Days of Future Past

Landhövdingehus Housing Typology Reinterpretation to Gothenburg Urban Environment.

Mikel López de Muanin
Chalmers School of Architecture
Deparment of architecture
Examiner:Björn Gross
Tutor: Mikael Ekegren

CHALMERS
UNIVERSITY OF TECHNOLOGY

Days of Future Past

Mikel López de Munain
mu nain@chalmers.student.se

Chalmers School of Architecture
Deparment of Architecture
Master Thesis, Autumn 2017
Architecture and Planning Beyond Sustainability
Examiner: Björn Gross
Tutor: Mikael Ekegren

ABSTRACT

The main purpose of this master thesis is to promote Gothenburg wooden building tradition as a sustainable solution to redefine its urban environment towards a greener one, responding to the context with roots to tradition and at the same time been innovative.

Interest to build in wood has increased sharply in Sweden. The main reasons are Climate change and the critical housing shortage. Gothenburg has a long tradition of innovative wooden houses. "Landshövdingehusen", a unique building type part of this city's identity provides architectural precedents that can be developed and interpreted using a modern design language.

The method of choice to execute this project is research by design.
The design proposal is based on a re-interpretation of Landshövdingehus housing typology, taking reference from its main characteristics. The constraints and spatial qualities of the site determine the scale and proportion, shaping the volume and the program that will take inside it. Landshövdingehus main characteristics determine the external and internal design

The outcome is a building formed by 2 wooden blocks that rely on a concrete plinth. Materiality, structure and the program are related, giving rise to a block of mixed use, where the commercial spaces are located in the concrete plinth that supports the CLT structure, which houses 75 apartments in 7 different arrangements with variety of sizes ranging from 60 to 130 square meters. The public square saves the existing unevenness of a floor and creates a strong connection with the surrounding serving as natural transit.
The block are divided in 3 modules, where the central core contains the humid spaces and storage, all this allows flexibility in the remaining 2 modules

As a conclusion, we need to think very differently about how we create the cities of the future. Using wood provides a positive response to a key environmental challenge as global warming.

STUDENT BACKGROUND

- BACHELORS DEGREE: Camilo José Cela University __ Madrid, Spain
  Gdańsk University of Technology __ Gdańsk, Poland

- Msc PROGRAMME: Architecture and Planning Beyond Sustainability
  Chalmers University of Technology__ Göteborg, Sweden

  Building design lab / Sustainable building: Competition / Sustainable architectural design / Design systems / Design and planning for social inclusion / Sustainable development and the design professions

- Chalmers University of Technology
- Master Thesis in Architecture 2017
- MPDSD Architecture and Planning Beyond Sustainability
- Building Design
-Tutor / Examiner : Mikael Ekegren / Björn Gross
- Autor : Mikel López de Munain

Throughout my career as a student I always worked with different themes, scales and contexts. At the time of choosing the theme for the master thesis, the opportunity to work on a multi-family housing project appeared, something that had only worked superficially in the first years of studies, and that had always caught my attention, since from my point of view, the design of housing is something that everyone should master. It may seem simple and everything fixes it, but this time it is a very complex problem and it addresses several concepts. The fact of studying in Sweden, in addition, offers a great opportunity in this subject, since this country has made one of the largest and deepest studies carried out in the field of housing. Possessing certain knowledge in construction and structures made me to enroll in the building design studio, where the aim is to reach a level of development of the project as close to reality as possible, where you get to study the detail in the construction, something that from my point of view It can is exciting, since the details is the difference.

TABLE OF CONTENT

01. INTRODUCTION

1.1. BACKGROUND

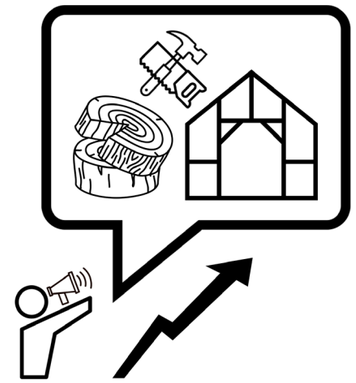
In recent years, the interest to build apartment buildings in wood have increased sharply both in Sweden and the rest of the world. The main reasons are Climate change and the critical housing shortage in Sweden, where approximately 440.000 new homes need to be built to year 2020. The majority of these houses will be located in growing urban areas as Gothenburg.
Since 1874, Sweden had a ban on building wooden homes above two stories. This ban was lifted in 1994 with the Swedish EU membership.
Gothenburg has a long tradition of innovative wooden houses. "Landshövdingehusen", a unique building type, which now are a big part of this city's identity came about in response to several problems of its time.
This provides architectural precedents that can be developed and interpreted using a modern design language.

1.2. MASTER THESIS QUESTION

How can Gothenburg building tradition redefine its urban environment towards a greener city ?

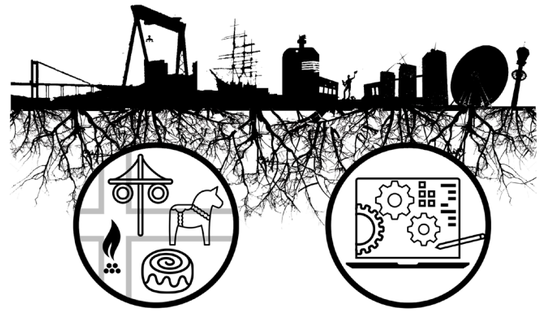
1.3. PURPOSE

WHY ?



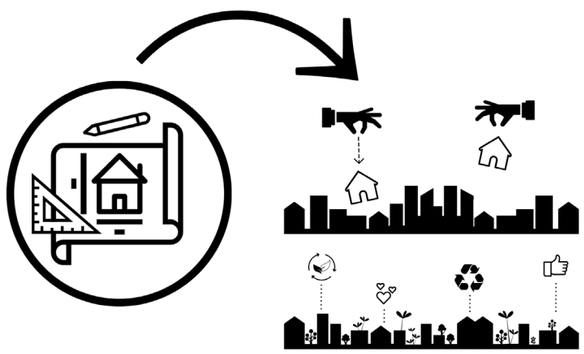
To promote Gothenburg building tradition as sustainable solution for the future

HOW ?



Respondig to the context with roots to the tradition while still been innovative

WHAT ?



Providing a Landshövdingehus reinterpretation design to redefine Gothenburg urban environment towards a greener city

1.4. METHOD

The method used to execute this thesis has been research by design. That made the design process been a continuous pathway through which new insights, knowledge or practices come into being. The design project has been carried out in an iterative design process, and as new factors enter the equation, new concepts were taken into consideration, analyzed and applied to the design, what resulted in a process of constant change until a rational result was obtained.

The main theoretical support will be references of architectural projects, having as main focus of study the "Landshovdingehus" housing typology, selected as the basis to develop a proposal of contemporary reinterpretation of it, where its architectural qualities are taken as reference for the creation of new design following the basic concept of this housing typology and adapting it to the context .The constraints and spatial qualities of the site determine the scale and proportion of the building proposal, shaping the volume and the program that will take inside it.

Studies in relation to the typologies of housing, facades, colors, building materials, detail and so on were made, which implies physical models, sketches, drawings and visualizations as the main tools of investigation.

1.5. DELIMITATIONS

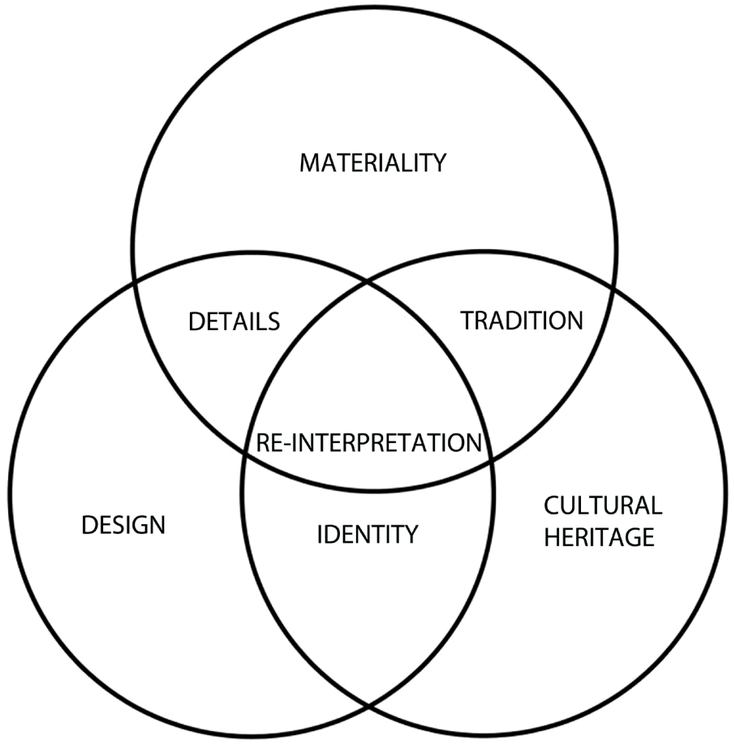
Taking as a starting point a site in Gothenburg and as a housing base program, the main delimitations of the project are marked.

The objective of this thesis is the creation of quality housing, from the interior design of the same to how the whole built adapts to the environment from an urban perspective. All this includes the one from the final form of the building, materials, public urban spaces, to the same construction detail.

The main research point has focused on the creation of a quality interior design in homes and the proportions of them. For this reason, different typologies have been designed, with different sizes, adapting to the different profiles of the market, from flats for a single person to flats for large families. All of them follow the same design concept, where the central core of the house provides entrance to it and contains the wet spaces and storage, providing great flexibility of distribution in the remaining spaces.
As a secondary the materiality of the building has been studied and the different options of exterior shape that the housing block can take within the urban environment the urban public spaces.

It has not gone into great detail in terms of the design of commercial spaces, but are designed in a way that provide great flexibility and different spatial options, where the premises can be extended both horizontally and vertically.

Regarding the technical aspects of the building, basic premises have been established, where the central core contains all the spaces dedicated to them, but the choice of them has not been considered. The ideal would be a type of installation as sustainable and autonomous as possible.



02. THEORY

2.1. CLIMATE CHANGE

Climate change has become the biggest environmental challenge in recent decades on all continents and in all sectors around the world. It occurs due to the increase in the temperature of the atmosphere due to the burning of fossil fuels and the release of greenhouse gases. These days, large amounts of fossil fuels are used as an energy source to boost a country's economy. This scenario contributes significantly to a large percentage of carbon dioxide emissions.

Energy consumption in buildings represents approximately one third of total consumption and is responsible for an equal share of carbon dioxide emissions in developed and developing countries. [1]
The building sector is expected to play a major role in mitigating climate change. In this regard, an issue of growing discussion is the effect of material choice on climate impacts of buildings.[2]

Figure 1. Polar ice melting. Image via Creative Commons.

1-Mardiana A, Riffat SB (2015) *Building Energy Consumption and Carbon dioxide Emissions: Threat to Climate Change. J Earth Sci Climat Change.* S3:001. doi: 10.4172/2157-7617.S3-001.Retrieved from https://www.omicsonline.org/open-access/building-energy-consumption-and-carbon-dioxide-emissions-threat-to-climate-change-2157-7617-S3-001.php?aid=53007
2-Ambrose Dodoo, Leif Gustavsson, Roger Sathre withi n the Sustainable Built Environment Group (SBER) at Linnaeus University, Växjö, Sweden. (2016) *Climate impacts of wood vs. non-wood buildings. The Swedish Association of Local Authorities and Regions.* Retrieved from http://webbutik.skl.se/bilder/artiklar/epub/7585-377-2.epub

2.2. WOOD AS SUSTAINABLE BUILDING MATERIAL

The construction industry consume huge amount of materials, energy and other resources. All this generates environmental impacts of great dimensions during the construction, execution and ultimately demolition of the building. As environmental awareness grows, the construction industry finds in wood an excellent sustainable option, which minimizes the use of energy, water and materials, and reduces impacts on human health and the environment. [3]

2.2.1. WHY WOOD?

Why is wood the best choice as a construction material?
RENEWABLE MATERIAL

The wood is that it is a naturally renewable material. A tree reaches an adequate harvest size in 25 to 80 years, while raw materials for bricks, steel and plastics are only renewed during geological time.

CAPTURE AND CARBON STORAGE

When wood is used in construction, it does not decompose, in this way Carbon is blocked in the built environment. If the trees used for the construction are replaced by new trees, the overall effect is less carbon in the atmosphere.

LOW EMBODIED ENERGY

Wood needs minimal processing, which means it is the lowest built-in energy of any major construction material, much lower than steel, concrete or aluminum.

EASY MAINTENANCE AND DURABILITY

The wood has a very high durability. Some wooden structures last for centuries. It is easy and cheap to maintain compared to other materials and has very good structural properties, being suitable for buildings of up to eight floors. It also has good fire resistance.

AESTHETICS PROPERTIES

Wood is a universally popular material to offer a warm and comforting aesthetic, also offering benefits for our health.

HIGHLY VERSATILE

The different tree species provide us with a range of different colors, textures and functional qualities. Wood has a huge variety of applications: from structural frames to exterior cladding and carpentry, deco-

3 – Swedish Wood. (n.d). *The Architect's Role in Climate Change – Now and Then.* Retrieved from http://www.architectsdca.com/the-architects-role-in-climate-change-now-and-then/

rative finishes, furniture, etc.

QUICK AND SIMPLE BUILD

Buildings with wooden structures are much quicker to erect than brick or stone buildings. A faster construction time means savings in time and money.

INSULATION QUALITY

A building constructed of wood allows more space for insulation than a brick building, and in addition, the wood also has thermal insulation properties.A better insulated house requires less energy to heat and cool, which generally means less use of fossil fuels and also lower costs for the occupants. All this acts as an indirect reduction of carbon emissions.

WOOD CAN BE REUSED

Only 35-45% of a log is suitable for pieces of sawn wood, but the versatility of the material offers that the other wood can be used as small wood products, fiber boards, OSB, wood fuel or even sawdust for animals. Wood can also be recovered from demolished buildings and reused. If no other use is possible, the wood can be composted safely or burned as fuel.

NON-TOXIC

In its natural state, the wood is completely non-toxic and can be used without being treated with any toxic product. Advances in green chemistry are providing more adhesives and non-toxic preservatives.

HUMIDITY REGULATOR

As an organic material, wood naturally regulates the moisture it absorbs or releases, according to humidity or dry environment. This has a beneficial effect on the quality of the internal air and also on health.

PROMOTE BIODIVERSITY

Forests are habitats with an incalculable value for wildlife, including many endangered species. The demand for sustainable wood means the demand for sustainably managed forests, which means more forest habitat.

PROMOTE SUSTAINABLY MANAGED FOREST

In addition to helping to combat climate change and being a refuge for wildlife, forests also provide many other ecological services.They help reduce the risk of flood, drought and soil erosion, stabilize and regulate the climate, purify the air by producing oxygen and absorbing carbon dioxide along with other air pollution.[4]

4 – KoruArchitects. (n.d). *13 Ways Sustainable Timber Is The Best Construction Material.* Retrieved from https://www.koruarchitects.co.uk/choose-sustainable-timber/

Figure 2. Harvested logs. By Albert Bridge, Creative Commons.

2.3. SWEDEN WOOD BUILDING TRADITION

Sweden has a long tradition of building one- and two-story wooden buildings. During the last years the recognition of the main technical and environmental benefits of wood has increased, which has led to an increase in the construction of wooden buildings.
At present, modern wooden buildings and account for 10% of the market, and interest continues to grow.
The techniques of construction in wood have been developed like no other.
The use of wood in buildings demonstrates a whole range of benefits compared to other construction methods. It is built profitably, quickly, safely and taking care of the environment.

A CLIMATE-FRIENDLY CONSTRUCTION PROCESS

Construction industry has worked enormously in recent years to reduce energy consumption in new buildings. However, we must not forget to take into account the actual construction process and the materials used in it. Wood is a renewable building material that stores carbon dioxide and it takes very little energy to build a wooden building. Realizing the structure of the building in wood instead of traditional materials greatly reduces carbon dioxide emissions. In addition, the building continues to store carbon dioxide throughout its useful life.

INDUSTRIAL PRODUCTION DRIVES CONSTRUCTION

Wood is a light and resistant material that is ideal for extensions and reconstructions in urban environments. It is also ideal for industrialization. The industrial production of wood offers us an excellent control of the quality, costs and logistics, reducing the amount of time that is spent in the place of execution of the project, causing less discomfort in the neighborhood. Modern industrial wood construction techniques save time and money.

CREATION OF JOBS AND COMPANIES

Buildings with wooden structure of several floors have been built in the USA. UU for some years and the trend has now moved to Sweden and the rest of Europe. Industrial wood construction offers a great potential. Cities are growing, and at the same time it is needed to develop the industry and the processing of forest raw materials. The increase in wood construction will make the Swedish industry grow throughout the country, which will generate more employment and new businesses, which will mean an increase in exports. [5]

Figure 3. Traditional Swedish red log house. (Pinterest)

5 – Swedish Wood Building Council. (n.d). *Modern industrial timber building techniques.* Retrieved from http://www.trabyggnadskansliet.se/english/industrial-timber-building

2.4. SWEDISH FOREST INDUSTRY

The Swedish forestry industry is working with sustainable development from an environmental, social and economic perspective. The industry bases its pillars on conducting business in a responsible manner and a long-term focus on the goals to be developed to improve the quality of products, safety and the environment.

ENVIRONMENTAL CONSIDERATION

Forestry industry environmental consideration is paramount. The raw material of the breeding forests is used to produce products and energy. The entire product is recycled, either as a material or as bioenergy.

ECONOMIC GROWTH

Forestry industry is one of the most important industries in Sweden, equivalent to 9-12% of total employment, exports, income and value added in Sweden, and an increase is foreseen during the following years as the industry is betting for it. As an example, the forestry industry invested SEK 28 billion during 2015 and 2016 and, so far, SEK 12 billion has been foreseen for investments during 2017 and 2018.[6]

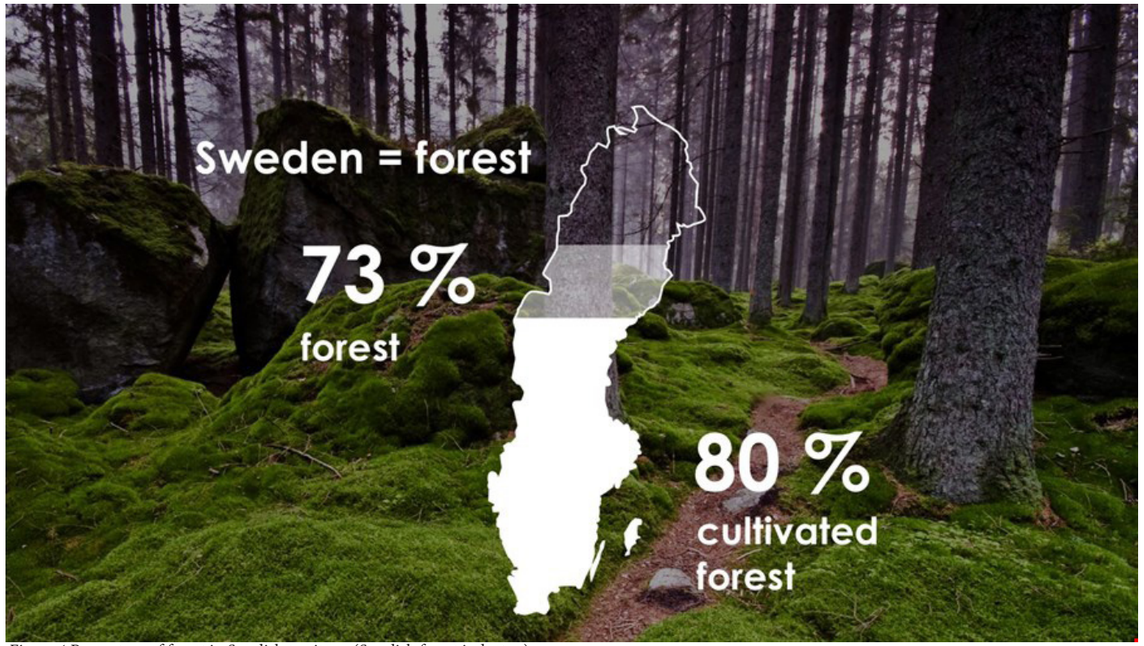


Figure 4. Percentage of forest in Swedish territory. (Swedish forest industry.)

6 - Wiklund, C. The Swedish forest industries. (n.d). Sustainability. Retrieved from http://www.forestindustries.se/forest-industry/sustainable-development/

2.5. FACTS ABOUT SWEDISH FOREST INDUSTRY

ECONOMIC SIGNIFICANCE

- World's 3rd largest exporter of pulp, paper and sawn timber
- Export value, 2016: SEK 125 billion
- 80% of the products are exported
- A little over SEK 17,5 billion was invested in 2016

PRODUCTION VOLUMES, 2016

- 11.6 million tonnes of pulp (of which 3.9 million tonnes market pulp)
- 10.1 million tonnes of paper
- 17.8 million cubic metres of sawn timber

EMPLOYMENT

- 70,000 employees in forestry
- A further 30,000 one-man businesses active in forestry

FORESTS

- 70% of Sweden is forest land.
- 80% of the forest land is in active use.
- 1% of the forest resource is felled annually.
- Over the past 90 years, Sweden's forest resource has doubled.

ENERGY

- 96% of the heating energy used by the forest industry is bioenergy.
- Electricity consumption: 20 TWh per year – just over 15% of Sweden's total electricity con sumption.

SUSTAINABILITY

- Of the country's total greenhouse gas emissions, the forest industry accounts for around 1%.
- Since the start of the 1980s, pulp and paper mills have reduced the organic materials they release into the water system by 90%. At the same time, pulp production has risen by 30%.
- Since the start of the 1980s, pulp and paper mills have reduced the sulphur compounds they release into the air by 98%. At the same time, pulp production has risen by 30%.

TRANSPORT

- Sweden's largest purchaser of transport services – SEK 25 billion annually

RESEARCH

- Every year, Sweden invests SEK 2 billion in forest research at universities, colleges and INSTITUTES.
- Forest industry companies annually invest SEK 2.3 billion in their own research.

MEMBERS OF THE SWEDISH FOREST INDUSTRIES FEDERATION

- 120 sawmills
- 40 companies closely connected to the production of pulp, paper or timber goods.[7]

7 – The Swedish Forest Industries. (n.d). *Fatcs & Figures. Sweden´s forest industry in brief.* Retrieved from http://www.forestindustries.se/forest-industry/facts-and-figures/

2.6. SWEDEN HOUSING MARKET SITUATION

THE HOUSING MARKET IN 2016-2017 IN EIGHT POINTS

– Of the country's 290 municipalities, 240 consider that there is a housing deficit in the market. There are 57 municipalities more than in 2015 Housing Market Survey.

– The situation is particularly challenging for groups of people who are new to the housing market, particularly young people and recent immigrants, and also older people looking to move to a more accessible home.

– The municipal non-profit housing stock has increased again for the second consecutive year after a fairly lengthy period of decline.

– In 2015, only 168 non-profit rental units were converted into tenant-owned flats.

– Fully 272, or 94%, of the country's municipalities consider that there is a deficit in housing for recent immigrants. The municipalities are found in all types of municipalities, both the large urban areas and the more sparsely populated areas.

– The challenges facing young people in the housing market have become more pronounced, 245 municipalities reporting a housing deficit, compared with 219 in last year's survey.

– Approximately 50 percent of the municipalities adopted guidelines for housing provision in the recent or the current mandate periods – a clear increase over prior years.

– Slightly more than half of the country's municipalities have some form of housing queue priority system.[8]

Figure 5. Neighborhood in Swedish municipality. (Helena Wahlman)

8 - Boverket. (2017). *The 2016 Housing Market Survey in brief.* Retrieved from https://www.boverket.se/en/start-in-english/living-in-sweden/the-housing-market/unique-overview-of-the-housing-market/the-2016-housing-market-survey-in-brief/

2.7. SWEDEN NEEDS TO BUILT FAST AND CLIMATE RESPONSIBLE

Interest in the construction of multi-story wooden buildings is rapidly increasing in Sweden. Currently, only about 10% of newly built multi-storey houses use wood structures. Forecasts predict a strong increase in this area. This growing trend is a good opportunity for the Swedish construction industry, as it has a long tradition in the construction of residential wooden buildings.

Until 1994, it was not allowed to build wooden houses with more than two floors in Sweden. But with the entry into the EU, new construction regulations came to Sweden, allowing the construction of wooden structures in buildings of more than one plant, which entails a more neutral use of materials.

Only in recent years has interest in the construction of modern wood dramatically increased. Climate change is one of the reasons, since it is the only renewable building material and provides a substantially lower carbon footprint. Another compelling reason is the need to build many houses in a short time. Sweden needs to build approx. 440,000 new homes until 2020 to cope with the increase in population. The majority of these houses will be located in growing urban areas such as Stockholm, Gothenburg and Malmö.[9]

Figure 6. New apartments being built in northern Stockholm. (Anders Wiklund/TT)

9 - Norlander, T. (2017). *Multi-storey wooden buildings are in focus in Sweden.* Retrieved from http://www.opportunities-abroad.no/2017/03/09/multi-storey-wooden-buildings-are-in-focus-in-sweden/

2.8. SWEDEN PLAN TO SOLVE MARKET CRISIS

Sweden needs a long-term sustainable housing policy. The shortage of housing puts future growth at risk, reduces mobility and hinders the interaction of different actors within the labor market.

Today, about 300,000 young adults between 20 and 27 years of age have no property. The local authorities of Sweden declare that they have shortage of houses.
From a climatic and environmental perspective, the properties we build today must remain for many years, therefore, it is important that we use the available means to do it right from the start. A sustainable direction is needed, for example, to build a lodging that is close to other houses, of several floors and with fewer parking places, we create opportunities for cheaper and space saving homes.

Today, very few houses are being built in Sweden. There is a shortage of rented apartments in the real estate market regardless of geographic location.
The goal of the government is clear: to solve the housing shortage, it is necessary to build more houses. The goal is 250,000 homes by 2020. The focus must be on sustainable homes.

Several active measures are needed in several areas to make this happen.

1. The state assumes greater responsibility for the creation of more housing.
Sweden has a serious problem of housing shortage. The situation is exceptional and requires the state to intervene to support local authorities with their responsibility to provide housing.

2. Focus on young people, students and newcomers
Lack of housing assistance hit harder on young people, students and newcomers.

3. Sustainable urban planning.
The new buildings tend to be of good quality when it comes to energy efficiency. We need to focus more on reducing carbon emissions from construction material and the construction process itself.

4. Investment in public transport opens the door to more households.
Investing in public transport is also an investment in more households. This, in turn, can open the door to new and attractive places for the construction of properties.

5. Increased competition.
Currently, only a few actors dominate the housing construction market. This decreases the chances of smaller companies competing with larger ones, endangering the market. If competition increases, the cost of construction decreases, making it easier for smaller companies to compete for agreements.

6. Efficient construction processes create cheaper housing.
The construction of homes must be done faster. Construction rules should be simplified and the decision-making process for a full house should be more efficient.

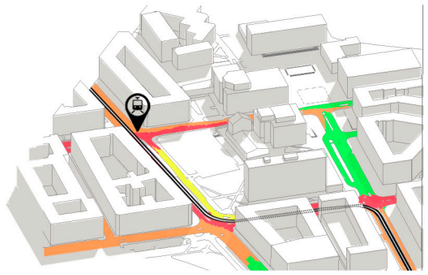
The shortage of housing can only be resolved through more households, which would increase the mobility of the housing market. Through active housing policies we can face the future in an economically, socially and ecologically sustainable way and, at the same time, build the Sweden of the future.[10]

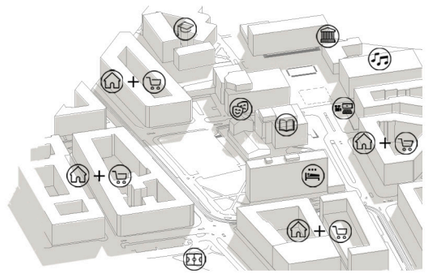
8 - Boverket. (2017). *The 2016 Housing Market Survey in brief.* Retrieved from https://www.boverket.se/en/start-in-english/living-in-sweden/the-housing-market/unique-overview-of-the-housing-market/the-2016-housing-market-survey-in-brief/

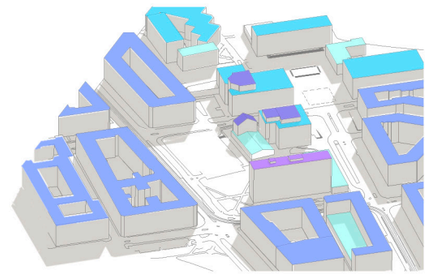
03. ANALYSIS

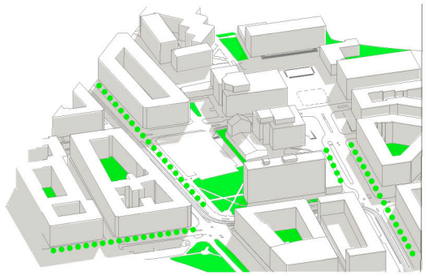
3.1. SITE

The plot is located in the Lorensberg district, specifically on the corner of Södra Vägen and Berzeliigatan streets. It is a very central urban environment and has difficulty when it comes to dealing with its design. Currently, the plot chosen for the project has a parking as use. During the first sketches the idea of maintaining the parking in the design was worked but finally this idea was discarded, eliminating the parking because it was not fitting to the concept of sustainability.
One of the characteristics that influenced more the design has been the unevenness of the plot, since the slope exists of the street Berzeliigatan until Södra Vägen has a slope of about 3-4 meters. This slope has been used to house commercial spaces and also as a starting point for the creation of an urban plaza that saves the difference of height between the streets, providing a more natural flow in the area, connecting the existing park with the central square of Götaplatsen, all this helps to create a constant flow of people, activating the commercial spaces located in it.
The site and the adjoining blocks suggest a closed block typology with a solid materiality such as brick or stone. However, the final result of the design in the thesis is completely different, it comes to the conclusion, from a personal design point of view, of an open block typology with a wood materiality will be the best solution to the main question proposed as a study in the thesis.
The building is treated as part of the urban area that surrounds it, taking into consideration the different properties of the surroundings close to it, trying to enhance them and at the same time creating new ones, improving the existing.









GRENNERY

The site is located facing the park located behind the Elite Park Avenue Hotel, and it aslo has a visual connection with the recreation area that contains football fields and other several spaces located between the streets Södra Vägen an Engelbrektsgatan. The park is taken into consideration in the process of creating the final design, trying to reactivate it from its current inactivity

BUILDING STRUCTURE

The surrounding buildings maintain the same height generally, having a height of about 6 – 7 floors. In the area, the height of the Elite Park Avenue Hotel stands out in a convincing manner, reaching 11 floors. In the proposed design it is chosen to give it a height of 7 floors, in this way it does not stand out and is integrated into the urban environment.

TRAFFIC

The plot is located in a very central area and therefore very busy. Södra Vägen has a considerable flow of traffic depending on the hours of the day. The area is very well connected and has the Berzeliigatan bus and tram stop a few meters away from it.

SERVICES

Being in such a central area, the area contains a wide variety of services within walking distance. There are restaurants, shops, theaters, cinemas, hotels, bookstores, etc. In the project it is decided to continue with the typology of block in which the low plants harbor commercial uses.

3.2. LANDSHOVDINGEHUS AS HOUSING TYPOLOGY REFERENCE

Landshövdingehus is a unique type of building from the Swedish city of Göteborg. It is characterized by the ground floor being built of stone, and the second and third floors are built on wood. The external wood materiality can be decorated in various styles giving a wide range of façade possibilities.The typical layout for this housing typology is being placed into a uniform quarters footprint. The quarter would act to build a large open yard with plantations for its residents and this area would be closed to the public.

There are also other aspects of the construction techniques. After the turn of the century it became more common to build the houses with a cellar. The cellar was typically cast in concrete with crushed stone. The bottom level was laid in brick. The wooden floors could be constructed by vertical planks separated by circulating details or in a more modern way, vertical tongue and groove planks continous throughout the two floors.

The essence of a governors house contains an aesthetic angle. It is interesting how this matter has changed throughout the years. Originally most of the governors houses were build for the working class and the apartments mostly consisted of one room and a kitchen. It was not uncommon that up to fifteen people would live in one flat due to the extreme lack of housing at that time. This explains why life on the street was so much more abundant within the vecinity.

The floorplans were simple, with just the basic amenities installed. The houses built before 1870 were connected to the city waterlines, however it was not until the turn of the century that each flat could have possibly equipped with running water in the kitchen, while more often that not lavatories were placed in the yard. Basic scrubbing floors were dominant in the flat.

landshovingehus house body generally is thin, around 9 to 10 meters wide. Typically the houses were built with inner courtyards and the one bedroom flats generally had incoming light from two directions, a window in the kitchen facing the courtyard and one or two windows facing the street. Commonly the bigger flats as the two bedroom were located in the corner. There was also a hierarchy in governors housing, the ground floor was not only the darkest but it was often dump since the moisture was sucked up through the brick foundations. The greatest flats were located on the top floor where the light was more generous.

As conclusion, it is possible to say that this typology of buildings were erected to provide the basic shelter for low income citizens. There were no hidden extras fixtures to be seen, the housing had the basic intentition to be affordable and to solve the lack of housing in the city. This is the basic essence of this typology of housing. It is not only aesthetic, it is also its intention which ads substance to the concept. It is also important to consider the scale of these typologies. The three stories was necessary to allow for a profitable venture, this scale was also determined by the city policies of its time. [9]

Figure 7. Landshövdingehus in Majorna, Göteborg. Built 1894. (Thomas Höjemo).

EVOLUTION OF LANDSHOVDINGEHUS

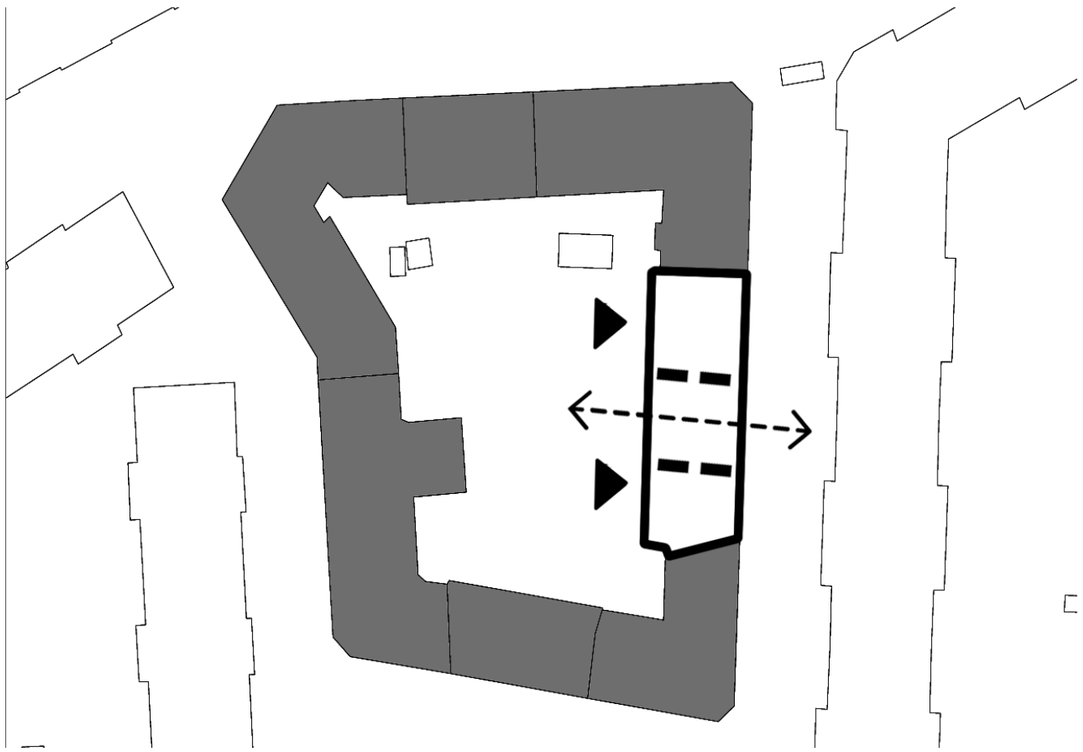
Even this typology was build with a simply structure, it has been influenced by the times prevailing architectural styles. Therefore it was not long before intended to imitate the fine stone housing around 1880. The tiled roof were replaced by plate, and compliment dormers were added. New renaissance windows surrounds and decoratively rastered ground floors displaying stucco or polished stone blocks with chamfered edges were commonplace.

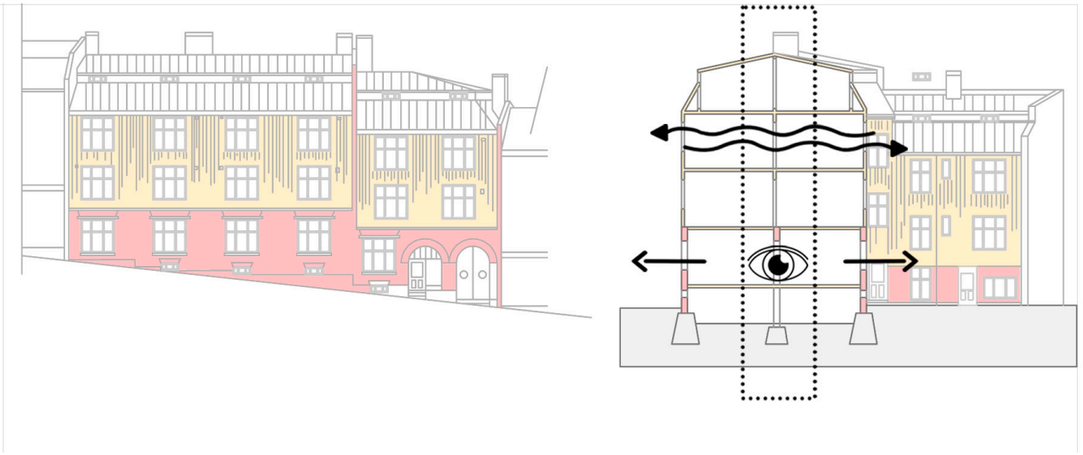
The most common landshovdingehus houses were built from 1880 to 1890 with horizontal panelling and dormer windows. The national romantic and jugend styles paraded darker coulours from 1910 to 1930. Details such as balconies and portals become commonplace and even traces of the lighter colums from 20´s style classicism and various other temple details. There was also a resurection of the saddle roof as opposed to the popular mansard models which were previously predominant. A heavily stressed horizontal meeting of materials also became a noticeable feature of the time.

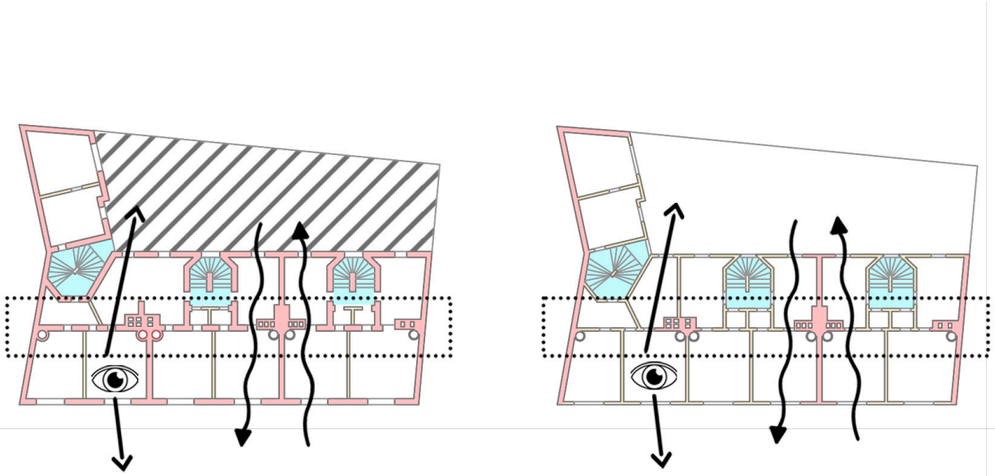
The main difference from the houses in the 1800s and 1900s is a tendency to lean towards anonymity. Functionalism also influenced the later governors houses. The facades were purged of all decorations. Simple wooden panelling made a comeback placed vertically in order to give a stricter effect and even the original tiles returned to the roofs. The ground floor generally was decorated with a clean and unpretentious stucco finish. The true evolution ended in 1936 with the decision that no more governors housing would be built in the city.[9]

Figure 8. Landshövdingehus variety. (Jesper Hallen).

9 – Loader, S.P.P. (2014) *Back to the Future: An investigation into a readaptation of a Landshövdingehus in Gothenburg.* (Msc thesis). Chalmers University of Technology, Goteborg, Sweden.







1. MATERIALITY / STRUCTURE

CROSS VENTILATION

SEE THROUGH

SERVICE CORE

STAIRCASE SITUATION

COURTYARD

VARIABILITY / PERSONALITY

3.3. MATERIALITY __ CLT _CROSS LAMINATED TIMBER AS STRUCTURE

PIONEER PRODUCT

Developed in Europe in the 1990s, CLT is an engineere wood panel typically consisting of three, five or seven layers of dimensional lumber. Kiln-dried boards are layered perpendicular to one another and then glued. This cross lamination provides dimensional stability, strength and rigidity. Most manufacturers use formaldehyde-free interior/exterior polyurethane (PUR) adhesives. Boards are face-glued and then pressed, planed and sanded into panels. Using Computerized Numerical Control (CNC) machinery, the panels can be custom fabricated to create openings, compound angles and unique features requiring complex geometry to meet specific end-use applications.

VERSATILITY AT WORK

Since CLT panels resist high racking and compressive forces, they are particularly cost effective for multi-story and long-span diaphragm applications. They weigh less than concrete or steel, so can also reduce foundation costs. In addition, CLT elements can be combined with other building materials such as glulam beams, enabling flexibility in design, style and finish architecture.While CLT panels act as two-way slabs, the stronger direction follows the grain of the outer layers. For example, when used for walls, CLT is installed so the boards on the outer layer of the panel have their grain running vertically. When CLT is used in floor and roof applications, panels are installed so the boards on the outer layer run parallel to the span direction.Because they are manufactured for specific applications, CLT panels are prefabricated and shipped directly from the manufacturer to the job site, where they can be quickly and efficiently lifted into place.[10]

Figure 9. CLT is made up of 2-by-4 beams laid out in perpendicular layers that are then glued together to make giant panels. (Don Ryan).

10 - Woodworks. Solid Advantages. (2012). *Cross laminated timber (CLT) offers a new building system option for non-residential and multi-family construction.* Retrieved from http://www.woodworks.org/wp-content/uploads/CLT-Solid-Advantages.pdf

3.3.1. BENEFITS & ADVANTAGES OF CLT

DURABILITY
With proper design and maintenance, wood structures can provide long and useful service lives equivalent to other building materials. The key is careful planning and understanding of environmental loads and other external factors likely to impact a building over its lifetime.

STRENGTH AND STABILITY
CLT panels form a robust, structurally strong building system. Cross lamination provides for superior dimensional stability and offers significant shear strength performance at a very unique weight to strength ratio compared to other common structural materials.

SEISMIC RESILIENCE
Because of their dimensional stability and rigidity, CLT panels create an effective lateral load resisting system. Researchers have conducted extensive seismic testing on CLT, founding panels to perform exceptionally well with no residual deformation, particularly in multi-story applications.

ACOUSTICS
Test results show that because the mass of the wall contributes to acoustic performance, CLT building systems provide superior noise control for both airborne and impact sound transmission.

THERMAL PERFORMANCE
CLT's thermal performance is determined by its U-value, or coefficient of heat transfer, which relates to panel thickness. Thicker panels have lower U-values; they are better insulators and therefore require little or no insulation. Because the panels are solid, there is nearly zero air infiltration into the building envelope. As a result, interior temperatures of a finished CLT structure can be maintained with just one-third the normally required heating or cooling energy.

FIRE RESISTANCE
CLT's thick cross-section provides valuable and superior fire resistance. Due to its mass, CLT panels char slowly. Once charred, combustion slows and eventually stops as the oxygen source is removed. CLT structures suffer less degradation than concrete and steel structures in a catastrophic fire event.

MOISTURE MANAGEMENT & VAPOR DIFFUSION
Wood is naturally hygroscopic and inherently serves as a moisture management system within a building envelope. The vapor permeable nature of wood allows CLT to transfer molecular moisture without trapping it and creating conditions for mold and decay. CLT buildings 'breathe', minimizing the risk for mold growth and maximizing the comfort of its occupants.

ENVIRONMENTAL
CLT is manufactured from trees harvested in sustainably managed forests. The raw materials for CLT are sourced from small and medium diameter timber. This responsible cultivation practice maintains and even enhances the long-term productivity and health of the forest.

HEALTHY INDOOR ENVIRONMENT
The only constituents of a CLT building system are wood and a non-toxic/non-VOC adhesives. CLT building materials do not introduce any toxins into the indoor environment providing clean indoor air quality. In addition, the CLT wall systems are naturally breathable, which, integrated with appropriate mechanical systems, will result in a healthy indoor environment that maximizes occupant comfort and health

LIFE CYCLE ANALYSIS
The longevity of CLT components ensures that the future value of any structure remains high. CLT buildings are easily altered and remodeled and are also fully recyclable once they reach the end of their

useful life.

COST EFFECTIVENESS
Comparing the cost of CLT versus certain concrete, masonry and steel building types and including the advantages of faster construction time and lower foundation costs, the estimated total costs of CLT structures can be very competitive.

DESIGN FLEXIBILITY

CLT has unique structural properties that allow architects and designers increased flexibility of design allowing for distinctive and innovative projects. Due to wood's inherent ductility and unique strength to weight ratio, wood offers many advantages over the other common structural materials such as masonry, concrete, and steel.

SPEED OF BUILD
From one-person builders to large construction companies, CLT structural systems will arrive on-site ready to assemble, saving time and money with a swift and accurate building process.

REDUCED WASTE
CLT panels are manufactured for specific end-use applications, which results in little to no job site waste.

3.4. MATERIALITY_ SHOU SUGI BAN AS TECHNIQUE FOR SKIN

What is Shou sugi ban?
Shou sugi ban is an ancient Japanese method of burning the surface of wood to preserve it. The final product is also known as Yakisugi (yaki means to cook/burn and sugi is the Japanese name for cedar), but shou-sugi-ban seems to have won as the most commonly used term in English, and it is sometimes simply known as carbonized wood.
Usually done with planks of cedar or larch, the thin film of carbon that is created during a very light surface burn protects the wood. This draws out moisture, and the resulting chemical compound protects the wood.
Cedar and larch are local, very durable and resistant to rot. This process can also be done with other common woods such as pine, hemlock, maple or oak.
How carbonized wood is made?
Wooden boards are burnt on each side, which is usually done with a blowtorch. Using a stiff brush, carbon residue is then removed from the boards and the material is rinsed with water.
Once a board is dry, a natural oil is applied to seal it. Colours usually range from a very rich natural wood colour to a deep black. The final appearance is determined by the species of the wood, the extent of the burn and how vigorously it is brushed. The colour can be further manipulated by using stain instead of oil.

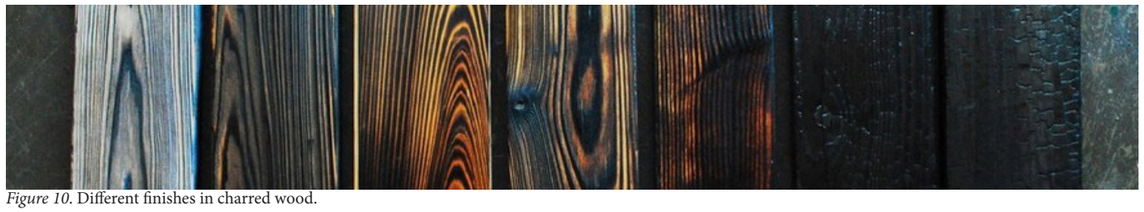


Figure 10. Different finishes in charred wood.

11 - Smartlam. (2018). *Benefits & Advantages of CLT.* Retreived from http://www.smartlam.com/about/benefits/

3.4.1. BENEFICTS

- Durable and long lasting: the life expectancy of shou sugi ban is estimated at more than 80 years when properly maintained.
- Life-cycle: Wood is a renewable resource and no chemicals are required for finishing. We would be remiss not to acknowledge the fact that fossil fuels are required for the burn process, but the ensuing lifespan makes that sacrifice negligible.
- Aesthetics: You can get a variety of beatiful colours out of it depending on how deep you burn and how deep you brush, to further alter or enhance colours - and it can be stained as well.
- Water resistance: The combination of carbonized wood and oil makes the board resistant to water and mould.
- Fire resistance: Believe it or not, burning wood can give it flame retardant properties. Who knew?
- nsect resistance: Termites and other problematic insects hate burnt wood.

MAINTENANCE

If the intended use is to have it outside and exposed to weather (cladding, fences, decking), it should be oiled about every 10-15 years, which is fairly standard for exterior wood treatment. It will retain its colour better and will remain water-resistant longer if it is well-maintained.
For interior purposes where it will mostly be seen and not touched, it will require virtually no maintenance.

When used as furniture, the required maintenance would depend on its use - a coffee table may take more of a beating than other pieces. But maintaining oiled wood is pretty simple; it takes little more than a quick hand-sanding if necessary, and wiping on a single coat of oil.[12]


Figure 11. Burning process step.(Max Marshall Design).

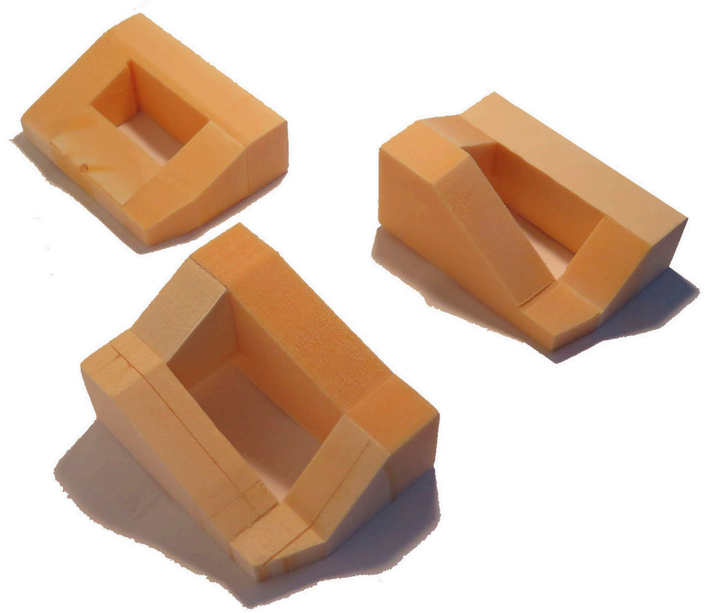
12 - Paradis Bolduc, L. (n.d). *Shou sugi ban carbonized wood siding .Shou sugi ban burnt wood exterior cladding is naturally made and very durable.* Retrieved from http://www.ecohome.net/guide/shou-sugi-ban-carbonized-wood-siding

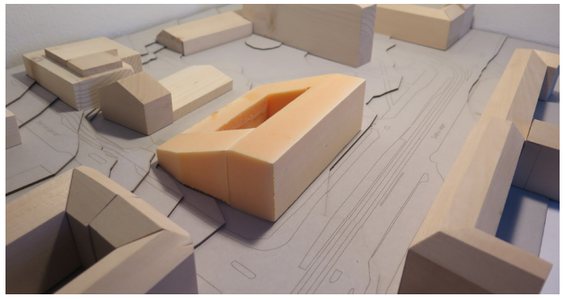
04. PROCESS

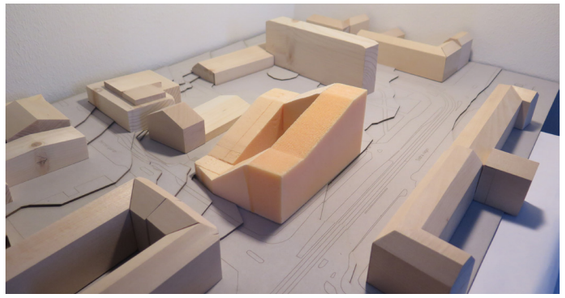
4.1. MASS & SHAPE + CONTEXT RELATION STUDY

PHASE 1 __ models 1 - 3

CONCEPT: working with sloped shapes, different heights, sunlinght and close courtyard

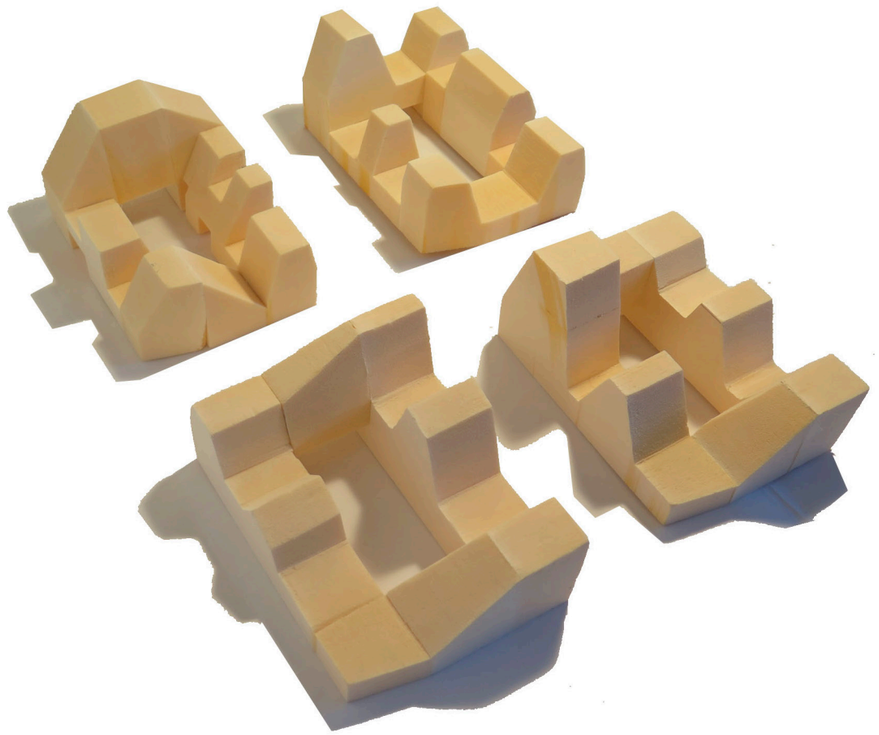


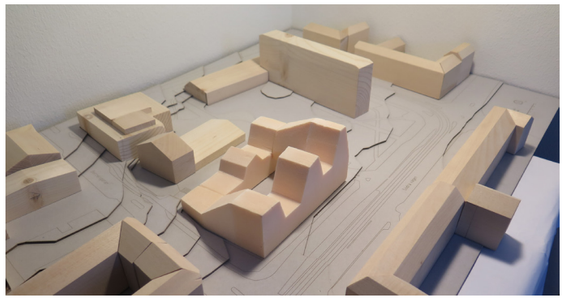




PHASE 2 __ models 4 - 7

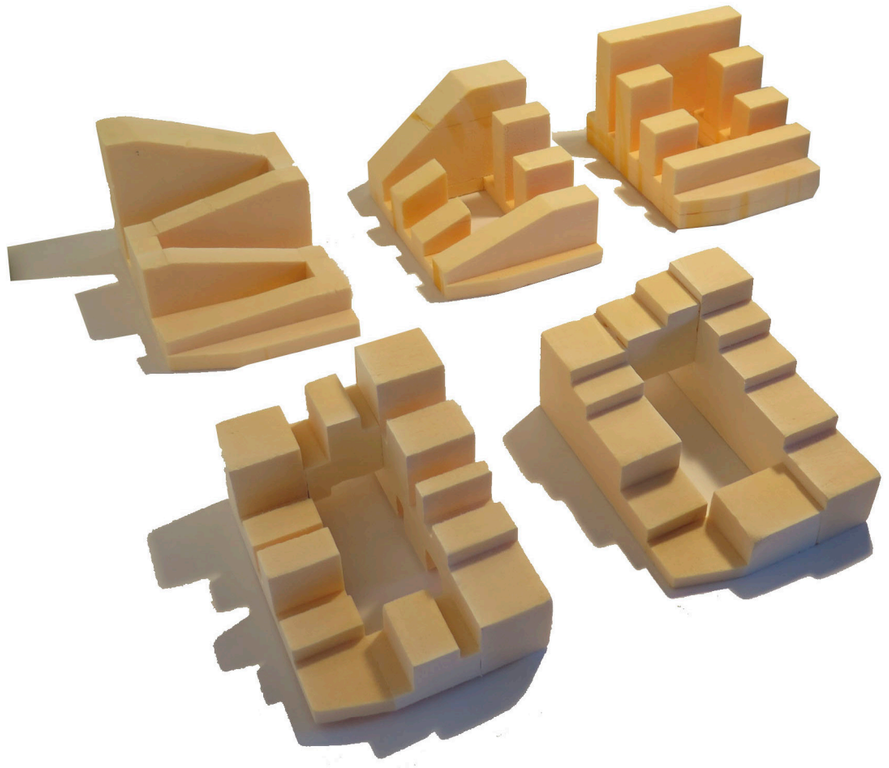
CONCEPT: continue with phase 1 + subtraction concept + inclined roofs



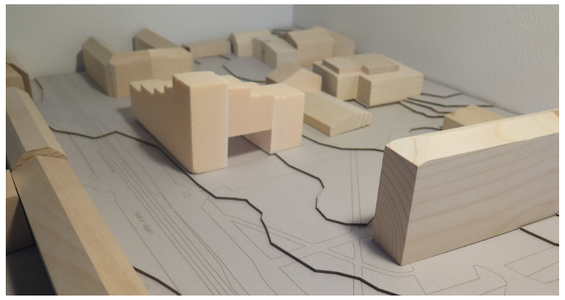


PHASE 3 __ models 8 - 12

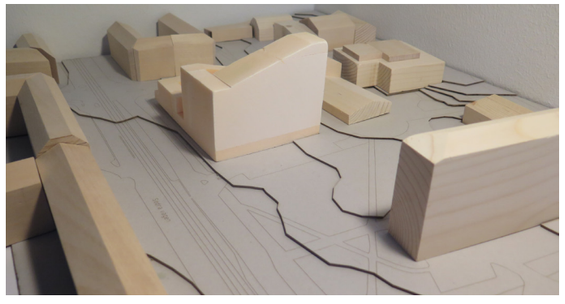
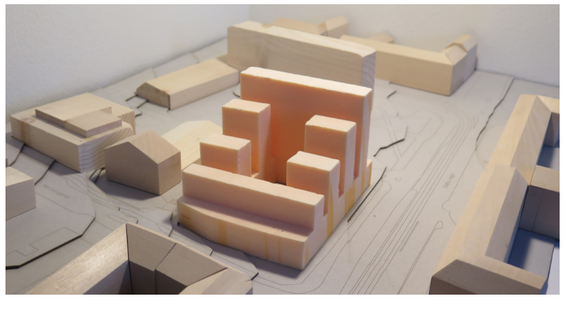
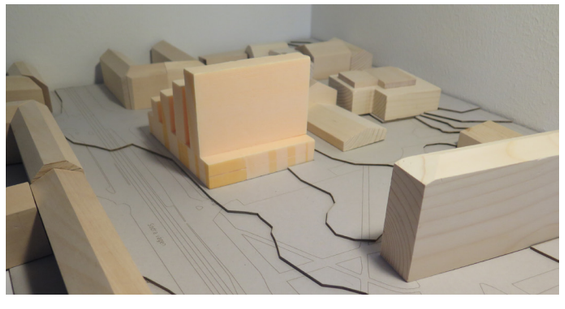
CONCEPT: continue with phase 1-2
STUDY CONCLUSION: the forms are too expressive for the context in which the building is located, it is necessary to adapt to the environment and offer a more subtle response





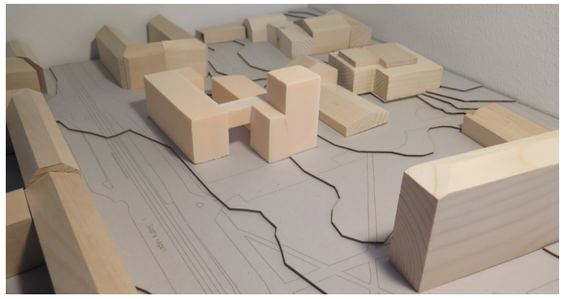



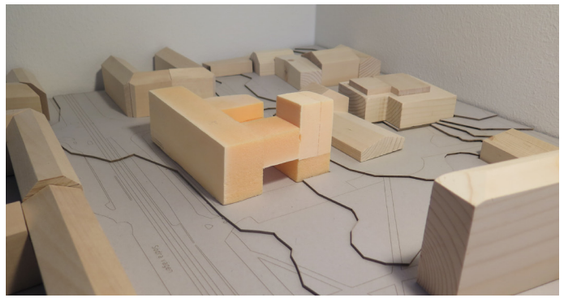


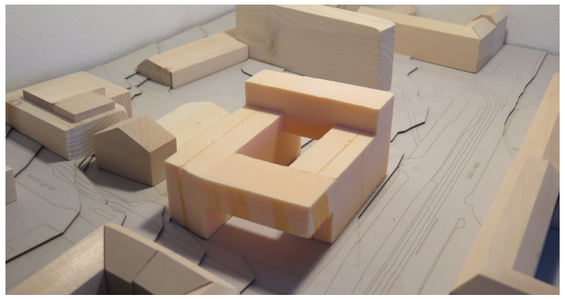




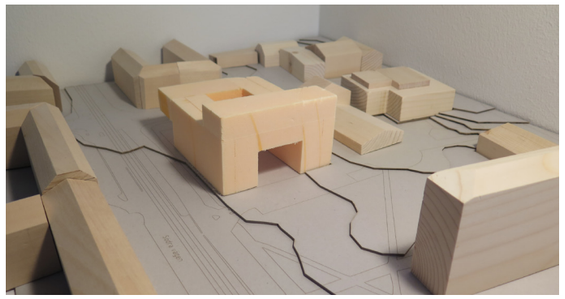
PHASE 4 __ models 13 - 20

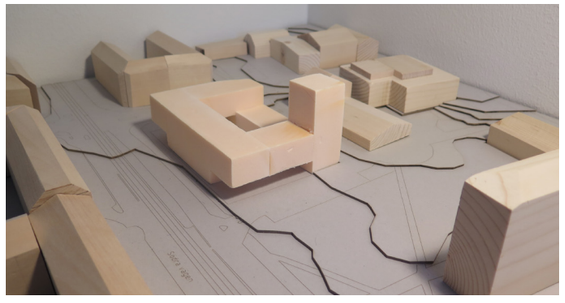
CONCEPT: continuation of height and shape from context blocks + work with a more open courtyard + tower as connection with the hotel + gates
STUDY CONCLUSION: courtyard need to be more open and more public to make the commenrcial spaces work

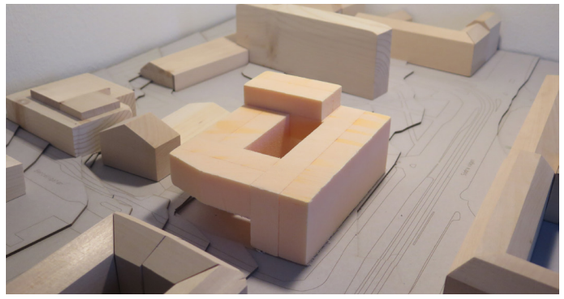


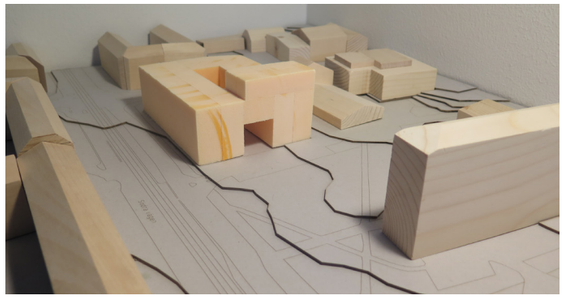






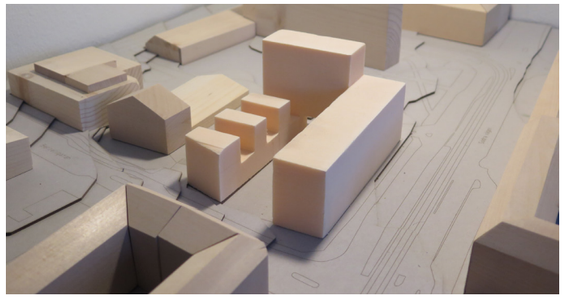
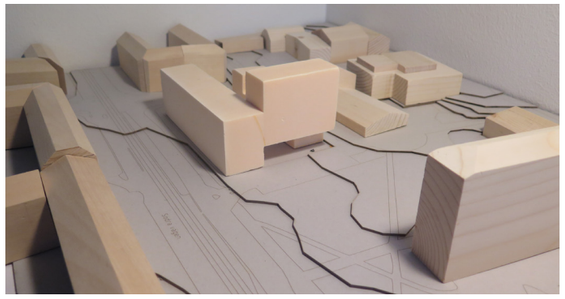
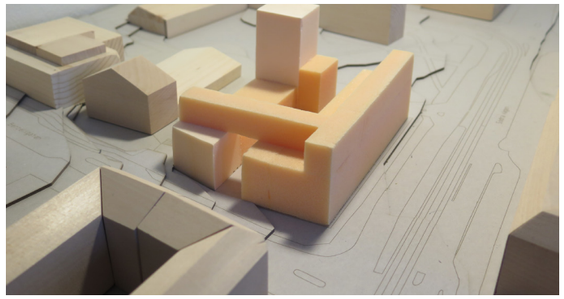
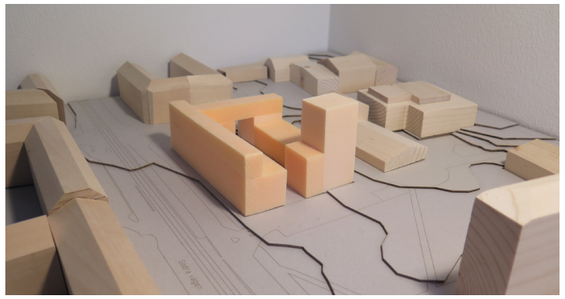
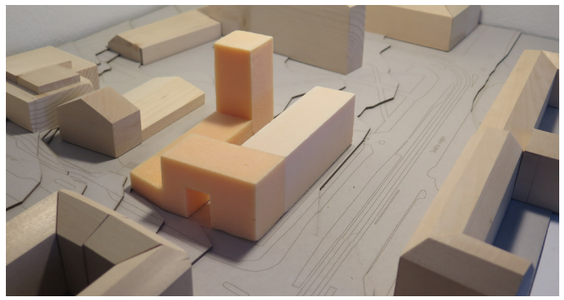


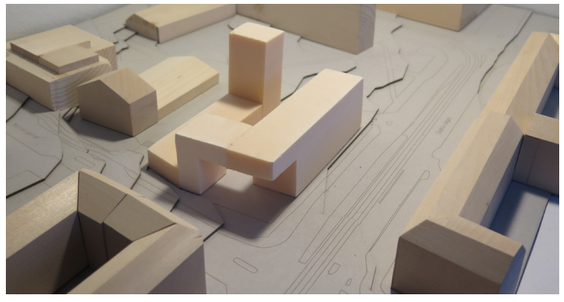
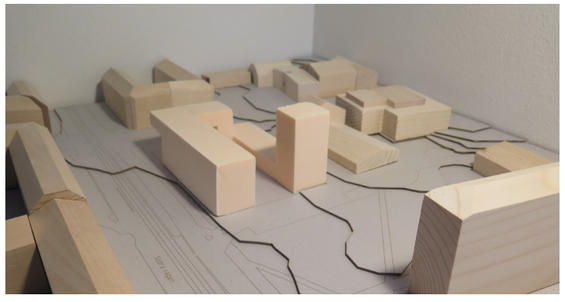


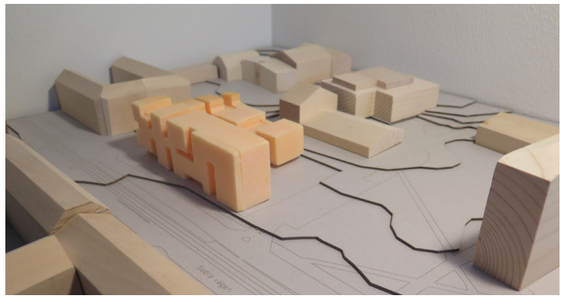


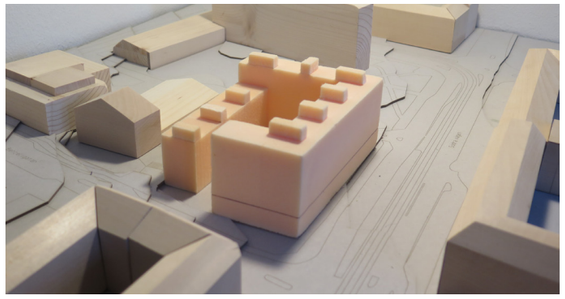
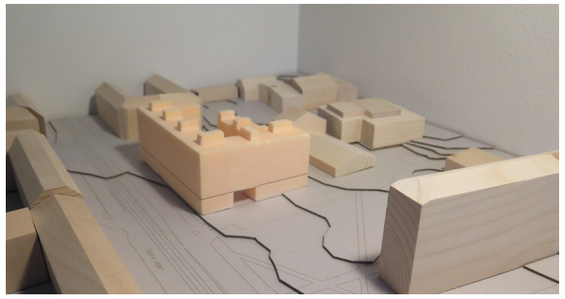
PHASE54 __ models 21 - 26

CONCEPT: open courtyard
STUDY CONCLUSION: the courtyard provides a better transit flow in the contex, 2 slabs shape seems to be the answer for the best working shape, discard tower within the block.

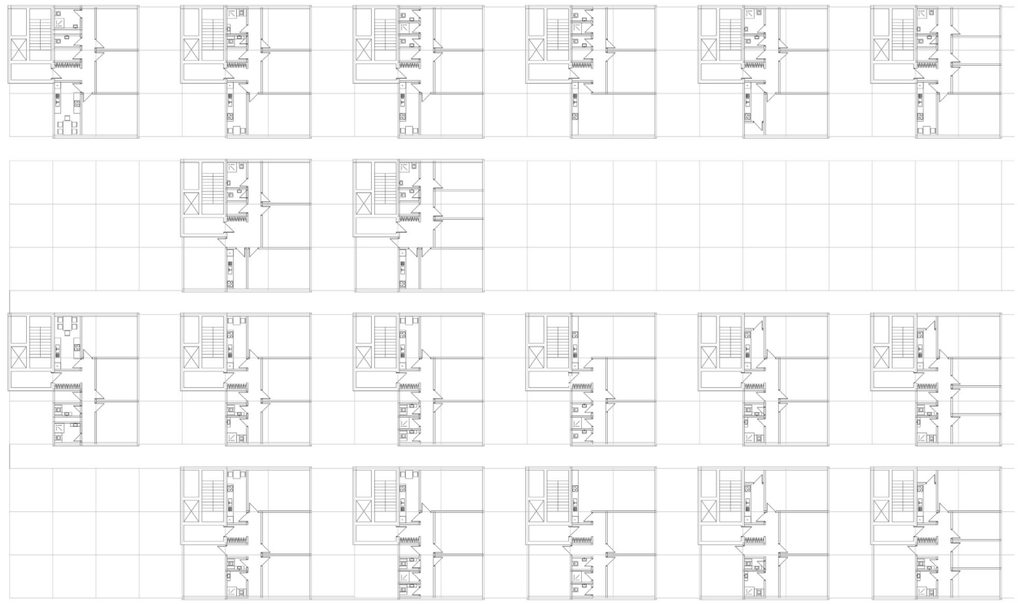






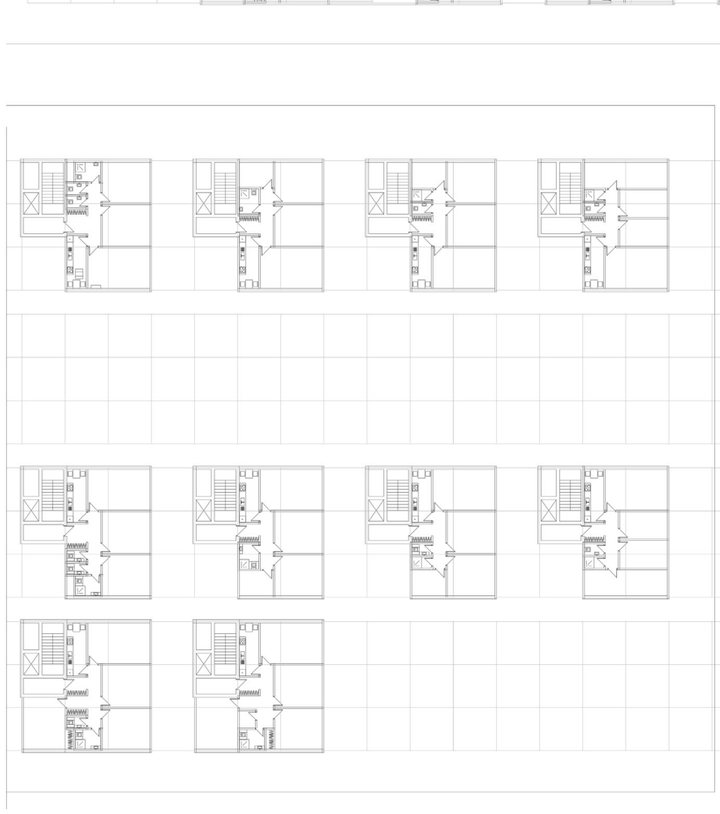



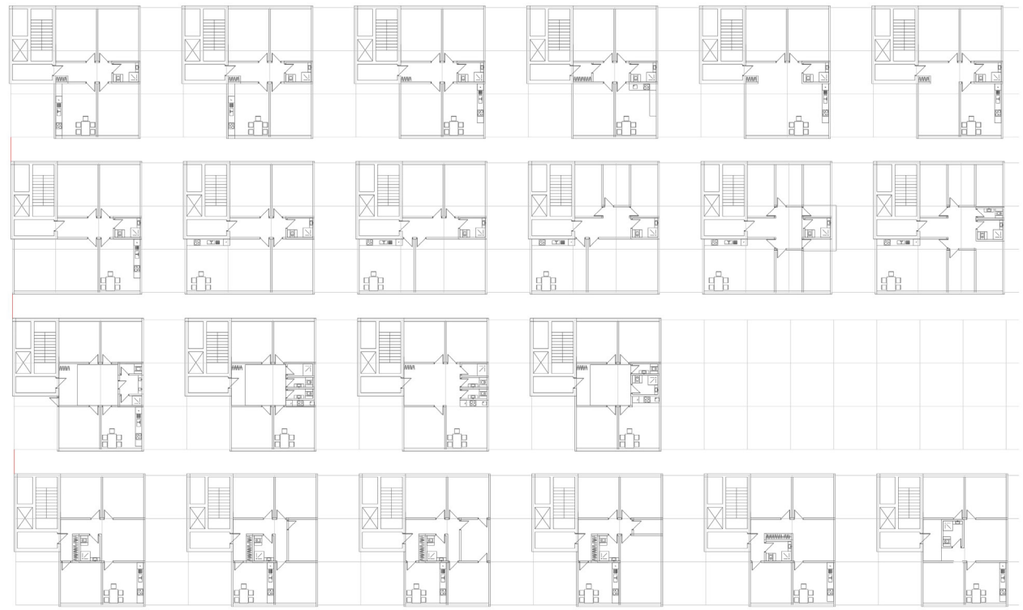


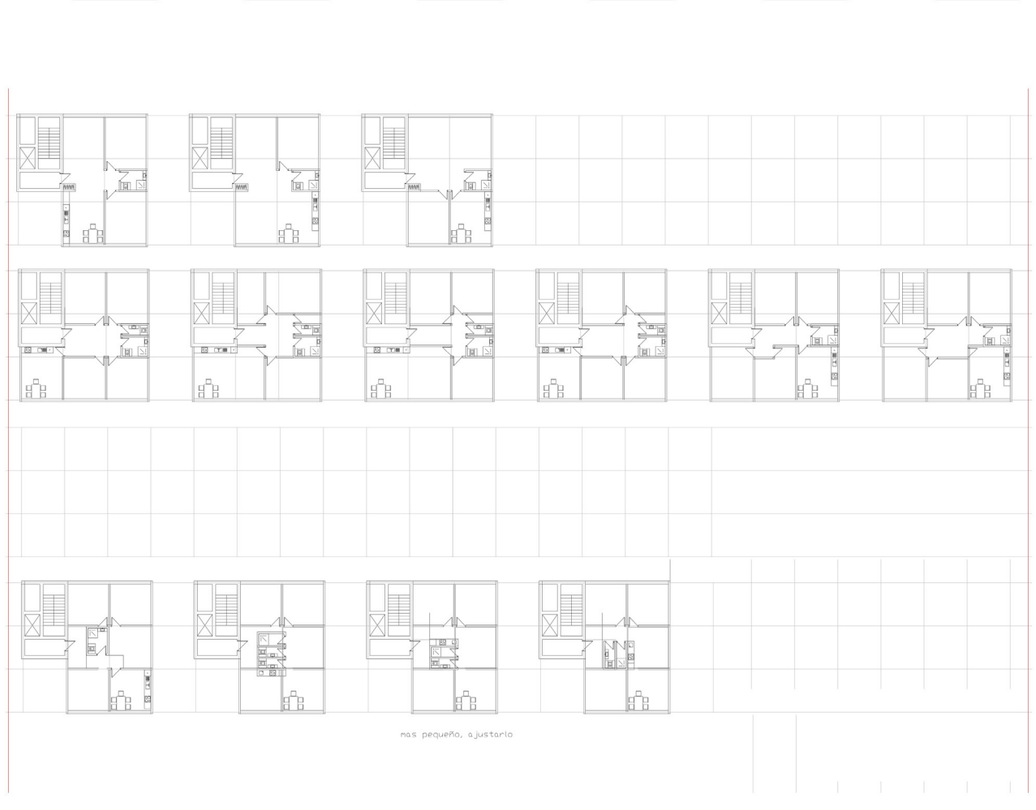



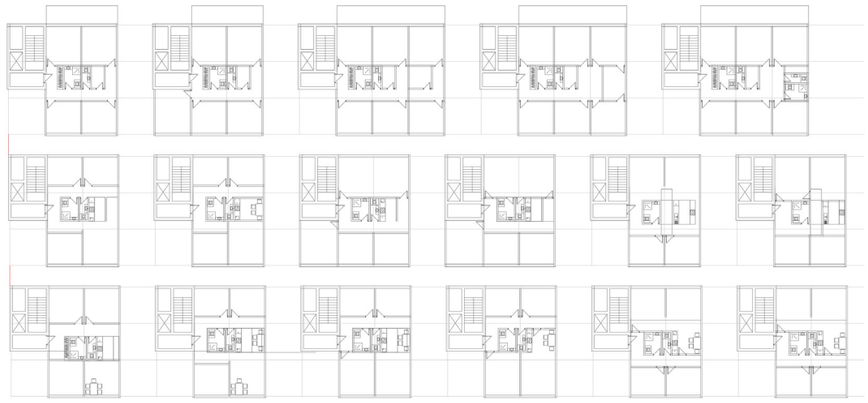
4.2. TYPOLOGIES + BLOCK STUDY EVOLUTION

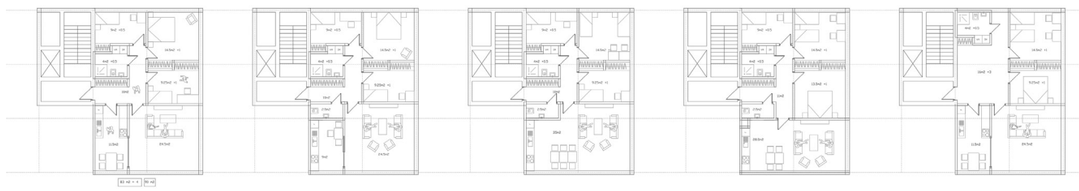


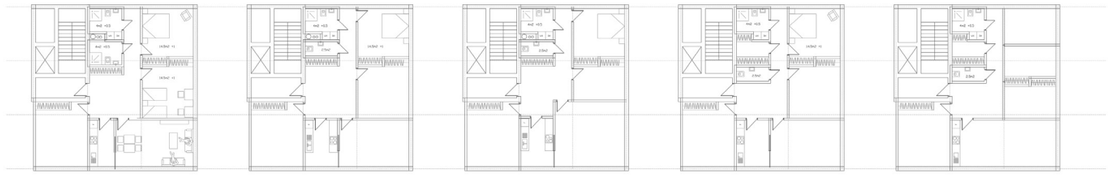


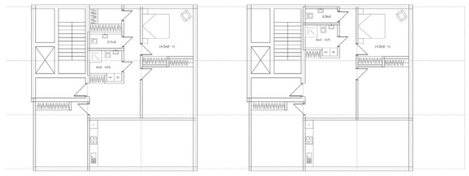


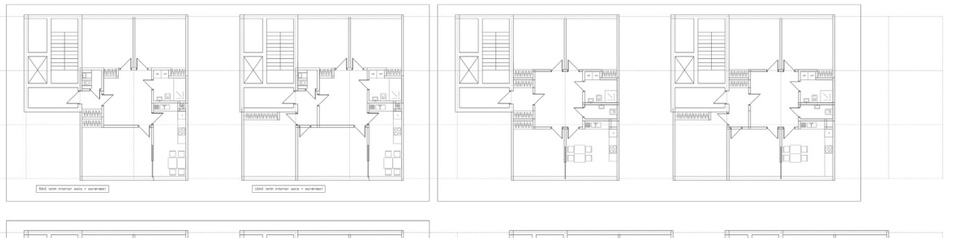


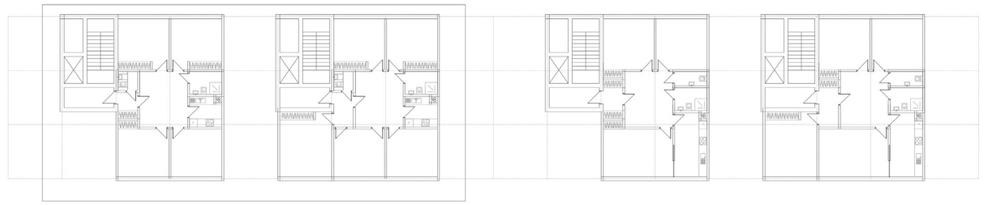


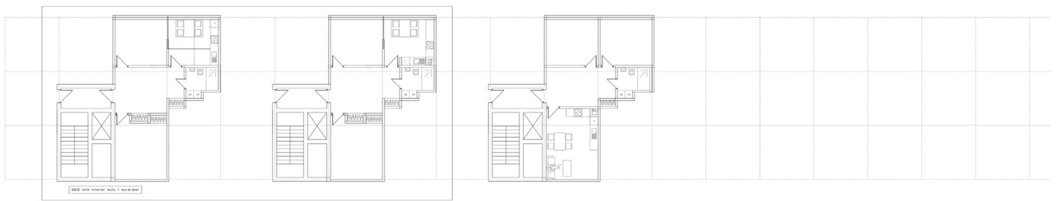


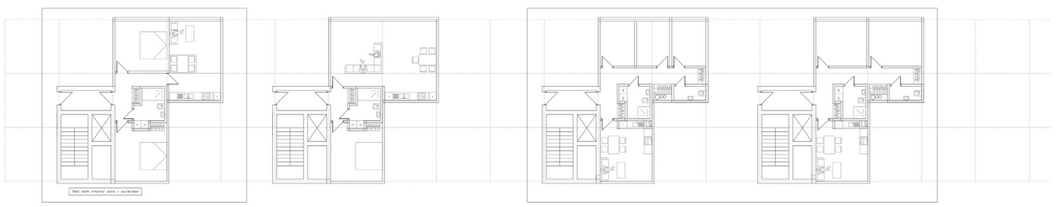


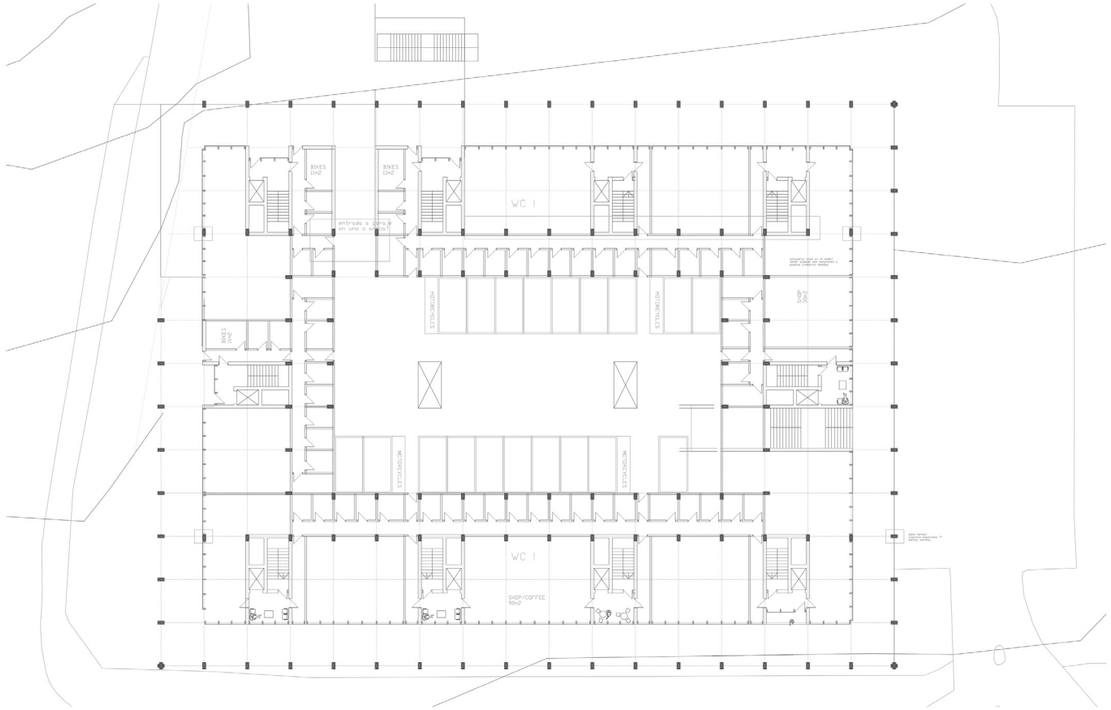


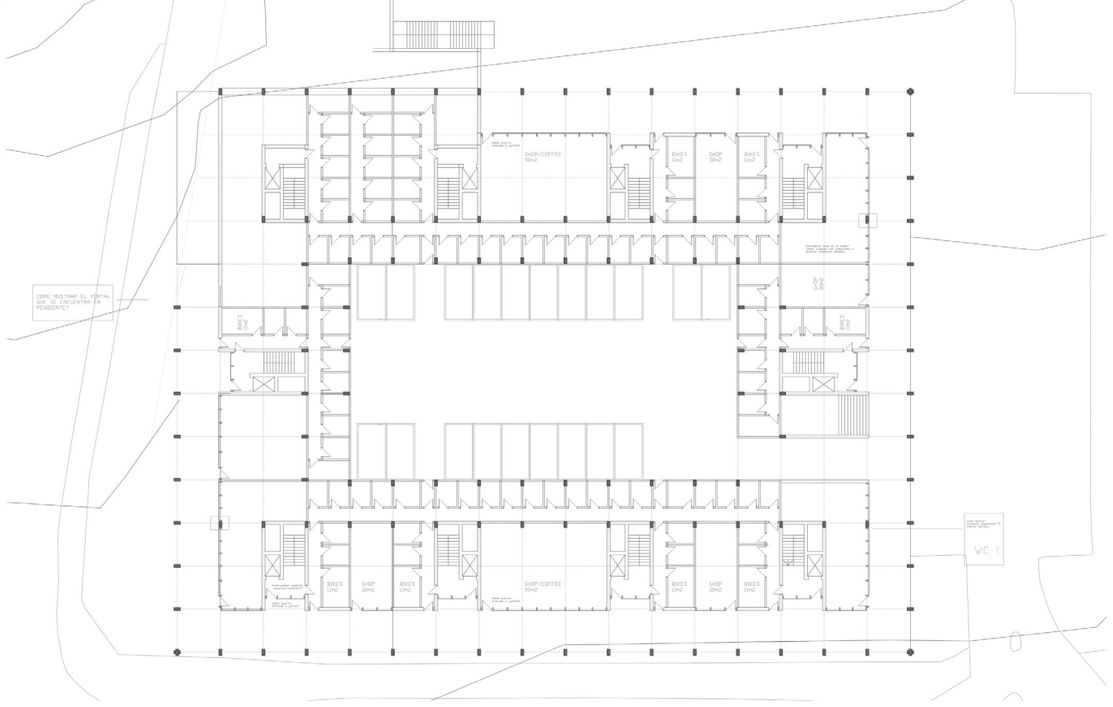


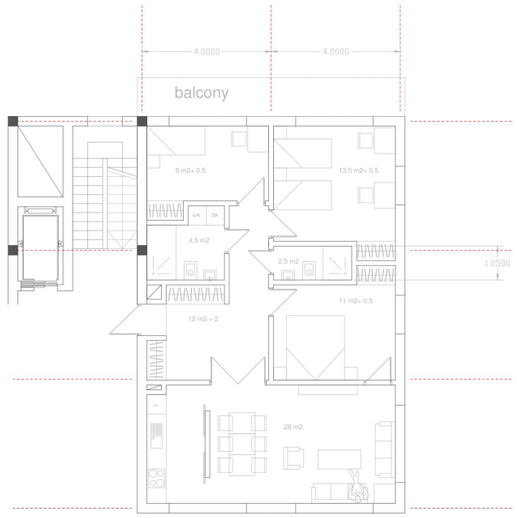






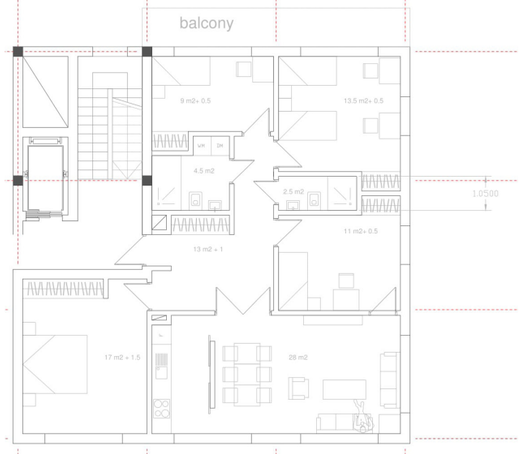

BIKES 12m2
WC !
SHOP 30m2
MOTORCYCLES
SHOP/COFFEE 150m2


SHOP/COFFEE 150m2
BIKES 12m2
SHOP 30m2
WC !



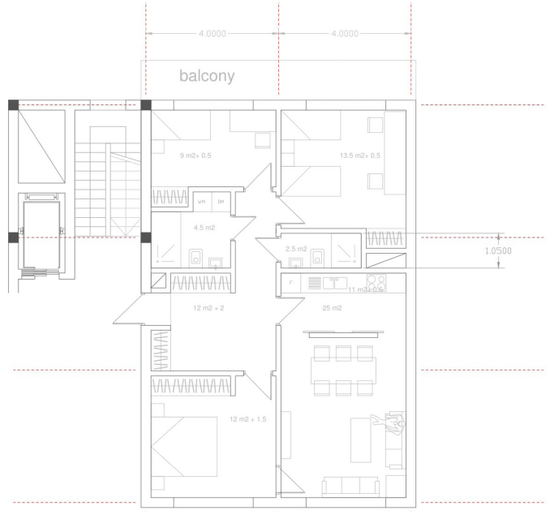
Total Area: 90 m2

TIPOLOGY 1
situated in the corners of the building



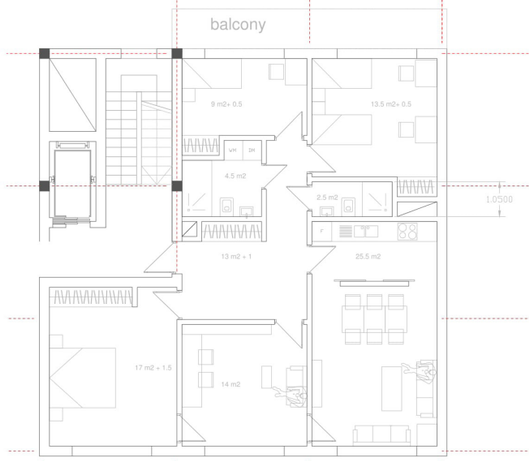
Total Area: 110 m2

TIPOLOGY 1+
situated in the corners of the building



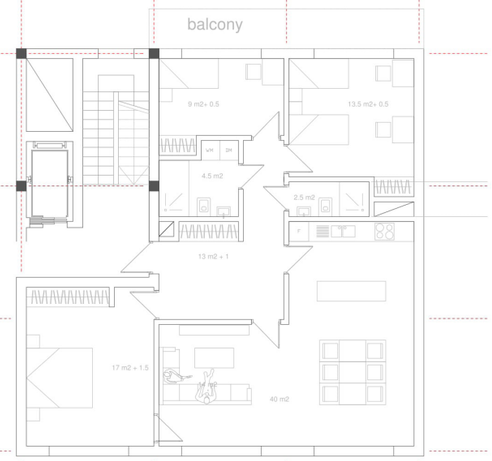
Total Area: 90 m2

TIPOLOGY 2



Total Area: 110 m2

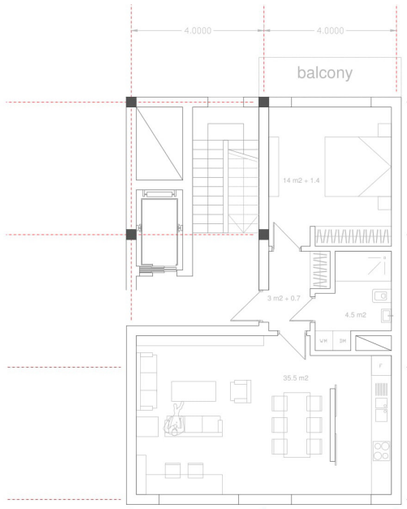
TIPOLOGY 2+



Total Area: 110 m2

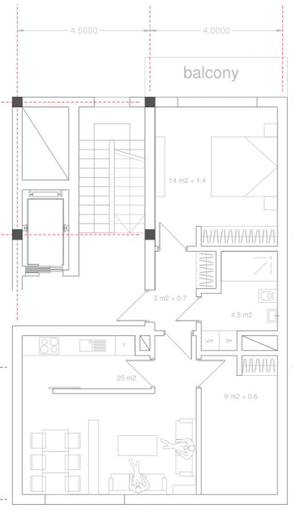
TIPOLOGY 2+

SCALE 1 / 100



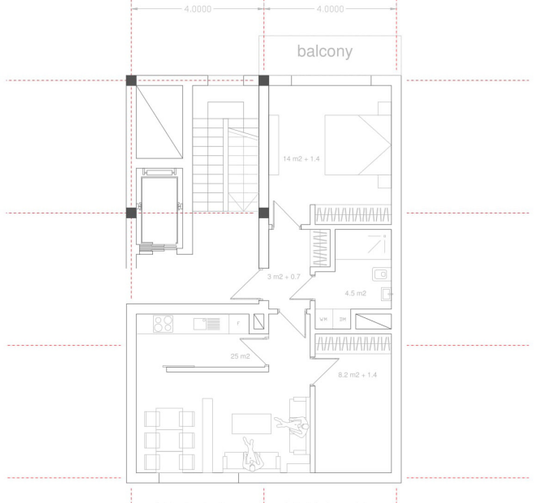
Total Area: 62.5 m2

TIPOLOGY 3



Total Area: 62.5 m2

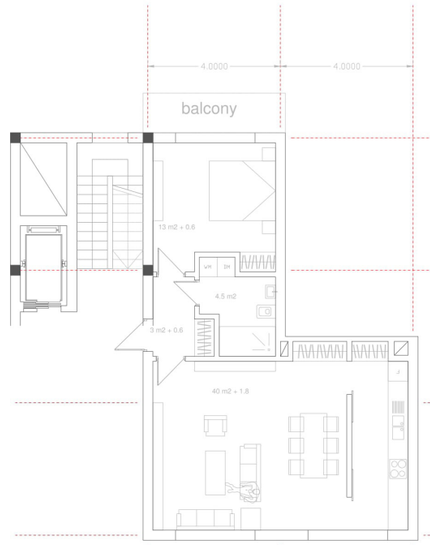
TIPOLOGY 3



Total Area: 62.5 m2

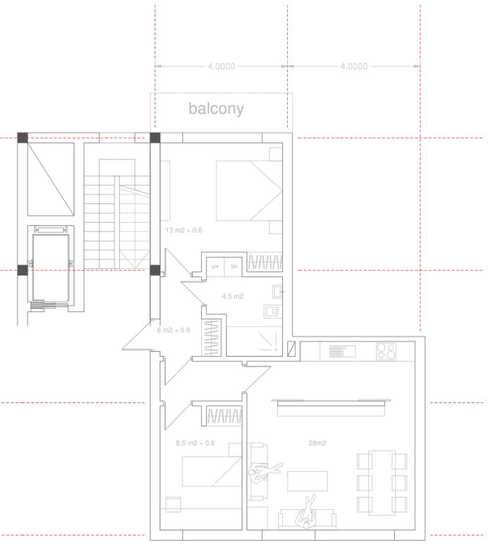
TIPOLOGY 3

SCALE 1 / 100



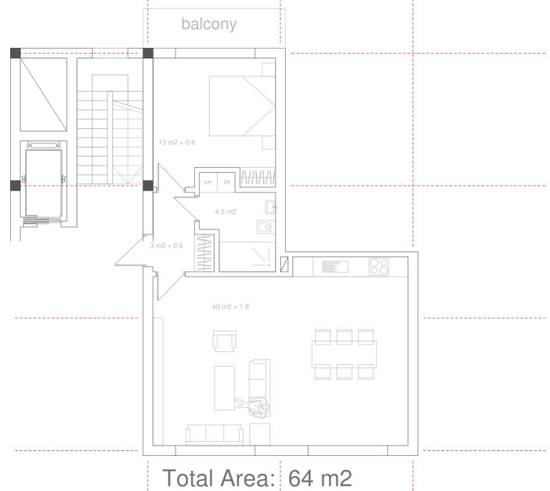
Total Area: 64 m2

TIPOLOGY 4



Total Area: 64 m2

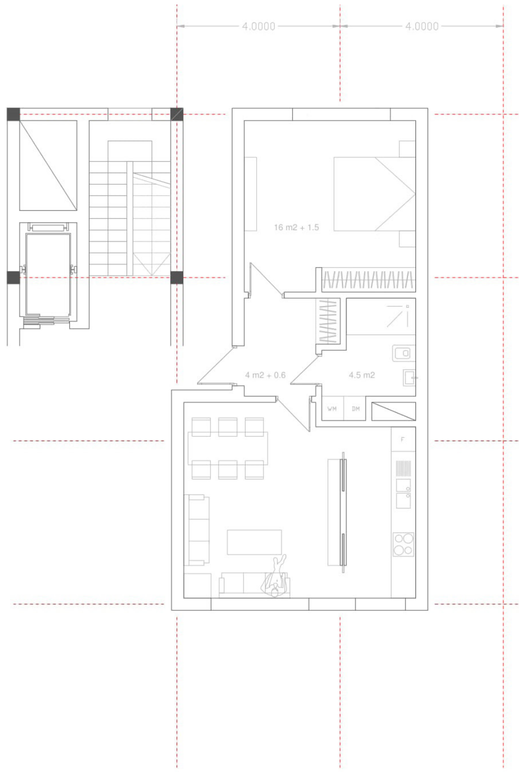
TIPOLOGY 4



Total Area: 64 m2

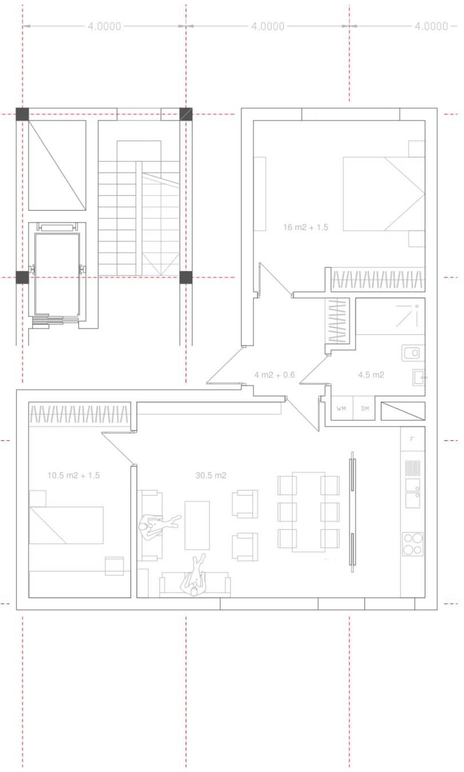
TIPOLOGY 4

SCALE 1 / 100



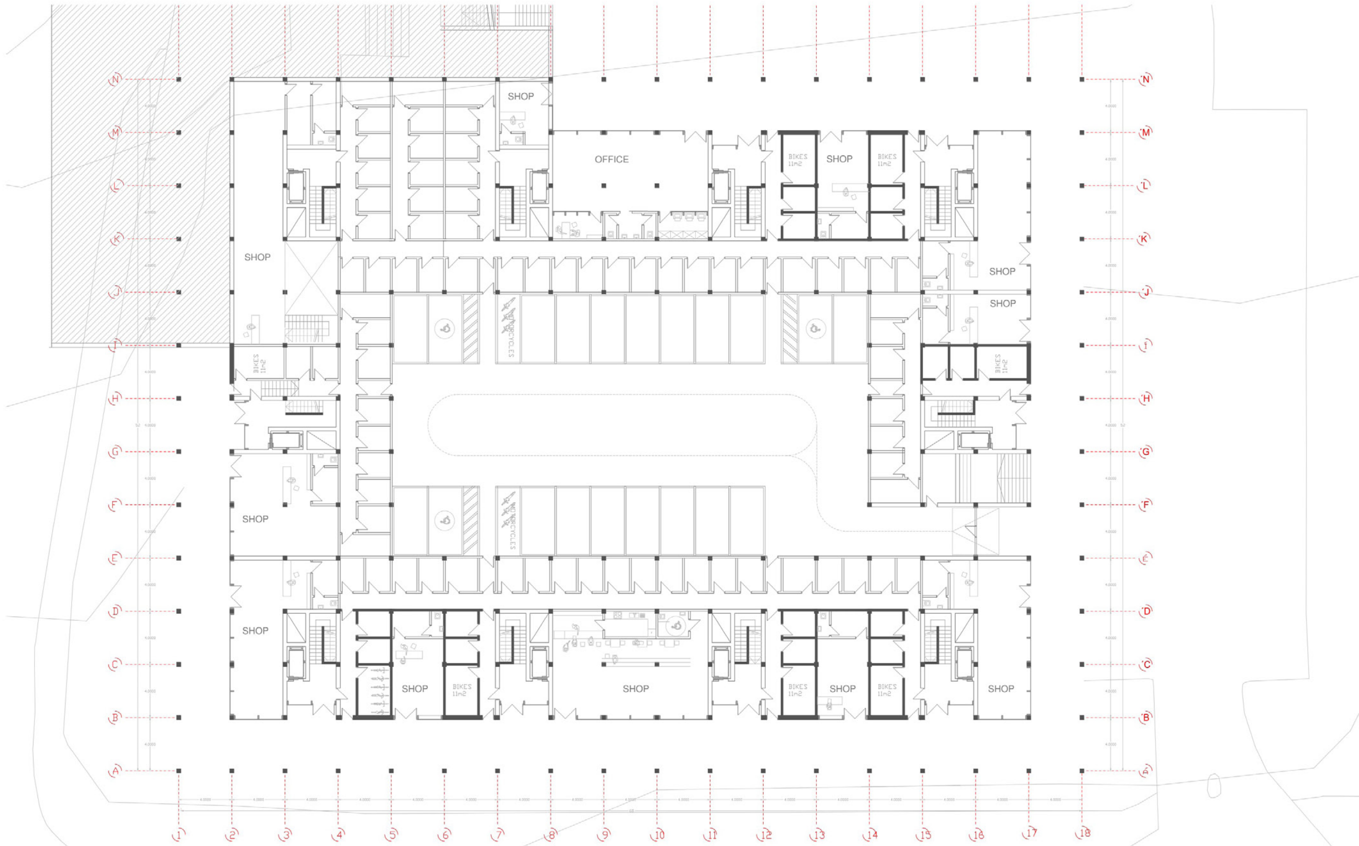
Total Area: 56 m2

TIPOLOGY 5
only in the first living level (garden)

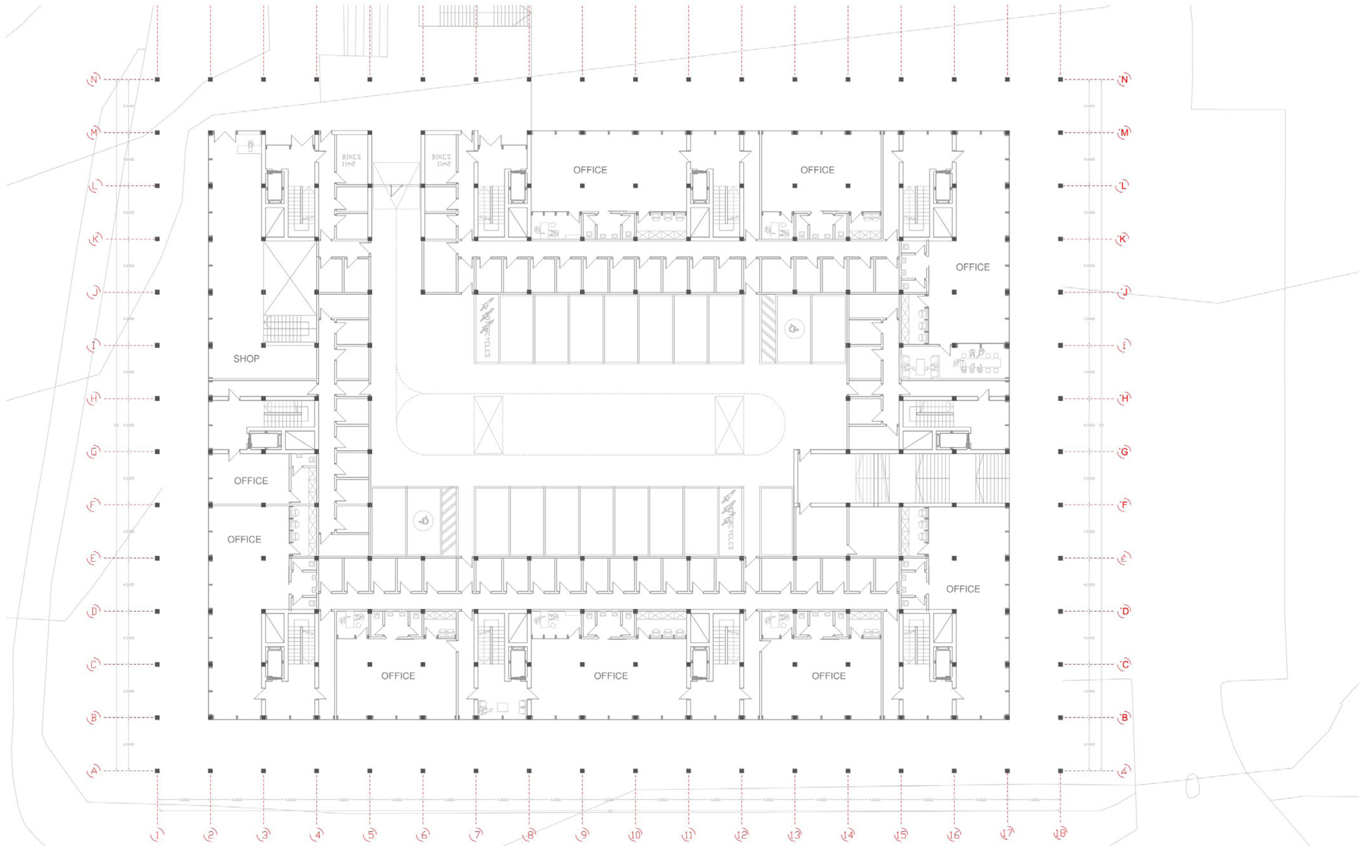


Total Area: 56 m2

TIPOLOGY 6
only in the first living level (garden



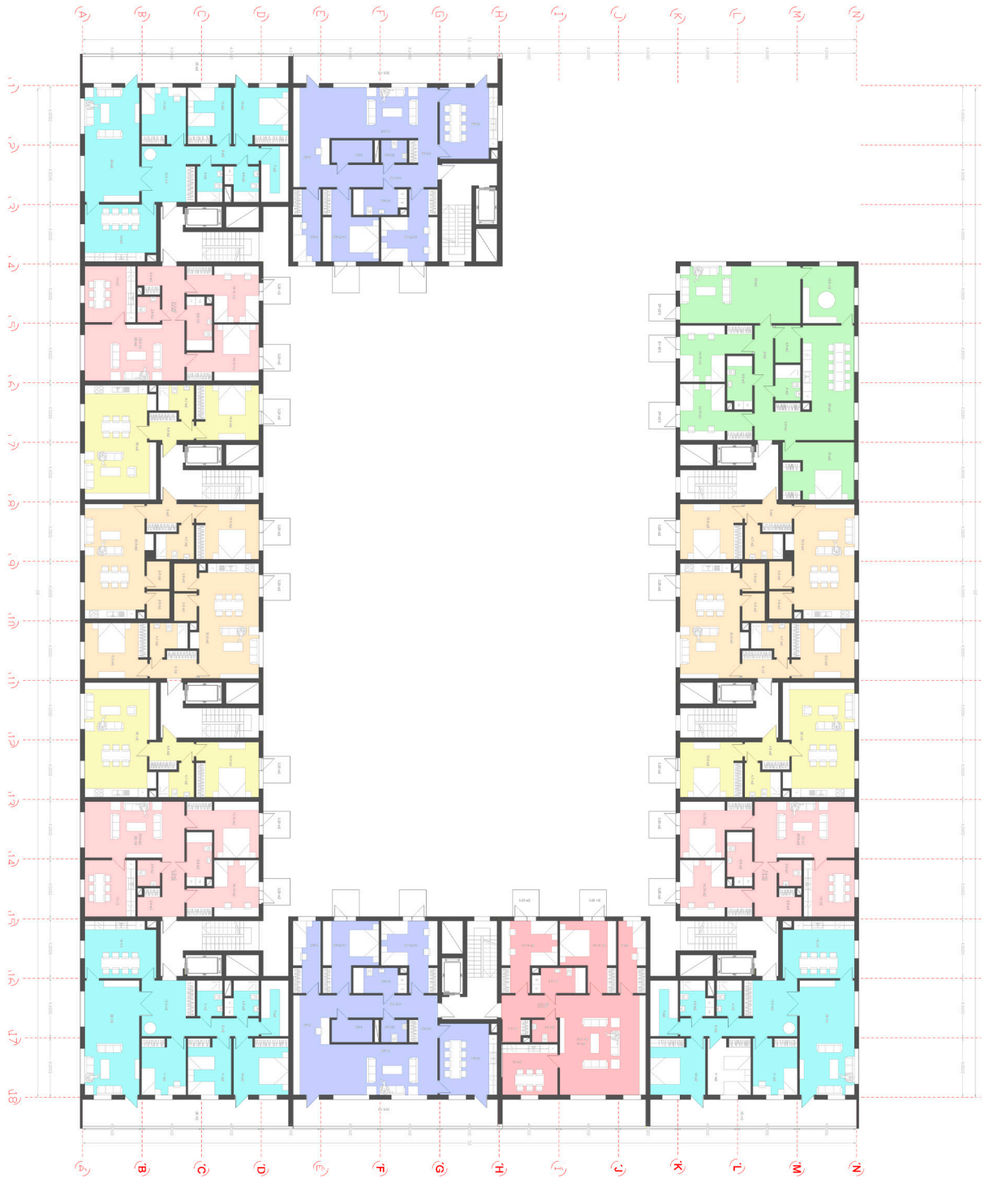
1st LEVEL GROUND FLOOR / COMERCIAL USE + PRIVATE _ scale 1/250



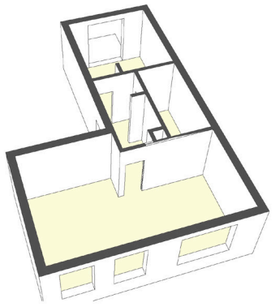
2nd LEVEL GROUND FLOOR / OFFICE USE + COMERCIAL + PRIVATE _ scale 1/250

1st LEVEL _PRIVATE HOUSING + COURTYARD _ scale 1/250

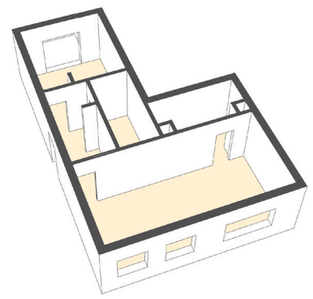
GENERIC HOUSING FLOOR _ scale 1/250



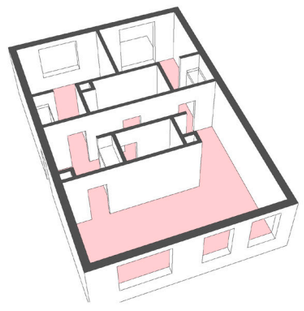

TYPOLOGY A
TOTAL = 80.2 m2 + 4.3
4.3 m2
14 m2
6.5 m2
5.6 m2
33 m2



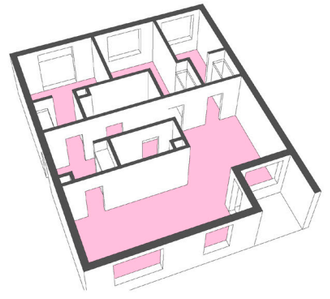

TYPOLOGY B
TOTAL = 62.5 m2 + 4.3
4.3 m2
14 m2
6.5 m2
7 m2
6 m2
29 m2



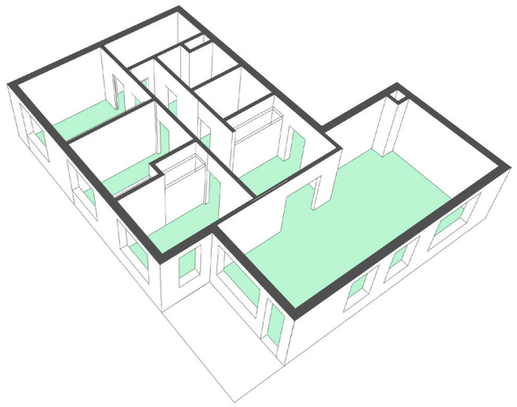

TYPOLOGY C
TOTAL = 81 m2 + 4.3
4.3 m2
14.7 m2
14.7 m2
5.6 m2
6 m2
7 m2
3.5 m2
4 m2
20 m2



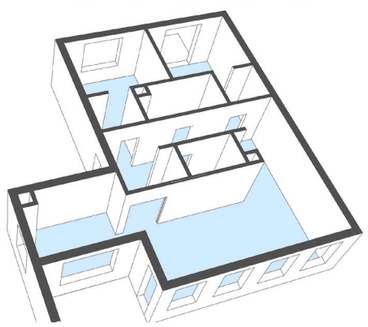

TYPOLOGY C +
TOTAL = 105 m2 + 4.3
4.3 m2
14.7 m2
13 m2
10.5 m2
5.6 m2
6 m2
4.5 m2
11 m2 + (3C)
4.5 m2
30m2 + (11)
5 m2



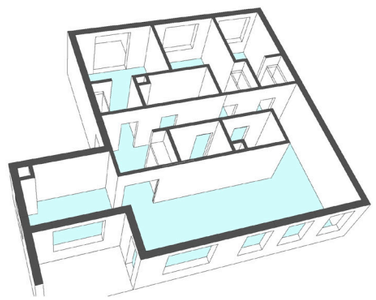

TYPOLOGY E
TOTAL = 118 m2 + 8.4
5.5 m2
14 m2
4.8 m2
10.8 m2
5 m2
4.6 m2
11 m2
12 m2
0.1500
8.4 m2
40 m2
0.4345

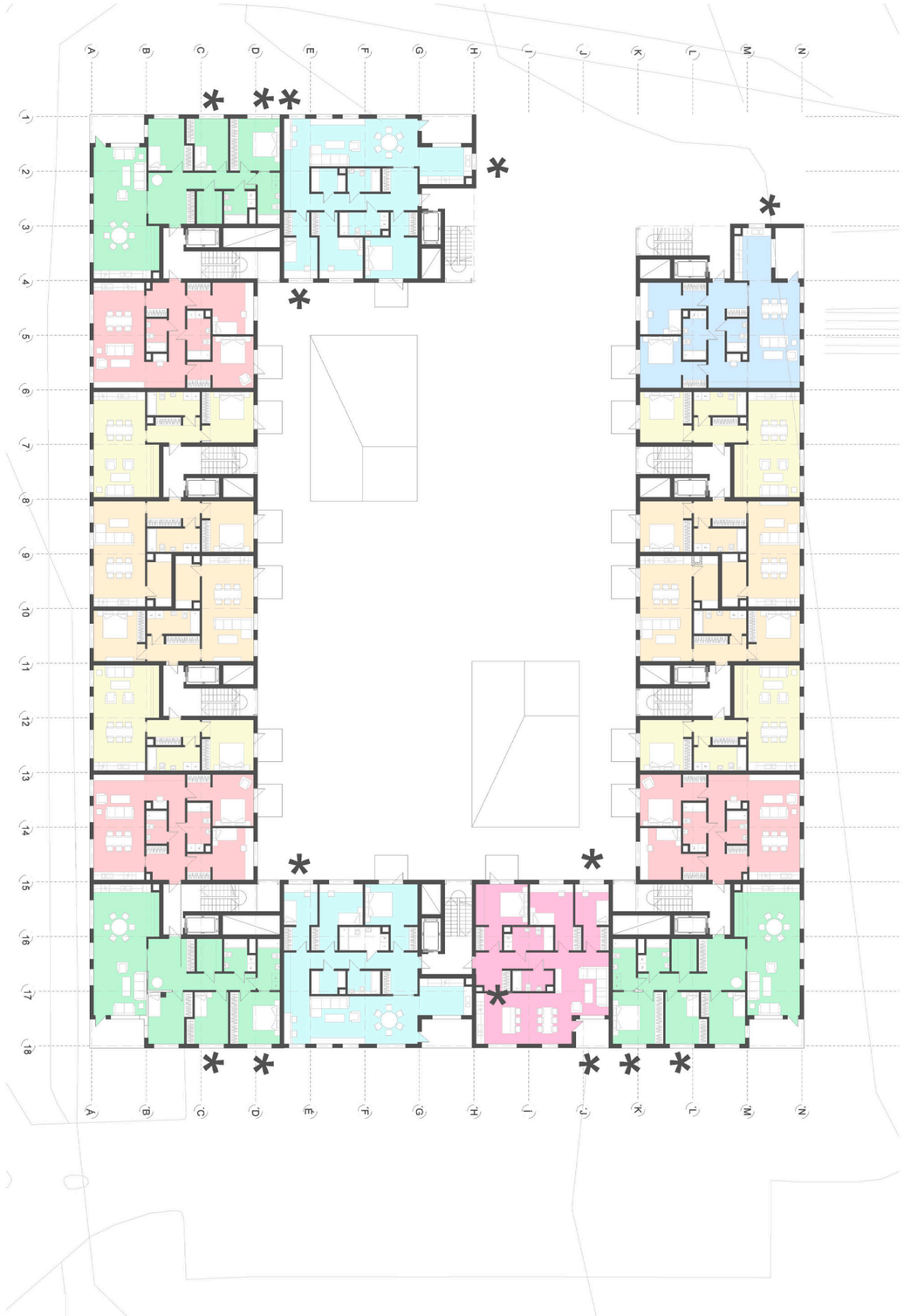



TYPOLOGY D
TOTAL = 102 m2 + 12
4.3 m2
14.8 m2
14.8 m2
6 m2
6.9 m2
6.3 m2
3.7 m2
3.4 m2
10 m2
28.6 m2
7.7 m2

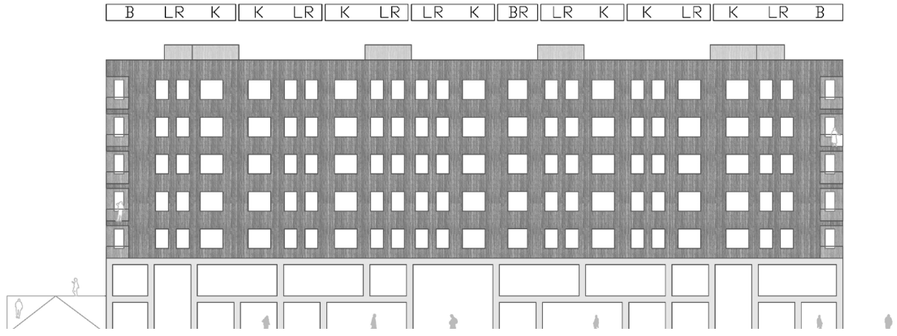



TYPOLOGY D +
TOTAL 125 m2 + 12
6.8 m2
14.5 m2
2.5 m2
4.7 m2

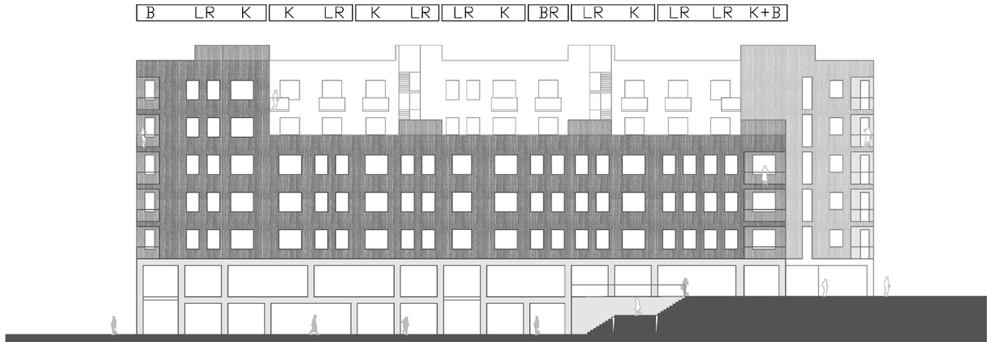



A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

NORTH

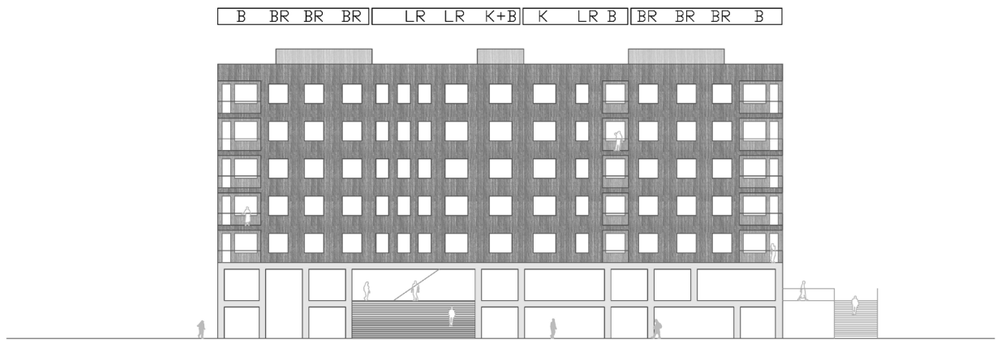


SOUTH

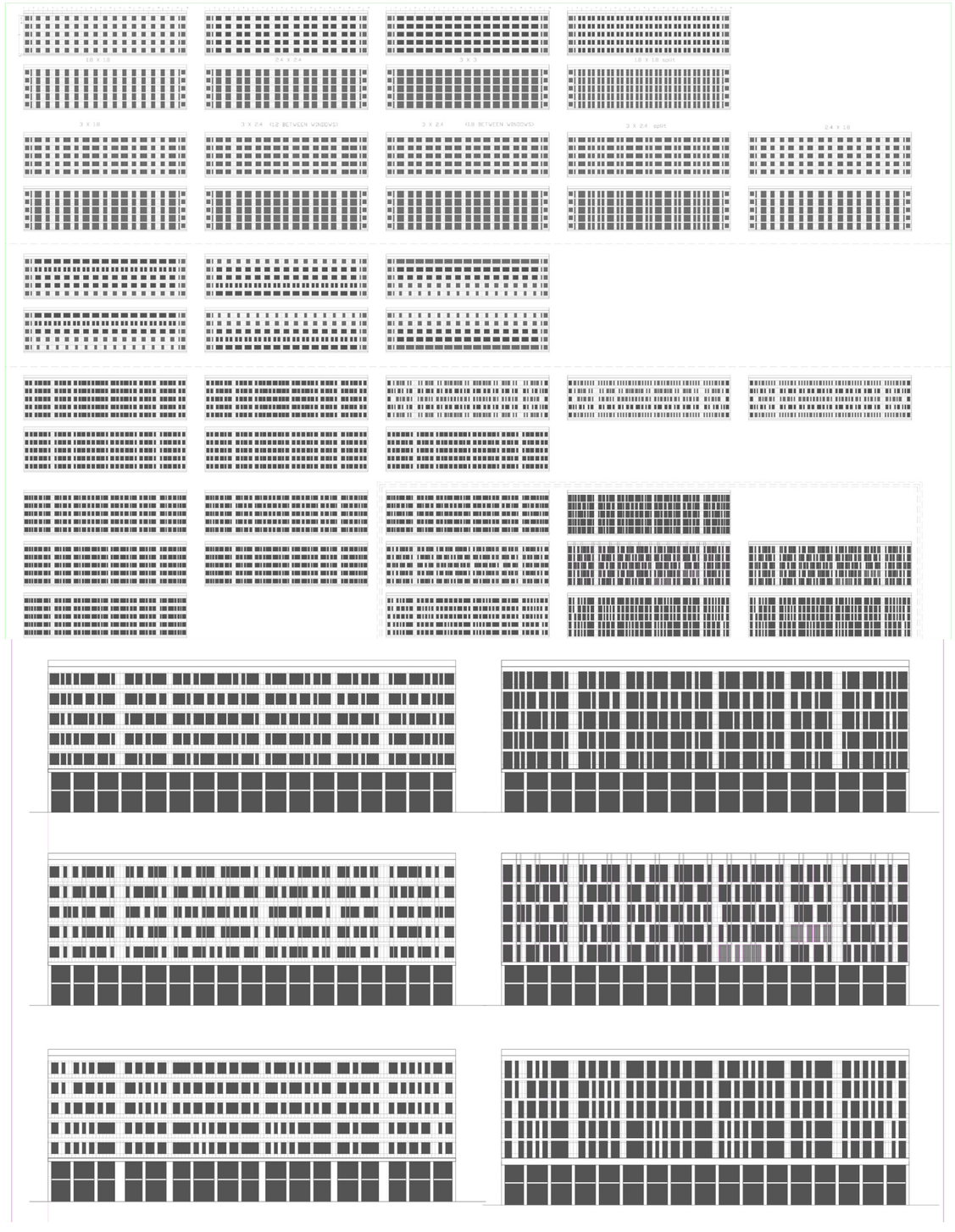


EAST

WEST



4.3. SUMMARY OF FACADE STUDY



05. RESULT / DESIGN PROPOSAL

The outcome is a detailed housing proposal, based on the re-interpretation of `Landshövdingehus´ housing typology in the historic urban environment of Gothenburg with nods to tradition, while still providing an innovative solution

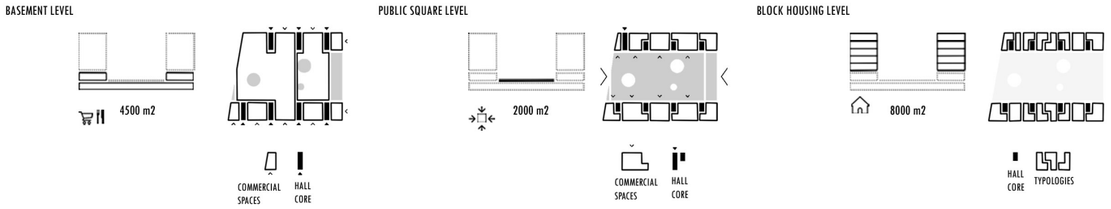
As result, an open building formed by 2 wooden slabs that rely on concrete plinth creating a connected block. The traditional courtyard from `Landshövdingehus´ housing typology is transformed into a public square that creates a strong connection with the surrounding public space giving a natural transit which saves the unevenness of a floor between both situations.

Materiality, structure and the program are related, giving rise to a mixed use building, where the commercial spaces are located in the concrete plinth that opens itself to the public square while supports the CLT structure, which houses 75 apartments in 7 different arrangements with variety of sizes ranging from 60 to 130 square meters.

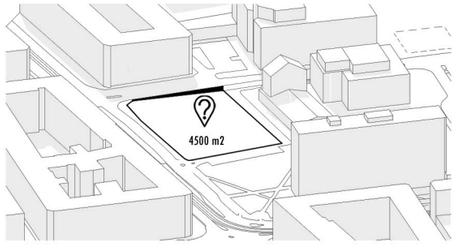
The proposal has 2 commercial + 5 housing stories heights and is based on a 4,2m modular grid that maximizes flexibility in layout, ensuring an efficient planning that facilitates optimal natural lighting conditions and full cross ventilation for all apartments.
Formed by 3 modules in its width, each dwelling occupying the total width, where the central core contains the humid spaces and storage. All this allows flexibility in the remaining 2 modules. Bedrooms face the courtyard, providing privacy and reducing noise while the living areas and kitchen face the street.

Exposed wood on the façade offers enormous opportunities for a varied and exciting look. The materialization of the facade in charred wood answers to aesthetic possibilities, but environmental and structural benefits as well. Still, the building's expressive facade stands apart with its own contemporary features such as multiple glazed openings and wooden slats scouring it project's rhythm in it.

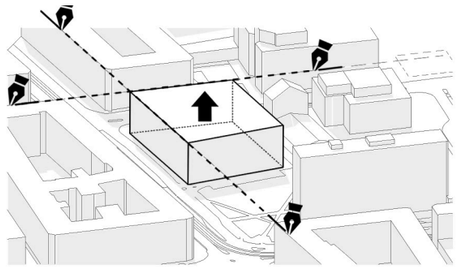
5.1. PROGRAM



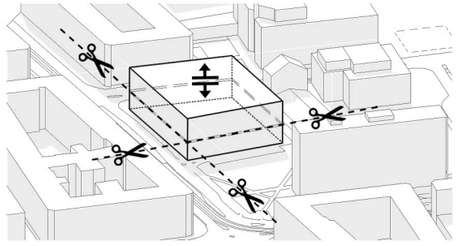
5.2. BUILDING CONCEPT



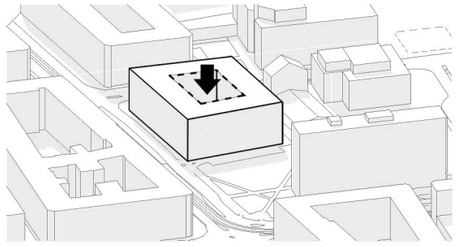
PROJECT AREA AND POSSIBILTIES



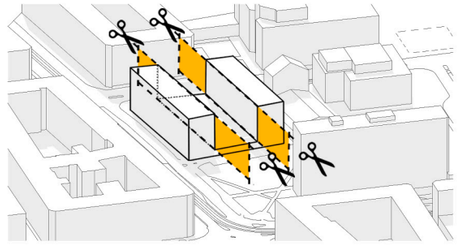
SHAPE THE VOLUME ADJUSTING IT IN HEIGHT AND ALIGNING IT TO THE URBAN ENVIRONMENT



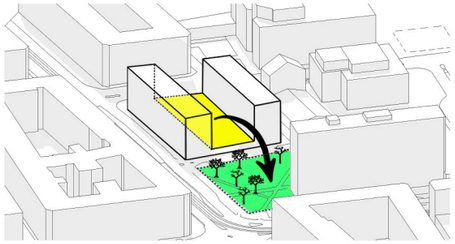
SEPARATE THE DIFRENT USES GIVING A CLEAR PROGRAMATIC IDENTITY



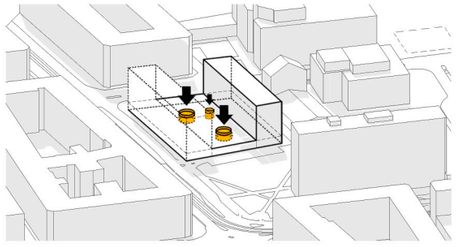
TURN THE SHAPE INTO A TRADITIONAL URBAN BLOCK



OPEN THE BLOCK AND MAKE THE COURTYARD PUBLIC TO ENHANCE THE SPACES

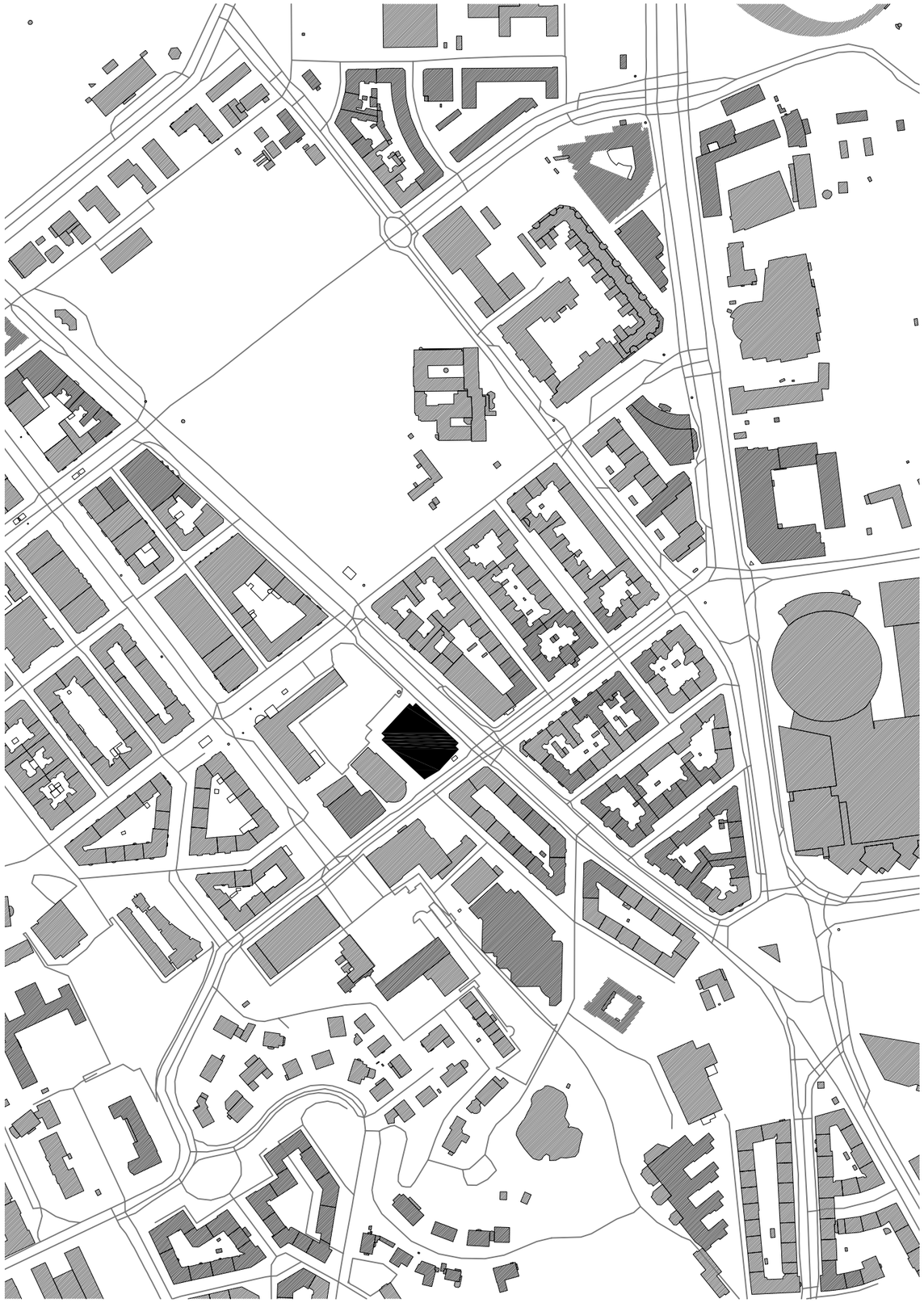


CREATE A STRONG CONNECTION WITH THE SURROUNDING



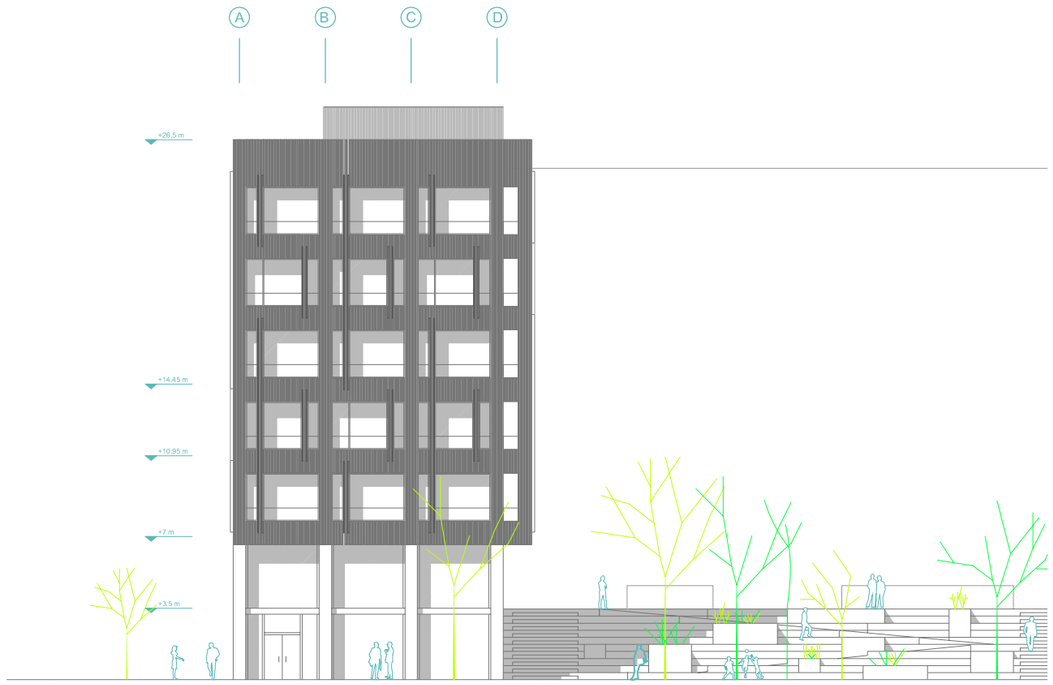
PERFORATE THE SQUARE PROVIDING NATURAL LIGHT AND CREATING VERTICAL CONNECTION WITH THE UNDERGROUND

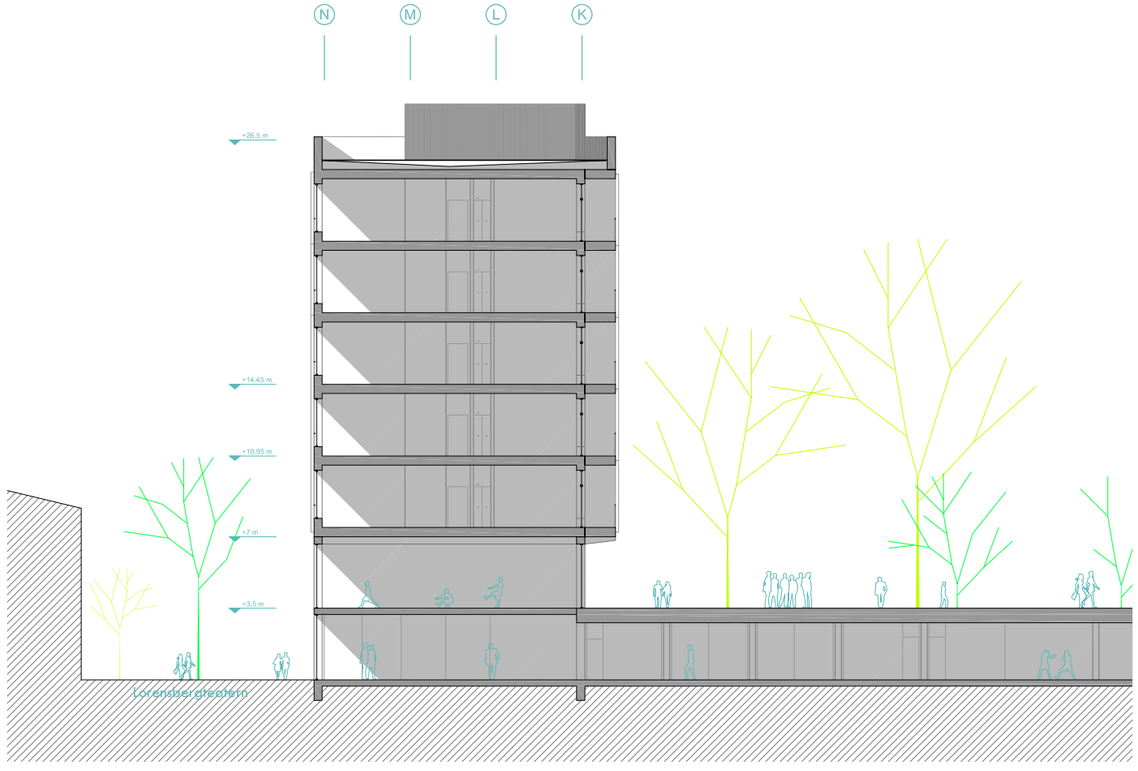
5.3. SITE PLAN / SCALE 1.5000

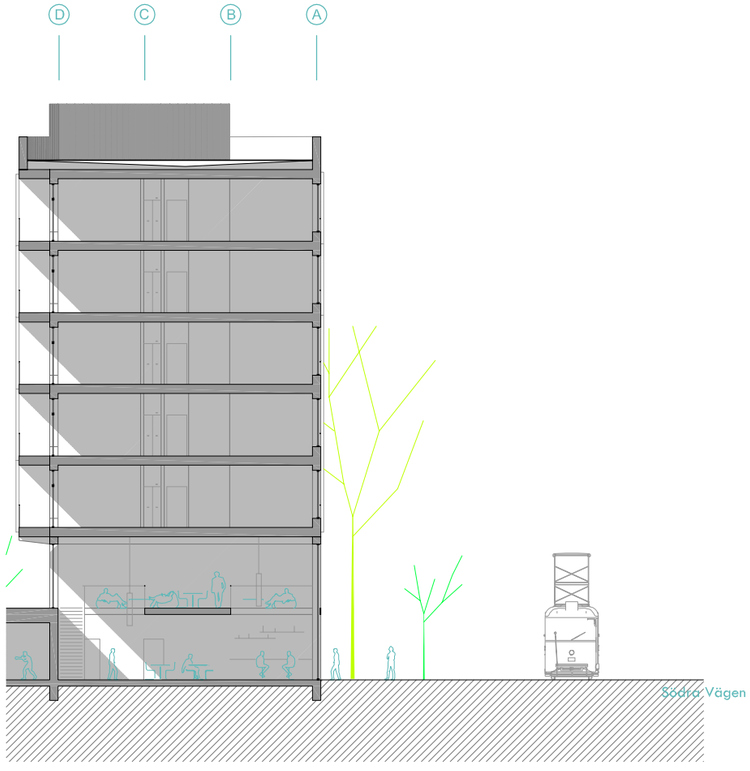


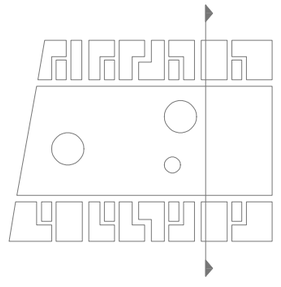
5.4. SITE PLAN / SCALE 1.1500

5.5. CROSS SECTION + ELEVATION / SCALE 1.300

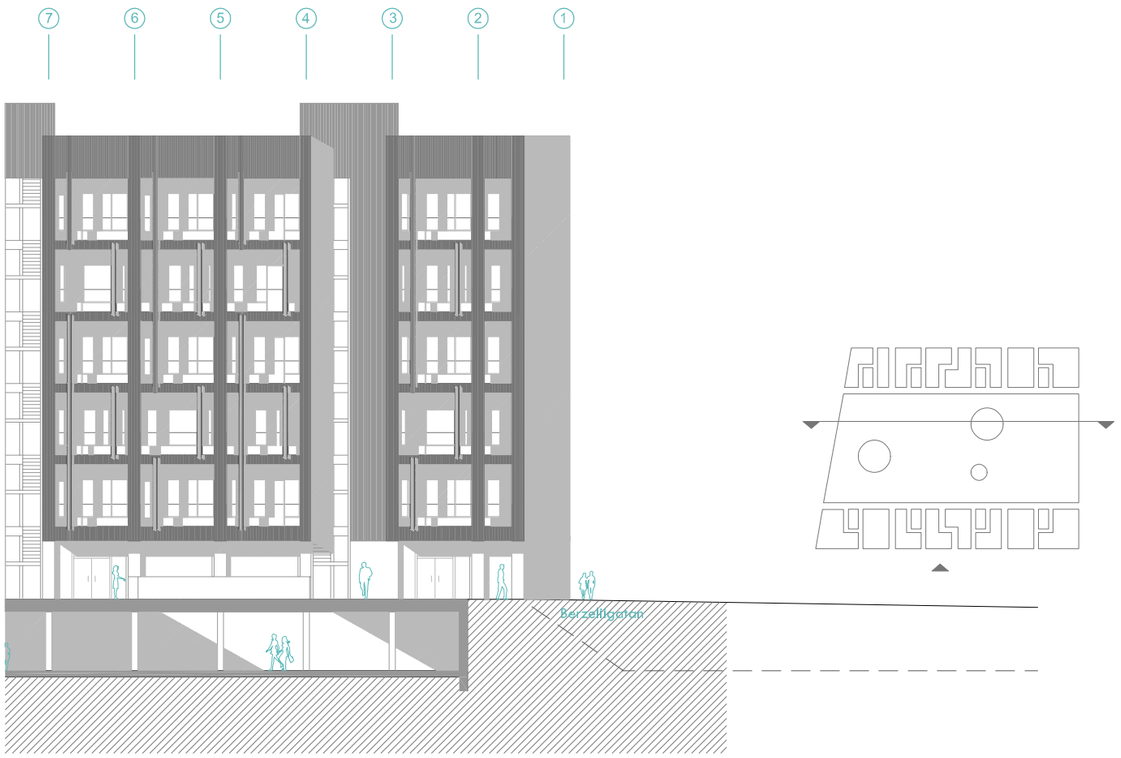




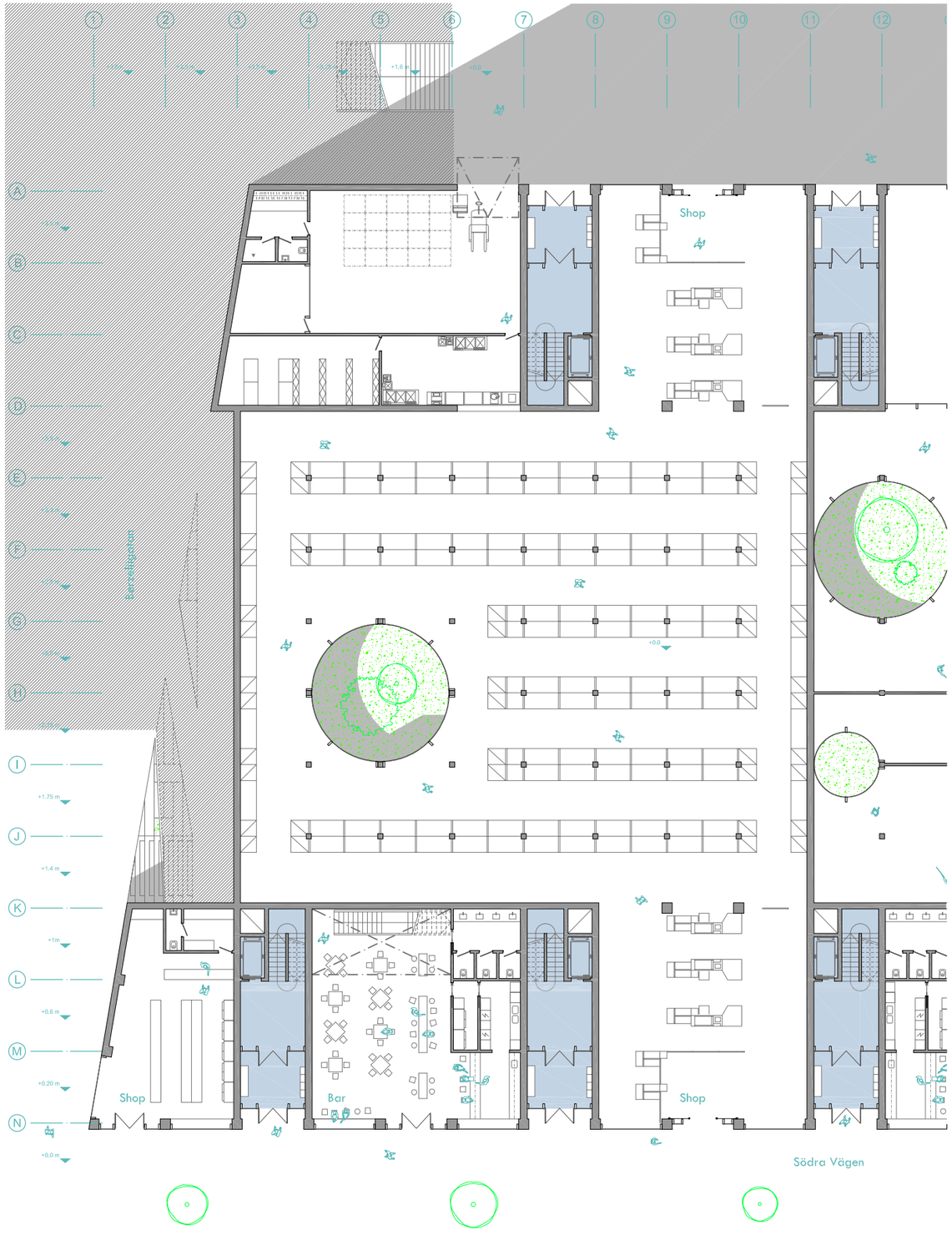


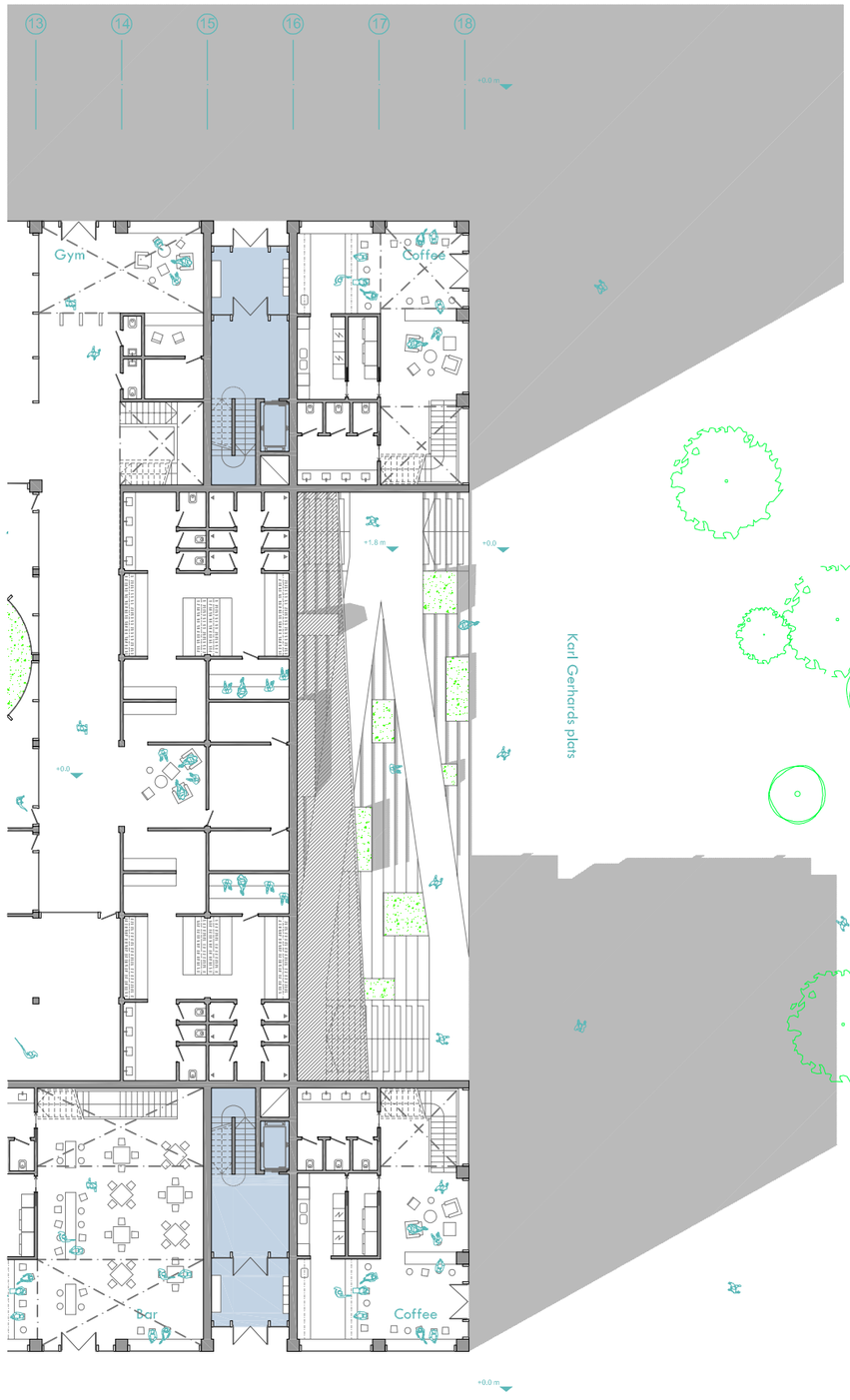


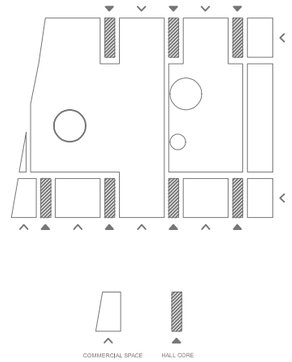
5.6. LONGITUDINAL SECTION + ELEVATION / SCALE 1.300



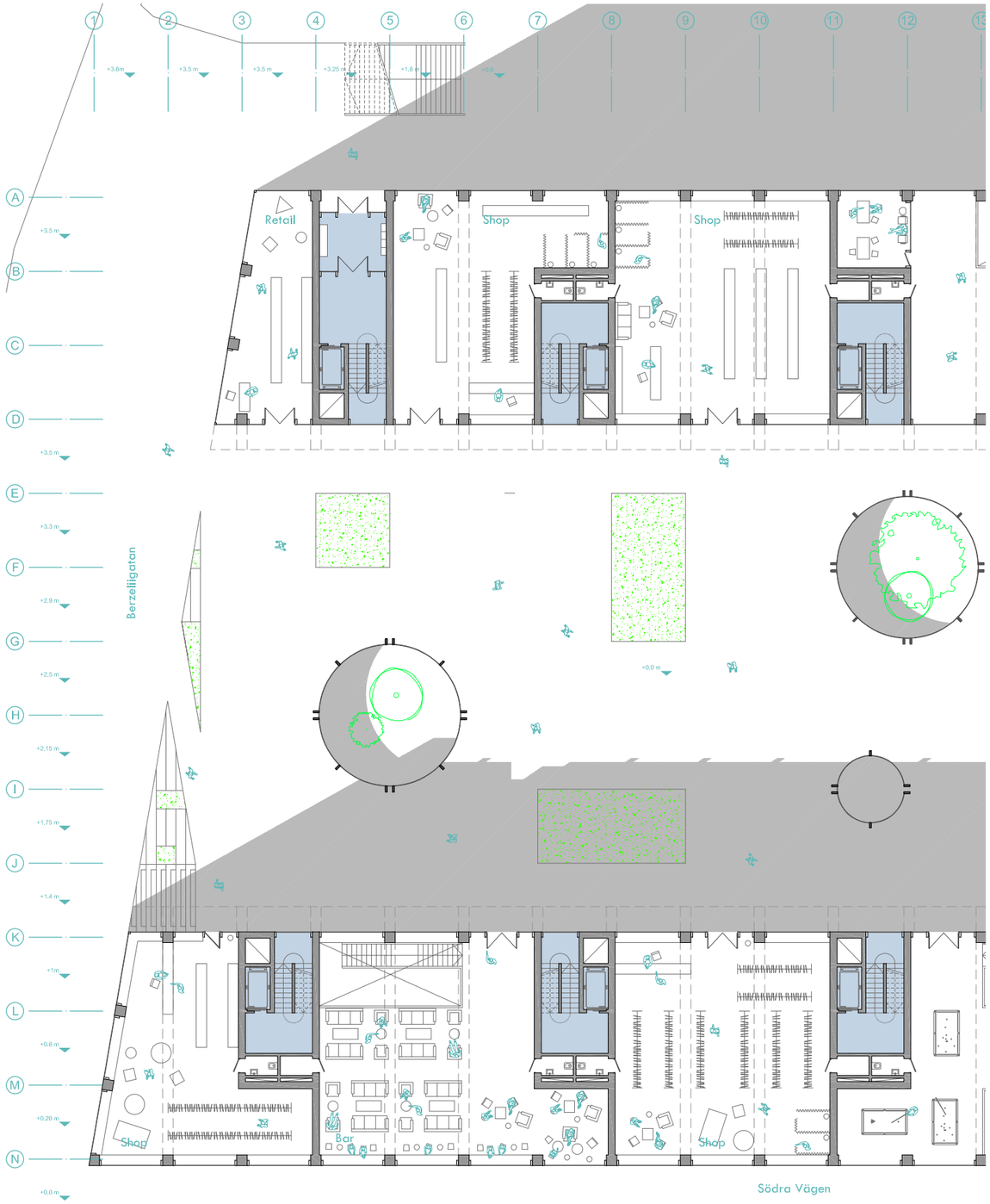
5.7. BASEMENT LEVEL / SCALE 1.300

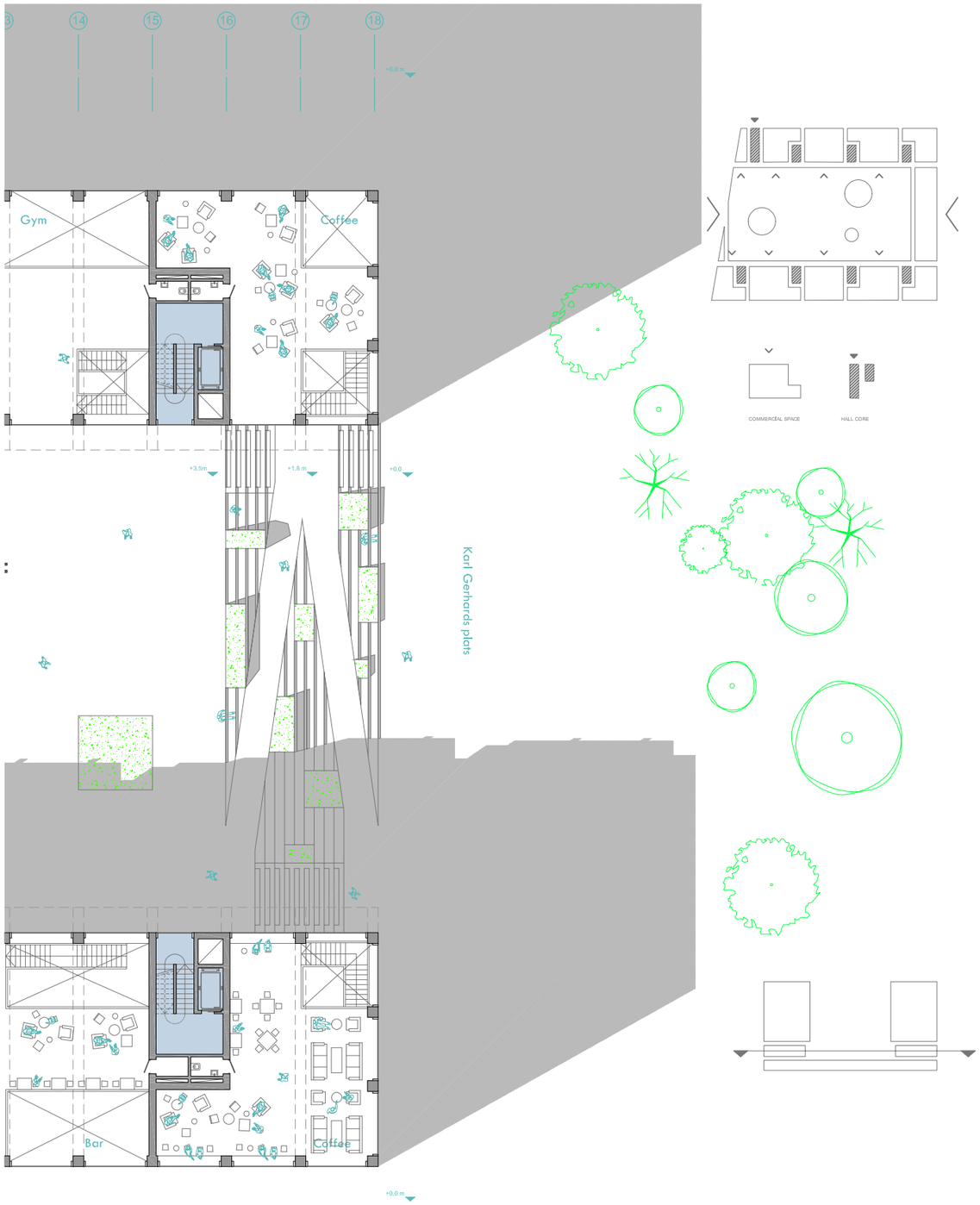




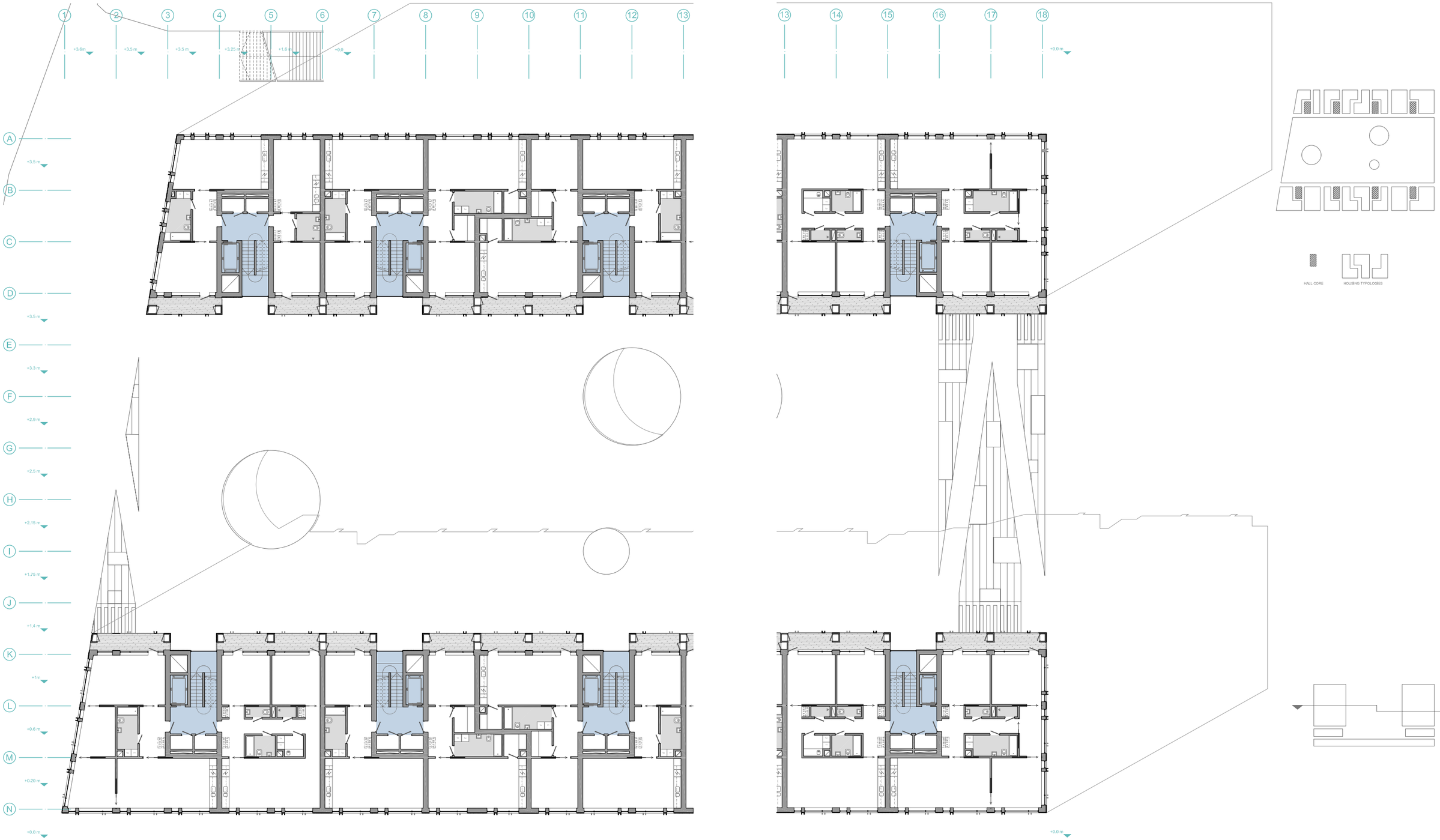


5.8. PUBLIC SQUARE LEVEL / SCALE 1.300

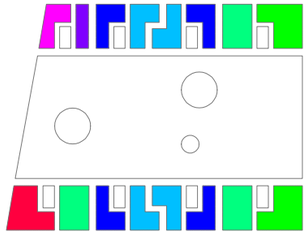




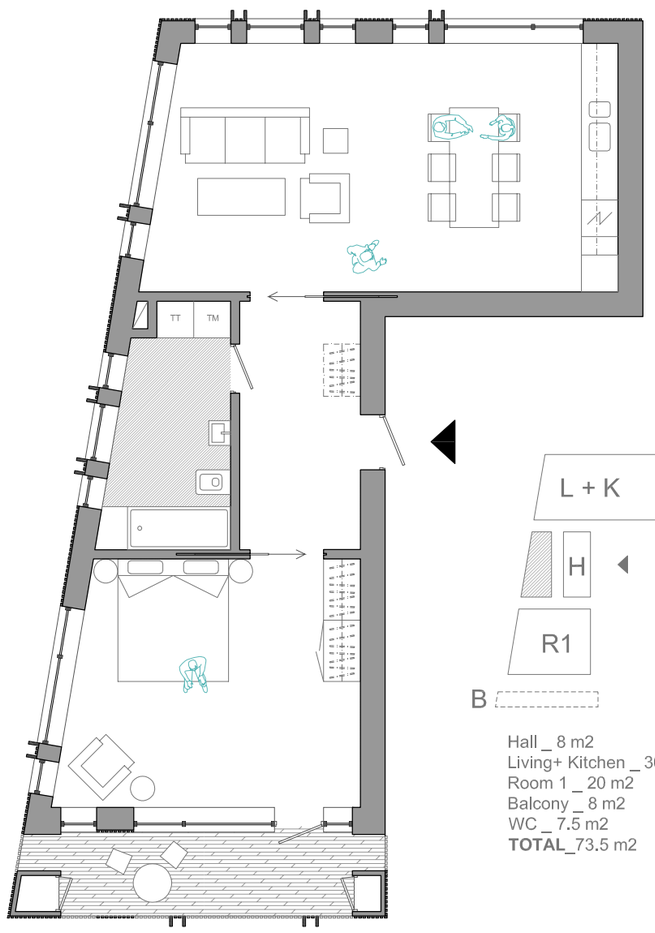
5.9. HOUSING LEVEL / SCALE 1.300



5.10. HOUSING TYPOLOGIES / TYPOLOGY 1 / SCALE 1.100

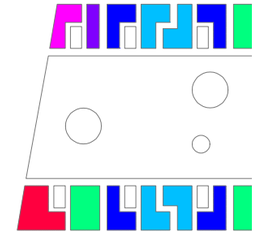


TYPOLOGY 1

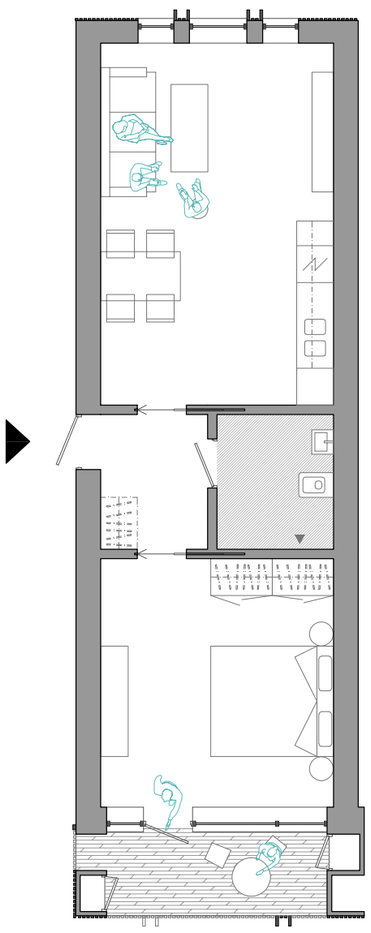


Hall _ 8 m2
Living+ Kitchen _ 30 m2
Room 1 _ 20 m2
Balcony _ 8 m2
WC _ 7.5 m2
TOTAL_73.5 m2

5.11. HOUSING TYPOLOGIES / TYPOLOGY 2 / SCALE 1.100

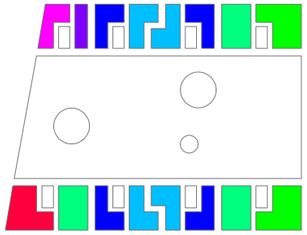


TYPOLOGY 2

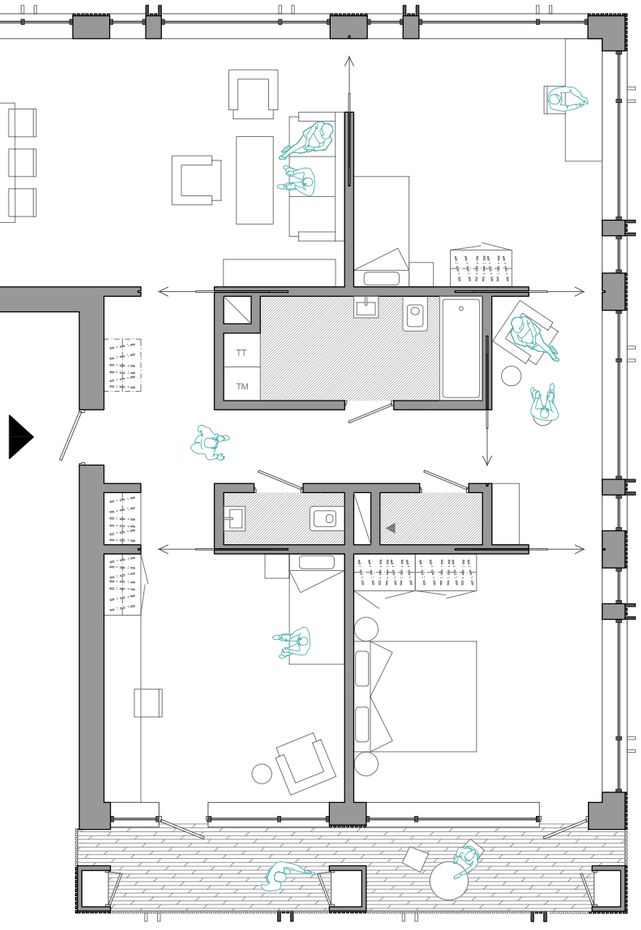


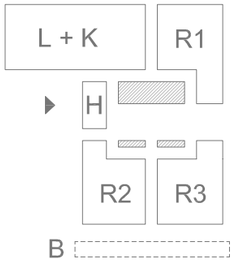
Hall _ 4 m2
Living + Kitchen _ 22 m2
Room 1 _ 15 m2
Balcony _ 6.25 m2
WC _ 4 m2
TOTAL_50 m2

5.12. HOUSING TYPOLOGIES / TYPOLOGY 3 / SCALE 1.100



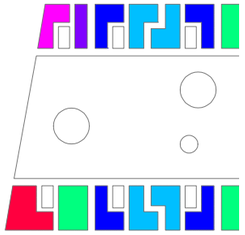
TYPOLOGY 3



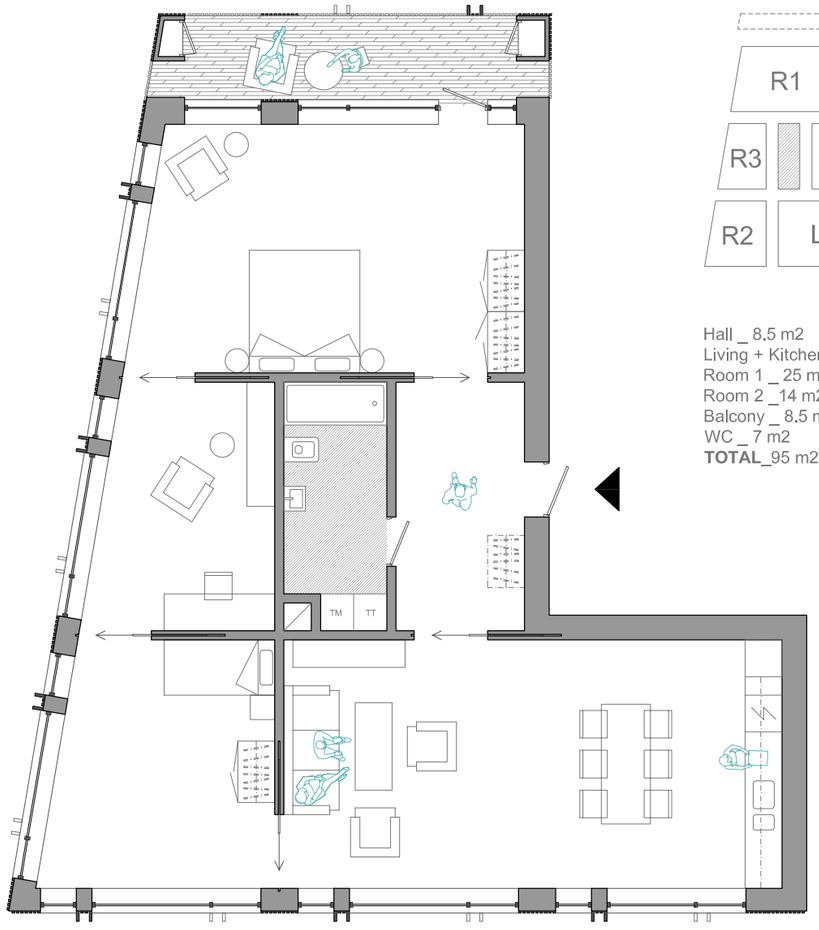


Hall _ 5.5 m2
Living + Kitchen _ 32 m2
Storage _ 3.5 m2
Room 1 _ 17.5 m2
Rom 2 _ 17.5 m2
Room 3 _ 17.5 m2
Balcony _ 12 m2
WC _ 7 m2
TOTAL_110 m2

5.13. HOUSING TYPOLOGIES / TYPOLOGY 4 / SCALE 1.100

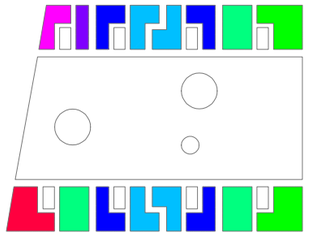


TYPOLOGY 4

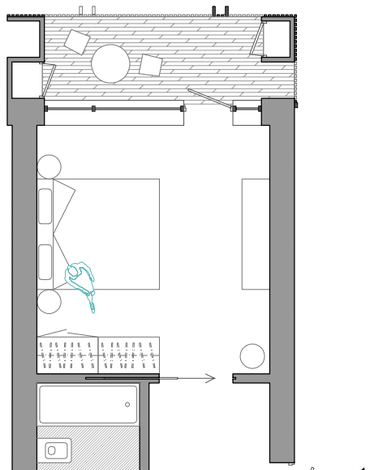


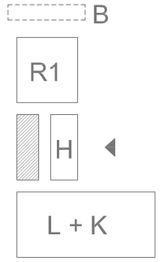
Hall _ 8.5 m2
Living + Kitchen _ 32 m2
Room 1 _ 25 m2
Room 2 _14 m2
Balcony _ 8.5 m2
WC _ 7 m2
TOTAL_95 m2

5.14. HOUSING TYPOLOGIES / TYPOLOGY 5 / SCALE 1.100

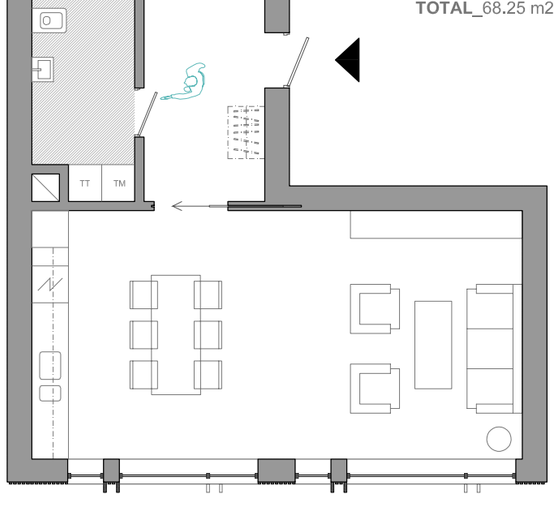


TYPOLOGY 5

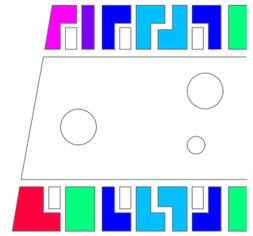




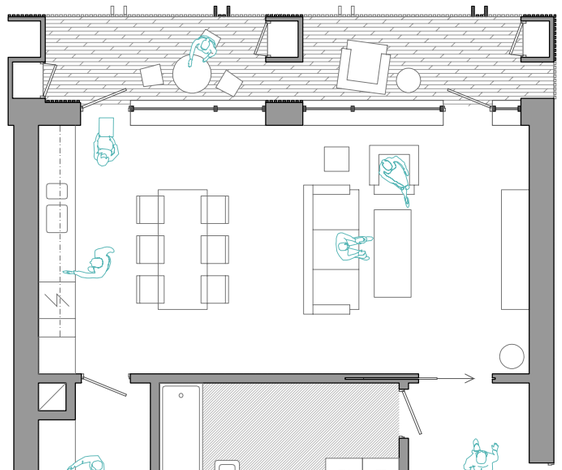
Hall _ 8 m2
Living + Kitchen _ 32 m2
Room 1 _ 15 m2
Balcony _ 6.25 m2
WC _ 7 m2
TOTAL_68.25 m2

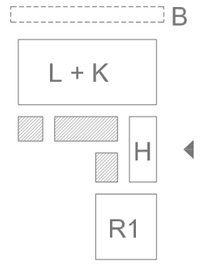


5.15. HOUSING TYPOLOGIES / TYPOLOGY 6 / SCALE 1.100



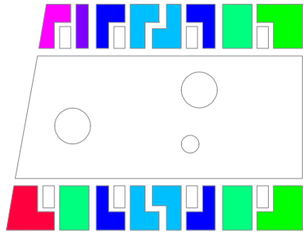
TYPOLOGY 6



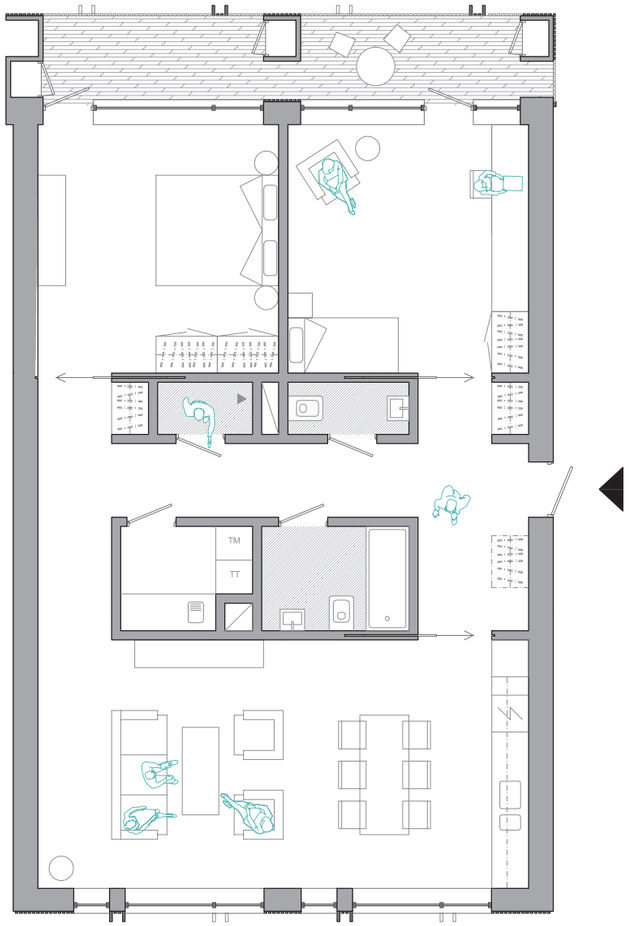


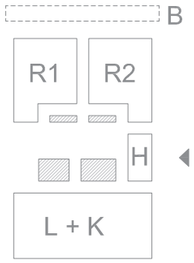
Hall _ 8 m2
Living + Kitchen _ 32 m2
Storage _ 7 m2
Room 1 _ 15 m2
Balcony _ 12 m2
TOTAL_75 m2

5.16. HOUSING TYPOLOGIES / TYPOLOGY 7 / SCALE 1.100



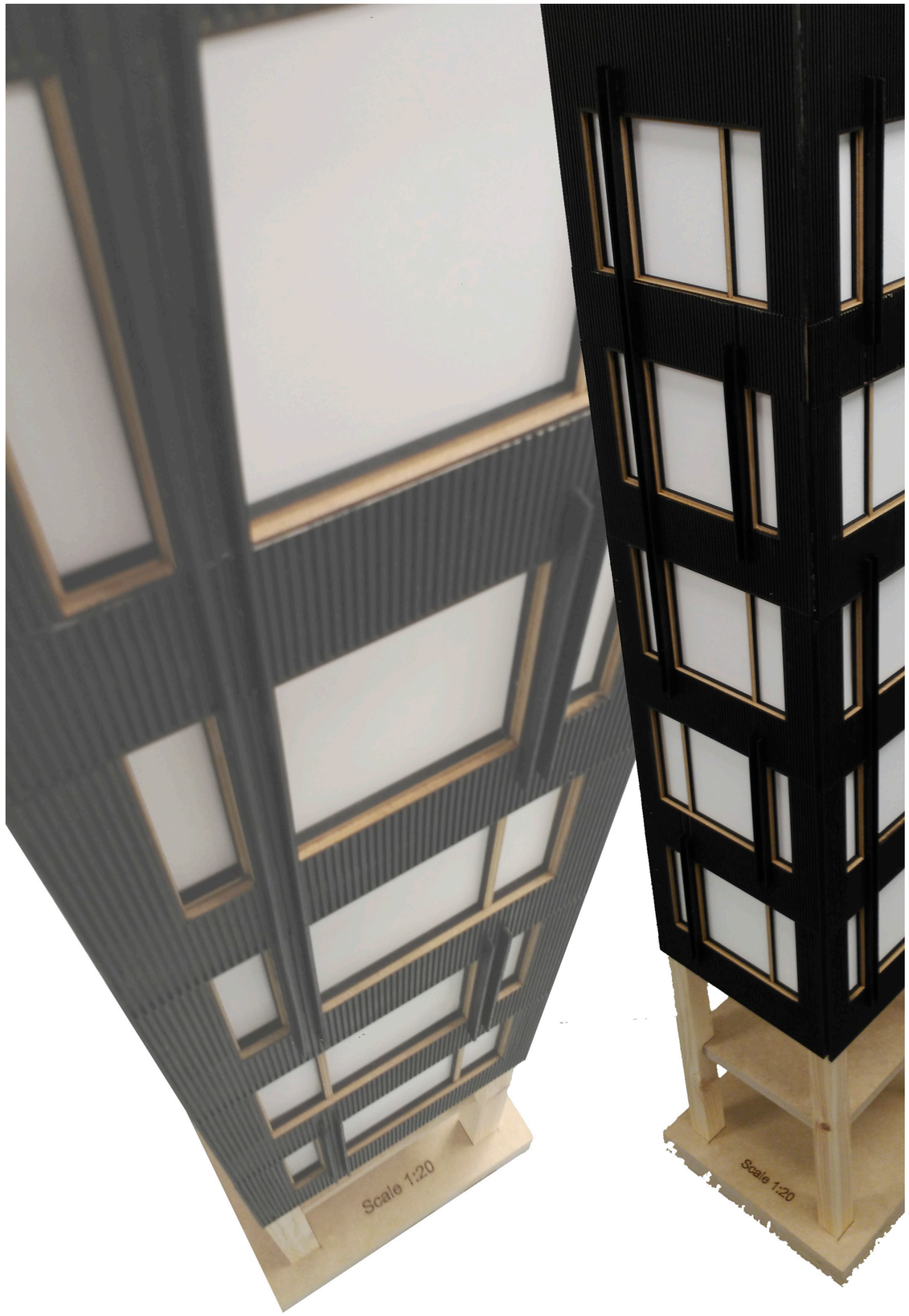
TYPOLOGY 7



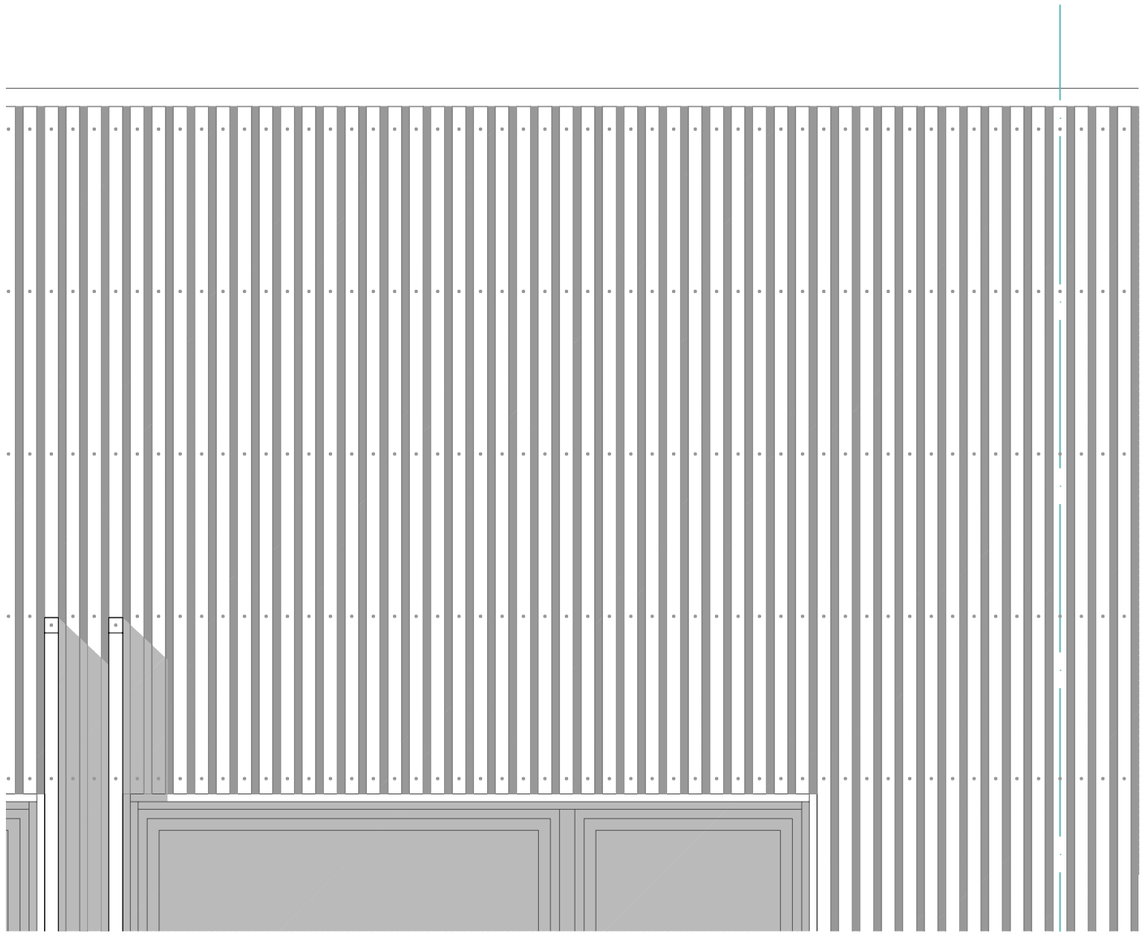


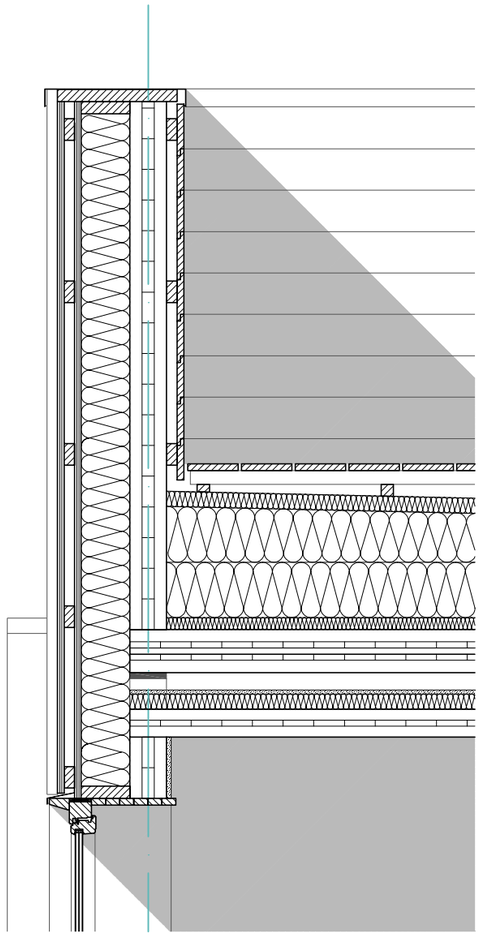
Hall _ 5.5 m2
Living + Kitchen _ 32 m2
Storage _ 3.5 m2
Room 1 _ 17.5 m2
Room 2 _ 17.5 m2
Balcony _ 12 m2
WC _ 7 m2
TOTAL_95 m2

5.17. FACADE MODEL / SCALE 1.20



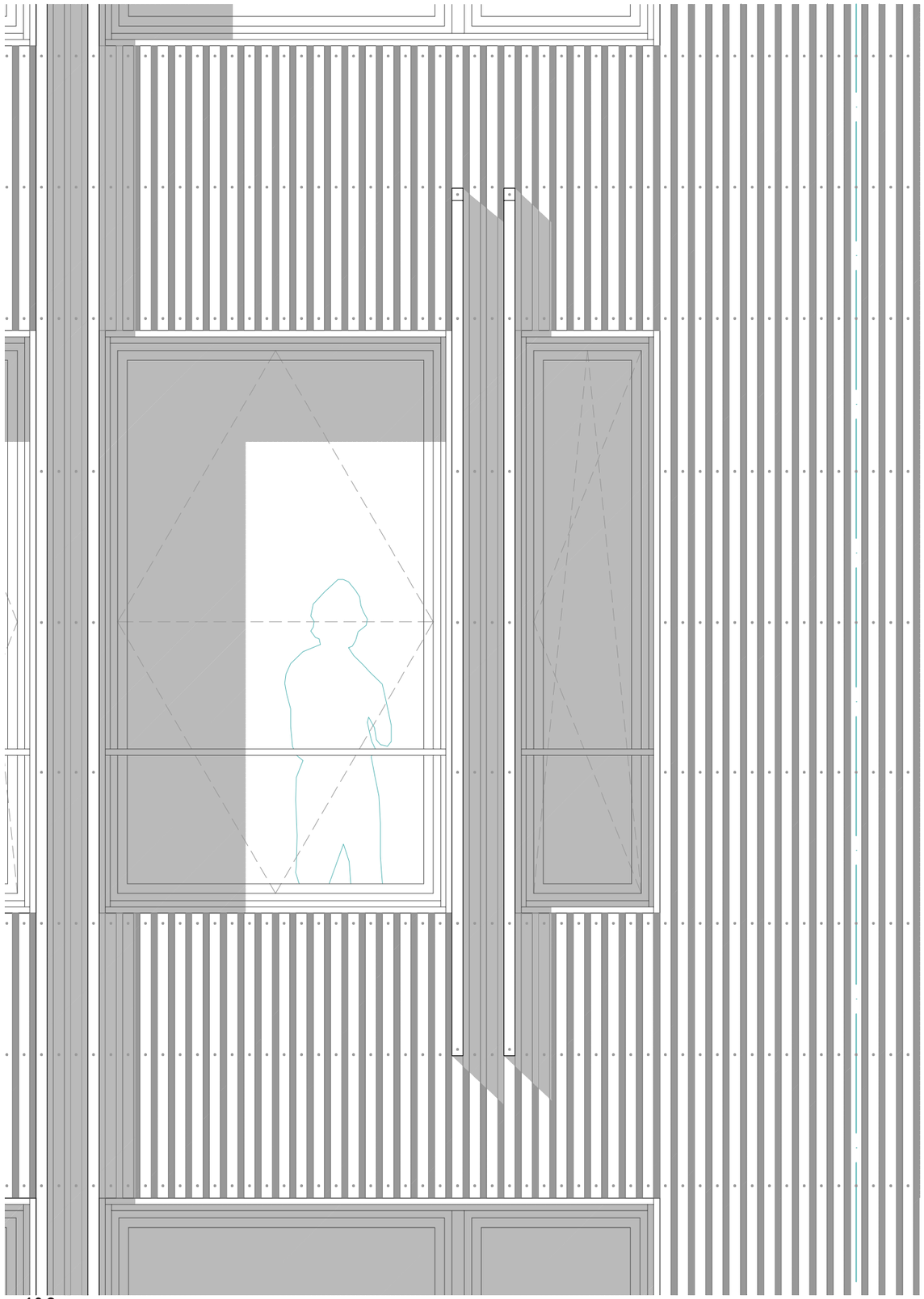
5.18. FACADE CONSTRUCTION & ASSEMBLY / SCALE 1.20

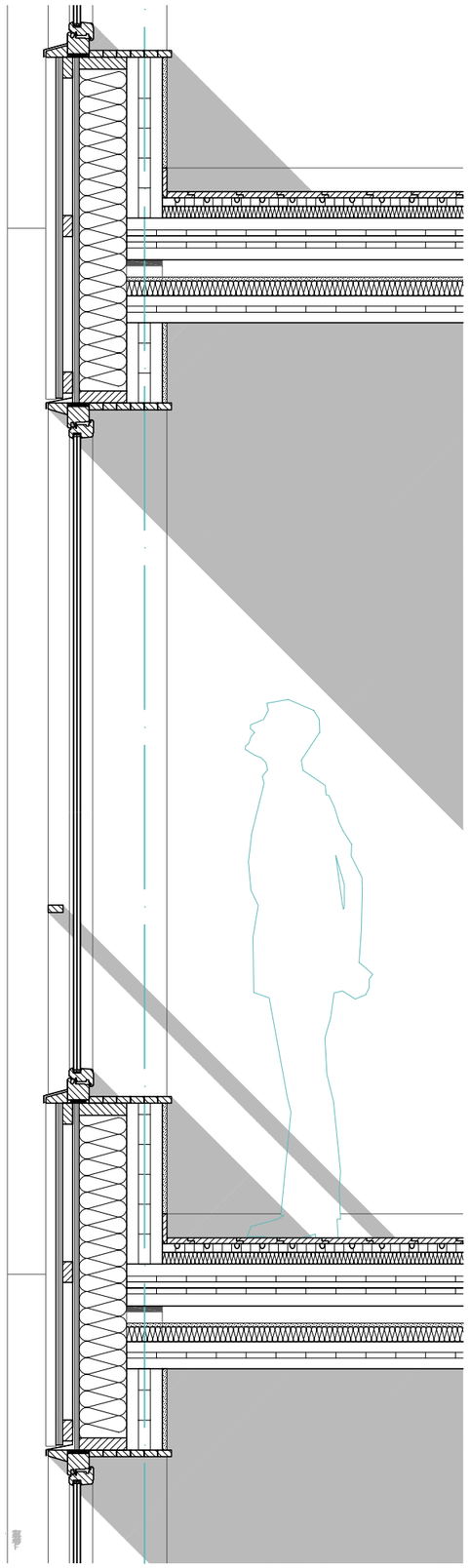




1.Walk on roof / Ceiling

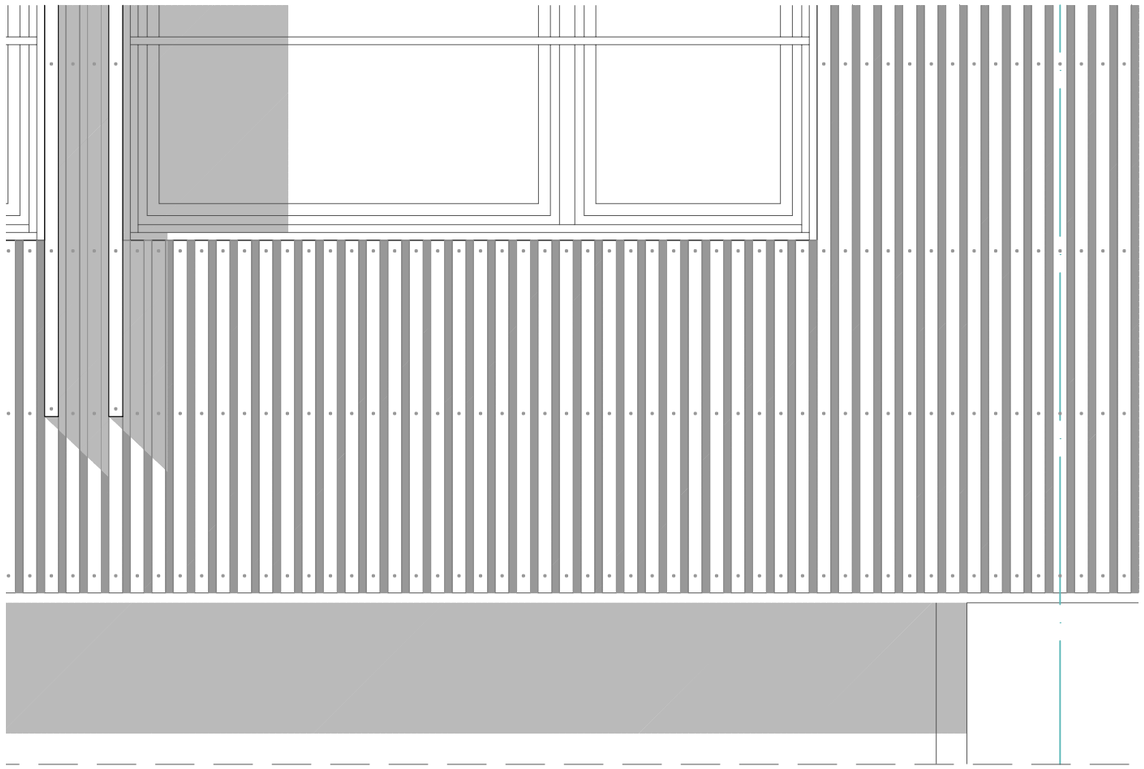
22	Flooring planks
	Wood grid
50	Insulation boards (Protection for sealin
	Moisture sealing (sealing layer)
180 -	Slope wedge insulation
180	Rock wool insulation
35	Foot step insulation board
	Vapour barrier
140	CLT floor structural panel
	Air gap (120 between CLT panels)
12.5	Gypsum board
50	Rock wool insulation
90	CLT floor structural panel

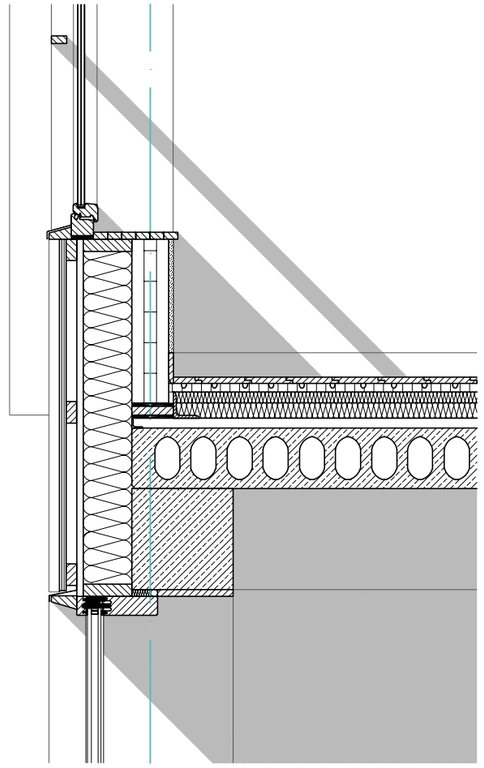




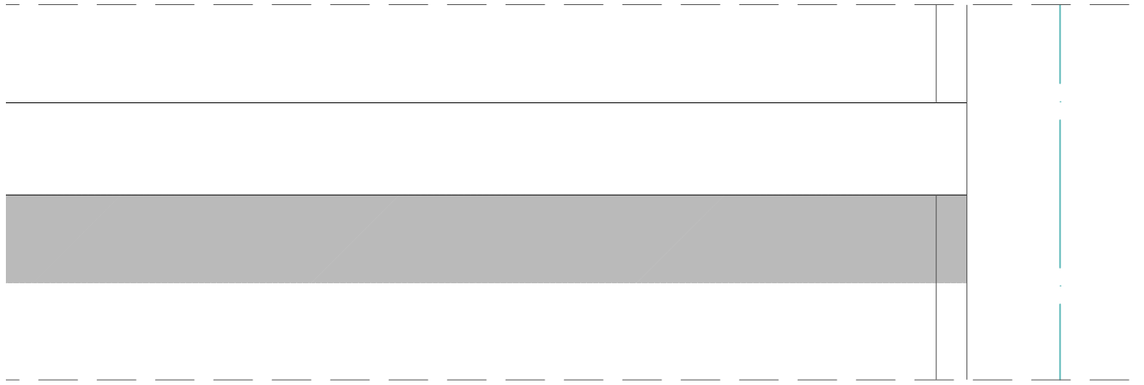
2.Exterior wall / Facade

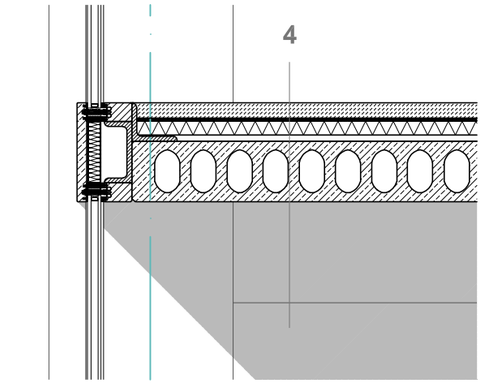
34/45	Sawn hardwood strips with charred finish,verti
22/150	Tongue and groove wood boarding with charred finish, vertical
34/70	Battens, horizontal
22/150	Tongue and groove wood boarding
	Windproof paper
	Vapour barrier
180	Rock wool insulation
120	CLT wall structural panel
15	Gypsum plasterboard



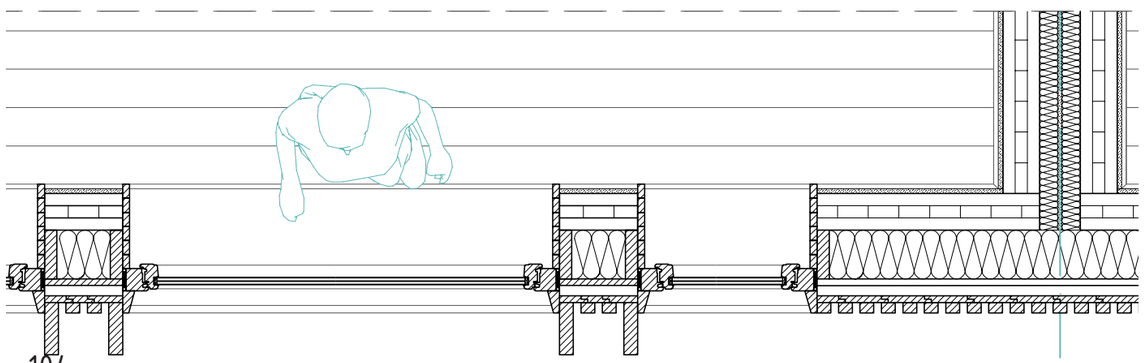


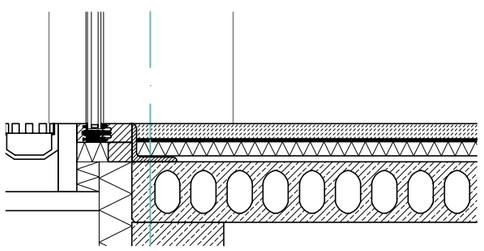
A.Separator element
Bearing of upper room module on individual 20 mm elastomer bearing points (area according to static requirements)





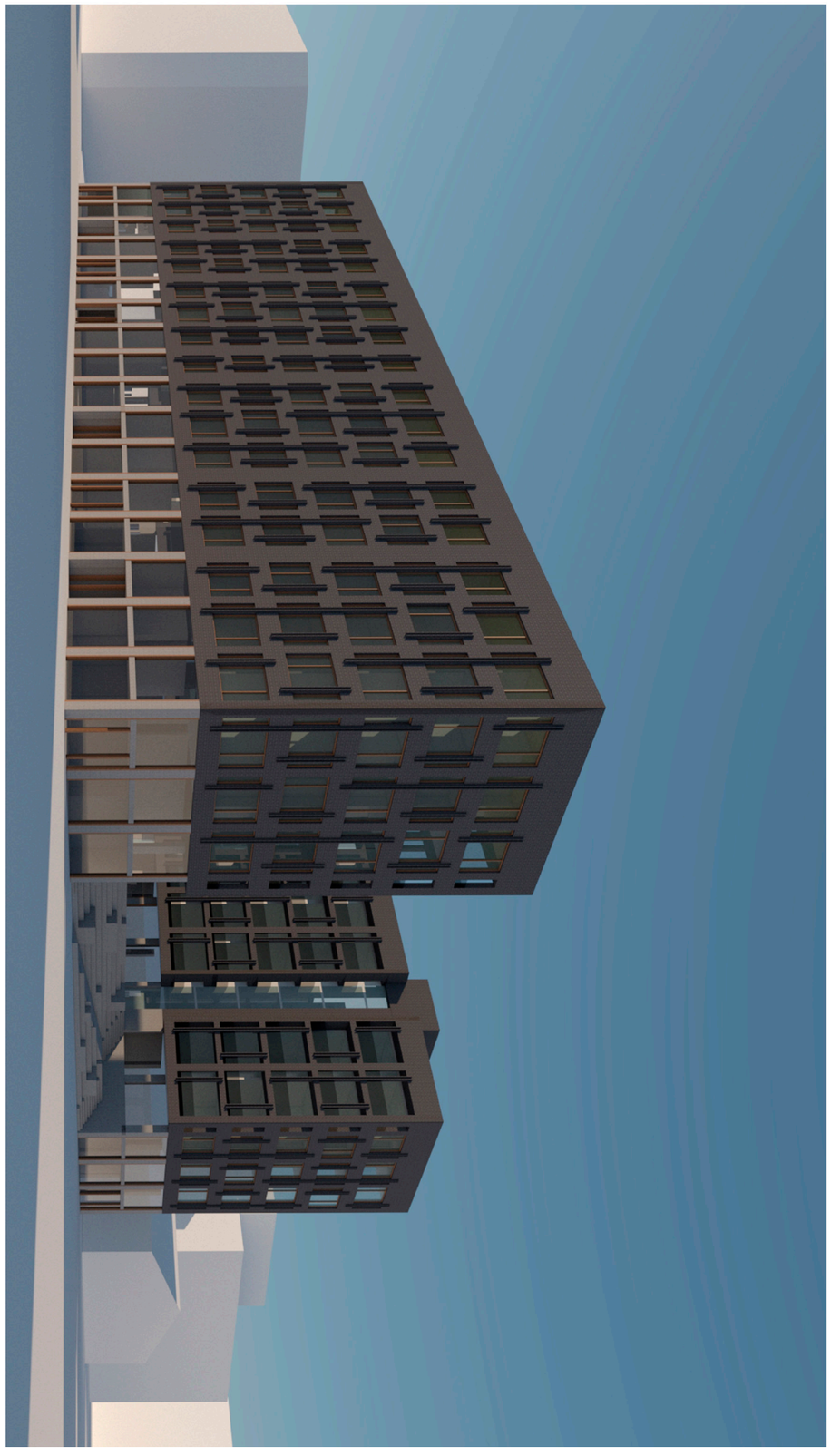
4.Floor / Commercial
50 Screed, polished
Separating layer
10 Impact sound insulation
45 Rigid foam insulation
Air gap (120 between CLT panels)
20 Leveling layer
200 Concrete alveolar plate slab
False ceiling (optional)





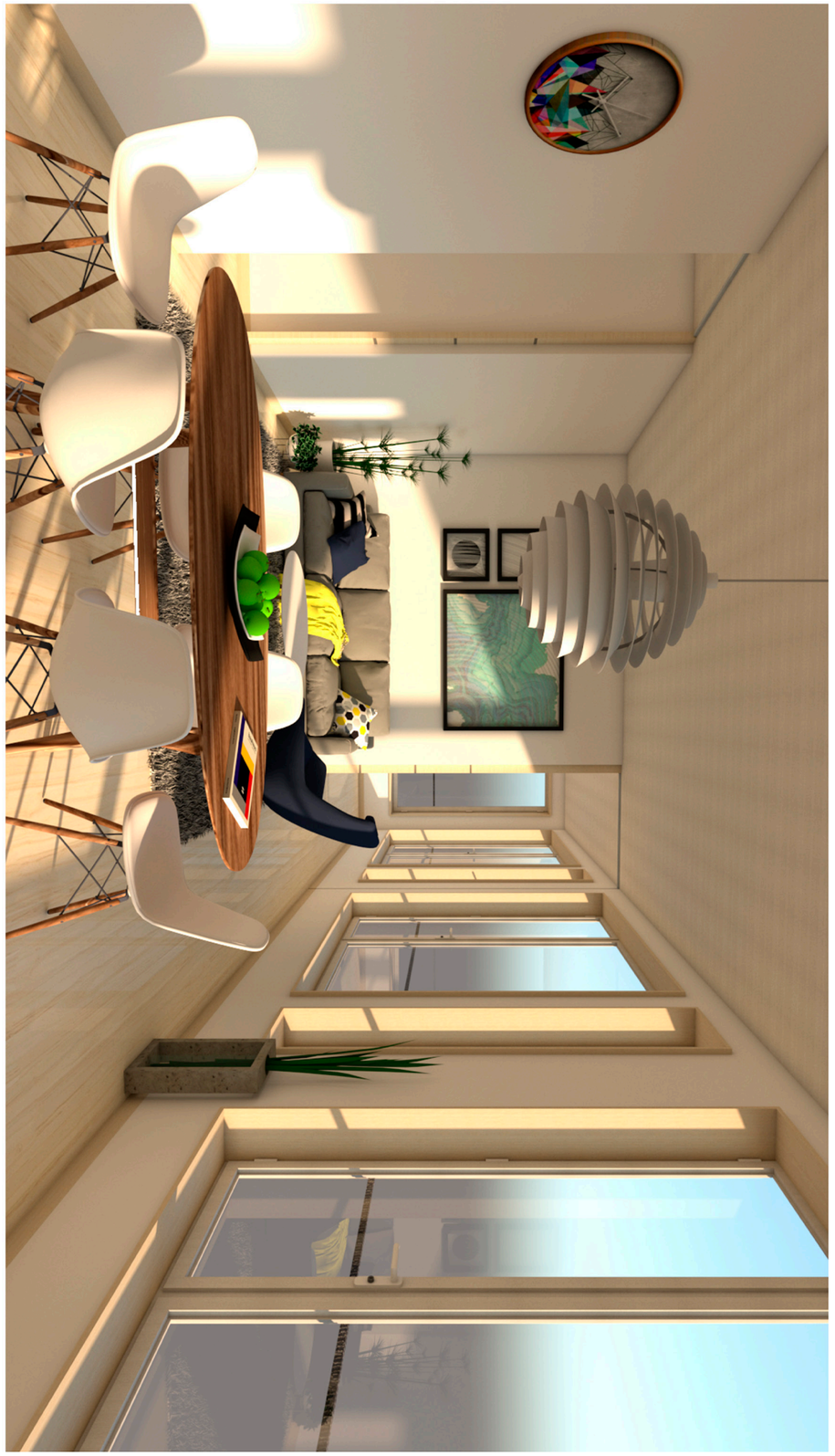
5.19. EXTERIOR RENDER / PERSPECTIVE 1

5.20. EXTERIOR RENDER / PERSPECTIVE 2



5.21. INTERIOR RENDER / PERSPECTIVE 1

5.22. INTERIOR RENDER / PERSPECTIVE 2



06.CONCLUSION

This thesis project is an example on how a unique building type, which are a big part of Goteborg´s identity, provides architectural precedents that can be developed and interpreted using a modern design language. Cultural heritage and tradition can be a valuable as a way of dealing with sustainability issues.
I believe this housing typology could be applied on another site, because its concept allows a great flexibility, wide range of urban block shapes could be developed, and still will maintain the qualities of its design.
Next steps that could be studied it is the vertical development of the housing typologies, for instance, working with duplex, even creating more type of typologies and opening new possibilities in the dwelling design, which also could be reflected on its exteriors facades.

Another point are the commercial areas of the program, could be further developed as well as the sustainable technical systems that could be used to make this typology as autonomous and sustainable as it is possible.

As a conclusion, we need to think very differently about how we create the cities of the future.
We cannot continue designing the buildings as we have been doing until now, the footprint of the building industry is huge, and I think, that we as architects have the great challenge of making the world a better place.

The way we build and the materials we use has to be developed and adapt to the climate change era, and from my point of view wood provides a positive response to a key environmental challenge as global warming. The future is wood.

07. REFERENCES

WEB PAGES

1-Mardiana A, Riffat SB (2015) B*uilding Energy Consumption and Carbon dioxide Emissions: Threat to Climate Change. J Earth Sci Climat Change*. S3:001. doi: 10.4172/2157-7617.S3-001.Retrieved from https://www.omicsonline.org/open-access/building-energy-consumption-and-carbon-dioxide-emissions-threat-to-climate-change-2157-7617-S3-001.php?aid=53007
2-Ambrose Dodoo, Leif Gustavsson, Roger Sathre within the Sustainable Built Environment Group (SBER) at Linnaeus University, Växjö, Sweden. (2016) *Climate impacts of wood vs. non-wood buildings. The Swedish Association of Local Authorities and Regions*. Retrieved from http://webbutik.skl.se/bilder/artiklar/epub/7585-377-2.epub
3 – Swedish Wood. (n.d). *The Architect's Role in Climate Change – Now and Then*. Retrieved from http://www.architectsdca.com/the-architects-role-in-climate-change-now-and-then/
4 – KoruArchitects. (n.d). *13 Ways Sustainable Timber Is The Best Construction Material*. Retrieved from https://www.koruarchitects.co.uk/choose-sustainable-timber/
5 – Swedish Wood Building Council. (n.d). *Modern industrial timber building techniques*. Retrieved from http://www.trabyggnadskansliet.se/english/industrial-timber-building
6 - Wiklund, C. The Swedish forest industries. (n.d). *Sustainability*. Retrieved from http://www.forestindustries.se/forest-industry/sustainable-development/
7 – The Swedish Forest Industries. (n.d). *Fatcs & Figures. Sweden´s forest industry in brief*. Retrieved from http://www.forestindustries.se/forest-industry/facts-and-figures/
8 - Boverket. (2017). *The 2016 Housing Market Survey in brief*. Retrieved from https://www.boverket.se/en/start-in-english/living-in-sweden/the-housing-market/unique-overview-of-the-housing-market/the-2016-housing-market-survey-in-brief/
9 - Norlander, T. (2017). *Multi-storey wooden buildings are in focus in Sweden*. Retrieved from http://www.opportunities-abroad.no/2017/03/09/multi-storey-wooden-buildings-are-in-focus-in-sweden/
10 - The Local. (2015) '*Sweden has to act now to solve housing crisis*'. Retrieved from https://www.thelocal.se/20150324/more-homes-are-needed-to-solve-housing-shortage
11 - Woodworks. Solid Advantages. (2012). *Cross laminated timber (CLT) offers a new building system option for non-residential and multi-family construction*. Retrieved from http://www.woodworks.org/wp-content/uploads/CLT-Solid-Advantages.pdf
12 - Smartlam. (2018). *Benefits & Advantages of CLT*. Retreived from http://www.smartlam.com/about/benefits/
13 - Paradis Bolduc, L. (n.d). *Shou sugi ban carbonized wood siding .Shou sugi ban burnt wood exterior cladding is naturally made and very durable*. Retrieved from http://www.ecohome.net/guide/shou-sugi-ban-carbonized-wood-siding

MASTER THESIS

Loader, S.P.P. (2014) *Back to the Future: An investigation into a readaptation of a Landshövdingehus in Gothenburg*. (Msc thesis). Chalmers University of Technology, Goteborg, Sweden.

IMAGES

Figure 1 . (n.d)*Polar ice melting*. (Creative Commons). Retrieved from http://www.uminnpressblog.com/2016/02/
Figure 2. Bridge, Albert.(n.d) *Harvested logs. (*Creative Commons). Retrieved from https://koruarchitects.co.uk/choose-sustainable-timber/
Figure 3. (n.d). *Traditional Swedish red log house*. (Pinterest) Retrieved from https://www.pinterest.es/pin/332070172499747466/
Figure 4. (n.d). *Percentage of forest in Swedish territory*.(Swedish forest industry). Retrieved from http://www.forestindustries.se/
Figure 5. Helena Wahlman.(n.d). *Neighborhood in Swedish municipality*. Retrieved form https://www.thelocal.se/20150324/more-homes-are-needed-to-solve-housing-shortage
Figure 6. Wiklund, Anders/TT. (n.d). *New apartments being built in northern Stockholm*. Retrieved from https://www.thelocal.se/20170828/the-story-of-swedens-housing-crisis
Figure 7. Höjemo, Thomas. (n.d). *Landshövdingehus in Majorna, Göteborg. Built 1894*. Retrieved from https://sv.wikipedia.org/wiki/Landsh%C3%B6vdingehus#/media/File:Cafezenit.jpg
Figure 8. Hallen, Jesper. (n.d). *Landshövdingehus variety*. Retrieved from http://gbg.yimby.se/2009/05/goteborg-berattar-landsho_2683.html
Figure 9. Ryan, Don. (n.d). *CLT is made up of 2-by-4 beams laid out in perpendicular layers that are then glued together to make giant panels*. Retrieved from https://phys.org/news/2016-12-wood-technology-struggling-timber.html
Figure 10. (n.d). *Different finishes in charred wood*. Retrieved form http://homeklondike.site/2017/03/29/charred-wood-siding-inexpensive-and-spectacular/
Figure 11. (n.d). Burning process step.(Max Marshall Design). Retrieved from http://www.maxmarshalldesign.co.uk/what-we-do/wood-burning-shou-sugi-ban-cornwall/