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# Mixed - Use Architecture

## Ageing | Dementia

Aalborg University
School of Architecture, Design and Planning

Master Thesis in Architectural Design
MSc4 ARC - ARK15

Mixed-Use Architecture
Ageing | Dementia

Project Title
Mixed-Use Facility for Ageing and Dementia

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Project Period
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## SUMMARY

This master thesis comprises of the architectural design of a mixed use facility for active-ageing and people with dementia, in Copenhagen - Denmark.
The report will include research material, reflections, analysis, the main presentation and other relevant material that sustains the project.
This thesis seeks to explore an evolutionary dimension to the relationship between the elderly, mentally impaired people, and society - through architecture.

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## MOTIVATION

I believe all human beings should live with dignity and wholeness throughout their full life span. I also believe that, as social catalyst, architecture is of utmost importance and should generate spaces that respond to everyone in a holistic way; regardless of their social, mental or physical being.
Furthermore, I think there is a need for future reprogramming of architectural typologies for dementia and ageing. As I researched, talked with people soon to enter elderly age and people with demented relatives, I concluded that it seems urgent to re-think a more holistic typology.
The idea of designing a facility for the elderly and people with dementia, starts from the motivation to create a better integration of these institutions, while responding to the complex matrix of users inhabiting them. I believe that this wide range of users and consequently - a wide range of user needs - demands an additional complementary dimension to the program and design of the current health-care typologies.

*"(...)In the context, or the vision, of dementia-friendly municipalities this means we must overcome the prevailing forms of care that segregate the ill and infirm into parallel worlds (for example nursing homes and so-called dementia neighbourhoods). Dementia-friendly communities need instead to find inclusive housing and care concepts and strategies that enable participation in social space. In this context, the term "inclusion" means that it is possible for people who are affected by dementia and those who are not to interact and be together in public space and that those suffering from dementia are able to articulate their own needs and take part in social life."*

*"By working to create a better framework for dementia, one must not forget the fresh elderly:*
*«There are two elements in the discussion; Residents in nursing homes today are typically very weak, making it less attractive for the fresh-bodied elderly people to live there. Therefore, one must also think about the fresh elderly in the building project. One can for example make a combined construction, where there are various facilities for the different groups. Unlike residents with dementia, the fresh elderly have totally different needs for more socializing, other recreational activities and more open outdoor areas,» "*
*[translated; in - Arkitektforeningen_Arkitektur og Design til demente]*

## GOALS

Nowadays, the infrastructures that provide support and care for both dementia sufferers and people in elderly age, rigidly fit a stereotype that translates a sense of isolation (in relation to the general urban context) and often reflects a narrow programmatic concept and spatial distribution.
I aim to design a building with a more flexible approach and with an additional outward focus, dedicated in its essence to people with dementia and the elderly, while incorporating a wider spectrum of uses and users.
The goal is to architecturally explore the duality of public and private, articulating these two dimensions to try and generate a more unified approach to health-care institutions.

# FRAMEWORK

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ageing and dementia

case studies

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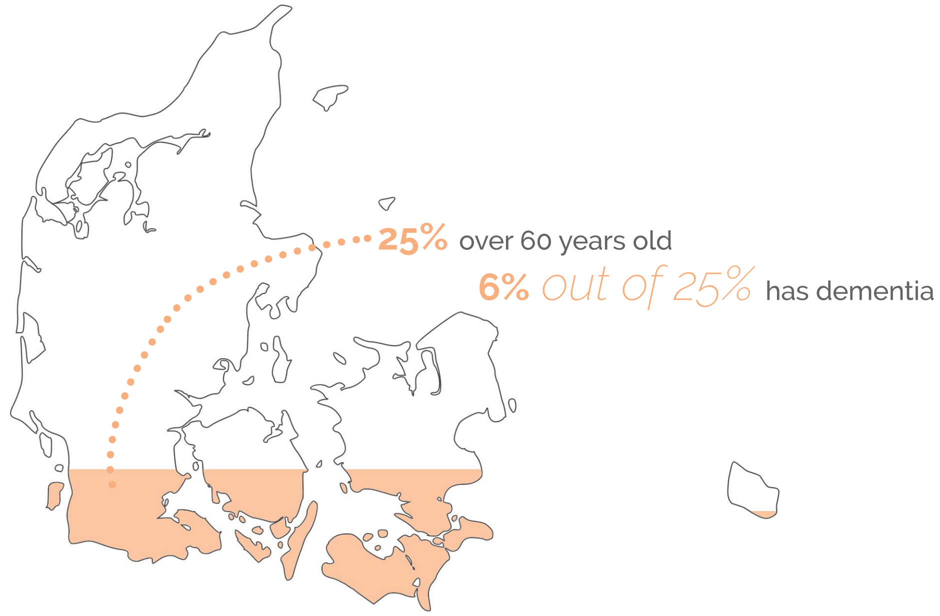
# AGEING AND DEMENTIA

The modern population's health evolution and general life conditions have been improving more and more throughout the decades. This fact is reflected by the numerous generation of people over 50 years old (see image illustration on the right), coming as a consequence of an increasing life span (along with a lower birth-rate) and unavoidably leading to a change in the ageing process of population.

As elderly people (definition refers to the chronological age of 65, as considered in most developed countries) enter the retirement age, their daily context and their role as senior citizens changes. Even though most of the ageing part of society still desire to be active, there is also a tendency for gradual isolation and – as the numbers show (see images on the right) – a great number develops dementia, as well as other chronic diseases.
The incidence of dementia is strongly associated with age, and as the older population is expected to grow dramatically in the coming decades, we must anticipate that the number of people with dementia will increase by approximately 50% by 2030.
Because the risk of developing dementia increases with age and because it is estimated that 60% - 80% of people in Danish nursing homes have dementia [estimates by National Dementia Research], it seems important that spaces for the elderly and demented are better thought out. Consequently, it becomes a challenge for us, as architects, to be able to design and create common environments in standard care centres, with a good balance of functions and resources that covers a relatively broad matrix of needs - for people with dementia and citizens who are still cognitively efficient.




Estimation of Population and Ages for 2016 - Denmark


Estimated percentage of people with dementia, currently living in standard nursing homes

## AGEING

It is estimated that from 2017, the number of elderly people will rise significantly in Copenhagen. Even though the incidence probability is higher in later age, the number of elderly people with dementia and multiple chronic diseases increases, along with a tendency for incraesing depression and emotional fragility, which can be as limiting as any other physical disability.

Parallelly, there will also be elderly people with a more active perspective in the future, therefore having other expectations than previous generations. This comes to contradict the old stereotype where getting older necessarily meant the need for tranquillity and seclusion.

## DEMENTIA

In addition to ageing as the main trigger, the development of dementia can also originate from a play of diverse social and health factors such as heredity, lifestyle and environment.

Dementia is the term used for a variety of diseases that affect the brain and impair mental and cognitive skills. This disease can come in 75 different types, but generally it deeply affects our identity and personality, resulting in symptoms such as memory loss, impaired judgement and difficulties with attention and language.

Dementia is a brain disorder that cannot be cured, but proper medical treatment, rehabilitative efforts and support, can help in both reducing and delaying the symptoms, while giving the citizen a better position to master his life as long as possible.

Studies show that early intervention in the form of preventive and supportive measures such as training and counselling, encompassed with some socially engaging activities, can help maintain and preserve the everyday quality of life of the demented.

# CASE STUDIES

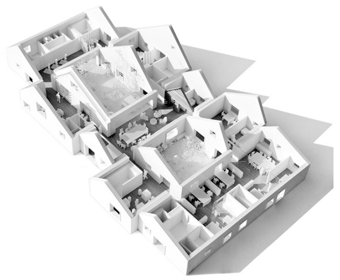
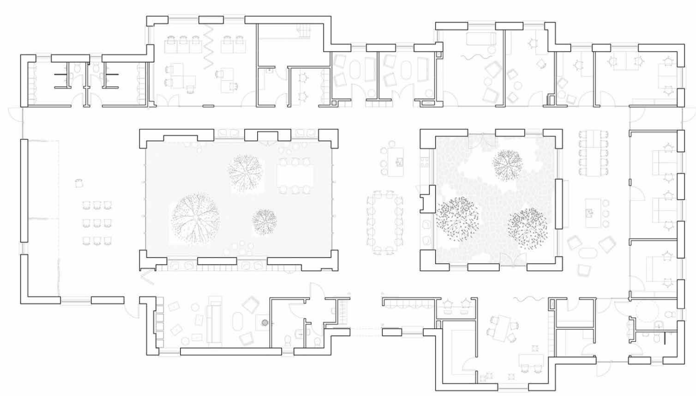
The following case studies were important references to understand and reflect on a variety of solutions and relevant dimensions in relation to the project aims.
Since the goal was to design a mixed-use facility related to health-care, I researched projects with different programs, that approach similar typologies and that integrate mixed functions, while expressing an interesting spatial character.
Both case studies are relevant for their variety in programmatic content and distribution - integrating health-care and other uses into a more informal flow of spaces.

## LIVSRUM CANCER CENTER
### EFFEKT

The new cancer counselling center is designed as a cluster of seven small houses. Similar to monasteries the careful layout features interlocking rooms that wrap around two central courtyards - one where you sit and meditate in silence and one that promotes physical activity and social interaction. Each house has its own specific program and together they form a coherent sequence of different spaces, which include functions such as library, kitchen, conversation rooms, lounge, workshop, gym and wellness area.
The site is surrounded by roads on three sides. By designing the courtyards in the centre of the building, the spaces will mostly turn inwards and will be guarded from noise. This also helps to create a stronger integration between the program areas and exterior.
The large communal living space is the heart of the house and forms a natural centre that allows continuous circulation throughout the building
There is a wide variety of users in this facility, ranging from children to elderly or disabled people. Some come just to practice fitness activities, and others casually come to meet patients or seek counselling. Therefore, all spaces are designed individually according to their different functions, providing a hierarchy when experiencing each area of the program - public to private.





## MAGGUIES CENTRE
### REIACH AND HALL ARCHITECTS

Magguies Centre is a type of architectural health-care facility spread throughout different places in the world and that integrates the idea of an informal and flexible building, which offers the social infrastructure for emotional support throughout cancer.
The perforated perimeter of the garden gives a sense of protection and safety, providing for a sense of enclosure, while allowing a controlled degree of permeability so that the building doesn't appear impenetrable. The interior spatial character lies in the contrast between the wooden bookshelves that run laterally and the glass walls. These glass walls, both on the facade surfaces and on the two internal courtyards, generate a free visual flow within the main central space, as well as a strong connection with the exterior areas.
This case study is relevant for its spatial language and for, despite its small scale, expressing a sense of familiar ground for necessary calm and serenity, with subtle partitions that divide the program, while generating communal spaces that encompass a strong relation with the green exterior.



# TECTONIC APPROACH

Tectonic architecture should be a driver across the entire design phase, whereby all issues are thought of and addressed.
As described in [Hvejsel 2010, Interiority a critical theory of domestic architecture] tectonics integrates a tangible and emotional realm, defining the terms of "gesture" and "principle" as a way to bridge the conceptual framework and practice of architecture.
It is inherent in tectonic design that within the spatial expression, the gesture should constantly refer back to its principle, generating a coherent architectural design, and contributing to an interconnected and solid experience of space. This means that the poetic narrative of the design, directly related to the building function and materiality, should generate the gesture of the building. Furthermore, through a reasoning of the conceptual thoughts, a principle should encompass the gesture, resulting in a coherence between form, structure and materiality.

As tectonics should be embedded within the design of the project, engineering, as well as some sustainable considerations, should be integrated, such that different parameters and elements can be manipulated, analysed and tested as variables that will follow the design ideation. By integrating tectonic thinking throughout my design process, I aim to achieve a holistic spatial expression and architectural identity, through a unity between structural principle and its details, and the conceptual idea.

# METHODOLOGY

In this project, Tectonic Architecture is investigated using the Integrated Design Process (IDP) as a tool.
This methodology was developed by Mary- Ann Knudstrup as part of the book Pandoras Boks [Knudstrup, 2005]. The process is divided into five phases, creating an iterative working method where aesthetic and technical aspects are equally considered in relation to one another.

1 {PROBLEM FORMULATION} The process will start with defining the problem related to the social-humanistic realm, health issues and architecture, occuring in Denmark and further approaching the city of Copenhagen.
2 {RESEARCH + ANALYSIS} This phase will be responsible for performing the site analysis, which will include urban and climate studies. The results will be evaluated and will serve as a second layer of concept implementation.
3 {SKETCHING + PRELIMINARY DESIGN} The focus of the Sketching phase is to arrange different studies in order to elaborate on the established principles of the concept. Using design loops this phase will include both engineering and architectural elements, which will be affecting and adjusting each other to reach unity. It will contain hand sketches, physical and digital models, diagrams. The use of software will be selected according to the task.
4 {SYNTHESIS} Based on sketching, the synthesis phase will unite all the components of the building design. This phase will include more detailed investigation and therefore will include working in different scales.
5 {PRESENTATION} The last phase of the second part will be devoted to present the produced material, it will focus both on process and final proposal. It will use both written and graphic communication in order to explain the project from different sides and at different scales.

# PLACE

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mimersparken

mapping

atmosphere

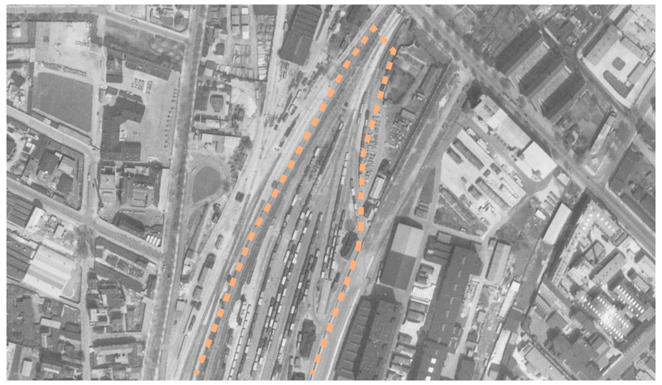
climate

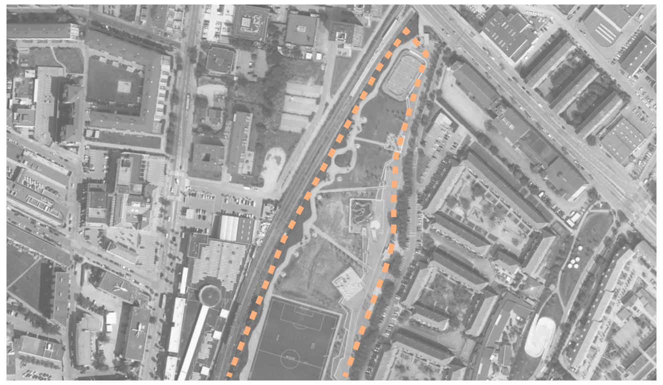
summary

# MIMERSPARKEN

This chapter will follow the analysis of the place chosen for this project - Mimersparken, in Copenhagen (see image on the right).
One of the reasons for the choice of this place is its interesting character - a result of its location, right at the border between the two districs of Nørrebro and Bispberg. It has a very particular relation with its surroundings. Before it become a recreational area, Mimersparken was an unused rear-train property from DSB (see (1) image below).
Due to its location - at the edge of two districts and bordered by the S-train line - Mimersparken had an isolated character and was therefore renovated in 2012 through an intervention that placed great focus on outdoor life and physical activity. This transformation was implemented by Realdania in partnership with Copenhagen Municipality and aimed to give the neighbourhood around Mimersgade (adjacent to the south-eastern edge of the park) - in Nørrebro - a new and more positive identity.

This partnership integrated a multi-visionary approach that focused on this park, together with Superkilen and Nørrebrohallen in order to improve the surrounding neighbourhoods and bind east and west of Nørrebro.
Resulting from the 2012 renovation, Mimersparken has a few interventions that are mainly distributed throughout the south-eastern edge of the site (see (2) image below). These interventions consist mostly of leisure areas, with different pockets that include playgrounds and sitting areas, places for barbecueing, street basketball and also a football court.
The renovation of Mimersparken in 2012 aimed to increase unity by promoting better integration within the district, as well as using social and cultural activities to attract new commercial investments and residential improvements.


(1) Mimersparken - 1954


(2) Mimersparken - 2016


Overview of Copenhagen - highlighted intervention site

## MIMERSPARKEN

The neighbourhood of Mjølnerparken, where Mimersparken is located, is a densely populated neighbourhood with around 16,000 inhabitants. The area, an old working-class neighbourhood, was previously a mix of housing, shops, and industrial companies and now contains mostly residential buildings. Children and young people make up a large proportion of the population, while the percentage of adults outside the labour market is also much higher compared to the rest of the city of Copenhagen.
For a long time, Mimersparken was not considered a social ly sustainable area due to its lack of safety and poor connections with the residential area. In 2012, when Mimersparken was renovated, there was a great improvement in the interaction between the site and its closest locals. Although the renovation did help to improve the neighbourhood, in 2014 it was still considered, according to the local plan from that same year, a marginalized and vulnerable urban area.
The Local plan was elaborated in 2014, outlining the zone as an area for new development, aiming to create new institutions, services and public purpose, improving infrastructures and connections, as well as increasing urban life and security in the area. This new development area included Mimersparken, as well as Mjølnerparken. It also considered their relationship with Superkilen (see images on the right) - an urban park that extends from Bispberg through Nørrebro - an urban void within this district, connecting the residential blocks and responding to the need for leisure areas in this dense part of Nørrebro.

Site surroundings landmarks - Superkilen.

# MAPPING

The data represented in the plan covers the most important infrastructures in relation to the project site - Mimerspaken.

ACCESS

Mimersparken is geographically bounded by Tagensvej, Mjølnerparken, Mimersgade and the railway line that connects Bispberg and Nørrebro Stations.

The access infrastructure represented in green (image on the right) covers the adjacent, main and secondary streets in relation to Mimersparken. These represent the main access points to the site. The importance of the marked streets has to do with their degree of direct or less direct connection to the site and whether they include car, pedestrian and bike infrastructures. One of the access ways is through Nørrebroruten and is marked differently due to its importance as a circulation line, extending from Tagensvej to Frederiksberg. Nørrebroruten runs within one of Nørrebro's important landmarks - the urban park, Superkillen (image on the right)

East: On the eastern area of Mimersparken, the access is made through the residential area, from the streets that run in between the different blocks and allowing a more intuitive flow for pedestrians or cyclists who can access it directly from Nørrebroruten - Superkilen. Vehicular access can be done in the same way, although cars are not able to directly circulate close to the park because of the existing hub between the green area and Mjølnerparken, which is exclusively dedicated to recreational activities, bikes and pedestrians.

West: The west area of the site has no direct access since on this side, Mimersparken is bordered by the S-train line that connects Nørrebro to Bispberg St,

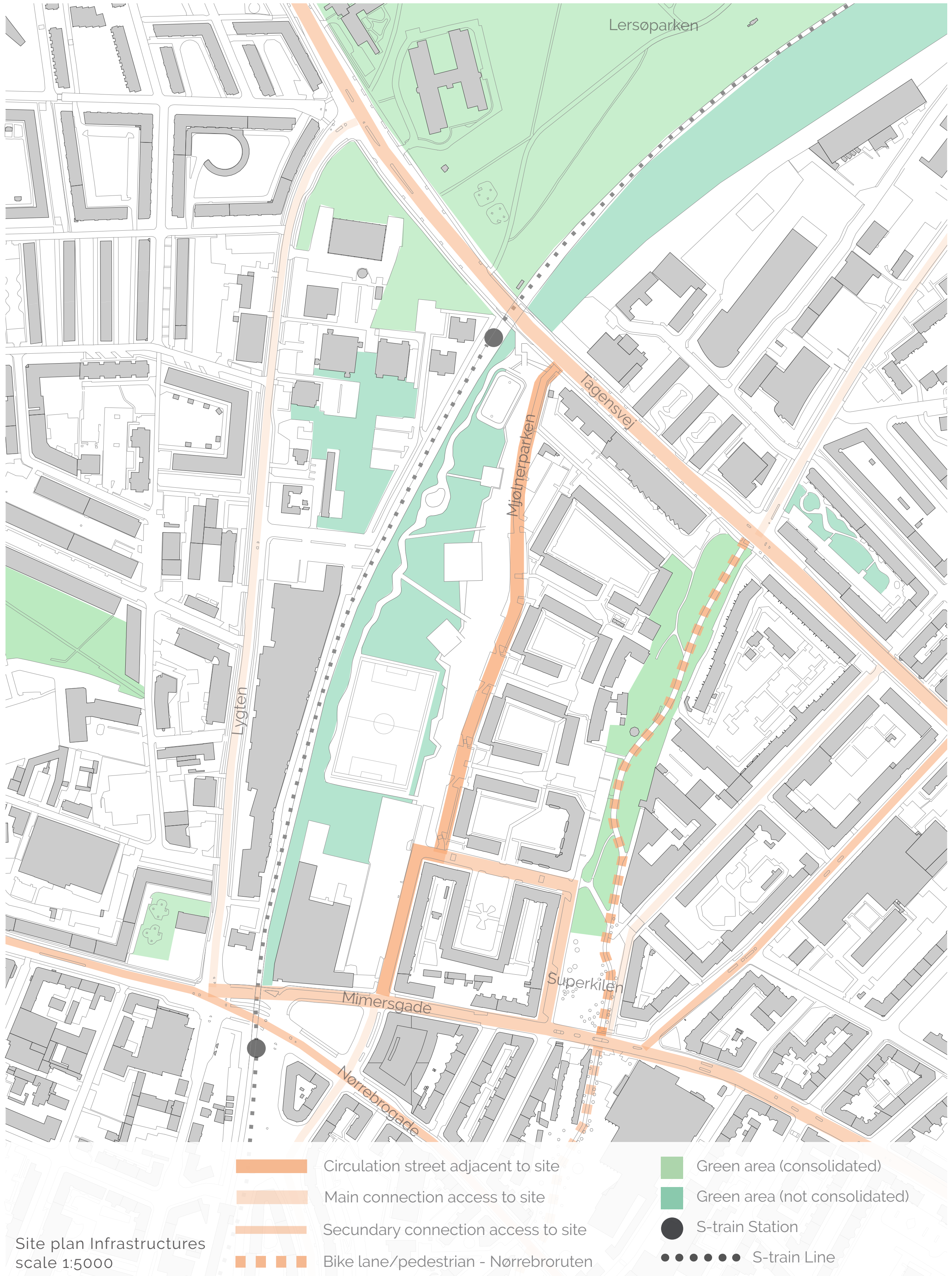
North: The area around the Bispberg Station is a complex urban area with a bridge that goes over Mimersparken, with a significant height difference in relation to the site, which can be accessed by stairs. The area is characterized by an intense traffic of trains, cars, cyclists and pedestrians. It is also possible to access the site area through Mjølnerparken and by going down a road (cars, bikes and pedestrians), that runs along the residential buildings.

South: The southernmost area of the site can be easily accessed through Mimersgade, which has a close connection to the intensely trafficked Nørrebrogade - an important axis that connects the site area to the centre of Copenhagen.

GREENERY

Mimersparken consists on a long stripe of low vegetation, part of a green band that exists from Nørrebro and extends to Lersøparken, in Bispberg.

After Fælledparken (north-eastern Nørrebro) and Nørrebroparken, Mimersparken is the biggest green park in the district of Nørrebro.




Site plan Infrastructures
scale 1:5000

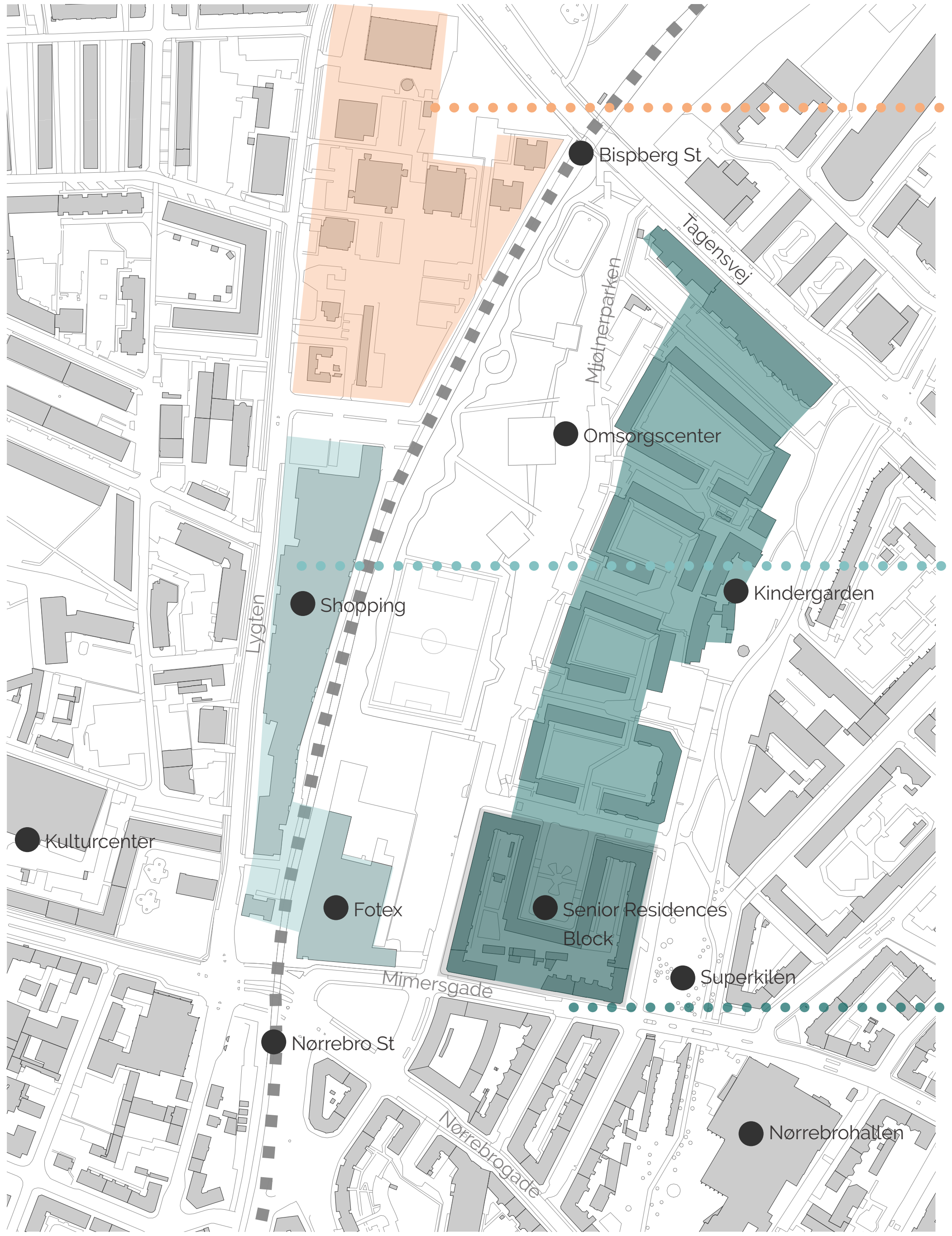
# MAPPING

The area defined as cluster 1 (see image on the right) is closest to Mimersparken, and the one that most directly relates to it. Cluster 1 comprises mostly residential buildings, with the exception of a day care centre and kindergarten, located at the east of this cluster. In this neighbourhood live approximately 2,500 people - mostly young families, except in the southernmost block, which is comprised of 103 Senior residences.

As mentioned before, one of the special particularities of the site is the fact that one of its edges is bound by a train line. The railway, which connects Nørrebro and Bispberg, also physically divides these two districts and creates a break in the connection of the urban grid. This same aspect ended up affecting the development of the adjacent areas, reflecting in the architecture of the surroundings.

Identified directly to the west side of the train rails beyond Bispberg station (see image on the right) is a second cluster of buildings. This presents a very different density from the east side of the rails, having a built environment that is more scattered and less consolidated. Cluster two consists predominantly of recently constructed residential buildings.

Cluster 3 (see image on the right), is a more industrial zone with services and commercial buildings that also follows the scattered urban expression also visible in cluster 2. This area visually "wraps" around the train line in an attempt to connect Bispberg and Nørrebro and bordering the south of Mimersparken.




Site plan - relevant surroundings and built typologies
scale 1:5000

Cluster type 1 - residential
Cluster type 2 - industrial + commercial
Cluster type 3 - residential
Limit between Norrebro - Bispberg

Cluster type 3

Cluster type 2

Cluster type 1

## ATMOSPHERE

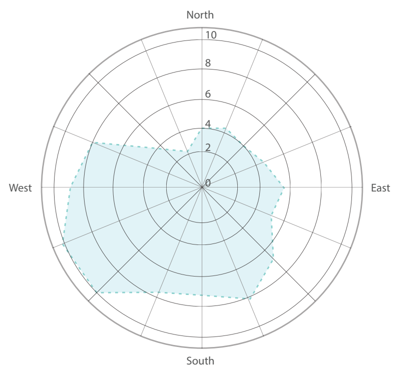
As mentioned before, the area used for the intervention is established as a park, although it is only consolidated along one of the edges (the eastern edge) - that, which was refurbished in 2012. This refurbishment consisted of a set of pockets cut out on the edge of the park, functioning as playgrounds, sitting areas, etc., and defining a difference of height of one meter from the adjacent road.
As shown in the moodboard (represented below) there is a very rich set of surfaces on the site. These result from the different materials used on the playgrounds and sitting areas, together with the different shades of brick facades from Mjolnerparken neighbourhood, as well as the expression of the new buildings on the western side of the site. The different typologies of the park result in very heterogeneous expression which gives a very particular dynamic.

# CLIMATE

Climate influences not only how we inhabit spaces, but also to a greater extent directly influences the culture and habits of a society.
Because it affects the atmosphere and the comfort levels, the weather in a city or country becomes key. For this reason, climate is a very important element to consider and its characteristics should reflect in how we think and design architecture.

## WIND

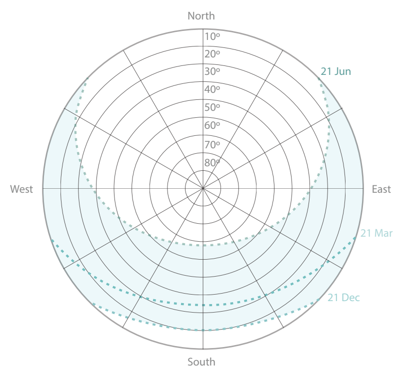
The wind is most often from the west (24% of the time), south west (17% of the time), south (15% of the time), and east (11% of the time).
Over the course of the year typical wind speeds vary from 2 m/s to 9 m/s (light breeze to fresh breeze), rarely exceeding 13 m/s (strong breeze). The highest average wind speed occurs in January and the lowest in August.




Wind Rose Diagram

## DAYLIGHT

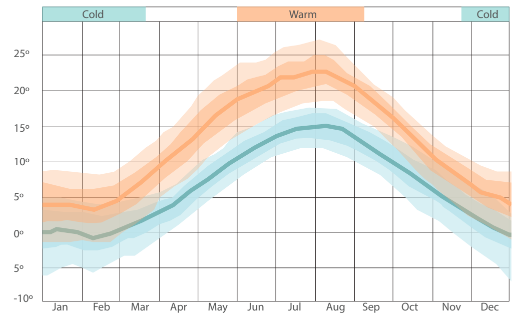
The length of the day varies significantly over the course of the year. The shortest day is December 21 with 7:02 hours of daylight; the longest day is in the 20th of June with 17:32 hours of daylight.




Sun Path Diagram

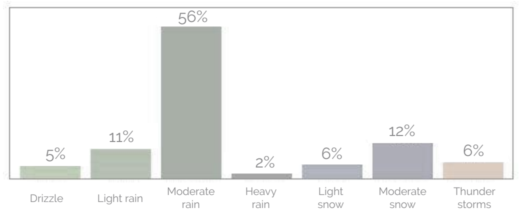
## TEMPERATURES

Over the course of a year, the temperature typically varies from -2˚C to 22˚C and is rarely below -8˚C or above 26˚C. The warm season (June 3rd to September 8th) has an average daily high temperature above 18˚C. The cold season (November 21st to March 22nd) has an average daily high temperature below 6˚C.




## PRECIPITATION

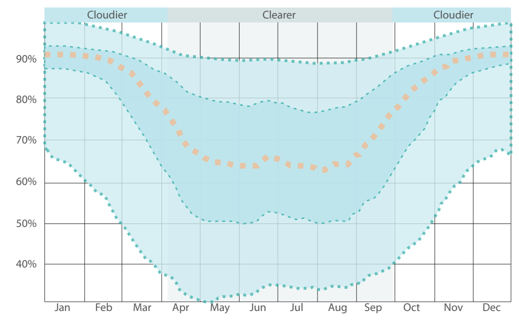
During the warm season, from June to September, there is a 55% chance of precipitation. In the cold season, from November to March, there is a 69% average chance of precipitation.




Average rainfall in a year

## OVERCAST

The median cloud cover ranges from 63% (partly cloudy) to 91% (mostly cloudy). The sky is cloudiest on January 1 and clearest on August 1. The clearer part of the year begins around April 6. The cloudier part of the year begins around September 30.




Median Cloud Cover Diagram

# SUMMARY

Even though the site is central and integrated in a very urban context, the train line, the height difference against Tagensvej and the football court in the south of the park, end up functioning as hubs, giving Mimersparken a special sense of protection. This sense of protection can be considered for the design for the more secluded areas of the project, while still using the eastern and more active edge of the site as benefit, relating it with the more public part of the project.

There is good access infrastructure by train, car, bikes and pedestrian links providing the users of the building with good connections from within or outside of Nørrebro.

The closest local inhabitants include numerous young families, their importance highlighted by the presence of a Kindergarden, and more than 100 senior residences on the southern area of the site, which can allow the right balance of users for the building.

The choice of Mimersparken as the site aims to integrate its current functions - playgrounds, leisure areas and the greenery, as key-potentials for the program of the building.

The existing uses of the site will not only contribute to an increase in the quantity of users throughout the whole neighbourhood, but will also allow to generate a diverse flow of users within the building, hence increasing the sense of connection between different generations, people with dementia and local society.

The new building will additionally help to establish complementary functions within the site, helping to create more life and new destinations in the area and contradicting its actual isolated and unsafe character.


Birds-eye view over Mimersparken - highlighted intervention area and landscape intervention

# PROGRAM

4

vision

users

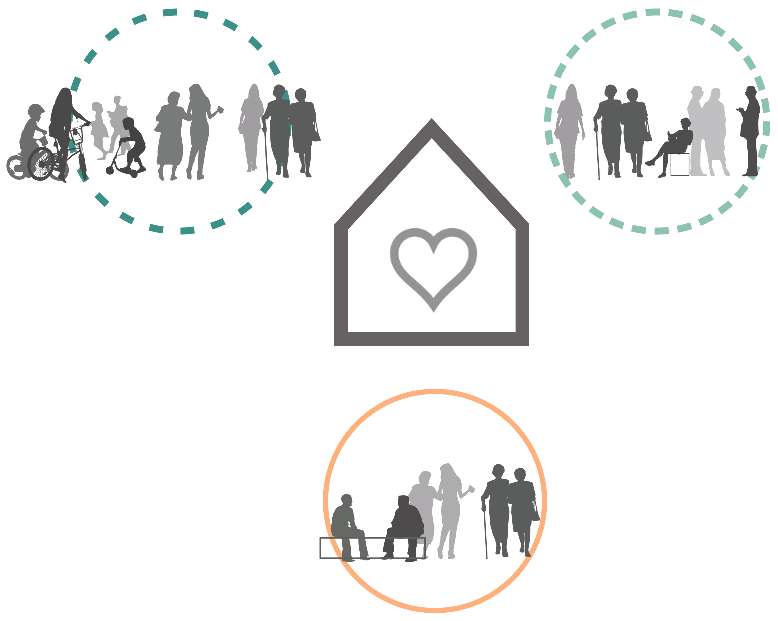
room program

How to do Architecture for the elderly and people with dementia, motivating a more continuous relationship with society and responding to a wider spectrum of user needs?

# VISION

*"Copenhagen care centres must be an active and integral part of local areas. Many residents in a nursing home want to preserve attachment to the local area where they lived before moving into care homes. Care Centres can be made more accessible to the outside world and invite neighbours and volunteers for the benefit of both the local area and residents. Physical environment, e.g., in the form the centre features can help support this and to bring more life to the care centre."*

*[translated from: Fremtidens plejeboliger - 10 principper april 2014, Københavns kommune]*



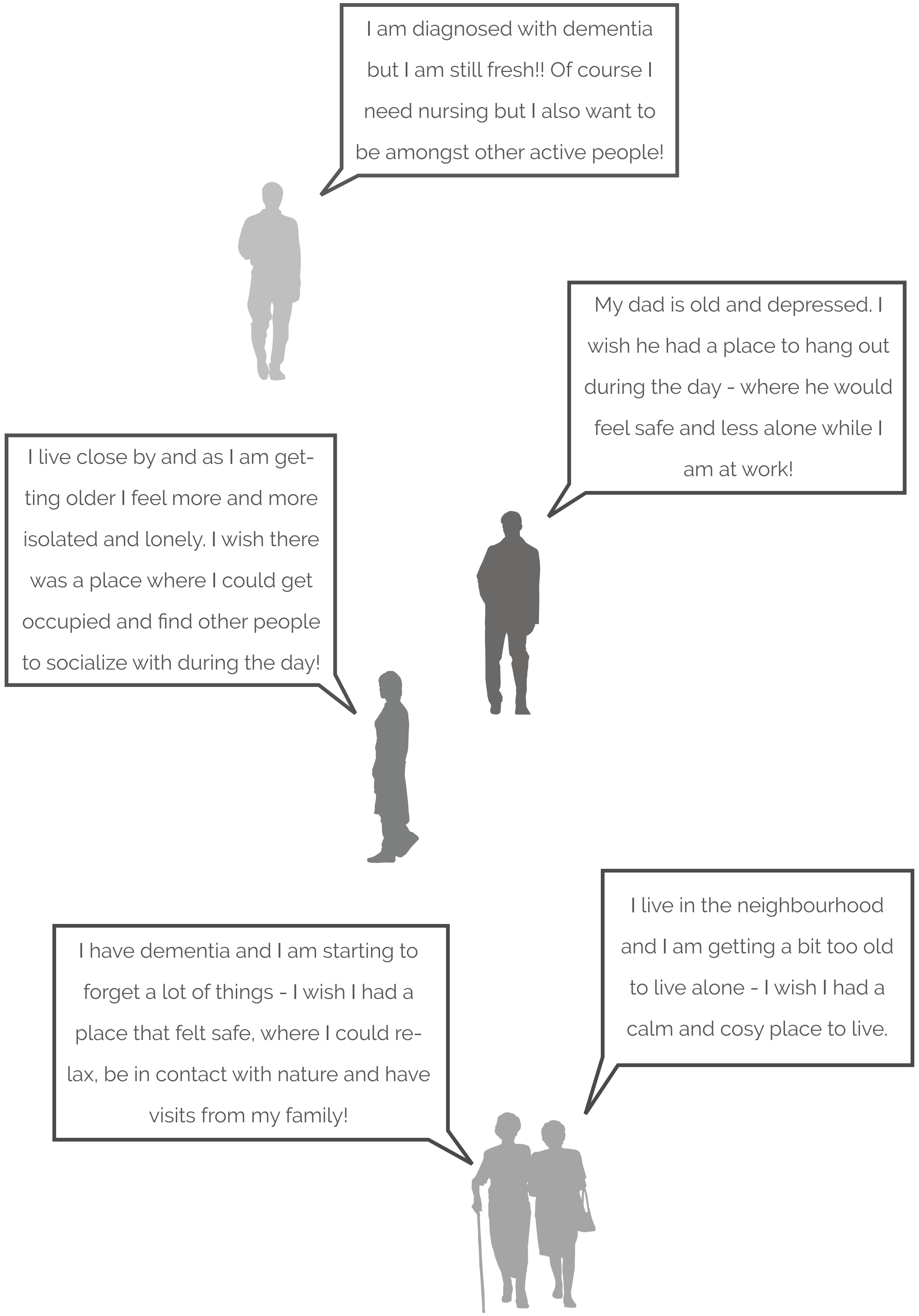

The vision for this project is to design a facility with a more holistic approach to institutional health-care, exceeding the boundaries of the generally exclusive private focus of these typologies. This approach will take on the recreational dimension existing within nursing homes together with mental health-rehabilitation, combining it and hence creating areas of confinement and with an inwards focus, as well as opening up to other public uses.
The result should be a facility that goes beyond what you expect of a typical care-giving institution, embracing the broader needs and aspirations of its users, while connecting with the local community and neighbourhood.

# USERS

The target users for this facility are people with dementia or elderly people, as well as the local community which will also be an integral part of the building dynamics. Furthermore, the users will range from permanent to temporary (see illustrations on the right)

Temporary Users:
- Staff, which should work in rotational shifts, temporarily inhabiting the building.
- Locals/regular users of Mimersparken, which will take part in the leisure activities or use the building as a day centre, therefore benefiting either of the private facilities or the public - depending on the case.
- Family members, which will generally come with the goal of visiting one of the permanent users, being able to use the family lounge in the private realm or any other of the public areas.

Permanent Users:
- people that need more intensive care or nursing due to diagnosed dementia or ageing, therefore having a permanent residence in one of the rooms of the facility.



## ROOM PROGRAM

- Promenade Hall - 2000 m2
- 2x Private lounge areas - 155 m2
- 30x Private Rooms - 795 m2
- 2x Secondary Private Lounges - 66 m2
- Family Lounge - 141 m2
- Dining Hall - 115 m2
- Common hall - 30 m2
- Tv Room and Lounge - 70 m2
- Activity Room - 110 m2
- Nursing Station and Physiotherapy - 95 m2

- Promenade Hall - 350 m2
- Open Workshop Room - 70 m2
- Foyer - 68 m2
- Cafe Lounge - 51 m2
- Cafe - 80 m2
- Multi-Room - 110 m2

- Kitchen area - 50 m2
- Staff and office areas - 250 m2

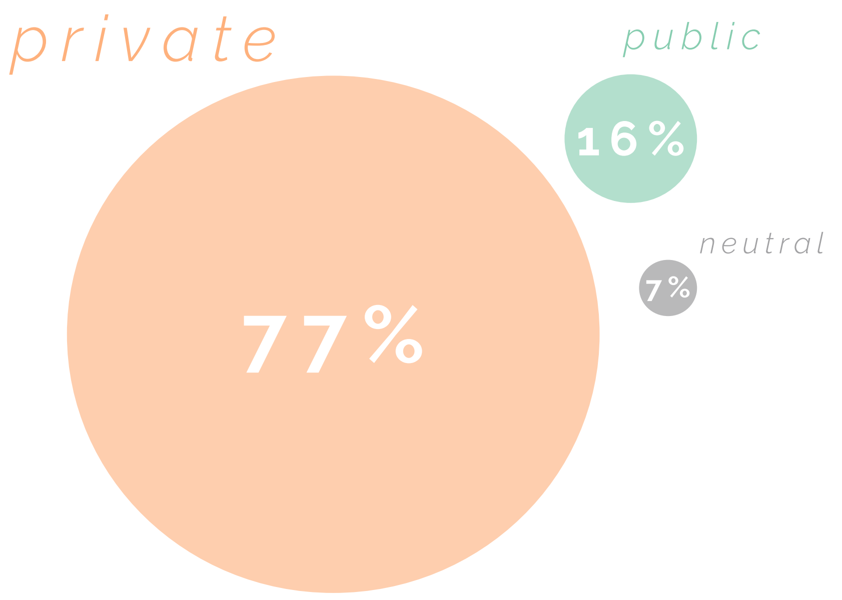
TOTAL AREA = 4606 m2
(from which an average of 120 m2 are wc and storage)

This project will propose a facility for an average of 200 total users.
The private facilities have capacity for 30 people that will permanently inhabit the private rooms of the building, together with an extra average of 100 people that (when fulfilling the requirements) may use the private facilities, then leave at the end of the day (day-care concept).
The public facilities are predicted to be used by an average of 70 people, either external or permanent users - local neighbours or others.

The building will have two promenade halls, along which the different functions of the program will be placed. Each of the halls define the two parallel dimensions of the project program - private and public. The staff rooms should be strategically located as an integral part of the remaining functions, as continuous vigilance is needed.

PUBLIC
The public areas consist of:
- a RECEPTION hall and foyer, where among other services, the users of the private areas can "check-in";
- an open WORKSHOP ROOM, which will be used for weekly activities and open classes of different natures, such as dance, pottery, etc. In summer the workshop can open to the exterior and extend the activity area towards the park;
- a CAFE that expands its use to a CAFE LOUNGE AREA, both opening up to an exterior green area and also to an interior courtyard;
- a MULTI-ROOM, which can be used for events such as small conferences and presentations, benefiting from an exclusive entrance and with the possibility of being isolated from the other public areas.

PRIVATE
The private areas consist of:
- PRIVATE ROOMS and LOUNGES, both turning towards private green courtyards.
- the FAMILY LOUNGE, meant as a neutral leisure and lounge area for the relatives of the permanent inhabitants;
- the COMMON HALL, as transition from the DINNING LOUNGE, which also extends to an exterior green area;
- the ACTIVITY ROOM, which can accommodate yoga, dance classes and other activities, also extending to a green area;
- the PHYSIOTHERAPY and NURSING ROOM;
- a TV-ROOM and lounge that opens up to a potential community garden.



# PRESENTATION

5

ideation

the design

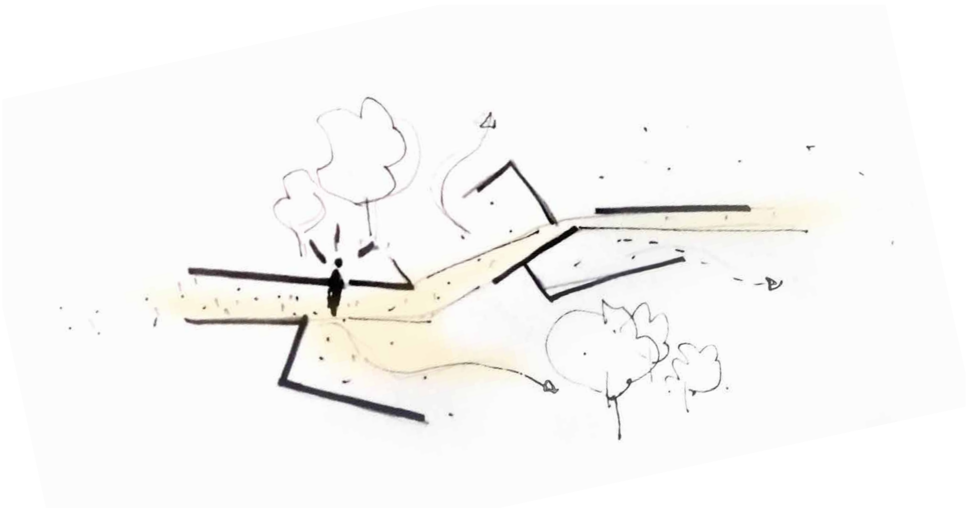
materiality

# IDEATION

## THE CONCEPT

The concept for this project - the promenade - emerged when reflecting on the action of dwelling.

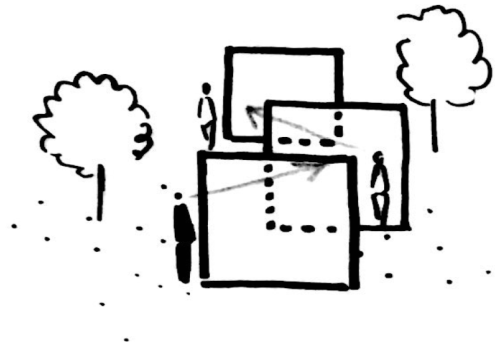
*TO DWELL*
*Action of dwelling and wondering, very common to people with dementia, as well as elderly people. Concept that ironically so, relates to a physical and subjective sense of existence.*



*THE PROMENADE*
INTUITION | PERCEPTION | CONNECTION

The concept of this project is based on the key term that appeared for the first time in Le Corbusier's description of Villa Savoye at Poissy - *promenade architecturale*.
I was interested in exploring the idea of the promenade as an element that supersedes the meaning of "circulation" and that can potentially offer a richer architectural experience. This experience should emerge as a narrative that results from spatial hierarchy, in which indoor or outdoor spaces are read as a sequence of images that unfold as the user inhabits the space.
"Architecture is experienced as one roams about in it and walks through it (...) Architecture constitutes the space of processes of movement."
Furthermore, as this concept connects to a constant visual perception in motion, the experience of space becomes a more intuitive experience, which is also an advantage for the user type of this project.

### spatial Framing

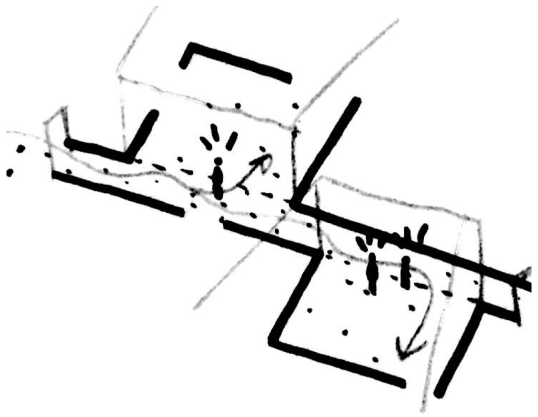


Framing of different focus points throughout the project, allowing the user to inhabit the openings while contemplating outdoors or other areas of the project.

### spatial Layering

Layering of the different room functions of the project - separated by the promenade and greenery, although allowing a continuous and in depth visual connection.

### spatial Contrast



Promenade in a more human scale, comprehending an inhabitable extension of the pockets of specific room programme, being the last ones emphasized vertically in order to establish a hierarchy of uses.

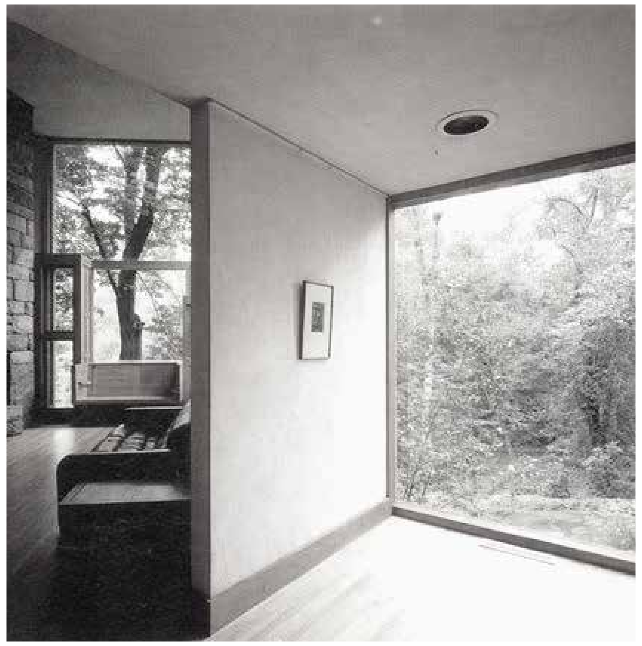
## IDEATION

### INSPIRATION

*"(...)by designing buildings to be self-evident and straight forward. That approach is also good for people without disabilities. The best architecture, weather complex or simple in its spatial configuration, should be self-evident to use."*

These images were references for the design, as they represent simple and clear approaches to the ideas of spatial expression mentioned previously (page 47) - spatial framing, layering and contrast - directly related to the concept of this project.



# THE DESIGN

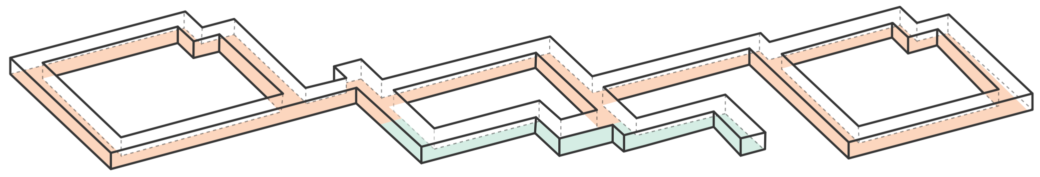
## THE STORY

The idea of this project follows the concept of the promenade as the spatial flow driver of this project.

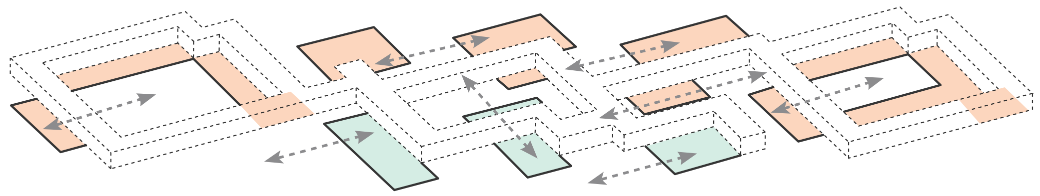
A public and a private promenade halls are designed, running parallel to each other and meeting in two transition nodes in the facility.

Adjacent to the promenade, pockets of space emerge, comprising the main functions of the program. By turning to either the interior or exterior edge of the promenade, the different pockets will either visually relate to each other, or solely turn outwards to the site and surrounding greenery.

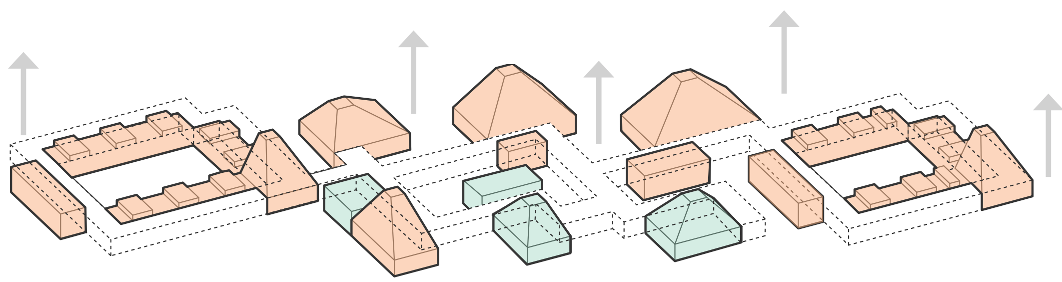
The vertical emphasis on the main functions, as contrast to the scale of the promenade, serve to mark the hierarchy of spaces. This hierarchy and functional separation between spaces will then be highlighted through the ceilings height and ultimately reflecting on the exterior expression of the building.



**Promenades as spatial drivers - public and private**
Two promenades that work as spatial drivers, generating the levels of privacy within the building, while keeping a strong connection with the surroundings.



**Pockets of functions**
Main spaces that emerge and encompass the two promenades, maintaining a visual connection between the functions and shaping the relationship with the site and greenery.



**Spatial hierarchy**
The volumes take shape and rise from a more human scale to a larger one according to the function. The concept of the extrusion of space, having a sky light on the taller and sloped volumes, expresses a exponential expression of this verticality.

Private Public

# THE DESIGN

## SITE PLAN

The mixed-use facility is located in Mimersparken, at the western edge of Nørrebro.

A set back of minimum 10 meters from the western edge was defined, in order to create a green wedge between the train track zone and the building. However, the line distance from Nørrebro to Bispberg is very short (around 500 meters), making the train almost inaudible (the train never reaches maximum speed).

A more organic expression of the landscape is given to the west, south and north of the project - through green hills that range from 0.4 - 1.6 meters and with the specific goal of embracing and protecting the private areas in relation to its surroundings.

The main and secondary entrances of the facility turn east, where the playground and leisure areas of the park are located. The orientation common to the two entrances is also the one to which all the public functions of the facility turn towards to. The orientation of these functions was intentionally defined, in order to connect and link the uses + users of the building and the park, mutually activating one another.

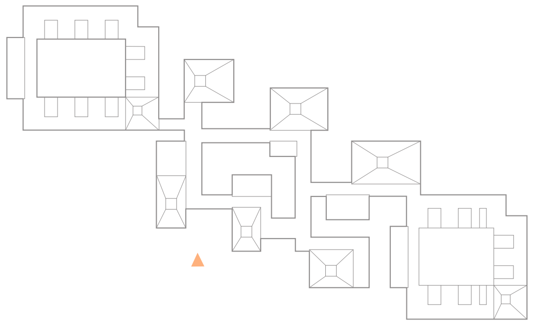
sc 1:1000

## THE DESIGN

MAIN ENTRANCE

The main entrance of the building, defined by a red-pigmented concrete ramp, establishes the beginning of the promenade, which will then extend to the interior of the building. Although originally in bare concrete, this ramp was already part of the site, as it connects the level of Mimersparken (+ 1 meter) to the main road (0 meter). The main entrance is embraced by two volumes - foyer, cafe - defining a more public area, surrounded by greenery and inviting the users in.

A secondary entrance is located further, being mainly used when there is an event and conference, since it has a more direct access to the multi--room. Depending on the occasion, this entrance can be used exclusively for that matter, since that area can be isolated from the inside of the building.



# THE DESIGN

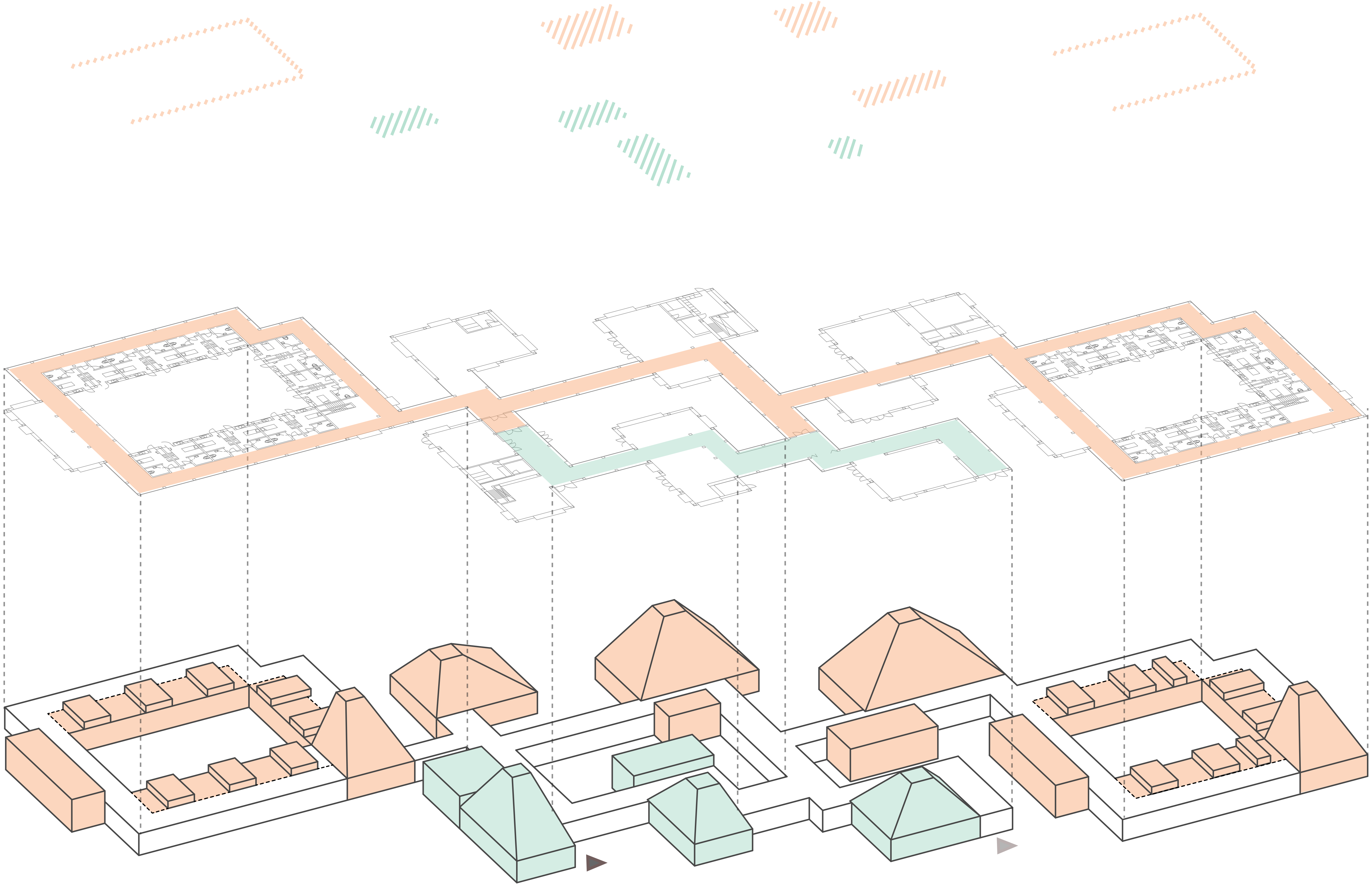
FLOW AND FUNCTION

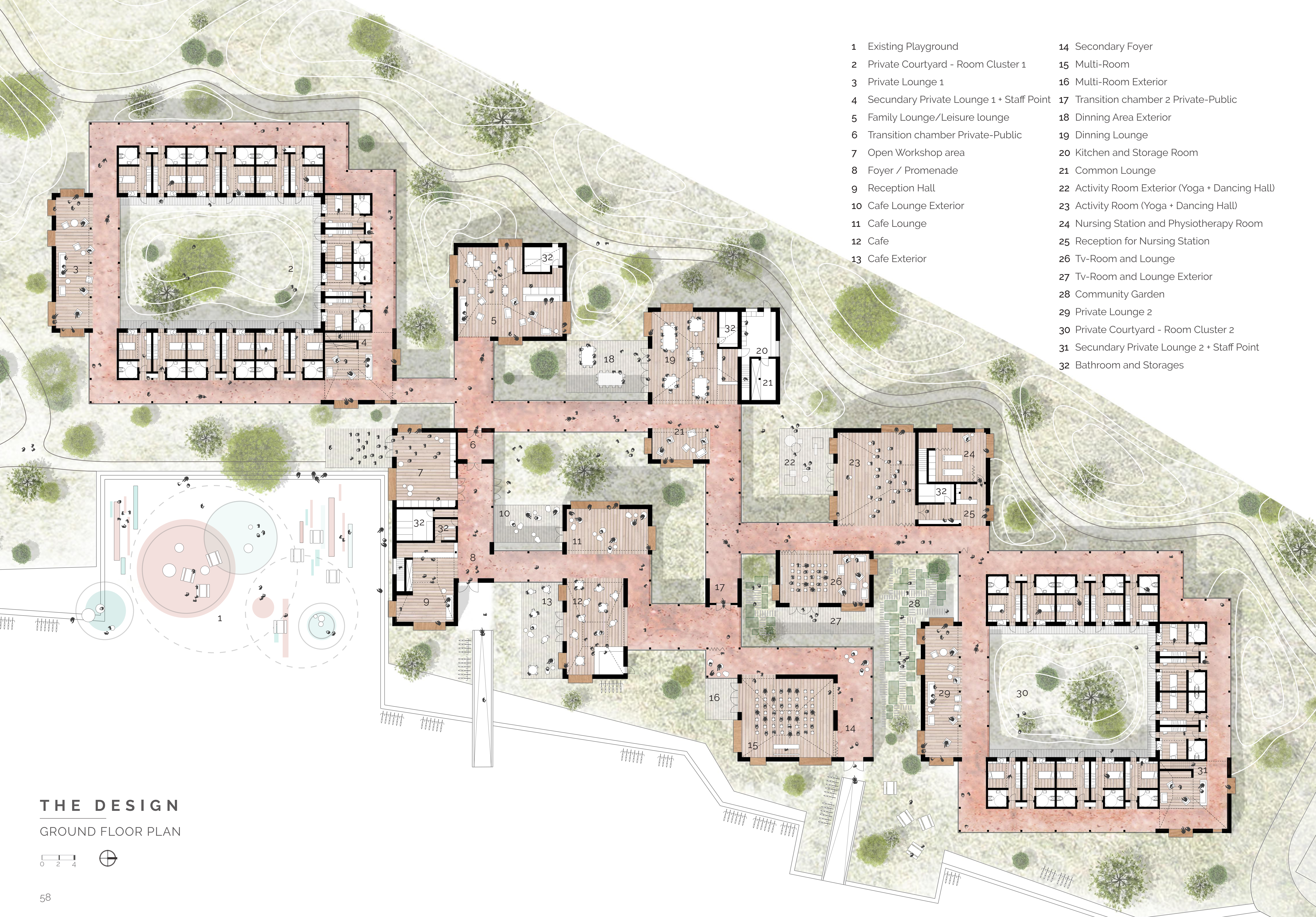
Private Public

EXTERIOR
AREAS
*room function extension*

PROMENADE
HALLS

ROOM
FUNCTIONS



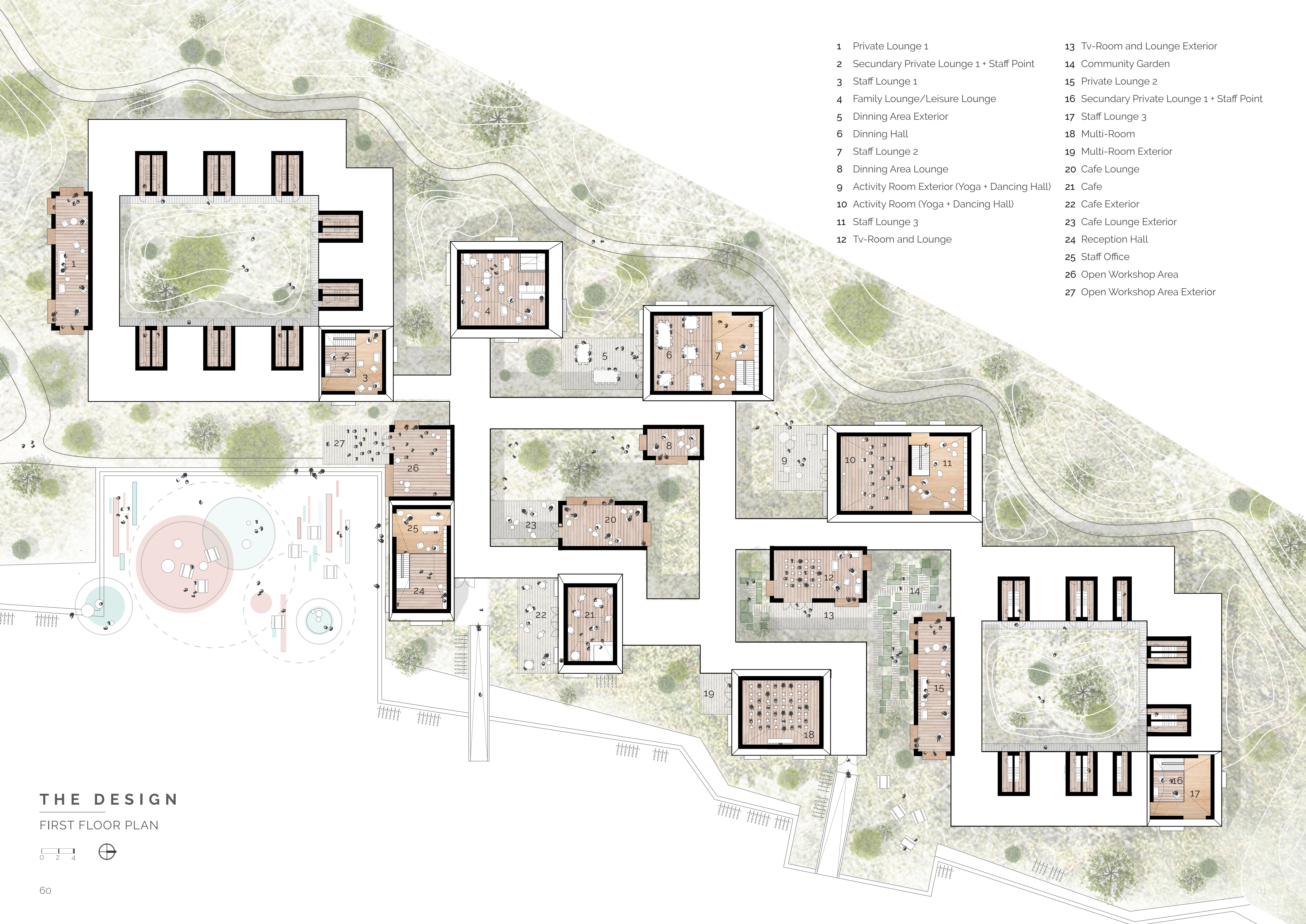


1 Existing Playground
2 Private Courtyard - Room Cluster 1
3 Private Lounge 1
4 Secundary Private Lounge 1 + Staff Point
5 Family Lounge/Leisure lounge
6 Transition chamber Private-Public
7 Open Workshop area
8 Foyer / Promenade
9 Reception Hall
10 Cafe Lounge Exterior
11 Cafe Lounge
12 Cafe
13 Cafe Exterior
14 Secondary Foyer
15 Multi-Room
16 Multi-Room Exterior
17 Transition chamber 2 Private-Public
18 Dinning Area Exterior
19 Dinning Lounge
20 Kitchen and Storage Room
21 Common Lounge
22 Activity Room Exterior (Yoga + Dancing Hall)
23 Activity Room (Yoga + Dancing Hall)
24 Nursing Station and Physiotherapy Room
25 Reception for Nursing Station
26 Tv-Room and Lounge
27 Tv-Room and Lounge Exterior
28 Community Garden
29 Private Lounge 2
30 Private Courtyard - Room Cluster 2
31 Secundary Private Lounge 2 + Staff Point
32 Bathroom and Storages

# THE DESIGN

GROUND FLOOR PLAN

0 2 4



1 Private Lounge 1
2 Secundary Private Lounge 1 + Staff Point
3 Staff Lounge 1
4 Family Lounge/Leisure Lounge
5 Dinning Area Exterior
6 Dinning Hall
7 Staff Lounge 2
8 Dinning Area Lounge
9 Activity Room Exterior (Yoga + Dancing Hall)
10 Activity Room (Yoga + Dancing Hall)
11 Staff Lounge 3
12 Tv-Room and Lounge
13 Tv-Room and Lounge Exterior
14 Community Garden
15 Private Lounge 2
16 Secundary Private Lounge 1 + Staff Point
17 Staff Lounge 3
18 Multi-Room
19 Multi-Room Exterior
20 Cafe Lounge
21 Cafe
22 Cafe Exterior
23 Cafe Lounge Exterior
24 Reception Hall
25 Staff Office
26 Open Workshop Area
27 Open Workshop Area Exterior

# THE DESIGN

FIRST FLOOR PLAN

0 2 4

# THE DESIGN

## VOLUMES

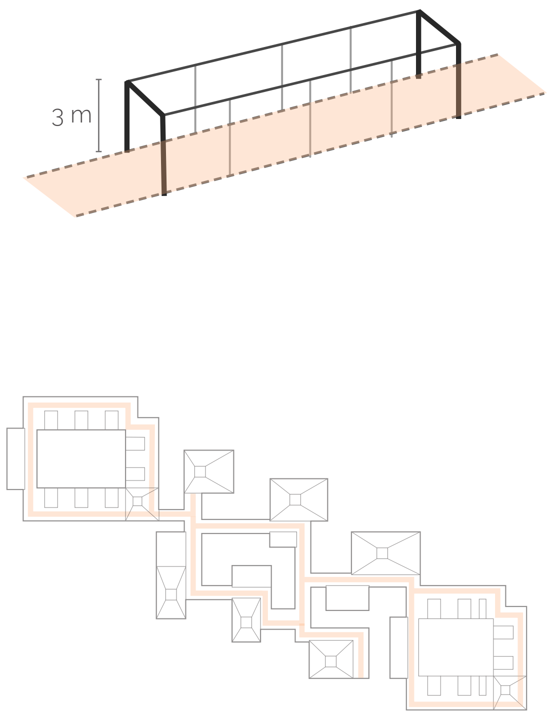
Represented below are the set of volume typologies that integrate and define the different spaces and functions of the building.

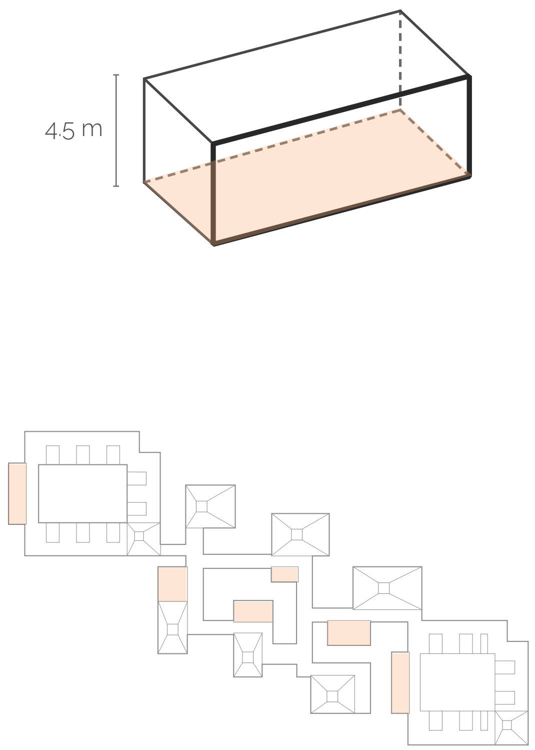
### *typology 1 - PROMENADE*

The first typology consists of the connecting element and flow driver of the project - promenade.
This space is defined as a visually permeable hall, that runs along the facility, adjacent to the main functions and greenery areas.

### *typology 2 - LOUNGES*

This second volume typology corresponds to all the lounge areas. This volume is designed in an intermediate scale and distinguishes itself from the promenade circulation, emphasizing the secondary main functions and creating a balance between the typologies 3 and 4.





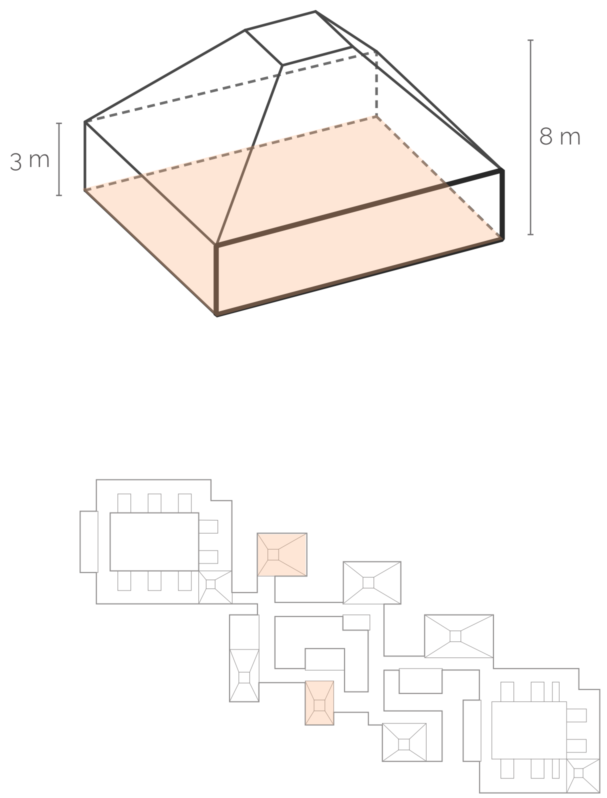

Additionally and as part of the volume's design, there are the two window typologies used throughout the project. The first one of them is a system of full glazing framed in black steel and supported by the structural columns, used in the promenade halls and materializing its more permeable character.
The second type of opening consists of niches in glass and wood, framed and structured in black steel and extruded from the facade alignment. This second window typology provides an integrated layer of furniture that is consistent throughout the main functions, allowing for partially enclosed and human scale nooks for the users to sit and contemplate from. These windows emphasize the idea of framing, defining different views from a specific room, towards the surroundings and other zones of the facility.

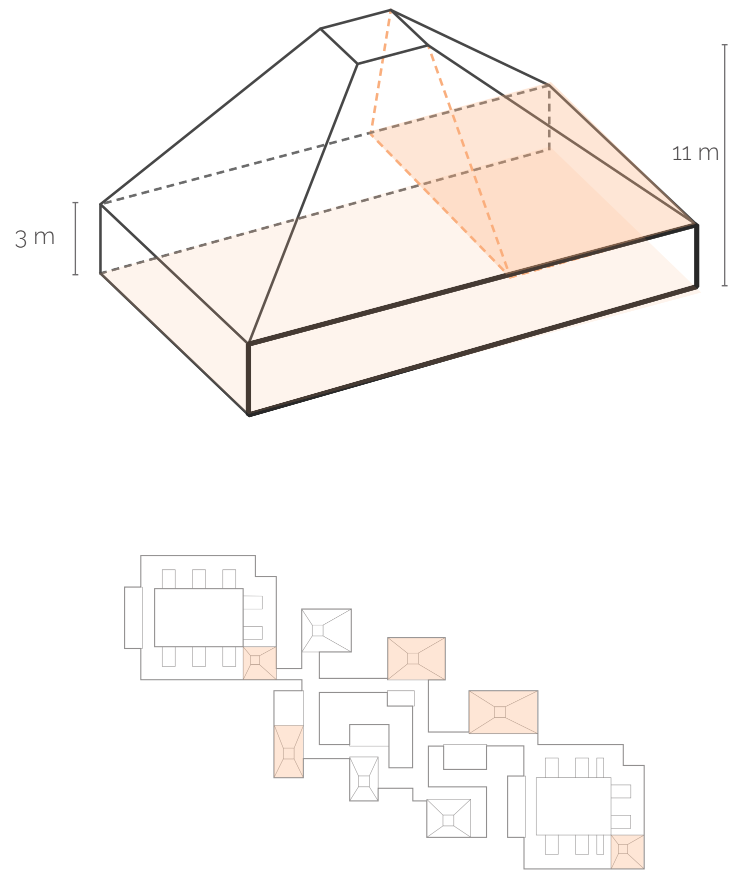
### *typology 3 - TOWER 0*

The main programme functions are defined by this third typology - *tower 0*. This volume consists of a sloped roof ending on a skylight, spatially contrasting from the promenade and emphasizing the central functions of this facility.

### *typology 4 - TOWER 1*

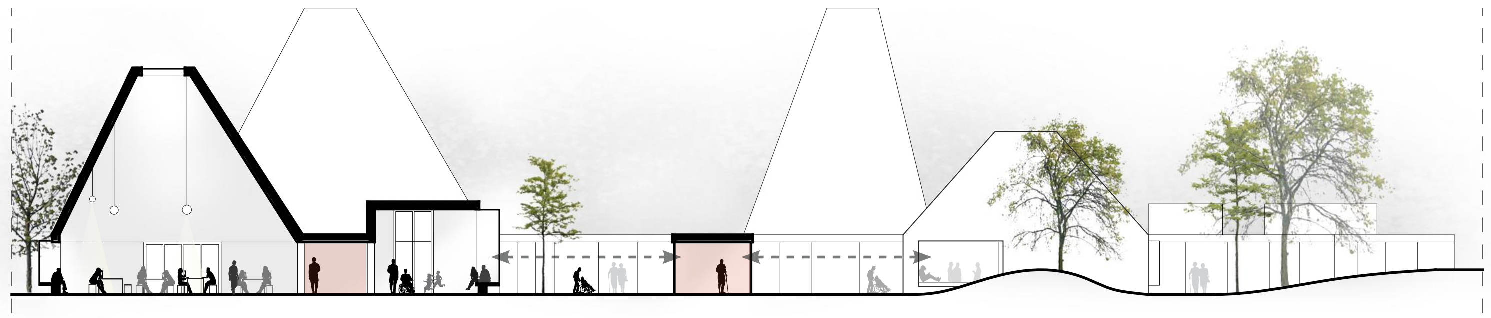
The staff lounges define the fourth typology - *tower 1*, which follows *Tower 0* principle, although taking on a bigger scale. Even though the aim was to think of the staff zones as rooms for the workers to somehow distance themselves from the service areas, it was also important to allow the staff to keep vigilant of the users.
For this reason, the staff lounges were designed on a second level above the main functions, setting back from the skylight and overlooking the main functions bellow.



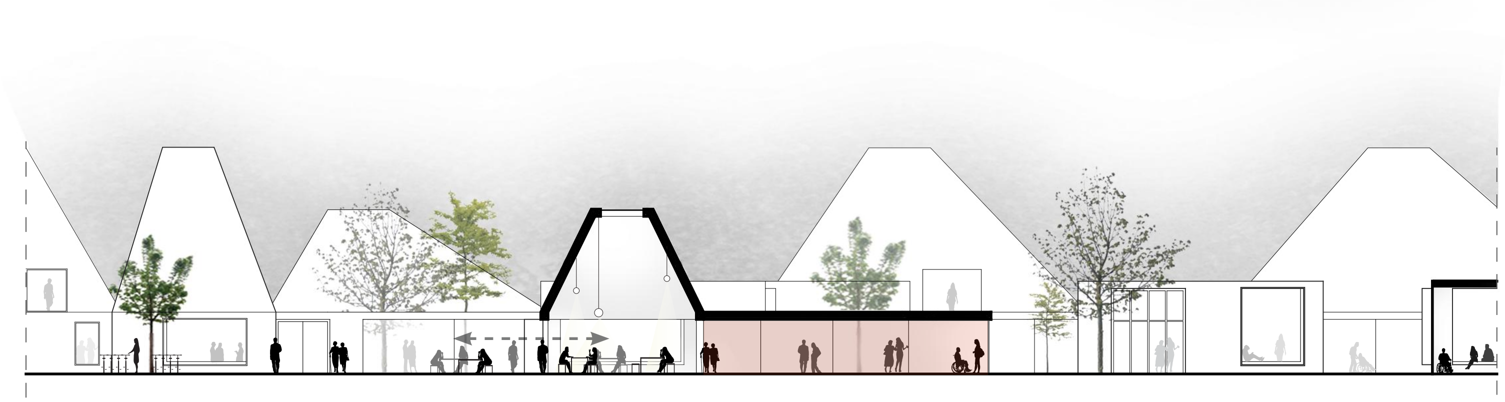



# THE DESIGN

## VOLUMES



Section A

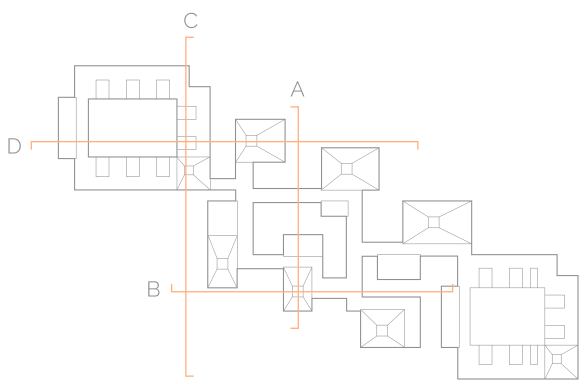


Section B

visual connections between functions

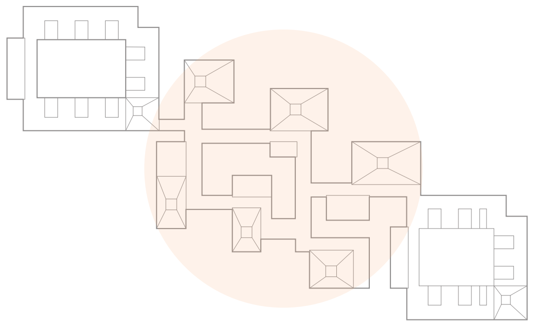
*promenade* halls

Section C




Section D

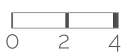
0 2 4



## THE DESIGN

### CORE FUNTIONS

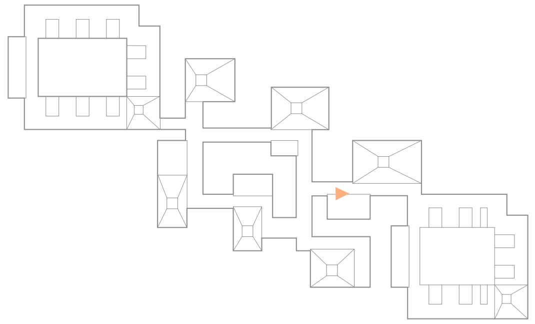
This plan focuses on the public areas and on private common rooms of the facility, which integrate the core of the building uses.



## THE DESIGN

CORE FUNTIONS

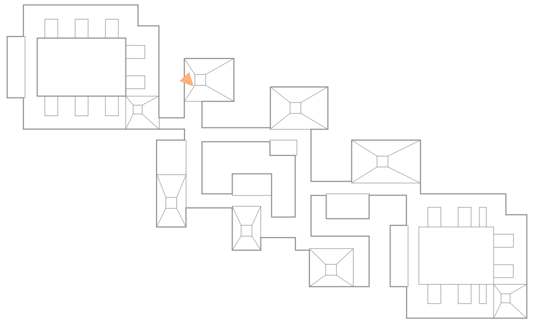
The private common areas are adjacent to the promenade, generally turning outwards on the main functions and inwards in the case of the secondary rooms/lounges.
The image below shows the tv-room + Lounge, while looking across to the activity room and its external area. As it is intentional throughout the project, the visual connections are consistent, allowing the user to have a deeper sense and perception of the surroundings. Because it is not a direct physical connection between the different room functions, but rather a visual one, it is established a sense of spatial intuition, without disrupting or interfering on the user experience of each space.
The user can be relaxing in the tv-room/lounge and look through to the green area, appreciating others doing yoga or other activities OR the user can be on a setback area of the tv-room/lounge, overlooking a more distant scenario such as the community garden or the further private cluster. This level of spatial depth is given by a spatial layering, framing and contrast, providing the user with a sense of safety and belonging.



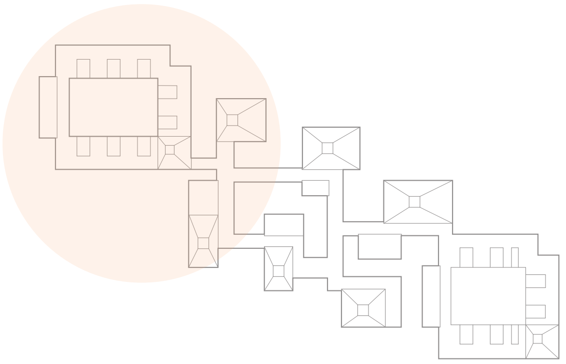
*Activity Room and exterior area + Lounge*

## THE DESIGN

CORE FUNTIONS



*Family Lounge/Leisure Room*



## THE DESIGN

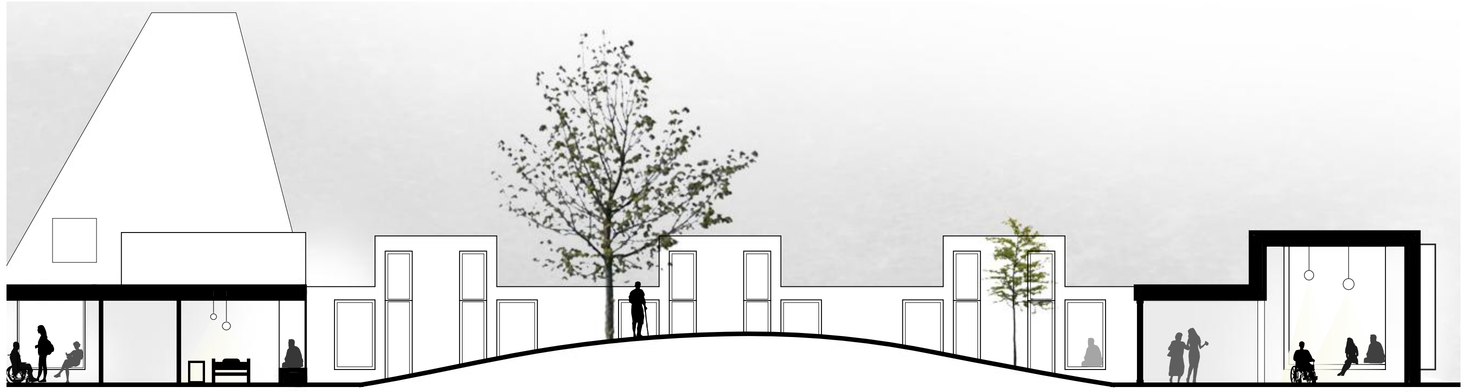
PRIVATE CLUSTER FUNCTIONS

This plan focuses on the typology for the rooms cluster, consisting of the most private area of the facility. This area integrates a green courtyard, to which the private rooms and the private lounge turn towards to, a secondary private lounge that allocates a staff area above and a promenade hall that connects these functions to each other.
The private cluster is located in the two extremities of the facility, being the one represented, located on the southernmost zone.

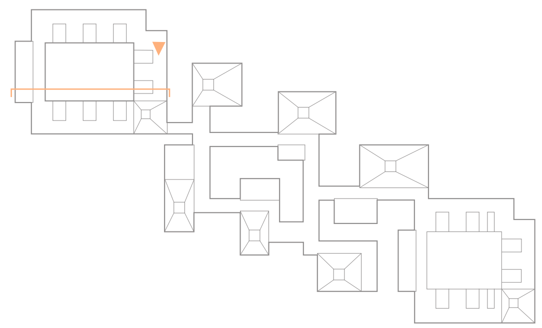
0 2 4

# THE DESIGN

PRIVATE CLUSTER FUNTIONS



The private rooms are organized around a green courtyard, having their entrances turning to the *promenade* hall. The doors of the rooms are mainly grouped two by two and set back - creating a small niche. This niche slightly distances the entrance from the *promenade* edge and has an exposed steel column, which divides the two doors and also integrates a bench.

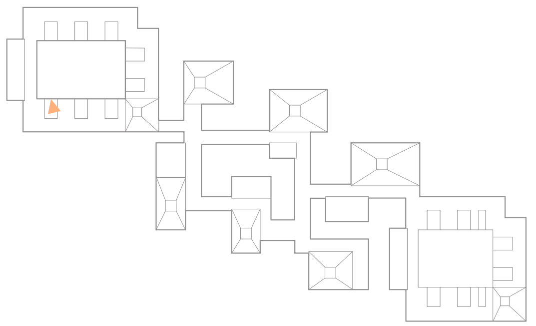


*Private Lounge and Courtyard*

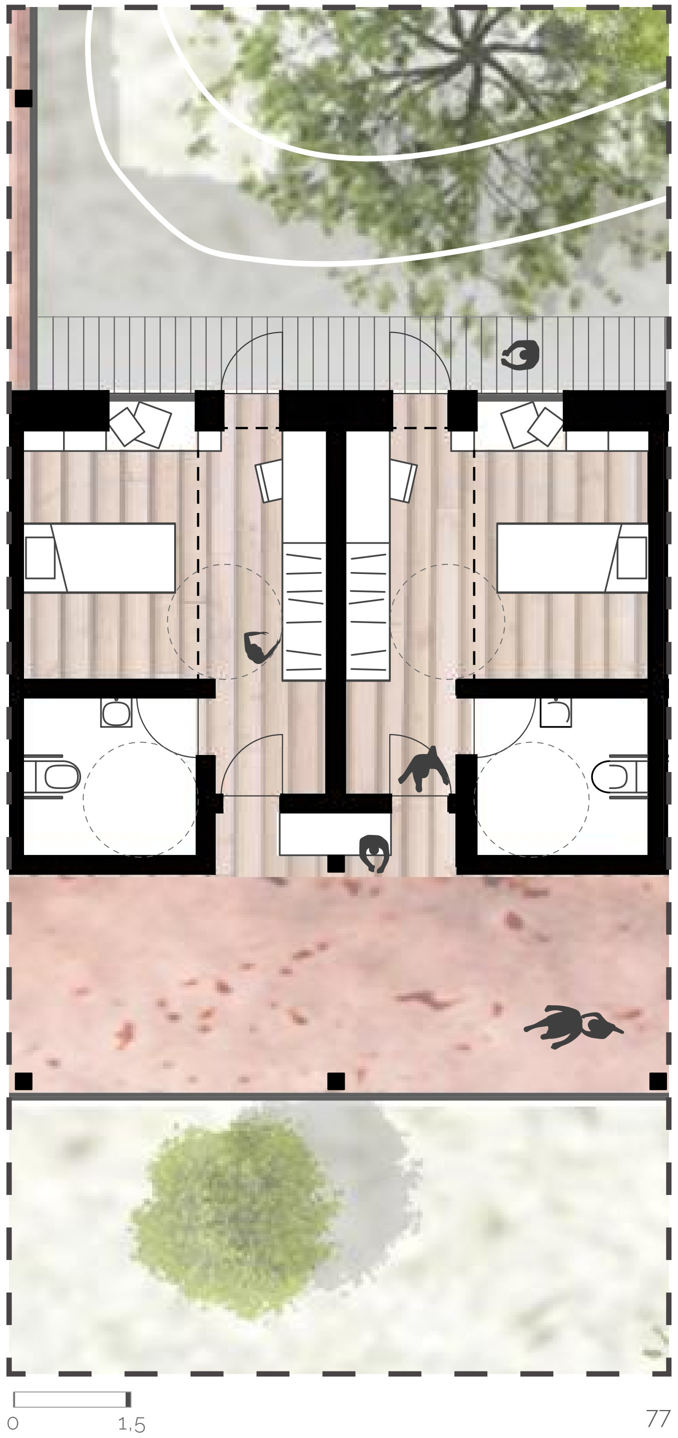
# THE DESIGN

## PRIVATE CLUSTER FUNTIONS

The private rooms are distributed around a green courtyard. This courtyard has the landscape rising around 1.2 meter, which provides a visual barrier in between the rooms opposite to each other.
The atmosphere of the room is warm and inviting, with a white interior wall and brick cladding on the wall next to the courtyard door. The brick is partially used in the interior cladding, as it relates to the link with the exterior (exterior facade also in brick tiles). This analogy is also emphasized through the ceiling's height, which runs 1 meter higher from the entrance door of the room and until the door that leads to the courtyard. The floors are in wood, extending towards the green area and the window framed in black steel, being also integrated as furniture.



*Private Room typology and Courtyard*



# MATERIALITY

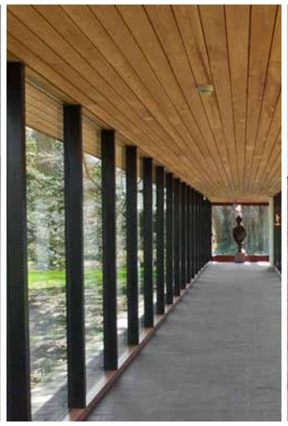
## MATERIALS

From the beginning, it was important to keep a relationship with the surroundings and reference the most typical and dominant material in Copenhagen - the brick. This emerged from the idea of establishing a sense of reminiscence, which would be important for the users, therefore helping to create a somehow inherent familiar atmosphere.
The main functional parts of the building are clad in brick tiles, supported by a system of steel columns and beams. The interior is clad in white plaster board, being the floors in pine wood (with the exception of the *promenade* halls), which emphasizes a warm and natural atmosphere.
Conversely, the *promenade* pavement, adjacent to the remaining functions, is in red-pigmented concrete - relating to the tone of the brick. This material underlines the promenade element as a strong link within the project, also helping to guide the users. In this case (*promenade*), the interior ceiling is in wood planks, being the external slab clad in fiber cement.
Black steel is also a material with a relatively strong presence as it is structurally exposed in the promenade, as well used as material for the frames of the windows. There are two main types of openings in the facility. The first type is present throughout the promenade and it is a full floor to ceiling glass, framed in black steel. The second type of opening consists of glazed niches, also framed in black steel, extruded from the facade alignment and integrating a wood seat on the interior.

### MATERIAL REFERENCES

INterior


White cladding


Glazing, Black steel and Wood ceiling (*promenade*)


Red-pigmented concrete floor (*promenade*)


Window niches


Wood flooring - Pine

EXTterior


Red Brick Tile


Glazing, Black Steel (*promenade*)


Fiber cement slab cladding (*promenade*)

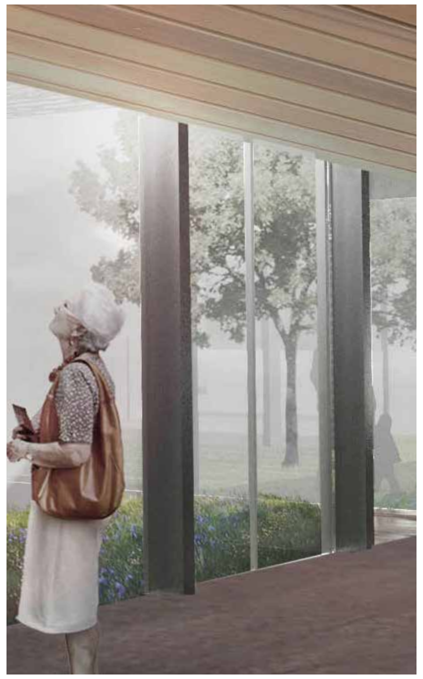

Window niches


Wood Deck

## ATMOSPHERE

INterior


Wood Flooring

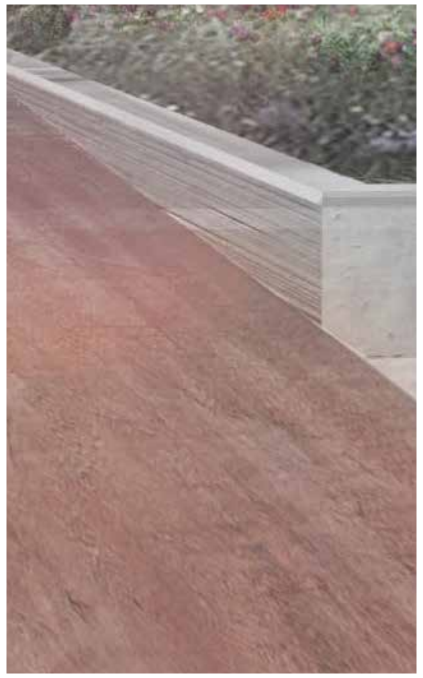

Wood Ceiling, Black steel structure and window frames and Red-pigment Concrete (*promenade*)


Window Niches with black steel structure and wood

EXTterior


Red Brick Tiles


Fiber ciment clad slab, Black Steel frames and structure (*promenade*)


Red-pigment Concrete pavement (*promenade*)

# MATERIALITY

## FACADE ELEVATIONS

South Elevation

North Elevation

East Elevation

West Elevation

0 2 4

# MATERIALITY

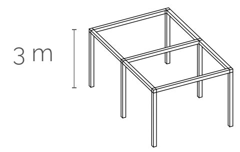
## CONSTRUCTION

The structure has a very important role as it reinforces and encompasses the ideation of the project, emphasizing a holistic perception and tectonic quality of the spaces.
The structure used for this project is a system of steel columns and beams - HEB 160 (as determined through the analysis - see appendix). This structure has the columns exposed throughout the promenade, and it is fully hidden in the main functional volumes (towers + lounges).

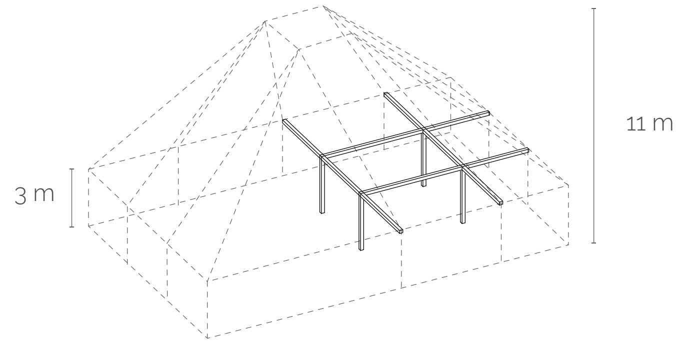
### Hidden Structure | Exposed Columns

By having the structure hidden in the main volumes and exposed in the promenade, the perception of contrast and hierarchy between circulation/dwelling halls and the core functions is emphasized. In the main volumes - towers and lounges, the experience is less transient and more permanent, as oppose to the promenade, in which the columns establish a visible rhythm and encompass a more permeable character.

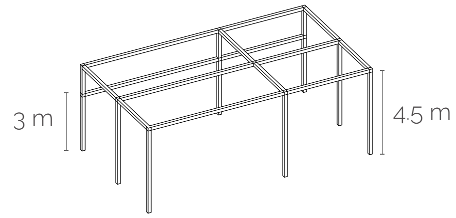
Even though on the volume typologies tower 0 and 1, the structural principle is the same as it is in the promenade, the gesture is different. In this case the beams are angled, generating a sloped roof that ends in a skylight. The top of the roof, where the skylight is located, is held by a ring steel which braces the angled beams in the attempt of increasing the structural rigidity and stability. Besides the rigidity element on the skylight, it has also been used a second steel ring in a lower level, which showed to statically help - analysis represented on the appendix.
A secondary structure is also used on the *tower 1* typology, serving to support the slab of the staff lounge located on the first floor (see figure on the right - C). It was chosen to have the slab supported as a structure that is independent from *Tower 1*, as it seemed more efficient to calculate *Tower 1* elements separately.



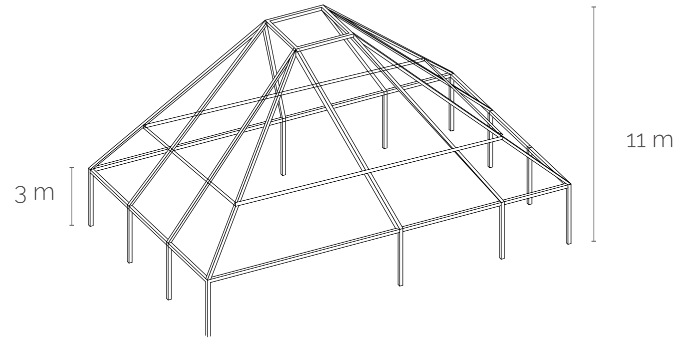

*A - Promenade*



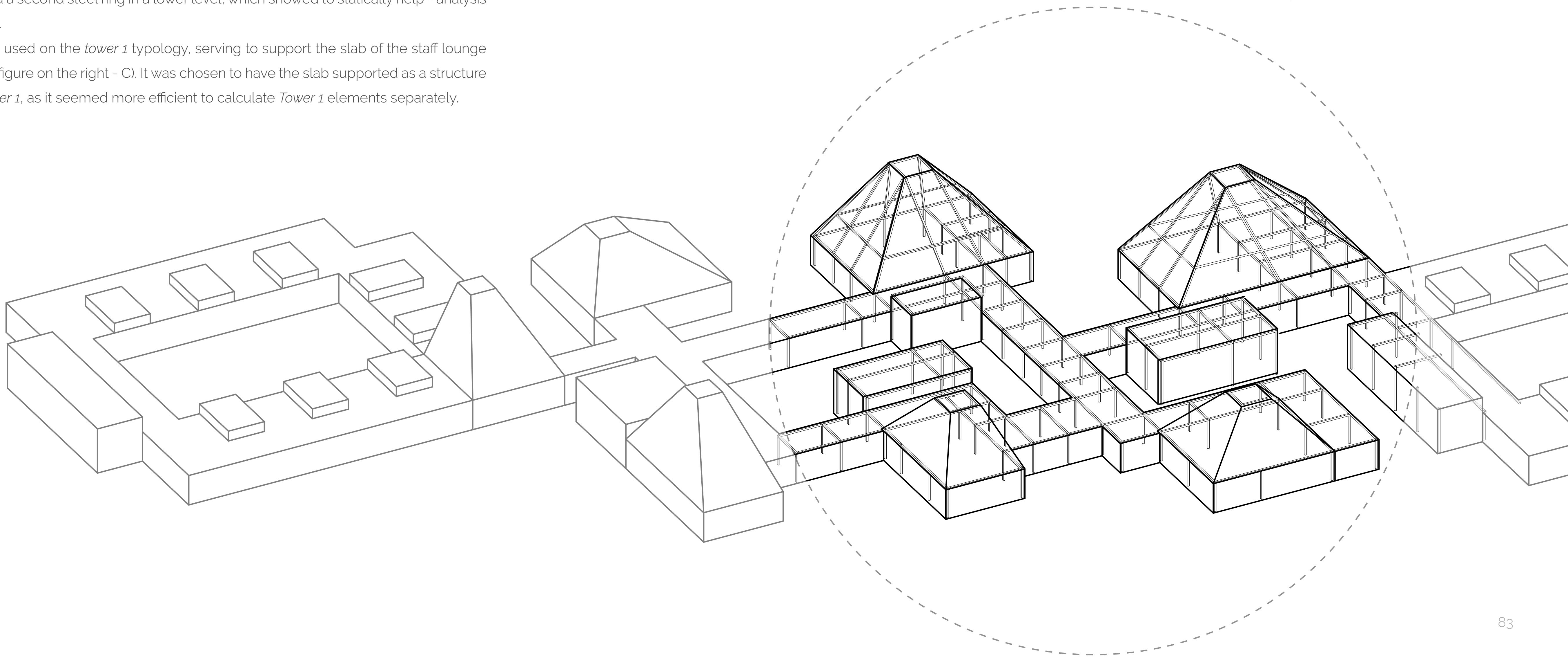

*C - Tower 1 staff*




*B - Lounges*

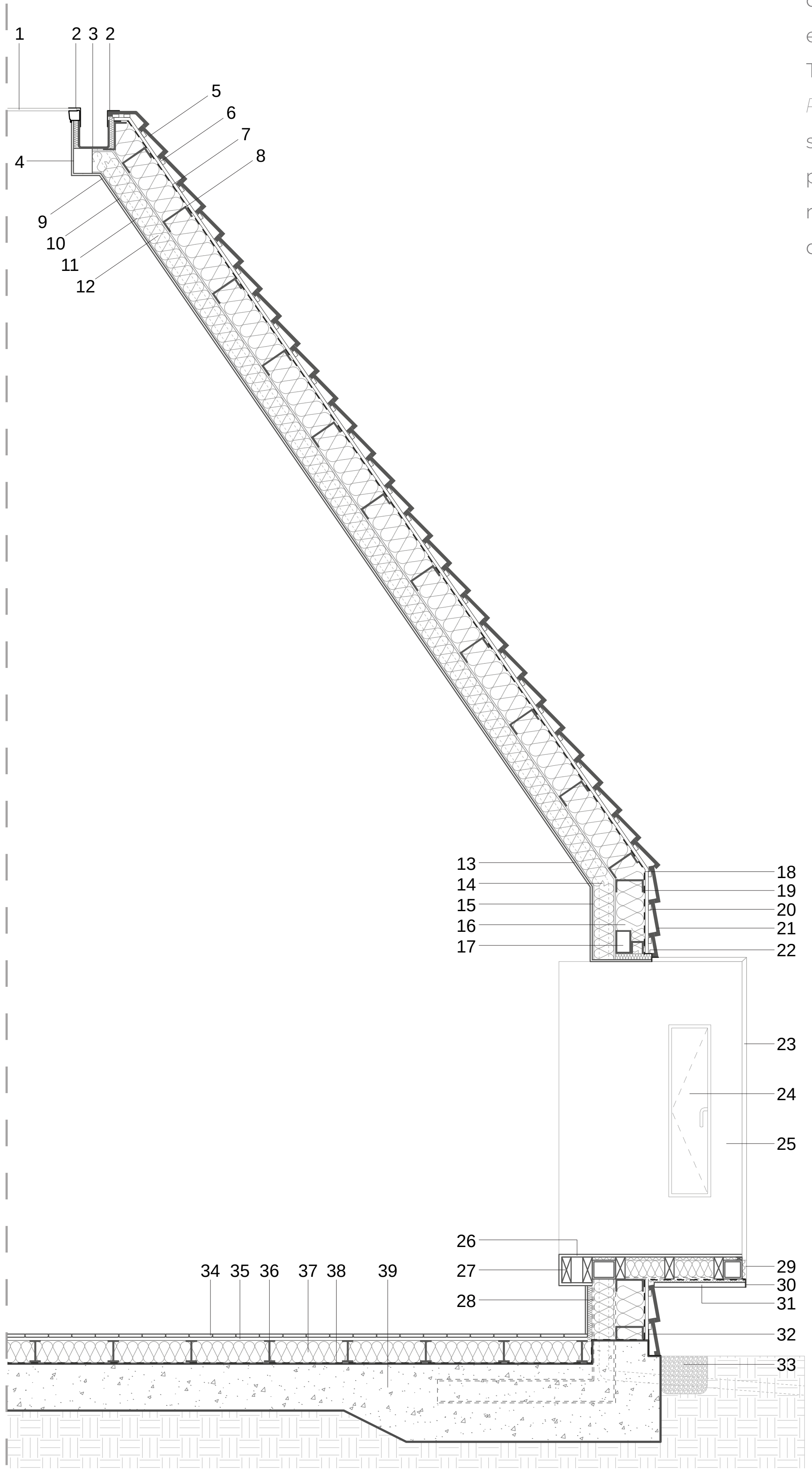



*D - Lower 1*

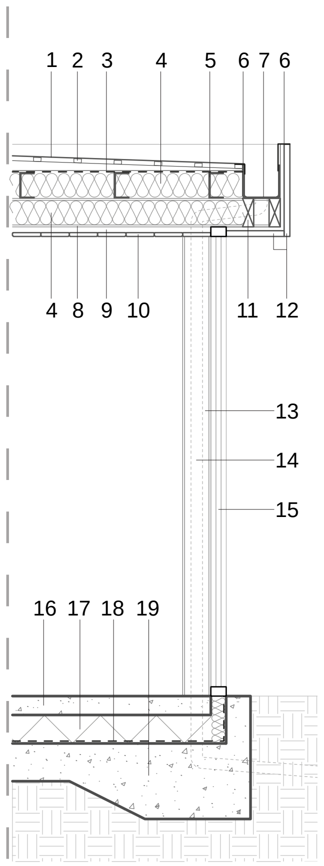


# MATERIALITY

## DETAILS
scale 1:40




Detail A




Detail B

The detailing design offers an overview of the construction of the building, and clarifies the larger scale expression of the elements.

The two typologies - *Tower* and *Promenade* - are shown in a full section going through the correspondent typical window and they represent the most important and defining elements of the building.

### Detail A

**Roof**

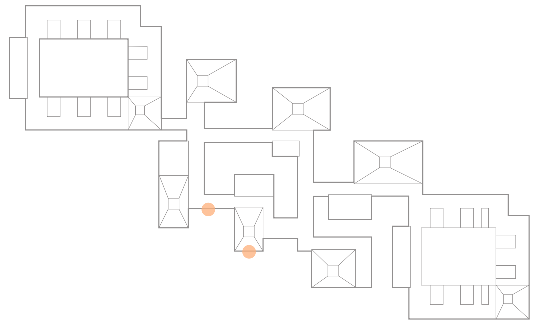
1 Velux flat roof skylight
2 Zinc flashing
3 Zinc box gutter 200x200mm
4 Ring Steel Beam
5 Petersen Cover C23 facade tile 240mm
6 Wood facade battens on joists
7 Vapour barrier membrane
8 'C' joists 180mm
9 White plasterboard 13mm
10 'I' beam 160mm
11 Rockwool insulation between beams and joists
12 Zinc downpipe 60mm to stormwater drain

**Window niche/wall**

13 White plasterboard 13mm
14 Zinc downpipe 60mm to stormwater drain
15 'I' column 160mm
16 Rockwool insulation between columns and joists
17 Steel lintel
18 Vapour barrier membrane
19 'C' joists 180mm
20 Wood facade battens on joists
21 Petersen Cover C23 facade tile 240mm
22 Two aluminium back to back channels
23 Structural glass 6/16/6 with stepped edges and black silicon joints
24 Side-hung window with locking handle
25 Pine window reveal with wax finish
26 18mm pine seat with wax finish on vapour barrier and 20mm rigid insulation
27 Timber seat frame members
28 Bitumen painted steel 'Z' frame fixed back to locally thickened ground slab
29 Back-painted toughened glass in front of structure with 20mm rigid insulation behind
30 Aluminium angle
31 Equitone classic grey fibre cement panel backfixed
32 Flashing
33 Gravel rainwater pit

**Floor**

34 Pine floor boards
35 Floor battens
36 'I' joists 150mm
37 Rockwool insulation between joists
38 Vapour barrier membrane
39 Reinforced concrete foundation 300mm thickend to 500mm under structural columns and 'Z' frames



### Detail B

**Roof**

1 NedZink zinc roof sheeting
2 Wood roof battens on 2° angled joists
3 Vapour barrier membrane
4 Rockwool insulation between beams and joists
5 'C' joists 150mm
6 Zinc flashing
7 Zinc box gutter 200x200mm
8 'I' beam 160mm
9 Wood ceiling battens
10 Pine ceiling boards
11 Supporting battens
12 Equitone classic grey fibre cement panels backfixed

**Wall**

13 'I' column 160mm
14 Zinc downpipe 60mm to stormwater drain
15 Window structural triple glazing with low-E coating

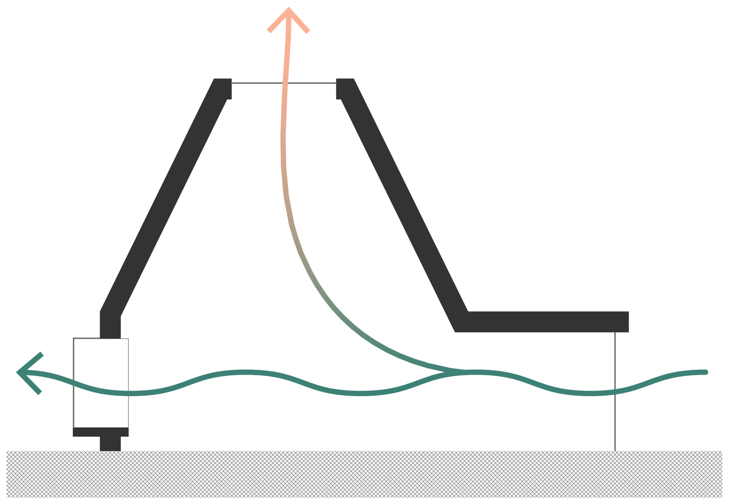
**Floor**

16 Red-pigmented concrete 100mm thermal mass
17 Rigid insulation 150mm
18 Vapour barrier membrane
19 Reinforced concrete foundation 200mm thickend to 400mm under structural columns

# MATERIALITY

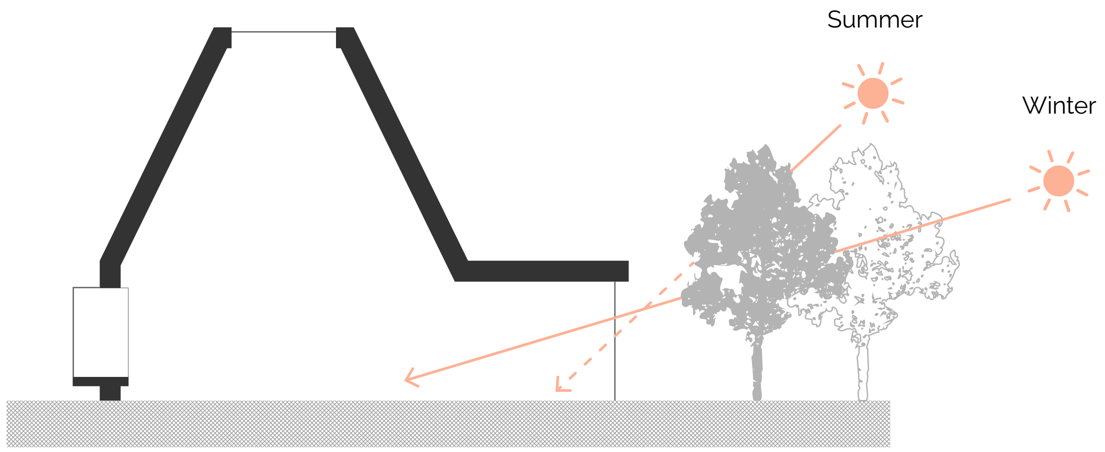
## SUSTAINABILITY

Although sustainability is not the dominant theme chosen for this project, design considerations have been integrated throughout the process to ensure passive sustainability strategies can be utilised. These strategies promote a better indoor environment and reduce the building's energy consumption.



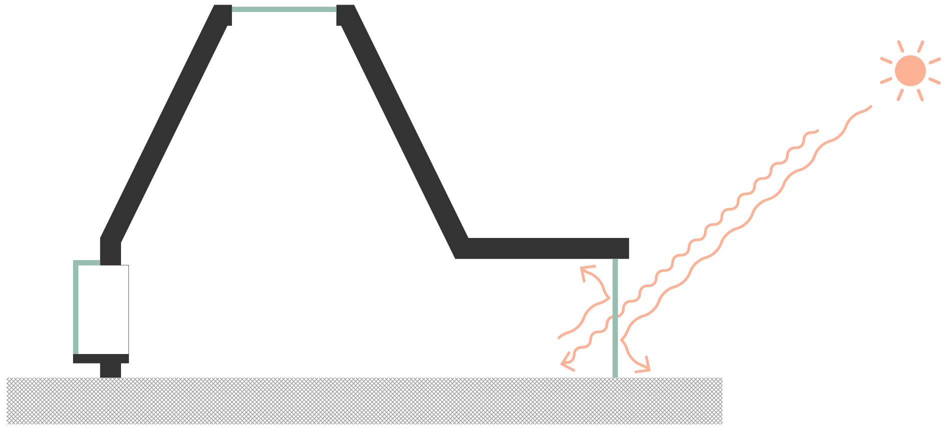
**Ventilation**

The considered positioning of openings facilitates cross ventilation in all parts of the building, and the stack effect in the towers, naturally cooling the building and venting to provide adequate fresh air inside.



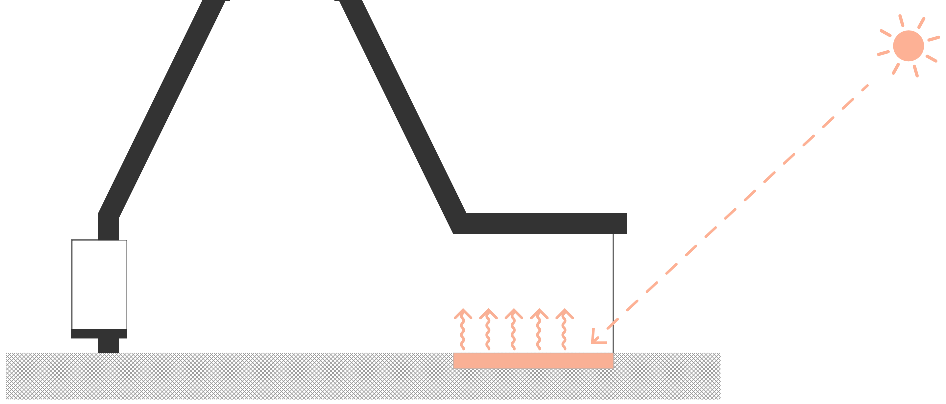

**Vegetation**

Deciduous trees shade openings in the summer while allowing light to pass through in the winter months. Use of vegetation around the building will also reduce the heat island effect of the surrounding urban context.



**Glazing**

Low-E coated glazing allows daylight to enter the building, while reducing heat transfer, keeping the warmth in in winter and the heat out in summer.



**Building envelope**

A well insulated and airtight building envelope minimises heat loss/gain in the building. Specific material choices, such as concrete flooring, allow for thermal mass to be used in maintaining a comfortable internal climate.

# CONCLUSION

6

reflection

# REFLECTION

This project contains a social approach, used as a design driver. The social realm together with tectonic architecture, aimed to achieve a spatial expression that ultimately responded to the functional problems established by the programme, while striving for a holistic result.
My proposal is a building that seeks to improve the experience of spaces for demented and elderly people, trying to get further from the typical institutional atmosphere by integrating mixed-use functions, embracing the surroundings and local community.

# APPENDIX

# 7

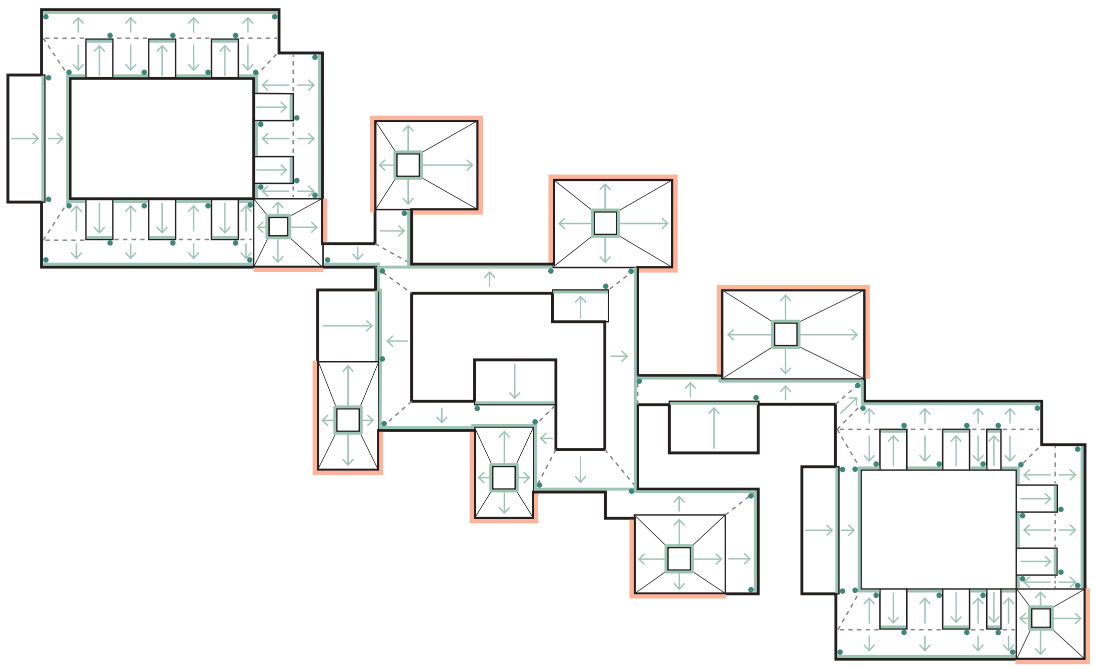
Serviceability Plans

Structural Analysis

Sources

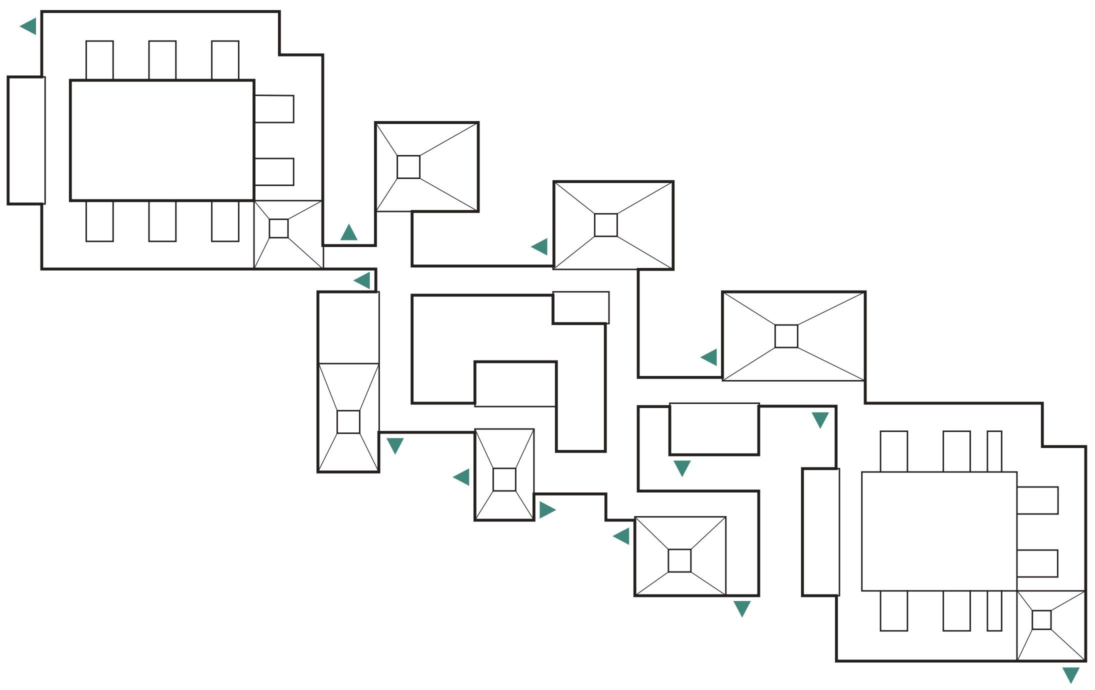
# SERVICEABILITY PLANS

## DRAINAGE



Slope direction
Roof ridges/valleys
Gutters
Downpipes
Gravel drain

## EMERGENCY EXITS



Emergency exits

# STRUCTURAL ANALYSIS

The process of defining the structural principle started by a preliminary sketching phase in which the form and geometry were explored, based on the relevant parameters that relate to the concept, users, site and program.

As the design progressed, it then became essential to test the structural behaviour of the structural typology of the largest tower, pointed on the diagram (on the right page). This volume typology was chosen as it seemed to be the most potentially critical, due to the long length of the angled beams.

The structural analysis was done through the software - Robot Structural Analysis Professional, making it possible to test all possible load combinations according to the Eurocodes, therefore finding the worst case for dimensioning. By using Robot to test the structure, it is provided a more objective and detailed insight of the overall performance of the elements.

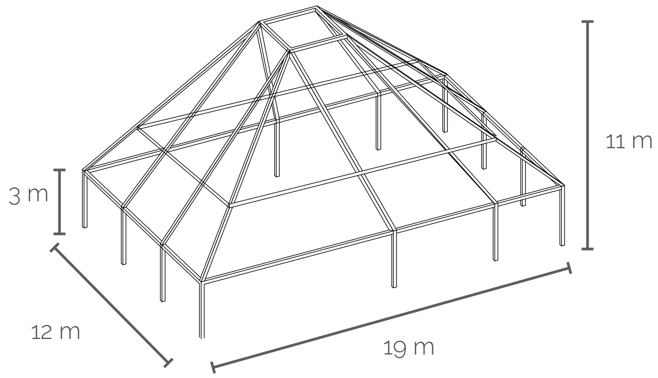
Process

1 - Started by calculating the different loads (shown on the right) to input the necessary parameters in Robot.

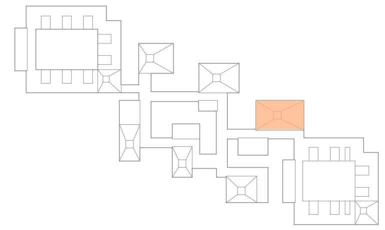
2 - Experimenting with steel, but also with wood in order to understand which material is more optimal. Started the test in 2D and using a fairly large section for the beams - 300 mm for and 100 mm for the columns. (page 98)

3 - The 2D had similar positive results both in steel and wood. For this reason and also due to the asymmetric nature of the structure, I decided to try and design de structure in a 3D version in Robot. This way, the columns and beams were tested as a group, giving more accurate results. (page 99)

4 – Final considerations - steel ultimately works better. Further adjustments of the section dimensioning and addition of extra elements to increase rigidity and reduce the buckling effect.




Structure Dimensions



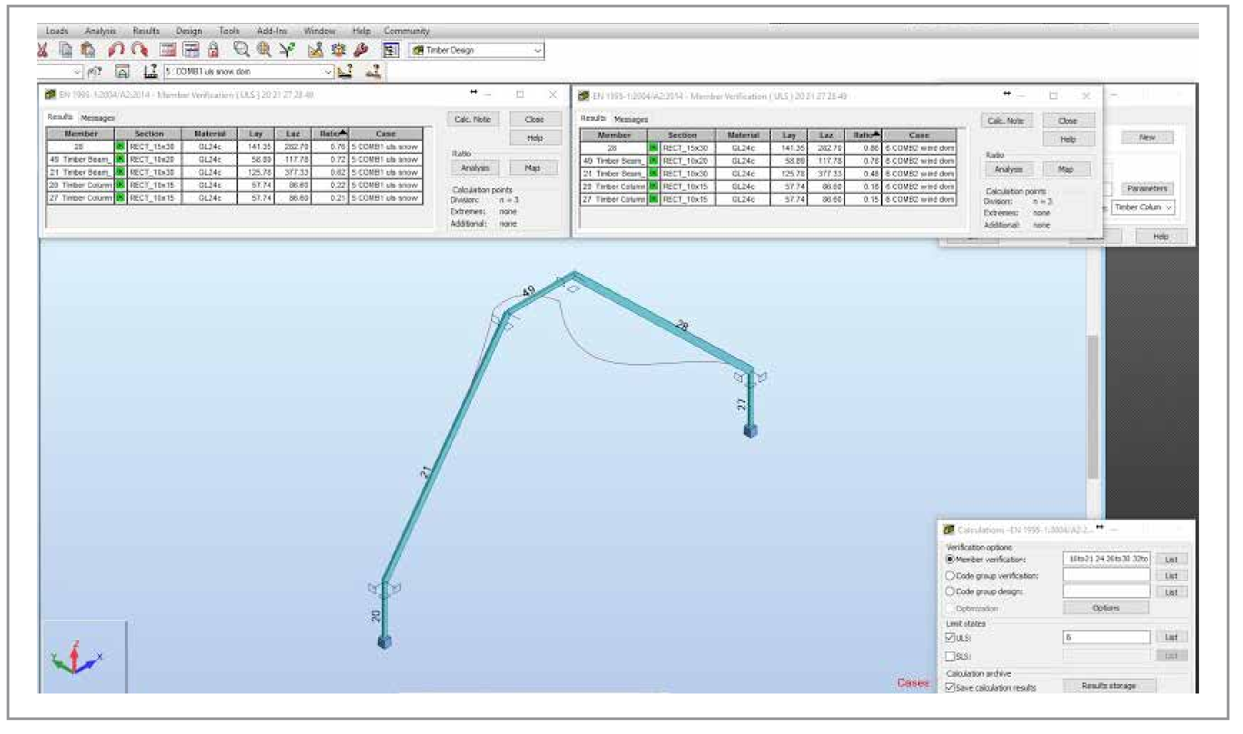
## Load Calculations

| Roof | Snow | Wind |
|---|---|---|
| total = 1,1 kN/m2 | total = 0.32 kN/m2 | total = 0.64 kN/m2 |
| To calculate the roof load, the weight of all the material components was considered, being the final roof load the sum of all these elements.<br><br>Roof Tiles - plain tile 311 handcrafted: 77,5 Kg/m2<br>(1.25 kg/tile and 62 tiles/m2)<br><br>Secundary Structure: 14,6 Kg/m2<br><br>Rockwool Insulation: 9 kg/m2<br><br>Plasterboard: 8,35 kg/m2 | $S = u_1 C_e C_1 S_k$<br><br>a (roof inclination degree) = 50º<br><br>$u_1$ (form factor depending on a)<br>30º < a < 60º = 2.4 - 0.04 a = 0.4<br><br>$C_e$ (exposure factor) = 1<br><br>$C_1$ (thermal factor) = 1<br><br>$S_k$ (characteristic terrain snowload) = 1 | The wind load value was directly taken from a static calculations chart (in references). This chart represents the typical wind loads depending on the terrain class or terrain roughness.<br>The terrain classes go from 1: flat areas without vegetation, to type 4: at least 15% of the surface is covered with buildings. Because the site of this project is closely located to a relatively dense housing neighboorhood, though less dense on the oposite side, it was considered terrain class 3. |

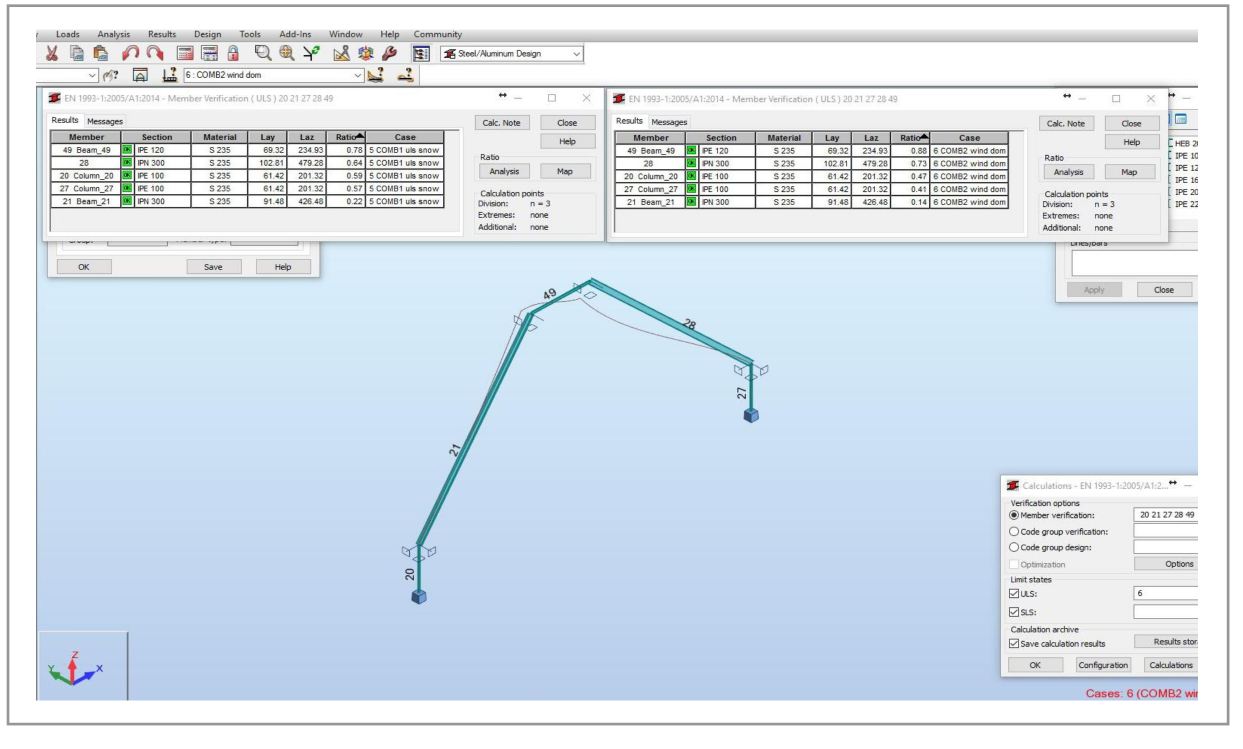
*Some of the data of the calculations was taken from documents with standard values - check Appendix 1, in references, and under the technical section.*

# STRUCTURAL ANALYSIS

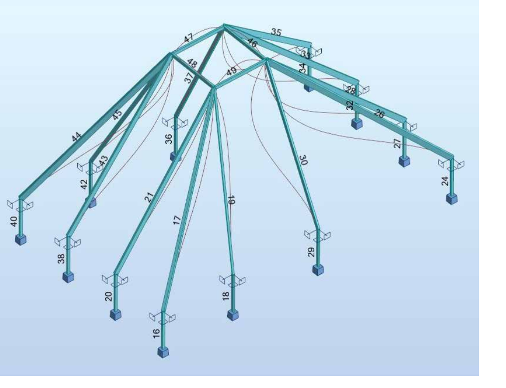
## Preliminary 2D Analysis - Glulam

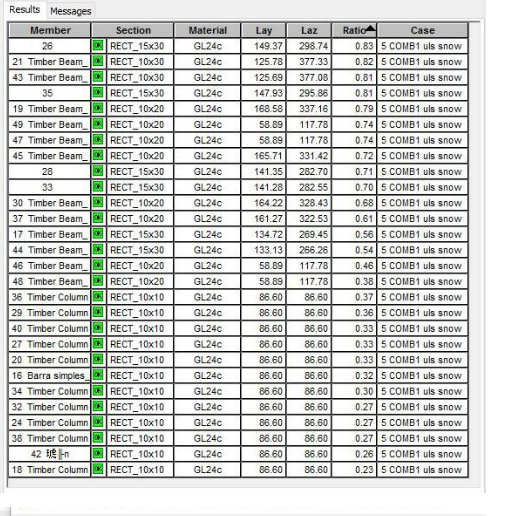


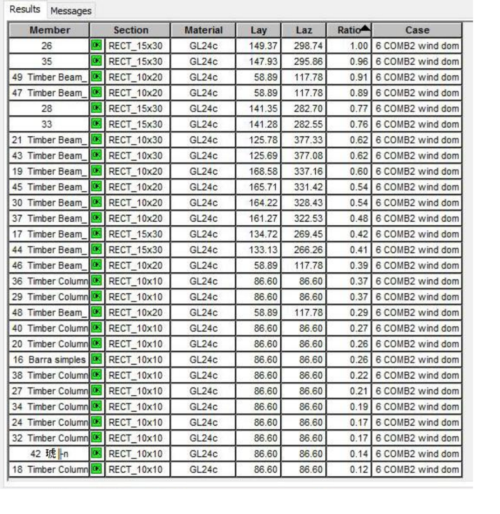
## Preliminary 2D Analysis - Steel



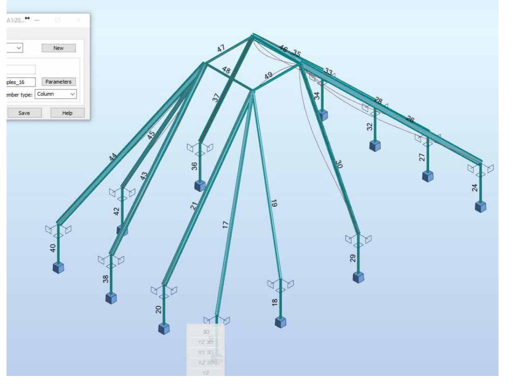
## 3D Analysis - Glulam

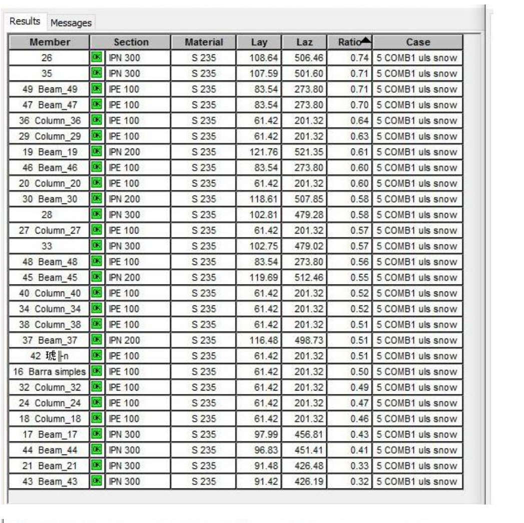


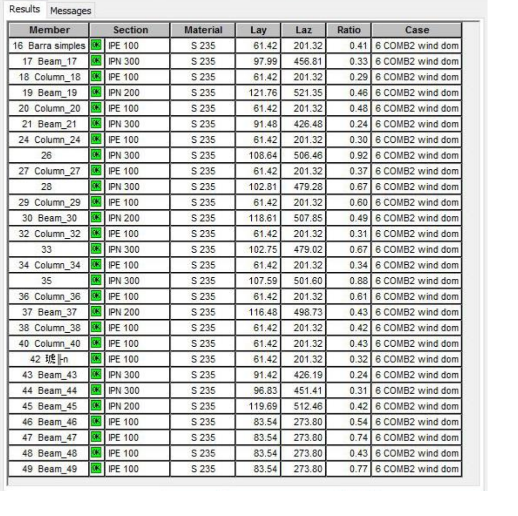




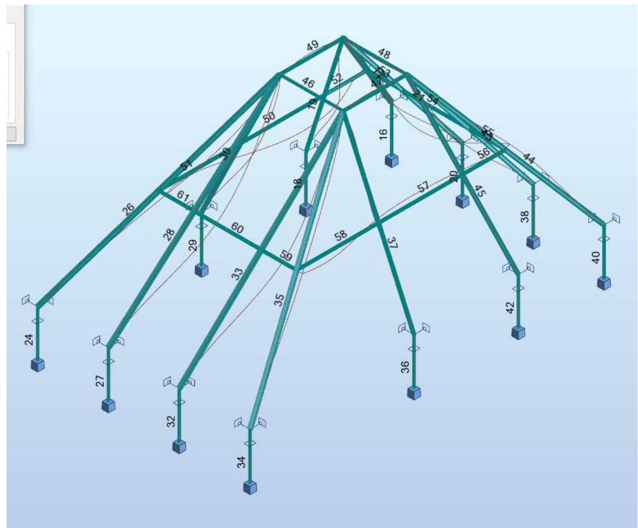
## 3D Analysis - Steel







# STRUCTURAL ANALYSIS



Final Structure - secondary ring beam is used

After following the different steps described before, it was concluded that the structure in steel would be the optimal choice in terms of the overall structural behaviour, as it allows a smaller section of the elements.

The final structure, taken as reference for the final design is the one represented on the image on the left. The elements considered for the final test were steel columns - HEB 100 and beams - HEB 160 (from which I decided to apply HEB 160 on the final design, for both columns and beams). The structure is then braced by two additional horizontal elements that consist of two beam rings. These rings are also in steel, being one of them located in the top extremity of the angled beams and the other in the middle.

Even though the structure already functioned without the second middle ring (page 99), I decided to add it, as it would potentially add to the stability of the structure, as well as reducing the buckling on the longer angled beams.

Furthermore, I also started looking to the possible connections between column-beam, as these nodes would be fragile zones of the structure. Even though I didn't go further with that analysis, this *frame knee joint* was considered as an additional element to provide more rigidity, being reinforced by a lower vertical bracket and other horizontal stiffeners.

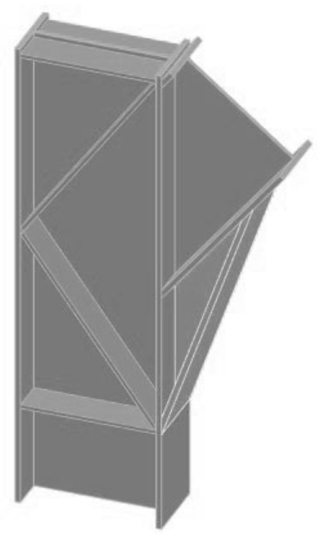
Results Messages

| Member | | Section | Material | Lay | Laz | Ratio | Case |
|---|---|---|---|---|---|---|---|
| 37 Beam_37 | OK | IPE 160 | S 235 | 141.55 | 504.93 | 0.97 | 5 COMB1 uls snow |
| 30 Beam_30 | OK | IPER 160 | S 235 | 143.29 | 517.94 | 0.93 | 5 COMB1 uls snow |
| 19 Beam_19 | OK | IPE 160 | S 235 | 147.97 | 527.83 | 0.88 | 5 COMB1 uls snow |
| 28 | OK | HEA 160 | S 235 | 186.35 | 307.22 | 0.83 | 5 COMB1 uls snow |
| 33 | OK | HEA 160 | S 235 | 186.25 | 307.05 | 0.80 | 5 COMB1 uls snow |
| 52 Simple bar_52 | OK | IPE 120 | S 235 | 46.90 | 158.92 | 0.75 | 5 COMB1 uls snow |
| 36 Column_36 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.66 | 5 COMB1 uls snow |
| 45 Beam_45 | OK | IPE 160 | S 235 | 145.45 | 518.84 | 0.65 | 5 COMB1 uls snow |
| 29 Column_29 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.65 | 5 COMB1 uls snow |
| 20 Column_20 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.59 | 5 COMB1 uls snow |
| 40 Column_40 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.57 | 5 COMB1 uls snow |
| 27 Column_27 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.56 | 5 COMB1 uls snow |
| 46 Beam_46 | OK | IPE 100 | S 235 | 83.54 | 273.80 | 0.56 | 5 COMB1 uls snow |
| 16 Barra simples | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.55 | 5 COMB1 uls snow |
| 34 Column_34 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.55 | 5 COMB1 uls snow |
| 38 Column_38 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.51 | 5 COMB1 uls snow |
| 24 Column_24 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.49 | 5 COMB1 uls snow |
| 32 Column_32 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.47 | 5 COMB1 uls snow |
| 56 Simple bar_56 | OK | HEA 100 | S 235 | 56.72 | 91.63 | 0.47 | 5 COMB1 uls snow |
| 48 Beam_48 | OK | IPE 100 | S 235 | 83.54 | 273.80 | 0.46 | 5 COMB1 uls snow |
| 17 Beam_17 | OK | HEA 160 | S 235 | 177.62 | 292.81 | 0.45 | 5 COMB1 uls snow |
| 58 Simple bar_58 | OK | HEA 100 | S 235 | 108.50 | 175.28 | 0.45 | 5 COMB1 uls snow |
| 44 Beam_44 | OK | HEA 160 | S 235 | 175.52 | 289.35 | 0.44 | 5 COMB1 uls snow |
| 47 Beam_47 | OK | HEA 100 | S 235 | 83.84 | 135.45 | 0.44 | 5 COMB1 uls snow |
| 49 Beam_49 | OK | HEA 100 | S 235 | 83.84 | 135.45 | 0.43 | 5 COMB1 uls snow |
| 42 琥-n | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.43 | 5 COMB1 uls snow |
| 51 Simple bar_51 | OK | HEA 100 | S 235 | 108.50 | 175.28 | 0.43 | 5 COMB1 uls snow |
| 21 Beam_21 | OK | HEA 160 | S 235 | 165.82 | 273.37 | 0.42 | 5 COMB1 uls snow |
| 43 Beam_43 | OK | HEA 160 | S 235 | 165.71 | 273.18 | 0.39 | 5 COMB1 uls snow |
| 18 Column_18 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.39 | 5 COMB1 uls snow |
| 35 | OK | HEA 160 | S 235 | 195.03 | 321.52 | 0.37 | 5 COMB1 uls snow |
| 26 | OK | HEA 160 | S 235 | 196.92 | 324.64 | 0.36 | 5 COMB1 uls snow |
| 55 Simple bar_55 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.33 | 5 COMB1 uls snow |
| 57 Simple bar_57 | OK | HEA 100 | S 235 | 110.97 | 179.27 | 0.31 | 5 COMB1 uls snow |
| 50 Simple bar_50 | OK | HEA 100 | S 235 | 110.97 | 179.27 | 0.30 | 5 COMB1 uls snow |
| 60 Simple bar_60 | OK | HEA 100 | S 235 | 88.77 | 143.41 | 0.26 | 5 COMB1 uls snow |
| 61 Simple bar_61 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.25 | 5 COMB1 uls snow |
| 59 Simple bar_59 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.25 | 5 COMB1 uls snow |
| 53 Simple bar_53 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.24 | 5 COMB1 uls snow |
| 54 Simple bar_54 | OK | HEA 100 | S 235 | 88.77 | 143.41 | 0.24 | 5 COMB1 uls snow |

Results Messages

| Member | | Section | Material | Lay | Laz | Ratio | Case |
|---|---|---|---|---|---|---|---|
| 28 | OK | HEA 160 | S 235 | 186.35 | 307.22 | 0.89 | 6 COMB2 wind dom |
| 33 | OK | HEA 160 | S 235 | 186.25 | 307.05 | 0.87 | 6 COMB2 wind dom |
| 37 Beam_37 | OK | IPE 160 | S 235 | 141.55 | 504.93 | 0.78 | 6 COMB2 wind dom |
| 30 Beam_30 | OK | IPER 160 | S 235 | 143.29 | 517.94 | 0.75 | 6 COMB2 wind dom |
| 52 Simple bar_52 | OK | IPE 120 | S 235 | 46.90 | 158.92 | 0.69 | 6 COMB2 wind dom |
| 36 Column_36 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.67 | 6 COMB2 wind dom |
| 29 Column_29 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.66 | 6 COMB2 wind dom |
| 19 Beam_19 | OK | IPE 160 | S 235 | 147.97 | 527.83 | 0.52 | 6 COMB2 wind dom |
| 49 Beam_49 | OK | HEA 100 | S 235 | 83.84 | 135.45 | 0.51 | 6 COMB2 wind dom |
| 17 Beam_17 | OK | HEA 160 | S 235 | 177.62 | 292.81 | 0.51 | 6 COMB2 wind dom |
| 47 Beam_47 | OK | HEA 100 | S 235 | 83.84 | 135.45 | 0.51 | 6 COMB2 wind dom |
| 26 | OK | HEA 160 | S 235 | 196.92 | 324.64 | 0.48 | 6 COMB2 wind dom |
| 44 Beam_44 | OK | HEA 160 | S 235 | 175.52 | 289.35 | 0.48 | 6 COMB2 wind dom |
| 20 Column_20 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.48 | 6 COMB2 wind dom |
| 40 Column_40 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.48 | 6 COMB2 wind dom |
| 16 Barra simples | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.46 | 6 COMB2 wind dom |
| 35 | OK | HEA 160 | S 235 | 195.03 | 321.52 | 0.46 | 6 COMB2 wind dom |
| 56 Simple bar_56 | OK | HEA 100 | S 235 | 56.72 | 91.63 | 0.44 | 6 COMB2 wind dom |
| 58 Simple bar_58 | OK | HEA 100 | S 235 | 108.50 | 175.28 | 0.44 | 6 COMB2 wind dom |
| 46 Beam_46 | OK | IPE 100 | S 235 | 83.54 | 273.80 | 0.43 | 6 COMB2 wind dom |
| 51 Simple bar_51 | OK | HEA 100 | S 235 | 108.50 | 175.28 | 0.43 | 6 COMB2 wind dom |
| 45 Beam_45 | OK | IPE 160 | S 235 | 145.45 | 518.84 | 0.43 | 6 COMB2 wind dom |
| 38 Column_38 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.42 | 6 COMB2 wind dom |
| 27 Column_27 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.35 | 6 COMB2 wind dom |
| 34 Column_34 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.35 | 6 COMB2 wind dom |
| 55 Simple bar_55 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.31 | 6 COMB2 wind dom |
| 48 Beam_48 | OK | IPE 100 | S 235 | 83.54 | 273.80 | 0.31 | 6 COMB2 wind dom |
| 24 Column_24 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.30 | 6 COMB2 wind dom |
| 57 Simple bar_57 | OK | HEA 100 | S 235 | 110.97 | 179.27 | 0.29 | 6 COMB2 wind dom |
| 50 Simple bar_50 | OK | HEA 100 | S 235 | 110.97 | 179.27 | 0.29 | 6 COMB2 wind dom |
| 32 Column_32 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.28 | 6 COMB2 wind dom |
| 21 Beam_21 | OK | HEA 160 | S 235 | 165.82 | 273.37 | 0.27 | 6 COMB2 wind dom |
| 43 Beam_43 | OK | HEA 160 | S 235 | 165.71 | 273.18 | 0.26 | 6 COMB2 wind dom |
| 53 Simple bar_53 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.24 | 6 COMB2 wind dom |
| 60 Simple bar_60 | OK | HEA 100 | S 235 | 88.77 | 143.41 | 0.24 | 6 COMB2 wind dom |
| 61 Simple bar_61 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.24 | 6 COMB2 wind dom |
| 59 Simple bar_59 | OK | HEA 100 | S 235 | 46.85 | 75.69 | 0.24 | 6 COMB2 wind dom |
| 54 Simple bar_54 | OK | HEA 100 | S 235 | 88.77 | 143.41 | 0.23 | 6 COMB2 wind dom |
| 42 琥-n | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.23 | 6 COMB2 wind dom |
| 18 Column_18 | OK | IPE 100 | S 235 | 61.42 | 201.32 | 0.20 | 6 COMB2 wind dom |

Final Structure - calculations results



3D representation of the potential connection between column and beam - *frame knee joint*

Properties of the *frame knee joint*

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## ILLUSTRATIONS

All the remaining illustrations not referenced bellow, were produced by me,


*Page 16 - http://www.archdaily.com/464296/livsrum-cancer-counseling-center-effekt*

*Page 17 - http://www.archdaily.com/620480/maggies-lanarkshire-reiach-and-hall-architects*

*Page 48 - picture by unknown author to the "Museu of Serralves" by Alvaro de Siza Vieira*

*Page 48 - http://www.archaic-mag.com/classics-insel-hombroich-erwin-heerich/*

*Page 48 - picture by unknown author to the "Benesse House Museum" by Tadao Ando*

*Page 49 - picture by unknown author to the "Fisher's House" by Louis Kahn*

*Page 49 - picture by unknown author to the "Louisiana Museum of Modern Art" by Vilhelm Wohlert and Jørgen Bo*

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