LIVSRUM

HERLEV HOSPITAL

Christian Roy Bendixen, MSc04 Arch 17, May 2017

ABSTRACT

Denne afhandling omhandler processen for tilblivelsen af et forslag til et nyt Livsrum beliggende ved Herlev Hospital.

I 00'erne opdagede Kræftens Bekæmpelse et behov for en udvidet rådgivning for kræftpatienter og derfor satte man ind på området og fik udviklet filosofien for Livsrum - den åbne rådgivning med fokus på både krop og sjæl.

Med udgangspunkt i teorien bag begrebet helende arkitektur fokuserer dette projekt på de mennesker som bevæger sig i bygningen og hvilke oplevelser de har. Den færdige bygning er indrettet med større sociale rum til at hylde fællesskabet og livet, men også mindre rum og zoner i forbindelse med de sociale områder hvor man kan trække sig og meditere eller på anden måde lade tankerne glide væk fra en periode i livet som vil være præget af bekymringer.

Projektet arbejder deslige med bæredygtighedsbegrebet for at opnå en bygning som har et behageligt indeklima samtidigt med at den overholder fremtidens energinormer.

READING GUIDE

This report is documenting the development of a a sustainable healthcare building.

The report is divided into five main chapters decribed below and should be read chronological.

#Programme

The program will give a broad understanding of the basis for the project. Theory about healing architecture will be investigated and the site inspected and analyzed both quantitatively and qualitatively.

#Presentation

This chapter will present the final project to the reader through drawing material including plan, elevations, sections and spatial illustrations. The presentation also includes the sustainable considertations in the final proposal.

#Design Process

The design process shows the development of the project from the first sketches to the detailing of speciffic parts of the building.

#Epilogue

The epilogue is containing a conclusion and a reflection of both the process and the final proposal. Here the literature- and illustation list can also be found.

#Appendix

Containing technical calculations and calculation methods documenting the results displayed in the project.

Enjoy reading!

COLOPHON

TITEL
Livsrum - Herlev Hospital

PERIOD
01/02-2017 - 18/05-2017

SUPERVISORS
Mads Dines Pedersen
Mingzhe Liu

GROUP

17 - Christian Roy Bendixen

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SEMESTER
MSc04 Arc

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Ill. 6.1: Map showing location of Herlev Hospital and its context

INTRODUCTION

"It is like a house which is not a home, a collective hospital which is not an institution, a church which is not religious, and an art gallery which is not a museum."

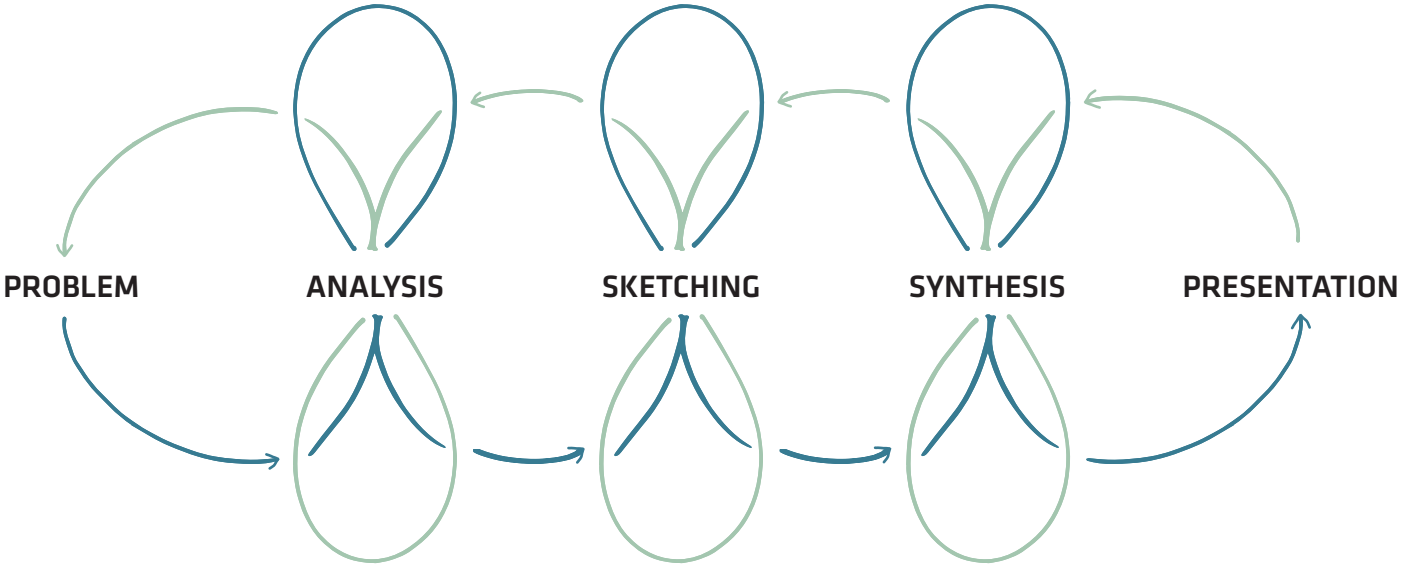
(Jencks, 2015 p. 28)

This qoute is decribing the main objective for a 'Livsrum'. A house for contemplation, a home away from home where you can meet others in a simular situation, seek help or simply just be, experience while gaining strength to live through an illness.

A vast variety of people will be using this building, all with the same objective and goal, but with different needs and ways to overcome the situation.

Based on the principles of healing architecture and with origin in competition material a proposal for 'Livsrum' at Herlev Hospital has been compiled. The building is located only 500 meters from the oncological ward at Herlev Hospital on the peripheral boundary of the plot on which the hospital is located. Herlev is a suburban area in Copenhagen located north-west of the city mainly consisting of residential areas with villas. The park where the site is located is called 'Hospitalsparken' and was founded in the same period as the hospital was build (herlev.dk, 2016.

The main purpose of the building is to enrich the life of cancer patients and their relatives through social interactions and mental- and physical theraphy. The architecture of the building should empathise this and the individual needs from the different users of the building while being a sustainable building with a healthy atmospherical and thermal indoor climate.



Ill. 7.1: Hermeneutic spiral of the integrated design process

METHODOLOGY

The overall process of this project has been following the basis of the 'Integrated design proces', ensuring a polytechnic fokus on both aesthetics, functionality as well as an optimized sustainable solution (Hansen & Knudstrup, 2005).

IDP is based on a hermeneutic and iterative process of learning and informing proposals by knowledge obtained through earlier phases of the process. The different phases are explained below:

#Problem
The problem phase has been consisting of information gathering and literature reviews circulating the problem in hand to gather information about the building type and the theory and philosophy behind 'Healing Architecture'.

#Analysis
The main objective of the analysis phase is to gain knowledge about the basis of the project. This phase is therefore containing both qualitative and quantitative analysis to understand the site and the context surrounding the site in addition with a search and arguementation for the right location for a site. These analysis are investigating the basics of the context of which the building is located such as the infrastructure and microclimate through the weather conditions. Also included are case studies and a collection of material to gain knowledge about the basis of sustainable solutions and analysis to understand terms from the problem phase.

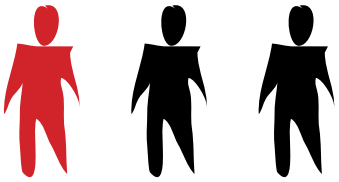
#Sketching
The skecthing phase is an iterative phase using different modelling tools and techniques consisting of hand sketching, physical modelling and computed 2D- and 3D-modelling. The various sketching techniques each has their own pros and cons, common for them is that they somehow display different spatial qualities of volumes or rooms. Through the different iterations a design concept is developed, afterwards a detailed sketching can contenue to make a proposal that is buildable.

#Synthesis
Based on the sketching phase that has been informed by the analysis software calculating the technical aspects such as the energy frame will optimise and inform the design creating a dynamic interplay between the synthesis phase and the skectching phase in an iterativ process ensuring and improving a building that is performing at the right standards and complying with predifined levels for a healthy indoor climte.

#Presentation
When the final proposal is finished, drawing material displaying the spatial qualities of the project is being produced. In addition, spatial vizualisations and references are showing how the building can be used.

#PROGRAMME

Ill. 9.1: View towards Herlev Hospital from 'Hospitalsparken'

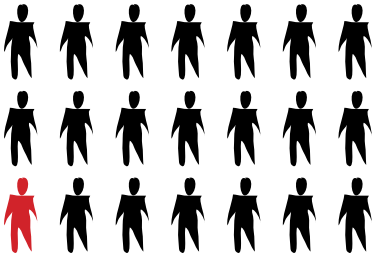


1 IN 3

Ill. 10.1: 1 in 3 will get cancer

AGE 0-65

Ill. 10.2: Most frequent cause of death for people below the age of 65



267.500

Ill. 10.3: 1 in 21 danes have cancer right now

MOTIVATION

The numbers speak for themselves. Cancer is the most frequent cause of death for danes younger than 65 (cancer.dk, 2017). One out of three danes will at some point become cancer patients (cancer.dk, 2017). Right now approximately 267.500 danes are living with a cancer diagnose and every year 35.500 new names are added to this statistic (cancer.dk, 2016).

The amount of people whose life is affected by cancer is huge because it is not only the person living with the diagnose who will get affected - it is also the family and social circle of the diagnosed.

This project has been especially important for me because of my own close contact with the ailment.

In the summer of 2013 my mother was diagnosed with inflammatory breast cancer and from the day she told me and the rest of my family my life changed.

My first reaction was denial - she did not look ill and described it very well herself be saying "When i walked into the hospital i was well, but when i walked out i was diseased".

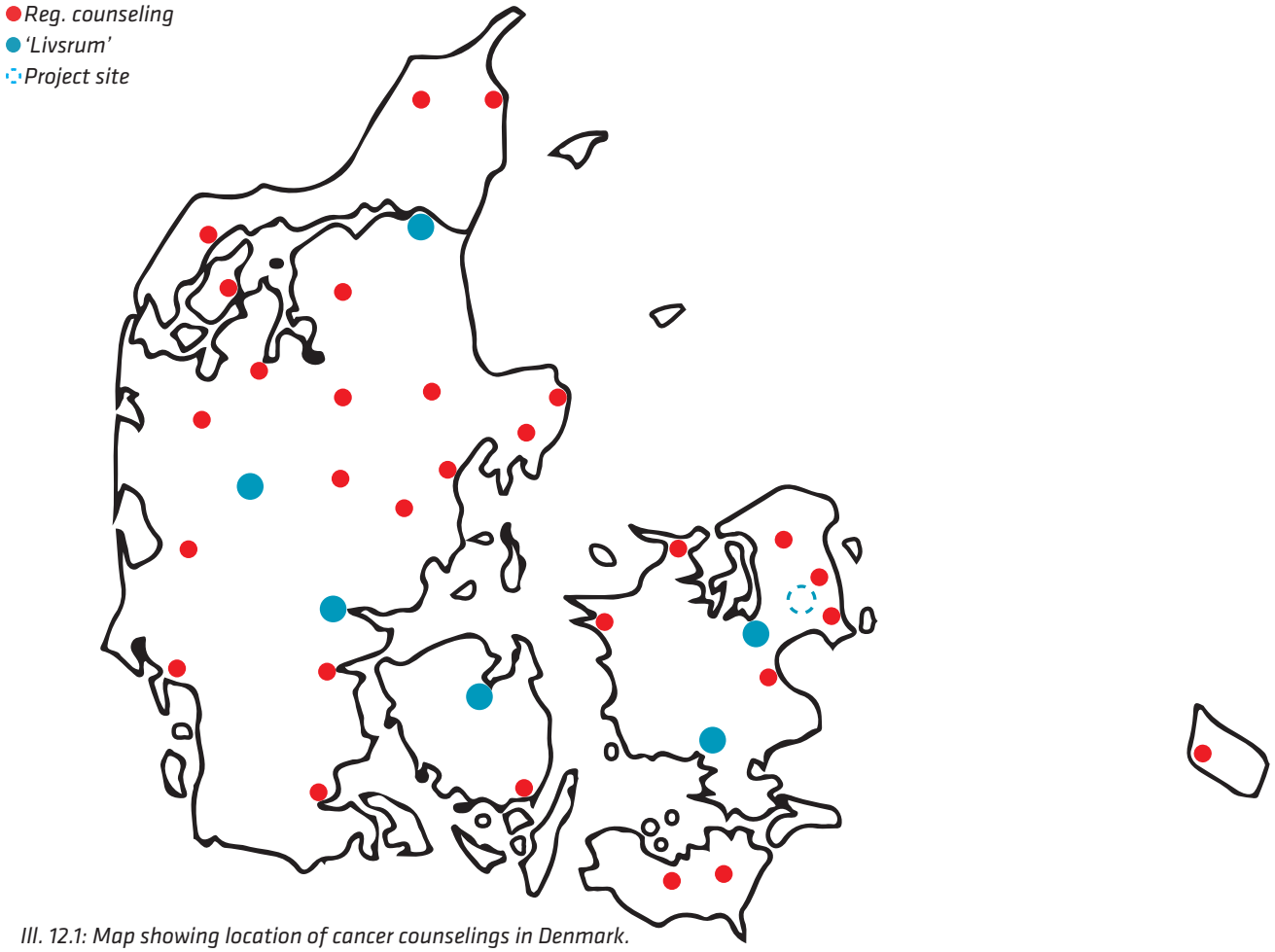
My denial contenued by looking very practically at the disease as something fixable and tangible but i soon came to understand that it was not just a quick fix. By watching what chemotherapy does to the human body while living with the uncertainty of the cancer spreading to more vital organs i saw a need for an extra care of individuals in this situation - the sort of care project 'Livsrum' provides.

My mother was a user of 'Livsrum' and the activities she attented here gave her the strengh to be a cancer survivor. The activities that 'Kræftens Bekæmpelse' offers are hugely encouraging the affected persons to keep on fighting.

This is just my story and I bet that there are many alike. There is a demand for centres like these to detaboo the illness and to help individuals going through a tough phase of life.

I want to support the philosophy of 'Livsrum' and I want to explore how centres like these and other healthcare clinincs can learn from the knowledge and aspects behind healing architecture to ease the course of the illness.

Ill. 11.1: Interior of 'Livsrum', Vejle



Ill. 12.1: Map showing location of cancer counselings in Denmark.

LIVSRUM

Project 'Livsrum' is based on an initiative from 'Kræftens Bekæmpelse' and Realdania to create buildings optimised for the healing process of cancer patients and their relatives (O'Bríon, 2015). The initiative stems on a need for counseling from the patients that was not met in the existing counseling centres, which are currently located and still operating in buildings, that were not originally intended for counseling purpose.

These centres function as local counselings, whereas the 'Livsrum' is based on a concept of direct counseling and therefore is located close to the oncological ward at the largest hospitals where the patients most likely will receive their diagnosis and a sudden need for counseling will be needed at the same (O'Bríon, 2015). 'Livsrum' and the other cancer counselings thrive to advise and help patients and their relatives in an open counseling where you can walk in from the street and talk to a psychologist, a nurse or a volunteer who has been in a similar situation. In fact the core value of 'Livsrum' is to be accessible and open to anyone who has the need to talk to a counselor. Another aspect of the healing process is the palliative need of the patient which the oncological wards fail to provide (Jensen, Weiss 2016). This is also a part of what the cancer counselings offer the patients to recover from the diagnose or to relieve the pain they might suffer while undergoing chemo or life-sustaining medication.

The third place

Besides being a place for counseling and recovery, the 'Livsrum' is described as a third place (O'Bróin, 2015). The philosophy behind the phrase is that the first place is our home, the second place is our workplace and the third place is a place to gather. This social gathering has a positive effect on our mood by counteracting loneliness and stimulating a sense of community (Oldenburg, 1999). The third place is characterized as being a home away from home where you feel comfortable and informal. You meet others on neutral ground with a mutual purpose and this is a need that many cancer patients feel (cancer.dk, 2014). T

he patients feel that they somehow lose a part of their own social circle because they might not have the energy to keep up with the social life or the events that they are invited to. The patients might also feel different from their social circle because of the disease and what it brings with it. Therefore there is a need to have a place to detach from the everyday life and be oneself or be part of a community where one does not feel different or out of place.

Ill. 13.1: Livsrum, Aalborg

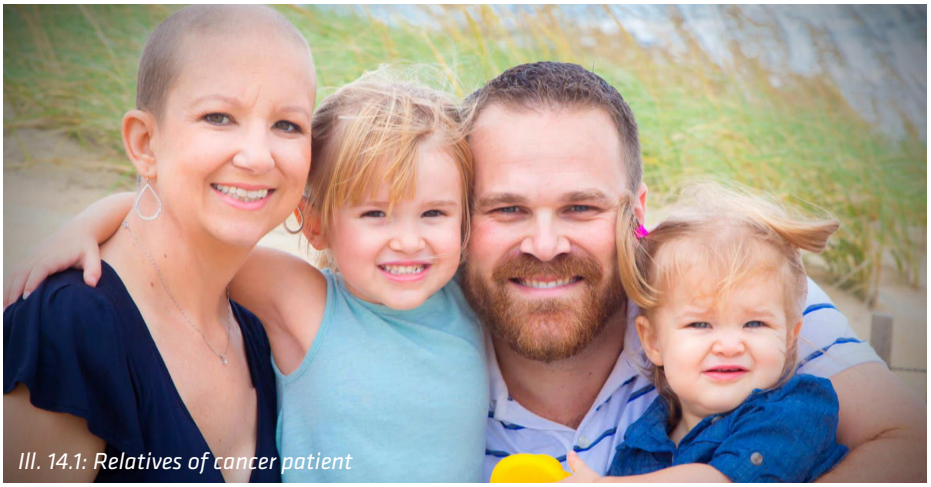
Ill. X.13: Livsrum, Vejle

Ill. 13.3: Livsrum, Roskilde

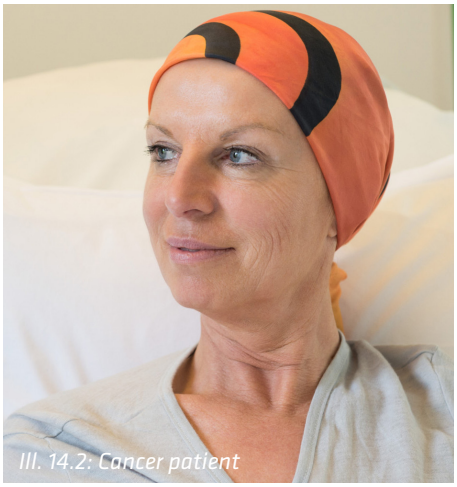
Ill. 13.4: Livsrum, Odense

Ill. 13.5: Livsrum, Næstved

Ill. 13.6: Livsrum, Herning



Ill. 14.1: Relatives of cancer patient



Ill. 14.2: Cancer patient

Ill. 14.3: Psychologist in conversation with teenager

Ill. 14.4: Social worker helping elderly woman

USER GROUPS

The 'Livsrum' will host many different functions and thereby a variety of people with different errands and needs while occupying the building. There are two main groups; the staff and the visitors. The staff can be grouped in two and consists of the employees and a large group of volunteers. There are many reasons to visit the 'Livsrum', and the group of visitors can be subdivided in patients, recovered patients and relatives (O'Bróin, 2015).

Staff

Employee

The fulltime staff of the 'Livsrum' consist of a variety of different fields of professions. As in any other workplace in relation to the healthcare system there is some kind of administrative personnel who handles any administrative task and makes sure that everything runs smoothly at the 'Livsrum'. Besides these functions the staff consists of psychologists, social workers and nurses who are ready to talk to patients relatives in the open counseling. The reason why the counseling does not only consist of psychologists is that the philosophy of 'Livsrum' is to be versatile in the counseling and not only focus on the patients mental condition, but also help with everyday struggles, inconveniences with the healthcare system or the patients social position in the society (O'Bróin, 2015).

Volunteer

For each 'Livsrum' about 300 volunteers are active in both during daytime but also in after hour activities. The volunteers are often former cancer patients or relatives to cancer patients who can relate to the situation the visitors are going through. The volunteers have different functions at the 'Livsrum'; some are welcoming the visitors and making sure that they feel well or are sent in the right direction. Other volunteers are helping with or hosting activities in the building of shifting character - some physically active other concentrated about the creative workshop (O'Bróin, 2015).

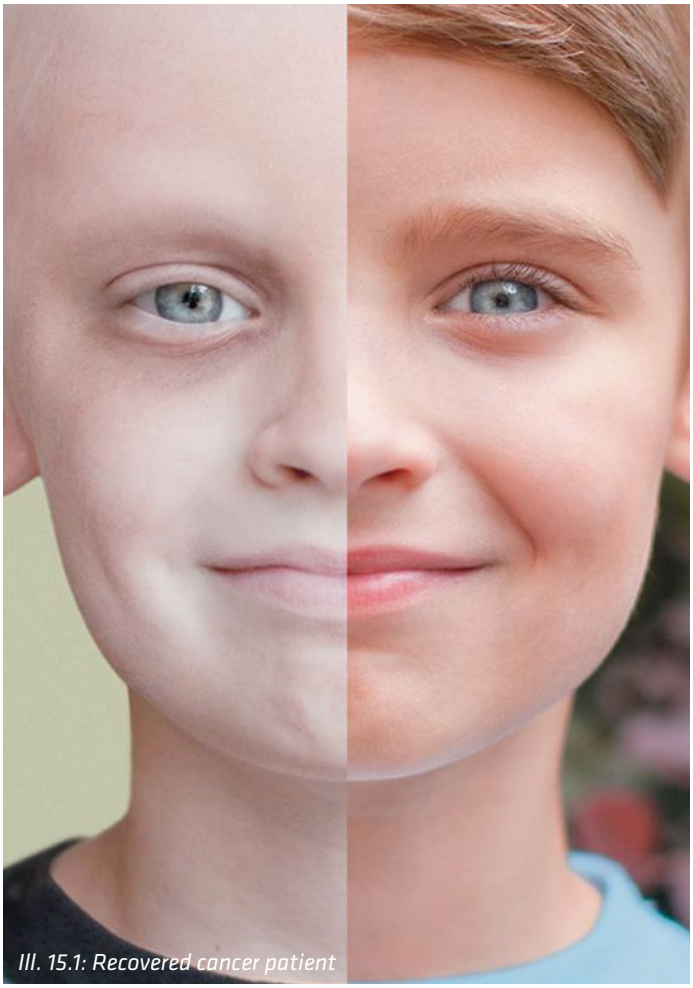
Visitor

Patient

One of the main goals for the concept of 'Livsrum' is the direct option for help and guidance when the diagnosis is established (O'Bróin, 2015). From that moment on the centre should be able to welcome a patient for whom one of the biggest life changing moments has just happened. The patient is the most frequent visitor of the 'Livsrum' - it is although mainly for the patients that the centres are being built. Here they come for different reasons; some come for the counseling that the employees provide, others for the different activities that either the employees or the volunteers arrange. The 'Livsrum' is used as a third place for many patients where the for a short while can forget about their diagnosis and the pain that they might feel (O'Bróin, 2015).

Recovered Patient

When a patient has recovered from cancer often the body might not feel as it did before and late complications will occur quite often. These complications can be both physical and mental, therefore even in the absence of disease one may not be fully recovered (Bergsøe & Nørbak, 2014). In this case the 'Livsrum' is being used to make a full physical recovery and to reflect upon the things that the patient has been through on a psychological level. Some of the social groups that were established while the recovered patients used the 'Livsrum' as patients might continue meaning that the patients have the opportunity to meet with a social group who might struggle with some of the



Ill. 15.1: Recovered cancer patient

Ill. 15.2: Cancer patient exercising

same issues as themself (O'Bróin, 2015).

Relative

The last of the visitor groups are the relatives of the diseased. It is mostly the closest relatives who make use of the 'Livsrum', to seek information, counseling and common ground. Often groups of relatives meet to share information and grief and continue to meet even after a possible decease of their relative. It can be helpful for some to meet under these circumstances and to share their experiences to others in a similar situation (O'Bróin, 2015)

All of the visitors have their individual reasons and errands to go to the 'Livsrum', and it is important to respect the different needs and wishes that the visitors have. This means a demand rooms with different social character; some that invites for social gatherings, some that are semi-private and some that are very private for confidential conversations and contemplation (O'Bróin, 2015)

Ill. 16.1: Isometric view of Herlev Hospital

HERLEV HOSPITAL

One of the core values in the concept of 'Livsrum' is that is has to be placed in close relation to the oncological wards at the hospitals. Herlev hospital has been chosen as the location of the seventh and last 'Livsrum'.

The main structure of the hospital consist of a 25 storey bed unit which acts as a vertical element in relation to the outpatient department, which with its 4 storeys and huge ground floor area seem very horizontal in its composition. The bed unit is also the tallest building in Denmark with a height of 120 meters at its tallest point (jyllandsposten, 2007).

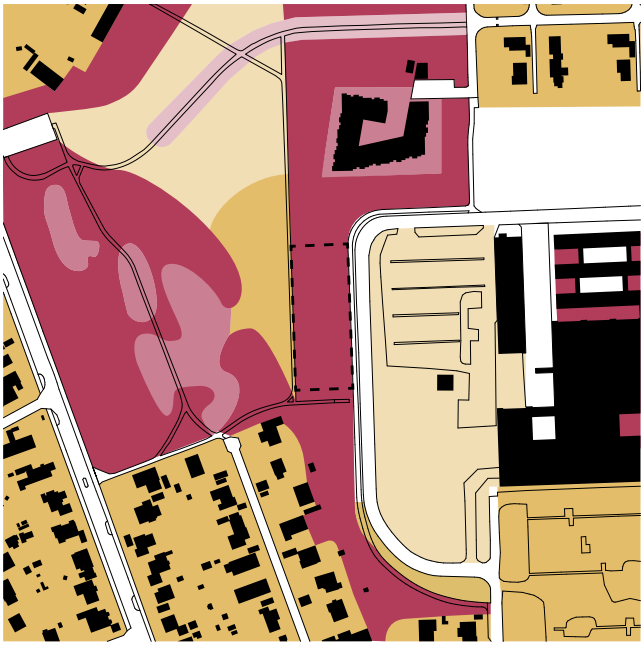
The hospital was designed by Gehrdt Bornebusch, Max Brüel and Jørgen Selchau and construction started in 1966 (denstoredanske.dk, 2013). When the construction finished in 1976 only 16 of the 25 storeys in the bed unit was furnished opened due to bad economy in the building process and it was not until 2007 that the 25th floor was put into use (denstoredanske.dk, 2013).

Besides the main structure of the hospital it consists of annexes - some originate from when the main structure was built in the 1970's, some has been added later and some are in the middle of construction. The first annex which was built in the same period as the main structure and was designed by the same architect who as the hospital (Johnsen, 2004). It was intended as a nursing school, but since 2010 it has functioned as an administration building for the hospital, but will now be demolished to make room for a new diabetic centre (phmetropol.dk, 2010; herlevhospital.dk, 2017). Other annexes that has been added later consists of service buildings for cleaning, sterilizing and garbage handling.

The future plan for the hospital are now being realised. An extension of 52.000 m2 is being built in connection to the existing building housing new wards and rehousing wards from the old part of the hospital (henninglarsen.com, 2014). This new building will take up a large part of the area south of the existing hospital within the district plan area that covers the of the hospital (herlev.dk, 2013).

Another annex that will be added to the complex is the new 'Livsrum', which is set to be located close to the hospital, so that the access from here to the 'Livsrum' is happening at ease and that a visit to the hospital can be combined with a visit to the counseling.

Ill. 17.1: Herlev Hospital seen from Herlev Ringvej



Inclosed

Clearing

Avenue

Scattered trees

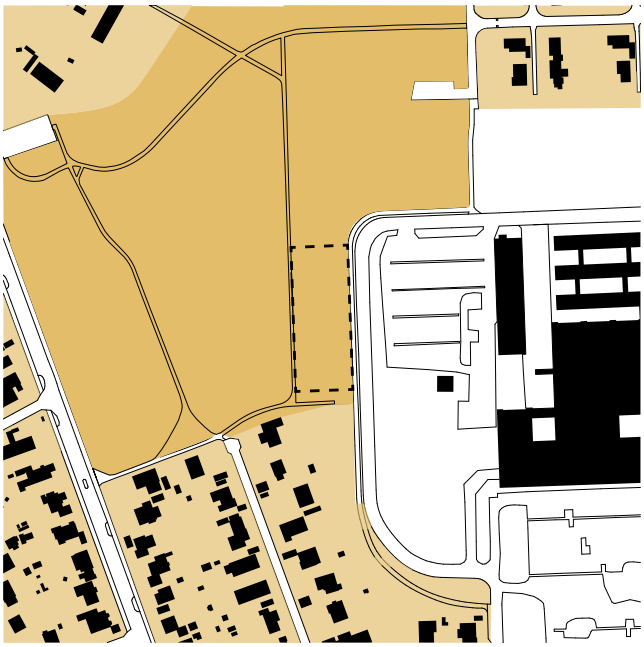
Open

Ill. 18.1: Spatial analysis of outdoor rooms in the context

SPATIAL ANALYSIS

By using the spacial analysis for outdoor areas developed Lene Lottrup, the characteristics of the site and its context is unfolded.

When looking at ill. 18.1, it is clear that the site is inclosed, but is in close relation to areas with a more open charater which provides longer views compared to the inclosed feeling of the site.



Not present

Highly present

Present

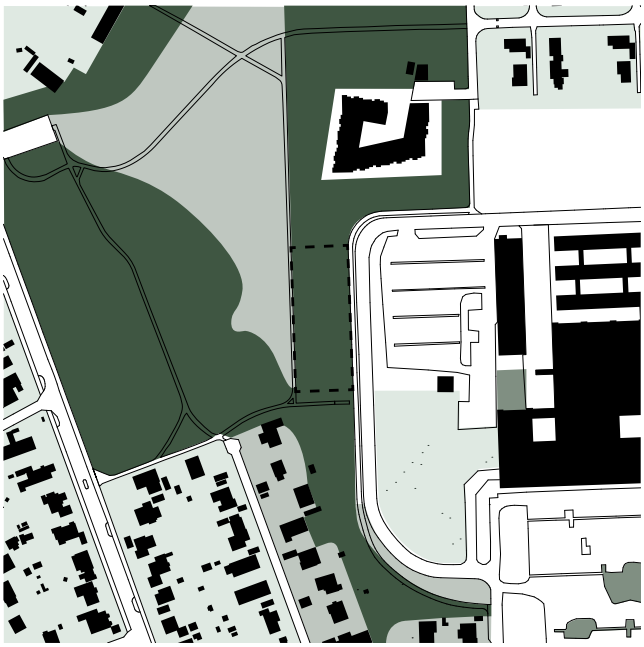
Vaguely present

Ill. 18.2: Feeling of safety in the outdoor room

SAFE

When walking in the close context of the site, a feeling of safety is present. The paths are visible from many places, but it is still possible to find spots that are less exposed.

The sites location between the park and the road means that it sits on the boundary between two zones of safety - one where you feel very safe and one where you feel more unsafe and exposed to traffic and noise.



Not present

Highly present

Present

Vaguely present

Ill. 18.3: Biodiversity in the context

BIODIVERSITY

The biodiversity of the scruff that the site is located in is vast and rich in comparason with parts of the context. The scruff acts as a barrier between the large hospital structure and the residential area west of the hospital.

The site has a vast majority of plants from ground cover to bushes and tall trees making it hard to navigate and access.

TOUCH OF NATURE

The site has as previously described, a vast biodiversity making the touch of nature very present at the site, as well as in the context.

The scruff continues both north and south of the site, and west of the site the park is providing views of different scenes of nature from a large lawn to an avenue to scruffs and trees scattered around the park.

Not present

Highly present

Present

Vaguely present

Ill. 19.1: The view of greenery in the context

PEACEFUL

As mentioned earlier, the site sits on the boundary between a park and a road. This means that there is some noise from the road transmitted to the site, whereas the park is calm and quiet.

Even thouth the location of the site is close to both the hospital and multiple main roads, it is still secluded by the amount of vegatation that surrounds it, making it peaceful.

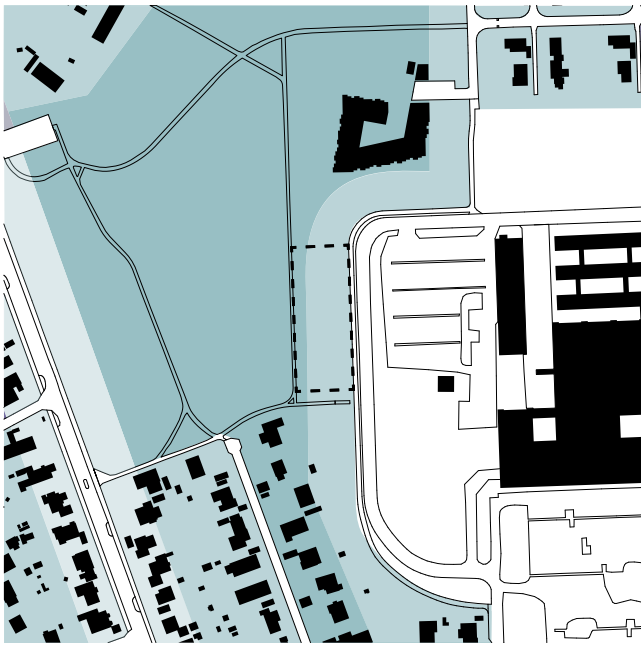
The road is mainly used for parking meaning at it is fairly busy during weekdays. The park is not very well-attended, and mainly used by the local population in the context.

Not present

Highly present

Present

Vaguely present



Ill. 19.2: Mapping of the feeling of peacefulness in the context

PARTIAL CONCLUSION

The program askes a different position for this project to be built on. However on the basis of this analysis this location has been chosen.

The original location is located at the approach road to the hospital in a traffic related nerve centre next to a 6-lane main road, the approach road to both the hospital and a resitential area and a future tram. This location would make the building very publically exposed and easy to access by public transportation and with a very short distance to the oncological ward also easy to access in connection to treatment or meetings at the hospital. This location would make 'Livsrum' Herlev the one of the seven with the shortest distance to the oncological ward with less than 100 m, others averaging 600 m. The location chosen is located 500 m from the oncological ward, making it just as accessable as the other 'Livrum' centres. However these are the only positive positive features of the site.

The originally intented site location is exposed to a large amount of noise from the vehicles travelling on the main road, but also from the sirens of the ambulances leaving and entering the hospital. This could cause a high amount of stress for the patients and is therefore untenable in terms of the principles of healing architecture that will be elaborated later in this report.

In a sustainable view the site also has its limitations. The close relation to the road means that when using natural ventilation, the occupants of the building will be exposed to damaging particles in stead of breathing fresh air meaning that the building would have a large need for mechanical ventilation.

Lastly the views fron the site will not be green but towards infrastructure or neighbouring buildings consisting of two undertakers and a church. In the difficult psychosocial situation that the users of this building go through when using the building it is not a very encouraging view.

The original location can be seen in appendix 8.

4 storeys

3 storeys

2 storeys

1 storey

DENSITY

This mapping is showing the building heights of the building in the surroundings of the site. This is done to gain knowledge about the different building volumes in the context and what becomes present is, that the area west, north and south of the site is characterized by 1-2 storey houses while the area east of the site is characterized by the hospital, with a larger coherent building volume in 3-4 storeys. The mapping is also showing, that the site is located between these very different typologies and somehow can act as a link in this transaction of scale.

Ill. 20.1: Spatial analysis of outdoor rooms in the context

Public accessable green

Public inaccessable

Private green ares

Pond

GREEN/BLUE

The green areas are grouped as private, public, semi-public and non-existing. Through the mapping it becomes apparent that most of the green areas in the context are private, but that a vast majority of the immediate context is either public or semi-public due to the lack of accessibility in the dense copse.

Ill. 20.2: Feeling of safety in the outdoor room

Quiet road

Busy road

Path

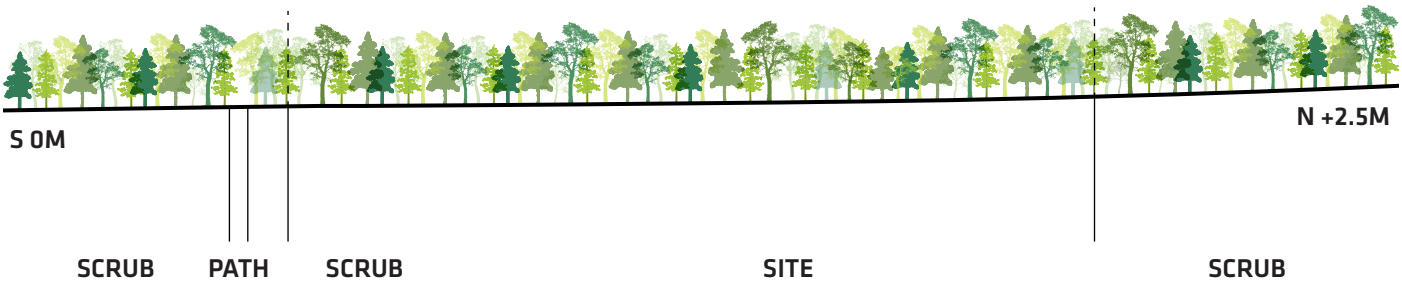
Bus route + stops

Parking

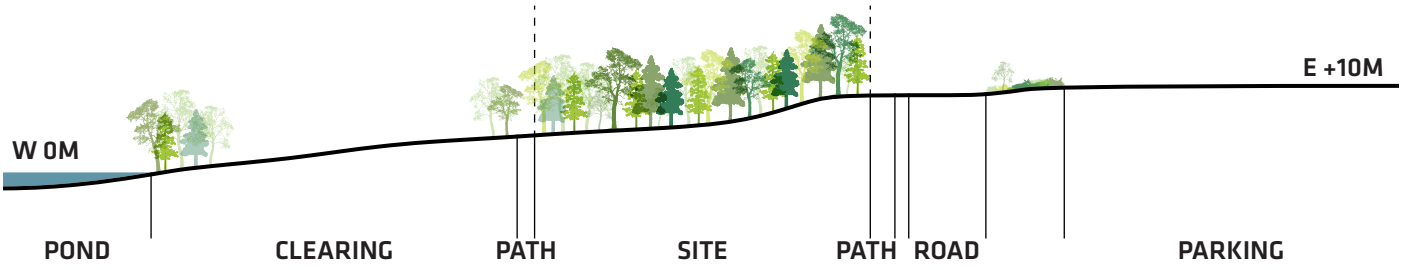
INFRASTRUCTURE

There are different ways of accessing the site. By foot it can be entered from 'Hospitalsparken' which connects the site to Hjortespringvej where several busses has their stops and connects the site to the public transportation network. Parallel to Smaragdvej run a bike-path and a sidewalk which also can be used for accessing the site as a pedestrian or a biker. Parking is available in close relation to the site. Both along Smaragdvej and at the nearby parking for the hospital which includes parking for more than 400 cars within 100 meters of the site (herlev.dk, 2013).

Ill. 20.3: Biodiversity in the context



Ill. 21.1: Section of the site - south towards north



Ill. 21.2: Section of the site - west towards east

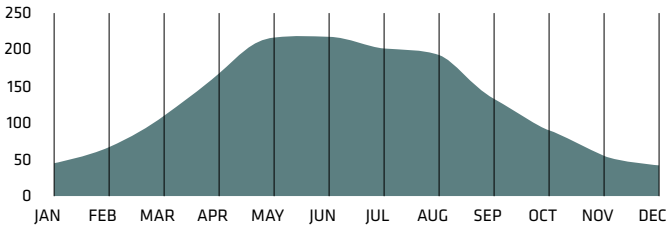
ELEVATION

As seen in both plan and section, the site is descending from northeastern direction. The highest point of the site is 5.5 meters above the lowest. As seen in the section, there is a steep slope beginning from the bike-path going eastwards and leveling out. This transaction in the landscape has to be coped with in the final design, as well as different levels in the building might be needed to manage the slope.

Ill. 21.3: Elevation of the site and context

SUN

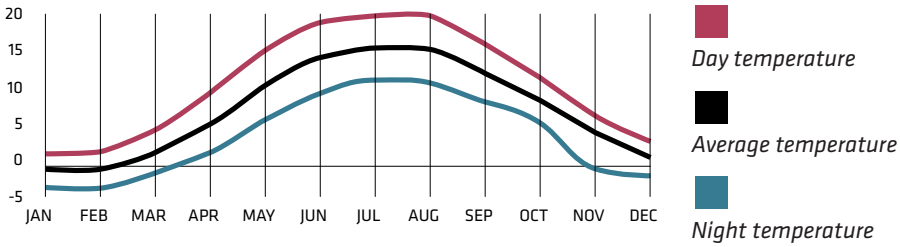
The average amount of sun hours spread across the year showing how many hours on average the active strategies of PV cells and solar heating can be used.



Ill. 22.1: Average amount of sunlight hours

TEMPERATURE

Thils graphs shows, that the natural ventilation can be used from approxomately may till septemper. During the remaining months the temperature is too low - extra heating will be required if using natureal ventilation within this period.

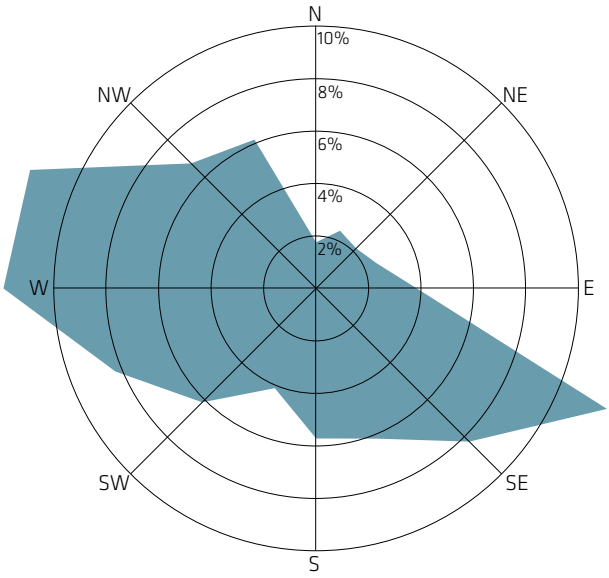


Ill. 22.2: Average temperatures

WIND

The illustraion shows the mean direction of the wind from may till septemper, which is the period of which natural ventilation will be used in the building, accoring to the average temperatures dureing this period (windfinder.com, 2017). The diagram shows, that the wind mainly comes from west or east during the period, meaning that openings for natural ventilation should be placed here to get the most optimal solution.

It should be noted, that the data is from a nearby location, but the local environment might be different than where the sample has been taken from, therefore this should be seen as guildline and not something termally.



Ill. 22.3: Average wind direction from may till september

WINTER

The overall aim for investigating the shading from the context, is to understand the amount of sunlight the site will be exposed to during the different seasons and thereby be able to elaborate on the postioning of the building.

The analysis has been in the time span from 8-18 which is the time span of which the building will be in its primary operation. The analysis is only taking buildings in the context into account and not the vegetation which will also influence the shading of the building.

At winter solstice, the southern most part of the site is shaded throughout the last part of the afternoon.

Ill. 23.1: Context shadows during winter solstice

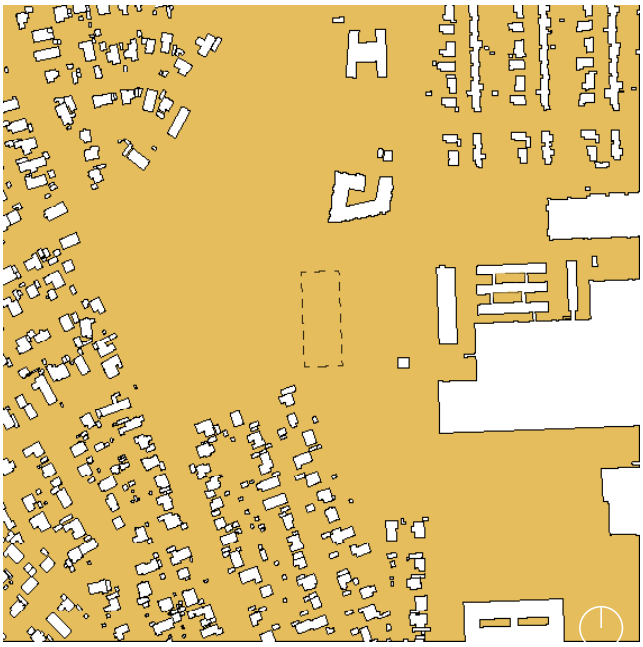
EQUINOX

As seen on illustration 23.2, the site is only shaded from the tower at Herlev Hospital in the early hours of the morning at equinox.

Ill. 23.2: Context shadows during equinox

SUMMER

At summer solstice, the site is not affected by the context buildings as illustrated on illustration 23.3.



Ill. 23.3: Context shadows during summer solstice

HEALING ARCHITECTURE

One of the negative side effects that cancer patients experience is stress. This stress can be caused of many reasons, although most patients are stressed because they are feeling threatened on their life and their social and psychosocial status and situation (Ulrich, 2008).

Through evidence-based research is it proven, that the architecture can influence both the stress and the pain that a patient might feel during a spell of sickness. The expression healing architecture covers the theory of how the physical environment can influence the human body in a positive way through architectural grips and solutions.

Via this theory it is possible to shorten the hospitalization and recovery time of patients, it is possible to avoid re-hospitalization and possible to strengthen the palliative care and attention for a patient in recovery or during a life-sustaining course. Besides having a positive effect on the ill, the architectural grips of healing architecture also affect the people using the environment in their daily life that being the medical staff and relatives of the patients (Frandsen, 2009; Ulrich, 2008).

While saying that these architectural grips can have an effect on the healing of a patient, it is not proven by certainty that the patients will heal faster. Instead there is a pattern of research results that ensures and supports the evidence for the results of the theory behind the different aspects behind healing architecture (Frandsen, 2009)

Healing architecture covers three main focal points; body, relation and safety, which will explained further in this chapter. The body aspect is focused around the human senses; sight, hearing, smell and the kinesthetics, in short how the human body is affected by the physical environment (Frandsen, 2009). The relation aspect is focused on the interaction between the human body and the different types of physical environments it gets into contact with but is also focused on the relation between the built environment and its surroundings (Frandsen, 2009).

Body

Sight

The sense of sight in terms of healing architecture is focused around what we see and how the view can affect the body. The human eye captures light and by doing so it has an influence on our mood. By being in a lit environment patients heal faster and feel happier and when asked the staff and the patients mention the access to daylight and windows as the most important factor concerning their well-being (Lawson & Phiri, 2003; Ulrich, 2008).

It is also proven that the mood of depressed individuals are affected in a positive manner by daylight and rather interestingly is the mood and stress level of people without a depression or any other psychiatric also positively affected by a large amount of daylight (Frandsen, 2009).

The other aspect of the sight is what we are looking at. The physical environment that surround us and what it contains of. The colors and artwork that we put into the our physical surroundings can have an distractive effect which mean that a patient can focus on an artwork for a while instead of the pain that they might suffer (Frandsen, 2009). Others point to that the best effect comes from art with a natural motive and that abstract art like the artwork seen at the existing Her-

lev Hospital can have a negative effect on the patients (Ulrich, 2008; Gernes & Hornung, 2003).

Hearing
The subject of hearing can have both a healing and a stressing effect on the body. Sound in terms of music can be used as a calming distractor while feeling pain or psychological traumas whereas noise acts as a stressor. In terms of the physical environment the sound and the acoustic quality of the room are the most influential on the healing where the noise can be explained as the different technical installations and acoustics that should fit the function of the different rooms (Frandsen, 2009).

It is proven, that silence or an absence of noise is de-stressing (Slevin et al., 2000). Therefore it is important that therapeutical rooms are both quiet and have a low reverberation time. It should be possible to seclude from noise in every part of the building to avoid unnecessary stress, therefore niches and room separators are admirable to include in the building (cancer.dk, 2014). The materials used in the physical environment have an effect on the reverberation time and therefore one should carefully choose the materials to each room fitting the admired reverberation time.

Smell
The sense of smelling is concerning the air that surrounds us and thereby both the quality of the air that the body inhales and the temperature that the body feels (Frandsen, 2009). It is a high priority that the air quality and indoor environment in a healthcare building is of high quality to avoid airborne contagion and to secure ideal conditions for a healing environment (Frandsen, 2009).

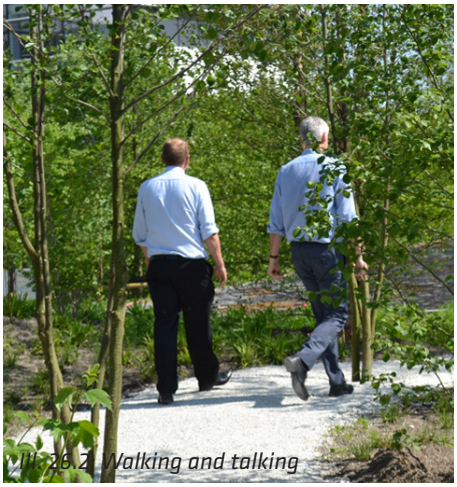
Kinesthetics
The kinesthetic sense relates to how the body moves and thereby how easy it is to get around. The accessibility and wayfinding of a building is covered by the kinesthetics - how easy is it to get in and move around the building and how easy it is to find where you are going and thereby also overview the building. It can be stressful to a patient or a relative if the wayfinding and overall orientation of a building is complicated and if they do not know where to go (Frandsen, 2009). Therefore a simple plan layout and a clear orientation is favorable in healthcare architecture.

Relation

Private/social
Many patients have a need to be alone in private surroundings where they can have confidential talks and relieve stress through meditation (Frandsen, 2009). This need is though different from patient to patient, but the tendency is that primarily female patients prefers the private rooms while male patients prefer social or semi-private rooms (O'Bróin, 2015). The social room supports the sense of community and amplifies the social cohesion between visitors and the staff (Frandsen, 2009). This is particularly important for cancer patients and therefore there should be a balance between the private, the social and the semi-private so that the highest percentage of needs are met (O'Bróin, 2015).

Outdoor
The importance of visual and physical contact to outdoor areas is a key part of healing architecture. This is beneficial not only to the patients, but also the staff and everyone else who visits the building. It has a positive effect on both the physical and mental well-being of the occupants of the building covering a measurable impact on the stress level

Ill. 26.1: Direct access from building to outdoor areas



Ill. 26.2: Walking and talking

Ill. 26.3: Multifunctional outdoor area at SEB Bank, Copenhaen

Ill. 26.4: Herbal gaden with multiple sensory perceptions

(Frandsen, 2009; Lottrup, 2012; Ulrich, 2008). There is a noticeable difference in the stress level between a person who has a view with nature and one with an urban view and by being in a building with view to the nature it is possible to affect both the stress level in a positive manner, help keeping the stress level down and improve the mood (Frandsen, 2009). In fact the if there is easy access to the outdoors from a room, the occupants of this particular room will perceive less stress than occupants with only the access of views to the outdoor (Lottrup, 2012). By letting the occupants of the building have views to the outdoor surroundings the spacial orientation of both the physical indoor and outdoor environment is eased which also has a positive effect on the stress level (Frandsen, 2009).

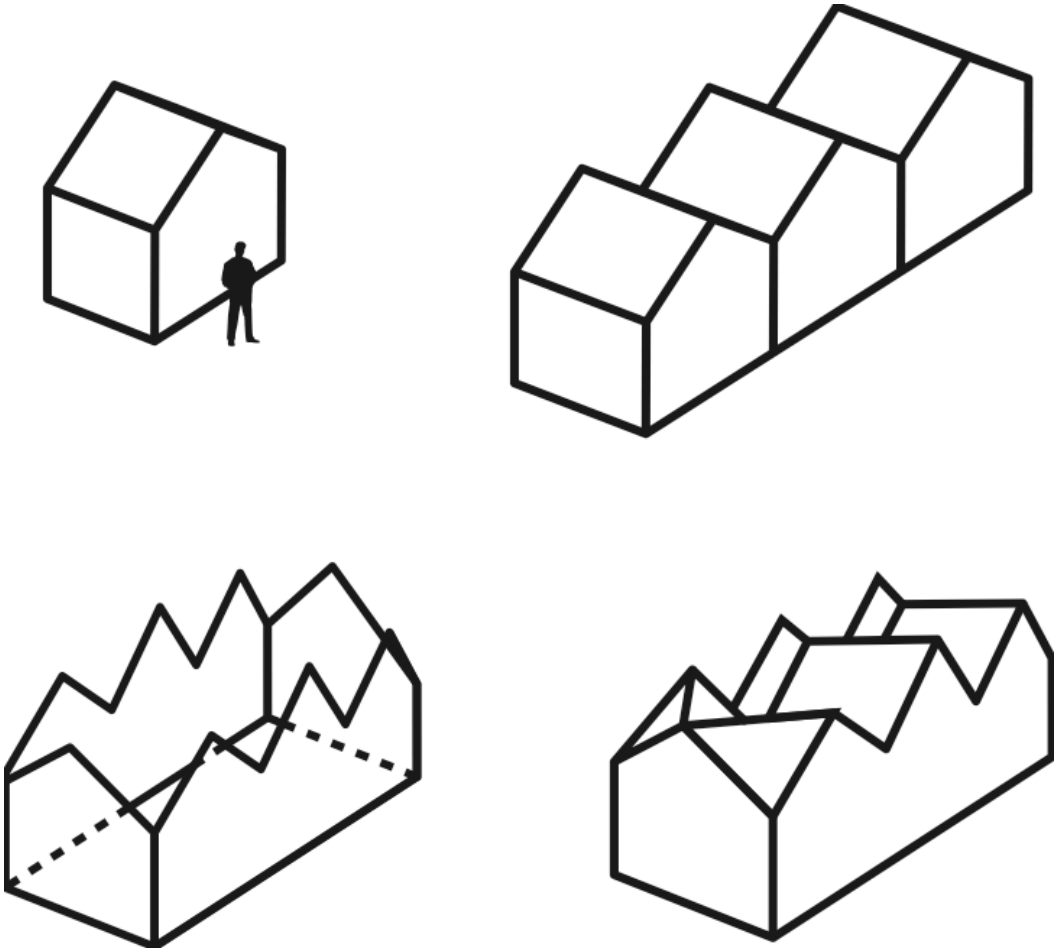
As mentioned, the access to outdoor areas has a stronger effect than just the view. This is partly due to the sensory richness that appeals to the sight, hearing and smell. This sensory experience provides a positive change of mood, a feeling of calmness and some even experience feeling refreshed after being in natural surroundings (Frandsen, 2009; Butterfield, 2015). Therefore the access or the ease of access of the outdoor area is crucial to the use of it. Studies have shown, that by having access close to outdoor areas in close relation to the social rooms, such as canteens, increase the use of the outdoor room (Lottrup, 2012; Frandsen, 2009).

The use of the outdoor areas differ between the users - especially according to age and gender. A parallel can be drawn to the private and the social rooms where some like to be social and active in the nature, while others like to be alone and meditate surrounded by the sensory richness of the nature (Frandsen, 2009).

Infact what does compare across the different users in the sensory impact that the nature has on the individual. This sensory experience differs throughout the year with the changing of seasons like a tale of life. The different senses are activated in an outdoor environment and this can be strengthened through carefully planned gardens and outdoor areas. As with the views to the nature from an indoor environment, walking in nature provides an ever changing view throughout the different landscape sceneries that change with the seasons. Different smells and sounds also appears while being in the nature. It has been proven, that the stress level is lower for people listening to birdsong and the swish from the wind and that it will rise when listening to traffic and the sounds of the city (Frandsen, 2009; Ulrich, 2008).

	Sight	Hearing	Smell	Kinesthetics	Private/social	Outdoor
Physical environment	*Placement* *Disposition* *Plan layout* *Furnishing* *Facadecomposition*	*Furnishing* *Materials*	*Furnishing* *Materials*	*Plan layout* *Furnishing* *Disposition*	*Plan layout* *Furnishing* *Disposition*	*Placement* *Plan layout* *Furnishing* *Disposition*
Effect	*Joy* *Calmness* *Distraction* *Satisfation* *Distration* *Orientation* *Stress* *Pain* *Circadian Rythm* *Mortality*	*Joy* *Stress* *Anxiety* *Privacy* *Communication* *Concentration*	*Stress* *Anxiety*	*Communication* *Orientation*	*Healing* *Comfort* *Stress* *Anxiety* *Security* *Privacy* *Control* *Being social* *Satisfaction* *Communication* *Joy*	*Pain* *Exercise* *Mortality* *Stress* *Anxiety* *Calmness* *Distraction* *Privacy* *Sorrow* *Being Social* *Concentration* *Joy* *Orientation*

Ill. 27.1: Effects on senses



Ill. 28.1: Diagrammatic story of the healthcare centre

HEALING ARCHITECTURE CASE

Case study of Healthcare Centre for cancer patients in Copenhagen by NORD Architects.

An early example of the principle behind healing architecture is the Healthcare Centre for cancer patients located in Copenhagen in close relation to Rigshospitalet, designed by NORD Architects. Here, many of the aspects behind healing architecture and the program paradigm for the 'Livsrum' are present and well integrated in the architectural language and solutions.

The architectural language of the exterior mimes and interprets the what is commonly seen as the home, but in a larger scale. The diagrammatic story of breaking the scale of a multiple storey building down by using shapes that are associated with shapes that is commonly seen as a typical as a house or a home is both symbolising the use of the building and the intented welcoming and warming gesture of a healthcare centre.

Because of the placement in the urban context, the exterior seems somewhat clinical and dismissive especially seen in connection to warm tonality of the red/brown bricks seen on many of the buildings in the close context. As soon as you enter the building though the warmth from the materials used and the brightness from the large amount of daylight gives another impression of the building - something you have to enter to experience. Therefore the exterior can be seen as a protective an repelling shell that is protecting the softer interior of the building and thereby also the users.

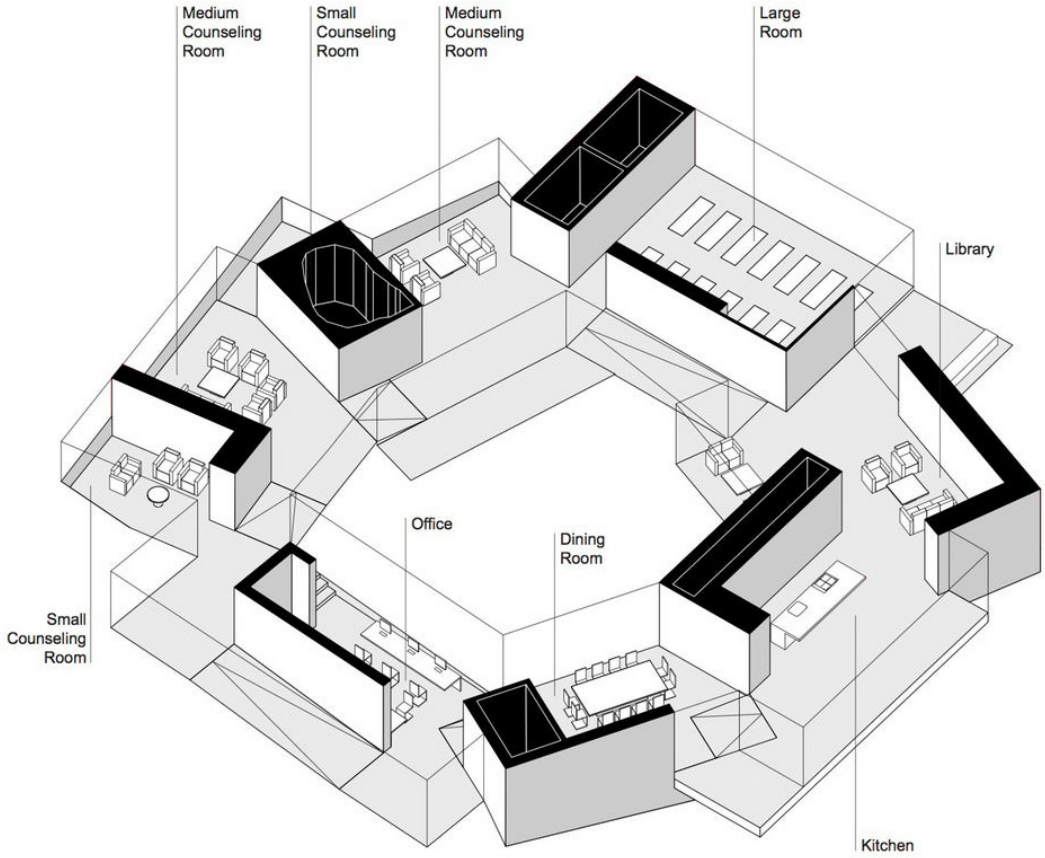
Because of the very urban context that the building is located in, access to outdoor areas are limited. To compromise on this, atrium yards has but cut out from the building volume. This means that even in this context, the users can find a peaceful and calm outdoor space to socialise or relax.

Ill. X.1: Arrival of the healthcare centre

Ill. X.2: Atrium yard in multiple levels

Ill. X.3: Access to outdoor area

Ill. X.4: Social room in multiple levels



Ill. 30.1: Isometric drawing of Maggie's Gartnavel

NATURE AS AN ARCHITECTURAL ELEMENT

Case study of Maggie's Gartnavel by OMA

The Maggie's Centres are the british equivalent to the 'Livsrum' - a cancer counselling with similar functions, program and concept (O'Bróin, 2015). The centre in connection to the Gartnavel Hospital in Glasgow, Scotland, was designed by OMA and built in natural surroundings in 2011 (Jencks, 2015). It seems like OMA has been hugely inspired by modernist Philip Johnson's Forest house with the transparent facades that creates a strong connection to the outdoor area. This connection is seen in every room throughout the building where the contradistinction between open and closed has been taken very literally. Open rooms have floor to ceiling windows while closed rooms have a roof window.

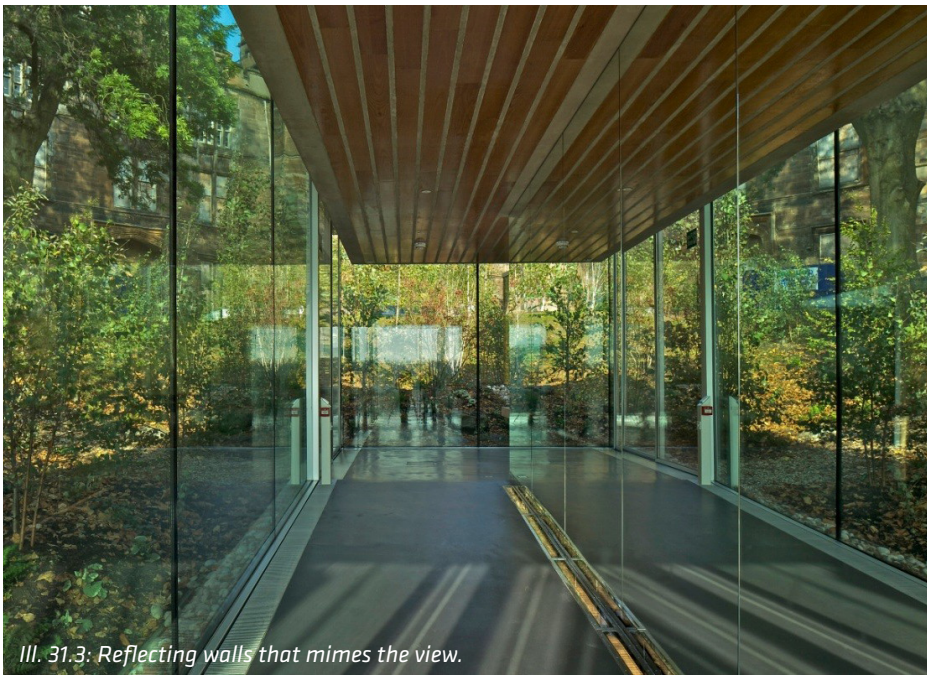
This contradistinction also plays part in the floor plan of the centre. Every room in the 'open' part has a strong connection to each other - either physical or visual, while the closed rooms are secluded and closed off from the rest of the building. The floorplan seems like the open floorplan solution of the modernist period that has been seen through the eyes of a deconstructivist - boxes that interfere with each other to create a loop that enclose a sensory atrium garden and ensures a feeling of community by always having a visual connection to other parts of the building. This helps creating a large social space in the centre with many smaller niches that are furnished for smaller groups to sit and talk while being close to the nature and indulged by daylight. The private rooms for confidential talks seems not to be apparent in the centre which seems to be a disadvantage of the very open and transparent building.

Throughout the centre it is evident that nature the nature plays a huge part in the design. It is like the nature becomes an extension of the room and is used as an interacting architectural element which is enhanced by large mirror walls that depicts the nature that is seen through the large windows.

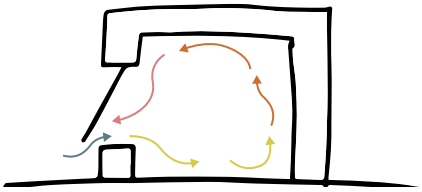
From the moment you arrive at the turf of the centre you discover the building that is almost hidden in a forest. From the path leading to the building you can choose to enter the envelope or take a walk in the surrounding outdoor area. The coherency between indoor and outdoor is thereby noticeable in both the concept of the building and in the architectural elements that is used to empathise this by representing itself as in integrated part of the architectural language rather than being an afterthought as an appendix to the building, which seems to be the trend in 20th and 21st century architecture (Jensen et al., 2016).

Ill. 31.1: Arrival at Maggie's Gartnavel

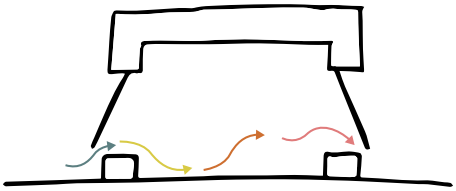

Ill. 31.2: Cozy niche.


Ill. 31.3: Reflecting walls that mimes the view.

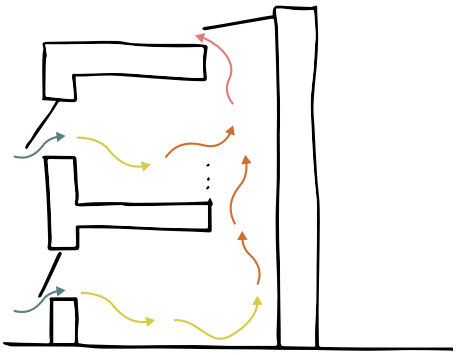

Ill. 31.4: Exterior view.



Ill. 32.1: One-sided natural ventilation



Ill. 32.2: Two-sided natural ventilation



Ill. 32.3: Thermal buoyancy principle

SUSTAINABLE STRATEGIES

When designing healthcare architecture the indoor climate has a great importance and that is the reason for the technical focus of this project. A component in the healing architecture is the sense of smelling meaning that the indoor environment should be comfortable to be in so that the patients will not get sicker by being in a building. When considering the indoor climate the focus will not only be on the atmospheric climate but also the thermal climate opting for a ventilation strategy that in connection to the building envelope creates a healthy environments for its users. This chapter will focus on the different aspects of the passive and active strategies and how these can be used as architectural tools in the thrive for a healthy indoor climate.

The program states that the indoor climate should generally meet category B for both atmospheric and thermal indoor climate while the common rooms should meet the minimum requirement, category C (cancer.dk, 2014). For the function of the building the argument of a healthy indoor climate would argue that it should be category A, and that this should be the aim for this project.

Passive strategies

Envelope

The field of sustainability is ever changing. Right now the standard for building is BR15 which i.a. states the thermal transmission of the envelope. Due to the thickness of the construction for containing the higher requirement for insulation the walls are now using a lot of space in a room (bygningsreglementet.dk, 2016). This becomes apparent when looking at the openings in the envelope - these openings can be used as an architectural element by making niches for furniture or as a seating area.

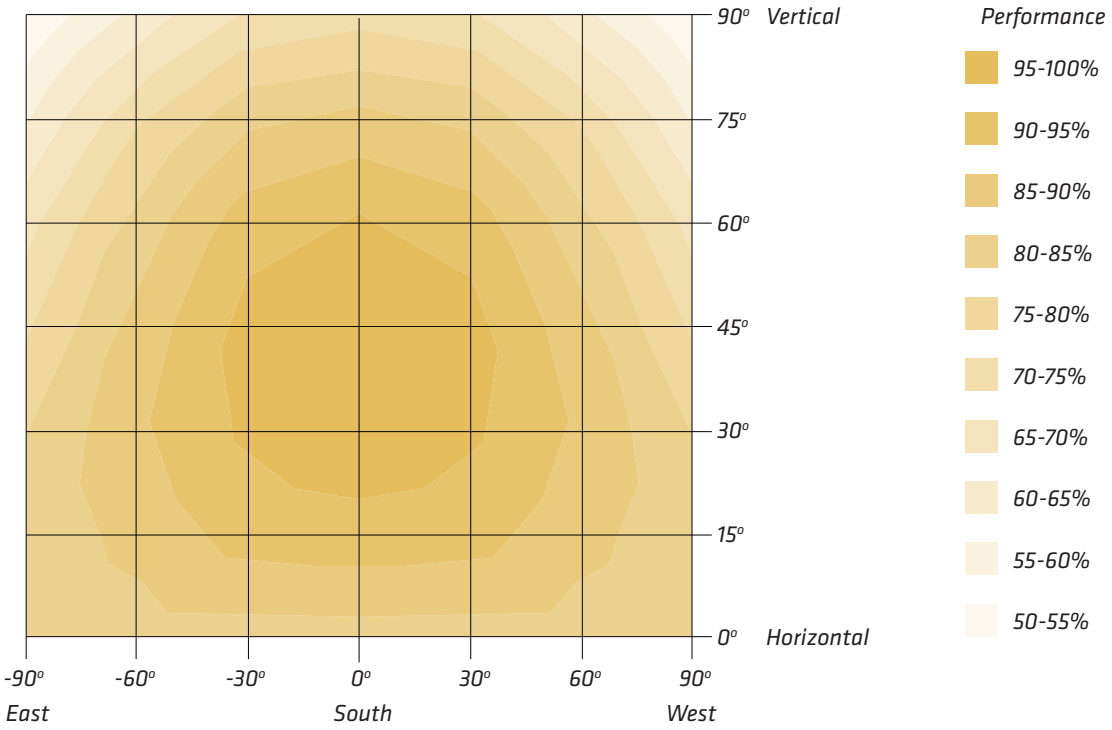
Depending on the construction of the envelope and interior walls, the thermal mass of the building can be used to either cool or heat the building. Heat from the sun is stored in the construction, and the need for heat supply will be lower (sbi.dk, 2006).

Ventilation

Different ventilation strategies can be used for a building on a general level, but also locally some strategies makes more sense than others. The three strategies that are know is mechanical, natural and hybrid. Mechanical ventilation is a closed system which operates in a state of equilibrium between injection and exhaust air (kilde). This type of ventilation is especially good in rooms with a high demand of air change such as the kitchen, bathroom and workout room. This solution is though demanding a lot of electrical power.

The term natural ventilation covers the principal of openings in the envelope that ventilates the building. For natural ventilation to work, wind must be present. There are different ways of using this principle depending on the layout of the building. The least effective kind of natural ventilation is one sided (ill. 32.1), where injection and exhaust air goes through the same opening. Two sided natural ventilation is more efficient (ill. 32.2) but demands that the injected air can pass through the room and thereby use the difference in air pressure on the opposing facades (sbi.dk, 2012).

Lastly thermal buoyancy can be used in buildings with either great room heights or a multiple storey building with an atrium. Here the difference in air temper-



Ill. 33.1: PV performance according to orientation

ature helps the exhaust air escape the building by being lifted to an exhaust opening (Andersen, 2012)(ill. 32.3). Natural ventilation is a sustainable solution in principle, but only during the summer months in Denmark due to the lower temperatures during the rest of the year. If natural ventilation is used during this period the energy demand for reheating the building will rise and the advantage disappears (Aggerholm, Heiselberg, Bergsøe, 2008). It is also important to shape the openings so that there is equipoise between the injection and exhaust to avoid draft or a failed normal (Andersen, 2012).

By mixing the two types of ventilation the principle of hybrid ventilation is created. During the warm months the natural ventilation is used and during the cold months mechanical ventilation with a possible heat recovery is used. This makes the least energy demanding solution, which makes this solution very suitable for a sustainable building (Aggerholm, Heiselberg, Bergsøe, 2008).

Openings/windows

Besides being accessways for the air used for the natural ventilation, the openings of the envelope also creates access for the daylight - by doing so the openings make way for solar heating (komforthusene.dk, 2017). To control this added thermal load a variety of different strategies can be used.

The G-value of the window tells how much of the solar heat it is letting through the glass. A high g-value window is letting more heat through the glass, meaning that if overheating is a problem, windows with a lower g-value could take part in lowering the overheating (kastrupvinduet.dk, 2017). Though there should be a certain awareness to find right right balance between the added heat load from the sun and the lowest amount of cooling needed. Therefore the g-value and the position of the window in the envelope is essential. When positioning the windows in the facade the orientation is essential to the amount of heating passing through the openings. North facing windows rarely lets direct sunlight into the building while east or west facing windows lets the sunlight the furthest into the building (komforthusene.dk, 2017).

Active strategies

PV-cells

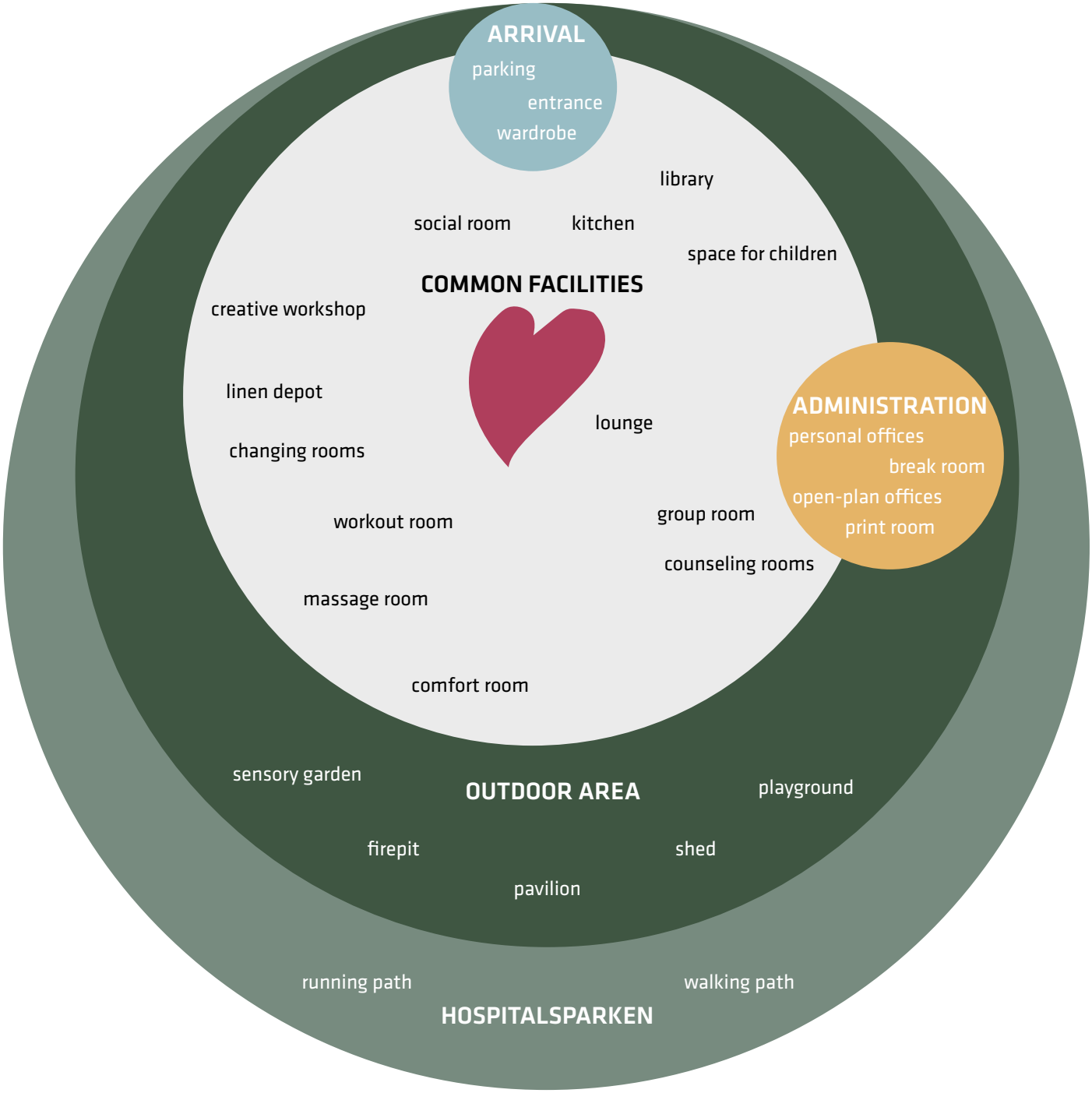
For designing with PV-cells first choosing the right cell is important. The cells commonly used used in domestic construction are monocrystalline, polycrystalline and thin-film cells - each has their own advantages and disadvantages. Monocrystalline cells is the oldest of the technologies and therefore also the most reliable of the technologies. It also has the highest efficiency of the different cells, but also the highest price and weight. The polycrystalline technology is similar to the monocrystalline, but has a lower price and efficiency. The advantage of the thin-film cell is weight and flexibility where the crystalline cells are in boxes with fixed measurements while the thin-film cells can be shaped more freely (bolius.dk, 2015).

When placing the PV-cells the orientation and incline is of high importance. Wrongly placed cells are less efficient than those placed correctly (bolius, 2015).

INITIAL ROOM PROGRAM

Roomtype	*Amount*	*Area (m^2)*	*Total Area (m^2)*	*Persons pr. room*
Arrival				
Entrance area	1	10	10	4-6
Wardrobe	1	5	5	
Common facilities				
Social room	1	50	50	15-20
Kitchen	1	15	15	6-8
Lounge	1	15	15	6-8
Library	1	10	10	3-4
Space for children	1	12	12	4-6
Group room	3	15-25	65	10-18
Counseling room	4	8-12	40	3-8
Workout room	2	60-80	140	16-32
Massage room	1	8	8	2
Linen depot	1	10	10	
Changing room	2	30	60	
Comfort room	1	15	15	2-3
Creative workshop	1	30	30	10
Depot	4	8-15	40	
Bathroom	2	4	8	
Administration				
Office for manager	2	10	20	2-4
Office for administrative personal	1	15	15	2
Office for counsellars	1	50	50	5-7
Office for consultants	1	40	40	4
Office for ‘Stafet for Livet’	1	50	50	6
Room for volunteers	1	12	12	
Print + depot	1	10	10	2-3
Break room	1	25	25	12-16
Wardrobe	1	10	10	12-16
Bathroom	2	6	12	
Other rooms				
Technical room	1	25	25	
Cleaning room	2	2	4	
		806		

ROOM DIAGRAM



Ill. 35.1: Room diagram

Ill. 36.1: Arrival at 'Livsrum' Herning, with benches for stay

Ill. 36.2: Semi-social area

Ill. 36.3: Social atmosphere of 'The room for life'

Ill. 36.4: Light workout room

ELEMENTS OF THE ROOM PROGRAM

The room program contains a variety of different functions which all have to suit certain needs and situations. This chapter will look more into depth of the functions and the atmosphere for the function one at a time and takes it point of departure in the program paradigm of the 'Livsrum'. The overall room program covers 4 main areas which are subdivided and explained in this chapter.

Arrival

The arrival situation is especially important and should already start when you enter the turf of the 'Livsrum'. When a patient takes the first step into the building he or she acknowledges the need for help or guidance. Therefore the first step can be particularly hard and the visitor can have a lot of second thoughts before stepping inside the building (O'Bróin, 2015). Therefore the entrance and arrival area should have a welcoming gesture and making a good first impression so that patients will get a good experience. This should also support the concept of the open counseling and that you can use the building and its facilities no matter the circumstances. At the arrival it is also important to empathise the kinesthetic theory of accessibility by establishing a quick overview of the building. An example of a well functioning arrival is the 'Livsrum' in Herning, ill x.1. Here benches are situated along the path from parking to the entrance of the building, so that first time visitors have the opportunity to rest before entering.

Common Rooms

The room for life

The heart of the building and the first room that the visitors meet is the room for life (livsrum).The room for life should have a homely feeling and include a kitchen, so that it mines the the family room that one would encounter in an ordinary house. The room should enhance the theory of 'the third place' and be a place for both social gatherings, activities and contemplation. The overall atmosphere of the room should be informal and release the feeling of community and enhance both large groups that are socializing and niches for those who wants to step away and be alone for a while (cancer.dk, 2014).

Workout room

One of the activities that takes place in the 'Livsrum' is varying types of workout - for instance the course 'Krop og Kræft' (body and cancer) (O'Bróin, 2015). Therefore facilities for this has to be present in the building. When you as a cancer patient receive chemotherapy and after the course, the body cannot do as much as it has been able to do before. Therefore it is very important to stay in shape, but to survive the chemotherapy but also to prevent spreading or a relapse of the cancer (cancer.dk, 2014). The workout spaces need a lot of ventilation due to the activity level in the room - it should therefore both have mechanical- and a possibility for natural ventilation. Large openings will also encourage the users to be active outside (Lottrup, 2012).

Comfort room

This room is intended for different sorts of therapy to distract the patients from their pain and to make them reflect upon life. The atmosphere of the room should be cozy to make the patients relax while having a break from the everyday life or after medical examinations at the hospital. The room has to be acoustically secluded from the rest of the building, so that the patient can calm down or even meditate in a silent room (cancer.dk, 2014).

Ill. 37.1: Niches integrated in envelope and shelving system

Ill. 37.2: Semi-social area

Ill. 37.3: Contact to outdoor area from counseling room

Creative workshop

This space is intended for the patients to express their artistic freedom and be a creative haven where the patients can both liberate their thoughts and minds and use it as a distractor in their course of illness (cancer.dk, 2014). Varying kinds of creative activities can take place here including painting and crafts (cancer.dk, 2014. Therefore the ventilation of this room should be mechanic to avoid obnoxious smells and the materials be robust to cope with the working environment.

Counseling

There should be different kinds of rooms for counseling meeting the different needs from the different users. Some like to have a confidential talk with their counselor while other feel more comfortable in an open space. Some like to have conversations with only one person while other feel more at home in a group. All of these different needs has to be taken into account when designing both the counseling rooms and the building in general. On the local scale in the counseling rooms they should have a certain flexibility and adaptability so that they can fit groups from 2 and up to 16 people at once. On the more general level the building should include seating areas and niches to account for the visitors who like to be in the open space but still secluded (O'Bróin, 2015).

Niches

The room for life is a social room where patients can meet each other but also where one can have the need and desire to relax and dissipate the tension that they might feel in their everyday life. This means that the room should account for both situations - this is where the niches can be used as an semi-social and semi-private architectural solution. Here the patients can resign from the social life and seek assurance and privacy while still being in close relation to a social gathering.

Kids

In the common room the kids and the youth should be taken into account. Stimulating play areas both inside and out should be included for smaller kids while the youth should have access to places for gaming or watching movies.

Administration

The administration of the 'Livsrum' has to be a function that is secluded from the common facilities and be the only part of the building that is not open for just everyone. It is important to stress the importance of the staff and therefore grant them the same atmosphere, views and opportunities as the rest of the building gives. A good working environment is important because if the staff feels looked after they will be more willing in their work and thereby the chance of leaving the visitors with a good experience is greater (Frandsen, 2009). The administration is composed of semi-closed offices and a common room for the staff to meet both formally and informally in their work at the 'Livsrum' .

Ill. 38.1: Entrance and cozy niche at 'Livsrum' Herning

INTERIOR ATMOSPHERE AND EXPRESSION

The program for the 'Livsrum' states that:

"The interiour decoration have to have a great extent of homeliness..." (cancer.dk, 2014, p. 21).

The reason for this is to be as little as an institution as possible - it should neither feel or look like an institution. It has been proven via evidence based research that patients feel more welcome, less stressful and that the spell of sickness is shortened in homely surroundings (Frandsen, 2009). The focus of this chapter is to get closer to this adjective and the meaning of it.

When building in Denmark and in the Nordic countries in general some characteristics recurs in both the overall architectural expression but also the layout of the building. In terms of the interior focus, the tendency is a thrive to optimise the light conditions in a room (Andersen & Schelde, 2012). During the winter in the Nordic countries the days are short and the tendency is that people wants the most out of the daylight that they get and therefore large openings in the building envelope is part of the new nordic architecture. This light is also quite vital for the users of the 'Livsrum', many of which struggle with depressive thoughts about their psychosocial situation due to their diagnosis (Frandsen, 2009).

'Hyga

Discussing the home and homeliness in a danish context it is very hard to avoid the term hygge. This is somehow emphasized in the architecture through the furnishing and the choice of interior materials where a combination of white walls and wooden panels are commonly seen in both contemporary and past architectural styles. The white walls drags the daylight far into the building while the wood gives the room a certain warmth which many would link to the feeling of 'hygge' (Andersen & Schelde, 2012). The warmth from the wood is needed to ensure that the whiteness of the interior does not become too clinical or sterile in its appearance. The mood also relates to 'the third place', a place people go to get an informal sense of 'hygge' on neutral ground, which in essence is the task of the 'Livsrum'.

An example of this is the Vipp Shelter which acts as a getaway with just the functions needed to sustain and destress from everyday life - a place for secluded relaxation. Even though the interior is characterized by dark tones the shelter implies coziness with the small floorplan where every square centimeter has been planned to optimise the feeling of relaxation and redemption in close relation to the nature and daylight.

Ill. X.1: Exterior of the Vipp Shelter

Ill. X.2: Interior of the Vipp Shelter

Ill. X.3: Clinical home interior

Ill. X.4: Interior of 'Livsrum' Odense

Ill. X.5: Interior of 'Livsrum' Herning

VISION

The vision for the new 'Livsrum' cancer counselling centre in herlev is to create a building with the user in mind throughout the process and in the finised proposal.

The driving force to keed the user in focus being the theory behind healing architecture and sustainable architectural solutions for a indoor climate suitable for a piece of healthcare architecture.

DESIGN PARAMETERS

From the program phase, designparameters for different fields of the final design were generated.

Architecture

 # The building has to be in 1 storey to make an access and orientation of the building as easy as possible for the user.

 # Welcoming gesture clearly indicating the main entrance for first time visitors.

 # Architectural language miming a homely expression.

 # Views and access to green outdoor areas.

Technical

 # Sustainable aspects and considerations integrated in the building shape and construction.

 # Energy frame complying to danish building calss 2020.

 # Thermal and atmospherical indoor climate complying to class A, DS/CEN/CR 1752.

Outdoor area

 # Clearly defines outdoor ares with different character meeting demands from various users.

 # Private outdoor spaces in connection to the building and public outdoor spaces connecting the building with the context.

 # Outdoor areas as extension of internal rooms.

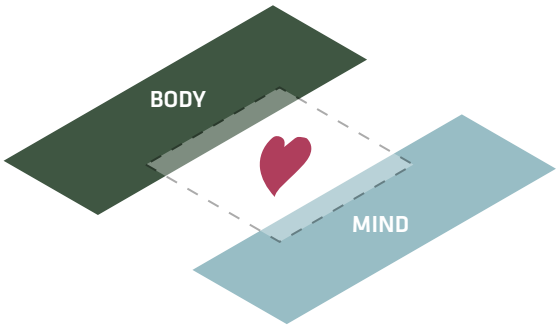
#PRESENTATION

Ill. 43.1: Overlooking the pont in 'Hospitalsparken'

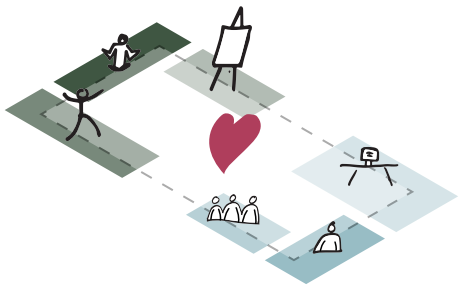
CONCEPT

The concept of Livsrum Herlev is highly informed by the room program which has been grouped into three major volumes - a volume the is concentrating around the body, one concentrating around the mind, the last binding the two in a social gathering space. The major volumes are function divided into six volumes and made to fit with the areas of the room program, yet still bounded by the the gathering space. The large social area is then scattered by letting the nature into the building through two atriums. The volumes are now melting together into seven volumes which are adapted to the landscape.

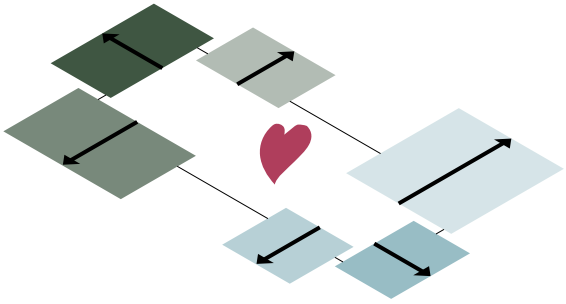
The concept highly informed by the nature, sloping the south facing roof in a 12 degree slope to make the PV cells operate at up to 95% of their total performance. The other side of the pitched roof is used to gain more daylight in the building providing indirect daylight. This pitched roof is at the same time miming the villa, making the counselling centre appear homely.



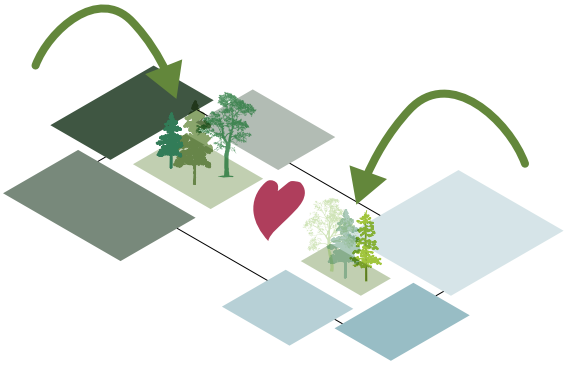
Ill. 45.1: Two parts connected in a common room



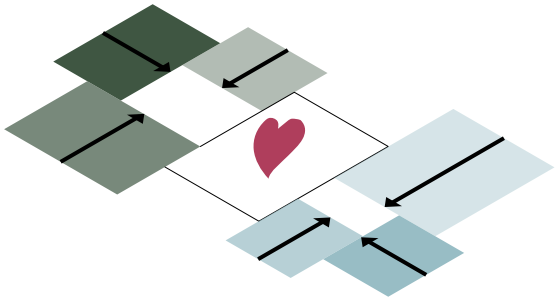
Ill. 45.2: Detailed division of the plan



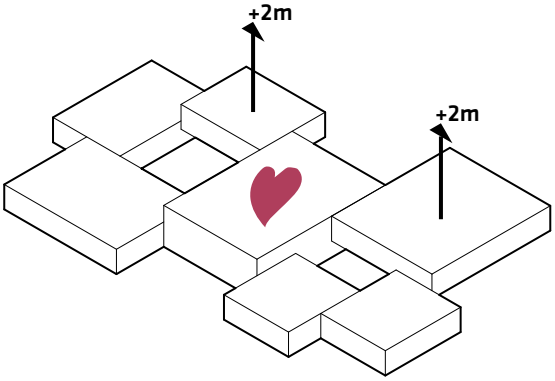
Ill. 45.3: Fitting the rooms to the room program



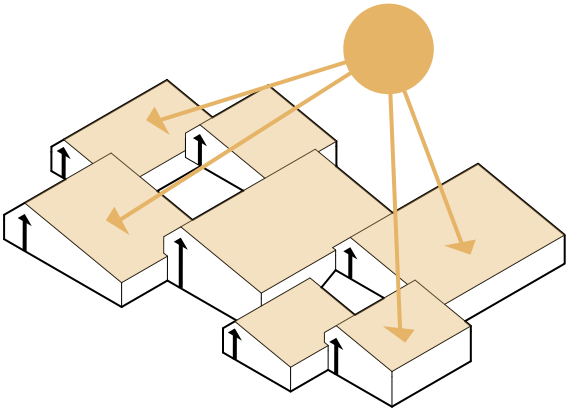
Ill. 45.3: Letting nature into the building



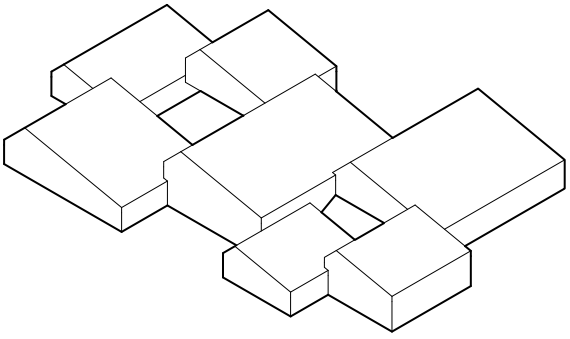
Ill. X.5: Volumes merging together



Ill. 45.6: Building adapting to incline of the site



Ill. 45.7: Shape informed by the sun



Ill. 45.8: Finished shape

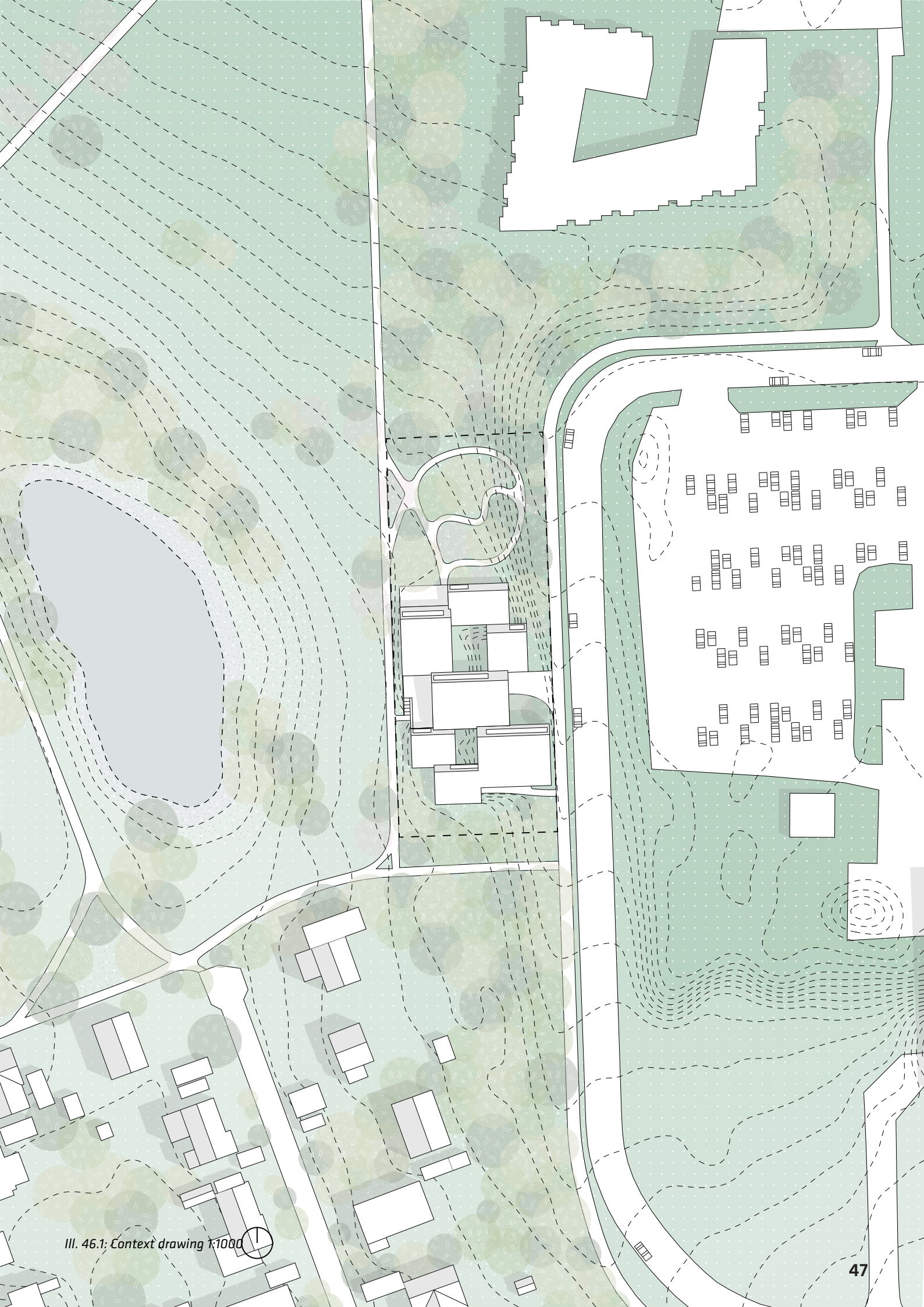
BUILDING IN CONTEXT

The site is located in the transition area between a residential area and the large hospital structure. This transition is marked by the park where the site is located in the periphery between Turkisvej and a public path in Hospitalsparken.

The building is located in the southern part of the site. Here the access from the hospital by foot is shorter compared to a more northernly position. The elevation distance is also the shortest on the site making the vertical barrier more managable.

The program askes for 1 parking lot in connection to the building. This parking lot is not included on the site hence parking is available both on Turkisvej and on the parking lot just 20 m east of the building.

The unused area in the northern part of the site is used as a continuation of the room inside building with a physically challinging landscape and a connection to the public path.



Ill. 46.1: Context drawing 1:1000

ARRIVAL

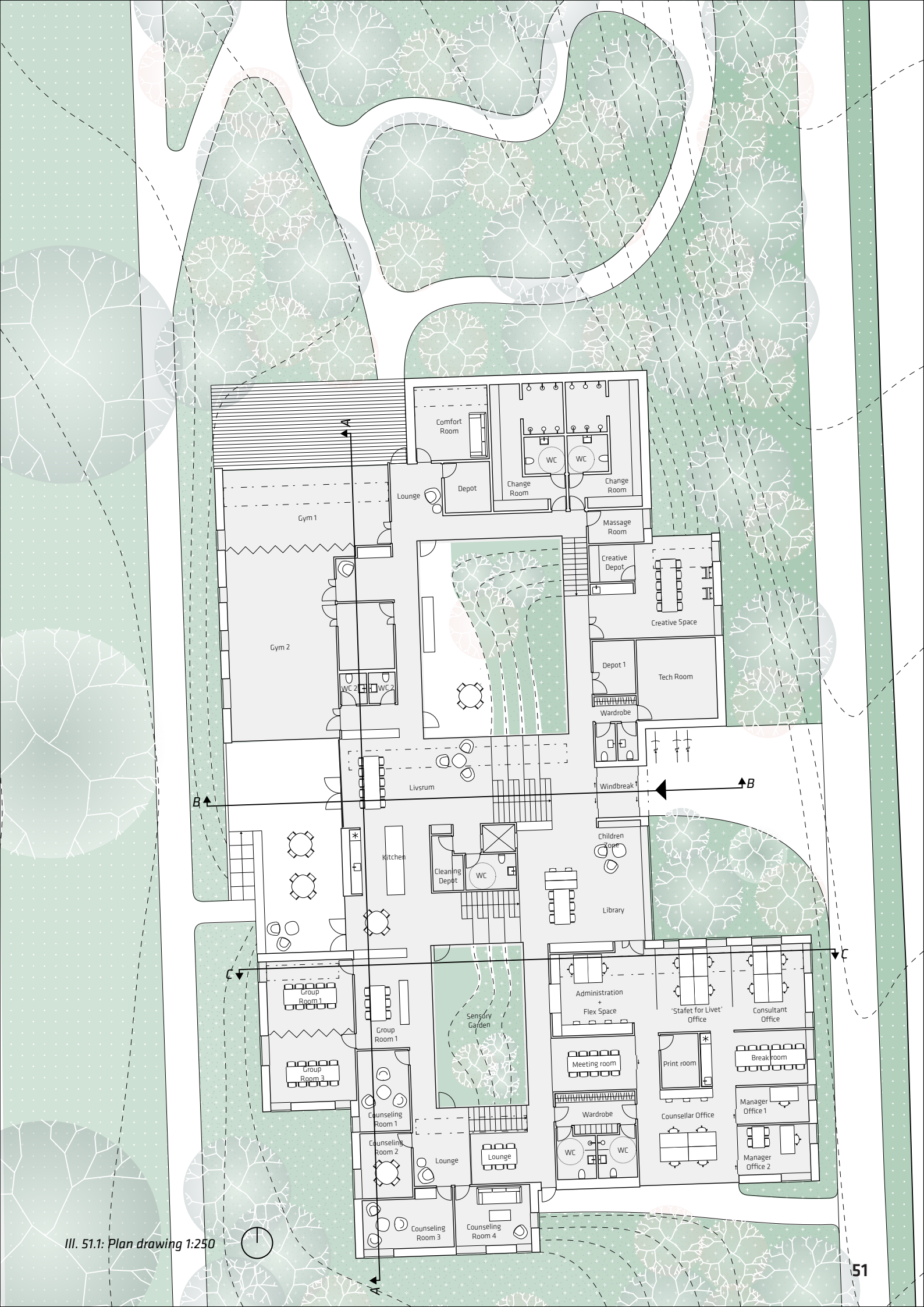
As described in the program, one of the most crucial moments that this building has to handle is the arrival.

To ease the accessability of the building the arrival and main entrance from Turkisvej is flat and appearent with large windows and 'Kræftens Bekæmpelse' logo clarly indicating the entrance.

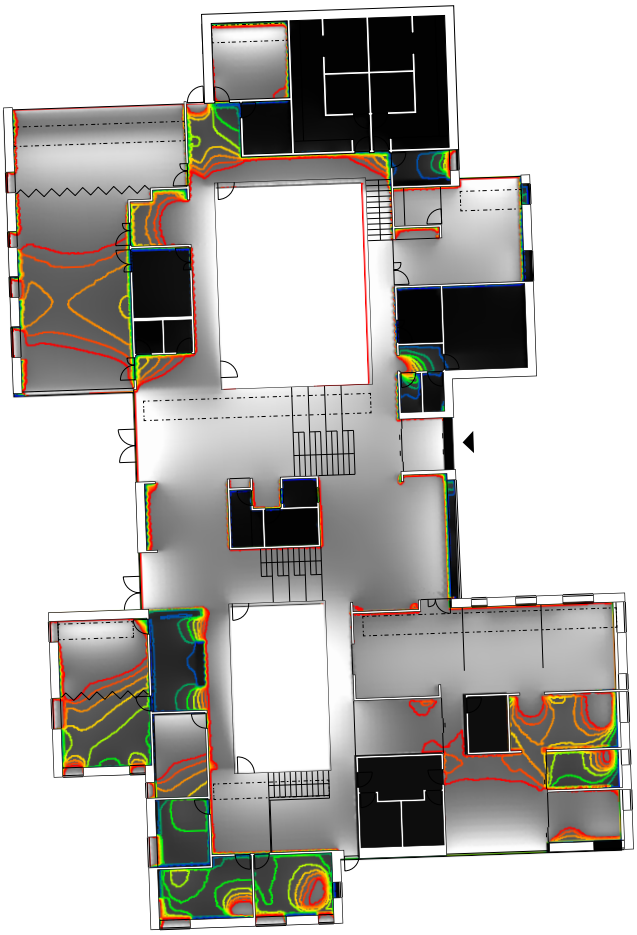
Ill. 49.1: Sorry for the bad render - ran out of time

ROOM PROGRAM

Roomtype	*Amount*	*Area (m^2)*	*Total Area (m^2)*	*Persons pr. room*
Arrival				
Windbreak	1	7.5	7.5	
Wardrobe	1	3.3	3.3	
WC	2	2.3	4.6	1
Common facilities				
Livsrum	1	104.1	104.1	15-20
Kitchen	1	17.0	17.0	6-8
Lounge 1	1	13.1	13.1	1-2
Lounge 2	1	14.4	14.4	1-2
Lounge 3	1	13.7	13.7	2-6
Library	1	27.2	27.2	3-4
Space for children	1	18.3	18.3	4-6
Group room 1	1	14.1	14.1	6
Group room 2	1	19.6	19.6	10
Group room 3	1	18.4	18.4	10
Counseling room 1	1	13.0	13.0	3
Counseling room 2	1	10.4	10.4	4
Counseling room 3	1	15.3	15.3	3
Counseling room 4	1	14.2	140	4
Gym 1	1	42.8	42.8	16
Gym 2	1	63.7	63.7	16
Massage room	2	7.2	7.2	2
Linen depot	2	7.0	7.0	
Changing room	1	22.6	45.2	
WC Changing room	1	4.8	5.6	1
Comfort room		18.1	18.1	2-3
Creative workshop		30.1	30.1	10
	1			
Administration	1			
Office for manager 1	1	8.2	8.2	1
Office for manager 2	1	11.3	11.3	1-4
Office for administrative personal	1	28.4	28.4	2-6
Office for counsellars	1	27.7	27.7	4-7
Office for consultants	1	19.5	19.5	4
Office for 'Stafet for Livet'	1	20.4	20.4	4
Print + depot	1	6.3	6.3	
Break room	1	18.4	18.4	6-12
Meeting room	2	14.4	14.4	4-10
Wardrobe		10.4	10.4	
Bathroom		5.7	11.4	
	1			
Other rooms	1			
Technical room	1	20.3	20.3	
Create depot	1	5.2	5.2	
Gym depot	1	11.6	11.6	
Depot 1	1	7.1	7.1	
Depot 2	1	4.6	4.6	
WC 2	2	2.5	5.0	
WC 3	1	4.8	4.8	
Hallways		107.0	107.0	
			934.7	
Outdoor areas				
Sensory garden	1	45.0		
Social garden	1	88.0		
Terrace	1	35.3		



Ill. 51.1: Plan drawing 1:250



Ill. 52.1: Plan with day light factor

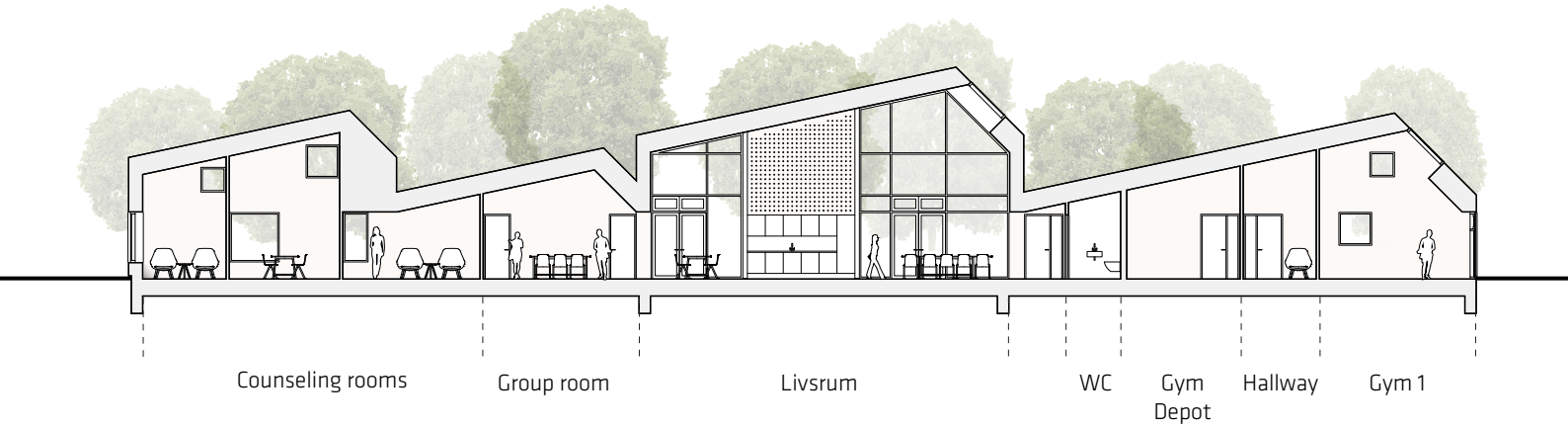
DAYLIGHT

The aim for the light in the building is to provide the large social spaces with a high daylight factor. What is opbvious is that the atriums and skylights provides a hight amount of daylight to the rooms they are adjoint to.

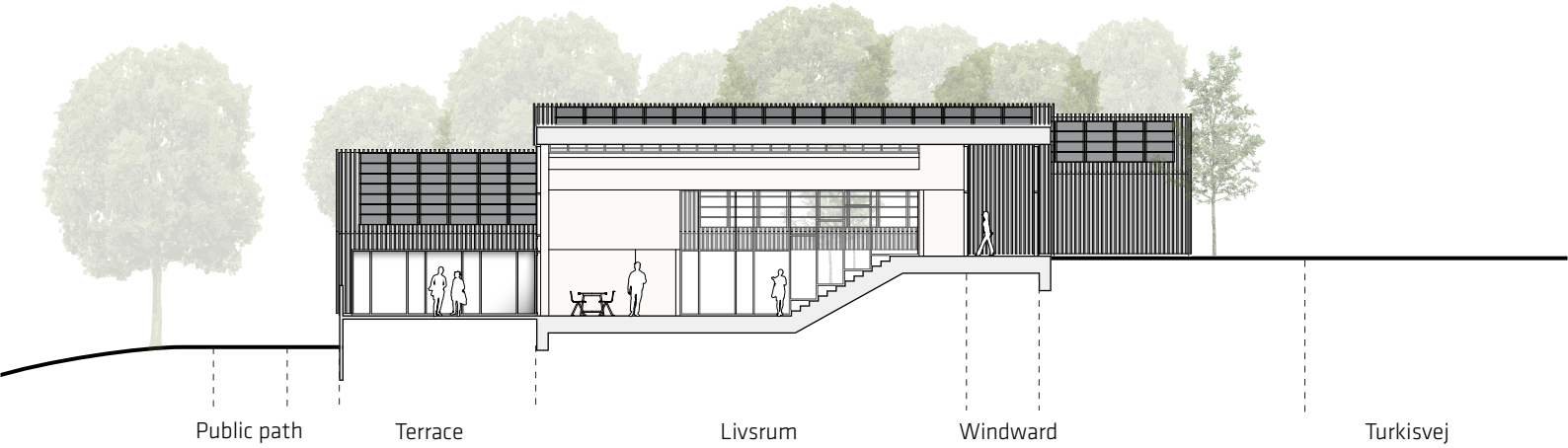
The most important rooms to check the daylight factor for are in the administration, where multiple employees have a workstation, which is obliged to have a daylight factor of at least 3.

The plan on ill. 52.1 also shows how the daylight factor is significantly lower in the more private and intimate consultation rooms creating characters of the different rooms.

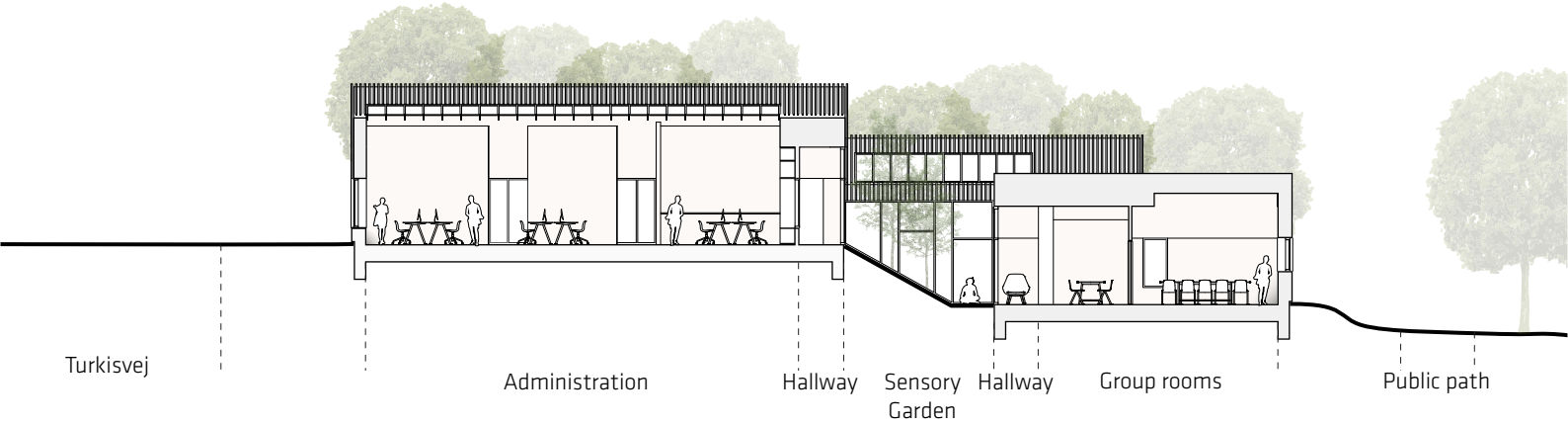
SECTIONS



Ill. 53.1: Section AA, 1:250

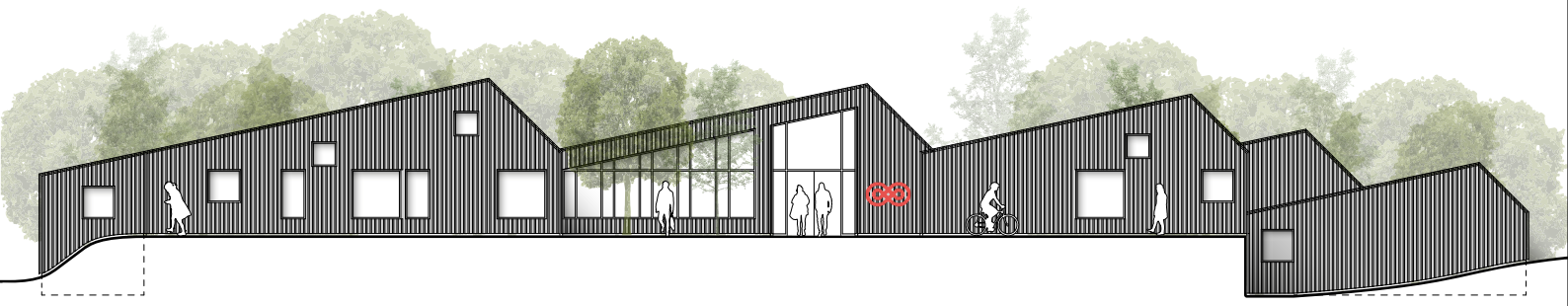


Ill. 53.2: Section BB, 1:250

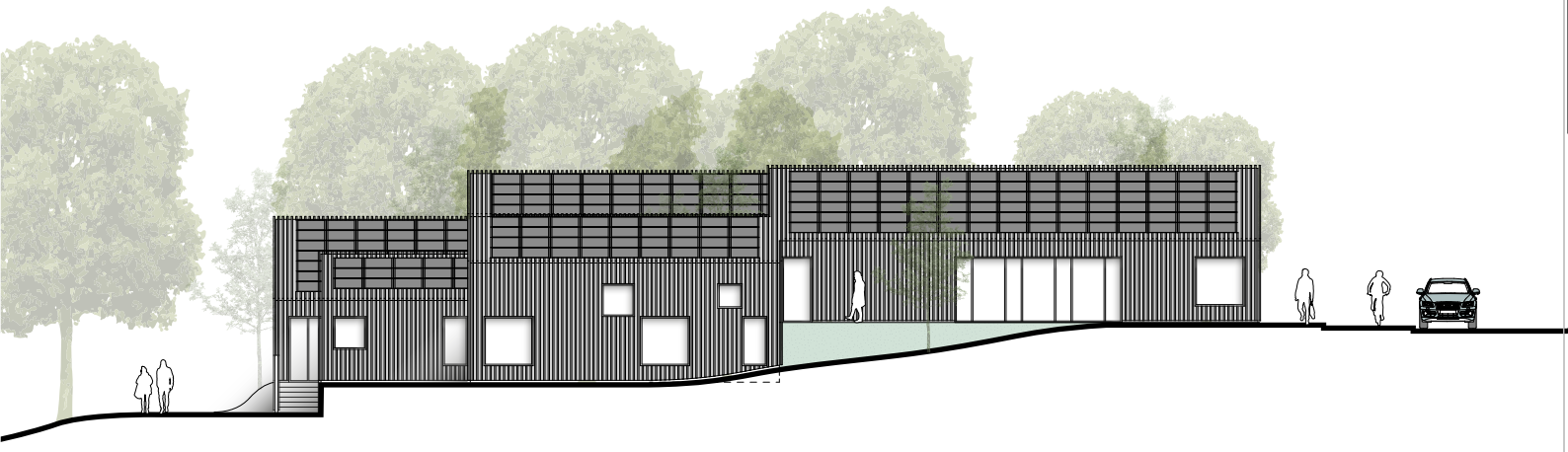


Ill. 53.3: Section CC, 1:250

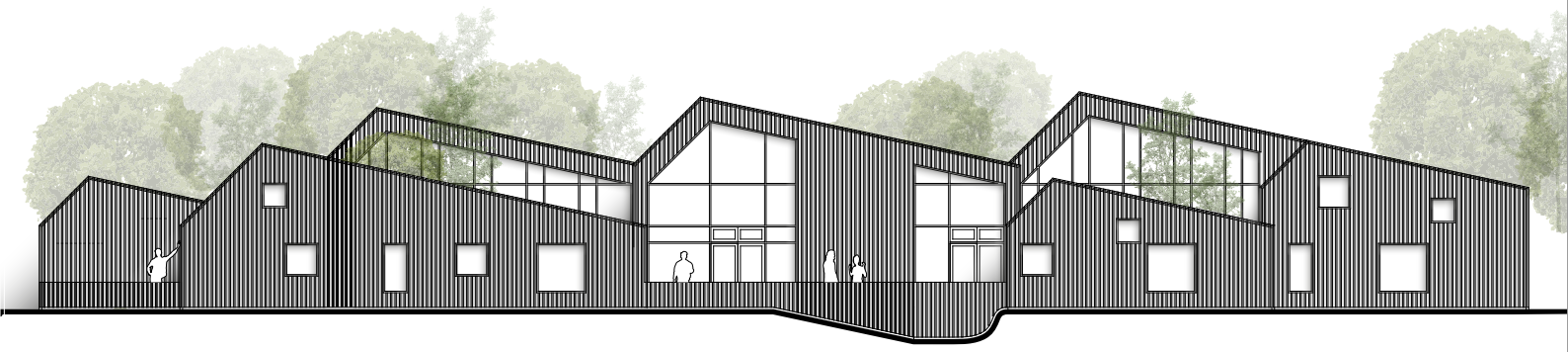
ELEVATIONS



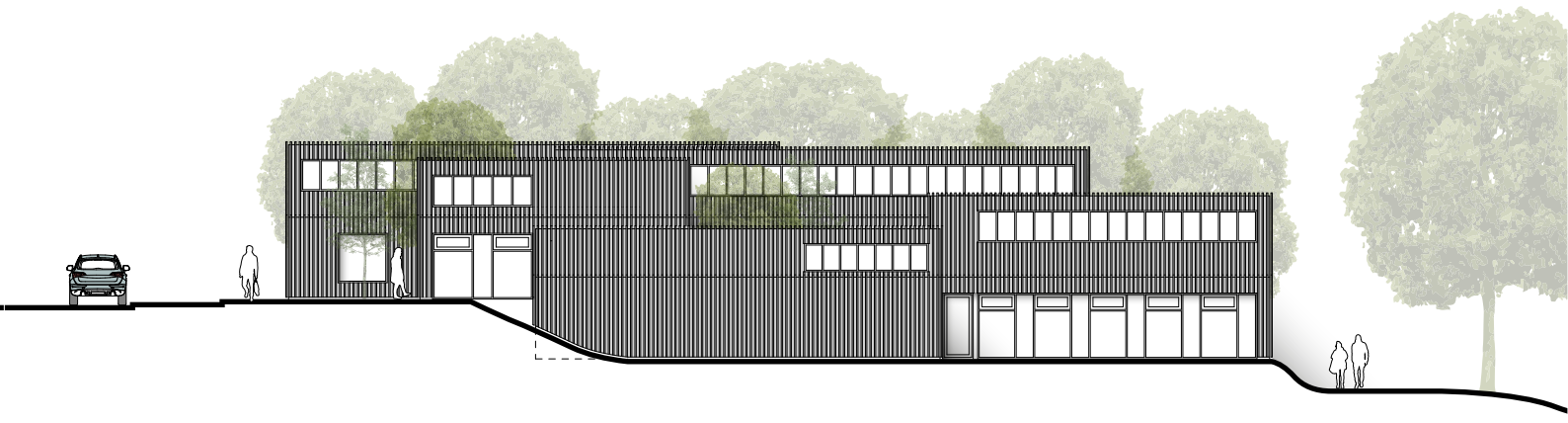
Ill. 54.1: East elevation 1:250



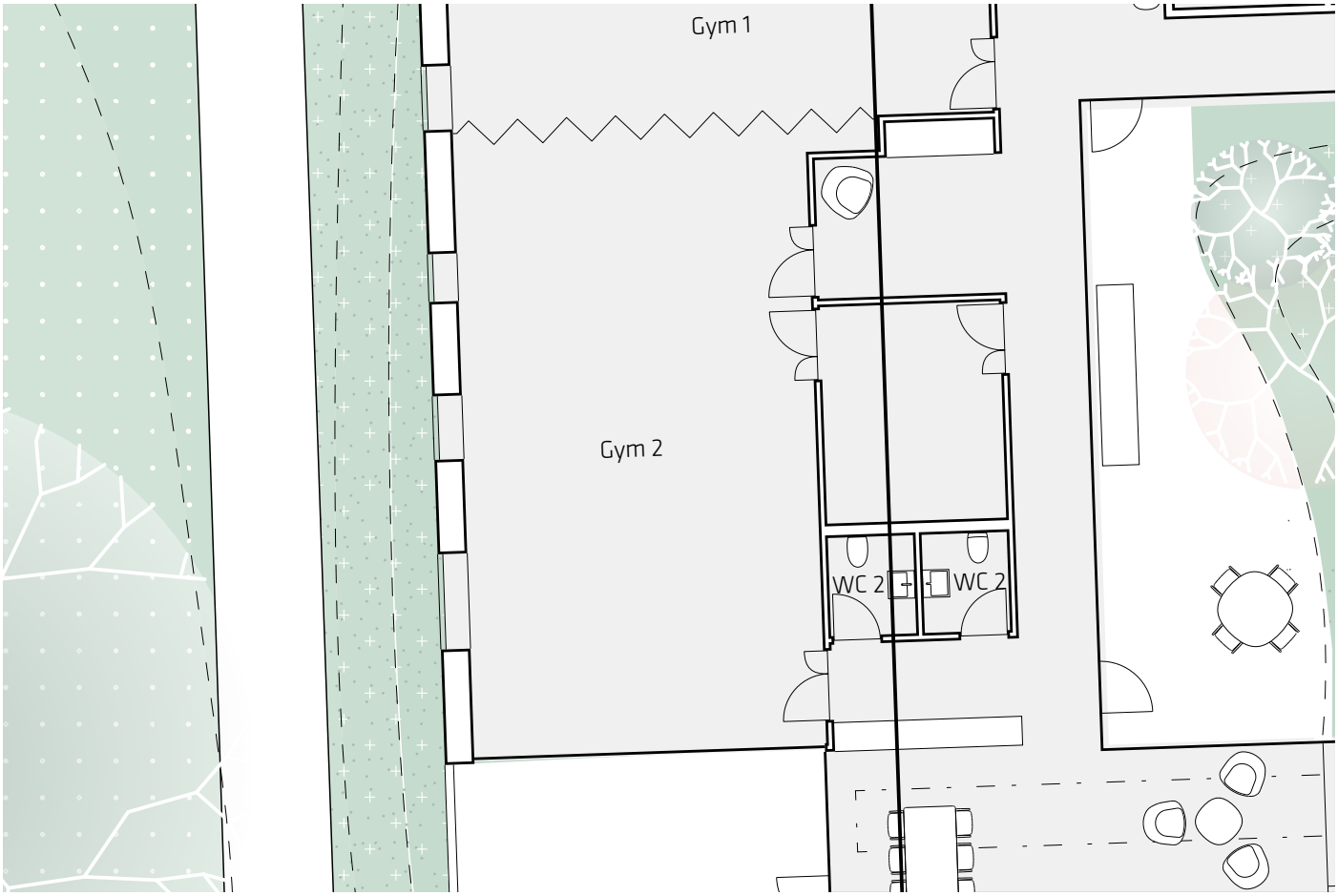
Ill. 54.2: South elevation 1:250



Ill. 55.1: West elevation 1:250



Ill. 55.2: North elevation 1:250



Ill. 56.1: Location of the room chosen for BSim simulation

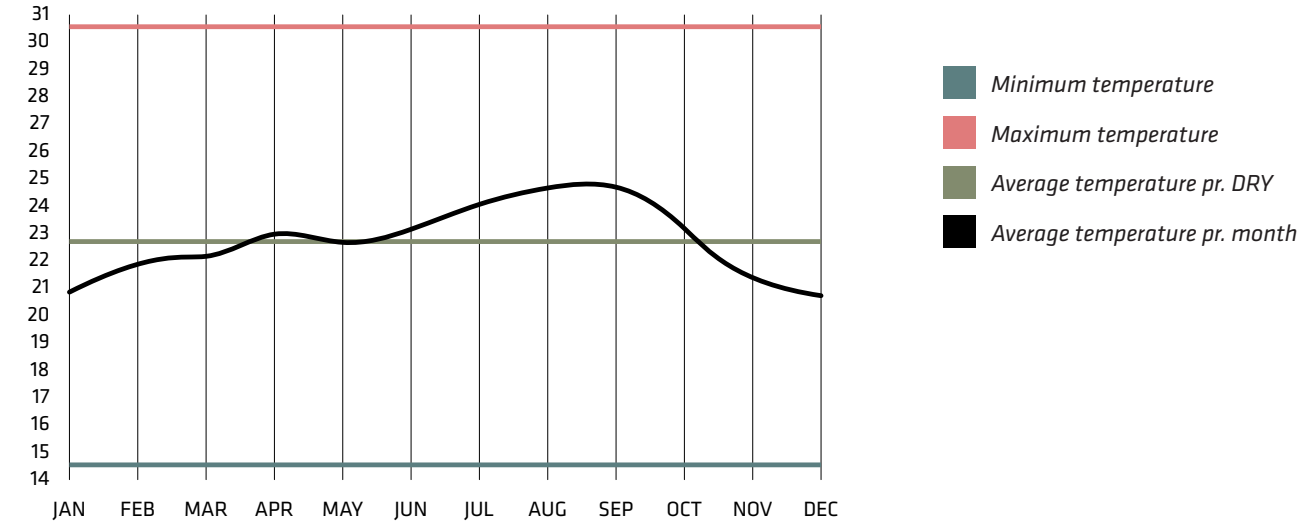
INDOOR COMFORT

The room chosen for the BSim simulation is the largest gym room (Gym 2, ill. 56.1) in the building. The reason for this choice is that this room is intented for a large amount of people with a high activity level in relation to the volume of the room.

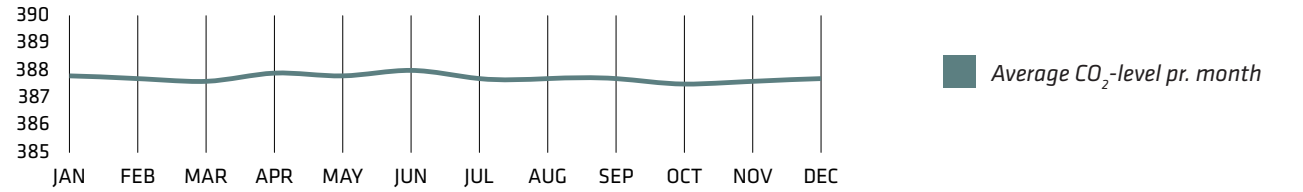
The room has a large south facing window which contributes with a high level of solar transmitted heat. This added to the activity level the room suffers overheating during the summer. Therefore a high amount of ventilation is needed to sustain a temperature that does not exceed 27 c° and a CO_2 level beneath 840 ppm.

What is evident from the BSim analysis, is that there is no issue with the air quality (ill. 57.2)- this can be caused by the large amount of ventilation which also influents the temperature in the room.

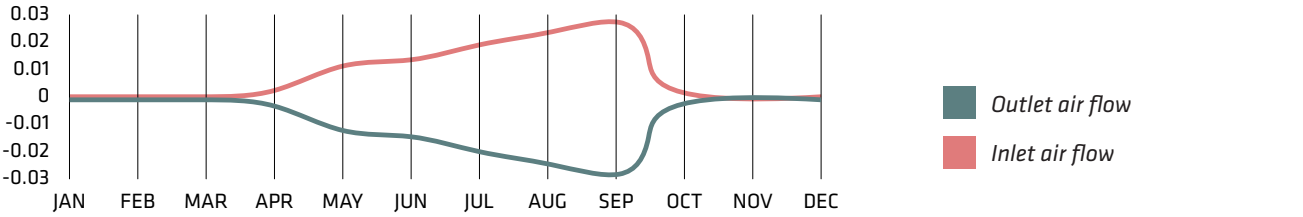
During the summer the room is heated only by the solar transmitted heat and the heat transmitted from the useres of the room and mainly ventilated using natural ventilation. The outdoor air temperature is however too low at times causing a large amount of hours with temperatures below 20 c° outside of the time the room is in use. This affect can be seen clearly in the operative temperature in may where the natural ventilation is turned on and the averate operative temperature is lower thanin april (ill. 57.1).



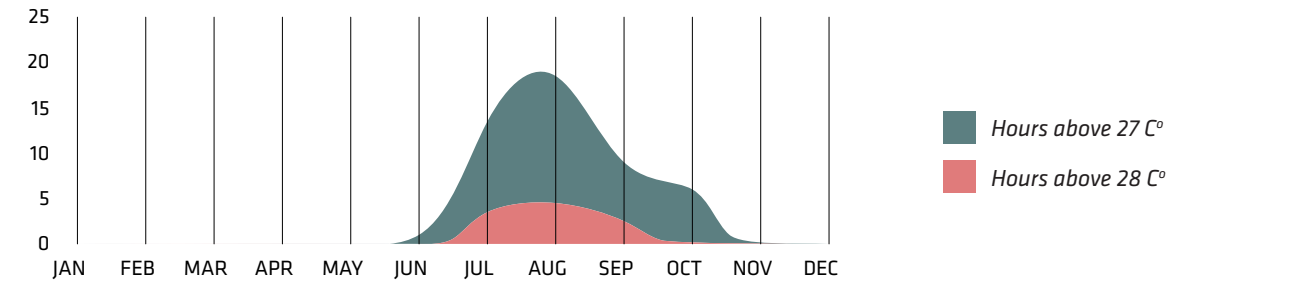
Ill. 57.1.: Operative temperature in C°.



Ill. 57.2.: CO_2-level in ppm.



Ill. 57.3.: Air flow rate for natural ventilation.



Ill. 57.4: Hours above 27 C° = 96, above 28 C° = 21.

Ill. 58.1: Mechanical ventilation plan

VENTILATION

The overall ventilation strategy for the building is a hybrid solution using a mix of mechanical and natural ventilation.

To ensure a good atmospherical indoor climate ventilation is either done according to olf or CO_2 levels. In most of the rooms in the building the dominat load is the CO_2 level, but for rooms without a large people load smell form the construction is making olf a more dominant load.

Mechanical ventilation

The mechanical ventilation is a CAV-system using heat recovery with a recovery rate of 85% meaning that the electricity used for heating the inlet air is reduced.

The system is CAV-system is located fairly centered in the building with easy access from the road for technicians in case of repairs. The position of the technical room is located closest to the rooms with the highest demand for mechanical ventilation meaning that the size of the ducts match the air supply level of the rooms. This makes the system almost symetrical which is the most optimal solution for this system.

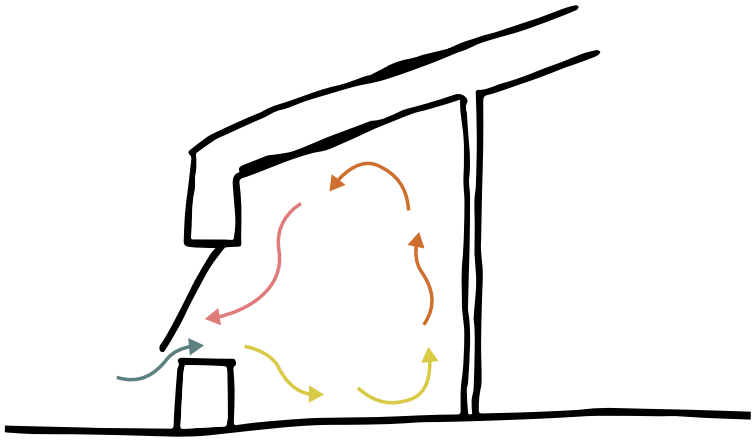
Because of the load bearing CLT-construction in the building, the location of the ducts are fairly free compared to a frame or beam system. Hence the surfaces of the ceilings are the exposed wood of the CLT, sagged ceilings are not a possibility and therefore the duct have to be located in the insulation-layer of the construction. To minimize the thermal bridge, rectagular ducts are used.

square vs. circular

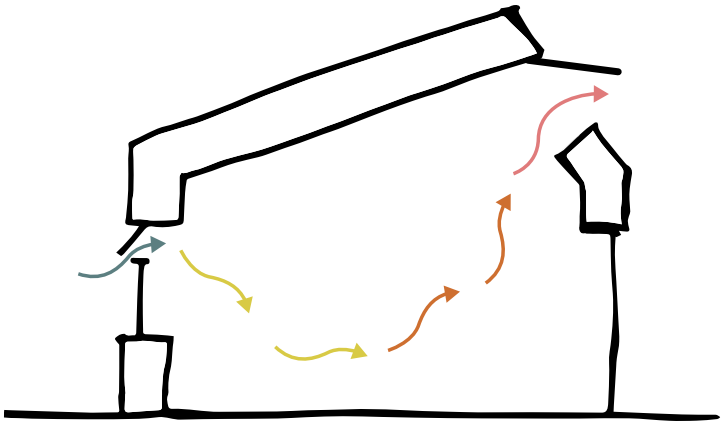
Natural ventilation

Multiple types of natural ventilation is used. The period of use of the natural ventilation is from the beginning of may untill the end of september, where the average temperature is above 15 c°.

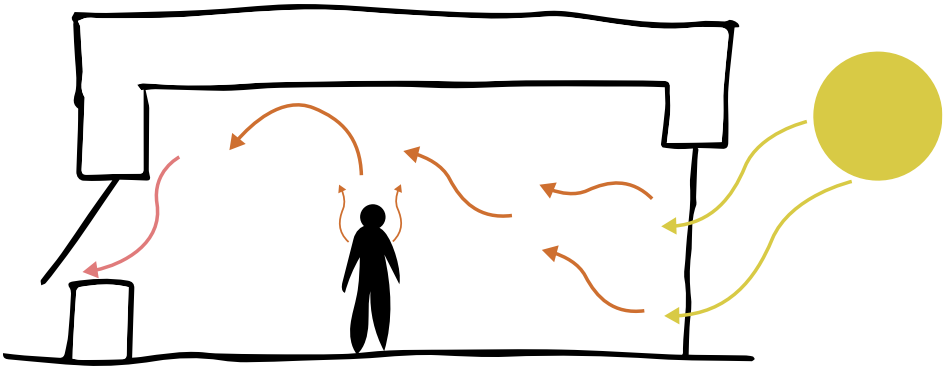
For the main part of the smaller and more private rooms, one-sided natural ventilation is used. For the most part of the larger rooms a principle of thermal buoyancy is in use. Here the strategy is to have mechancally operated windows in the facade open together with the ceiling windows to take advantage of the buoyancy effect.



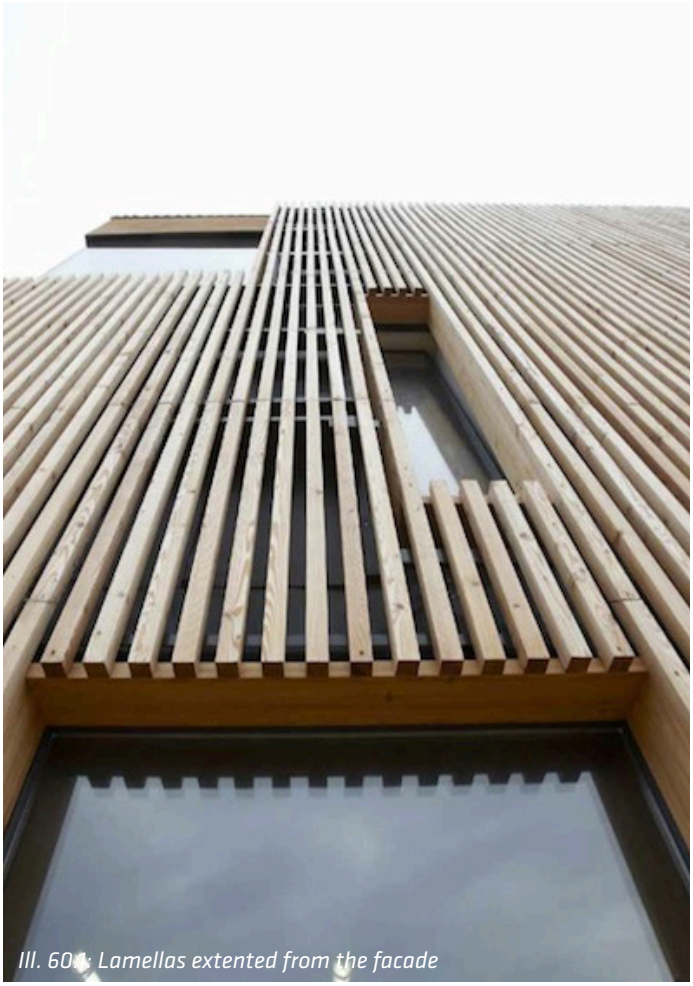
Ill. 59.1: One sided natural ventilation principle



Ill. 59.2: Thermal buoyancy principle



Ill. 59.3: Principle diagram of thermal loads



Ill. 60.1: Lamellas extented from the facade

Ill. 60.2: Wood lamellas with reflecting material behind

Ill. 60.3: Lamellas covering the entire facade

MATERIALS

It might seem odd - a wooden house in a context only consisting of buildings made from brick and concrete.

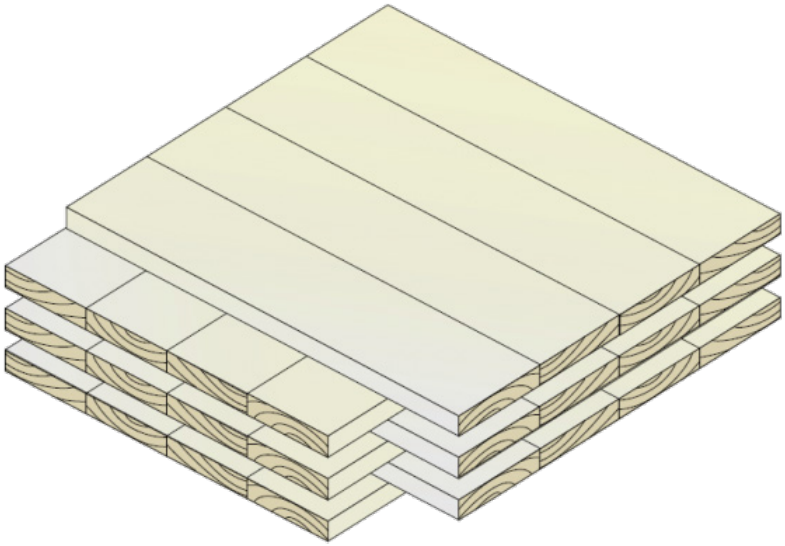
The approach to the materials used in both the construction and facade cladding was to use what is removed from the site, wood. The location of the building inside the scrub in close contact to the nature calls for a building in the same tonality as what surrounds it. The lamellas of the facade are made from larch wood, which has one of the longest expected lifetimes of the wood that can be found locally in Denmark. The larch has a yellowish tone when applied to the facade, but over time it patinates to a grey tone.

To weatherproof the thermal envelope, zinc sheets are applied beneath the lamellas. When first applied, the shiny surface might reflect the nature while the reflectance dimse during the patination of the material, making the tone of the zinc similar to the one of the patinated larch wood.

Ill. 61.1: Render of the facade when it is new, 1:1

Ill. 61.2: Render of the facade when it is 1 year old, 1:1

Ill. 61.3: Render of the facade when it is 5 years old, 1:1

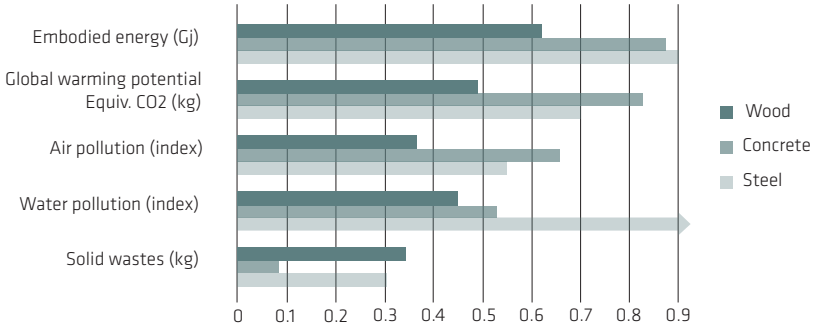


Ill. 62.1: Construction technique of CLT

CONSTRUCTION

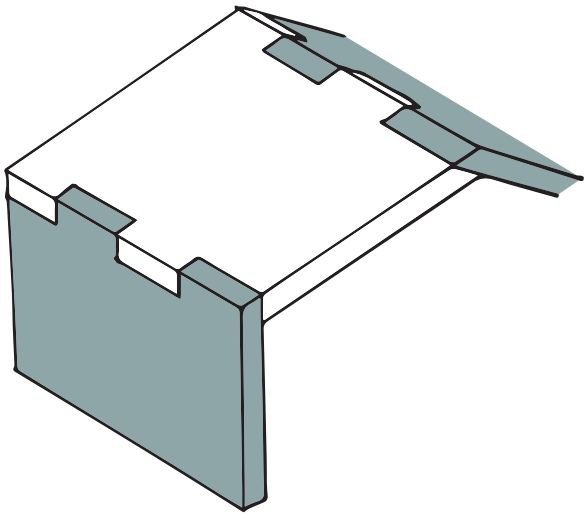
An overall concept for the construction was to use the materials that are removed from the site meaning that the wood in the scruff will be used in the construction of the building.

The construction will consist of pre-fabricated CLT-slabs, with cutout sections of windows and ventilation ducts. The slabs ensures the stability of the building while being a more sustainable method than pre-fabricated concrete slabs according to both the fabrication process and the carbon footprint (ill. 62.3). The disadvantage of using wood instead of concrete is that the thermal mass of wood is lower and concrete, meaning that the stored heat enbodied in the material will be lower than of concrete but higher than of a light column-beam construction.

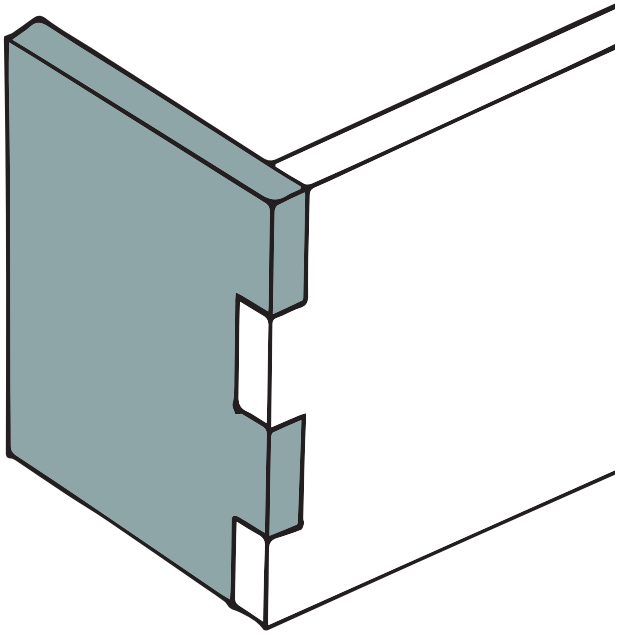


Ill. 62.2: Comparison of the environmental damage of different construction materials when building.

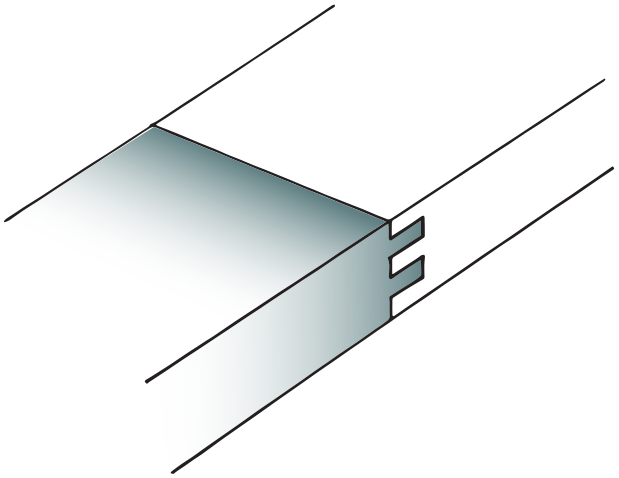
Ill. 62.3: Comparison of different construction materials in terms of ecosystem damage and resourece consumpsion.



Ill. 63.1: Joints of wall meetong roof



Ill. 63.2: Wall joint



Ill. 63.3: Connection between two CLT-slabs

Energy frame BR 2015

Without supplement	Supplement for special conditions	Total energy
42.0	0.0	42.0
Total energy requirement		33.9

Energy frame BR 2020

Without supplement	Supplement for special conditions	Total energy
25.0	0.0	25.0
Total energy requirement		25.0

Contribution to energy requirement		Net requirement	
Heat	23.2	Room Heating	23.2
El. for operation	6.1	Domestic hot water	0.0
Excessive in rooms	0.0	Cooling	0.0
Selected electricity requirements		**Heat loss from instalations**	
Lighting	5.6	Room heating	0.0
Heating of rooms	0.0	Domestic hot water	0.0
Heating of DMW	0.0		
Heat pump	0.0	**Output from special sources**	
Ventilators	0.5	Solar heat	0.0
Pumps	0.0	Heat pump	0.0
Cooling	0.0	Solar cells	0.0
Total el. consump.	21.2	Wind mills	0.0

Ill. 64.1: BE15 key numbers of building without PV cells.

Energy frame BR 2015

Without supplement	Supplement for special conditions	Total energy
42.0	0.0	42.0
Total energy requirement		8.9

Energy frame BR 2020

Without supplement	Supplement for special conditions	Total energy
25.0	0.0	25.0
Total energy requirement		0.0

Contribution to energy requirement		Net requirement	
Heat	23.2	Room Heating	23.2
El. for operation	-3.9	Domestic hot water	0.0
Excessive in rooms	0.0	Cooling	0.0
Selected electricity requirements		**Heat loss from instalations**	
Lighting	5.6	Room heating	0.0
Heating of rooms	0.0	Domestic hot water	0.0
Heating of DMW	0.0		
Heat pump	0.0	**Output from special sources**	
Ventilators	0.5	Solar heat	0.0
Pumps	0.0	Heat pump	0.0
Cooling	0.0	Solar cells	0.0
Total el. consump.	21.2	Wind mills	0.0

Ill. 64.2: BE15 key numbers of building withPV cells.

ENERGY FRAME

The design manual for the project states, that the building should comply with the energy frame BR2015 with an energy frame of 42 kWh/m^2/year. However, to build a sustainable building which is future proof, the goal was to comply with BR2020 with an energy frame of 25 kWh/m^2/year.

The key numbers are calculated differently according to the energy frame used. The heat contribution is multiplied with a factor of 0.6 in 2020 and 0.8 in 2015, while the electricity is multiplied with 1.8 in 2020 and 2.5 in 2015 (rockwool.dk, 2017). Therefore the most important factor to minimize is the power used for electric appliances in the building.

The roof has been fitted with building integrated PV cells with an area of 544 m^2 on the south facing roofs. The incline of the roof, the shade from obsticals and whether or not the PV cells are building integrated has an influence on the efficiency of each panel. In this case, the building has a calculated yearly use of 16462.25 kWh on appliances, and with an output of 98.73 kWh/m^2 from the panels 166.74 m^2 are needed to cover the electrical operation of the building on a yearly basis (App. 2). The rest of the PV cells can either give back to the net of be replaced with solar heat cells that will heat the water used to heat the building.

Factors

Thermal envelope

One of the main factors when calculating the energy frame for a building is the area of the thermal envelope.

In this case the loadbearing elements of the CLT-construction is placed towards the inside of the envelope making space for a light in-homogenious structure of a mix of insulation and a wooden frame. To minimize the area of thermal bridges the layers are switched in both the facade and on the roof.

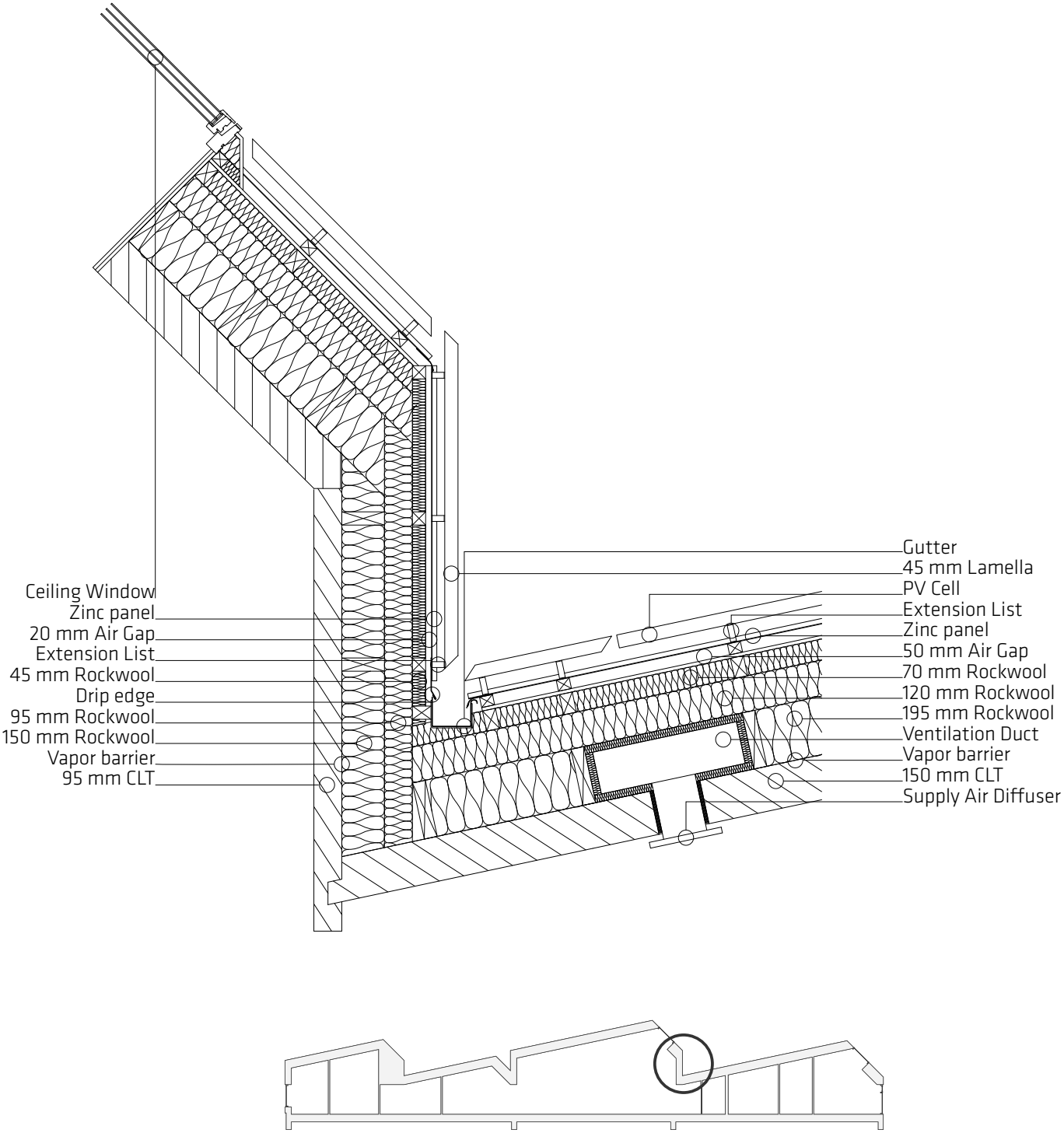
U-vaules:

- External walls: 0.089
- Roof: 0.079
- Floor: 0.080
- Windows: 0.78

Windows

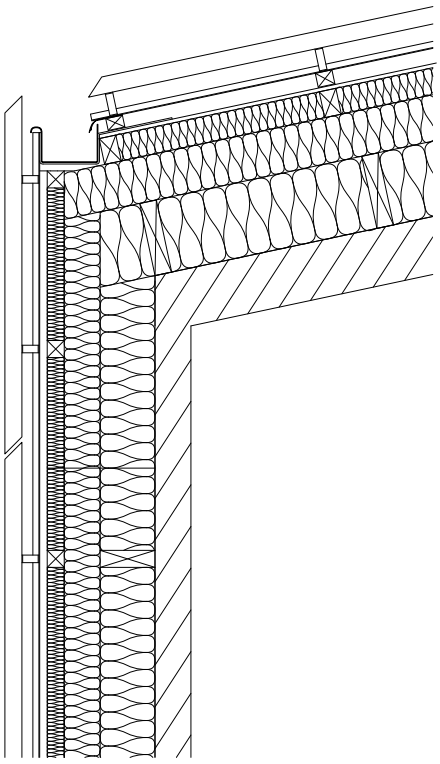
Another part of the envelope are the windows - the building is equipped with three types of windows with different technical qualities. Along the atrium yards, large curtain walls with a g-vaule of 0.5 letting a large amount of solar transmitted heat through the openings. The rest of the windows has a g-value of 0.38 and are thereby letting less solar transmitted heat through to the indoor area. It is especially important, that the skylights does not have a low g-value, because the solar radiation is higher on the sloped roof.

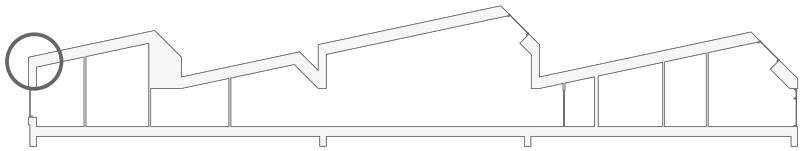
DETAIL 1



Ill. 65.1: Detail of roof meeting facade.

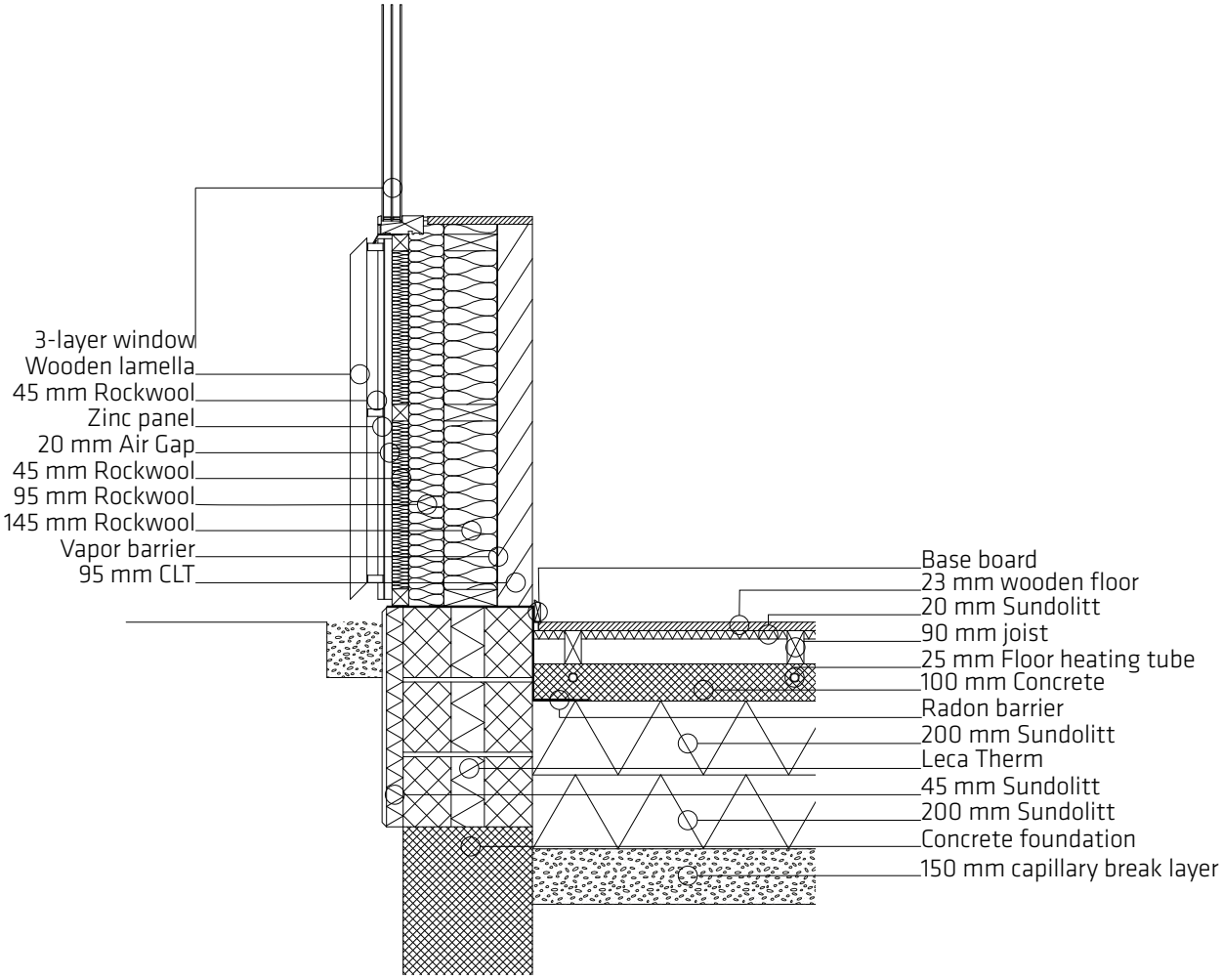
DETAIL 2

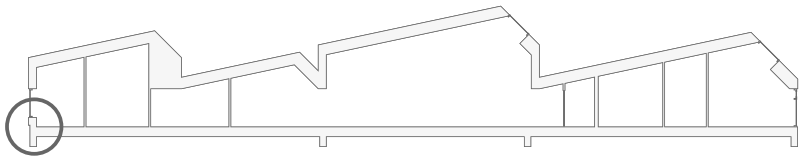




Ill. 66.1: Detail of roof meeting facade, gutter and lamellas.

DETAIL 3





Ill. 67.1: Detail of foundation

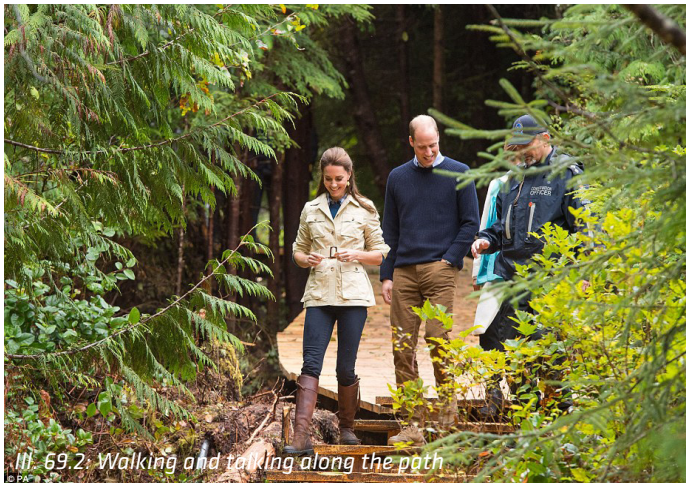
OUTDOOR AREA NORTH

The overall strategy for the outdoor areas is to preserve as much as possible of the scrub of which the site is located in. In the northern part of the site a path is connecting the building with the public path in the park. The path loops up the slope to making a challenging path for users in recovery. The path cutting through the loop is path with obstacles for patients who wants to challenge themself or for children to play in while visiting the centre.

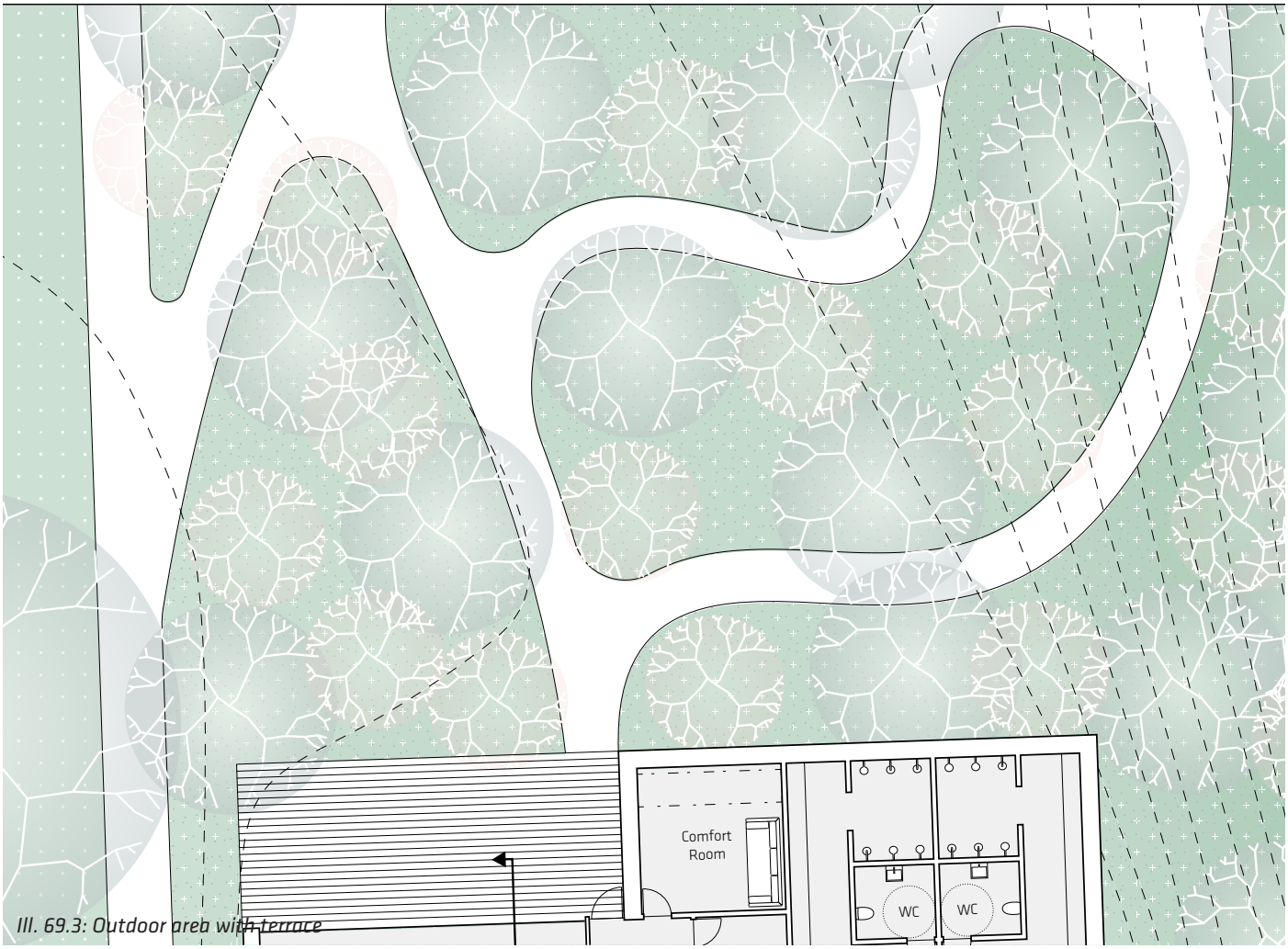
When connecting to the public path, this area becomes part of the park encouraging users of the park to make use of the outdoor areas of the building. This connection can also be seen as a strategy to make the users of the centre use the park for walks or runs.

In connection to the northern facing gym, a terrace is proposed as an extension of the indoor room. Here users can do outdoor yoga as well as doing other physical activities sheltered by a shallow fence and the vegetation.

Ill. 69.1: Using the nature as finess equipments



Ill. 69.2: Walking and talking along the path



Ill. 69.3: Outdoor area with terrace

Ill. 69.4: Outdoor yoga on terrace

Ill. 69.5: Existing srrub on site

Ill. 70.1: Using the steps as seating

Ill. 70.2: Atmosphere of social garden

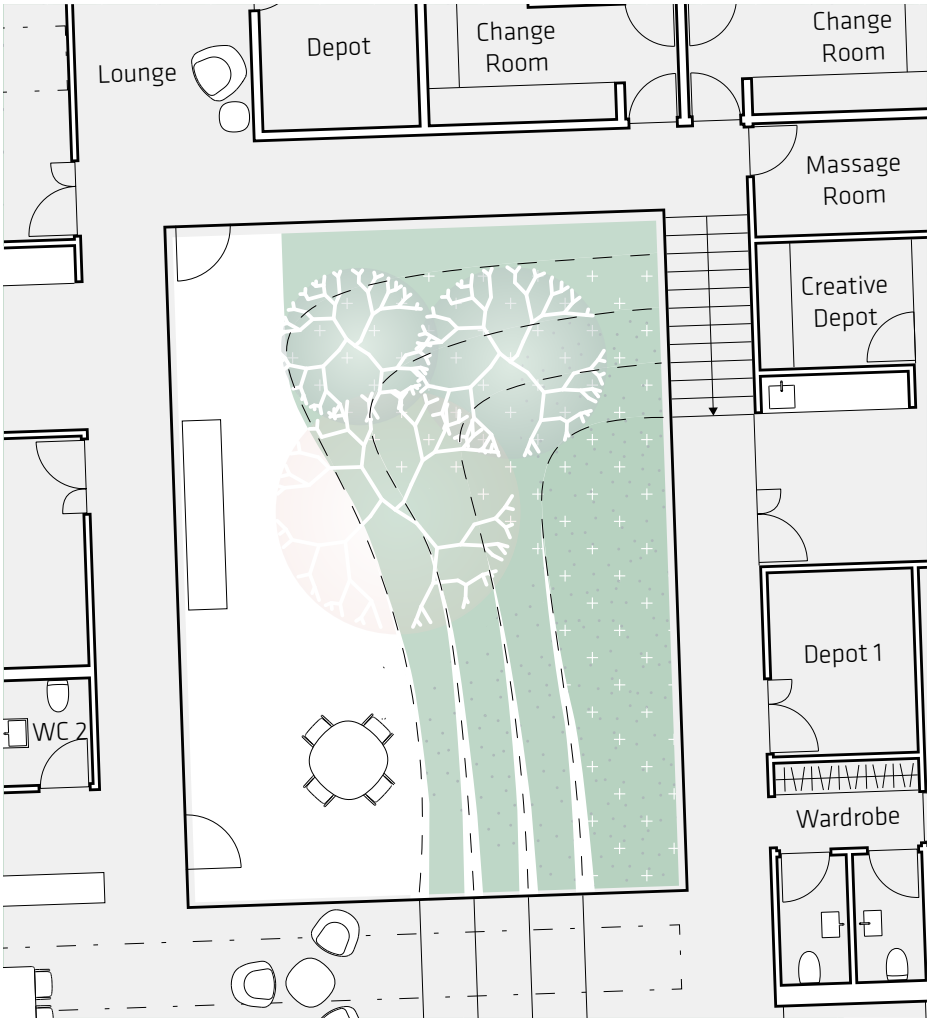
Ill. 70.3: Social gathering in atrium

ATRIUMS

The two atriums each have different characters and qualities responding to the areas of which they are located in. Common is that they both have a slope to overcome in relation to stairs. This transition from indoor to outdoor is marked by the stairs evolving into the nature gradually becoming a slope. The atriums are surrounded by glass providing the adjacent rooms with a large amount of daylight, but with daylight comes solar radiation, which is reduced by trees.

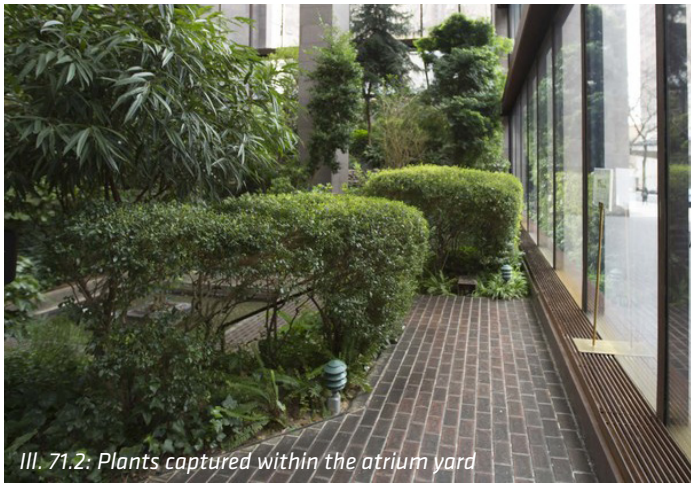
Social garden

The social garden is referring to the social area has a more social character than the sensory garden. This northerly located atrium is the larger one, making room for more furniture, to users to stay during sunny or warm days.



Ill. 70.4: Downstroke of social garden, 1:125

Ill. 71.1: Garden bed



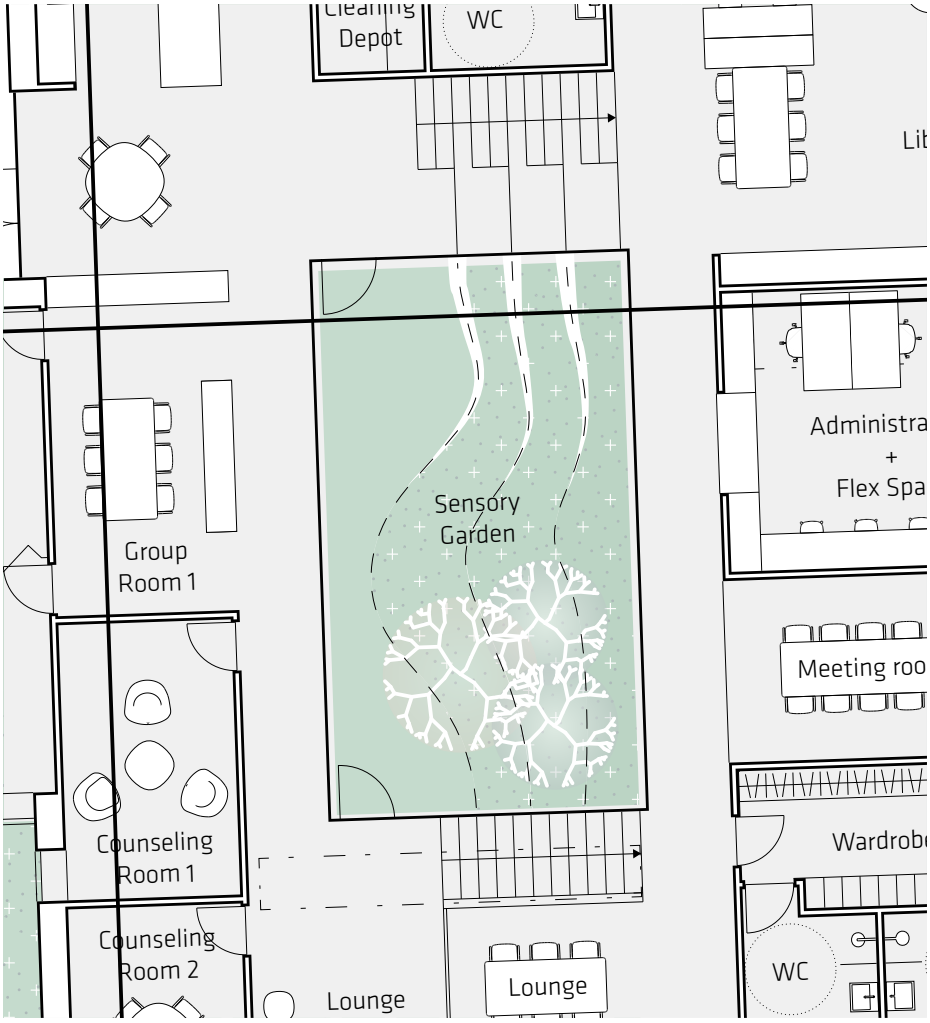
Ill. 71.2: Plants captured within the atrium yard

Ill. 71.3: Relation between indoor and outdoor environment

Sensory garden

The sensory garden is the southern atrium of the building located close to counselling rooms but also in relation to the social area and the kitchen. The sensory garden should therefore be a place to quiet contemplation with stimulants of multiple senses while also applying to the social area. This coherency can be find in the kitchen garden in the raised beds closest to the social area, where users of the kitchen can go and pick up vegetables to use for cooking in the kitchen or in relation to a social activity at the counselling centre.

The herbs and vegetables gives both a palette of different colors and smells to activate the senses making this outdoor space suitable for both meditation, relaxation and social activities.



Ill. 71.4: Downstroke of sensory garden, 1:125

#DESIGN PROCES

Ill. 73.1. Path in 'Hospitalsparken'

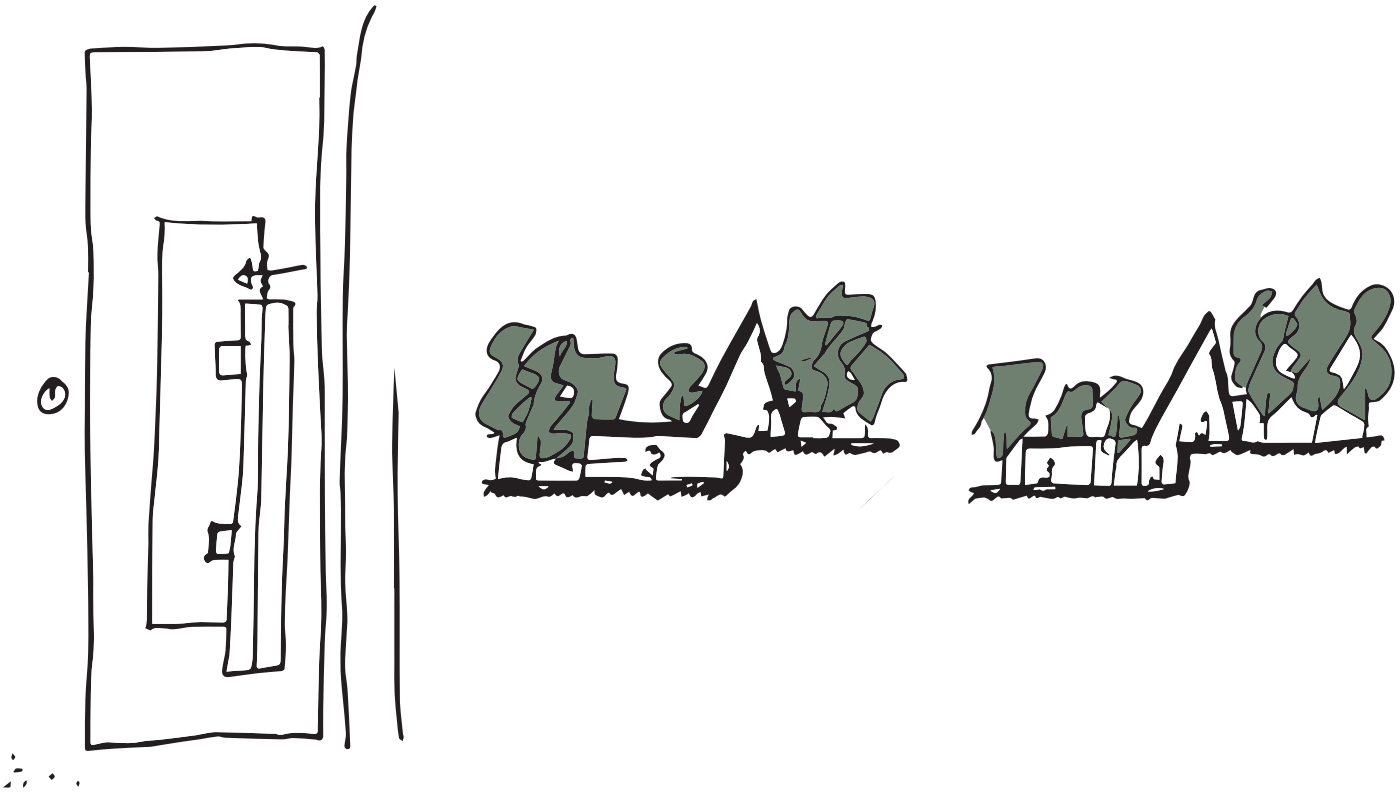
Ill. 74.1: Volumes scattered in the landscape

SKETCHING

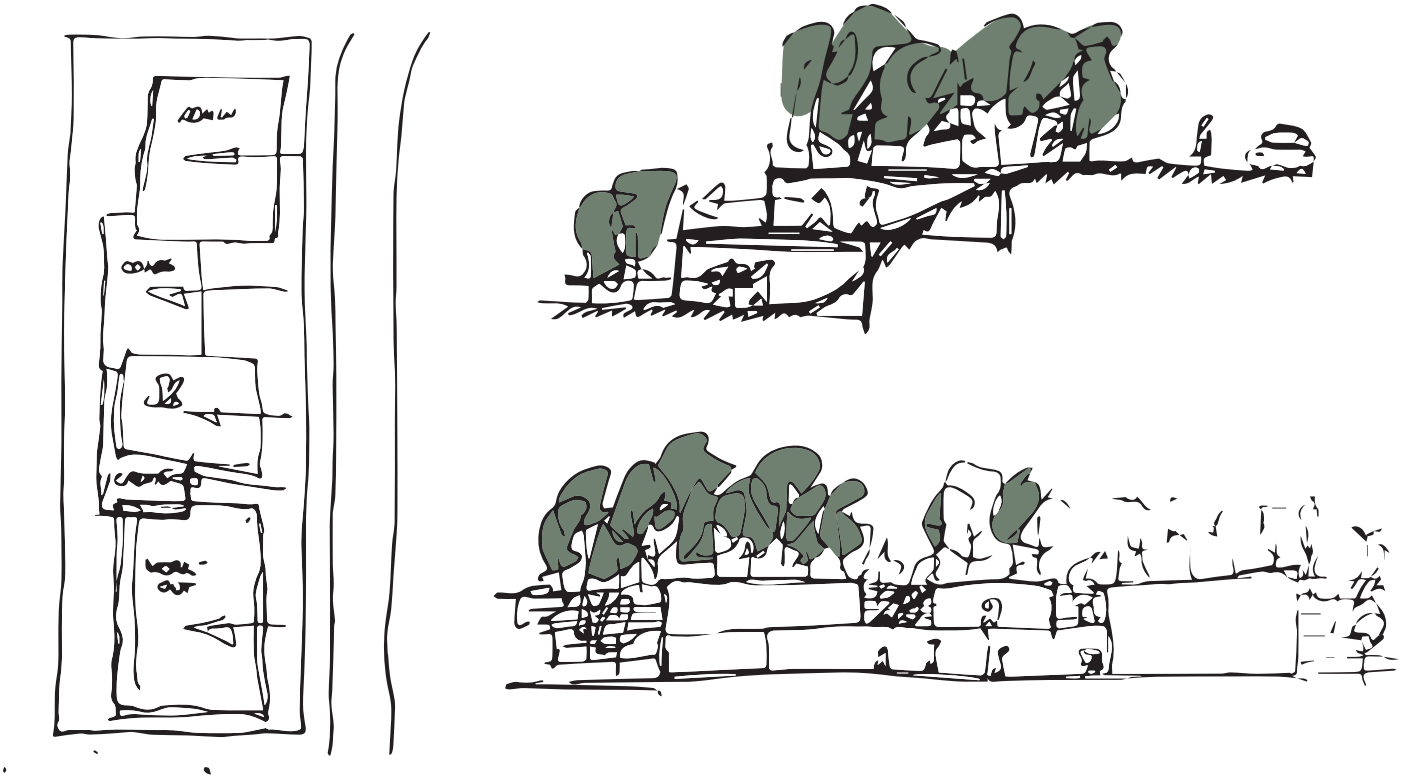
The initial sketching phase started off as a phase without boundaries or rules. Here, everything was possible and ideas were tested without a prior knowledge or sense of the context.

These initial sketches provided understanding of the site, its possibilities and its limitations for the further design process. Many of the ideas were disqualified, but thought the process of using the room program actively in the design phase to create the right connections and solutions in the building.

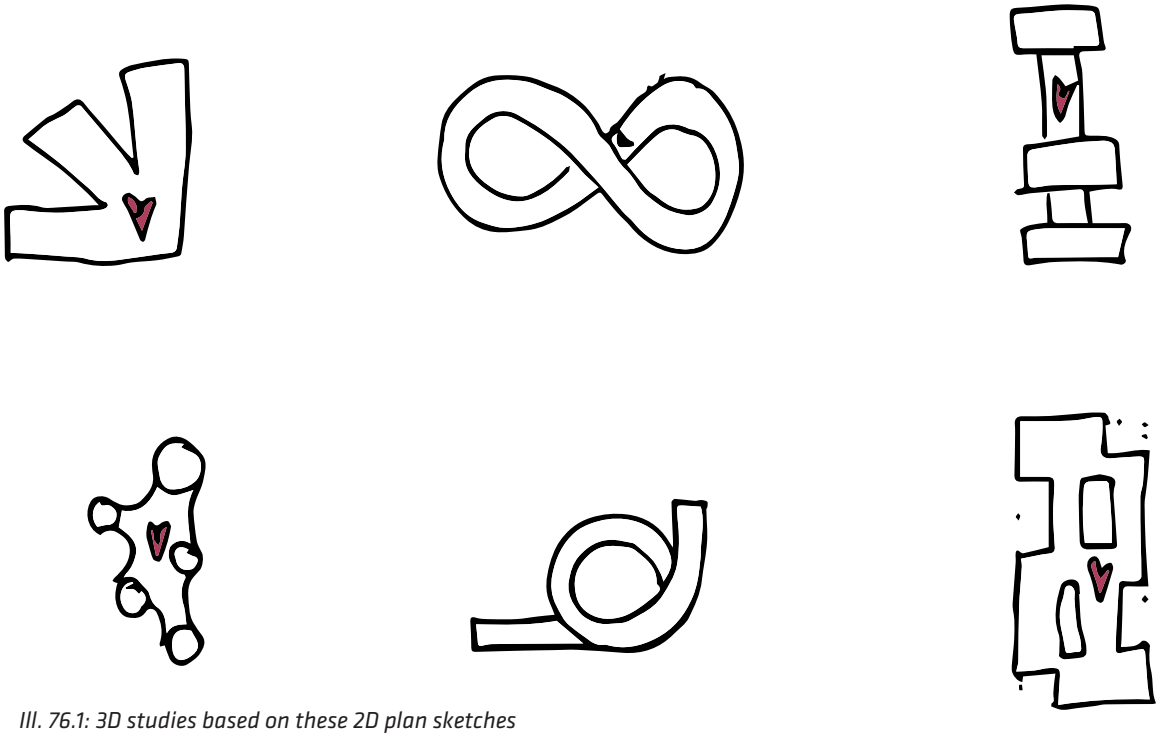
The technique used in this phase was mainly 2D hand sketches, working with both plan, elevation and especially the section, gaining knowledge of how to use the slope of the site in the architectural language.



Ill. 75.1: Pitched roof landing in a flat roof structure



Ill. 75.2:Building hiding within the slope

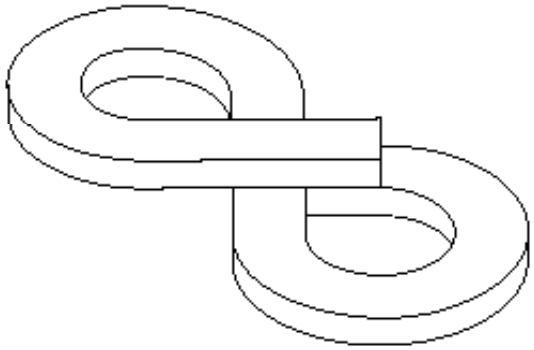


Ill. 76.1: 3D studies based on these 2D plan sketches

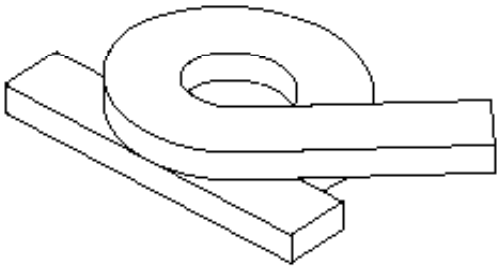
VOLUME STUDIES

During the initial phases of the design phase a lot of ideas floated and ideas from the earlier sketching phase were tested in 3D to valuate the concept and deliberate on the potential for further work. The initial thoughts circulated around such as; should the building relate to the context or should it stand out? Should it the building be a landmark or should it be a hidden gem? Should the architectural language be easy to read by the common man or should the building be a high-tech monster from another world?

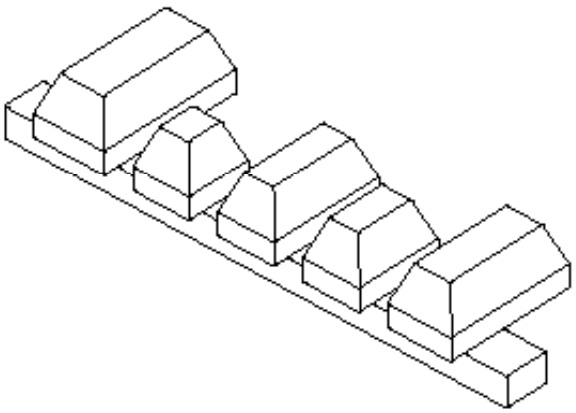
Different shapes were tested and qualified or disqualified, until a line was drawn for how the following process could continue.



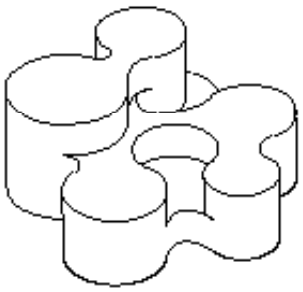
Ill. 77.1: Infinity loop miming the logo of 'Kræftens bekæmpelse'



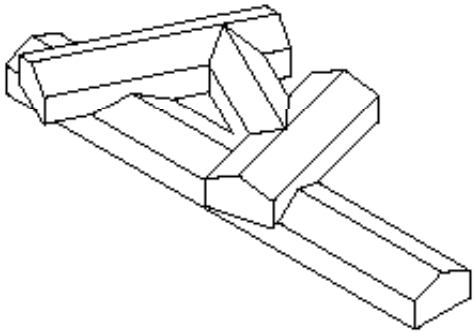
Ill. 77.2: Ribbon loop



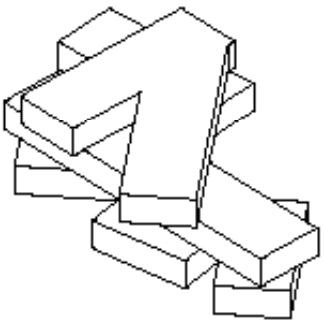
Ill. 77.3: Shelters connected in bacement



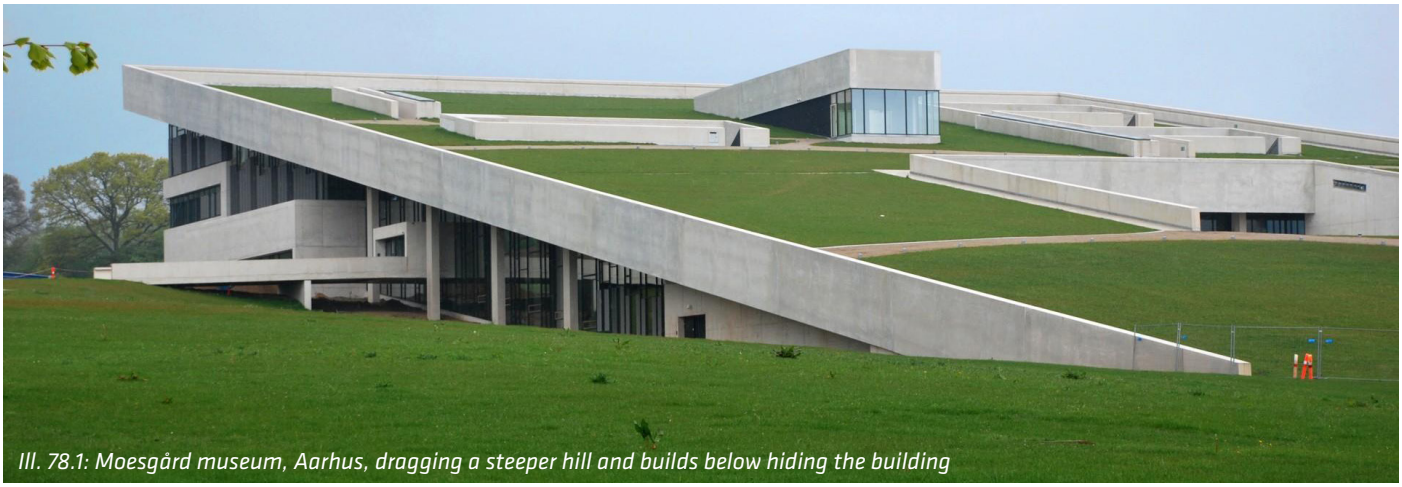
Ill. 77.4: Organic shape



Ill. 77.5: Pitched rood orientated towards views



Ill. 77.6: Sticks orientated towards views



Ill. 78.1: Moesgård museum, Aarhus, dragging a steeper hill and builds below hiding the building

Ill. 78.2: Building climbing with the slope overlapping itself

Ill. 78.3: Contour lines of the landscape informs interior

LANDSCAPE AND BUILDING

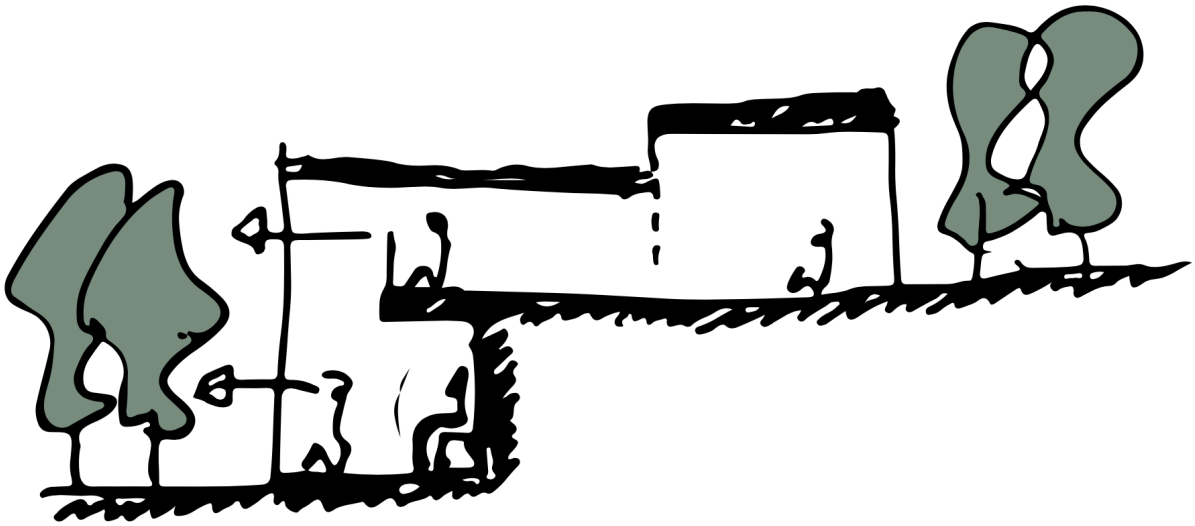
Throughout the proces one of the main concerns in the design and overall organisation and room disposal has been the steep slope of the site. Initially using references as the point of origin for the overall design development understanding how others have set about the challenge of a sloping site.

To overcome this slope multiple different designs were developed in the attempt to use the heigh difference constructive in the final proposal rather than not making use of it.

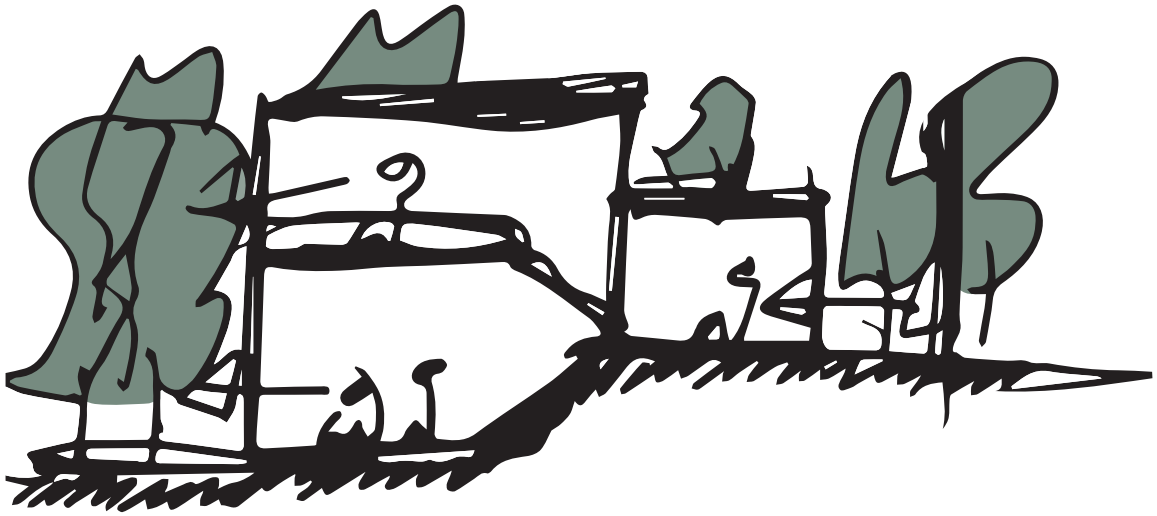
The technique behind the section drawing was very useful in the part of the process to understand the spatial qualities of different proposals and solutions.

Two overall ideas were found - one using the landscape actively, another avoiding and ignoring the landscape. An example of a project that at first glimpse seems to use the landscape actively is Moesgård Museum by Henning Larsen Architects, which is using th inclined hill as an interpretation of the landscape placing decks beneath to make a functional building. Two projects that work more actively with the landscape is Villa GUG by BIG and CBS Kilen by Lundgaard & Tranberg, where the landscape either informs the shape of the building or has a spatial impact of the interior of the building.

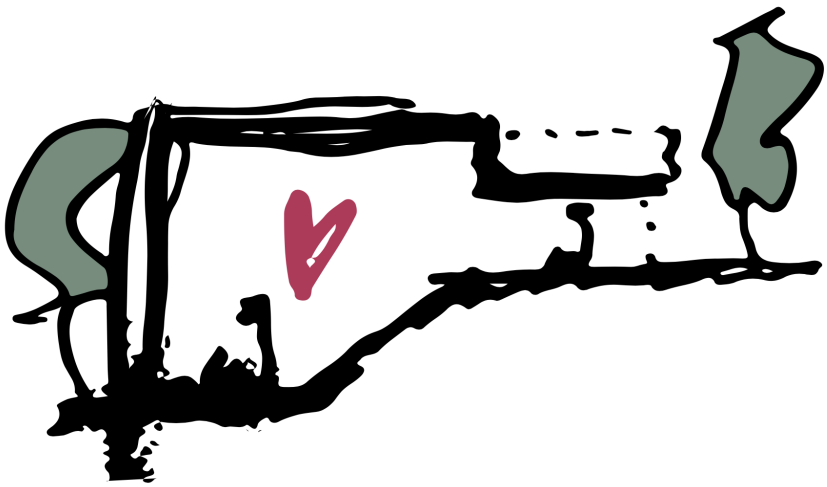
On the opposite page, three proposals of using the slope in section. The proposals illustrated on ill. 78.1 and 78.2 the rooms seem somewhat divided and disconnected and with shallow room heights. The proposal on ill. 78.2 will also have an accessability issue due to the three floors displayed on the section. The section displayed on ill. x.3 the spatial effect of entering a shallow room that opens up and unfolds a large volume seems to work very well defining different zones and spatial qualities.



Ill. 79.1: Disconnected floors



Ill. 79.2: Three different storeys might conflict with the accessability of the different rooms



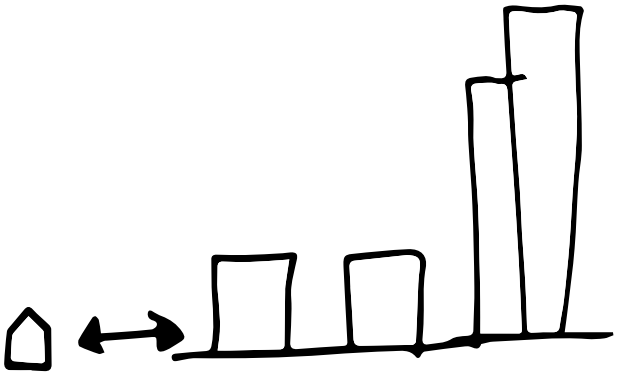
Ill. 79.3: One large and open room unfolding itself through the room height

Ill. 80.1: Inspiration from context

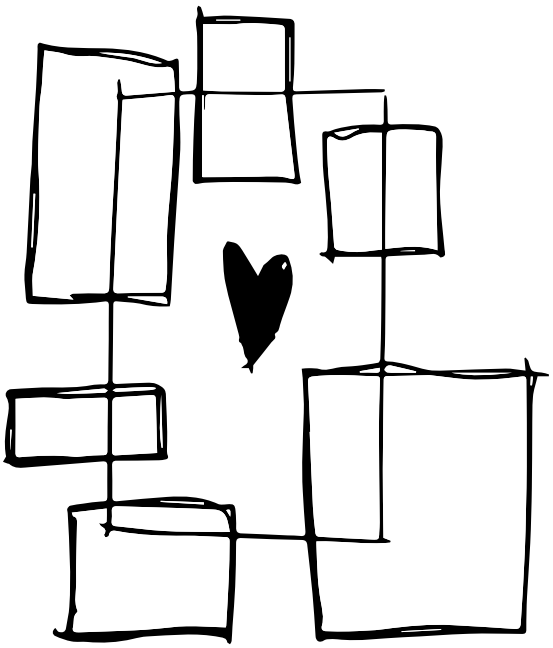
CONCEPT

The knowledge acquired through the program and the iterations of the previous stages of the design phase led to a concept for a building. With the context in mind inspired from both the large structures of the hospital and the smaller volumes of the residential area the outlines for a concept was formed.

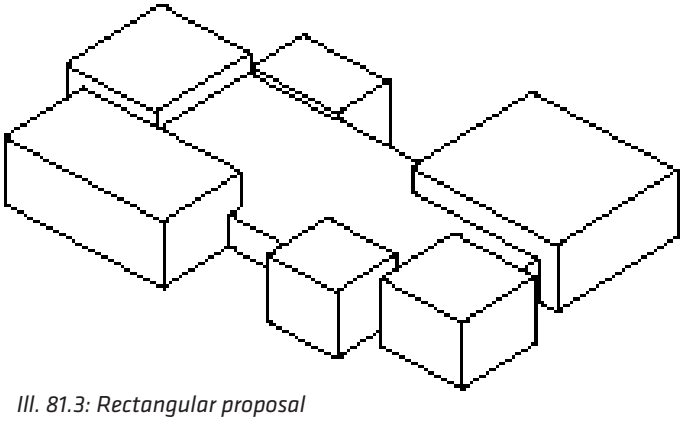
Inspired by the tower of Herlev Hospital, where volumes are added to at a tower the idea of a common gathering point with volumes with the functions of the room program was based for further development and shape finding.



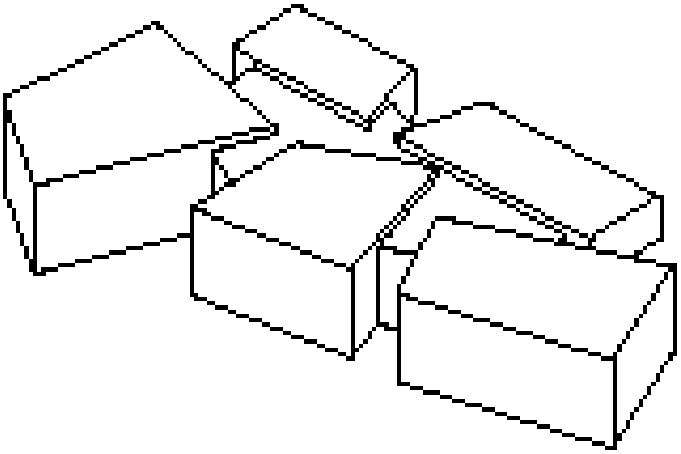
Ill. 81.1: Site location in the boundary between small and large scale



Ill. X.2: Concept of floorplan



Ill. 81.3: Rectangular proposal



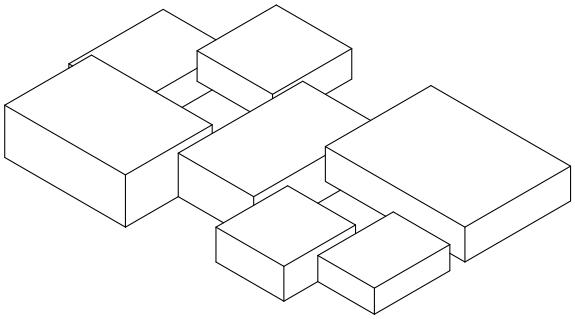
Ill. 81.4: dynamic proposal aiming facades towards views

SHAPE FINDING

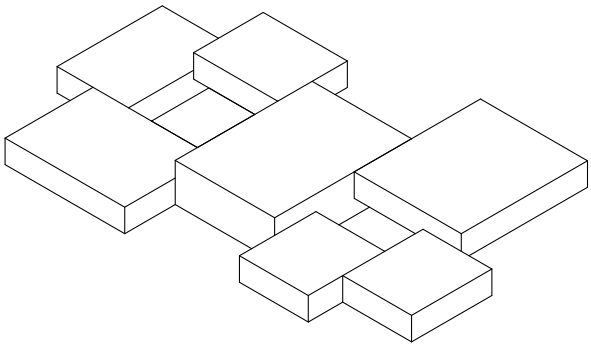
When the preliminary concept was found, the nest step of the process was shaping a building that would respond to the concept.

The sketching took its origin in the context, shaping the building towards views of greenery. This was although a very narrow sighted research and sustainable aspects started playing a larger role in the design process. Viewing the diagram pragmatically and using just the volumes added to the social gathering space as the volumes that could change, made a strange composition of the building. When the volumes started to merge and use the same expression in shape, the building started appearing coherent and assembled.

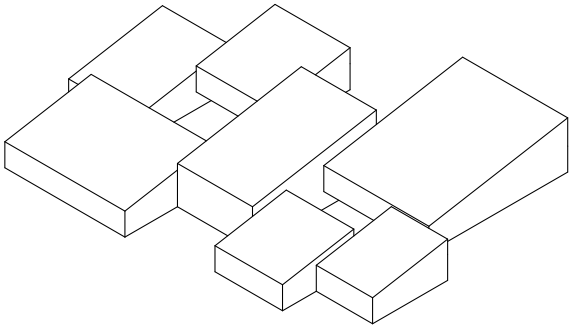
The process of the roof design ended up consisting of many different shape proposals deciding whether the roof should be flat, have an angle or be pitched. It was not until the PV cells came into the process and informed the design with a south facing sloped roof that the decision was made on the pitched roof. Different inclinations were tested to create both the right room height and the most optimal incline for the PV cells to operate.



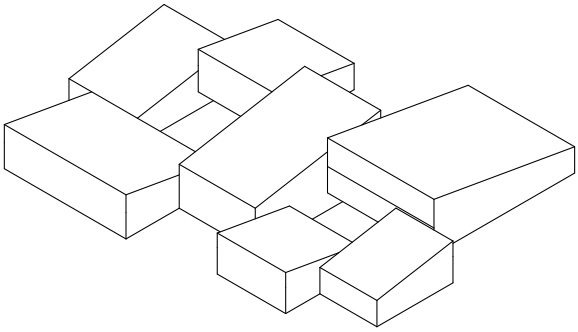
Ill. 83.1: Flat roof, social room with low ceiling height



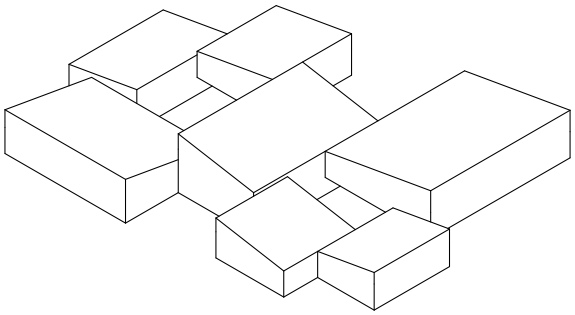
Ill. X.83: Flat roof, matching heights according to level



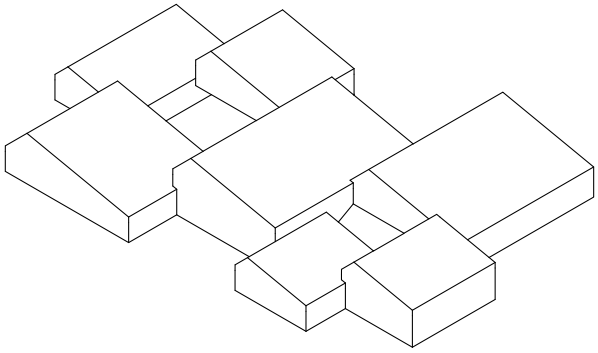
Ill. 83.3: Roofs sloping with the landscape



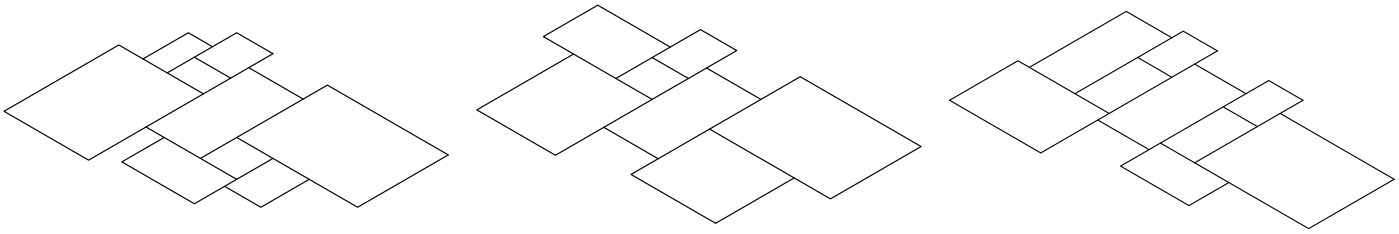
Ill. 83.4: Slopes opposing each other



Ill. 83.5: Sloped roofs, scattered



Ill. 83.6: Pitched roofs towads south



Ill. 84.1: Conceptual basis of the plan layout

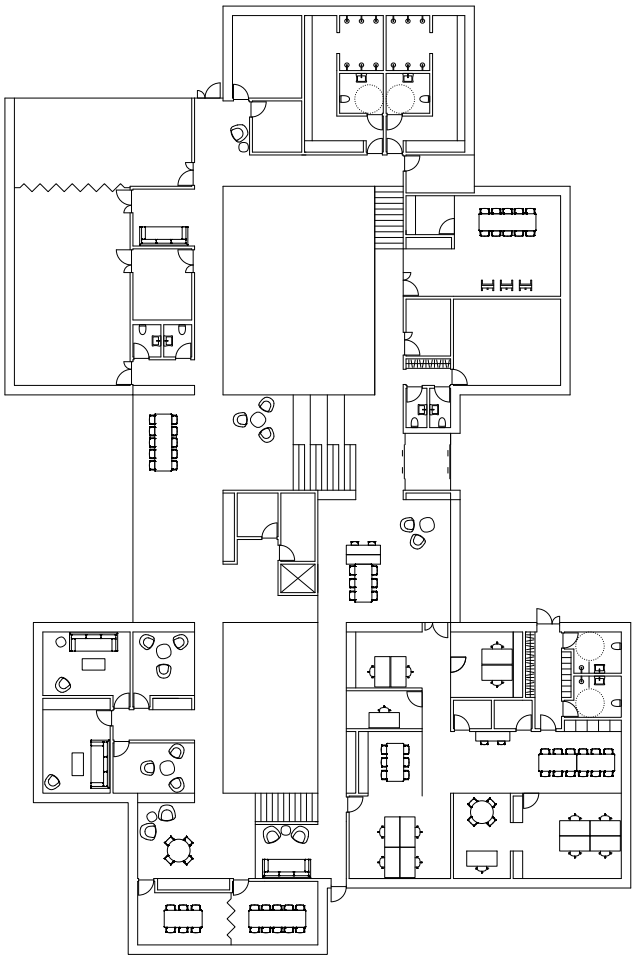
PLAN STUDIES

The plan study has been made for many of the proposals during the design phase to verify the concepts.

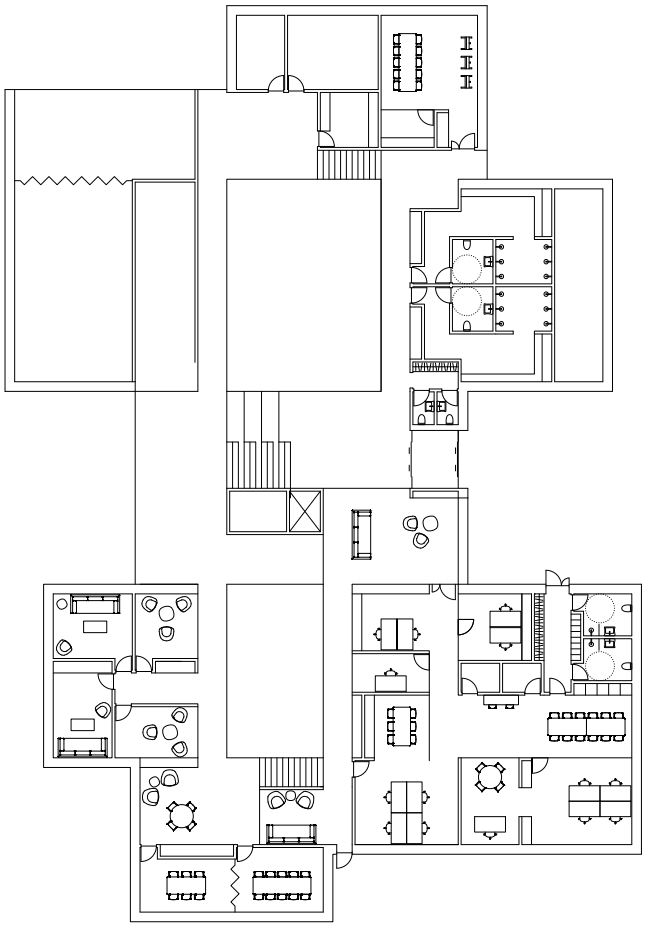
The objective for the plan studies was to create a building that responds to the room diagram whilst searching for new connections and places to safe space.

A great help during the plan study was to furnish the rooms. The rooms were described in detail in advance from the competition material making the furnishing of the rooms a useful tool in the search for spacious rooms with both social, semi-private and private spheres possible.

On of the main concerns in the plan study was the slope of the site and how this would be integrated in the plan. Should it be a multi storey building using the negative space beneath an overhang as a -1 floor or should the floor and elevation of the landscape follow each other making the plan scattered in platforms. In the end a solution where stairs melted into platforms was chosen because the other solutions did not match with the desired need for an accessible floor plan.



Ill. 85.1: Detailding of the plan



Ill. 85.2: Detailding of the plan

MATERIAL STUDIES

Multiple factors were considered while searching for the right facade material. Should the building mime the context, and be using the same materials as either the hospital or the villas in the residential area, or should it stand out and be something completely different?

The concrete construction of the hospital is looking dull and shabby and when applied to the building using this material might associate the user with bad experiences from the hospital visits. Therefore the concrete facade is discarded.

The red bricks that are found on most of the villas in the neighbouring residential area would give a warm tonality to the building while making it familiar to the user because of its main use as building material in residential architecture. This might have the side effect, that the building would become unnoticable, and therefore hard to distinguish from neighboring houses because of the shape miming exactly this typology.

This meant, that a different material has to be used. The choice of wood as a general and consistent material for both the structural basis and the cladding of the building semt like a strong concept for the building - when removing trees from the site to built, these could be used in the fabrication of the building, while making it stand out from the context.

Ill. 87.1: Concrete as seen on Herlev Hospital

Ill. 87.2: Bricks, as seen in residential area

Ill. 87.3: Wooden facade

CONSTRUCTION STUDIES

As decided earlier, as much of the building should consist of wood. This meaning, that theconstruction principal should also be made from wood.

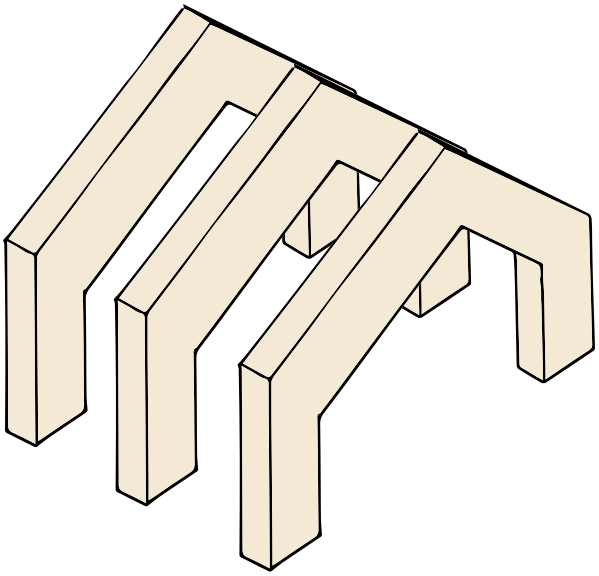
Different principles of wooden construction were tested and together with the plan and building shape to find the construction best suited for the final proposal.

The main factors for deciding the constion for the building were that the construction should not have an impact on the floor plan of the building, and that the facade should be fairly free, so that the facade expression would not be limited by the construction.

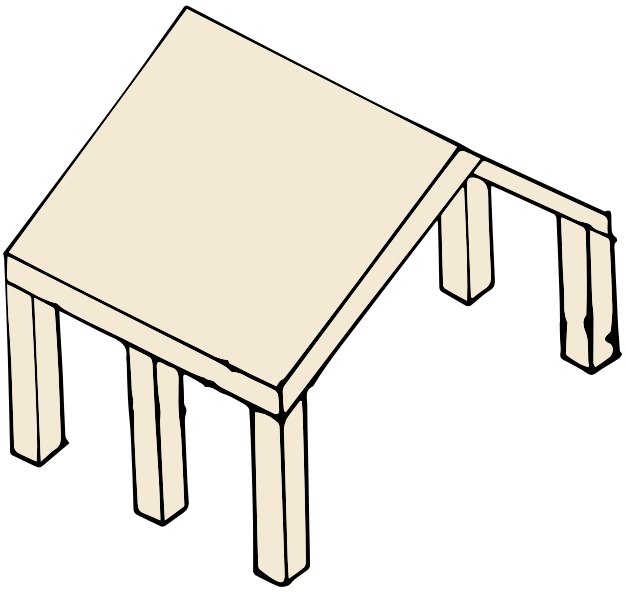
Glue laminated timber frames is the construction with the smalles consumption of resources, ill. X.1, would have an impact on the floor plan and were therefore discarted from the further work. The reason for the impact is that with the expected dimensions of the frames they would take up space along the facade. This could although have been used as a shading in relation to windows or to create niches. The frames would also have to be standing at a certain distance making the possibilities in the facade very limited.

A combination of a cross laminated timber slab as roof construction and glue laminated timber colums as seen in ill. X.2 would make the facade more flexible. Thouth the construction would be very strange and unstable discarding it from further development.

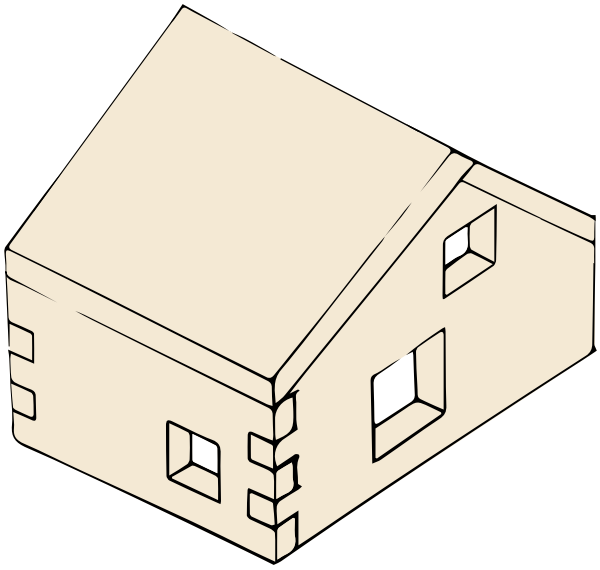
A full CLT construction will make the construction of the building rigid meanwhile the facade stays flexible.



Ill. 89.1: GLT frame construction



Ill. 89.2: CLT slab roof in GLT colums



Ill. 89.3: CLT slab construction

FACADE STUDIES

After choosing the material for the construction and the facade, different proposals were made.

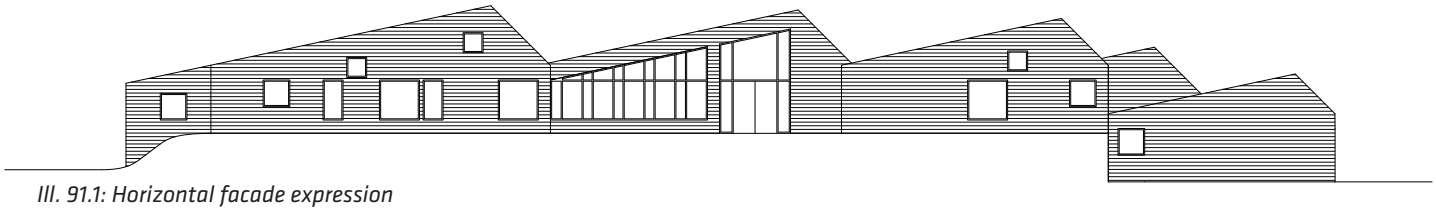
Firstly it was tested whether the wooden boards should be mounted horizontally or vertically. The horizontal proposal binded the facades together, but look odd in connection to the sloped roof. The vertical lines still makes a coherent expression while matching the geometry of the building.

Next step in the detailing of the facade expression was testing if the wooden facade should be seen as a shell making windows in the same level as the cladding, or if the facade should be light, and if so, how light and airy it should be.

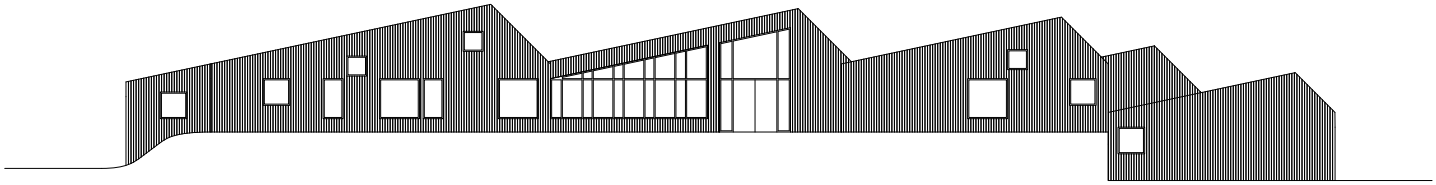
The test of the shell turned out to be a very clean and sleak looking facade expression making the building look repellant, distant and almost clinical - the exact opposite of what is requested for this building. The more airy expression of lamellas with an air gap between fits better with the welcoming gesture that is opposed for in the design. Different sizes of lamellas and air gaps were tested as well as of whether or not the lamellas should be covering some of the windows in the facade. Through these tests it was discovered that the lamellas covering the windows made it feel like looking through a window in a prison and therefore opted out.

Windows

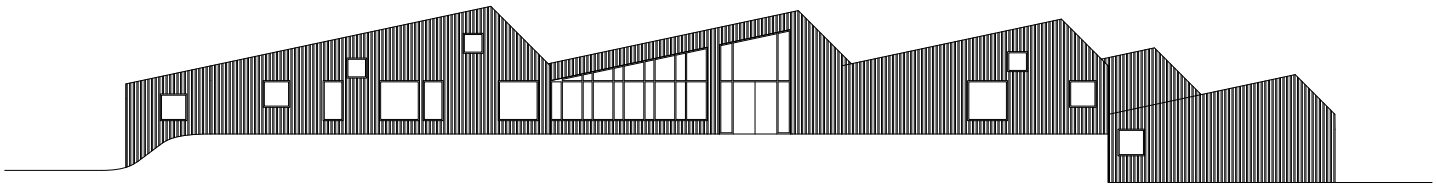
The composition of the windows depended on the construction. Had the frame construction been chosen, the facade would have to follow strict lines and would not be free in its form, making it look staccato and rigid. This did not match the shape of the building and a more dynamic facade expression was tested. Here it was discovered, that with a small amount of various window sizes, a very dynamic yet calm expression could be achieved.



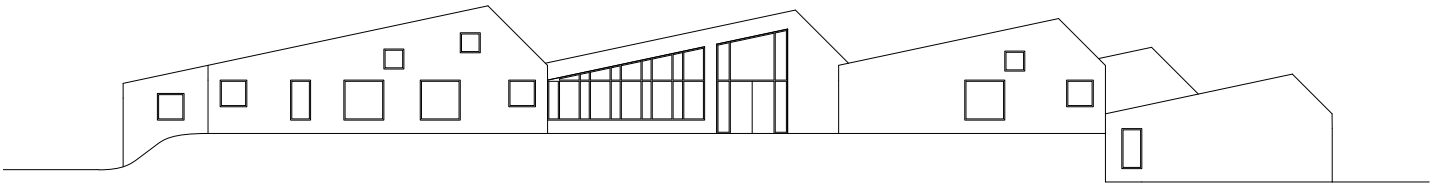
Ill. 91.1: Horizontal facade expression



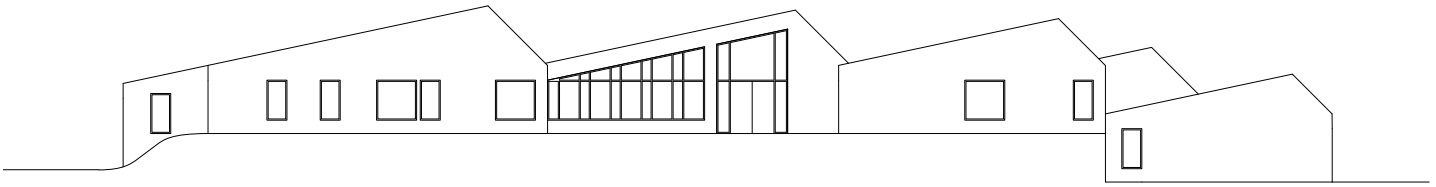
Ill. 91.2: Vertical facade expression



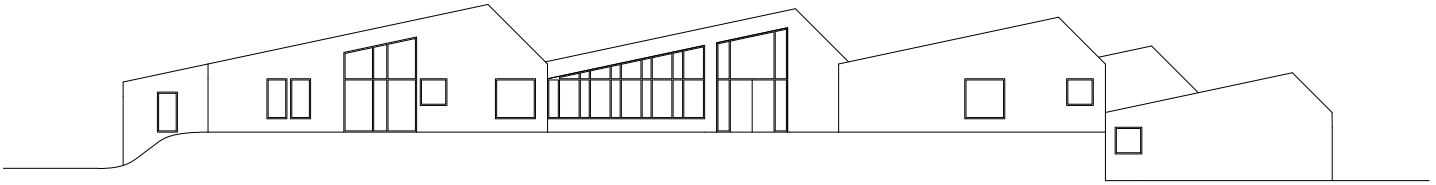
Ill. 91.3: Lamella facade



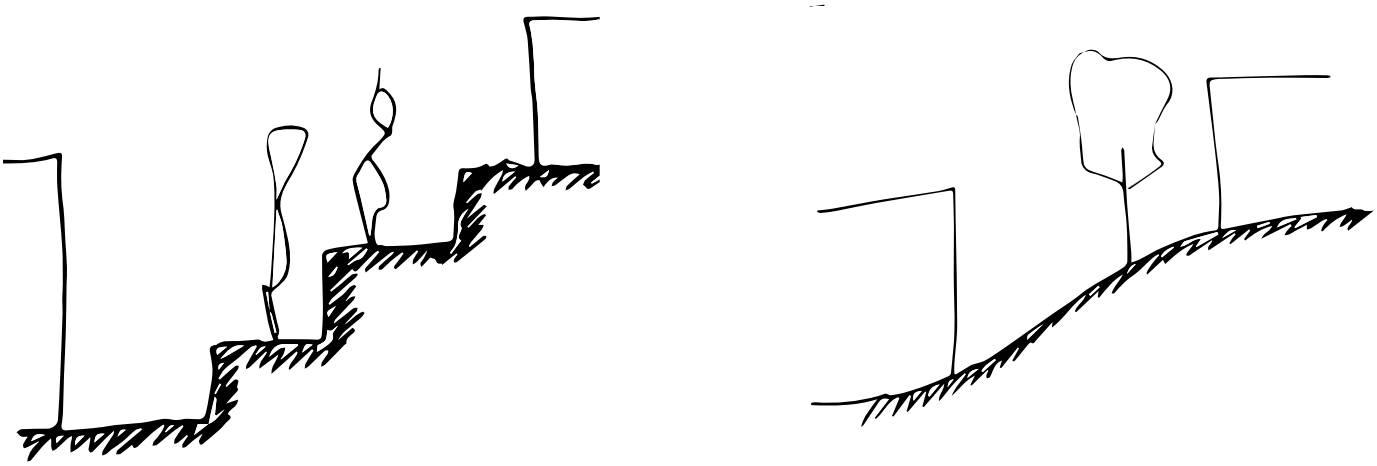
Ill. 91.4: Scattered facade expression



Ill. 91.5: Vertically positioned windows



Ill. 91.6: Facade expression with high transparency



Ill. 92.1: Atrium landscape investigation

OUTDOOR STUDIES

Designing the outdoor spaces of the building was not just one process. At first the landscape needed to fit with the building, meaning changing the landscape so that it would match with the levels of the building. This was done with a huge respect for the landscape slope on the site making sure not to remove too much of the soil to be able to build on the site. Because of this the building was located in the southern part of the site, where the slope is the least steep.

The overall plan for the outdoor areas was to define each one of them to find the right character for the location of the outdoor outdoor area in relation to the building followed by a detailing process. Though the overriding theme for the outdoor area was to preserve as much as possible of the existing scrub, using it and the rest of 'Hospitalsparken' as a green background canvas as the view from the building.

#EPILOGUE

Ill. 94.1: Couple enjoying the sun in 'Hospitalsparken'

CONCLUSION

The iterative design phase has founded the basis of which a cancer counselling centre has been composed with the aspects behind the term 'Healing Architecture' in mind. The building sits in the preliminary boundary of 'Hospitalsparken' in close proximity to Herlev Hospital. A location that makes the building easy to access and part of the local community in Herlev. The goal of creating a building which will enrich the life of its users while encouraging them for a fast recovery seems deliberated with the location in natural surroundings

The shape of the building responds well with both the use of the building and the climatic aspects of a sustainable building. The pitched roof is miming the typology that would commonly be seen as a residential house - a home. One of the main objects for the cancer counseling centre is to not be like an institution, but a home away from home which goes along with the scale of the one storey building. The pitched roof is meanwhile beneficial for the the sustainable strategy of the building. The south facing inclined roof is used for PV cells sloped in a position where the performance is up to 95% of the potential output. The north facing roof is supplying the building with daylight while being part of the ventilation strategy making thermal buoyancy possible as the main natural ventilation strategy.

The facade solution is making the transition from outside to inside happen at ease with the light expression of the wooden lamellas that by time will patinate to a grey tone matching the underlying zinc that will act as protect the building envelope. Because of the extended lamellas, the PV cells seem integrated in the facade solution rather than something added making the building as a whole simple in its expression. The windows are making expression more dynamic to look at while adding different spatial qualities to the rooms within the building.

The overall room distribution for the building seems clear and accessible for all users. The segregation between the different functions seems in plan to be the right thing to do in a building like this separating functions based on the sound level. The plan offers both rooms for large social gatherings, smaller and more intimate conversations and spaces in between created with niches and semi private spheres and zones. The indoor spaces in the building appear light and spacious due to the ceiling height alluding to the clean indoor environment which has been supported by the BSim simulation. Especially the grand social space appears spacious, light and welcoming with its double height room.

Knowledge about the benefits of green views and access to green areas has been implemented in the final proposal, where outdoor areas with different characteristics have been detailed to comply with the various needs of the users.

This finished proposal is displaying how the framework of healthcare architecture could look like in the 21st century with a rising energy demand and a focus on the wellbeing of the users. This leads to a greater success rate for people surviving life threatening illnesses and in a larger perspective also the patients time of hospitalization, but is also enriching the life of the users - ill or well. In the end that is the greatest accomplishment of a building - enriching the life of the users, making their life better by being in a building.

REFLECTION

The process of this project has from the early stages been an iterative process of gaining knowledge and using this knowledge in the design proposals.

The decision-making has been extremely though which comes down to the paradox of being in a one person group where the only decision-maker has no one but him to ask for advice or blame for mistakes. A lot of self-confidence and gut feeling is needed to be in a position like that and that has had an impact of the final proposal which would have looked differently has it been a group project with its dynamics.

During the early stages of the project, a decision of moving the project site to another location was made. Whether this decision was right or not comes down to the final proposal. A lot of architectural limitations were seen at the original site location especially in terms of the 'Healing Architecture' aspects where the chosen location suited these such as the positive effect of a green view that the originally intended site would not be able to provide. Though the chosen location is somewhat hidden in relation to the very exposed original site, making the access of the building more difficult. Here one must try understanding or imagining how it would feel like being a cancer patient walking into an publicly exposed building for therapy - in the understanding of the author, this is not a beneficial solution for anyone. Therefore the argue of moving the location for this theoretical project stands.

One might also ask if this project is relevant or if it is just a first word problem being solved with the embetterment of the well being of patients of a specific illness - is the physiological treatment of cancer patient not enough? To this, it has been argued throughout the program, that the service the hospitals provide is not sufficient for the patients who are in a daily struggle.

The shape of the building seems somewhat simplistic in its expression only violated with the dynamic placement of the windows. Thus, shape refers to something recognisable for the users - their home. The security of walking into a building that does not seem distant from the norm is suiting the difficult psychosocial situation of the users quite well.

Working with 'Healing architecture' the principles behind the theory has been informing the design process to a point of it being too thorough. Therefore one of the main aspects from the theory has not been implemented and detailed into the final proposal as well as it was intended. Especially the integration of greenery in in the architectural language is lacking as well as the views from the different rooms could have been detailed more thoroughly to make a plan for the windows responding to the furnishing of the building.

Overall, the aspects of sustainability has been implemented in both the conceptual shape of building and calculated in the final proposal to an extend so that the energy frame is performing better than what is asked for in the competition material as well as the indoor climate is performing better as well. The focus on the performance has informed the shape creating a building based on the theory of integrated design.

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#APPENDIX

APPENDIX CONTENT

APPENDIX 1 - U-VALUE CALCULATION

The u-values are calculated by using the following method:

$$U = \frac{1}{R_i + \frac{e_1}{\lambda_1} + \frac{e_2}{\lambda_2} + \ldots + R_o}$$

Exterior wall

Inside			0.13	
Rockwool	0.032	0.285	8.91	
CLT	0.130	0.095	0.73	
Air	0.02	0.020	1	
Outside			0.04	
U-value				0.092

Floor

Inside			0.17	
Sundolit	0.031	0.420	13.55	
Wood	0.130	0.023	0.18	
Air	0.020	0.070	3.5	
Concrete	2.000	0.100	0.05	
Outside			0.04	
U-value				0.057

Roof

Inside			0.10	
Rockwool	0.032	0.385	12.03	
CLT	0.130	0.150	1.15	
Air	0.020	0.050	2.5	
Outside			0.04	
U-value				0.063

APPENDIX 2 - PV CALCULATION

Energy demand	14315	[kWh]
Inverter, I%	15	[%]
Opt. production	1097	[kWh/m^2]
Solar reduction factor, S%	60	[%]
Panel efficiency, P%	15	[%]

Energy demand with the inverter

$$A = kWh \times \left(1 + \frac{I\%}{100\%}\right) \tag{1}$$

$$A = 14315kWh \times (1 + \frac{15\%}{100\%}) = 14315kWh \times 1.15 = 16462.25kWh \tag{2}$$

The efficiency of the panels is given by

$$B = kWh/m^2 \times \left(1 + \frac{S\%}{100\%}\right) \times \left(1 + \frac{P\%}{100\%}\right) \tag{3}$$

$$B = 1097kWh/m^2 \times \frac{60\%}{100\%} \times \frac{15\%}{100\%} = 1097kWh/m^2 \times 0.6 \times 0.5 = 08.73kWh/m^2 \tag{4}$$

The area of Solar Panels (SP) is calculated by

$$A_{SP} = \frac{A}{B} \rightarrow \frac{16462.25kWh}{98.73kWh/m^2} = 166.74m^2 \tag{5}$$

APPENDIX 3 - REVERBARATION TIME CALCULATION

Reverbaration time in the large social room. Here tested with a reflective material.

Equivalent ab	Material		Areal	125 Hz		250 Hz		500Hz		1000Hz
			S(m^2)	α	Sα	α	Sα	α	Sα	α
gulv			30	0.01	0.3	0.02	0.6	0.06	1.8	0.15
loft			30	0.1	3	0.05	1.5	0.06	1.8	0.07
væg 1			28.8	0.1	2.88	0.05	1.44	0.06	1.728	0.07
væg 2			24	0.1	2.4	0.05	1.2	0.06	1.44	0.07
Absorption from persons			**Antal**	**Sα/stk**	**Sα**	**Sα/stk**	**Sα**	**Sα/stk**	**Sα**	**Sα/stk**
personder			0	0	0	0	0	0	0	0
stole			0	0	0	0	0	0	0	0
Absorption in air										
v/ 50% RF			**Volumen**	**125 Hz**		**250 Hz**		**500Hz**		**1000Hz**
			[m3]	m	mV	m	mV	m	mV	m
			72						0	
Total absorption					8.6		4.7		6.8	
Efterklangstid					1.3		2.4		1.7	

	2000Hz		4000 Hz		
Sα	α	Sα	α	Sα	
4.5	0.25	7.5	0.45	13.5	
2.1	0.09	2.7	0.08	2.4	
2.016	0.09	2.592	0.08	2.304	
1.68	0.09	2.16	0.08	1.92	
Sα	**Sα/stk**	**Sα**	**Sa/stk**	**Sα**	
0	0	0	0	0	
0	0	0	0	0	
	2000Hz		4000 Hz		
mV	m	mV	m	mV	
0		0		0	
10.3		15.0		20.1	
1.1		0.8		0.6	

Reverbaration time in the large social room. Here tested with an absorbing material.

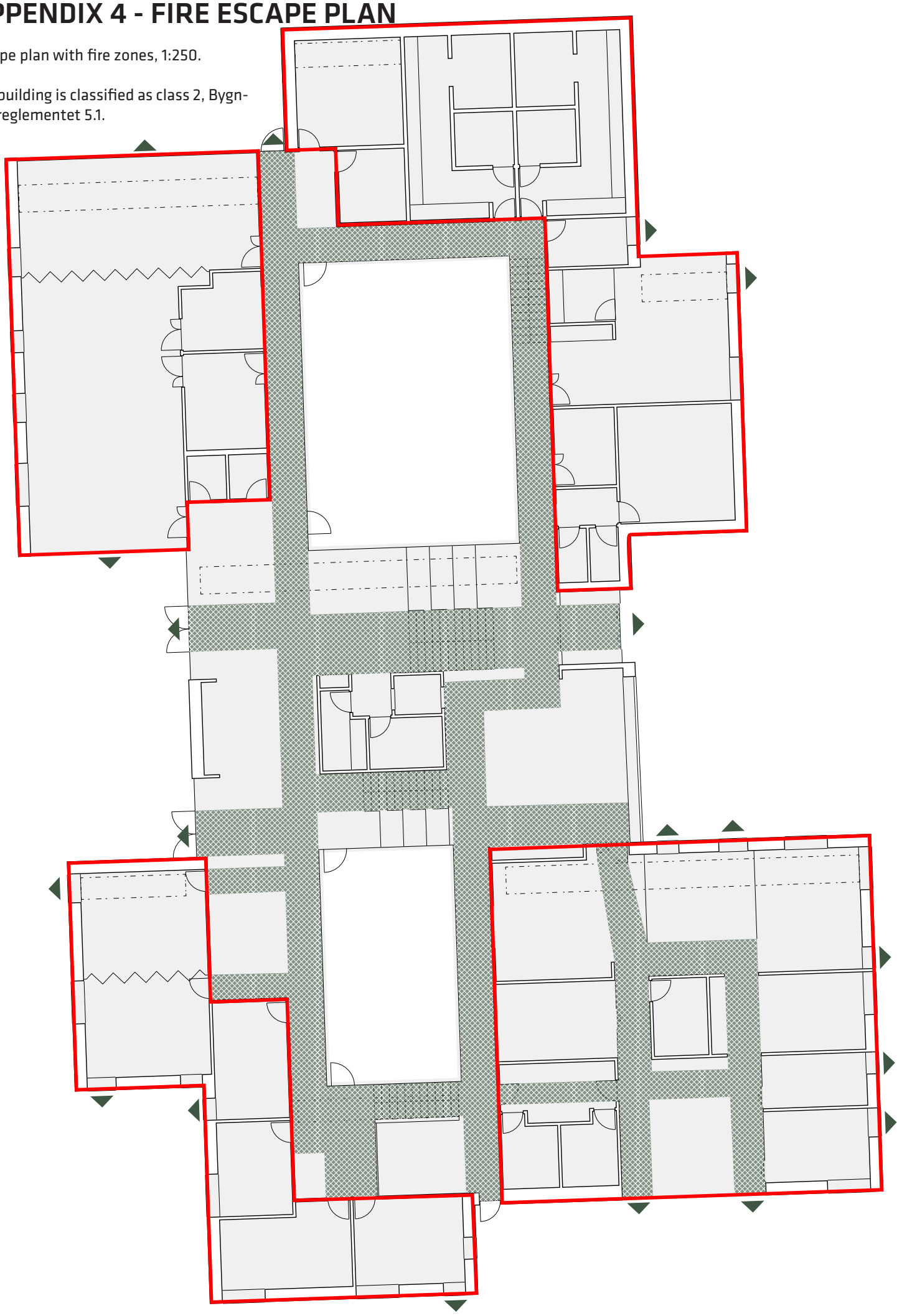
Equivalent ab	Material		Areal	125 Hz		250 Hz		500Hz		1000Hz
			S(m^2)	α	Sα	α	Sα	α	Sα	α
gulv			30	0.01	0.3	0.02	0.6	0.06	1.8	0.15
loft			30	0.1	3	0.05	1.5	0.06	1.8	0.07
væg 1			28.8	0.1	2.88	0.05	1.44	0.06	1.728	0.07
væg 2			24	0.1	2.4	0.05	1.2	0.06	1.44	0.07
Absorption from persons			**Antal**	**Sα/stk**	**Sα**	**Sα/stk**	**Sα**	**Sα/stk**	**Sα**	**Sα/stk**
personder			0	0	0	0	0	0	0	0
stole			0	0	0	0	0	0	0	0
Absorption in air										
v/ 50% RF			**Volumen**	**125 Hz**		**250 Hz**		**500Hz**		**1000Hz**
			[m3]	m	mV	m	mV	m	mV	m
			72						0	
Total absorption					8.6		4.7		6.8	
Efterklangstid					1.3		2.4		1.7	

	2000Hz		4000 Hz		
Sα	α	Sα	α	Sα	
4.5	0.25	7.5	0.45	13.5	
2.1	0.09	2.7	0.08	2.4	
2.016	0.09	2.592	0.08	2.304	
1.68	0.09	2.16	0.08	1.92	
Sα	**Sα/stk**	**Sα**	**Sa/stk**	**Sα**	
0	0	0	0	0	
0	0	0	0	0	
	2000Hz		4000 Hz		
mV	m	mV	m	mV	
0		0		0	
10.3		15.0		20.1	
1.1		0.8		0.6	

APPENDIX 4 - FIRE ESCAPE PLAN

Escape plan with fire zones, 1:250.

The building is classified as class 2, Bygningsreglementet 5.1.



APPENDIX 5 - VENTILATION DUCT PLAN

APPENDIX 6 - VENTILATION CALCULATION, OLF

Når der undersøges på ventilation, altså hvor meget der skal ventileres, så ses der på to tilfelde.
1. Ventilation i forhold til lugt i Olf
2. Ventilation i forhold til CO2

1. ventilaiton, Olf

Room	Areal [m^2]	umhøjde [m	Rum Volumen	al peros	pr. Pers	Olf fra Personer	f pr. m^	ra bygnir	Ønsket antal Olf	Olf fra indblæst luft	Volumenstrøm	Luftskifte
	A	h	V							Ci		
Counseling Room 1	12,97	2,45	31,7765	3	1	3	0,3	3,891	1	0	0,5313030069	1,912690825
Counseling Room 2	10,4	4,56	47,424	4	1	4	0,3	3,12	1	0	0,6846153846	2,464615385
Counseling Room 3	15,29	3,81	58,2549	4	1	4	0,3	4,587	1	0	0,5616088947	2,021792021
Counseling Room 4	14,24	3,81	54,2544	3	1	3	0,3	4,272	1	0	0,5106741573	1,838426966
Staff Change/WC	5,67	2,48	14,0616	1	4	4	0,3	1,701	1	0	1,005467372	3,61968254
Staff Wardrobe	10,38	3,01	31,2438	1	1	1	0,3	3,114	1	0	0,3963391137	1,426820809
Consultant Office	19,48	3,8	74,024	4	1	4	0,3	5,844	1	0	0,505338809	1,819219713
Manager Office 1	8,2	3,03	24,846	2	1	2	0,3	2,46	1	0	0,543902439	1,95804878
Printroom	6,3	3,6	22,68	0	1	0	0,3	1,89	1	0	0,3	1,08
Corridor	3,9	3,6	14,04	0	1	0	0,3	1,17	1	0	0,3	1,08
Run for Life Office	20,43	3,8	77,634	2	1	2	0,3	6,129	1	0	0,3978952521	1,432422907
Administration	24,92	3,8	94,696	3	1	3	0,3	7,476	1	0	0,4203852327	1,513386838
Break Room	28,39	3,6	102,204	12	1	12	0,3	8,517	1	0	0,7226840437	2,601662557
Meeting Room	14,4	3,6	51,84	6	1	6	0,3	4,32	1	0	0,7166666667	2,58
Manager Office 2	11,28	2,49	28,0872	2	1	2	0,3	3,384	1	0	0,4773049645	1,718297872
Counsellar Office	27,72	2,73	75,6756	4	1	4	0,3	8,316	1	0	0,4443001443	1,599480519
Group Room 1	14,05	3,21	45,1005	6	1	6	0,3	4,215	1	0	0,7270462633	2,617366548
Group Room 2	19,64	3,25	63,83	10	1	10	0,3	5,892	1	0	0,8091649695	2,91299389
Group Room 3	20,86	2,66	55,4876	10	1	10	0,3	6,258	1	0	0,7793863854	2,805790988
Lounge 1	13,68	3,5	47,88	3	1	3	0,3	4,104	1	0	0,5192982456	1,869473684
Change Room	22,56	3,03	68,3568	8	4	32	0,3	6,768	1	0	1,718439716	6,186382979
Toilet Change Room	4,83	3,1	14,973	1	4	4	0,3	1,449	1	0	1,12815735	4,06136646
Comfort Room	18,05	3,3	59,565	1	1	1	0,3	5,415	1	0	0,355401662	1,279445983
Massage Room	7,2	2,28	16,416	2	1	2	0,3	2,16	1	0	0,5777777778	2,08
Linen Depot	7,02	2,75	19,305	0	1	0	0,3	2,106	1	0	0,3	1,08
Depot 3	11,63	3,33	38,7279	0	1	0	0,3	3,489	1	0	0,3	1,08
Gym 1	42,78	3,86	165,1308	12	10	120	0,3	12,834	1	0	3,105049088	11,17817672
Gym 2	63,7	3,27	208,299	12	10	120	0,3	19,11	1	0	2,183830455	7,861789639
Create	30,07	3,54	106,4478	10	4	40	0,3	9,021	1	0	1,630229465	5,868826072
Create Depot	5,23	3,21	16,7883	0	1	0	0,3	1,569	1	0	0,3	1,08
Hallway 1	22,33	3,13	69,8929	1	1	1	0,3	6,699	1	0	0,3447828034	1,241218092
Hallway 2	21,61	2,5	54,025	1	1	1	0,3	6,483	1	0	0,3462748727	1,246589542
Hallway 3	31,43	3,5	110,005	1	1	1	0,3	9,429	1	0	0,3318167356	1,194540248
Hallway 4	12,15	2,28	27,702	1	1	1	0,3	3,645	1	0	0,3823045267	1,376296296
Hallway 5	16,5	3,3	54,45	1	1	1	0,3	4,95	1	0	0,3606060606	1,298181818
Depot 2	7,05	2,85	20,0925	0	1	0	0,3	2,115	1	0	0,3	1,08
Wardrobe	3,29	2,35	7,7315	1	1	1	0,3	0,987	1	0	0,6039513678	2,174224924
WC Type 1	2,28	2,2	5,016	1	4	4	0,3	0,684	1	0	2,054385965	7,395789474
Technical Room	20,25	2,68	54,27	0	1	0	0,3	6,075	1	0	0,3	1,08
WC Type 2	2,51	2,7	6,777	1	4	4	0,3	0,753	1	0	1,893625498	6,817051793
Windbreak	7,5	3,99	29,925	1	1	1	0,3	2,25	1	0	0,4333333333	1,56
Kitchen	16,98	5,27	89,4846	6	1	6	0,3	5,094	1	0	0,6533568905	2,352084806
Library	45,33	2,93	132,8169	6	1	6	0,3	13,599	1	0	0,4323626737	1,556505625
Lounge 2	13,05	2,84	37,062	1	1	1	0,3	3,915	1	0	0,3766283525	1,355862069
Handicap WC	5,56	2,5	13,9	1	4	4	0,3	1,668	1	0	1,01942446	3,669928058
Depot 5	4,59	3,5	16,065	0	1	0	0,3	1,377	1	0	0,3	1,08
Social Room 1	74,09	5,06	374,8954	12	1	12	0,3	22,227	1	0	0,4619651775	1,663074639
Social Room 2	29,98	4,18	125,3164	6	1	6	0,3	8,994	1	0	0,5001334223	1,80048032
Lounge 3	14,4	4,04	58,176	6	1	6	0,3	4,32	1	0	0,7166666667	
	923,72											

APPENDIX 7 - VENTILATION CALCULATION, CO_2

2. ventilation, CO2

Rum	Areal [m^2]	umhøjde [m	Rum Volumen	al perso	sniveau (	ldledning [m^3	CO2 bel	oncentra	uftskiftet [h-1] [2	enstrømmen [l/s*m^2] [3]
	A	h	V		M	q	C	Ci	n	
Counseling Room 1	12,97	2,45	31,7765	3	1,2	0,0612	840	380	4,186851235	2,849384868
Counseling Room 2	10,4	4,56	47,424	3	1,2	0,0612	840	380	2,805403978	3,553511706
Counseling Room 3	15,29	3,81	58,2549	4	1,2	0,0816	840	380	3,045088127	3,222718268
Counseling Room 4	14,24	3,81	54,2544	4	1,2	0,0816	840	380	3,269620609	3,460348477
Staff Change/WC	5,67	2,98	16,8966	1	3	0,051	840	380	6,561649398	5,431587557
Staff Wardrobe	10,38	2,44	25,3272	1	1,2	0,0204	840	380	1,750996008	1,186786183
Consultant Office	22,05	3,8	83,79	4	1,2	0,0816	840	380	2,117093977	2,234710309
Manager Office 1	10,87	3,21	34,8927	2	1,2	0,0408	840	380	2,541954397	2,266576004
Printroom	4,85	3,9	18,915	0	1,2	0	840	380	0	0
Corridor	8	3,69	29,52	0	1,2	0	840	380	0	0
Volunteer Office	0	3,5	0	2	1,2	0,0408	840	380	#DIV/0!	#DIV/0!
Administration	24,92	3,75	93,45	3	1,2	0,0612	840	380	1,423686231	1,48300649
Break Room	29,44	2,88	84,7872	12	1,2	0,2448	840	380	6,276583176	5,021266541
Meeting Room	10,51	3,69	38,7819	6	1,2	0,1224	840	380	6,861111924	7,032639722
Manager Office 2	12,83	3,58	45,9314	2	1,2	0,0408	840	380	1,931046129	1,920318095
Counsellar Office	22,28	2,73	60,8244	4	1,2	0,0816	840	380	2,91644972	2,211641038
Group Room 1	14,05	3,21	45,1005	6	1,2	0,1224	840	380	5,899867108	5,260714838
Group Room 2	19,64	3,25	63,83	10	1,2	0,204	840	380	6,947802928	6,272322087
Group Room 3	20,86	2,66	55,4876	10	1,2	0,204	840	380	7,992384981	5,905484458
Lounge 1	13,68	3,5	47,88	3	1,2	0,0612	840	380	2,778685845	2,701500127
Change Room	22,56	3,03	68,3568	8	3	0,408	840	380	12,9753956	10,92095796
Toilet Change Room	4,83	3,1	14,973	1	3	0,051	840	380	7,404632687	6,37621148
Comfort Room	18,05	3,3	59,565	1	1,2	0,0204	840	380	0,7445282647	0,6824842426
Massage Room	7,2	2,28	16,416	2	1,2	0,0408	840	380	5,403000254	3,421900161
Linen Depot	7,02	2,75	19,305	0	1,2	0	840	380	0	0
Depot 3	11,63	3,33	38,7279	0	1,2	0	840	380	0	0
Gym 1	42,78	3,86	165,1308	12	6	1,224	840	380	16,11370844	17,27747627
Gym 2	63,7	3,27	208,299	12	6	1,224	840	380	12,77427911	11,60330353
Create	30,07	3,54	106,4478	10	3	0,51	840	380	10,41539282	10,24180294
Create Depot	5,23	3,21	16,7883	0	1,2	0	840	380	0	0
Hallway 1	22,33	3,13	69,8929	1	1,2	0,0204	840	380	0,6345111748	0,5516722158
Hallway 2	21,61	2,5	54,025	1	1,2	0,0204	840	380	0,8208760035	0,5700527802
Hallway 3	31,43	3,5	110,005	1	1,2	0,0204	840	380	0,4031437306	0,3919452937
Hallway 4	12,15	2,28	27,702	1	1,2	0,0204	840	380	1,600888964	1,013896344
Hallway 5	16,5	3,3	54,45	1	1,2	0,0204	840	380	0,8144687987	0,7465963988
Depot 3	7,05	2,85	20,0925	0	1,2	0	840	380	0	0
Wardrobe	3,29	2,35	7,7315	1	1,2	0,0204	840	380	5,735992509	3,744328444
WC Type 1	2,28	2,2	5,016	1	3	0,051	840	380	22,10318286	13,50750064
Technical Room	20,25	2,68	54,27	0	1,2	0	840	380	0	0
WC Type 2	2,51	2,7	6,777	1	3	0,051	840	380	16,35968204	12,26976153
Windbreak	7,5	3,99	29,925	1	1,2	0,0204	840	380	1,481965784	1,642512077
Kitchen	16,98	5,27	89,4846	6	3	0,306	840	380	7,433875676	10,882368
Library	45,33	2,93	132,8169	6	1,2	0,1224	840	380	2,003411889	1,630554676
Lounge 2	13,05	2,84	37,062	1	1,2	0,0204	840	380	1,196584806	0,9439724582
Handicap WC	5,56	2,5	13,9	1	3	0,051	840	380	7,976227713	5,539047023
Depot 5	4,59	3,5	16,065	0	1,2	0	840	380	0	0
Social Room 1	74,09	5,06	374,8954	12	1,2	0,2448	840	380	1,419526388	1,995223201
Social Room 2	29,98	4,18	125,3164	6	1,2	0,1224	840	380	2,123321102	2,465411724

APPENDIX 8 - SPATIAL SITE ANALYSIS

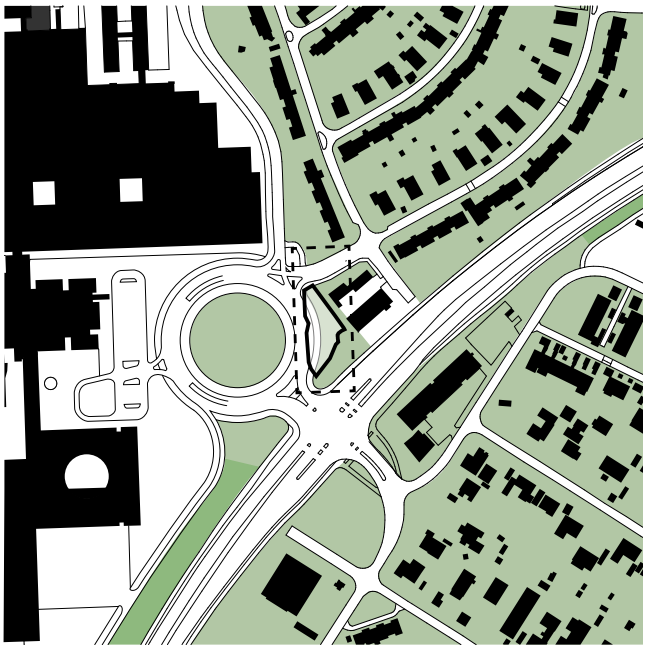
TOUCH OF NATURE

Not present

Highly present

Present

Vaguely present



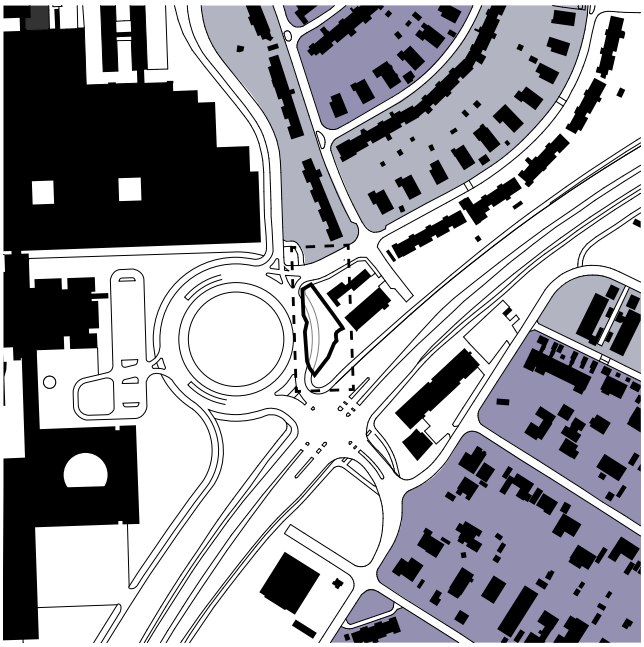
PEACEFUL

Not present

Highly present

Present

Vaguely present



SPATIAL ANALYSIS

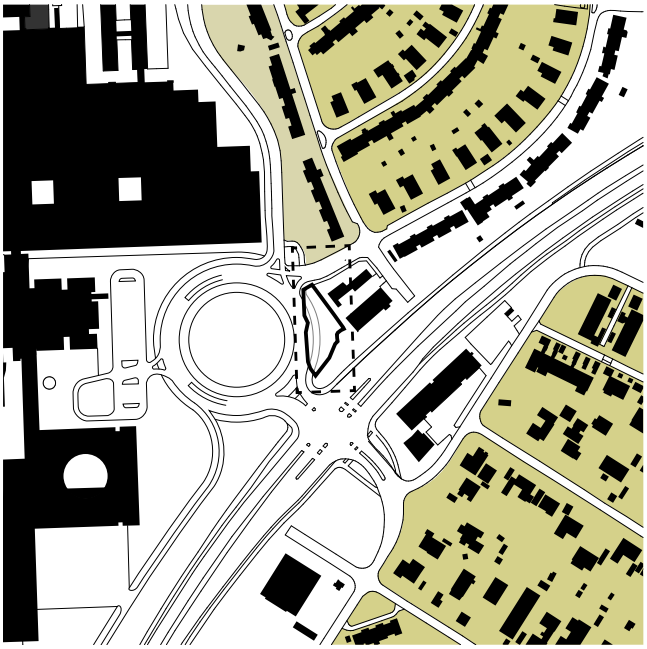
Inclosed

Clearing

Avenue

Scattered trees

Open



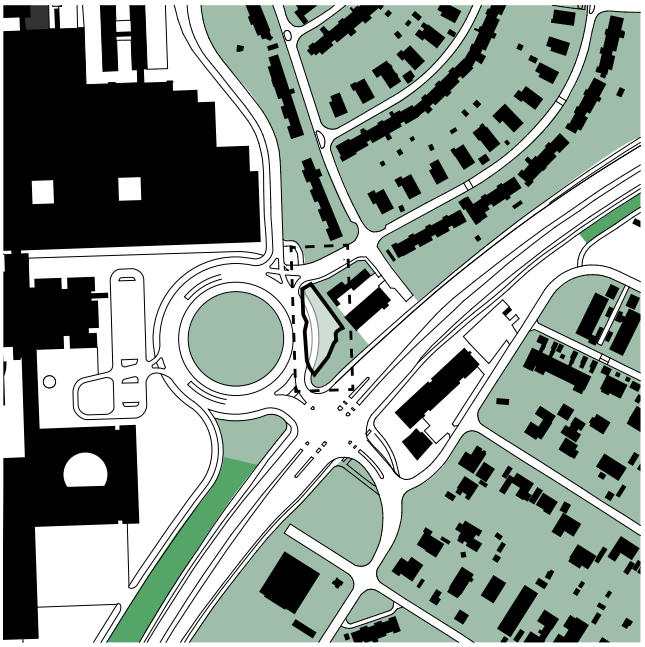
SAFE

Not present

Highly present

Present

Vaguely present



BIODIVERSITY

Not present

Highly present

Present

Vaguely present