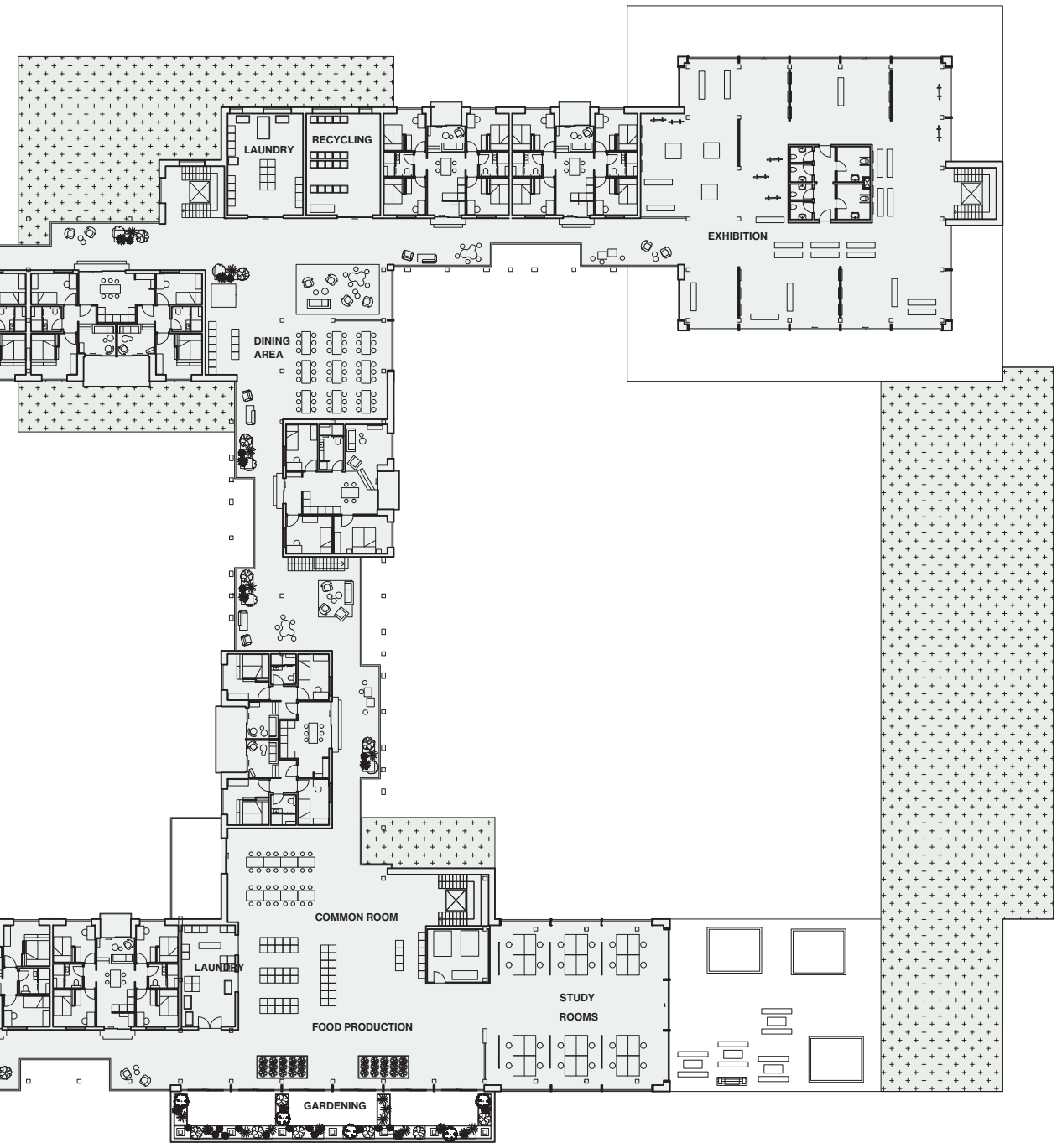

OFFICE


OFFICE
CAFE/BAR

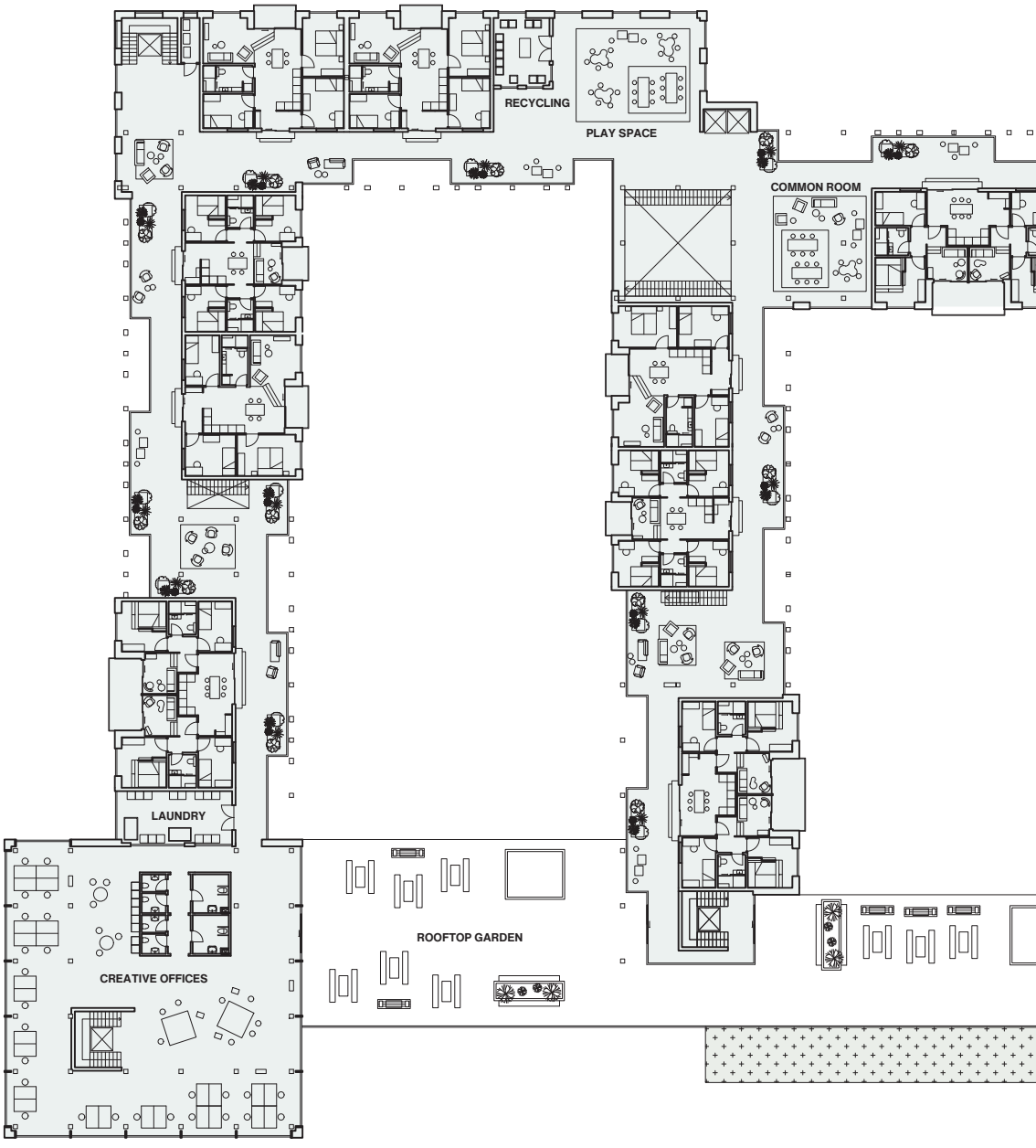


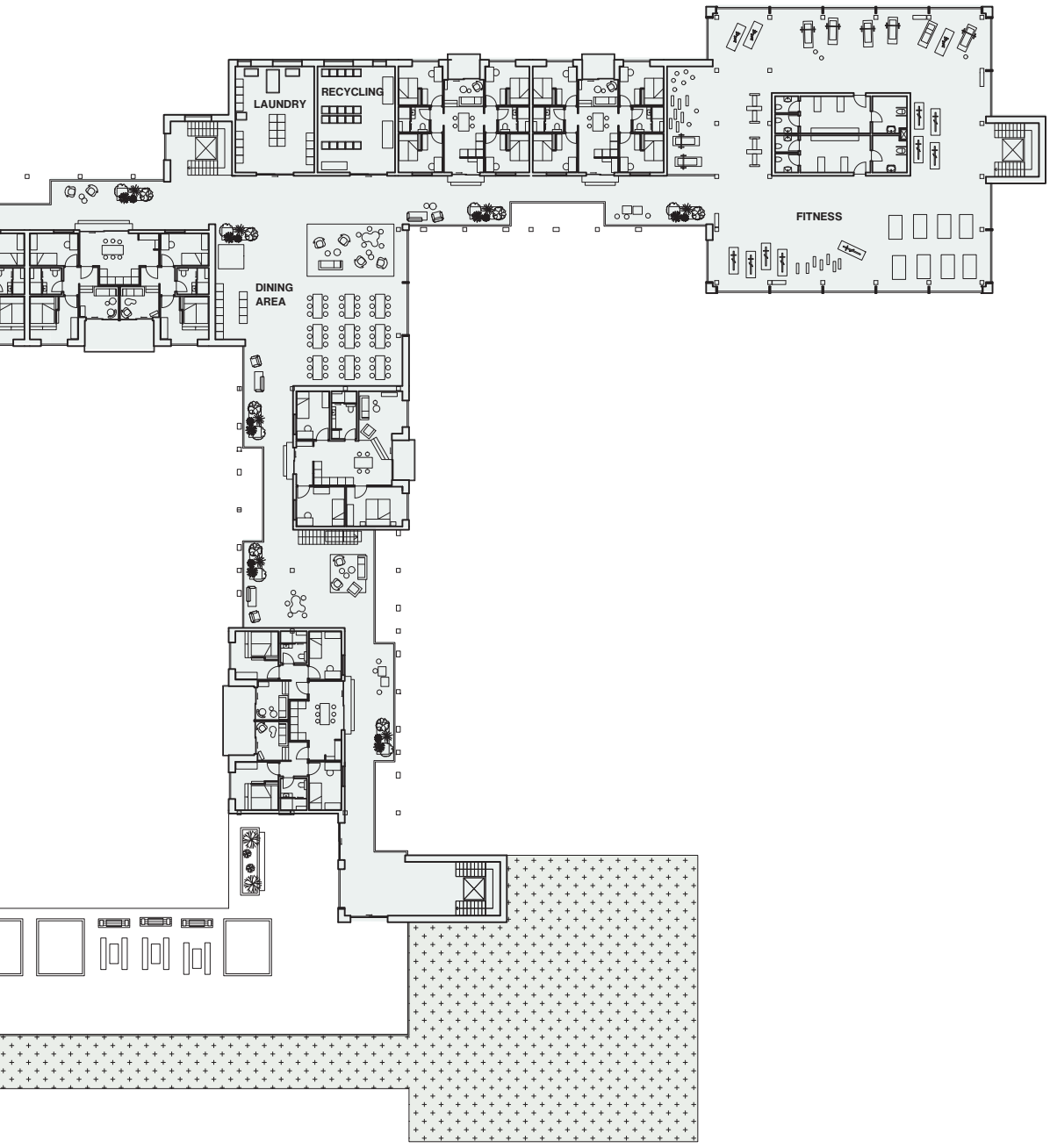
64. 2nd to 4th floor 1:500


RECYCLING
PLAY SPACE
COMMON ROOM
LAUNDRY
START-UP OFFICES
STUDY ROOM
PLAY SPACE

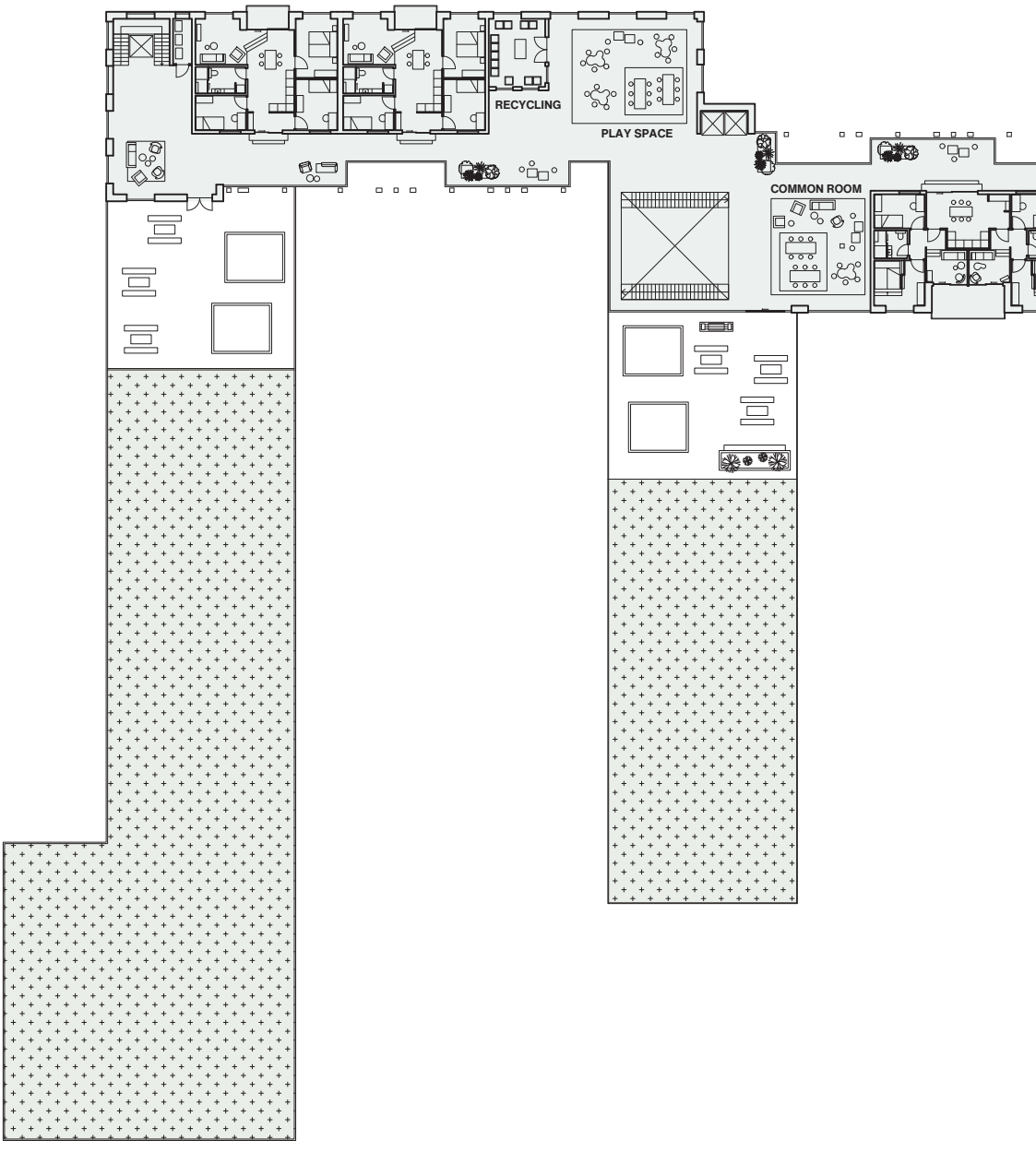


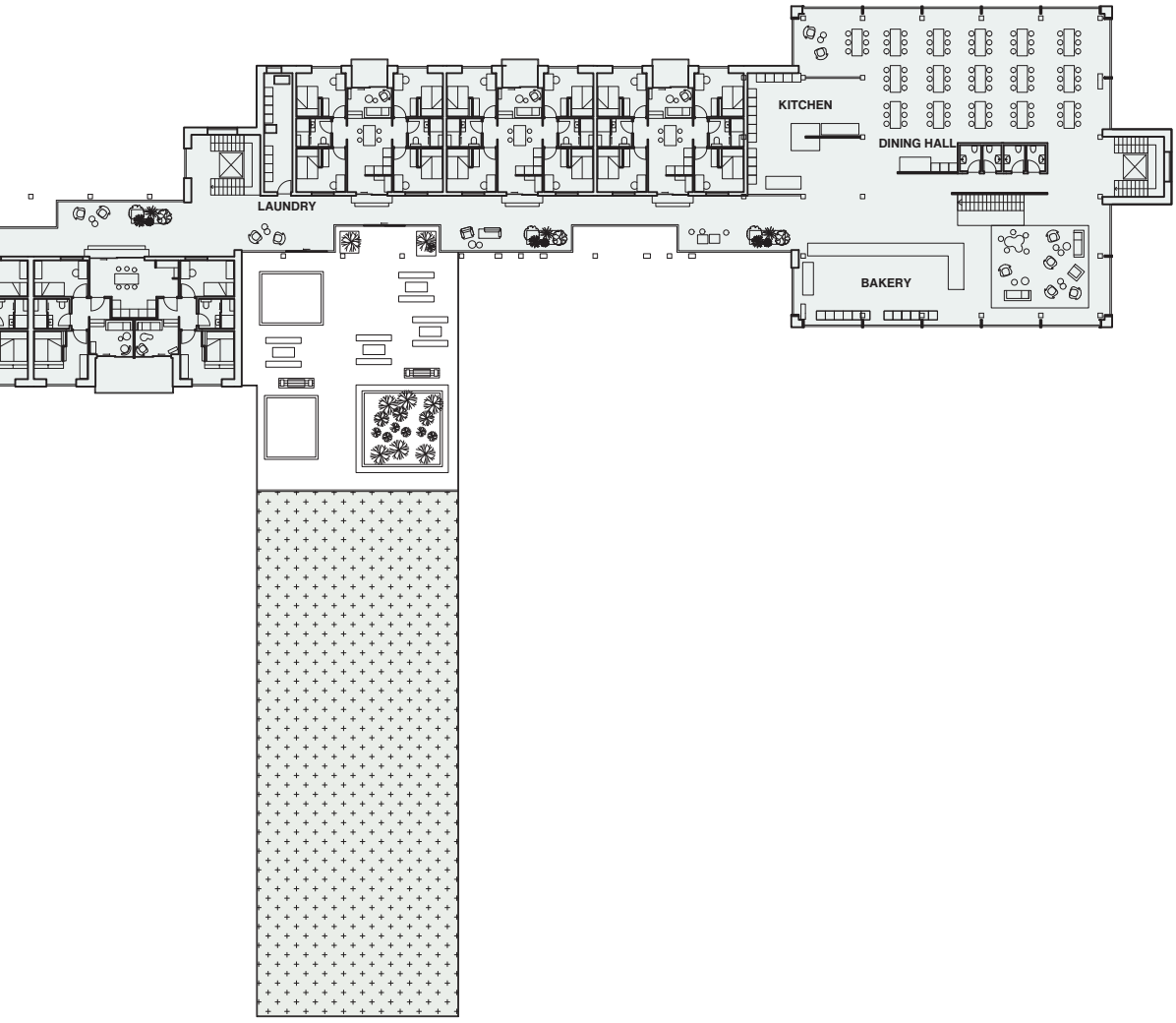
65. 5th to 6th floor 1:500


RECYCLING
PLAY SPACE
COMMON ROOM
LAUNDRY
CREATIVE OFFICES
ROOFTOP GARDEN

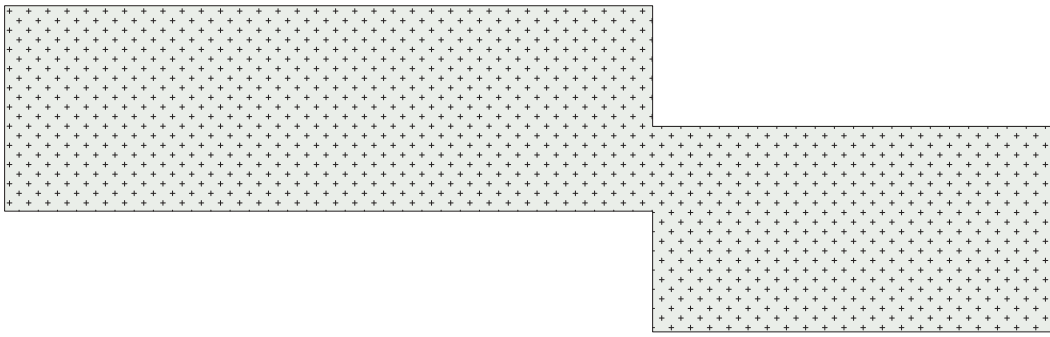


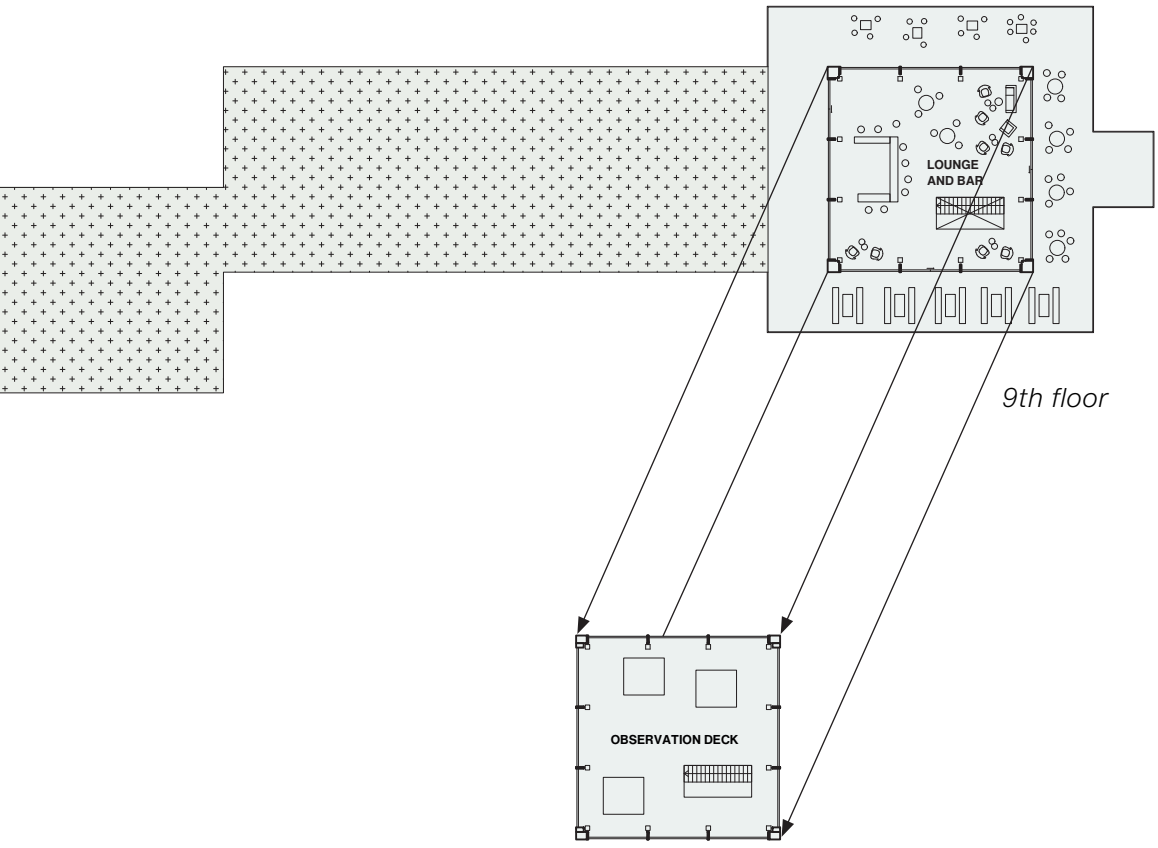
66. 7th floor 1:500


RECYCLING
PLAY SPACE
COMMON ROOM



67. 8th floor 1:500



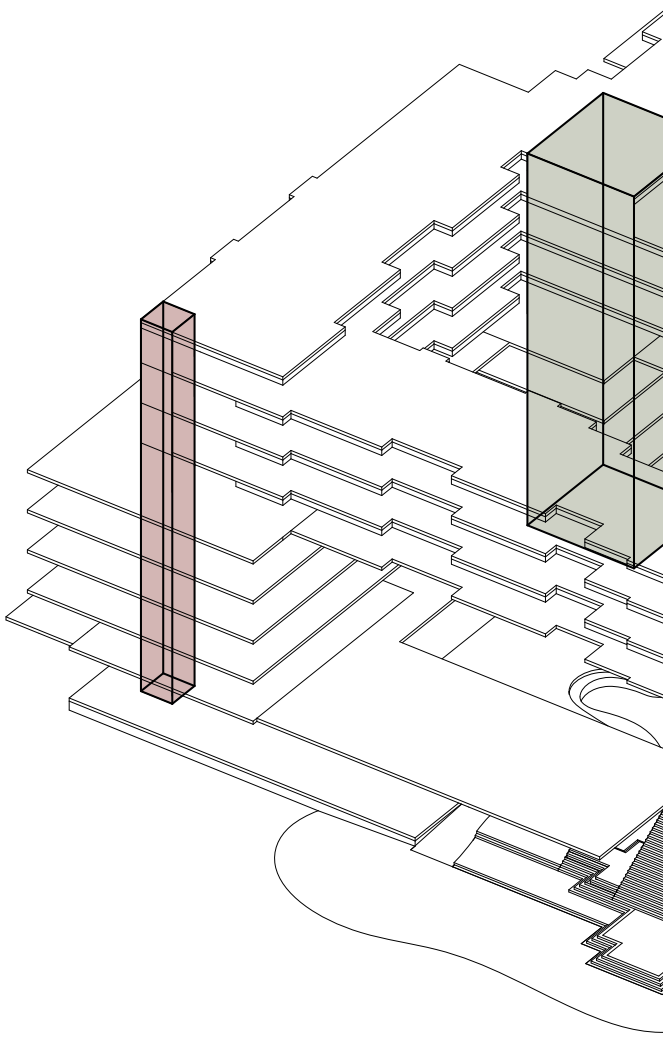


68. 9th to 12th floor 1:500

Circulation

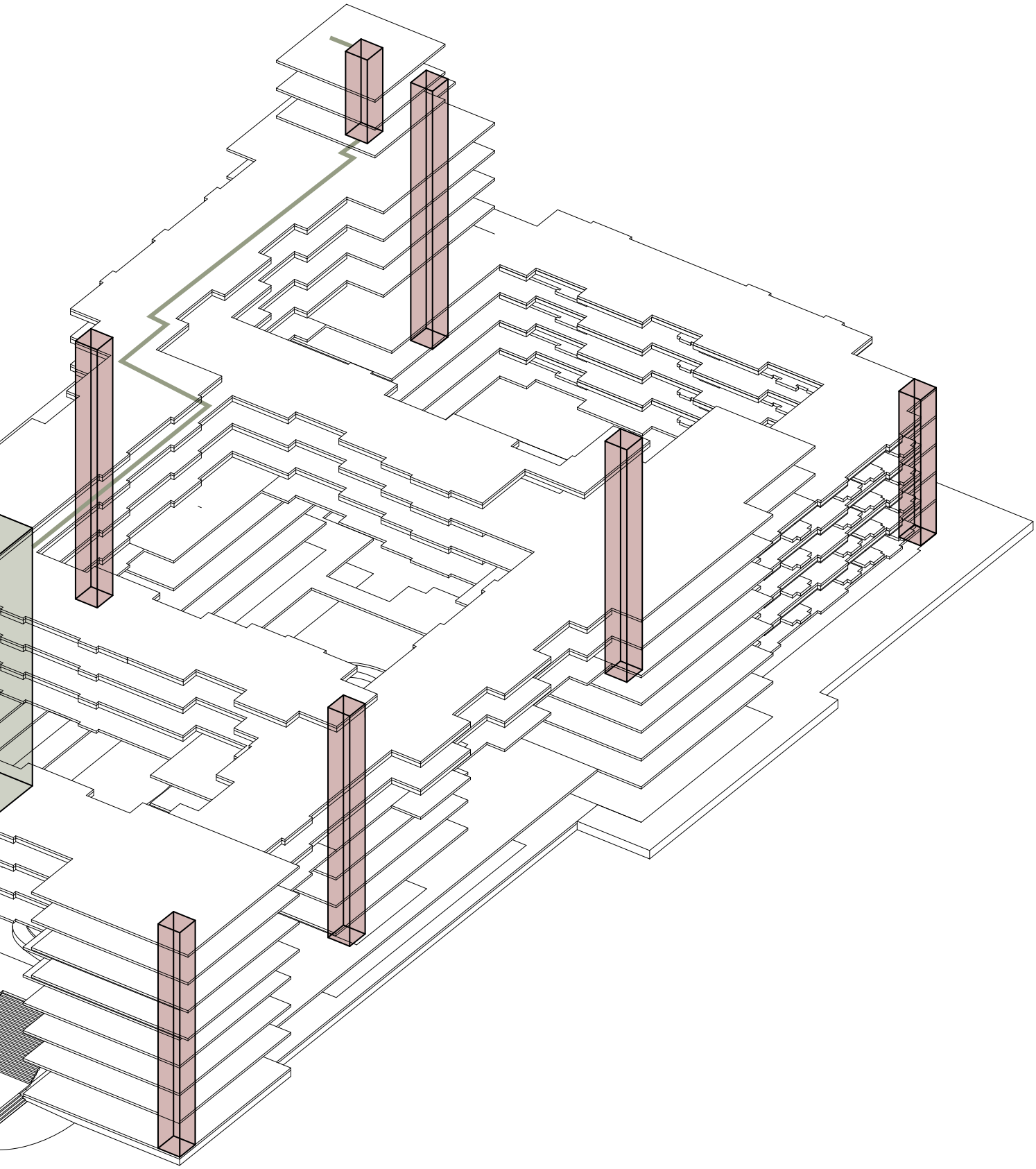
The circulation through the building has been located in each of the building cores. The placement of the circulation cores is based on that the users, residents and visitors of the high-rise will be able to experience the life inside the building when moving upwards. The red circulation cores are intended for the users and residents of the high-rise.

The high-rise features one public core that is intended as a part of the public loop of the building. It is also located in the middle of the building to provoke the public to move through the internal courtyard spaces of the high-rise. The public loop starts at the circulation atrium and moves through office areas, work functions, a gallery and a residential hallway before arriving at the rooftop terrasses.



Public core

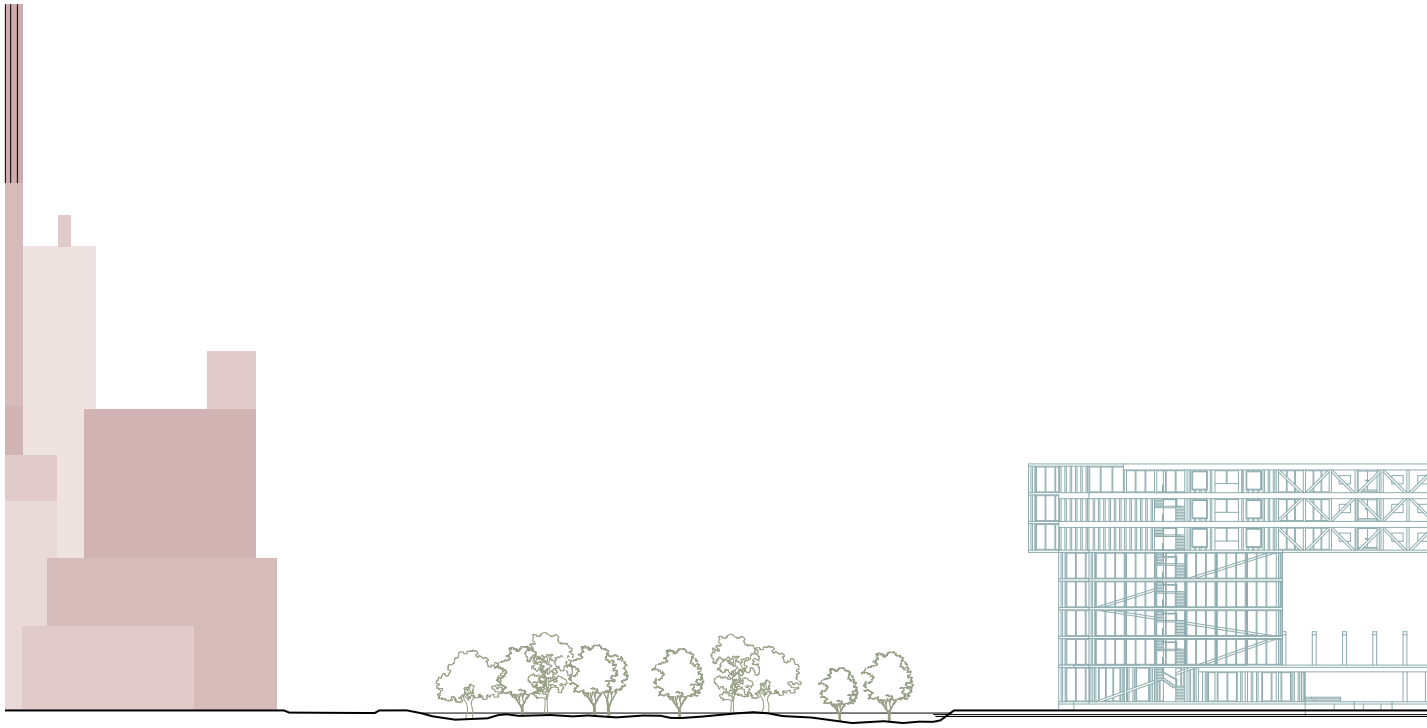
Placement of circulation cores



69. Circulation

Contextual relation

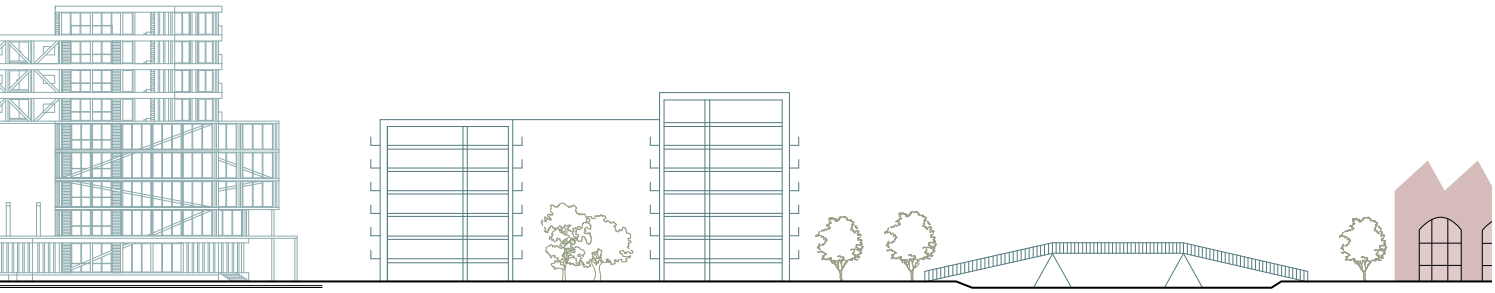
The high-rise location provided many challenges that needed to be considered. This contextual section attempts to describe how the different challenges have been dealt with. This relates to both large infrastructural nodes, climate change, energy consumption, historic heritage and new urban development.



H.C. Ørstedværket
The high-rise is limited in its height because of pollution from the natural gas power plant. This meant that the high-rise could not reach over 60 m. In addition, there is also an opportunity to experience the creation of power from the high-rise through the chimneys.

Wetland
The green area right besides the high-rise was an existing green buffer that was used to decrease noise pollution from the adjacent ring road. The green area has been transformed into a wetland to provide local water management solutions to extreme rainfall events.

The high-rise
The high-rise is located on the southern part of Jernbanebyen which is envisioned as mostly residential. It is the aim that the high-rise would provide all the work and public functions for the area, and in its openness provide pleasent and generous areas.

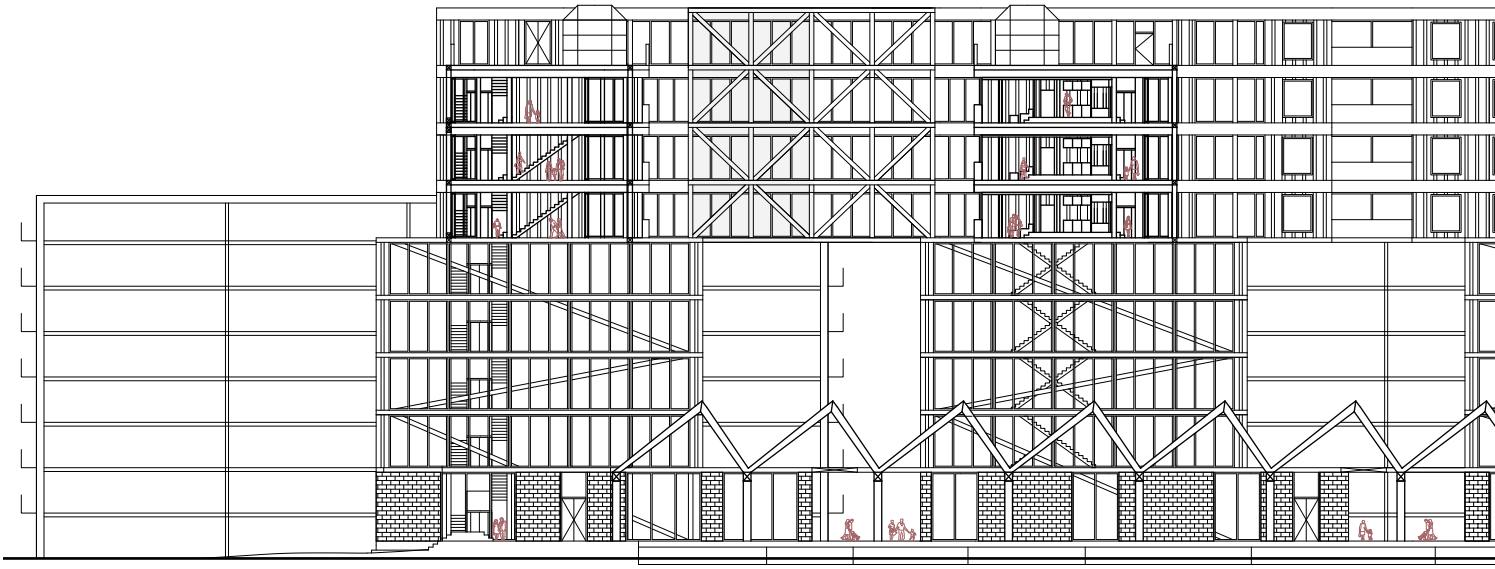


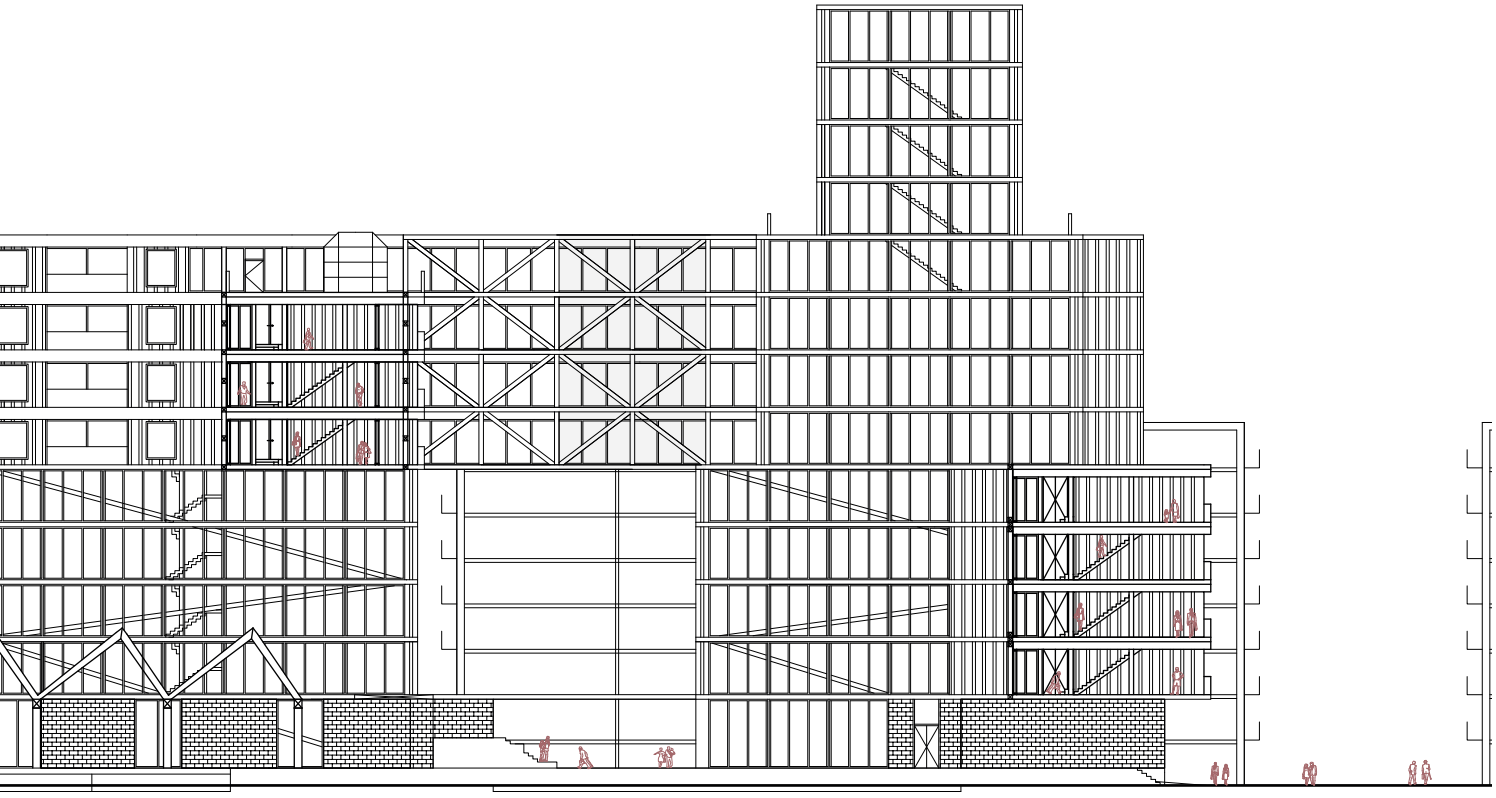
Urban blocks
The urban blocks on the southern part of Jernbanebyen varies between 6-10 floors. The amount of floors is based on the southern context which features the same heights. The high-rise is a little bit taller than the others blocks to provide a beacon for the public.

Metro preparation area
The metro preparation formerly served as a barrier for Jernbanebyen, dividing the site in the middle. A bridge will connect the northern and southern part, in the new masterplan. The high-rise will use its height to provide viewing experiences of the metro area.

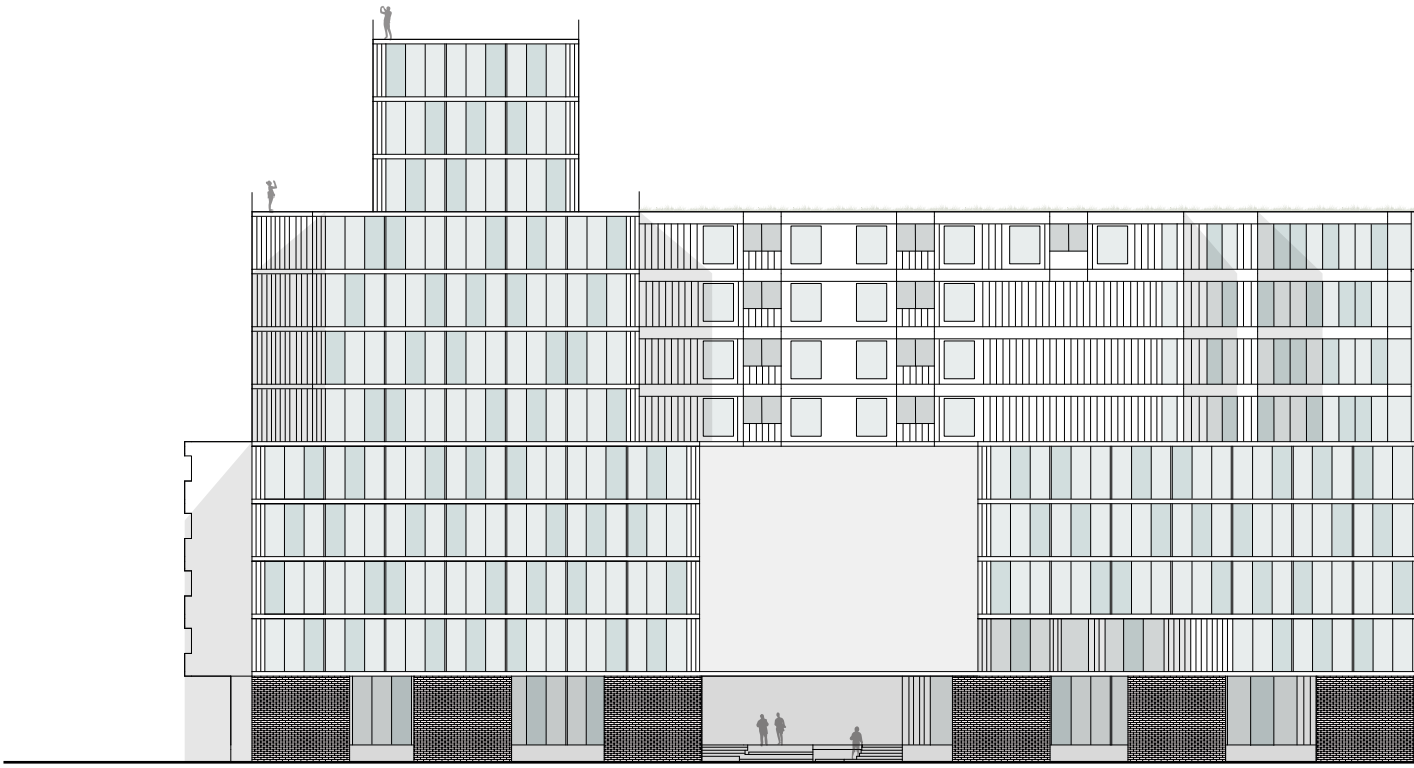
Site heritage
The high-rise, in its height and location attempts to not ruin the historical urban environments. Most of these areas are located on the northern part of the site. The northern area will supplements the work and housing functions of the high-rise with cultural aspects.

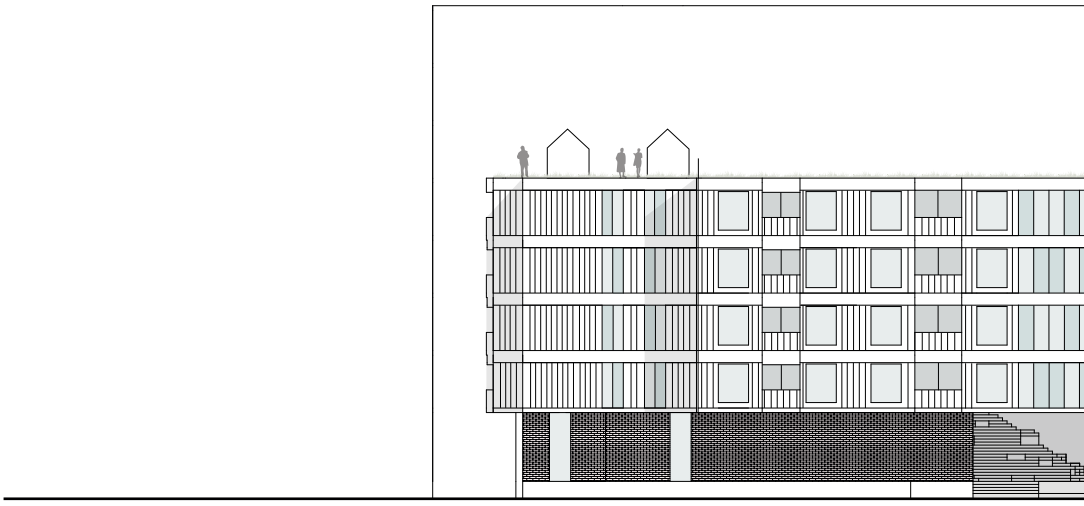
70. Contextual section 1:1000

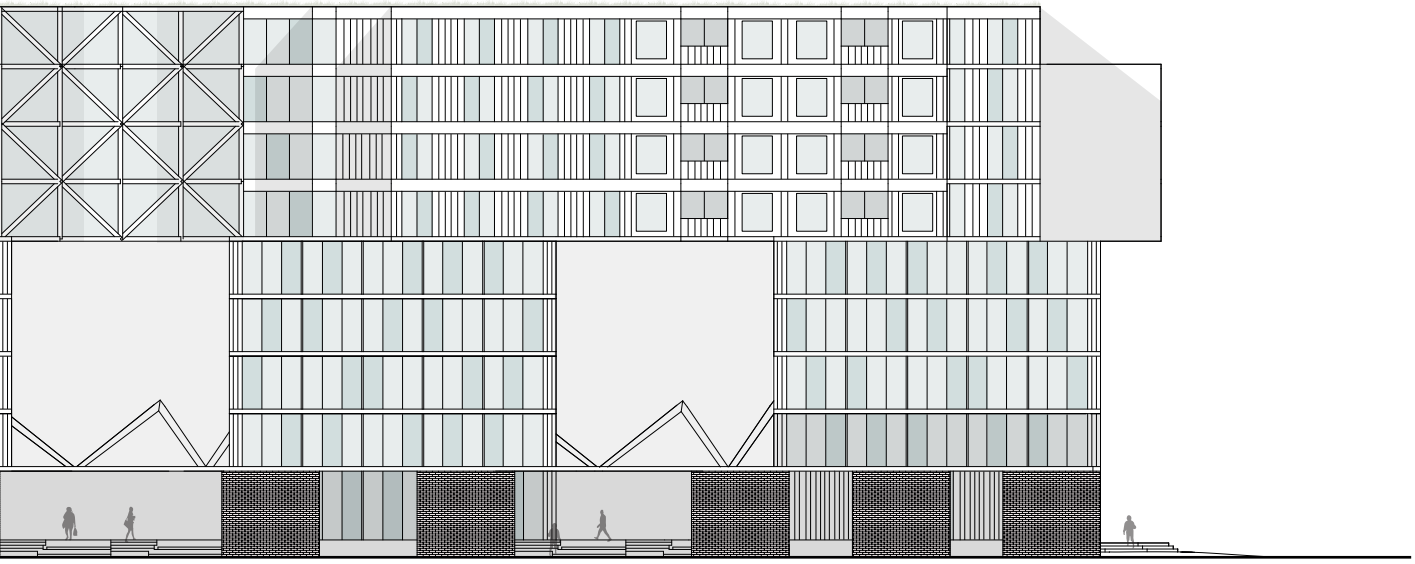




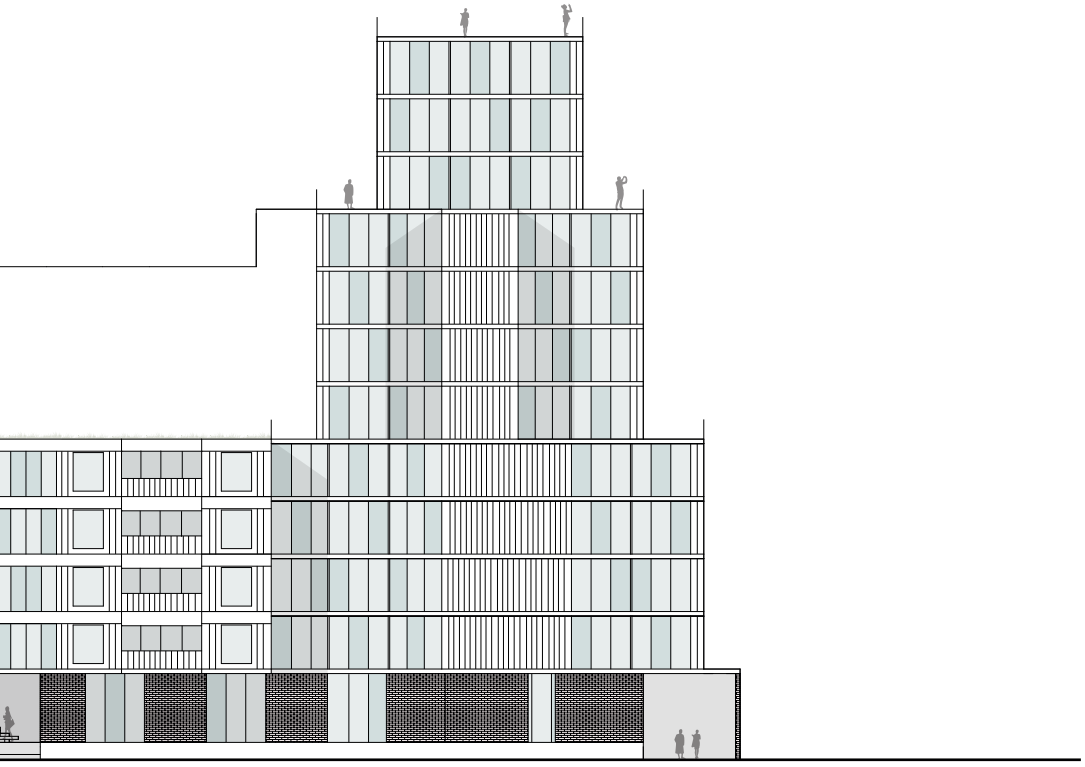
71. Section of high-rise 1:500





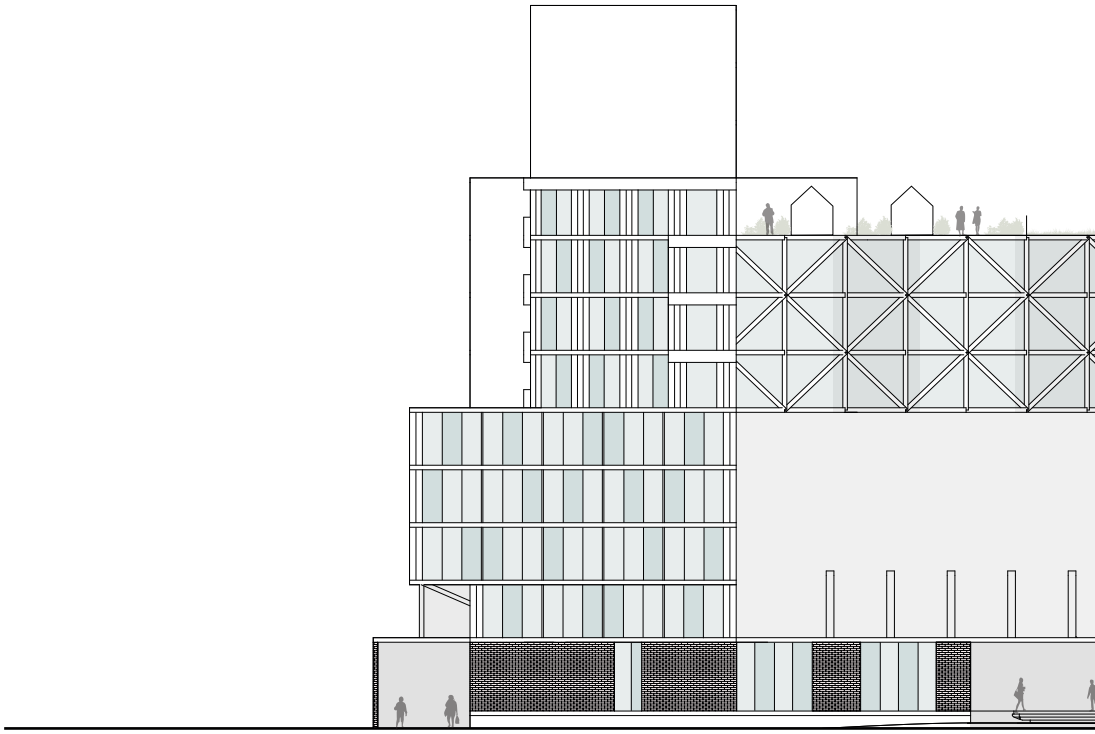


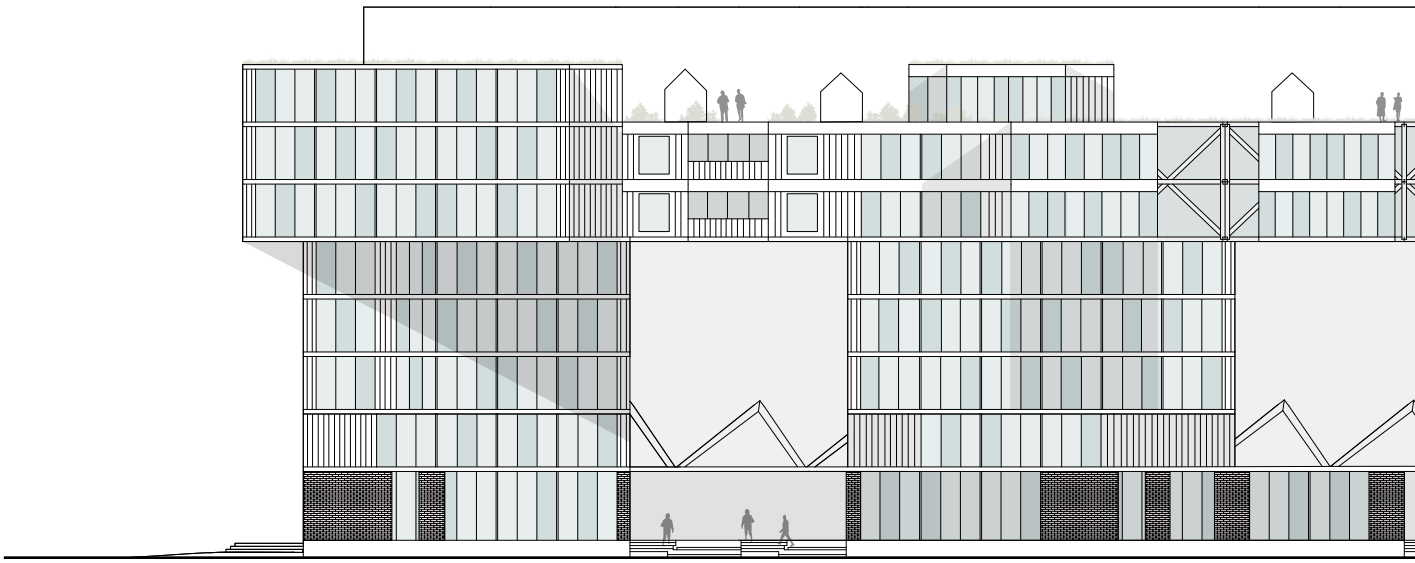
North elevation

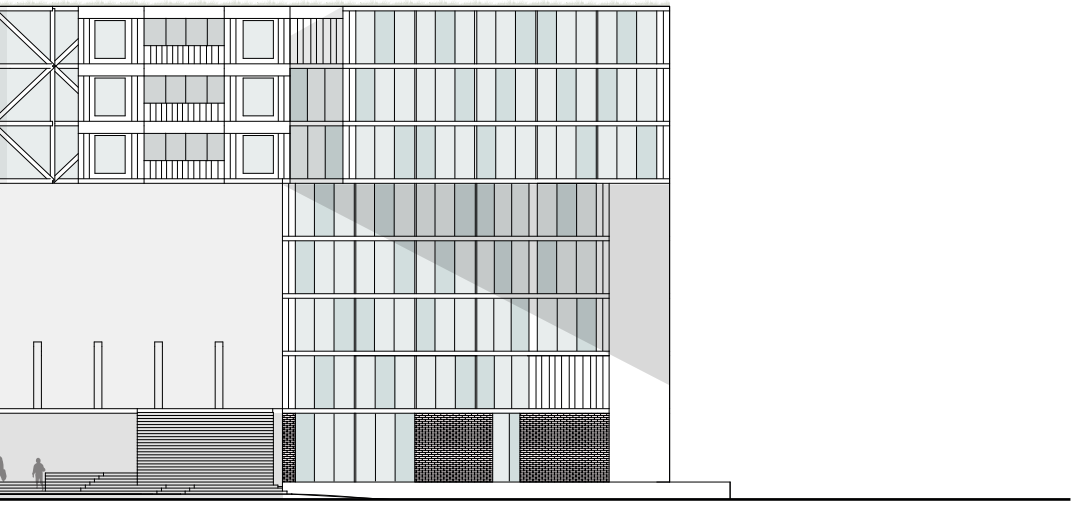


East elevation

72. Facade elevations 1:500







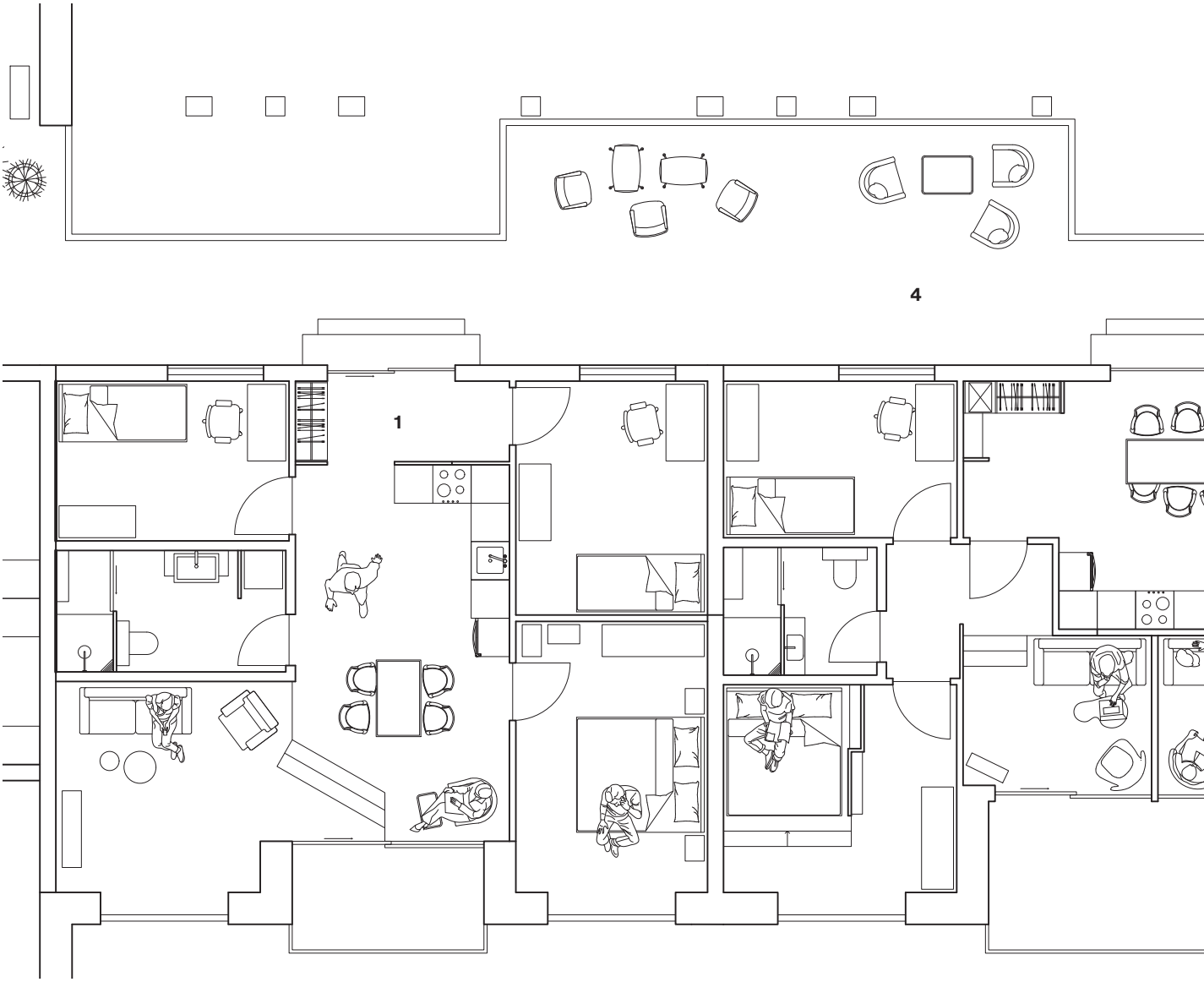
West elevation

South elevation

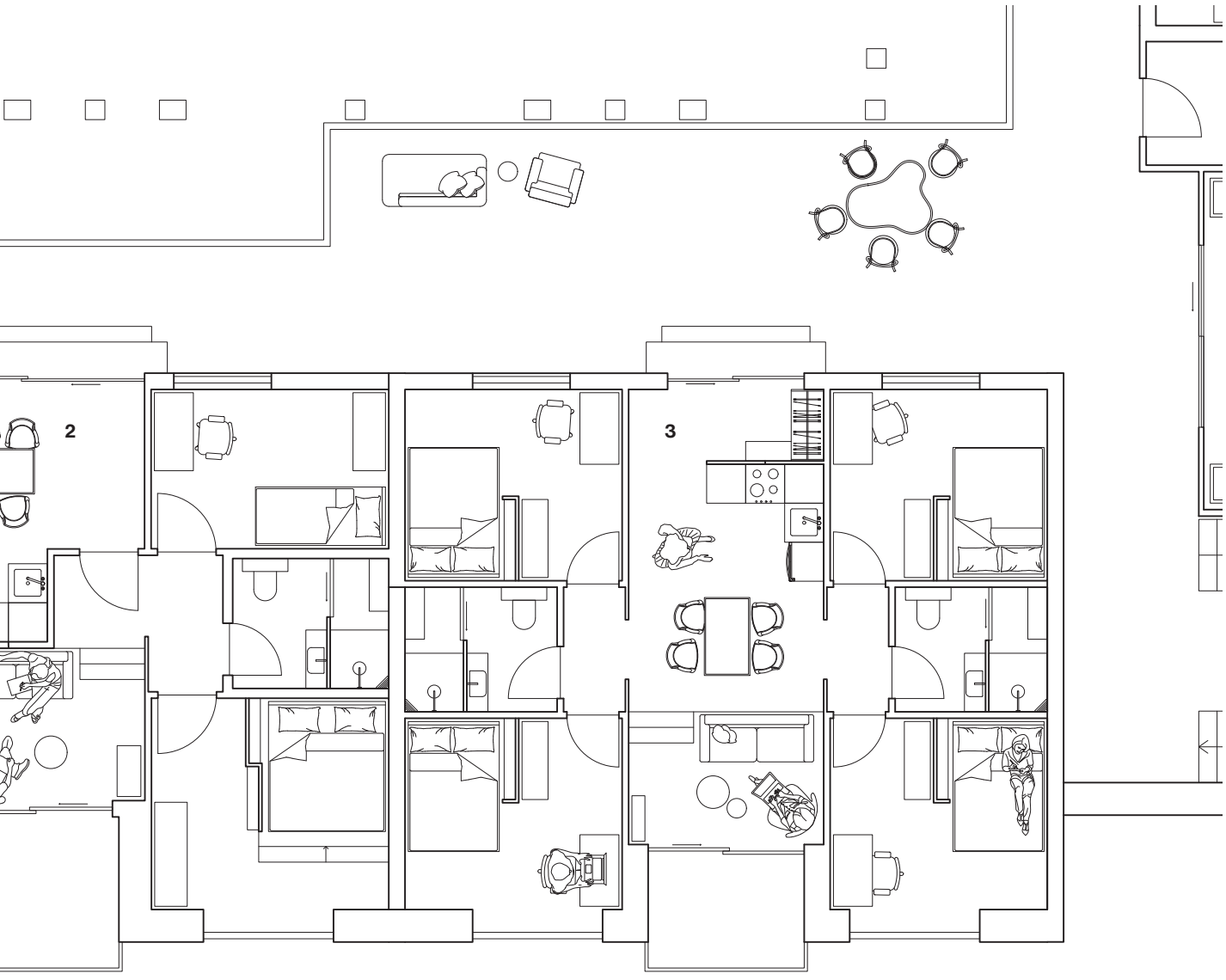
73. Facade elevations 1:500

Apartment units

The high-rise consists of three different housing units that emphasizes different degrees of collective living. They are located at a hallway that allows for social interaction with the reisdents and others using the building. All of the different housing units features a sliding door at its main entrance to allow for an connection between the private and public space, and invites the residents to engage the private life with the public. The units considers shared facilities within different degrees, still with the hallway functioning as a kind of front yard for all the units.



1. Family apartment unit
2. Shared unit for couples and seniors
3. Student unit
4. Residential hallway



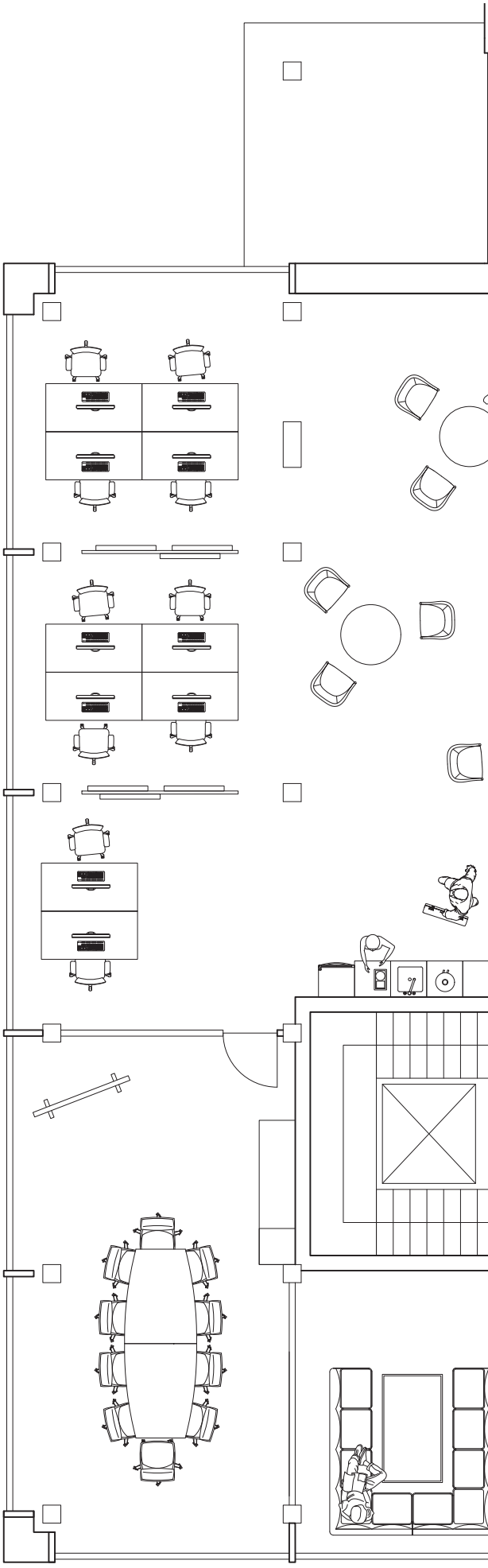
74. Plan 1:100

75. Residential hallway

76. Inside student apartment unit

Work area

The high-rise envisions to create synergies between the residents and workers in the building. This is done in this zoom in plan by extended the residential hallway into the start-up office space. The start up office space itself is envisioned to be an office collective that allows for many start-up companies to gather and share experiences. The office space also features study spaces for students that allows for a bigger working collective acorss ages. In addition, the laundry room and hallways extends into office space thereby allowing for informal encounters between the workers and residents.



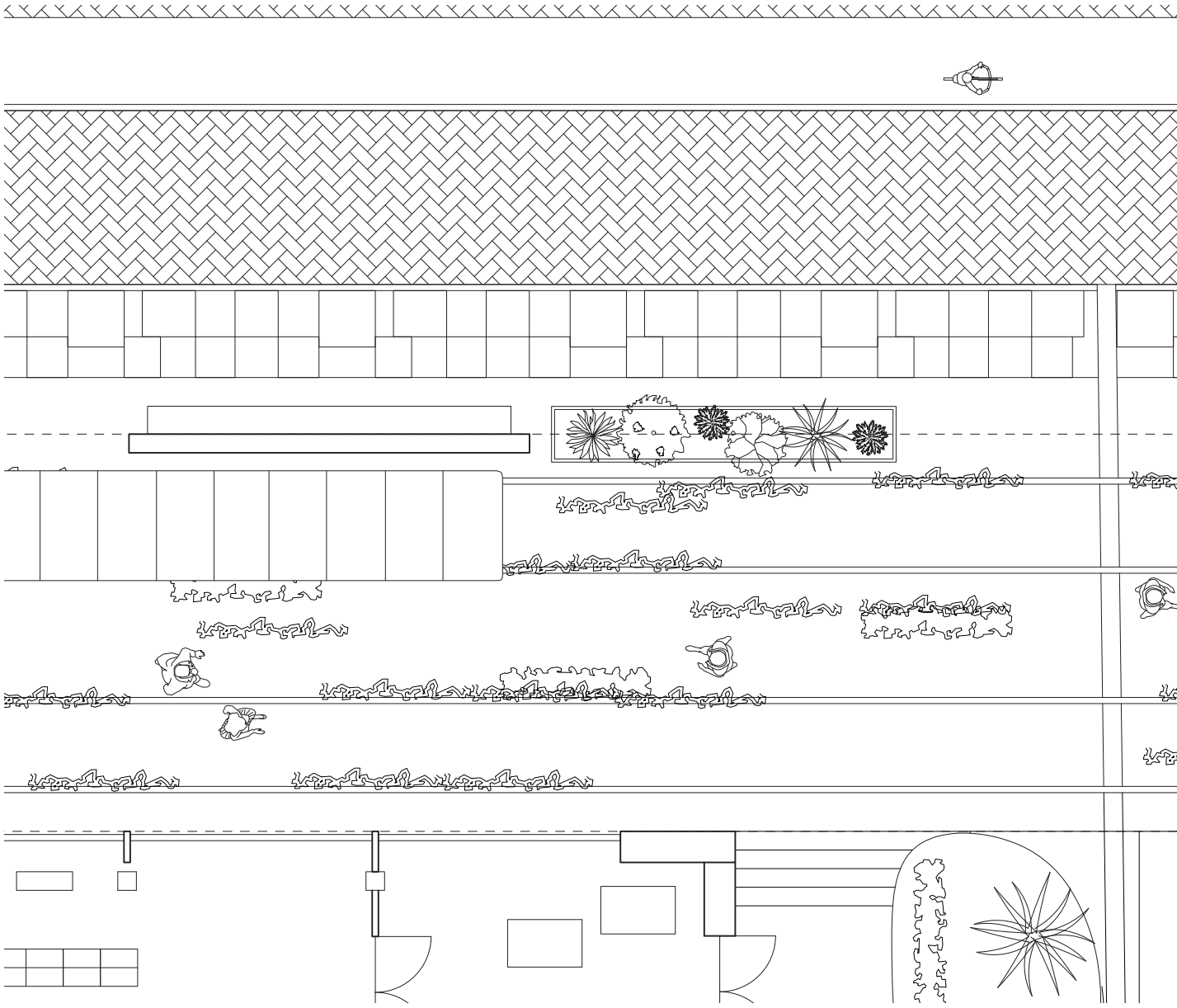
1. Start-up office space
2. Student study space
3. Residential laundry room
4. Residential hallway

77. Plan 1:100

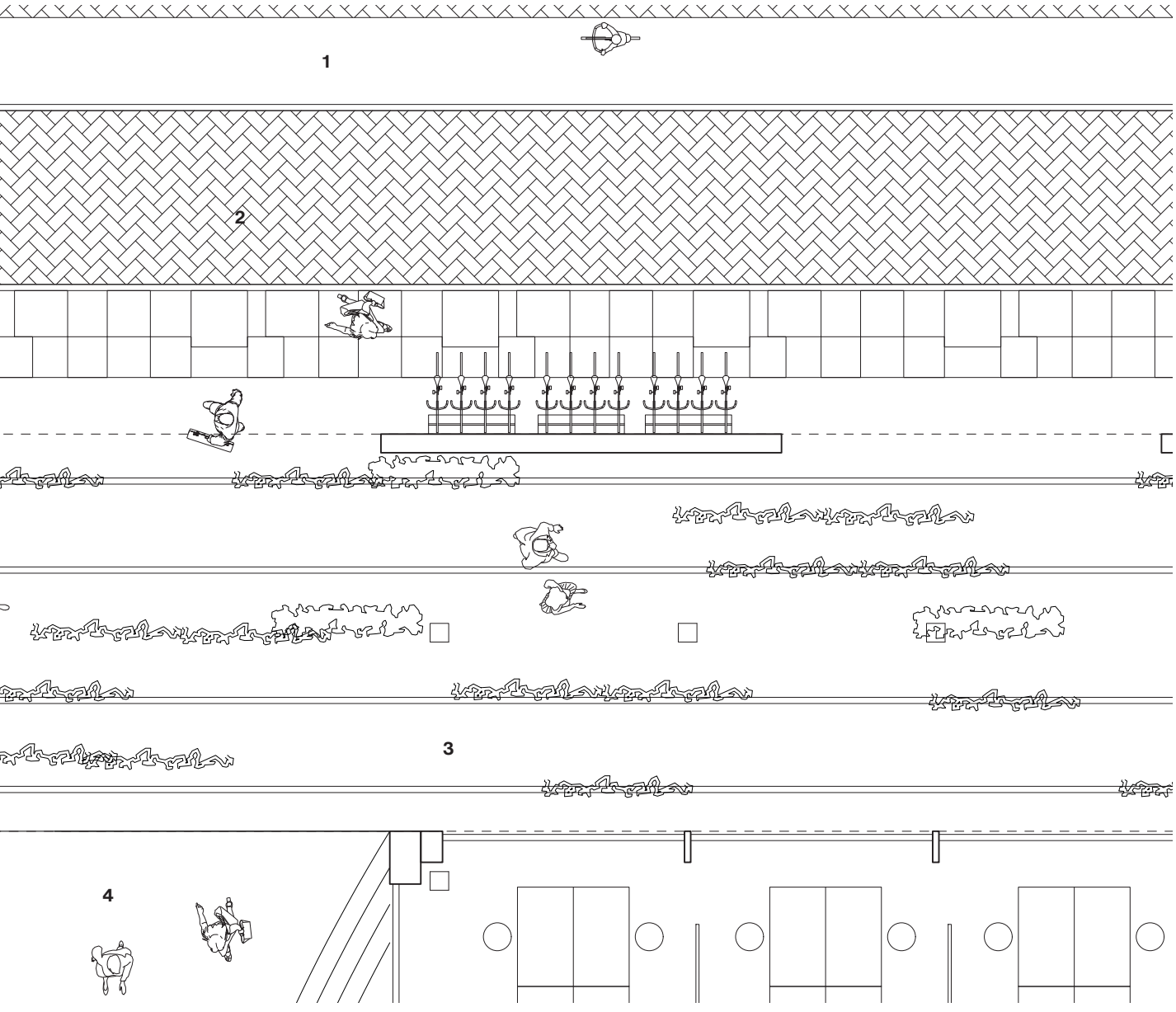
78. Laundry and work area

The rails

The rails has gotten its name because of the presence of existing railway tracks that narrates the historic identity of the site. The adjacent buildings and the high-rise form a pedestrian street suitable for walking, that also features an bicycle path that ensures the use of soft mobilities at Jernbanebyen. The pavement varies depending on the desired speed of the area. The existing bricks walls have been opened up through holes to provide peeks into what is going on inside of the building for the bypassers. The rails in combined with greneery provides a pause space for the people walking and creates different walking environments allowing the users to choose.



1. Bicycle path
2. Pedestrian street
3. Green rail buffer zone
4. Entrance to high-rise

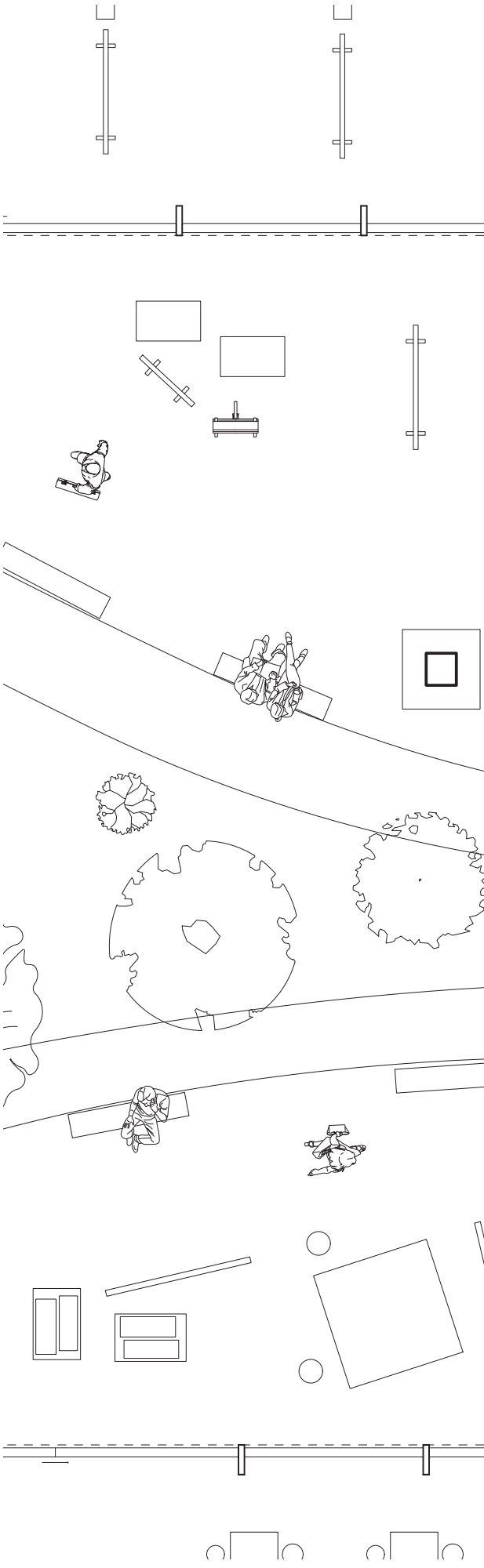


79. Plan 1:100

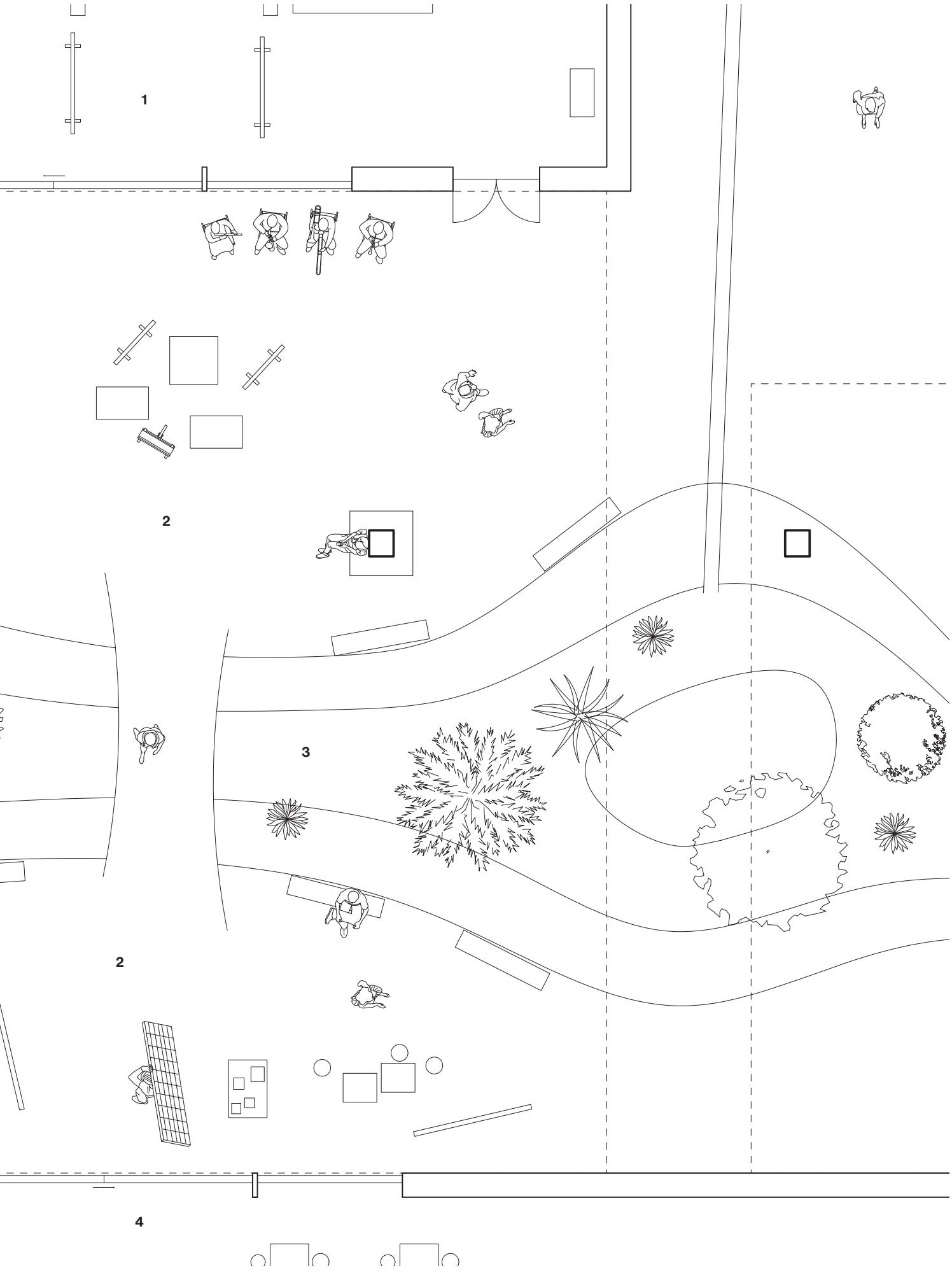
80. The railway corridor

The valley

The valley is the main public square that the high-rise offers for the public. In the valley, you are able to experience the life inside of the building both on the ground floor, but also on the floors above you. The valley emphasizes relaxing and recreational activities in relation to the rails. The valley provides a secret path through the building instead of using the pedestrian street. The fragmented facades of the northern part of the high-rise allows for peaks inside to this valley that contains different ecological flows such as nature, water, people that work and use the high-rise, the new building structures that rises besides the valley and traces of old building elements sticking out of the new structure. The peaks and viewing lines trickers a sense of curiosity for the walkers that paves the way for discovery. In the exploration, appears the valley that is a kind of secret recreational space inside the high-rise that provides a pleasent and exciting space for self reflection and social gatherings.

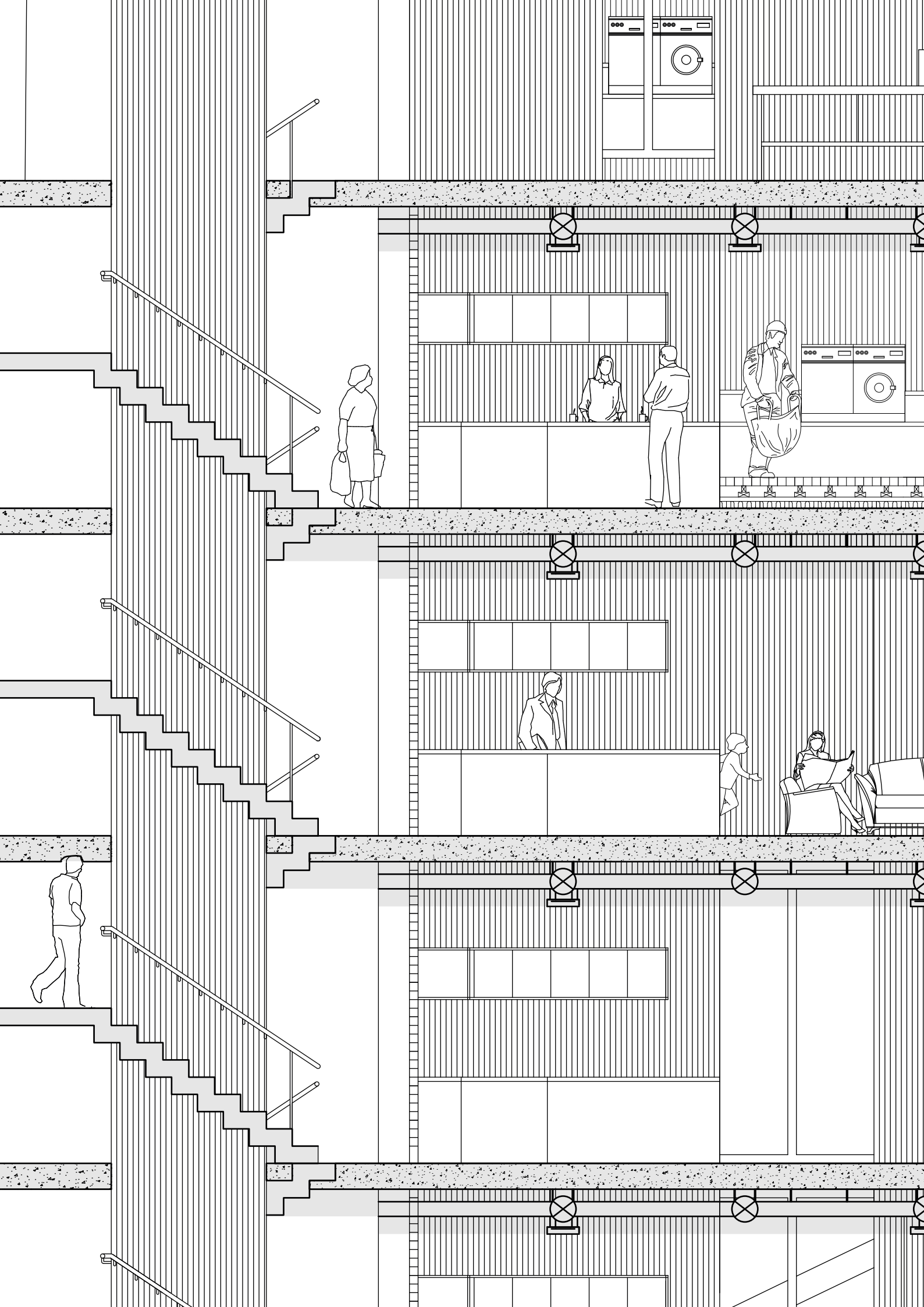


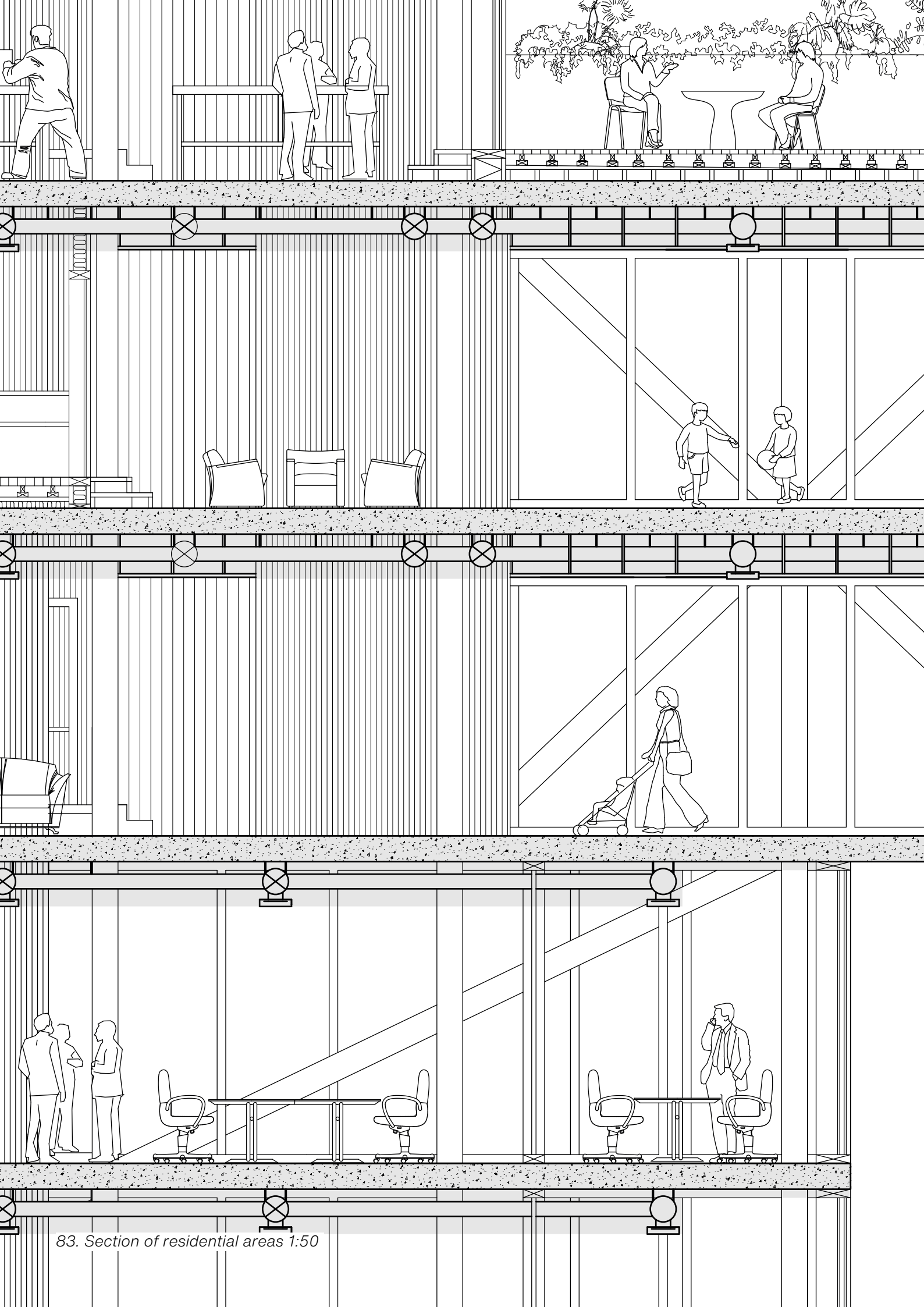
1. Showroom/Gallery
2. Public square and outdoor workshops
3. Storm water management pond
4. Creative offices and start-ups



81. Plan 1:100

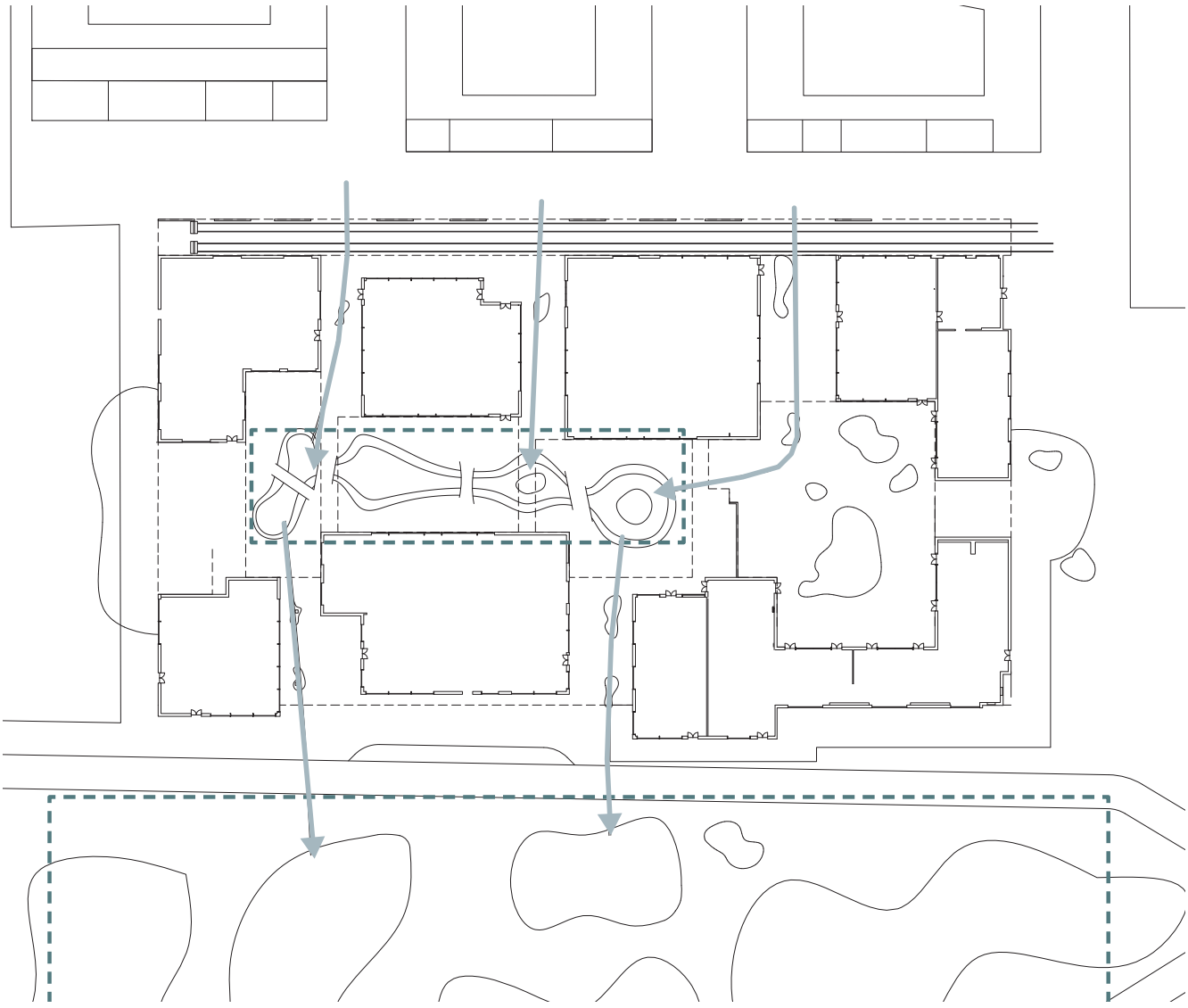
82. The valley





83. Section of residential areas 1:50

Water management and mobility

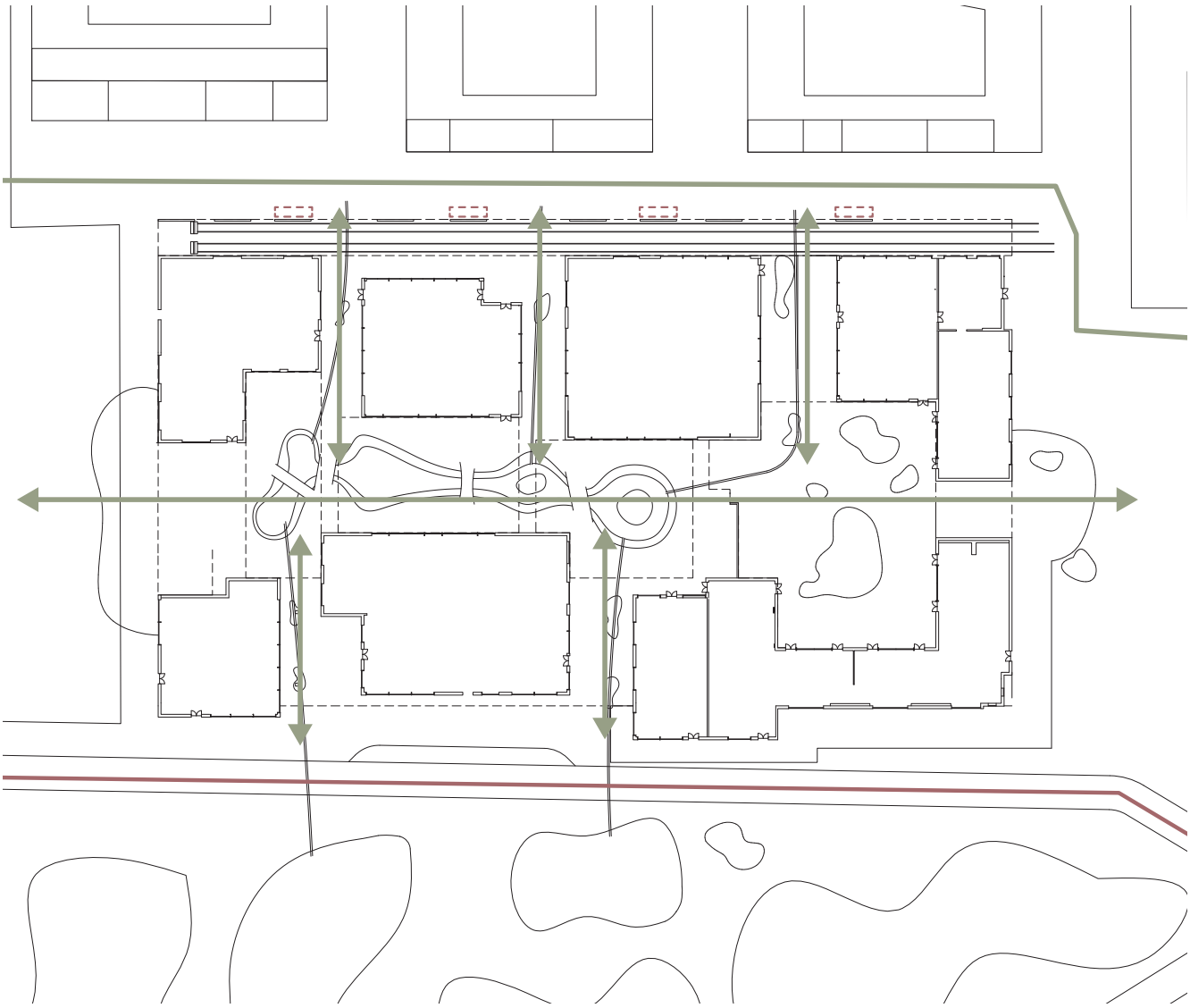


84. Water flow and catchment area

The high-rise is located on a very little slope, in which the wetland on the southern part of the site is the lowest and the pedestrian street and the northern part is the highest. Smaller open channels have been placed at all the northern alleys to lead the water into the permanent pond in the valley area of the rise. In case of too much rain, will the water be led through channels to the wetland area that will absorb the water through permable surfaces. The wetland should also be able to collect water from the ring road.

Water collective areas

Runoff direction



85. Mobilities

One of the main goals for Jernbanebyen is that it will be car free. This means, that the northern part of the high-rise will only be for soft mobilities with a dedicated bike lane. However, all the paths are wide and capable enough to provide for a variety of larger service and maintenance vehicles. Vehicle transport is possible on the southern part of the high-rise which is right at the edge of Jernbanebyen. This is also just for service, maintenance and deliveries.

Soft mobilities

Vehicle mobility

Indoor environment

The indoor environment has been evaluated at some critical spaces which are the key functions located on the southern facade. The areas have all been evaluated through different categories of comfort - thermal, atmospheric, acoustic and visual here, mostly emphasizing acoustic and visual. Many of the indoor environmental aspects has been considered on a conceptual basis in terms of required standards, norms and rules. In addition, there has also been considerations related to passive strategies, such as natural ventilation in terms of cross and single sided ventilation. Furthermore, the location of ventilation aggregates have been considered in which the spaces are also intended to provide structural stability.

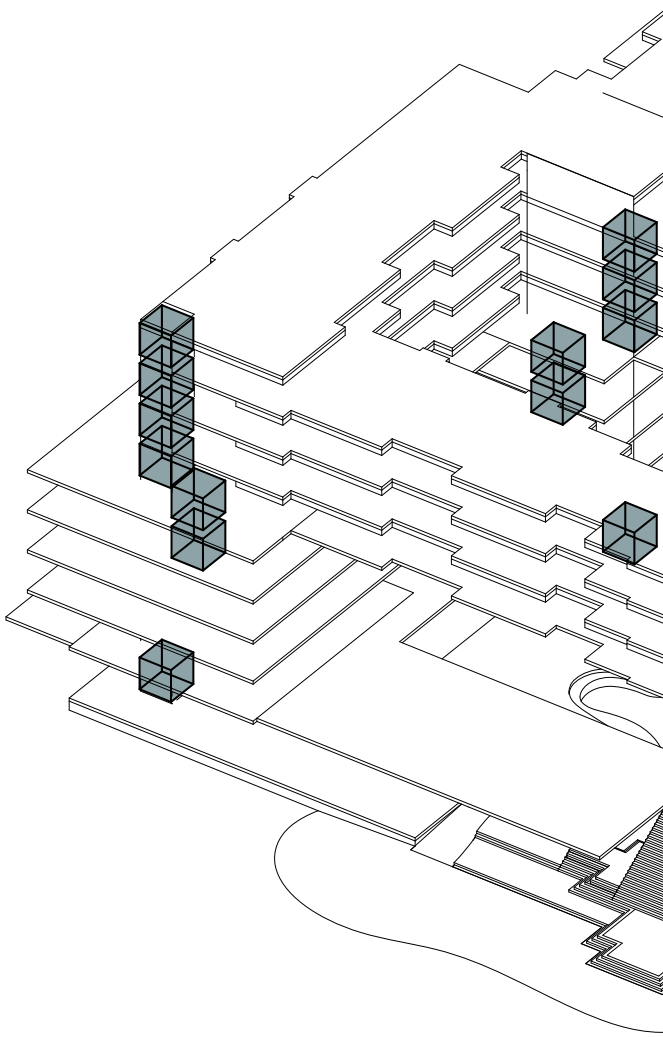
U-values
Facades: 0,3 W/m2K
Roof: 0,2 W/m2K
Floor: 0,5 W/m2K
Walls and floor at ground: 0,3 W/m2K
Windows: 0,6 W/m2K
Glass sliding doors: 1,1 W/m2K

Acoustics (reverberation time)
Apartments: 1,1 ratio rule (0,6 s)
Offices: 1,1 ratio rule (0,6 s)
Circulation and common rooms: 1,0 s

Daylight factor (DF)
Apartments: 10% rule (2% DF)
Offices: 3% DF
Workshops: Artificial lightning demands (1000 lux)

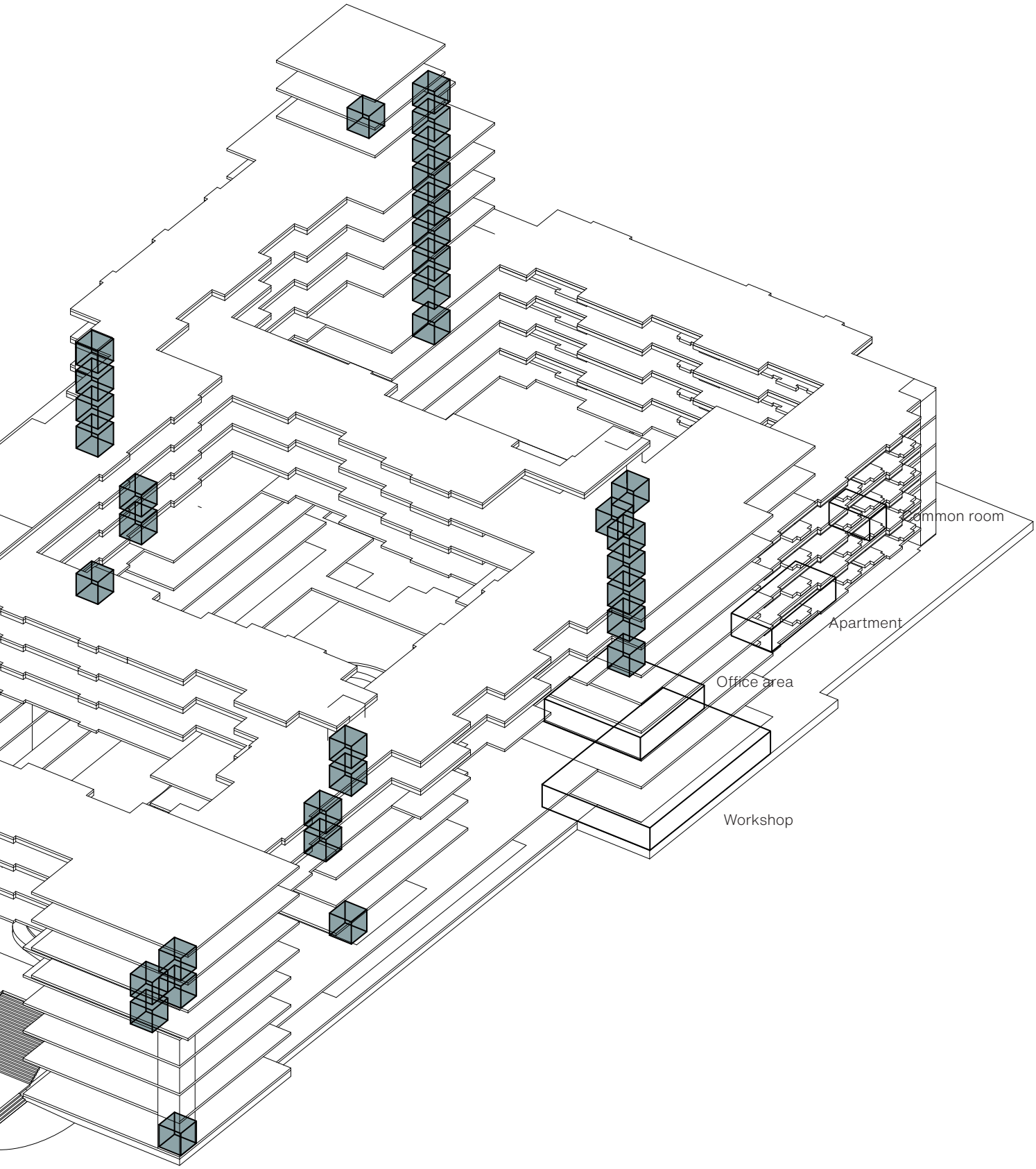
Over temperature
Apartments: 13 h > 28 C and 55 h > 27 C
Offices and work: 19 h > 28 C and 67 h > 27 C

Air change
Apartments: 0,5 h
Offices: 0,5 h
Workshops: 1 h



Critical spaces chosen for evaluation

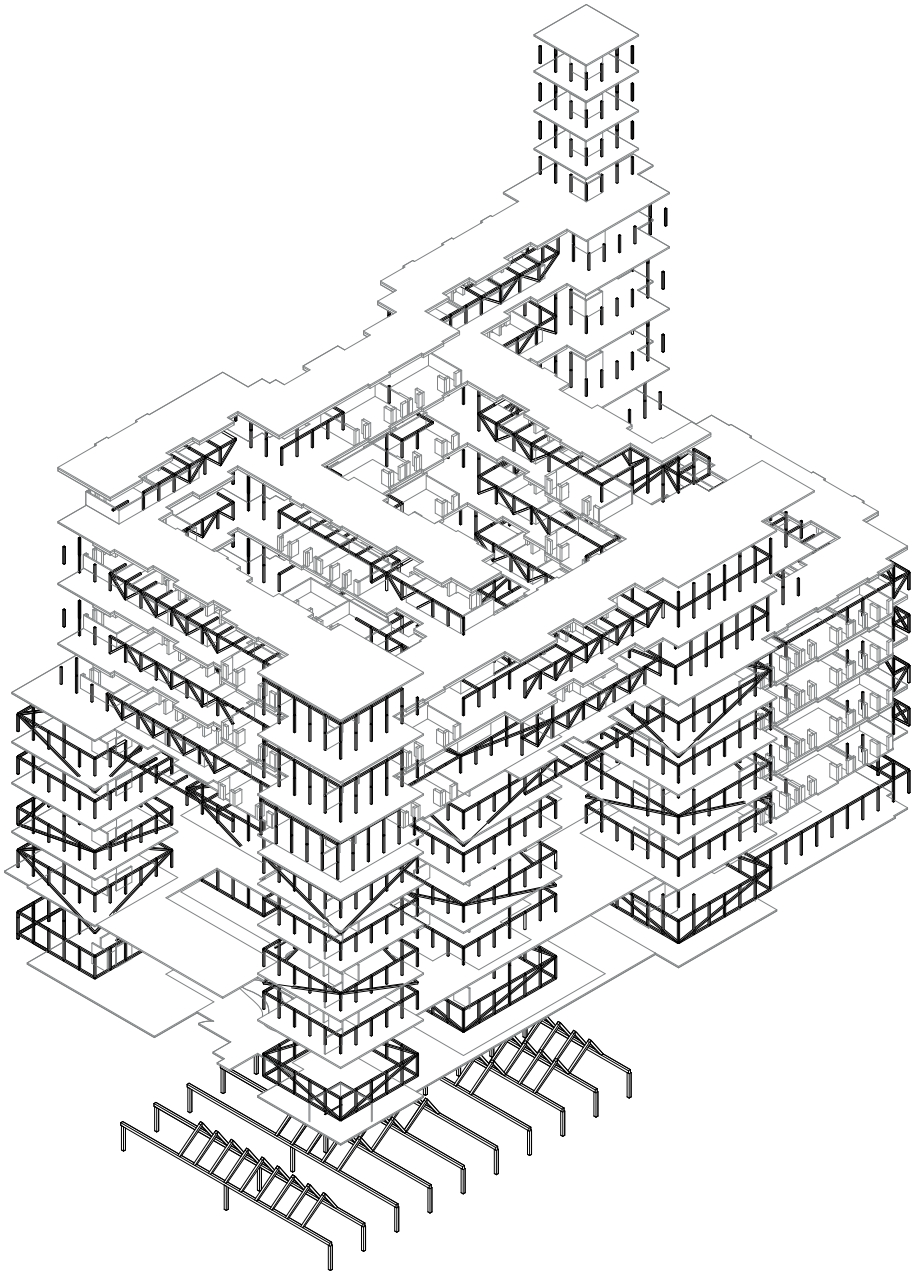
Placement of ventilation cores



86. Ventilation strategy

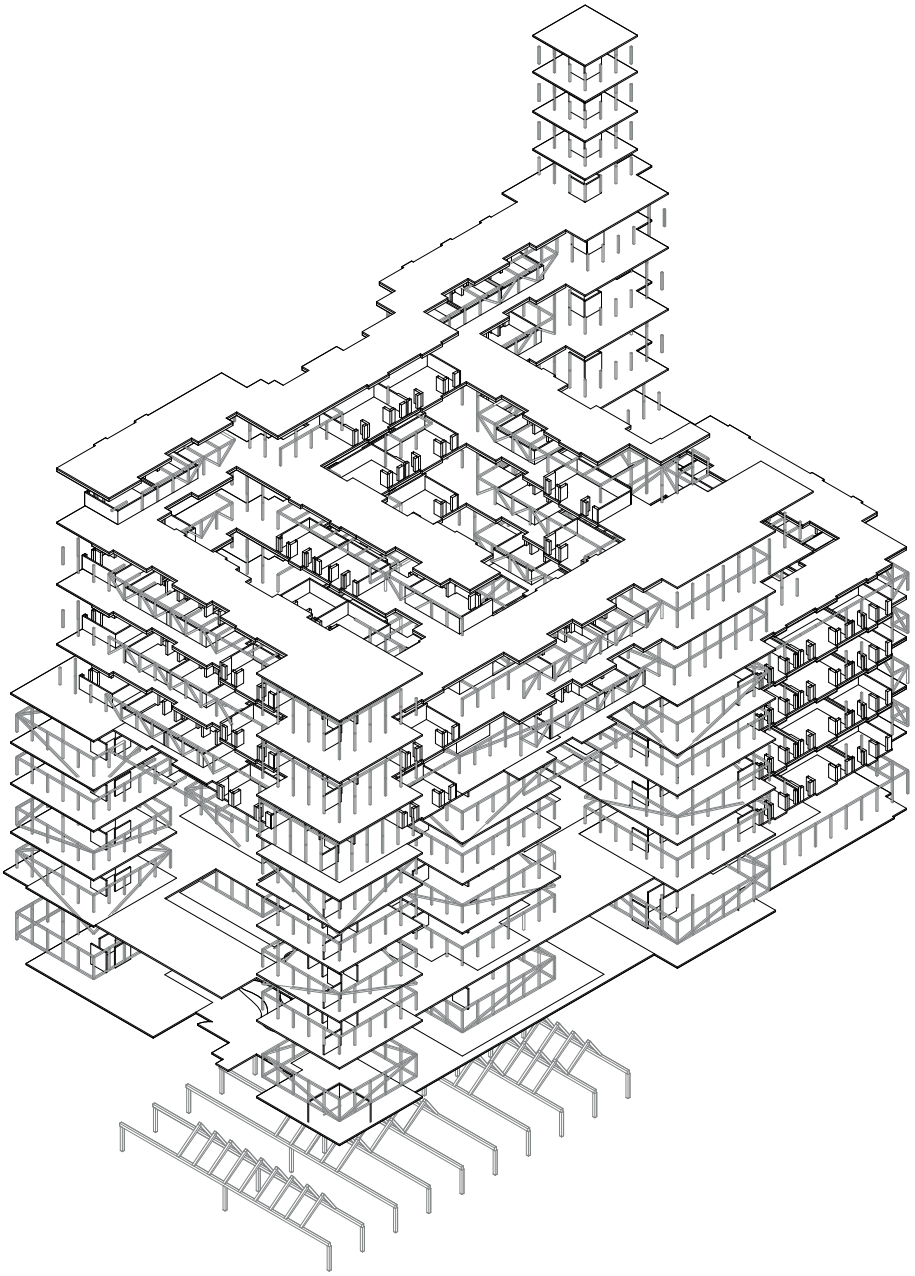
Structure and construction

The high-rise consists of a hybrid structural system that both uses a column/beam system and a slab/shear wall system. This ensures that some of the bigger spaces have a bigger flexibility. In this structure, the toilet and circulation core would also provide stability and be load bearing. The complexity of the programming and the form of the building resulted in many challenges related to providing only one concept for the structural system. The hybrid system er therefore used to accommodate the complexity of the form and the space requirements.



87. Column and beam system

Dimensions
Shear walls: 250 mm width (CLT)
Slabs: 300 mm height (Concrete)
Beams: (300x300 mm Steel S235)
Columns: (300x300 mm Steel S235)



88. Slabs and shear wall system

89. Looking from the old

08 Process

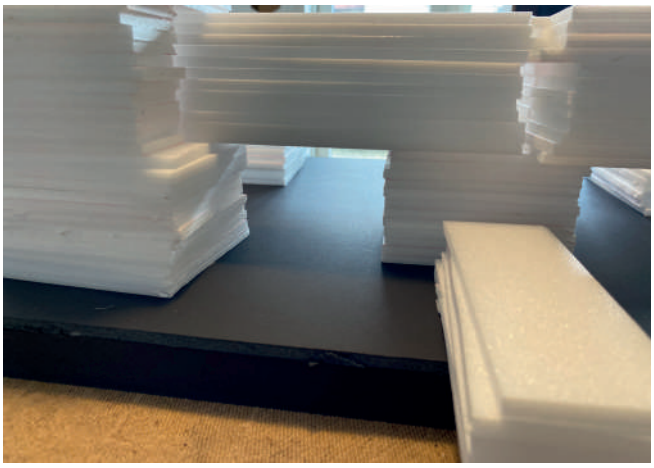
The following section will sum up the design process. It is important to note that the process in all is aspects is messy and non-linear which means that this linear report does not capture the unregularity, simultaneously and loops of the design process. However, it has been attempted by the group to display the design process in a manner that represents crucial decision making points and concsiderations. This also means that there will be jumps in how the different phases relate to each other.

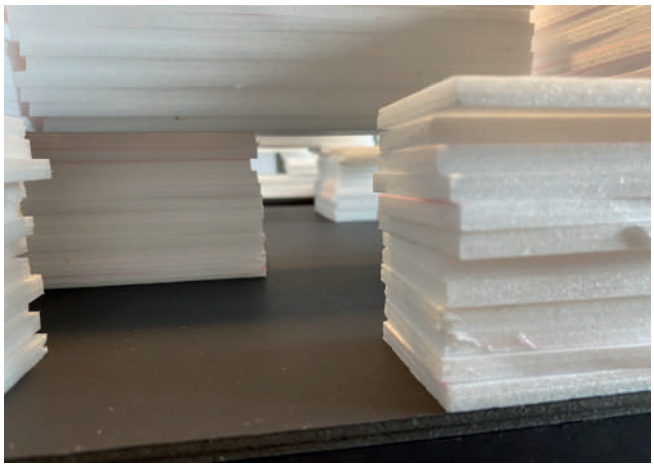
Preliminary sketching

The design process started off by working on various principles to get an idea of what will be emphasized in the design proposal of the project. This phase was deployed very early in the project which was to decide where the high-rise should be located on the site. The thesis started off by just focusing on the whole site and deciding the specific site later, but it was later discovered that it was necessary for the group to put focus on the southern part of Jernbanebyen.

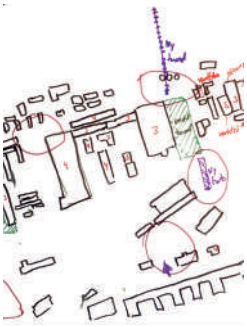
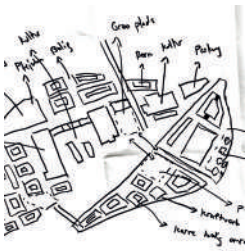
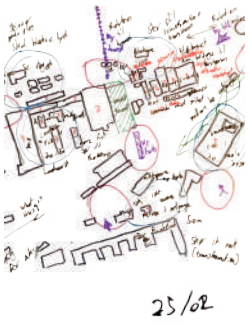
In the preliminary sketching phase, the group also discovered that the high-rise should be placed on top of the existing chosen warehouse building. Preliminary model studies were also done to get an overall idea of how the structure could fulfill the huge square meter demands to obtain the high floor area ration. The white block on the model is displayed as the new addition on top of the existing black warehouse block. Early work shows that the groups envisioned the high-rise to open in its form.

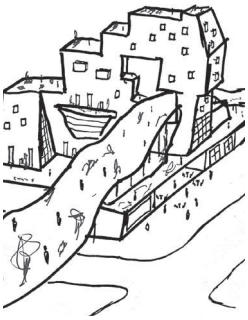
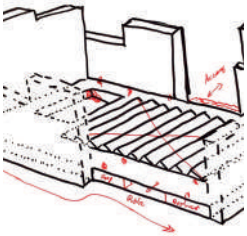
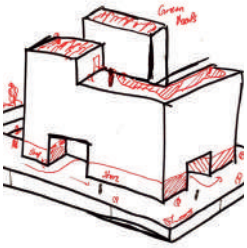
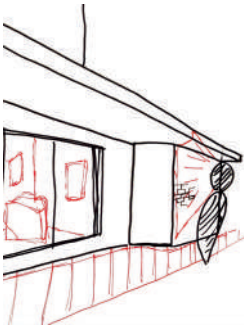
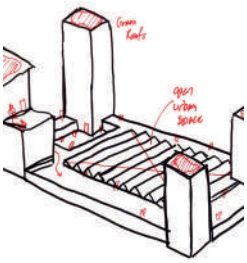
In addition, a lot of emphasis was put on how the high-rise should be a part of the green axis. This also opens to the next sketching in which the group needed a more detailed overview of the site and the masterplan of Jernbanebyen.

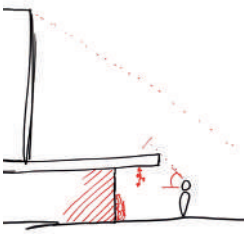
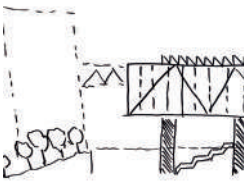
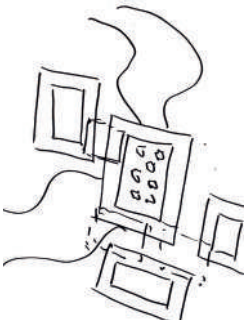
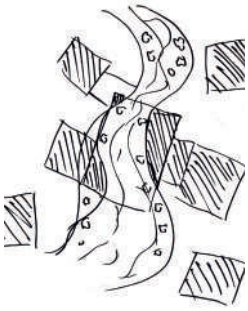
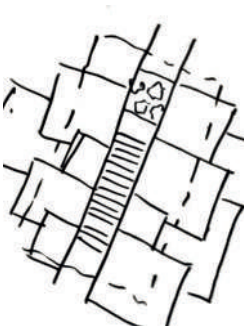
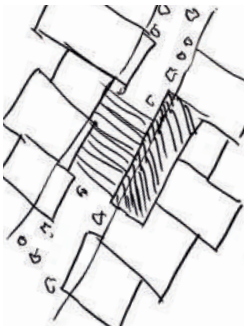




90. Early models

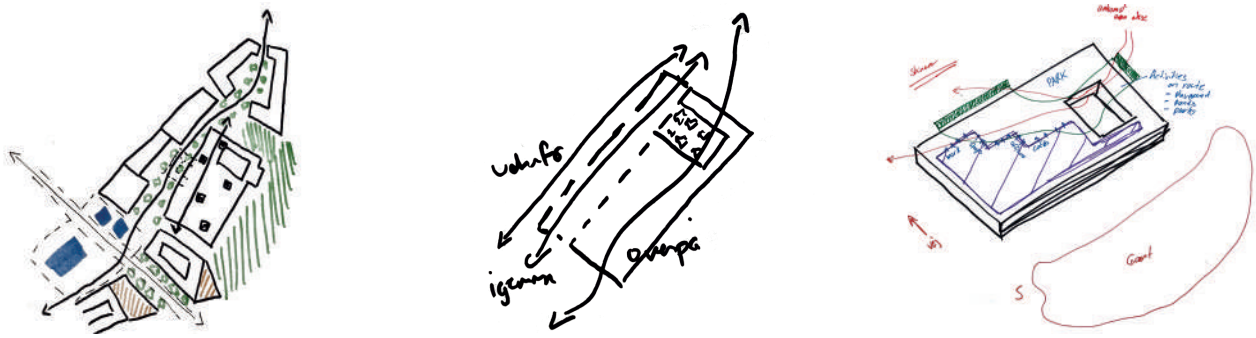







91. Early sketches

Masterplan development

The sketching of the masterplan was laid out in four major points. The first point concerned to grid related to how the built structures should be placed according to the roads and how people should move. The mobility plan emphasized softer mobility options. The choice for the masterplan concerned a more organic road system on the southern part and a strict grid on the northern that accommodates the existing structures.

The second point followed up on the mobility study in which it laid out the parking strategy in relation to the high-rise developments that would occur at Jernbanebyen. It was decided that the parking should be located on the outskirts of the area. The two last points concerned where green and recreational spaces should be located and how the green axis should place in accordance with the chosen location for the high-rise. It was there decided that the green axis should move through the high-rise in a conceptual plan of the area. The masterplan for the whole site is very conceptual thoughts in which it does not allow us to know what kind of flows is desired around the site. Therefore, zoomed in site plans were sketched to get an idea of how the flows should be around the high-rise on a site plan level.



Based on the sketching, the group decided that two different flows should occur at the high-rise, one going on the northern part of the building and the other one going through building. In this phase, it was not clear how the flow should be going through the building – it was decided that the flow through should both be on the ground floor and on the roof of the existing structure. This also means that the group lacked an understanding of how the flows should be laid out inside of the building in relation to the outdoor flows which will be discussed in the next phase.

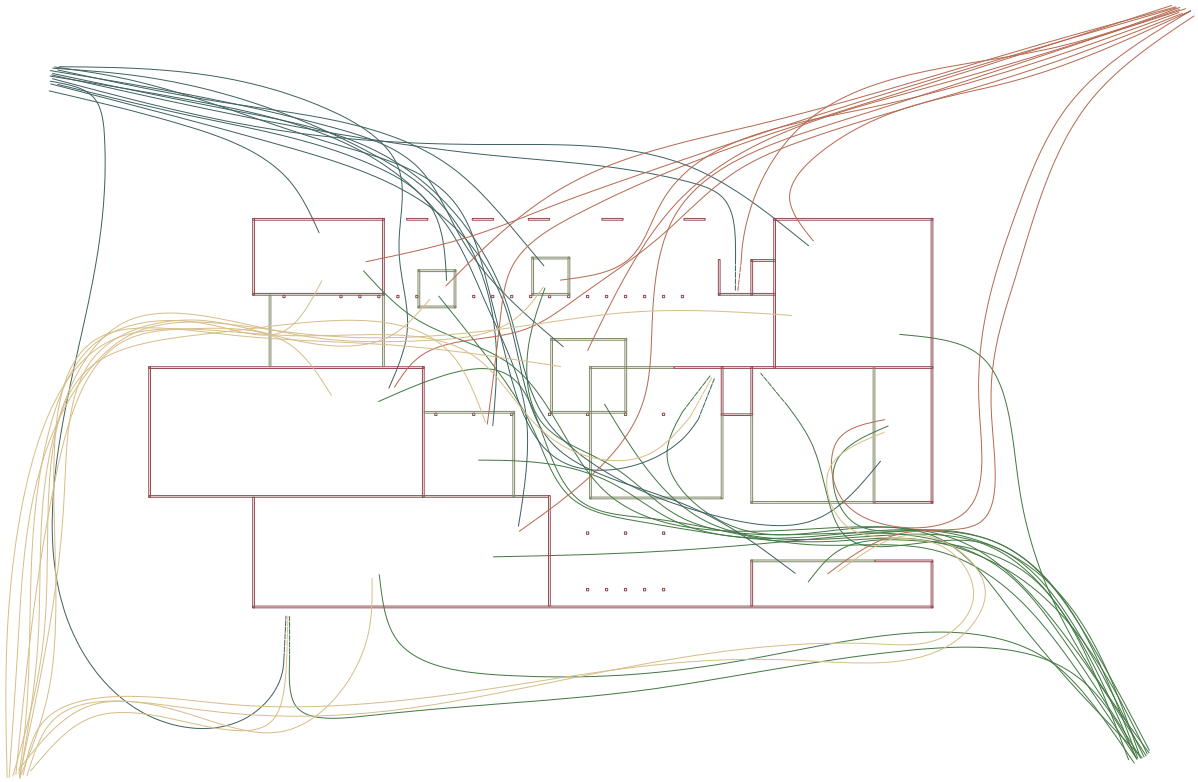
92. Siteplan sketching

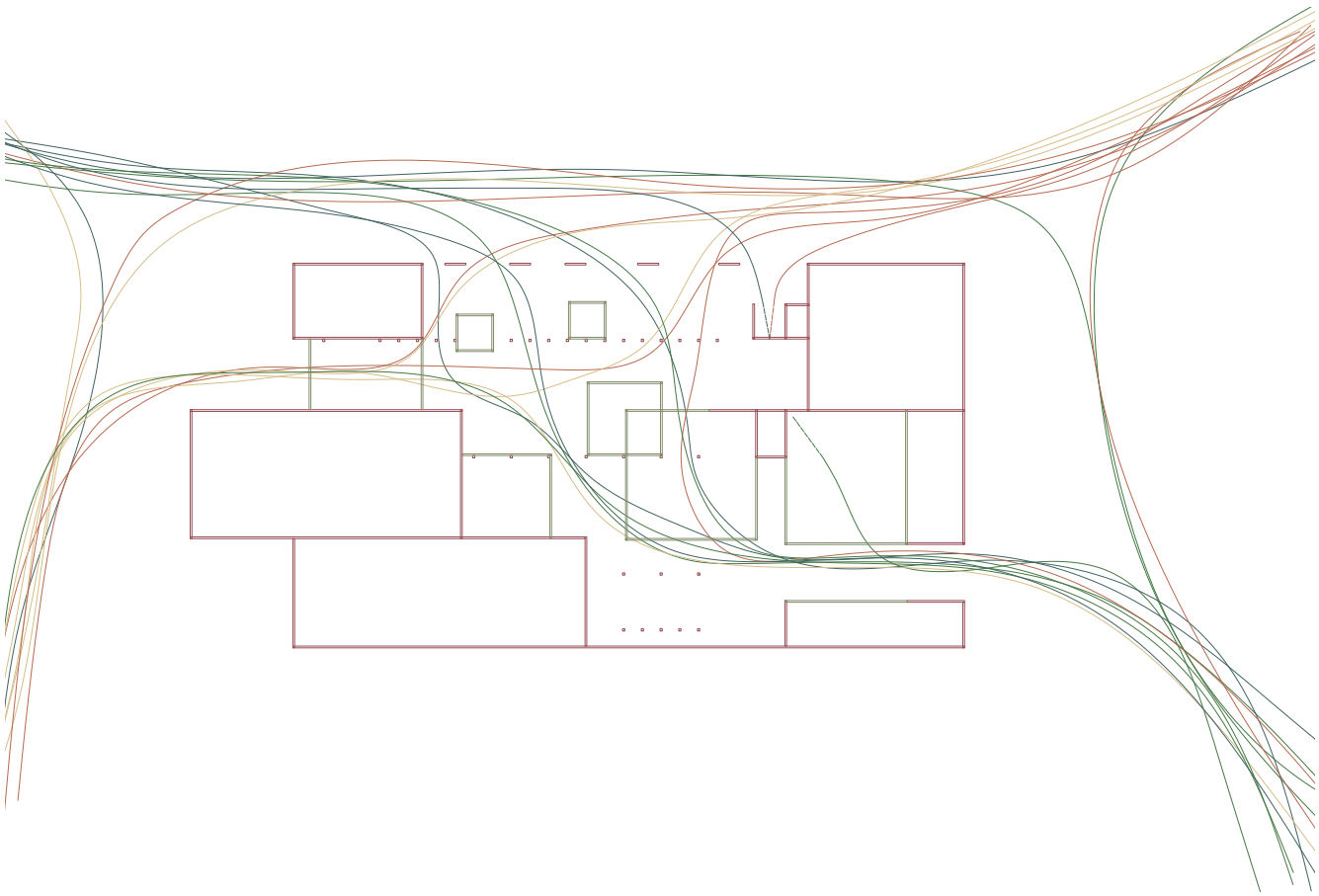
93. Masterplan sketching

Mobility and flows

The infrastructure and flows study attempts to fulfill the visions on the previous phases, but also to get an understanding of how the flows should be laid out in the building. The flows inside are based on the principles of the masterplan flows. By doing this phase, the group also got an insight to how than plans should be organized in relation to creating good experiences and create meeting areas through the flows.

The main conclusion for the study shows that the building should be open and allow for flows in many directions. In addition, the flow illustrations show the flows as being very two dimensional. This means that there is a need for further three-dimensional studies that can accommodate the experiential flows in a vertical manner. The next phase in the design process will therefore be initial form studies.



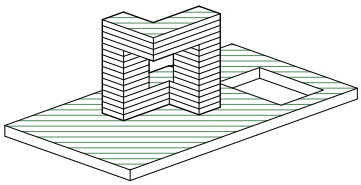


94. Sketches of flow

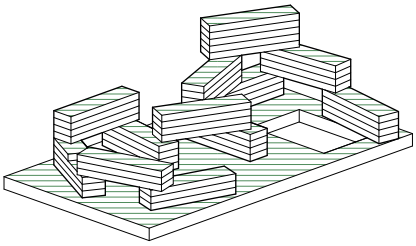
Initial form studies

This phase lays out many different forms in an initial form study. The aim for the study was to develop a form concept that would be in accordance with the different flow ideas developed in the previous phases. The main criteria for the form study are based on the idea of the high-rise being to close and pervious. The study tries to develop form concepts that are welcoming, engaging, and open for human flow across different floors.

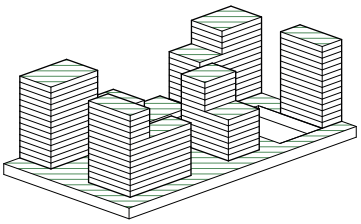
All the options were laid out as additions to the existing form because of the concept of being able to walk on the roof. The chosen forms were chosen because of their way of encircling a variety of courtyard spaces. The forms choices were very much based on conceptual ideas of quality spatiality's. However, it was discovered in the same study how the daylight of the building units and the areas of the courtyard does not comply with sufficient daylight demands for comfort and well-being. However, the group still felt a potential in the two forms which is why in the next phase they will be merged and optimized to gain better human comfort in the courtyard and daylight in the building blocks.



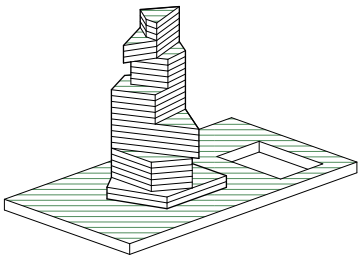
Floors: 17
Height: 53,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 3



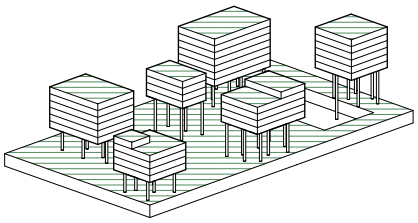
Floors: 14
Height: 44,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 4



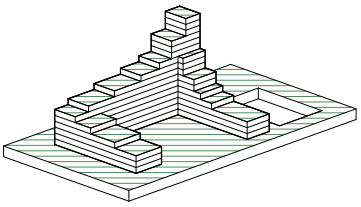
Floors: 15
Height: 47,5 m
Daylight score (1-5): 3
Surface radiation score (1-5): 3



Floors: 28
Height: 89,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 3

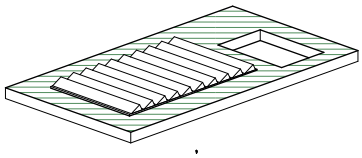


Floors: 8
Height: 36,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 4

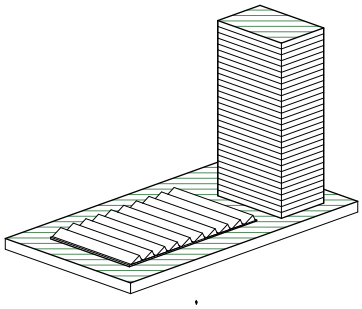


Floors: 16
Height: 53,5 m
Daylight score (1-5): 3
Surface radiation score (1-5): 3

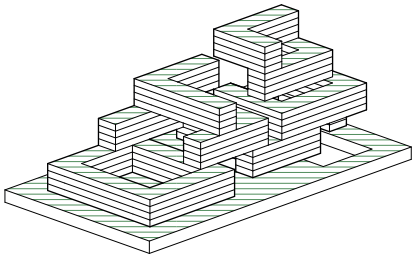
95. Initial form studies



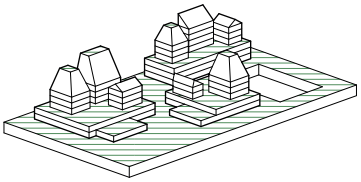
Floors: 1
Height: 9,5 m
Daylight score (1-5): 5
Surface radiation score (1-5): 5



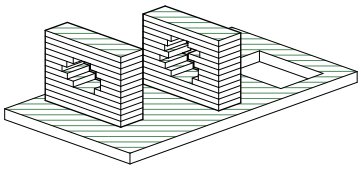
Floors: 31
Height: 95,5 m
Daylight score (1-5): 5
Surface radiation score (1-5): 3



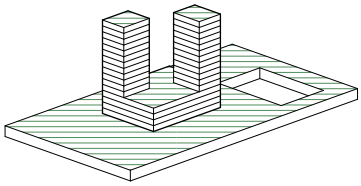
Floors: 17
Height: 53,5 m
Daylight score (1-5): 3
Surface radiation score (1-5): 3



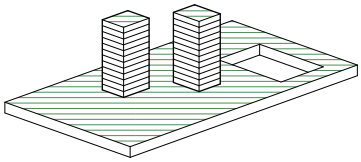
Floors: 10
Height: 33,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 5



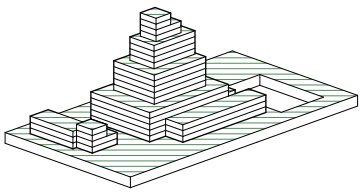
Floors: 12
Height: 41,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 3



Floors: 17
Height: 53,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 3



Floors: 17
Height: 53,5 m
Daylight score (1-5): 4
Surface radiation score (1-5): 4



Floors: 18
Height: 59,5 m
Daylight score (1-5): 3
Surface radiation score (1-5): 3

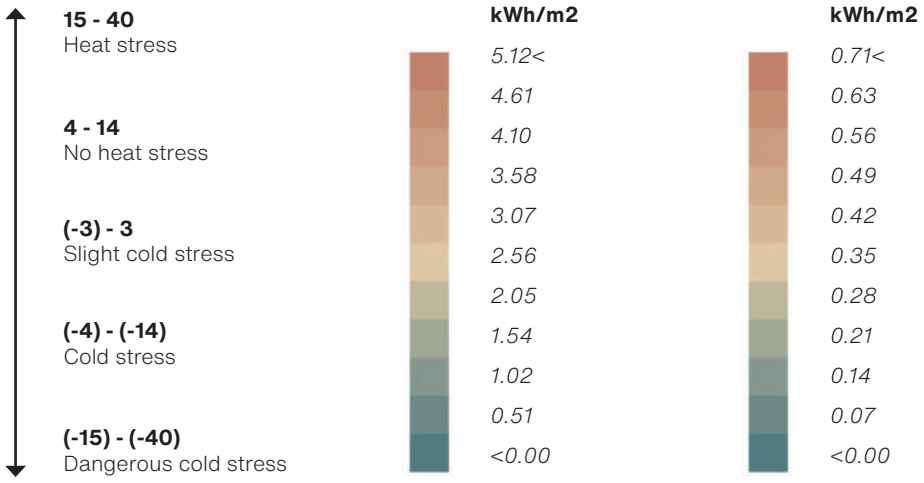
Outdoor comfort and daylight

The aim for this phase was to optimize the chosen form in accordance with human comfort and daylight inside of the buildings. The study concerns both the public spaces related to human comfort in which we evaluate wind conditions, humidity, direct sunlight, and shadows, and the indoor spaces that in which a radiation study is deployed to provide a conceptual sense of how the facades responds to the sunlight.

The study concludes that the closed shape of the roof on the existing warehouse building does not get adequate sunlight to be pleasant. This requires that the roof structure needs holes or windows. At the same time, this raises question to which the existing warehouse should be an outdoor or indoor space if holes are needed in the roof. In addition, even if there will be openings to provide daylight it will not be sufficient for some functions which is why functions that does not have demands for large amounts of daylight factor can be placed down there.

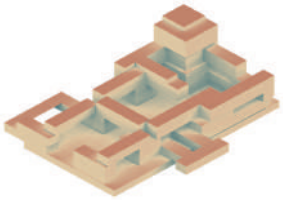
The group found form 1 as the best solution in terms of the creation of two separate geometric courtyards. In addition, it was also proved that both the outdoor spaces have a good human comfort and many of the building blocks will have enough daylight. Functions that do not require a lot of sunlight can be in the blocks that does not get a lot of sunlight.

The group also attempted to do other iterations of form 1 that would attempt to maximize the daylight in accordance with orientation towards south. This did not make a huge different which is why the group chose to work with form 1. However, the biggest conclusion to the study was the hierarchy of floors in which there will be more floors in the north east corner and least at the south west corner. The study also concluded that the group needs to program the blocks based on the daylight output on the different blocks from this study.

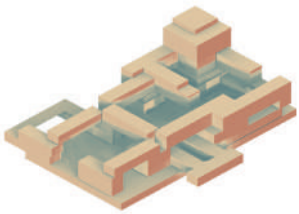


96. Radiation studies

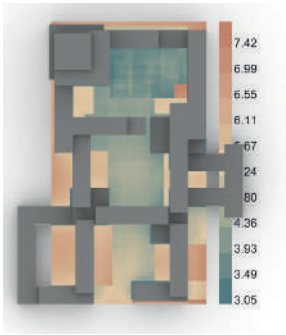
Form 1



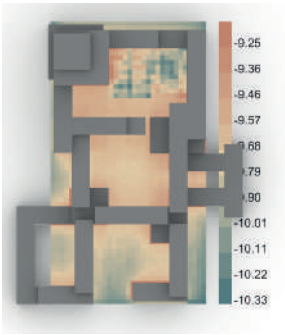
Radiation summer



Radiation winter

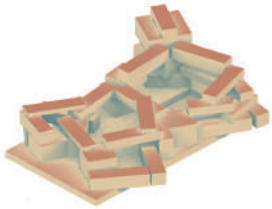


Human comfort summer

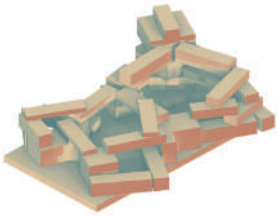


Human comfort winter

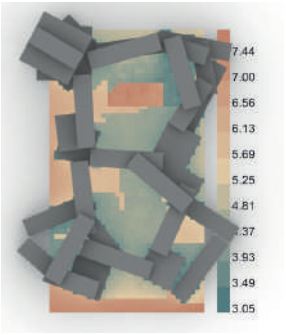
Form 2



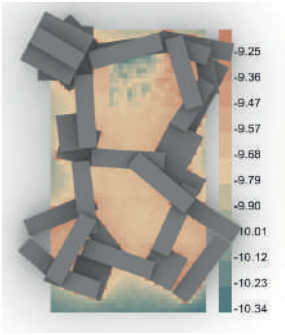
Radiation summer



Radiation winter

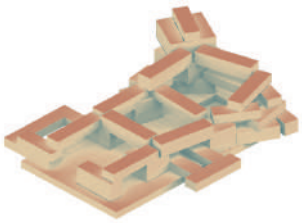


Human comfort summer



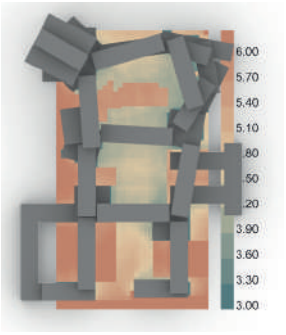
Human comfort winter

Hybrid form 1

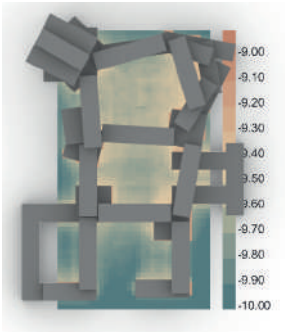


Radiation summer

Radiation winter

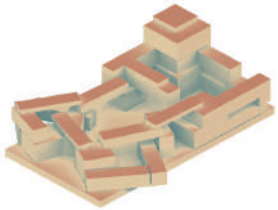


Human comfort summer

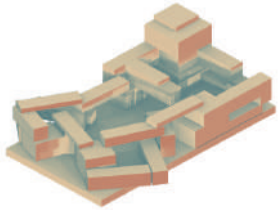


Human comfort winter

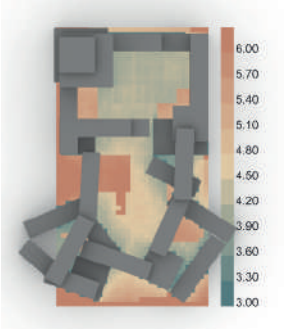
Hybrid form 2



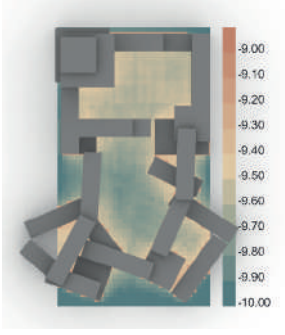
Radiation summer



Radiation winter



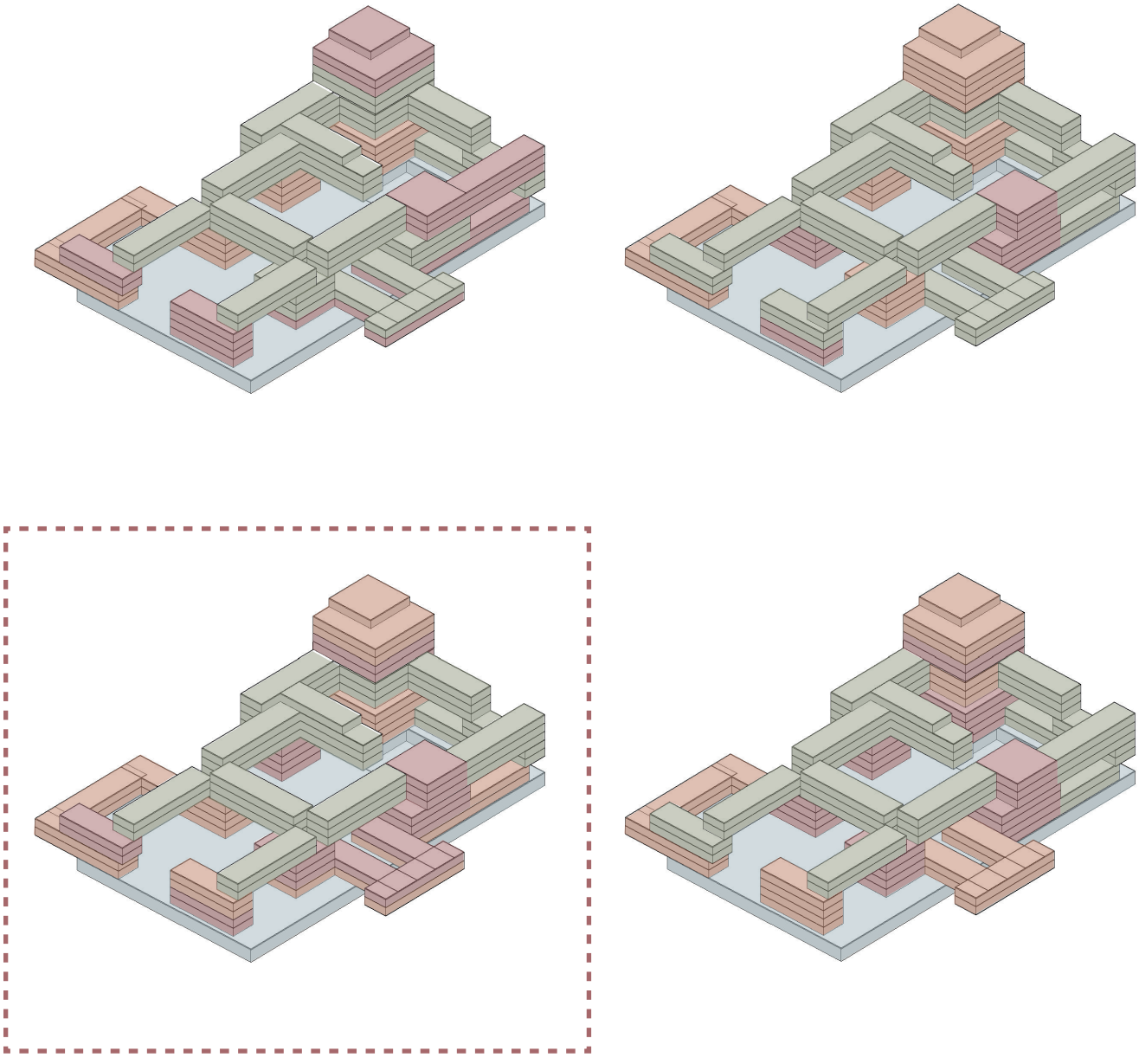
Human comfort summer



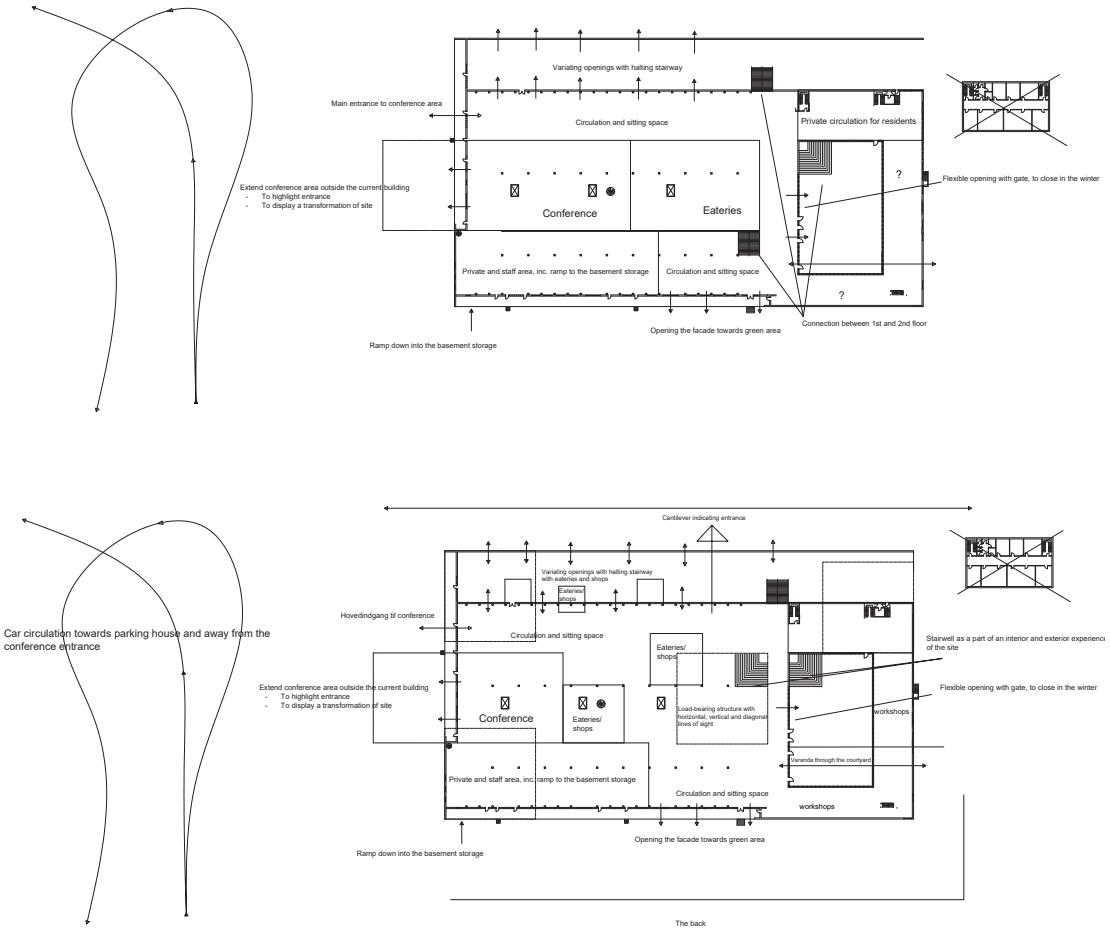
Human comfort winter

Programming the surfaces

This phase aims to investigate the form in relation to how the functions should be located. Some clues are already giving in the former phases of the design process. The desired flows and which blocks gets most daylight. The study also considers public functions and their demand to be on the ground floors to provide adequate accessibility for all. In addition, the synergies the functions provide both in the relation between indoor and outdoor, and the vertical hierarchy. The diagram shows different iterations that considers all the aspects.



97. Function diagram of additional structures



98. Structure, functions and space intertwines

In the deside to program the surfaces, it also came up that the group needed to study the ground floor further because of the functions in the main load bearing cores would intertwine with the activities on the ground floor. The design of the structural principle also came up as a challenge that needed further exploration.

Housing

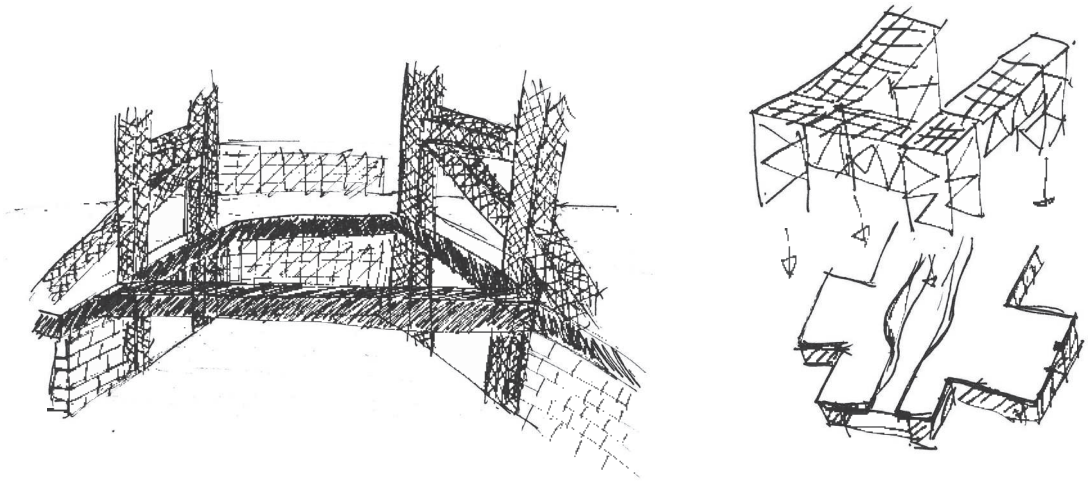
Mixed business, services, culture and recreational

Culture, physical activity and recreational

Work, knowledge and shops

Structural design

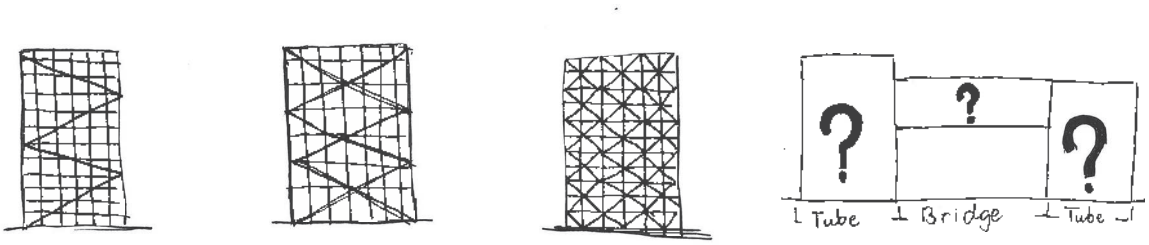
This phase explains the structural consideration and exploration in its material, displacement and openness of the stucture. The structural system is split into two separate structures. First one being the first and second level of the building, consisting of parts of the current buildings structural system, such as beams, columns, and walls. This structure is heavily transformed to accommodate new spatial arrangement created by the position of the second structure, that transfers loads off the remaining floors of the building and down through the first structure.



99. Spatial sketches of new structure

This new structure penetrates the boundaries of the current building, creating new openings in its walls and roof, leaving a clash of contrast between the new and old structure, visible in its (hard vs soft, transparent vs solid) material and (large vs small) elements and volumes. Wood will mainly be preferred as the structural material, however reinforced concrete and steel will be explore. The first structure, also called the current buildings structure will mainly not be interfered. The second structure, also called the added or new building structure, is a simple grid system distributed across the entire plot in a 3D manner. The vertices represent possible positions of joints, that connect either a slab and column or a column to the ground.

Our structural version is modified to increase the possible connected floor area by relocation the structural inner tube towards the edge of the high-rise, using it as a stairwell. This does increase the span of the floor area, that needs to be reduced through additional columns. These columns follow the positioning of the outer tube columns in a grid like manner, and its placement is determined of the spatial arrangement. Further the bridges between tube-in-tube structure will mostly host a larger number of apartments needing the facade to be less disturbed. Thus, the diagonal elements are moved, enveloping the hallway instead, while still ensuring the lowest displacement. The hallway also hosts some windows and entrances to the apartment; thus, it is needed to explore the structural arrangement in its diagonal system, depended on the openness between columns.



100. Structure 1, 2 and 3, and tube and bridge form

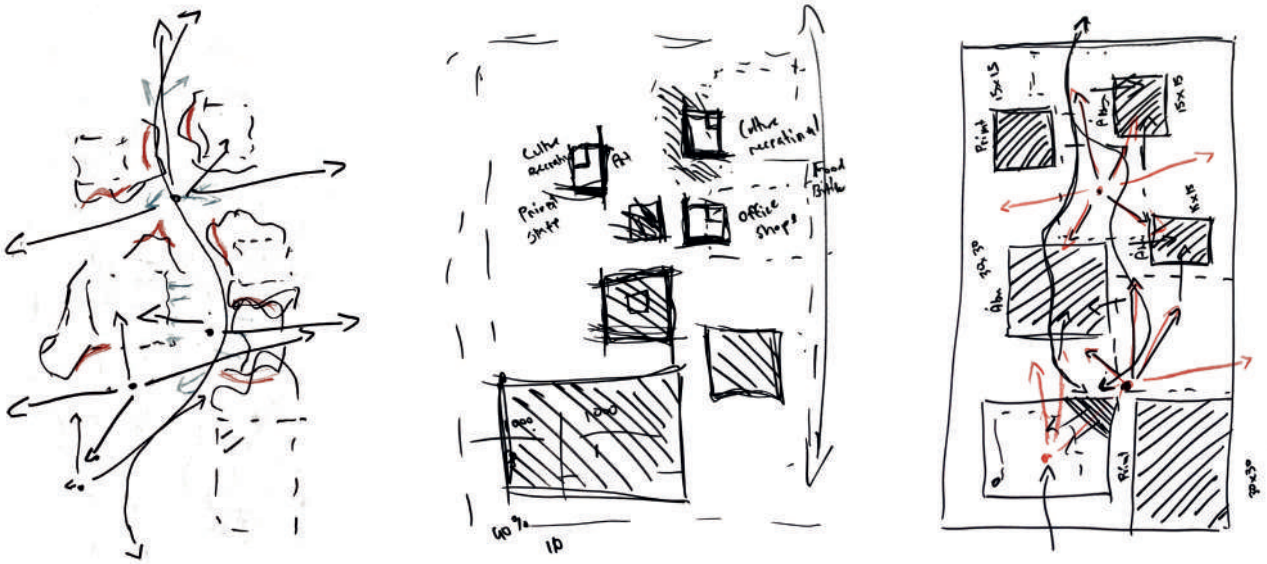
The structure is judged through a point system: Good = 1 point, Better = 2 points, Best = 3 point. The first represent a comparison of the displacement in the row, second is the column, third is the material and forth is the "openness." Since wood is the preferred material, they start with a +3, Steel +2 and concrete +1. Openness is judge by how much diagonal material exist between two columns, the more diagonal material, the worst score. Structure 1 is with lest amount + 3, structure 2 is medium +2 and structure 3 is most diagonal material +1. The score tell us that all steel structures and structure 2 as wood is the most viable, a different concern is that the displacement is to large which is why some critical areas on the construction would be further strenghtened.

	Structure 1	**Structure 2**	**Structure 3**
Wood C24 450x450	5.96 cm 1+1+3+3=8	4.2 cm 2+2+3+2=9	3.44 cm 3+1+3+1=8
Steel S235 300x300	1.62 cm 1+3+2+3=9	1.51 cm 2+3+2+2=9	1.41 cm 3+3+2+1=9
Concrete C15 300x300	5.12 cm 1+2+1+3=7	4.42 cm 2+1+1+2=6	3.35 cm 3+2+1+1=7

101. Early structural spatial progress

It was further on discovered that the structural system did not meet the requirements for the spaces and functions. This is why the group in the final design solution used a hybrid system that would cater to all the different functional and spatial needs through the use of multiple load bearing and stabilizing elements.

Ground floors and edge zones



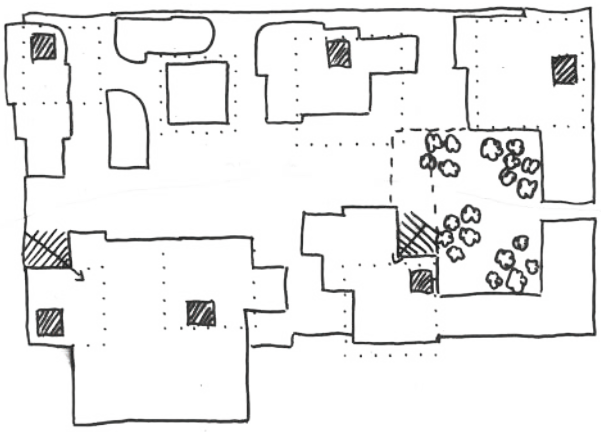
102. Principal sketches of flow on the ground floors

As the former phases showed, the most public elements will be located at the ground floors. The group envisions a large public space through the relation between the ground floor and first floor. The floors consider the bearing cores in which the structures merges in with the existing structure. The vision for the floors is that the green axis will be continued down through the ground floor which is why the group attempted to draw out different flows through in accordance with the different viewpoints and functions on the path.

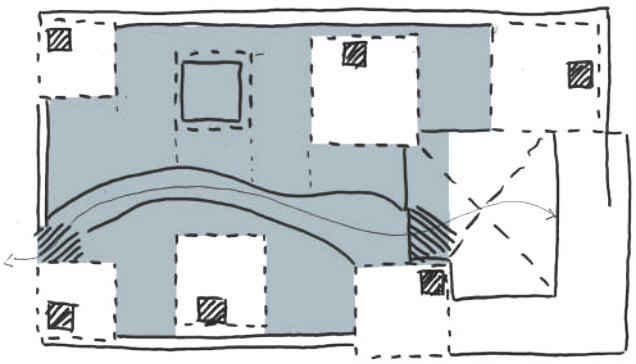
It was therefore decided very early in the process that the existing glass roof would be removed to ensure a visual connection between the floors. It was also decided early that the ground floor and first floor would not be heated, but rather only the boxes that was derived from the bearing cores would be heated. The first concept related to roof considered an organic roofscape that moved people through the form. The concern on this topic was that the public would not go up to the first floor without knowing what is going on and being able to see what is going on. The decision was then just to remove the existing roof instead and let it just form a massive courtyard feeling on the ground floor. The final decision was based on keeping the spatial qualities of the building in which the glass roof would be removed, but the roof structure would be kept. This would also maintain the courtyard atmosphere. The following phase will illustrate the different spatial studies related to the roof configurations.

Movement

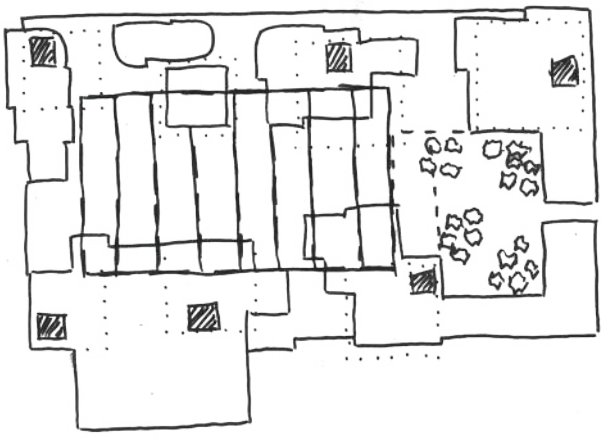
No movement



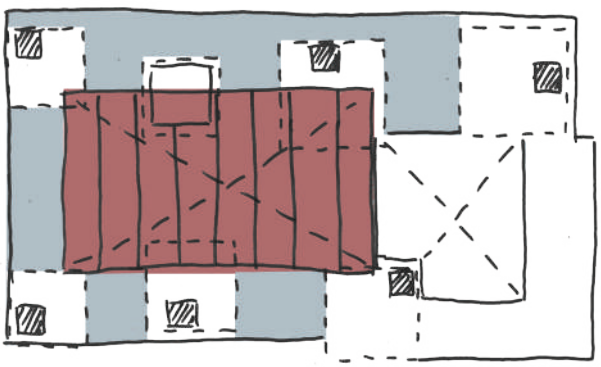
Ground floor with roofscape



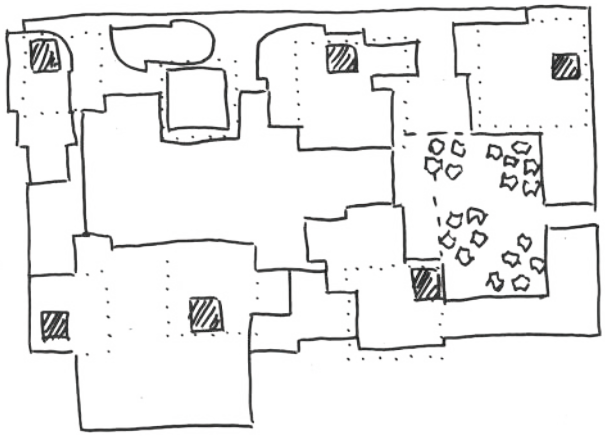
First floor with walkable roofscape



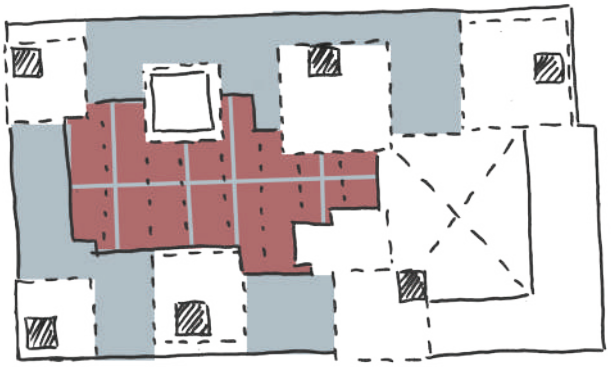
Ground floor with existing glass roof



First floor with existing glass roof



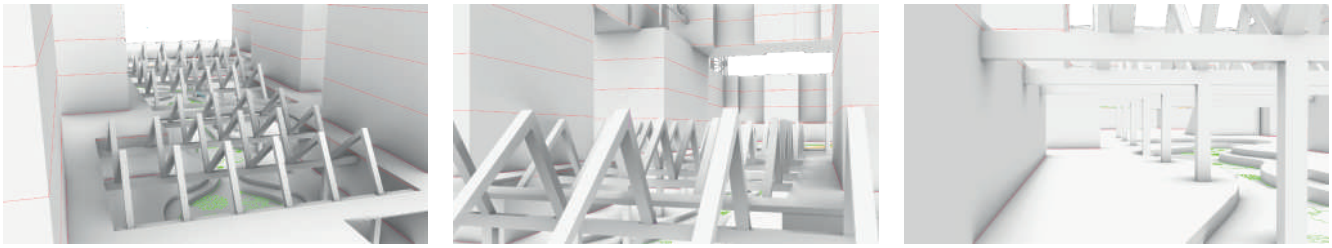
Ground floor with existing roof structure



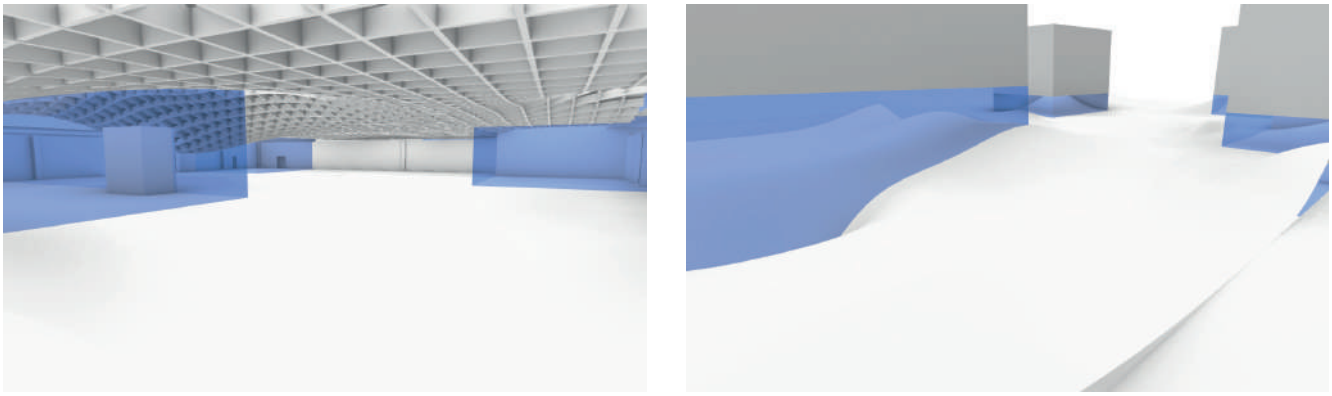
First floor with bridges between the roof structure

103. Sketches of ground floors

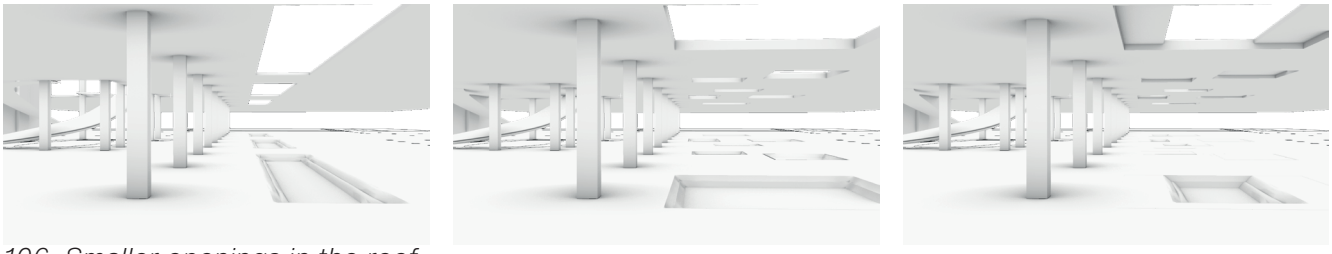
Spatiality of the ground floor



104. Maintaining the existing structure

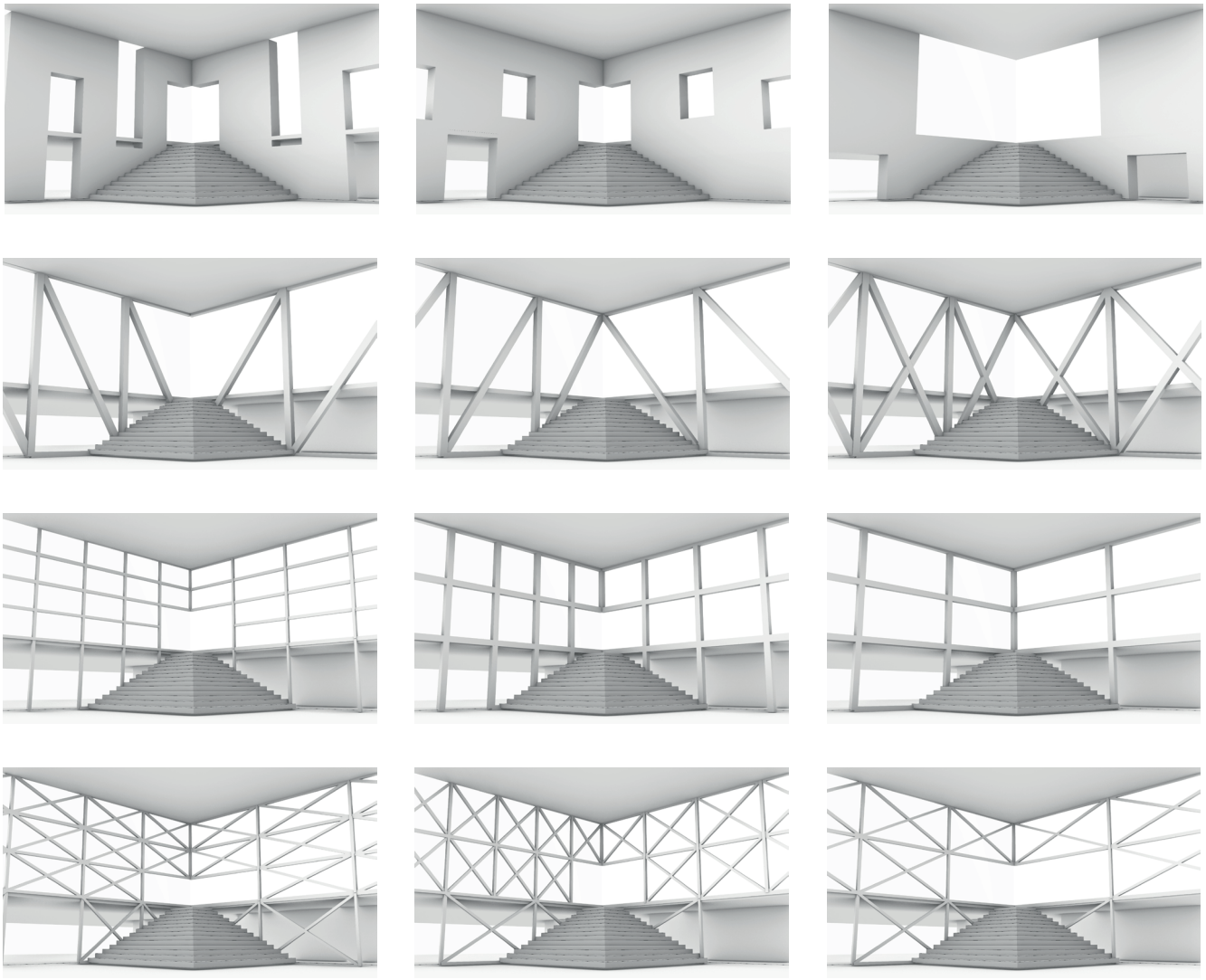


105. The organic roofscape

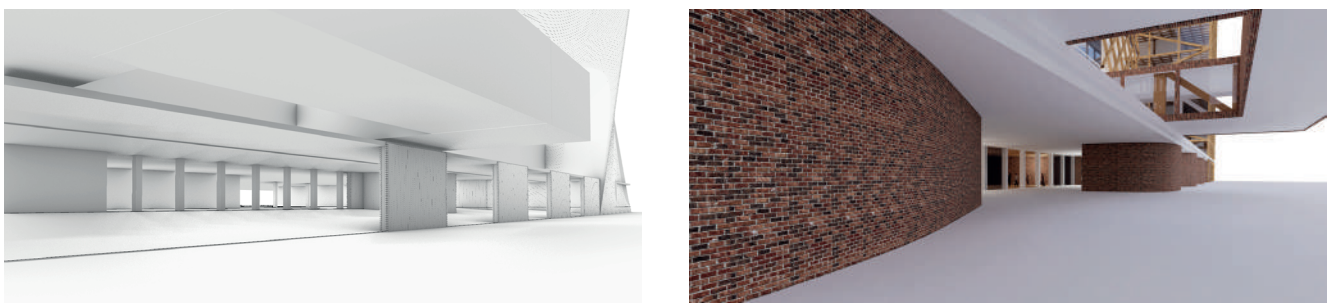


106. Smaller openings in the roof

The group found the spatial qualities of the roofscape to be interesting in its structural synergi with the space. However, it felt distant in terms of the form in relation to the other elements in the design. Openings were also attempted to be made in an just flat roof, but there was also an concern about too much space on the first floor that could not be filled with activities and just look to empty. There was also an discussion about how the structural system connect the ground floor and first floor to provide glimpses and entrances between them. The disussion about connection between the floors opened up an uncertainty about where the circulation should be formed and located which will be further explored in the next phase.



107. The synergy between ground and first floor



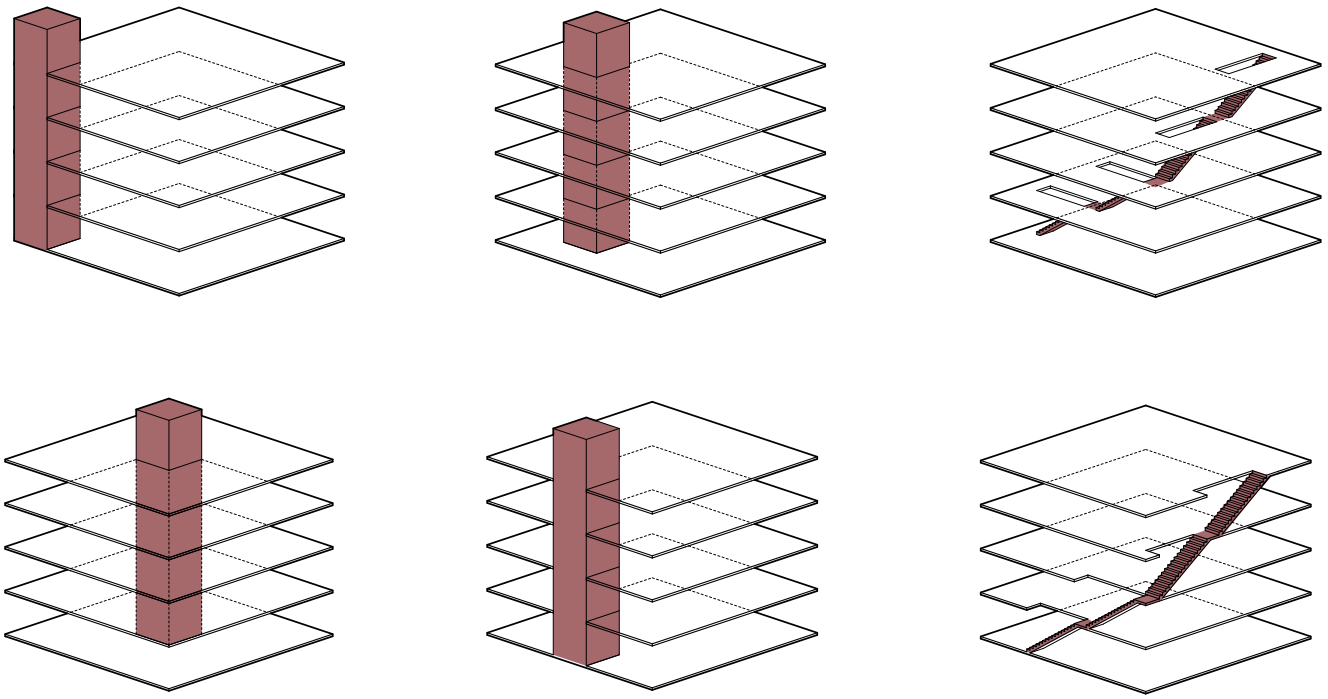
108. Maintaining the existing roof

Circulation

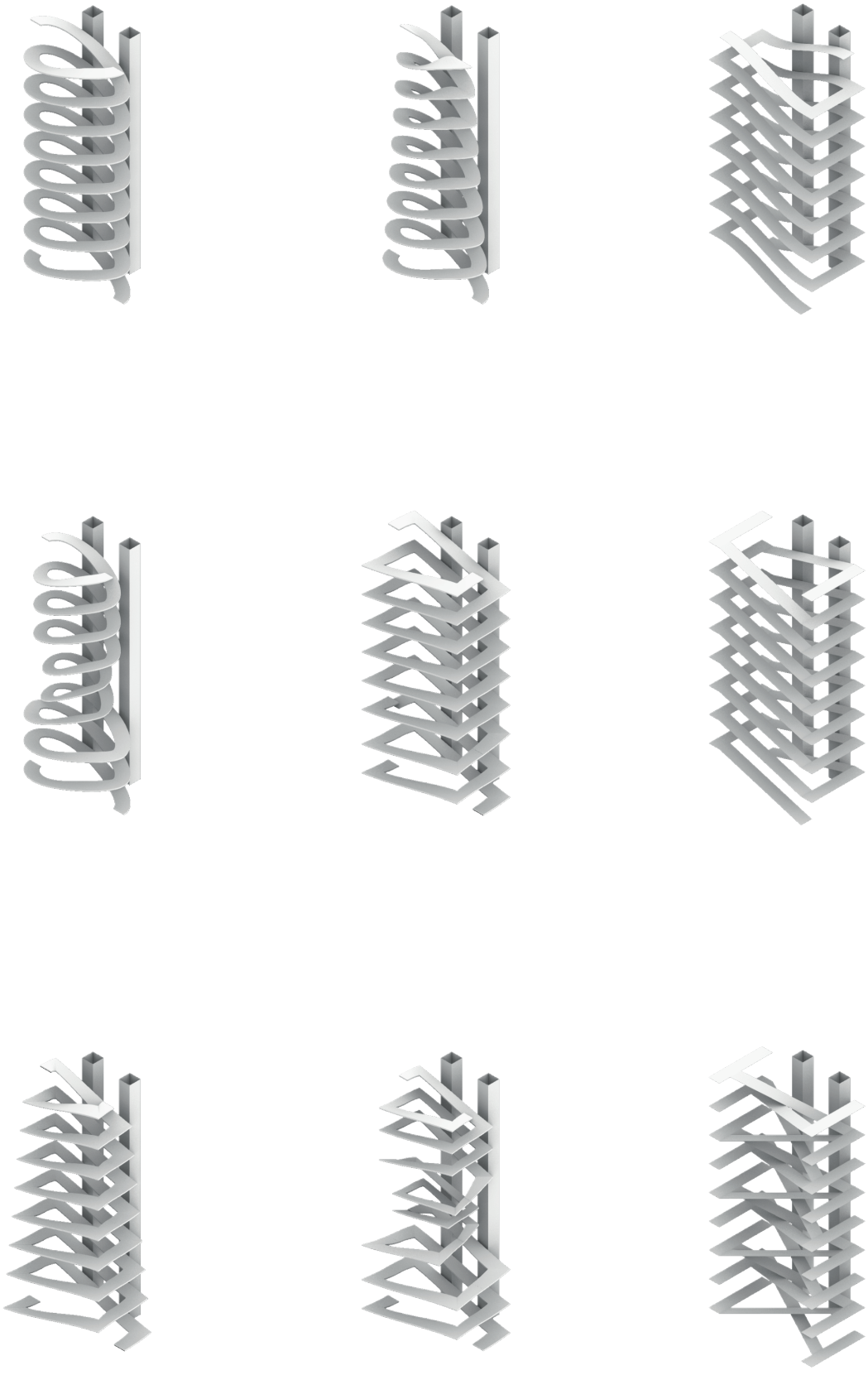
The aim for the circulation phase was to get a sense of coherence and connection between all the floor now that the relation between the more public ground floors has been established. The more upper floors require a different approach because it was earlier on decided that the more private functions would be located on the upper floors.

The first part of the study attempted to map out different circulation principles in the bearing cores. The conclusion was that the different options were found fitting in terms of different activities, but there was also a lack of knowledge to which kind of function the circulation would arrive in. Therefore, the plan study was done concurrently with this study to allow for a coherence between the circulation principles and the adjacent functions. One circulation principle was not chosen, but all the options provided qualities in terms of arriving to a specific function. This would be handy later because of the large-scale typology can contain many functions.

The second part of the study involved more spatial constructions of the staircases. The idea with the design was that the stair would be able to direct and show moving people different views and allow insights inside of the building. It was also here the group discovered that there was a lack of knowledge in the spatial construction of the spaces you arrive in.

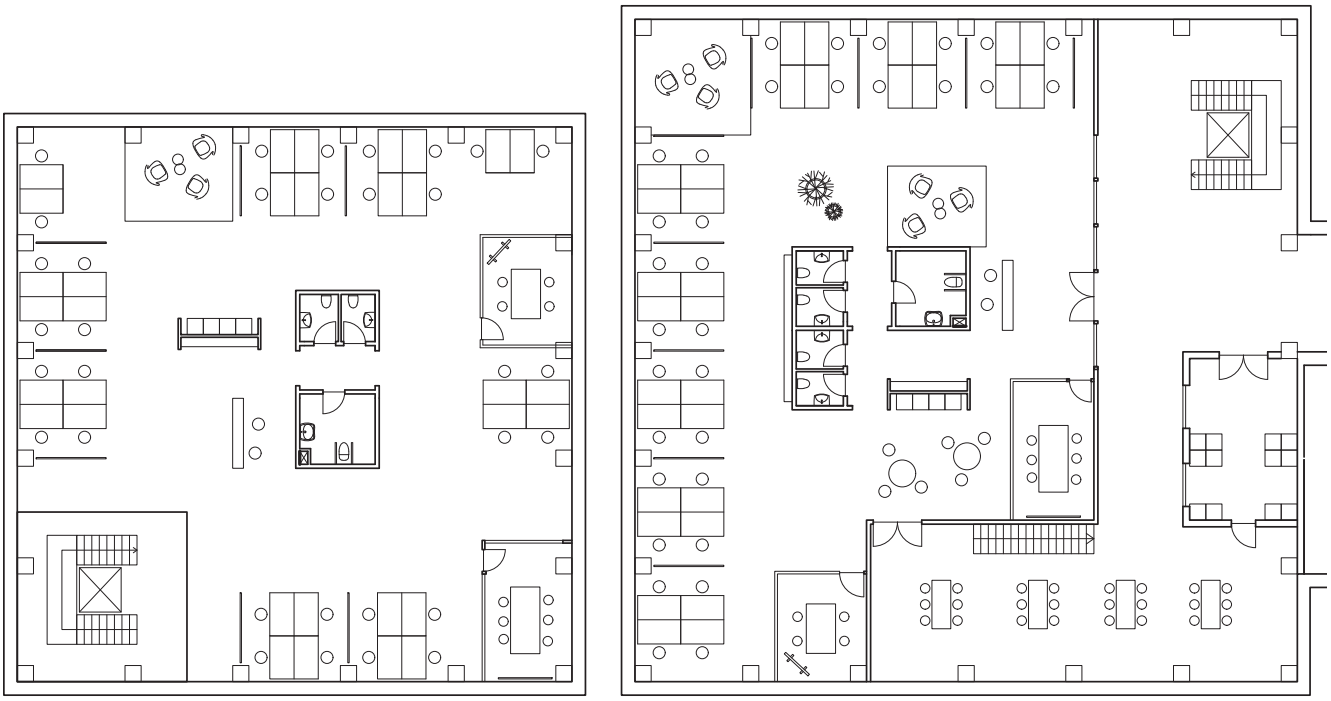


109. Circulation location principles



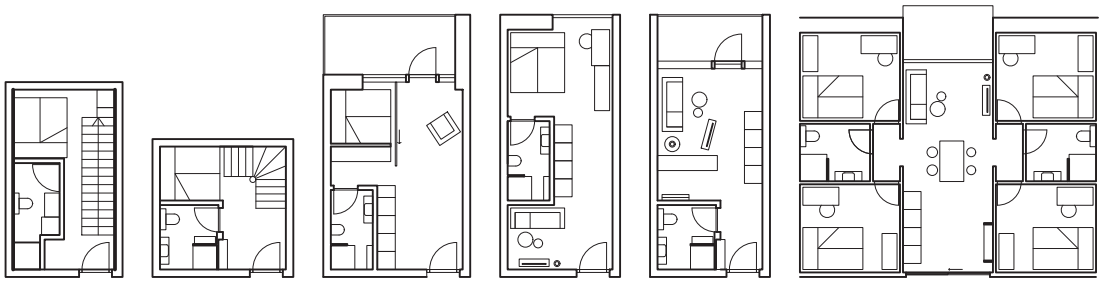
110. Stair iterations

Plan organization



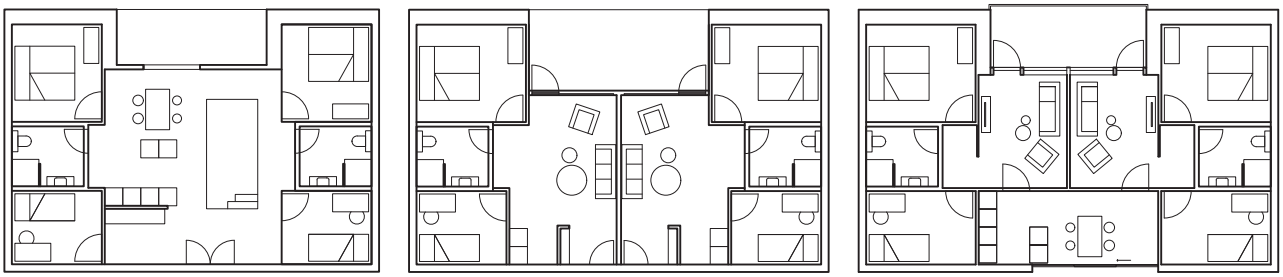
111. Core plans

The aim of this study was then to through plan to organize the more private spaces you would arrive in on the upper floors. First, the groups attempted to draw offices in relation to a living corridor and attempted to create synergies between the stair, living hall and office.



112. Student housing plans

The group also needed to sketch the different housing units that would comply with the other spaces. The group took the point of departure in the student housing unit. The narrative of this specific typology involved criticising the individuality and thereby made collective living units instead. The group also attempted two floor apartments.



113. Apartment plans

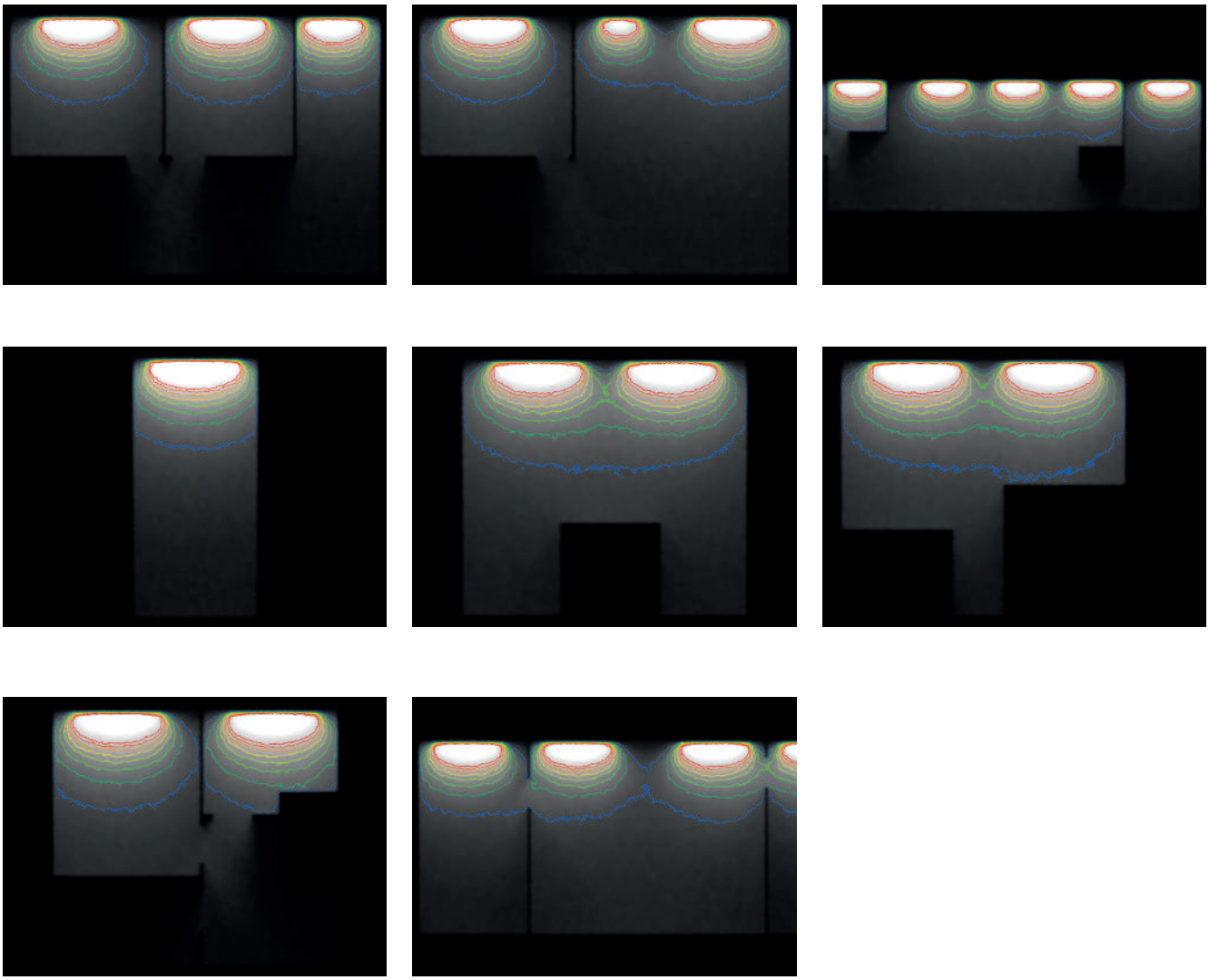
This principle of collective living was further on established in the senior unit, the couples unit and the family unit. There would also be attempts to create two floor apartments, but the layout would not fit the overall floor plans. These apartments plans have different degrees of collectiveness dpeneding on the specific target groups living there.

114. Hallway principles

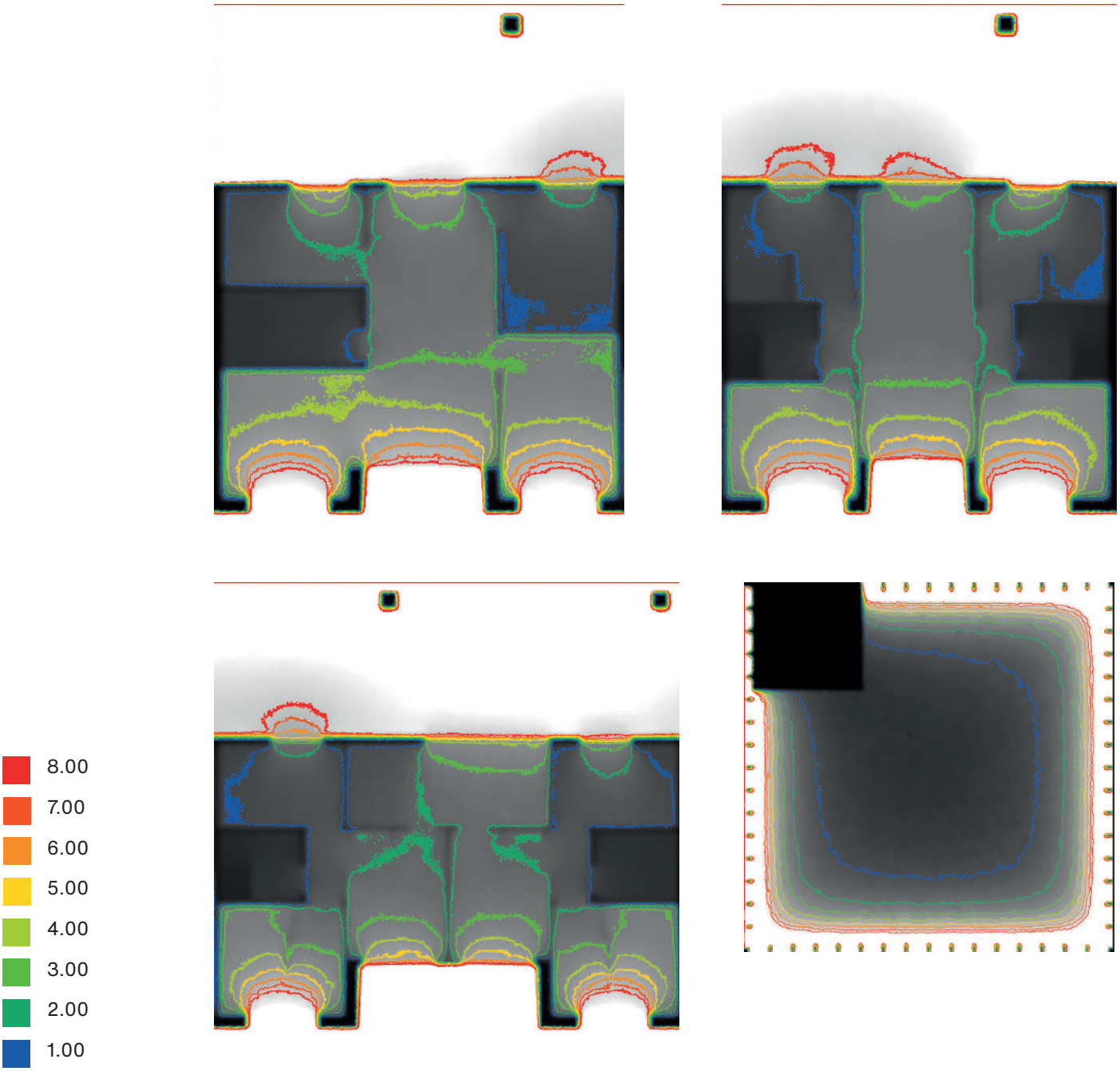
The notion of collectiveness was further brought on as a concept when organizing the hallway. The idea is that all the apartments would feature sliding doors that would allow the residents to drag the apartment out on the hallway. The plan sketching was done concurrently with daylight study that would inform if the rooms got sufficient amounts of daylight

Daylight studies

The daylight studies was done concurrently with the plan studies. The first page shows early attempts on daylight simulations in accordance to very early drafts of floor plans. All the early plans was based on a principle in which only one facade had windows. The depth of the room made it possible to give the right spaces sufficient daylight. However, the plan was very one dimensional and limited in terms of changes which is why the group changed it to be two facades that would feature windows. It was discovered in this study and the plan study that the group lacked an spatial understanding of the plans which is why a spatial study would be the next point in the process.



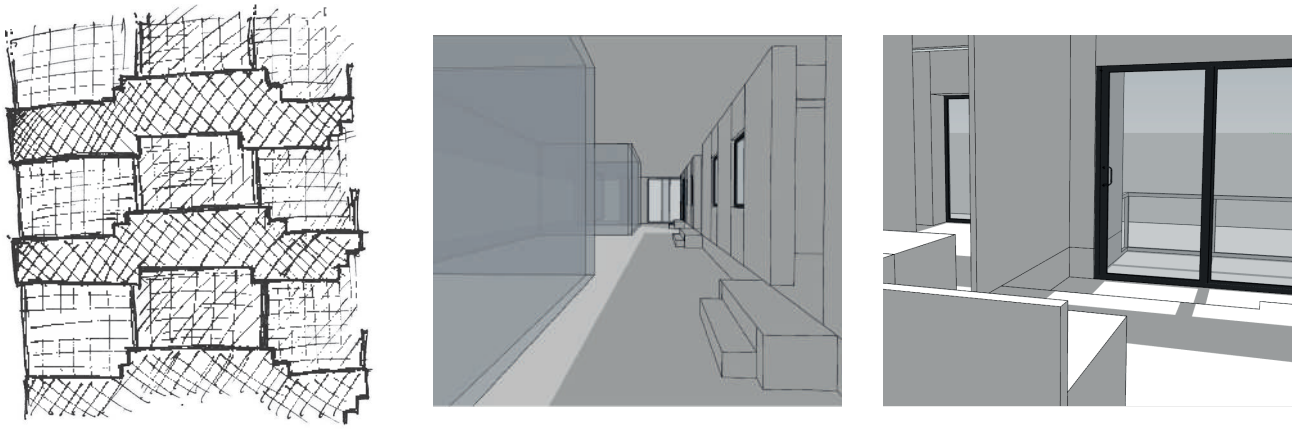
115. Initial daylight studies



116. Daylight studies on later iterations

Materiality and spatiality

The group decided in a later stage of the spatial investigation to put their focus on four critical points of contact. The four points were chosen because of the size and scale of the high-rise. In addition, this was also the points that the group had focused the most on during the process. This phase then attempted to construct the spaces to gain an spatial understanding to further move on in the process.

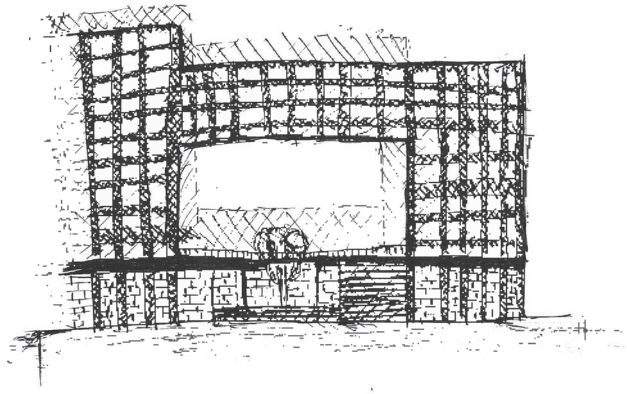


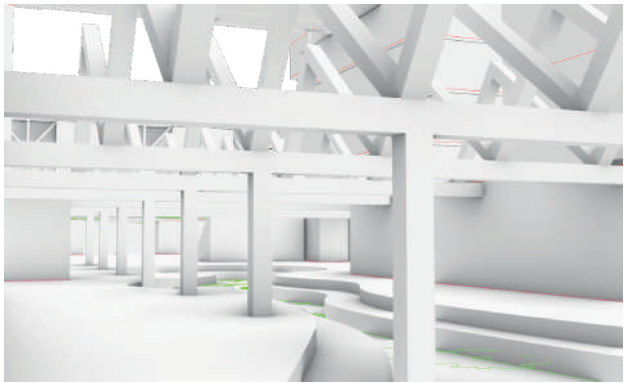
117. Hallway, apartments and balcony

The first point that group decided on was the transition zone between the housing units and the more public hallway. The overall idea was to drag the private residents out in the hallway to engage with other residents, visitors and workers in the building. The hallway was then through multiple iterations from a linear concept to at more dynamic concept that would feature built-in niches.

118. Offices and common spaces

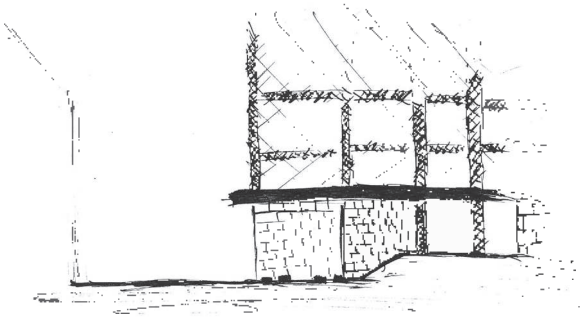
The second point concerned the transition zone between the office work spaces and the common rooms that are used by both residents and workers. The general idea was to generate social interaction between the different users. In this building, the majority of users are either workers or residents.

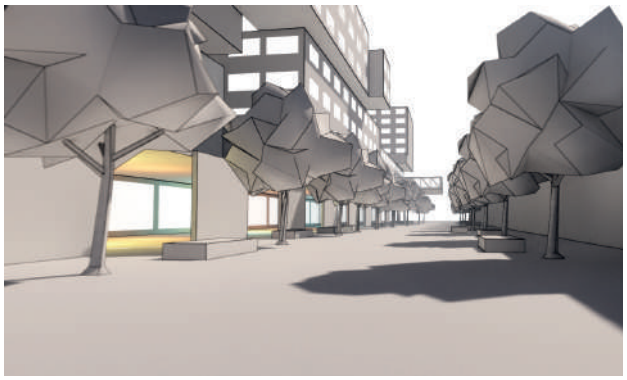




119. The valley

The valley is what the group decided to call third points which is located on the ground floor. The area is complex with the old existing warehouse structure being maintained, the newer structures being built around and on top of it, and the greenery in the center that would function as the continuation of the green axis. The space was complex and hard to define in terms of what should actually happen.





120. Public street and rails

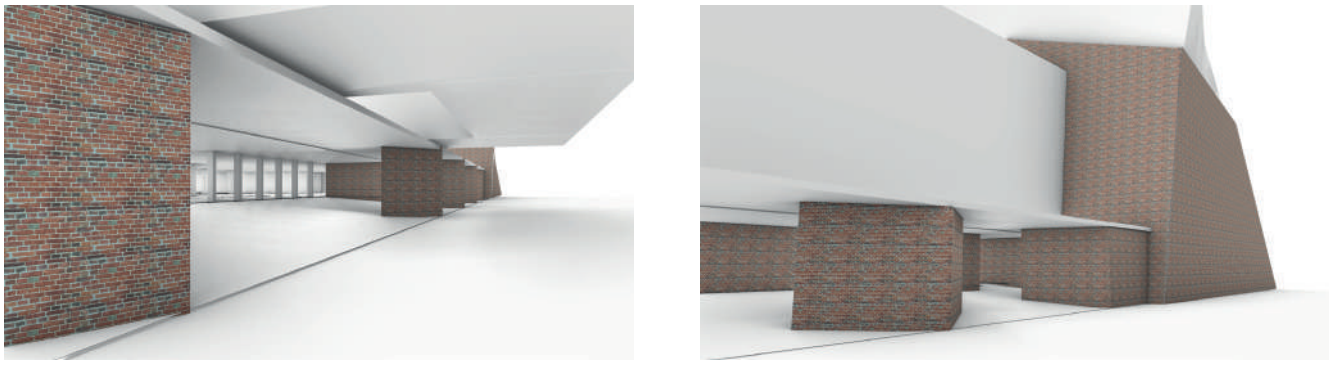
The last point was deciding was early in the process as a point because the group wanted to work with the existing brick facade. The group later on found that old rails were laid out right behind the brick walls which would create a spatial trace back to time. In all the spatial study, the group discovered that there was an lack of detailing in the facade which is can also be seen in all of the 3D investigations.

Facade studies

The facade study can be divided into two parts: the investigation related to the existing brick facades on the ground floor and the facade on the new addition. The group worked a lot on the idea of a curved brick wall to challenge the historic tradition of brick walls to create a reintepretation of the brick wall. The was also an argument to keep the brick facades and create curved brick walls in other areas. It was settled on maintaining the outer brick wall as it is, but to exploit existing port openings and also create openings through the outer wall.

121. Regular brick facade

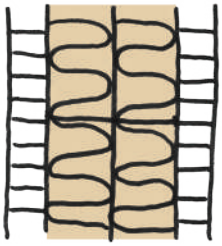
122. Curved brick facade



123. Triangular brick facade

The facades on the new additions were based on the idea that the group would attempt to give glimpses into what was happening inside of the buildind, to allow bypassers and others to see what people are doing inside. That led to the conversation about using polycarbonate because you would be able to see silhouttes through the material. However, the u-value is not very good in relation to other materials which is why other options were also discovered. It was settled on deploying the concepts in different areas of the high-rise.

124. Polycarbonate facade and detail



125. Brick facade and detail

126. Wood facade and detail

09 Epilogue

The epilogue of this thesis report contains the last considerations of the project, here outlining the considerations and challanges that has arisen throughout the thesis. Firstly, an conclusion to the thesis. Secondly, a reflection that discusses different aspects and dimensions of the project, and how it could be further developed. Lastly, illustration list and reference list.

Conclusion

An attempt of a critical re-thinking of the high-rise typology has been developed through this inter-disciplinary master's thesis between architectural design and urban design. The building rises above the context as the beacon of the area and at eye height provides pleasant and generous experiences. The high-rise is an attempt of a re-thinking of the building typology, here considering aspects such a resilience, sustainability, cultural identity, and the human scale.

The building pushes the boundaries of the perception of the high-rise and questioned the need for verticality in the city of Copenhagen. It ended up becoming a large-scale structure that corresponds with the heights of the context and exploits the form to create social and sensorial experiences. The main concept for the high-rise was the idea of the permeable building to criticize current tall building tradition in its relation to the city that did not give many spaces back to the city. The openness of the building was an idea based on the danish courtyard tradition; a typology that holds many qualities related the human scale.

The notion of cultural identity was also key aspect in to creating a high-rise that can be identified in its cultural context. Therefore, it was chosen to transform an old warehouse building into the high-rise. The warehouse featured qualities concerning a low wide building tradition. In addition, with its unique rooftop window construction.

The qualities related to its form, structure and materials were therefore re-used for the first couple of floors to provide a sense of belonging for the high-rise in the environment. Furthermore, it was also discovered that the building holds traces back in time, such a railway tracks inside of the building and the social production tradition in which the buildings were once used as. The high-rise narrates the past both physically and mentally. In addition, using other materials further up the building that solves current and future challenges.

Providing spaces that enhances all aspects everyday life which is done through the merger of different functions. Another important aspect that critiques the current life inside the high-rise in which this building now showcases the different narratives and lives inside the building, giving the users, residents, and visitors the opportunity to experience the different lives the unfolds in the high-rise, sometimes also intertwining with each other through the merger of the different spaces. In addition, emphasizing communities, collective living and working to accommodate a bigger social agenda.

The building critiques the current tradition in its relation to the city, as they are currently perceived as urban archipelagoes. The location of Jernbanebyen is also perceived as an urban island and have huge potentials to connect many areas of the city. The building is through its openness and use of greenery an attempt to how a building can enhance connections in the city and merge into the city grid. Through its use of greenery attempts to sort of the different ecologies flowing around the area - keeping away the noise from the cars, allowing softer mobilities and manages rainwater.

The high-rise project is in many ways a utopian attempt to provide a new kind of framework for creating large scale urban developments. The potentials of the high-rise have been exploited and the challenges has been reformed into qualities instead. This have been done through realistic and research-based design decisions. An attempt of a new high-rise typology that provides spaces for all, rather than consumes them to benefit the users, residents and visitors, and the city.

Reflection

The project aimed at criticizing the high-rise th-rough many different aspects. One of the key characteristics of the high-rise lies within its ver-ticality that also provides a landmark for the city and the area. With its emphasis on the verticality lies many challenges that in this thesis has been a point to re-think. To create better social and senso-rial spaces – both inside and at the urban areas, it was in the thesis envisioned that the re-thinking of the form could drastically improve these areas and thereby creating a high-rise that appeals more to the human scale.

Of course, another benefit to the form is the very large floor area ratio which it can generate to a dense urban area that lacks space. The process of choosing form was a draining and long running pro-cess, both in terms of evaluating its qualities, the floor area ratio and engineering aspects such as daylight and human comfort. In addition, the variety of forms that could be generated seemed almost endless which is why the group opted for a specific expression based on the courtyard typology.

The scale of the project also presented the group with many challenges. The scale required that the group needed to show fluid use of different know-ledge sources to evaluate the different spaces. This meant that the project presents itself through many kinds of spaces such as housing, offices etc. that could almost be a thesis on its own. The group had a hard time focusing on one step at the time and instead flew around in different aspects of the high-rise and attempting to re-think all aspects.

Especially, there was an urge for the group to try and re-think all the functions that was features in the high-rise. Firstly, this was attempted through the function's relation to each other, however, it was also noticed that the functions on its own needed to have considerations about how they should be used and their architectural character. This meant, that the many functions of the high-rise were thought of in a conceptual level and it was later decided that the group would detail some critical functions based on the lack of focus in the project.

This also means that the material palette varies through the different spaces. A big challenge is that even though the spaces were quality, there would need to be a relation between them all. You should be able to confirm that all the spaces are in the same building even though their requirement varied a lot. The structural material is however the same through the whole high-rise. The group believed that they could do a one structural system fits all which was not the case.

Because of the demands for the different spaces, it did not seem like one structure could be beneficial for all the spaces. Therefore, the group opted for a hybrid structural system that was decided very late in the process because of an urge to make the one structure work. In addition, there was also a shift in structural materials late in the process because of the very demanding building structure that is not very considerate of material resources.

The cross disciplinary creation of the group was based on the ambition that the re-thinking of the high-rise typology required multiple specialties that would propose a more holistic solution to the problem. In the quest of attempting to formulate a cross disciplinary workflow, it became clear how necessary it was to approach the design from diffe-rent points of departure, thereby considering all the spaces throughout different lenses. As the building became a city within a city it also became clear that it was necessary to exploit even more specialties that the group was incapable of to create a holi-stic solution. Even though the group attempted to consider many aspects in terms of urban design, architecture, and structural design, it is also why the project lacks in some aspect, especially in the indoor environmental and energy aspects, universal design, and economy.

List of illustrations

01-04: **Own illustration**

05: **DSB and Freja Ejendomme**

06: **Luftfotodanmark**

07-08: **Own illustration**

09: **Tegnestuen LOKAL & Hampus Berndtson**

10: **Tegnestuen LOKAL & Kirstine Mengel**

11-13: **Own illustration**

14: **Mariano Mantel** (*https://www.flickr.com/photos/mariano-mantel/26005765176/*)

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