Between Inside & Outside

This master´s thesis project aims to explore what spatial, social and energy saving opportunities lies within the building envelope. Rather than looking on the exterior wall as a standard element cutting a sharp border between inside and outside the thesis reinterprets the properties of the wall. Finding ways of living with the seasons in a more flexible way, exploring the social boundaries of an apartment and also breaking up the sharp boundary between inside and outside.

Today there are many ways of making a building energy efficient, with several different components available on the building market. However, too often it is about technical solutions, which on one hand meets their purposes but on the other doesn't connect to an overall architectural concept. The concept of an energy efficient building today lies more in giving it a green image with solar cells rather than exploring new ways of living and building.

The thesis revolves around an existing building in Norra Masthugget, Göteborg. On the river bank of Göta Älv an old and withered cold storage building stands more or less deserted, waiting for demolition to leave place for the expanding city. The building holds a mysterious aura with it s massive, windowless and graffiti covered concrete walls. The explorations of this thesis are done within the context of this building. Showing a suggestion of how it could be given a new life and function in the new city instead of being demolished.

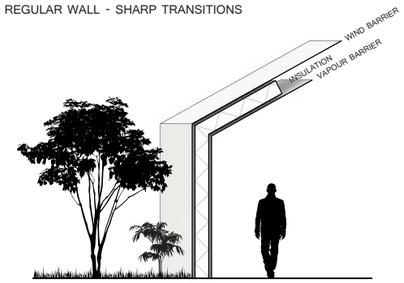
THE ENVELOPE

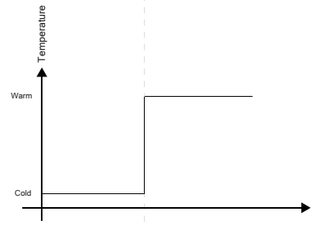
The exterior boundary of our homes hold many purposes. Looking at a traditional wall it is built up by an exterior cladding, wind barrier, insulation, vapour barrier and interior cladding. Every layer has one or more properties to fulfil, keeping the internal comfort by maintaining the right temperature and humidity. This is achieved by an as tight air- and vapour barrier as possible to minimize transmission losses and vapour exchange between inside and outside. The building envelope also hold properties of providing safety, privacy and keeping out noise from the surroundings.

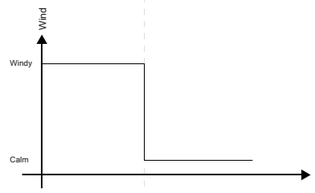
This project explores what happens when you extrude the building envelope, searching for energy saving, social and spatial properties within this extended boundary between inside and outside. The properties of the traditional wall are spread out over a longer distance and layers, giving different climate zones and more diffuse boundaries regarding privacy and noise.

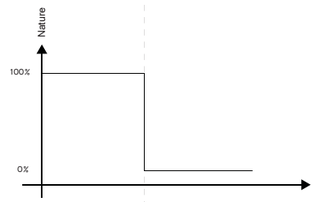
As climate change over the year so would the climate in the different living zones, making it possible to live large in the summer when transmission losses and energy use are low and smaller/tighter in the colder months of the year to minimize energy use. Living within these zones requires a flexible lifestyle, moving and expanding your living space throughout the year or making an active choice of which functions you want to use all year round.

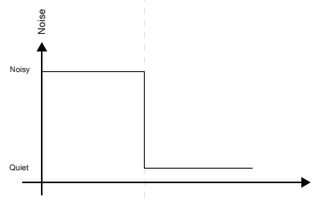
REGULAR WALL - SHARP TRANSITIONS

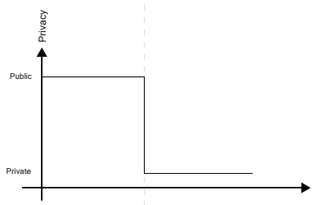




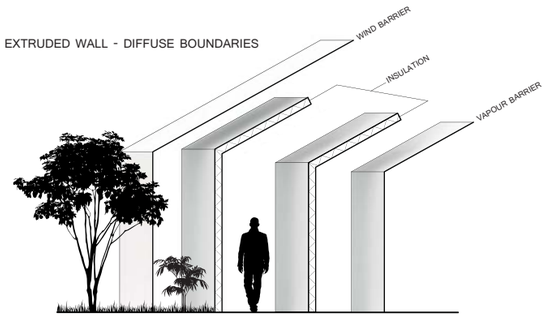


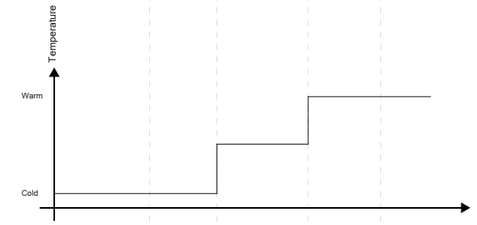


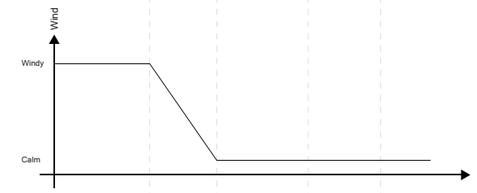


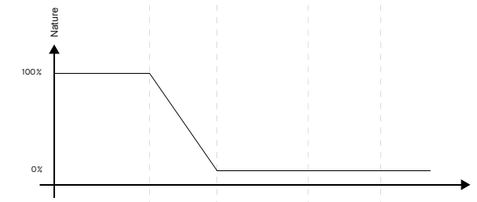


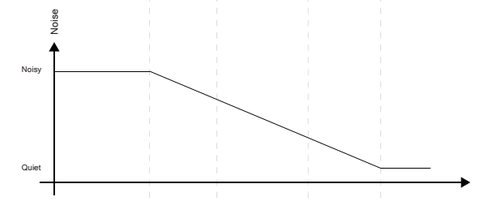
EXTRUDED WALL - DIFFUSE BOUNDARIES

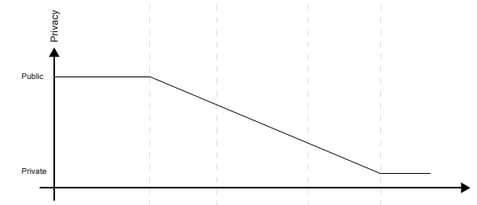


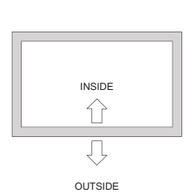


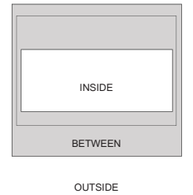




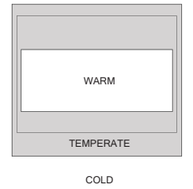




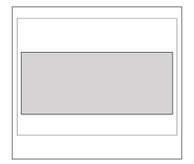


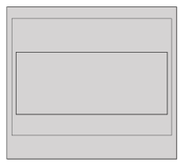


BETWEEN SPACE - Extruding the building envelope inwards and outwards gives an inbetween space, a transition between inside and outside. The result is a smaller inside space and a new between volume with new properties.

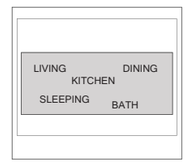


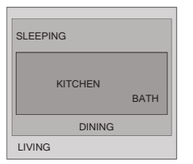
LESS CONDITIONED SPACE - Instead of conditioning the whole living area you can regard the inbetween space as a temperate zone with a climate that is affected by the outside weather and the transmission losses of the conditioned spaces.





EXPAND WITH THE SEASONS - The seasonal climate of Göteborg with cold winters and warm summers gives a changing climate in the between volume. During winter you reside in the inner conditioned core minimizing the energy needed for heating. First when the weather gets warmer you can expand further and further out into the transition layer.





FLEXIBLE LIVING - The changing amount of space over the year can be used by living with flexible furniture. Moving your room to what you find is the right place depending on the season and weather.

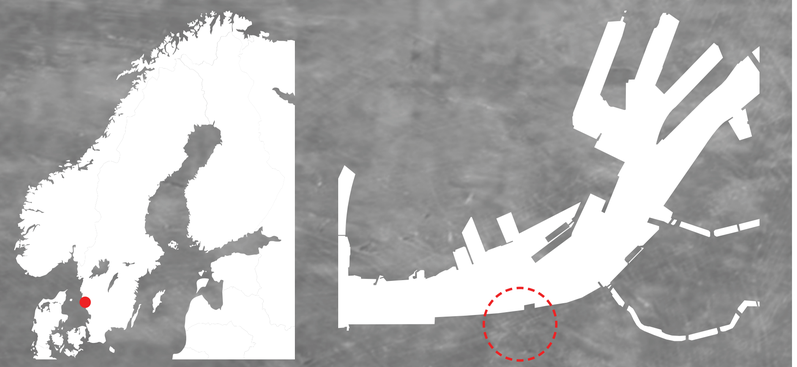
STATIONARY LIVING - In contrary to living flexible, you can also make an active choice which functions that fits in the different zones. Giving more space in the core but also the limitation that some functions only can be used a limited time of the year.

THE SITE

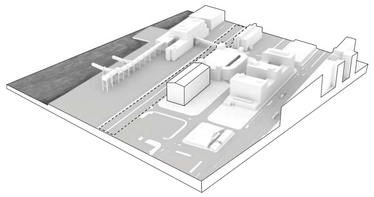
NORRA MASTHUGGET

Masthugget is situated close to the west city centre of Göteborg. It is close to the lively square Järntorget and popular restaurant and pub streets leading into the city. The area grew around the old ship harbours along the river bank. Today the part of Masthugget closest to the river is a rough area of parking lots and storage houses cut off from the river by a highway and a big ferry terminal. The old ship harbours are long gone and the area is despite its proximity to the city mostly without activity.

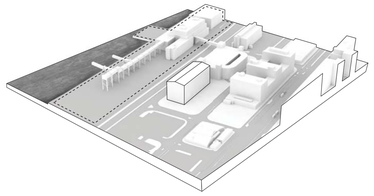
The city of Göteborg is working on early ideas on new plans for densifying the area. It want to expand the area to a mixed use part of the city with housing, office and retail, making it lively and active throughout the day. Stretching the popular streets and life of Järntorget further into Masthugget is the main objective with the city expansion. The biggest issues are the highway and the ferry terminal. Both act as a barrier between Masthugget and the river and are the source of noise and pollution. Possible measurements are to dig the highway down, build over it or making it into a city boulevard. This together with a move of the ferry terminal would reconnect the area to the river. However except stating that digging the highway down would be to expensive no decisions have been made so far .



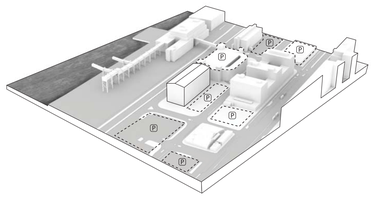
10 m 50 m 100 m SITE PLAN 1:1000



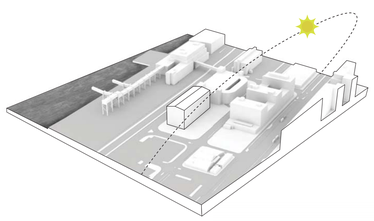
OSCARSLEDEN - A city highway is passing by right behind the north side of the building. It is heavy trafficated, a source of noise and air pollution and acts as a barrier cutting Masthugget off from the river. The long term plan from the city is either to build over it or to change it to a city boulevard with slower and less traffic.



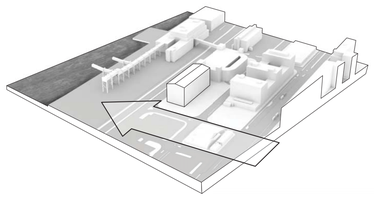
THE STENA TERMINAL - A second barrier cutting Masthugget off from the river is a big ferry terminal. Today it attracts a lot of international travellers but also a lot of heavy traffic. Large ships come and go throughout the day and obstructs the views to the north. There are loose plans to move the terminal but nothing has been decided so far.



PARKING - Today the sites around the building are mostly parking lots or parking houses. Though Masthugget will be densified in the near future which means that many of these sites will be turned into new blocks.



THE SUN - As the surrounding sites are empty today, the building and its site are sun lit most of the day during the summer. In winter the hill of Masthugget and the office building to the south partly obstructs the sunlight leaving the lower parts of the building in shadow.



FUTURE CONNECTION - As no plans have been approved for Norra Masthugget it is hard to say how the area will be developed in the future. However a strong idea from the city is to connect the square Masthuggstorget and the river with a park stretching all the way from the square down to the river bank.

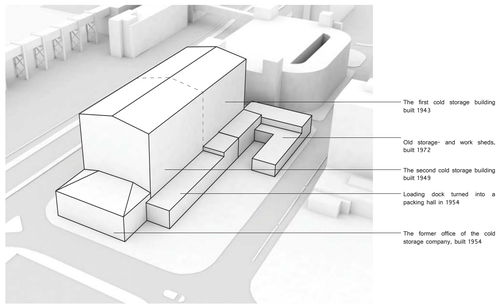
THE BUILDING

VIEW FROM SOUTH WEST

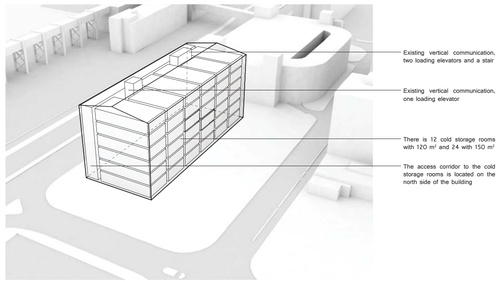
The cold storage building is designed by the Göteborg architect Nils Einar Eriksson, with its oldest parts dating back to the 1940s. It stands in the shadow of some of the architects' other works' in Göteborg, the Concert hall and Folkets hus. The cold storage building has a clear design for its purpose, where the windows of the northern facade lets light into the access corridors, the only area of the building where people used to dwell, leading into the 36 cold storage rooms. The façades enclosing the former cold storage halls are windowless and used to be tightly insulated to keep the cold gods.

The cold storage building is built in two stages entirely with site cast concrete. It is surrounded with different smaller buildings in various stages of decay. Today the owner rents out the old cold storage units as stock place, however the building has withered and is the base of an ongoing discussion what should be done with it. Demolishing or hiding it away with new buildings are the two options today.

It is a very interesting building and the massiveness of it is intriguing. The withered and graffiti painted concrete façades gives it a nice patina and character. People know it from the "Låt Stå" graffiti painted on the southern facade and it would be a shame if the building would disappear with the expansion of the city.



AREAL VIEW



INTERIOR STRUCTURE

EAST FACADE

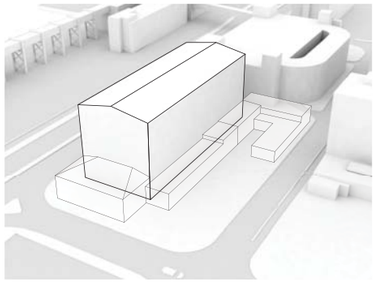
NORTH FACADE

THE OLD OFFICE BUILDING

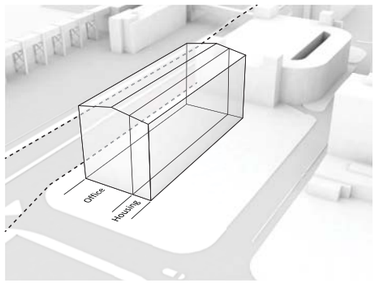
THE ACCESS CORRIDOR

OLD WORKING SHEDS

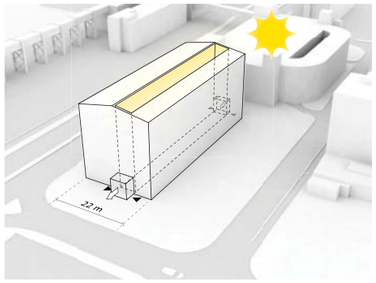
DESIGN



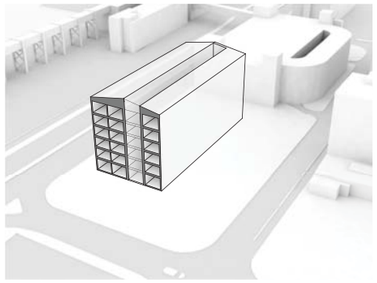
1. CLEAR THE SITE - The buildings surrounding the cold storage building are all in different shapes and stages of decay. They are torn down to reveal the full massiveness of the six storey concrete building.



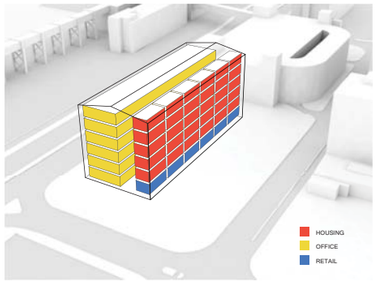
2. DIVIDE THE BUILDING - As Oscarsleden is passing the site directly to the north, noise regulations makes it very difficult to plan housing units facing the highway. This leads to a division of the building with office space to the north and housing units to the south.



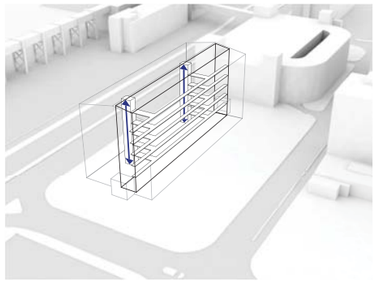
3. LIGHT SHAFT - To provide light into the very deep building and to give the housing units two sides, a light shaft is cut through the building. Entries into the shaft is done by cutting free plates of concrete and pushing them outwards.



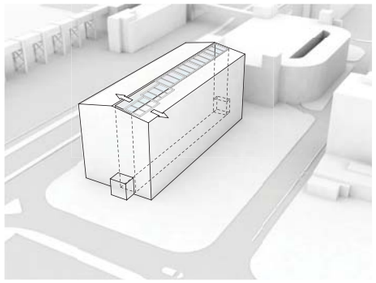
4. CUTTING THE SHAFT - The light shaft is cut with regards to the existing structure of the cold storage building. As every storage unit is divided in three cases in the north south direction, taking away the middle case leaves two stable building bodies.



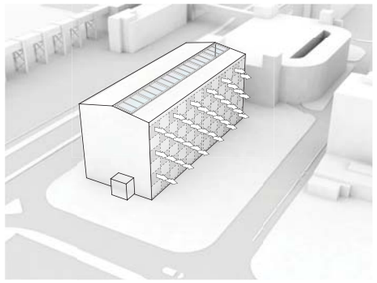
5. PROGRAM - The new functions of the building are gathered around the light shaft. The housing units of the project are placed in the southern remains of cold storage cell from plan 2 to 6. Office space for renting is placed on the entire north side. On the ground floor, with the ability to expand out into the light shaft, place for retail is planned.



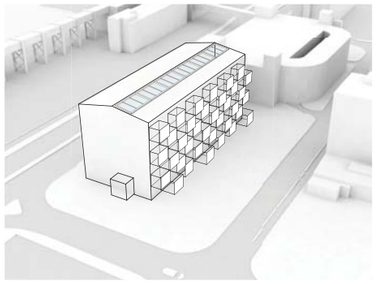
6. VERTICAL COMMUNICATION - The light shaft serves as the common vertical communication space for the building. Two of the three existing fright elevators are turned towards the light shaft and new stairs are fitted into the remains of the smaller cold storage units. The apartments are then reached from public access balconies protruding out into the shaft.



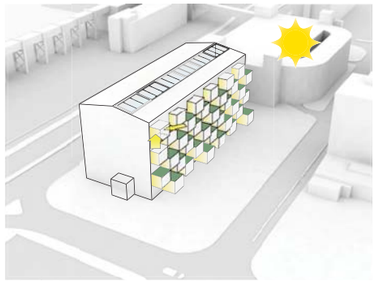
7. CLOSING THE SHAFT - To be able to use the shaft as extra living and social space throughout the year, operable windows are fitted on the roof. They also help to control the natural ventilation of the building.



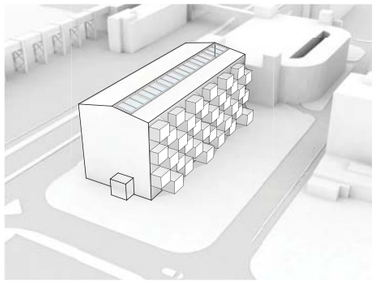
8. THE SOUTH FACADE - To play with the massiveness and leave the great patina of the graffiti on the building, the south facade is divided in rectangles with regards to the pillars and beams on the inside. Every other of these rectangles are cut out with a diamond saw and then extruded.



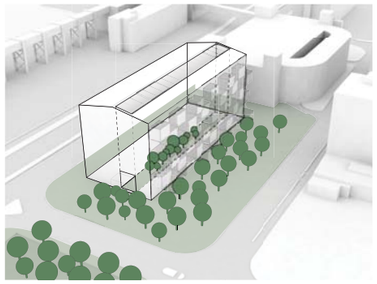
9. STRUCTURE - A new steel frame structure is put on the south facade. The cut away and then resized concrete pieces of the old facade are used as fronts of this frames. Hiding the structure and maintaining the massiveness of the southern facade.



10. THE CONCRETE BOXES - The sides of the concrete boxes are fitted with windows, letting light into the apartments and the top is used as terrace space. The inside volume of the box is only semi conditioned, making it a room where the occupants feel the changes of the season and are only able to use during parts of the year.

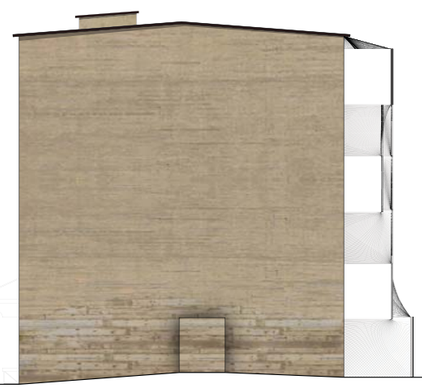


11. METAL MESH - A metal mesh is suspended between the concrete boxes. It works as railing and gives the residents the possibility to grow plants to themselves be able to control the amount of wind- and sun protection their terrace will get. The mesh also gives a new look to the facade while maintaining the possibility to glimpse the concrete facade behind it.



12. PARK CONNECTION - The new park connection from Masthuggstorget to the river goes by directly west of the site. The park will be allowed to extend over on the site of the cold storage building and continue into the light shaft, providing a connection of nature in the shared semi conditioned space.

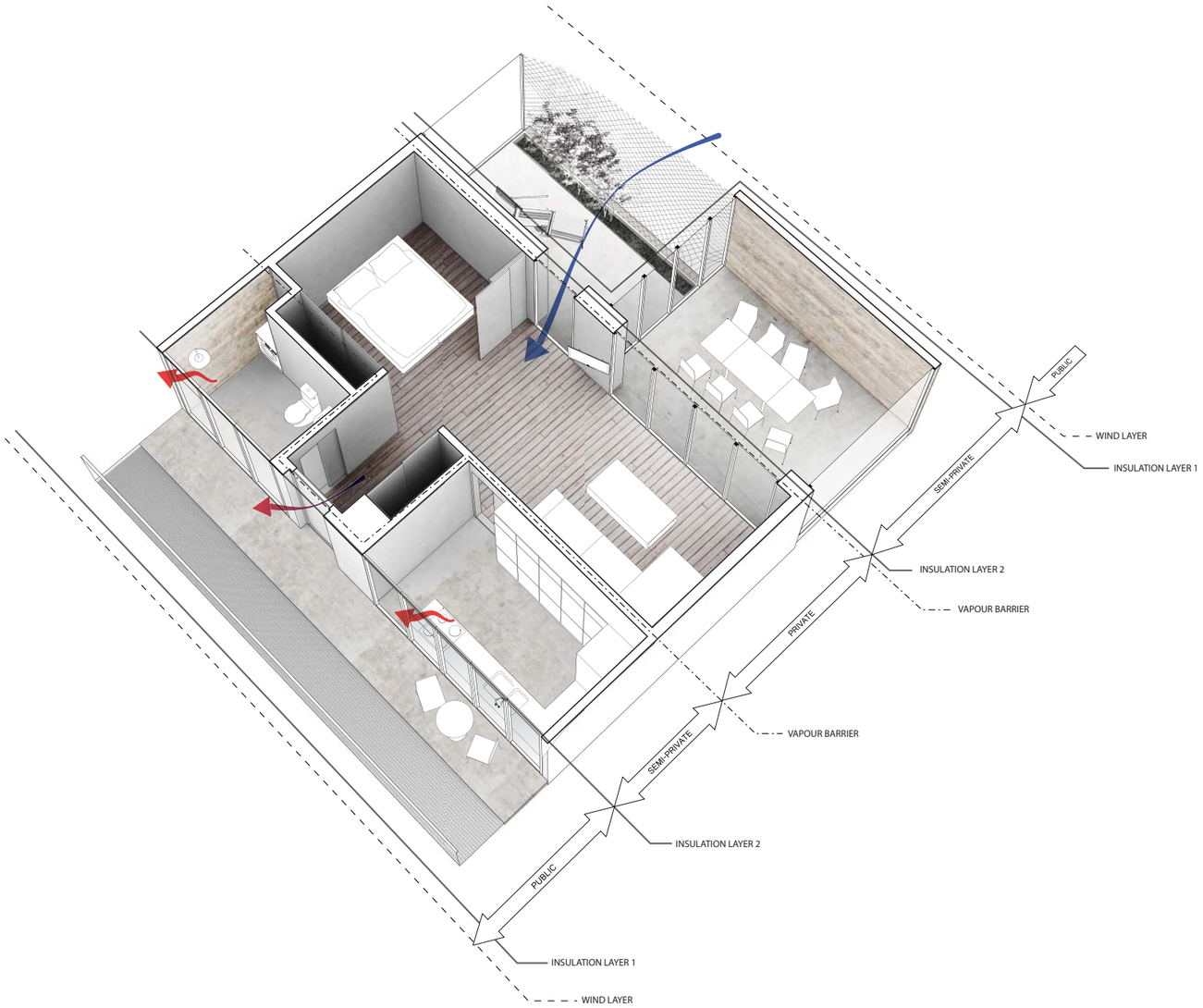
NORTH FACADE 1:200



WEST FACADE 1:200

SOUTH FACADE 1:200

LIVING IN THE ENVELOPE



THE LIGHT SHAFT - The light shaft acts as first buffer zone between inside and outside. The old concrete facade is laid bare and works together with operable windows at the top as wind barrier and the first insulation layer. Due to its height the shaft provides natural ventilation so the kitchen and bath rooms can be ventilated right out into the shaft. During the warmer moths of the year the light shaft is open and provides passive cooling to the apartments and offices..

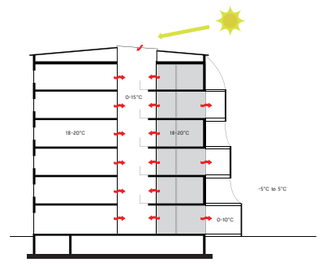
THE BATHROOM - The bathrooms are situated in wet niches of the apartments. Cut of from the light shaft by a opaque glass wall the bathroom is a private space when closed, where you still perceive what happens on the outside. When you need more space for household work you can open up the glass wall and expand out into the light shaft.

THE KITCHEN - Like the bathrooms the kitchens are also placed in wet niches. Behind a glass wall the kitchen is a semi-private area where you can both see and hear what happens in the light shaft. It is a functional kitchen which can expand out into the light shaft when the climate allows. The extra space gives the residents the possibility to gather around the cooking and preparation area.

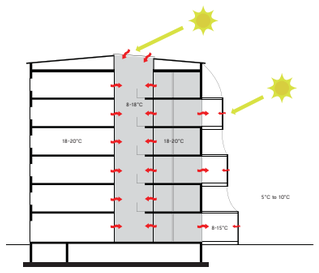
THE LIVING/SLEEPING ROOM - The entrance leads directly into the open combined living/sleeping room. Here you are in a completely private space with no contact to the neighbours when closed. This is the space where the residents have to live during the coldest months of the year. There is a possibility to close one part off for a more private sleeping area.

THE CONCRETE BOX - The concrete box works like the light shaft as a buffer zone between outside and inside. The existing concrete facade has been extruded and are covered on the sides by glass walls. One opens up to and extends the living room out into the concrete box. One opaque glass pane provides a semi-privateness from the neighbour and the last opens up towards the terrace. It is heated by the sun and the transmission losses from the core. The concrete box can be used as extra space during times of the year when the temperature allows it. It is large enough to hold any of the living/sleeping functions of the apartment and it is up to the resident to find which function fits which temperature.

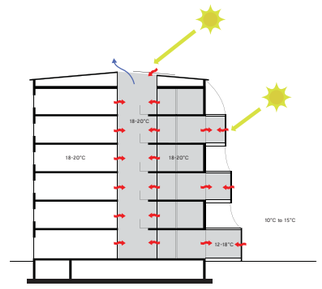
THE TERRACE - The terrace is the extension of the concrete box. This is as far as the residents can expand during the warmest months of the year. It is protected by a metal mesh, suspended between the concrete fronts. It has the possibility to work as wind breaker and solar shading. Parameters that the residents themselves have to control by growing plants in the green patches.



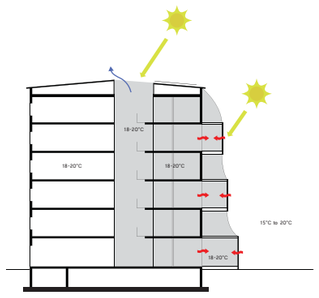
TEMPERATURES WINTER



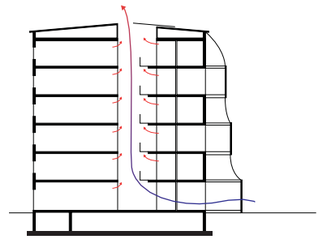
TEMPERATURES EARLY SPRING/LATE FALL



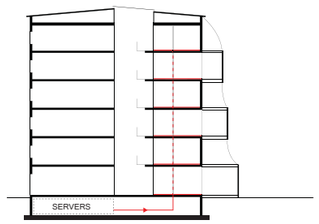
TEMPERATURES LATE SPRING/EARLY FALL



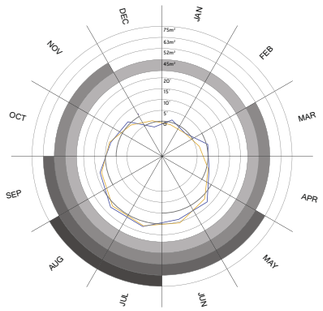
TEMPERATURES SUMMER



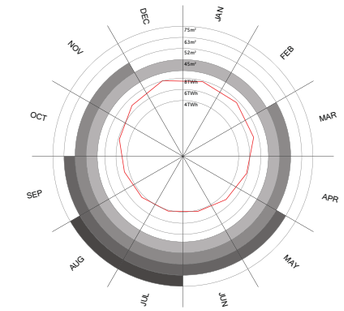
NATURAL VENTILATION AND PASSIVE COOLING



COMPUTER SERVERS AS POSSIBLE HEAT SOURCE



TEMPERATURES AND AREA - As parts of the living area is affected by the exterior temperature the amount of living space changes over the year. The graph shows the average temperature of Göteborg each month and gives a picture of when the different zones can be used. Though, the average high- and low temperatures vary significantly more, making it hard to predict the temperatures in the buffer zones.

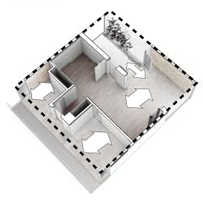


ENERGY AND AREA - More than 50 % of the residential energy usage comes from heating, where the biggest part comes from compensating for the transmission losses during the coldest months of the year. The new apartments in the cold storage building tries to minimize the energy consumption in the winter by living as small as possible and making the most of the climate buffers provided by the area between inside and outside.

WINTER - During the coldest months of the year the residents have to contract into the core of the apartment. The combined living- and sleeping area together with the kitchen and bathroom adds up to 45 m²

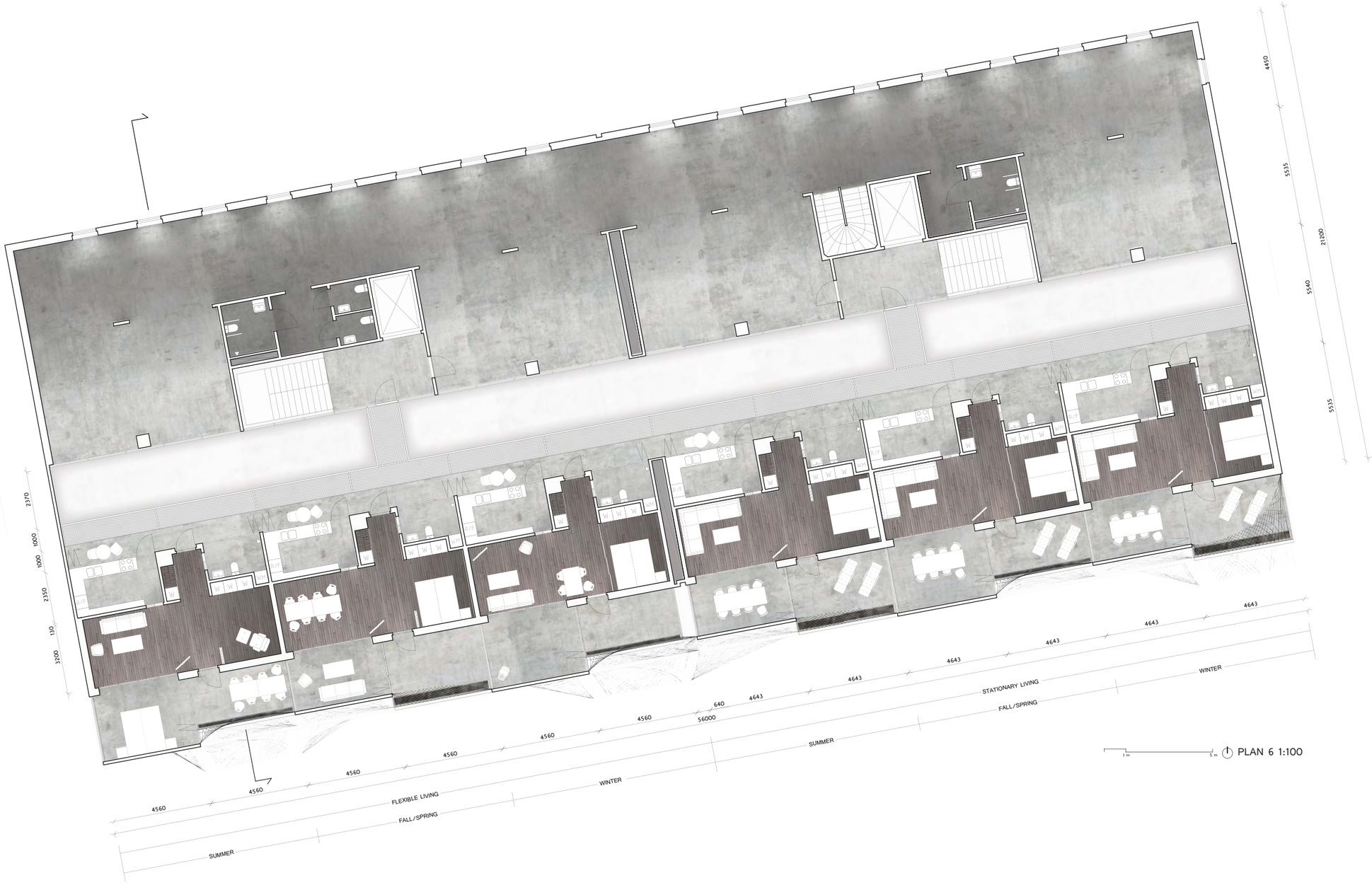
EARLY SPRING/LATE FALL - The residents have the possibility to expand the kitchen and bath into the light shaft to gain 7 m² extra space when needed

LATE SPRING/EARLY FALL - These times of the year it is possible to use the concrete box as living space, giving the residents a total of about 63 m² to live on

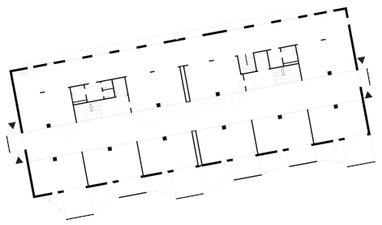


SUMMER - During the warmest months of the year the residents can make the most of their apartment as it is possible to expand out onto the terrace. The total living area now adds up to 75 m²

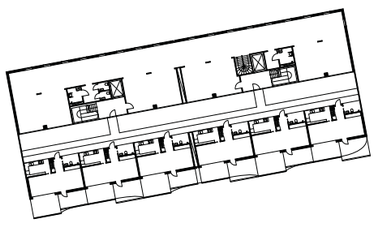
PLAN



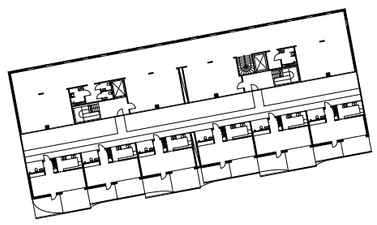
PLAN 6 1:100



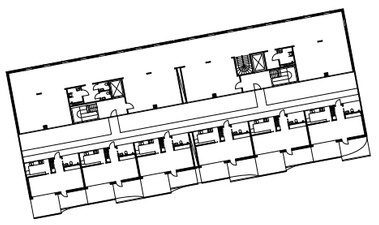
ENTRANCE PLAN 1:500



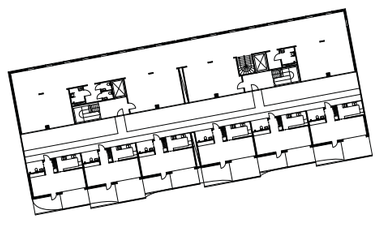
PLAN 2 1:500



PLAN 3 1:500



PLAN 4 1:500

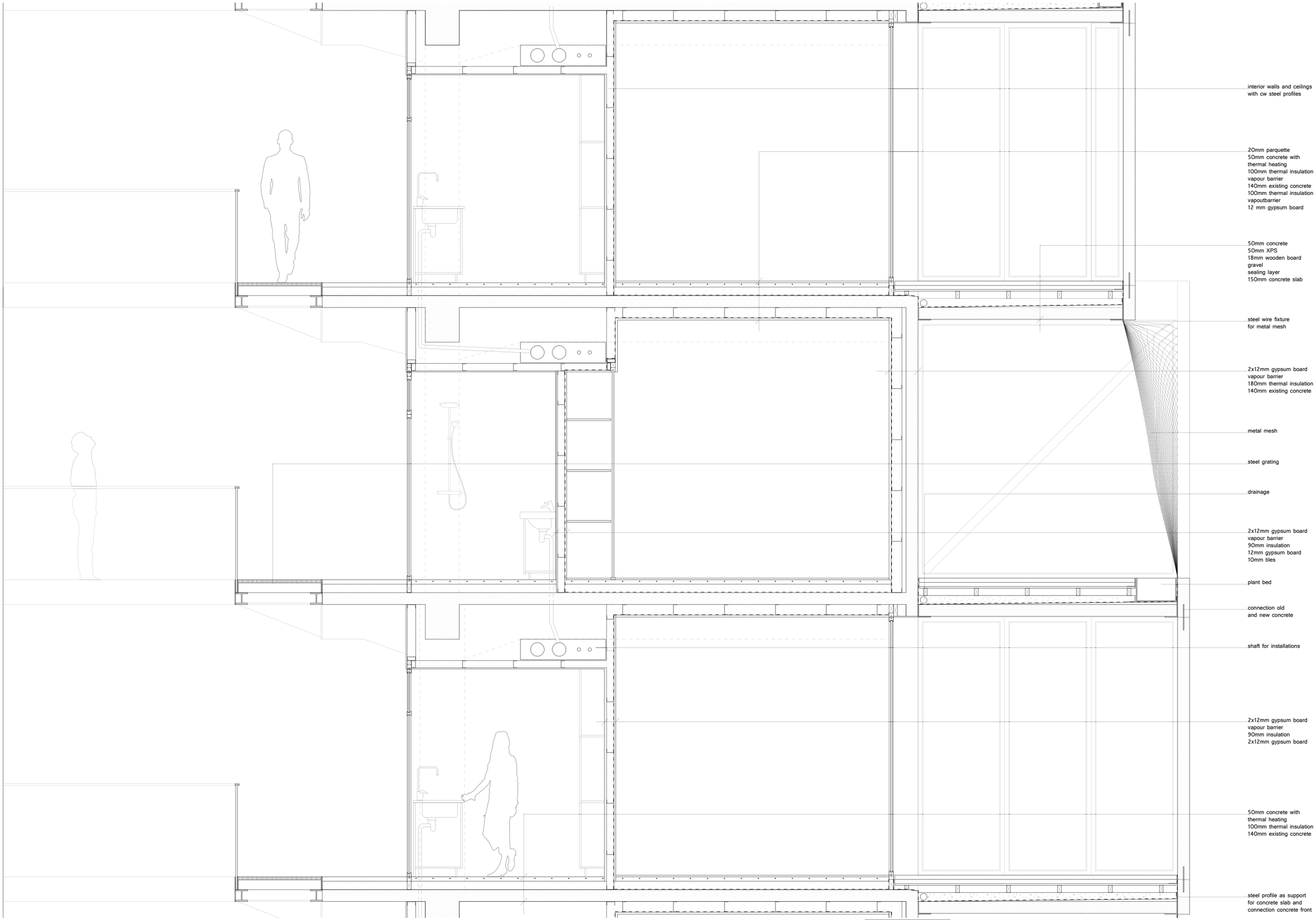


PLAN 5 1:500

SECTION

SECTION 1:50

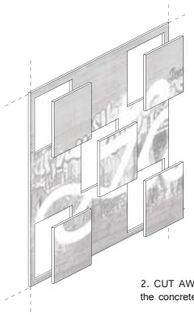
DETAILED SECTION



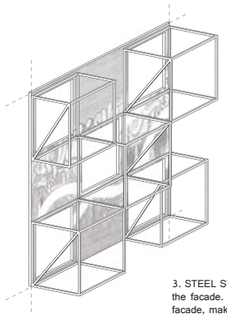
DETAILED SECTION 1:20

BREAKING UP THE CONCRETE

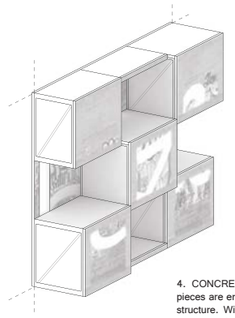
1. DIVIDING THE FACADE - The facade is divided with regards to the interior structure of the building. A sufficient amount of concrete are left to still be able to carry the slabs and beams, which are cast together with the facade.



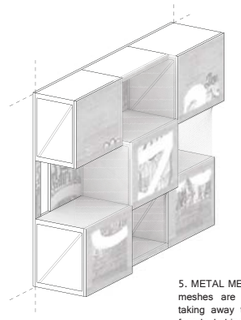
2. CUT AWAY CONCRETE - Openings are made in the concrete with a diamond saw.



3. STEEL STRUCTURE - A steel structure is fitted on the facade. It is connected to the ground and to the facade, making a stable structure.

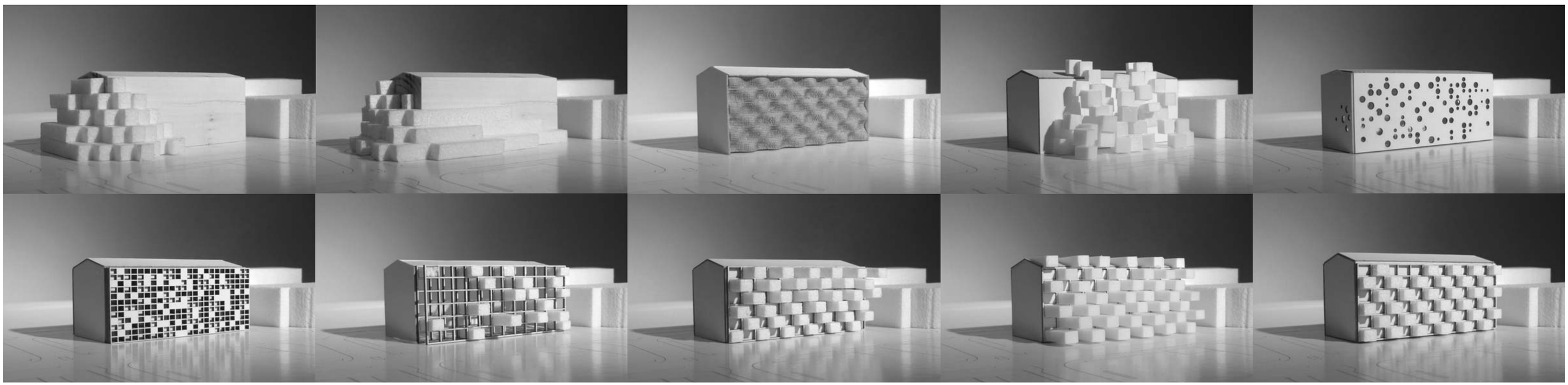


4. CONCRETE FRONTS - The cut away concrete pieces are enlarged and put back as fronts of the steel structure. Windows are fitted to the sides, making a semi-climatized volume inside. The top of the boxes acts as terrace to the apartments. An extra opening is cut into the facade to give a direct access to the terrace.



5. METAL MESH - Between the concrete fronts metal meshes are suspended. Acting as railing without taking away the possibility to glimpse the concrete facade behind it. It also holds the possibility to act as trellis for green patches, making it possible for the residents to customize its properties breaking the wind and shading the sun.

CONCEPT MODELS



MODEL STUDIES

MODEL

THE APARTMENTS

BEHIND THE MESH

THE LIVING AREA - LOOKING TOWARDS TERRACE

THE LIVING ROOM - LOOKING INTO THE CONCRETE BOX

THE LIVING ROOM - LOOKING TOWARDS THE NEIGHBOURING TERRACE

THE LIGHT SHAFT

AT THE TOP OF THE LIGHT SHAFT - VERTICAL CONTACT

ON THE ACCESS BALCONY - MEETING YOUR NEIGHBOURS

AT THE BOTTOM OF THE SHAFT - YOU STILL GLIMPSE THE LIGHT

THE GLASS WALLS - CONTACT THROUGH THE LAYERS

THE BOXES

THE BOXES - VERTICAL AND HORIZONTAL CONTACT