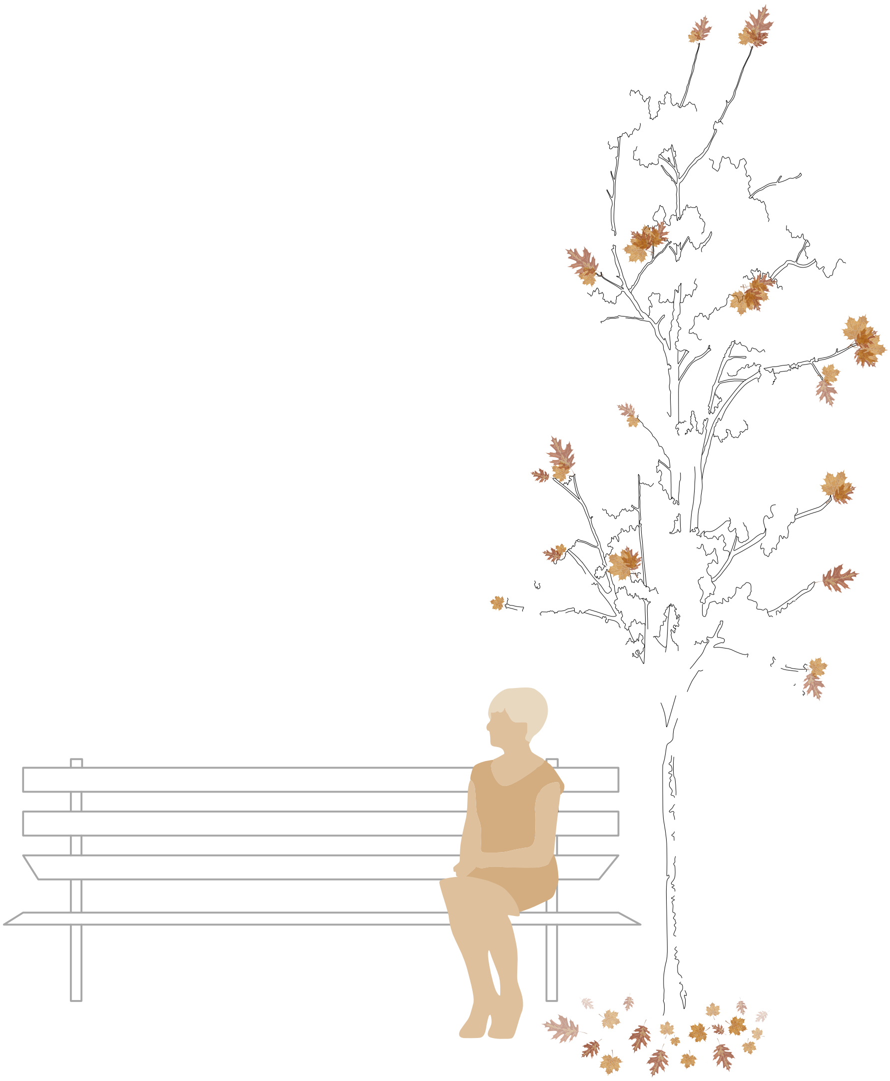

Hospice Vejlbo

"A space to say goodbye"

May 2023 | Msc04 | Group 13 | Architecture & Design | Aalborg University

Hans Christian Sivertsen
Mikkel Bømfeldt Poulsen

Title Page

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Hans Christian Sivertsen

Mikkel Bømfeldt Poulsen

Abstract

This architectural report investigates the relationship between architecture, technical solutions, healing design, sustainability, and life cycle assessment in the context of a hospice in Silkeborg. In addition to providing end-of-life care to patients, the hospice is designed to be sustainable, with reduced environmental impact and operating costs. The report examines how sustainable materials and passive strategies can be incorporated into the hospice design to achieve these goals. It also considers the life cycle of the hospice, from construction to decommissioning, to identify opportunities for reducing its environmental impact. Moreover, the report analyses how the design of the hospice can support the well-being of patients and their families through healing design principles. natural light, ventilation, and the use of nature, colours, and materials are all considered in the design.

The report concludes with recommendations for future hospice designs that prioritize sustainability, life cycle assessment, and healing design principles. By considering these factors, hospices can provide high-quality end-of-life care while also reducing their environmental impact and operating costs.

Reading Guide

The thesis consists of seven chapters and an appendix; The appendix is in referenced order in the report.

Chapter one is an introduction giving some general thoughts and questions regarding the topic. This chapter also explains our motivation and vision for the project. Then the applied methodologies and methods are disclosed. The chapter concludes with our problem statement framing the scope of the project.

The second chapter is a theoretical chapter discussing the necessary knowledge required to design a hospice.

The third chapter is the presentation of the final design: Here the project is visualised through renders, plans, sections, and elevations alongside some relevant diagrams.

Chapters four and five contain the project's main analyses and investigations: Chapter four discusses our user investigations. Some AI generated storyboards were made to establish a deeper understanding of the user. Chapter five consists of the presentation of the chosen site and some relevant site analysis.

The design process is documented in chapter six. It will specify the process leading to the final design and the arguments behind it.

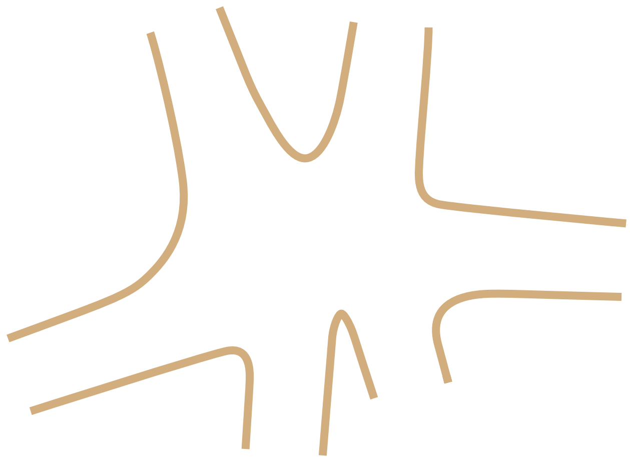
The thesis concludes with an epilogue concluding and reflecting on the learnings from the design investigation in chapter seven.

Certain ideas may have become implicit to our understanding of the project. This reading guide will aid the understanding by explaining certain terms and annotation styles applied to sketches and diagrams:

For parts of the design process, iterations of various kinds have been compared. These will reference the corresponding illustrations that are horizontally aligned with the text, if no illustration is directly referenced in the text.
Most illustrations used in the report have been made by us. Credits to owners of images not made by group members are included in the illustrations list on pages 134-135. Illustrations' numbers and text give brief descriptions of what the image depicts regardless of copyright ownership.

Certain annotations and notes are in Danish, as most of the dialogues during the design process were in Danish. An example is that the letter P will appear on some of the sketches in the design process with different meanings. It will either refer to the direction of the parking lot compared to the discussed building volume i.e., illu. 101 on page 93, or it will represent a scale of privacy if opposed by an 'O' as on illu. 86 on page 86 symbolising "Privat & Offentligt" (Private and Public in Danish).

Unless a Northern arrow explicitly depicts otherwise, all maps and concept sketches face north.



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01 INTRODUCTION

Introduction

"How do you design for saying goodbye?"

Death is an inevitable part of life. For some it is more immediate than for others. Patients in a hospice usually have only months, weeks or even days to live, and for that reason it is important to give them the highest possible quality of life in their remaining time.

This thesis investigates how to design a good hospice: How to make space for all types of users and removing as many obstacles as possible to create a better user experience:

General hospice design will be investigated along with some relevant theories regarding the topics of barrier free design, healing architecture, biophilic design, sacred or spiritual architecture.

A good hospice is designed with the main users in mind. Understanding their situation and sympathising with them and their relatives to see the extraordinary circumstances surrounding the topic of pain, loss, and bereavement. The primary function of a hospice is to give relief to physical and psychological pain. Therefore, a lot of emphasis should be placed on bringing all users together, letting them share their experience and supporting each other.

Finding an ideal location and forming a building that nudges people to be social and investigating principles that embody and improve the quality of life for the people suffering from various terminal illnesses and their relatives.

Motivation

When identifying a problem for the master's thesis, a competition brief about children's hospice was brought forward by a lecturer. The challenge of making a space for people in a hopeless situation, and the possible impact of atmosphere, spatial layout and architectural quality really spiked the group's interest. When researching about hospices the word *palliative care* came up almost synonymous with hospice care.

The Danish Health Administration open their 2017 guidebook for palliative care by saying:

"Many patients' lives are increasingly affected by life-threatening diseases, with the need for palliative care continually becoming more important." (Anbefalinger for den palliative indsats, 2017a)

Thus, the need for institutions specialized in palliation is growing. Coupled with the group's interest in biophilic design it is a socially relevant, ambitious, and exiting project to undertake.

Problem Statement

How can a new hospice in Silkeborg, Denmark, be designed to integrate healing architecture, biophilic design, social and environmental sustainability, and comprehensive end-of-life care to promote physical and psychological peace of mind for patients and their families, whilst giving the best working conditions for staff to perform palliative treatments?

Vision

The vision for this project is to create a future hospice for adults that contributes to the patients well being up until their end-of-life journey. A hospice that prepares the patient and their relatives for the inevitable in a secure and dignified "space to say goodbye" and give them the tools to handle this difficult time. Through the surroundings of forest and lake in Silkeborg, the hospice will enhance the well being of both patients and relatives in an environment where connection, comfort and professional support has carefully been implemented in the design.

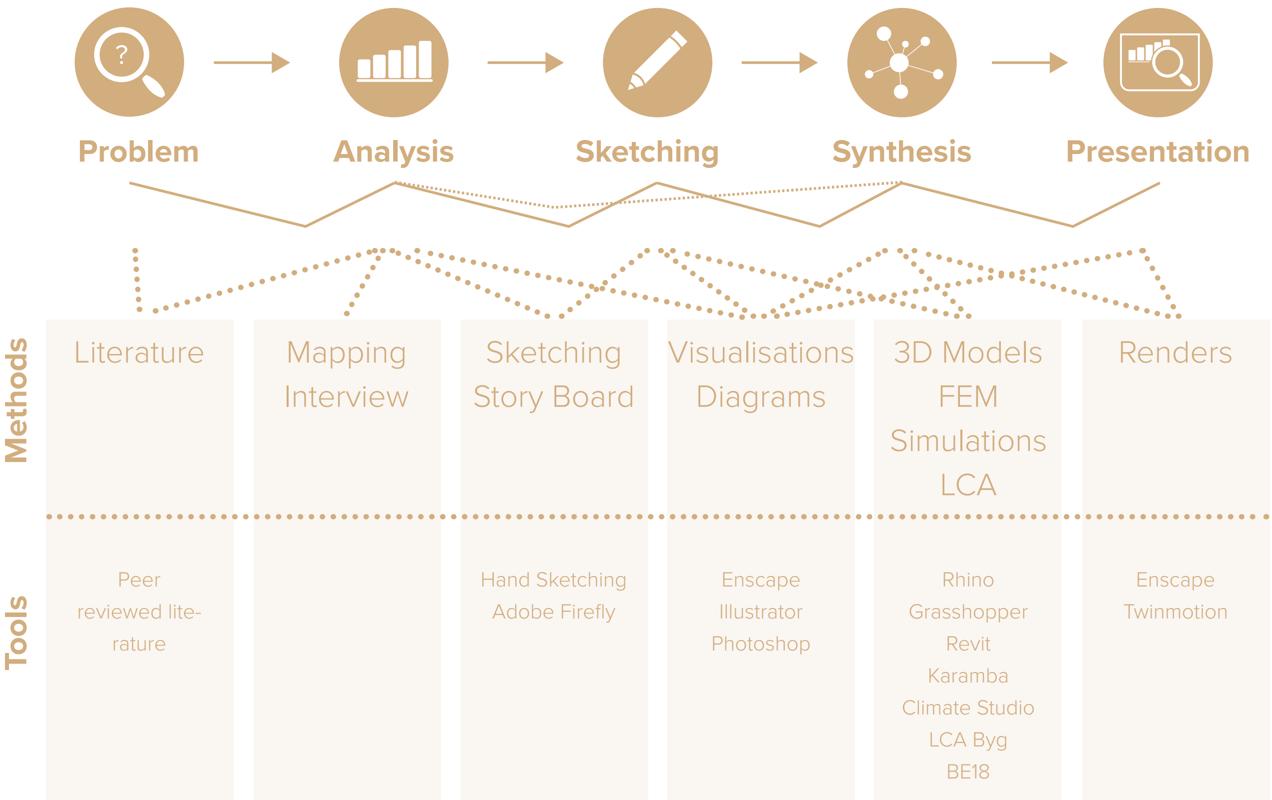
A building that pays respect to its surroundings by placing the hospice between trees or utilising cut down trees as building material. The project aims to create compliant spaces through functions that supports the vulnerable patients and the staff in the best way possible. A building that supports care through spaces defined by the shape and structure.

Methodology

"The Integrated Designprocess"

This thesis uses Mary-Ann Knudstrup's Integrated Design Process (IDP) as a template for all stages of the design process (Knudstrup, 2004). This process uses an iterative sequence of steps to ensure all aspects of the design are integrated in a cohesive way. The iterative nature is to identify problems during one of the phases and going back to an earlier stage to elaborate on the investigation and understanding - even revising the initial question - to re-enter the various phases with a deeper holistic understanding. (Illu. 2)
The Steps are:

1. Identifying a question or problem
2. Analysing and understanding the challlengens linked to the project
3. Sketching ideas, principles and concepts to solve the various parts of the problem
4. Synthesising and merging the various design aspects into cohesive solutions
5. Presenting the Project through drawings, renders, diagram and literature



Illu. 2 - The integrated Design Process and the Applied Methods

However, the group's experience with the IDP is that we are reluctant to go back to earlier steps: Rather than spending time finding a stronger concept, flawed concepts will be tweaked to satisfy the technical requirements - leading to some architectural quality being lost. To mitigate some of these perceived shortcoming in the IDP, some additional pragmatic methodological theories will be implemented into our work-flow. (Table. 1)

"Methods"

Methods	What	How	Why
Literature	Reading to obtain relevant knowledge	Critically choosing credible sources related to the topic	Gain trustworthy information for the project
Mapping	Mapping various data to find possibilities and properties	Drawing maps to analyse	Understand the project's context
Interview	Learning from experiences of relevant professionals	Asking professionals questions about their work	Understand what the essential needs are
Sketching	Sketching with pen and paper or on tablets	Using freehand sketching to express abstract concepts	Quickly express ideas and visually discuss them
Story Board	AI generated images to illustrate the routine and experience of users	AI generated images for literature and interviews	Become immersed in the experience and gain empathy for users
Visualisations	Visual representation to clarify text	Visual interpretations of topics discussed in the report	Clarify concepts and avoid confusion and misinterpretations
Diagrams	Diagrams to meditate findings in mapping	To simplify and articulate imbedded data	Explicitly articulate findings
3D Models	Digital models for exploring design	Using CAD software to draw and investigate models	To correlate form and space in plan, section, and 3D
FEM Calculations	Finite Element Method for solving construction Design	Calculations of strength requirements in structural members	To ensure integrated architectural and engineering solutions
Simulations	Simulations on indoor environmental conditions	By running system checks for indoor quality	To ensure healthy comfortable indoor environments
LCA	Assessment of materials' impact on the climate	Calculating the GWP for different material options and combinations	To make an environmentally sustainable building/Lower greenhouse gasses from the construction
Renders	Spatial and atmospheric visualisation	To investigate and assess architectural quality	To capture users and investor's' imaginations

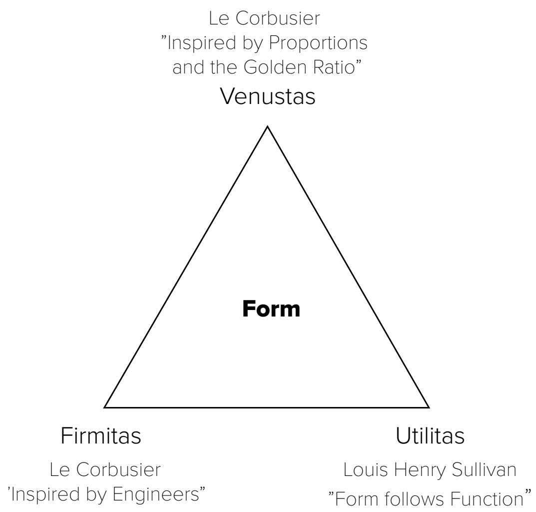
Table. 1 - Applied Methods' What, How, and Why

"Method"

Vitruvian triangle

Claus Bech-Danielsen has written a paper trying to tie some of ancient architectural theorist Vitruvius' views into the modernist philosophy (Bech-Danielsen, 2014). The basis for the principle is the Vitruvian Triad saying that architectural form is based on a strong link between **beauty, function and durability** (Illu. 3). He goes on to quote Le Corbusier, Louis Henry Sullivan, and Walther Gropius and comparing their architectural views with the views of Vitruvius.

This way of thinking durability, useability and aesthetics into every component of the design and choice of material will add a basic but vital checklist to ensure the **highest quality** throughout the project.
These ideas are implicitly included throughout the design process



Illu. 3 - The Vitruvian Triad

Story Boards

The method and usage of storyboards in architecture is to draw up scenarios that illustrate the **user needs, actions, and behaviours** in buildings. It can be used to visualise different actions, interactions or flows regarding various users' usage of the building but also certain problems that occur regularly in the daily routines, which can be bettered or solved through design.

This method's main intention is to make the building as **socially sustainable** as possible by referencing the various users point of view as accurately as possible. It's a tool that require user interactions and discussions, which in turn betters the end product for the users.

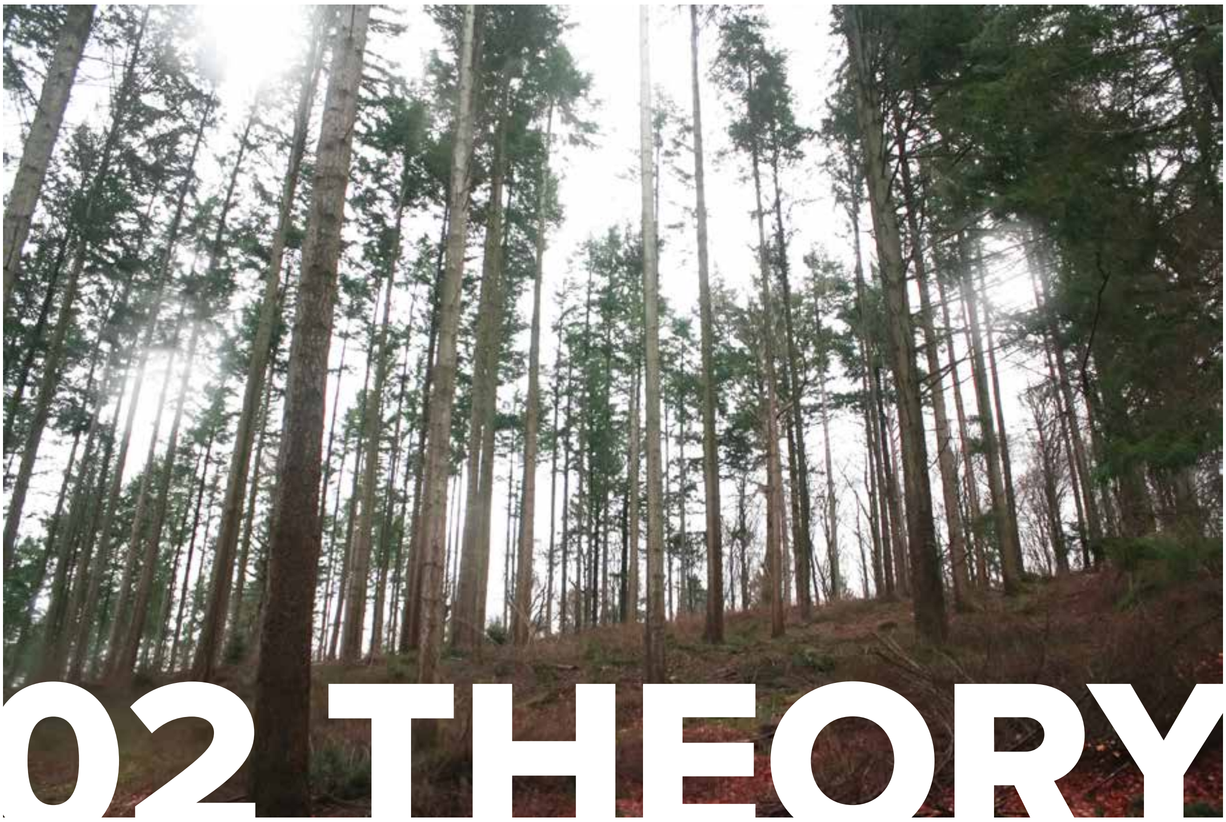
By adopting a **comic-style graphic**, user interactions and perceptions can be depicted with a **detailed emotional data**, whilst having an **elevated level of clarity** (McCormick-Huhn and Shields, 2021) (Illu. 4). Using this style of narrative with AI illustrated storyboards, quick iterations on perceptions of spatial sequences and compositions can be compared, as an aid in deciding between various design solutions – though particular care must be taken to visualise to different options objectively.

Illu. 4 - Storybaords made by AI

Design Criteria

	Design Goals	Design Strategies	Design Criteria
Site	Impact the site environment as little as possible	Remove as few trees as possible for both building and parking area	Map trees for accurate placement
Energy	Low energy building without active strategies.	Make the building com pact and efficient: Take up little space and use little energy for low climate impact.	Using good insulation and thermal mass to effectively balance and store energy
Materials	Sustainable choice of material	Establish a forest atmo-sphere inside and outside.	Utilise the removed trees in the construction
Functionality	Have an open, inclusive, and social building.	Central core that can gather people for social activities	Equal walking distances for shared functions
	Homely feeling	Spatious apartments, with room for personalisation	White walls and of storage space for customisations options in apartments.
	Dignity and Privacy	Space to move beds around in all parts of the building and no direct view into apartments' windows.	Apartment side of residen-tial wings are angled at least 90° away from the other wings, and are 30m^2 minimum.
	Low mobility usability	Paths are wide enough for several wheelchairs or beds to pass.	Paths are surfaced with firm materials, that don't restrict wheels
Tectonic	Flexible Construction	A structural principle that enables long spans and organic building shapes.	Corridor widths of at least 2,6 meters

Table. 2 - Design Criteria



02 THEORY

Healing architecture and Biophilic Design

"Enhancing Well-being and Connection to Nature"

Healing architecture is a design approach that recognizes the impact of the built environment on health outcomes. It aims to create spaces that promote healing and well-being for patients and staff.

Healthcare environments play a vital role in the promotion of patient recovery and staff well-being. The design of these environments can significantly impact the healing process of patients. Even though hospice patients are not there to heal, the physical environment and the healing factors is still important for these people.

In the article “A Review of the Research Literature on Evidence-Based Healthcare Design“, research on the impact of physical environmental factors related to healthcare outcomes was investigated. This included patient recovery, staff well-being and patient safety. They found that multiple design factors contribute to healing environments. This is access to natural light and views of nature, control over the environmental stimuli, appropriate levels of noise and privacy and comfortable furniture and decor. (Ulrich et al., 2008)
A key finding in the research was the importance of nature in healthcare environments. Exposure to nature through windows or access to outdoor, has been linked with positive health outcomes, including faster recovery and reduced stress. Views towards nature has also shown improvement in patient outcomes, such as reduction in pain medication. (Ulrich et al., 2008)

In the journal “Healing environment: A review of the impact of physical environmental factors on users” the importance of natural elements is further supported. They found that green spaces such as gardens or parks have a positive impact on stress and well-being. (Huisman et al., 2012)

Noise and privacy are also important to consider in healing environments. In the article “A Review of the Research Literature on Evidence-Based Healthcare Design“, they found that being exposed to noise can have a negative effect on patient outcomes related to stress, recovery and sleeping patterns. Appropriate levels of privacy can also relieve the patient of stress by promoting a sense of control. (Ulrich et al., 2008)

Furniture and decor also impact the healing environment. In the article “A Review of the Research Literature on Evidence-Based Healthcare Design“, they found that comfortable furniture and positive décor can improve patient and staff well-being. They also identified the importance of creating spaces that promote social interaction, which can improve staff morale and reduce turnover staff rates. (Ulrich et al., 2008)

Representing and incorporating natural elements into architecture and interior design has gained more attention throughout the years. This approach is known as biophilic design and has been found to improve well-being by connecting humans with nature. In a hospice care, patients and families are often preparing for the patients end of life journey. Therefore, creating a restorative and comforting environment is very important.

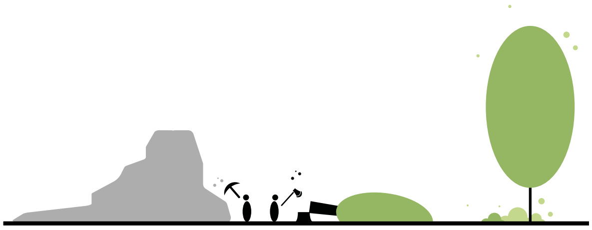
In the review “The Role of Nature in Coping with Psycho-Physiological Stress: A Literature Review on Restorativeness”, Berto provides an overview on natures role in managing psycho-physiological stress. Berto highlights the importance of mixing architecture and natural elements to reduce stress, improve mental health and promote restorative experiences. This is relevant for healthcare facilities such as hospitals or hospices, as patient and families can find themselves stressed, which therefore calls for restorative and calming environments. The study supports biophilic design principles in healthcare facilities to promote healing and well-being. (Berto, 2014)

Another important aspect related to humans and their well-being is a term called “connectedness”. In the article “Nature connectedness and biophilic design” it is argued that connectedness is fundamental for humans and can enhance well-being by being connected to nature. This connectedness can be achieved by incorporating natural elements into the built environment which can be particularly important in a setting where patients might feel disconnected from nature due to their confinement to indoor spaces. (Richardson and Butler, 2022)

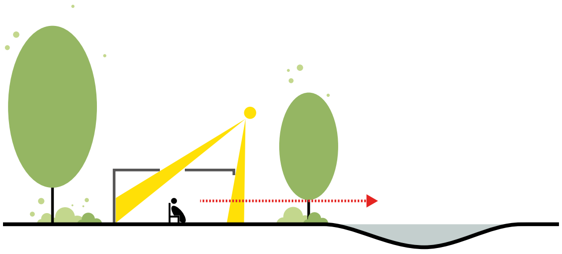
In practice, a research article called “The impact of biophilic design in Maggie’s Centres: A meta-synthesis analysis”, investigates the impact of biophilic design in Maggie’s cancer centre by Foster+Partners. The analysis highlights the positive impact that biophilic design have on the patients emotional and physical well-being. They found that using natural materials, colours and views towards nature can improve the patient’s mood, reduce stress and anxiety, and enhance life quality. (Tekin, Corcoran and Gutiérrez, 2023)
Overall, the information about biophilia in care facilities highlights the importance of such implementation for both patients, visitors, and staff.

One of the most extensive books about biophilic design is “Biophilic design: the theory, science, and practice of bringing buildings to life”. The book covers all aspects of biophilic design in relation to different building types such as healthcare. The book unfolds the importance of biophilic design, in among other things, healthcare facilities, and puts it emphasis on stress, anxiety and pain reducing environments, improved cognitive function, increased activity, enhanced healing and better indoor air quality. This can have both positive outcomes in terms of patient care, but also economical in terms of less medication and use of expensive equipment. (Kellert, Heerwagen and Mador, 2011)

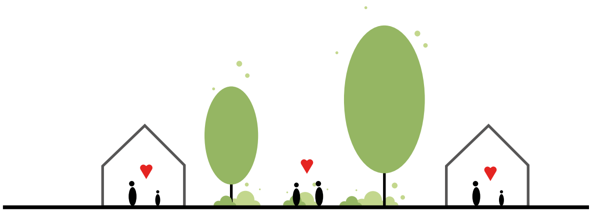
The difference from healing architecture, is that biophilic design focuses on incorporating natural elements into the built environment to promote well-being. Healing architecture on the other hand, aims to improve health outcomes in its design approach. Biophilic design lies as a component, which encompasses healing architecture. Therefore, the knowledge about both subjects produces a strong baseline for creating good healthcare facilities.
From the knowledge of the books and articles, some strategies for implementing healing architecture and biophilic deign will be defined (Illu. 5).



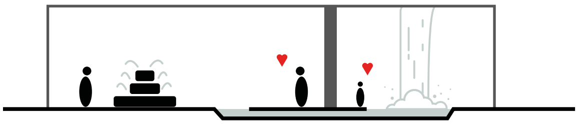
1. Use of natural materials (Wood, stone and plants)



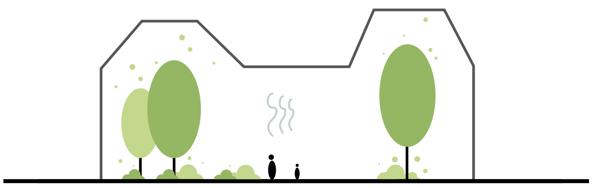
2. Daylight and views



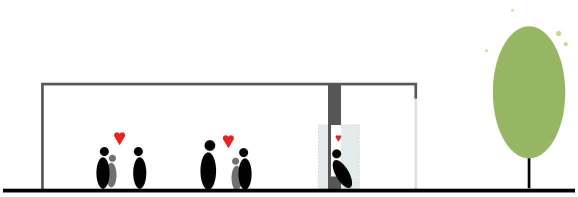
3. Social interaction and connection to the outside world (outdoor spaces and communal areas



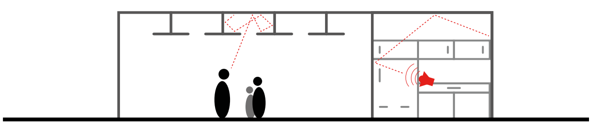
4. Water features such as fountains, waterfalls or reflective mirrors



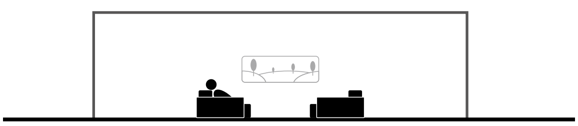
5. Indoor greenery to improve indoor air quality.



6. Promote privacy.



7. Reduce noise.



8. Comfortable furniture and decor.

Illu. 5 - Design Strategies from Biophilic Design and Healing Architecture

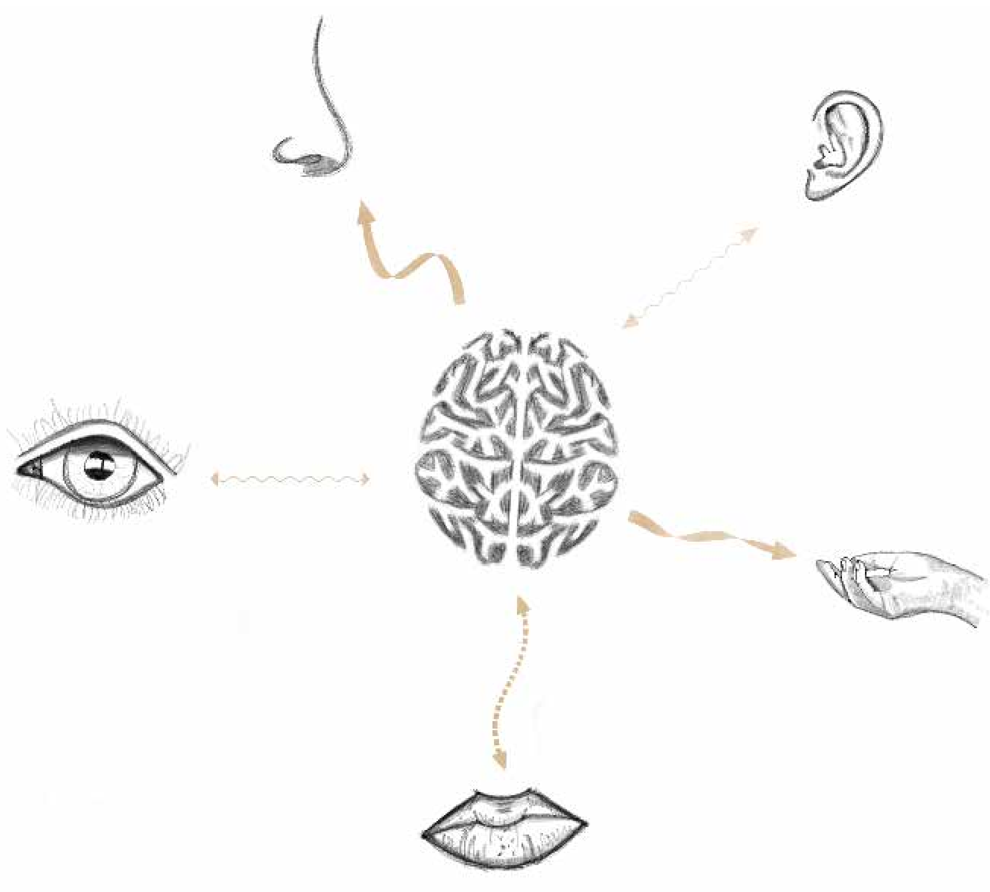
Juhani Palasmaa

"Senses and Architecture"

Architecture in the western culture has adopted a mindset, which places a large emphasis on the visual experience whilst neglecting the other senses. Juhani Pallasmaa goes to great lengths explaining the importance of considering every category of senses in his book "The Eyes Of The Skin". He argues that the atmosphere is created through a multi-sensory experience of material tactility, scale and movement, as well as smell and acoustics. The imbalance of the senses impacts the spatial perception and reducing architectural qualities. (Pallasmaa, 2015)

When considering those who spend time in the Hospice, they come to find peace, relief, and a homely sense of security. This contrasts typical hospitals, where hygiene and durability are prioritised to lower maintenance cost; people associate hospitals with a cynical, sterile, and clinical atmosphere, due to the choice of materials and colours.

Considering the patients in the hospice, who suffer from various illnesses, and a short rest life expectancy, their surrounding environment should be exciting, interesting to inspire the patients to enjoy their existence through playful experiences, provided by the architectural stage. By making their surroundings more interesting will distract them from their suffering, aiding the palliative treatments and increasing the quality of life to the greatest possible extent.



Illu. 6 - Senses in Architecture

Sacred and Spiritual Architecure

"That Special Place"

As hospices are places where many people face the end of their lives, sacred spaces to cultivate spirituality is important to better their well-being. Similarly, it is important for the healing and well-being of relatives. These spaces should promote holistic care by creating a space where patients feeling vulnerable or afraid can reflect upon their situation and regain composure by being in a calming environment.

The sacred space should be for religious and non-religious individuals to support diversity. This is because the patients, relatives and staff might have different cultural, spiritual and religious backgrounds.
To get a better insight in the world of sacred and spiritual architecture, a case study was made to investigate the use of light, materials and colours, and spatial compositions.

Case Study

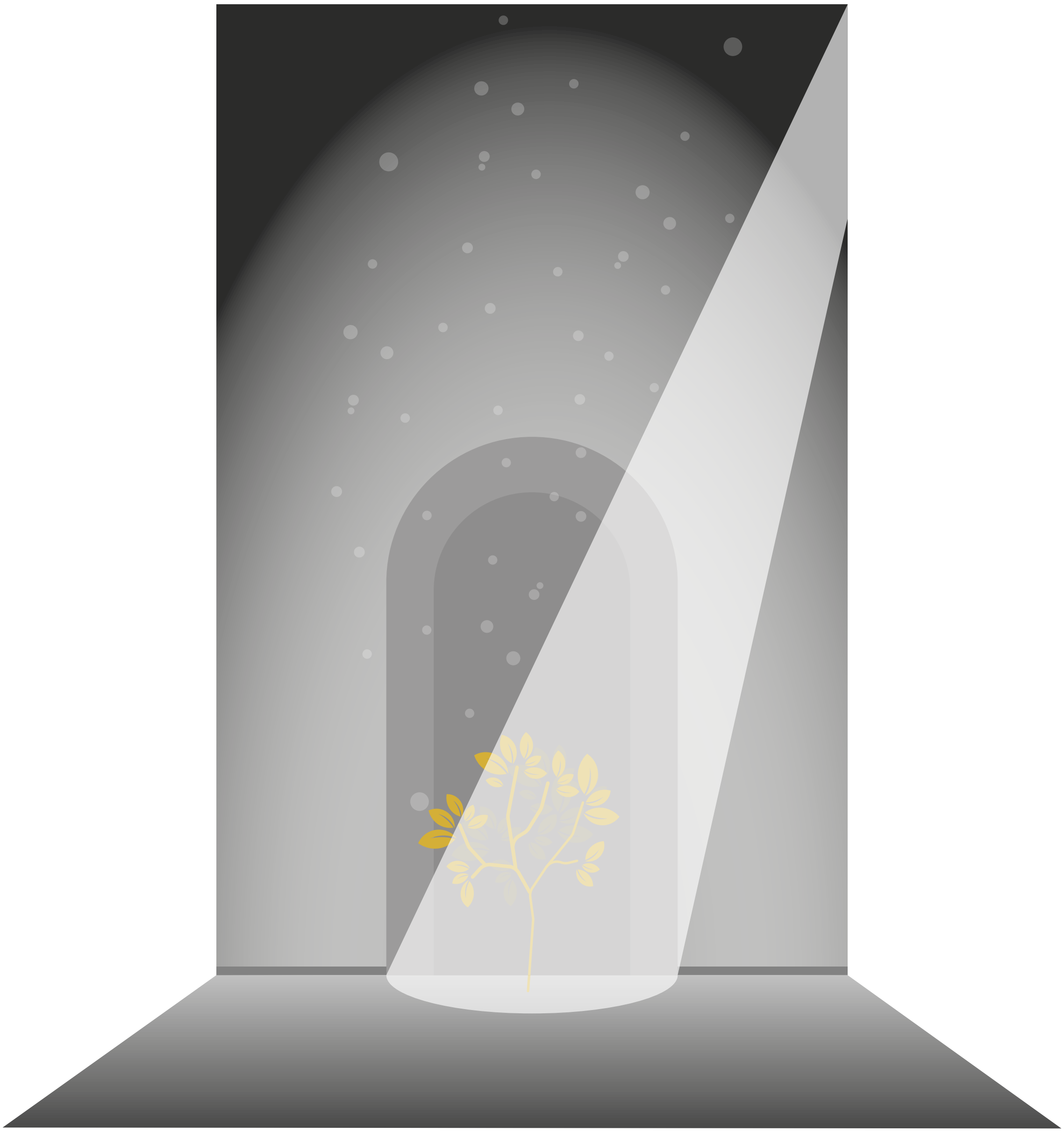
Name: Church of Light
Architect: Tadao Ando
Completed: 1989
Location: Ibaraki, Japan

Illu. 7 - Church of Light by Tadao Ando

The Church of Light by Tadao Ando is a notable example on creating a “holy” or spiritual atmosphere in a sacred space. Even though the church is a religious place with the symbol of a cross, there are still elements to take from this project.

The church expresses a religious atmosphere through the cross shaped in the facade of the building. The cross acts like a window where light can enter. Instead of hanging s cross like in a normal church, Tadao Ando uses the natural elements to create a symbolic gesture within the building by incorporating the cross in the window design. This symbolic gesture is supported by the materials used; The church is made from dark concrete, which creates a cold and dark space. In contrast to this, the light casts its rays onto the dark surfaces and creates a feeling of warmth and hope. The seating placement is also important, as in a normal church, you are looking in a certain direction. This direction is often towards a motif, in this case the symbol of the cross. This is amplified by the strict symmetry in the room, the simplicity of furniture, and window geometry symbolising a higher religious order. This can also highlight the stark contrast between geometric man-made objects, the organic shapes in nature, and the dynamic ever-changing light.

Concluding this case study, spatial spirituality can be achieved by incorporating simplistic and symmetrical elements, that focus on a motif that frames a peaceful yet dynamic world, which a user can feel connected to and find their place within.



Illu. 8 - Imagination of a Sacred and Spiritual Space

Hospice Design
”Principles and Requirements”

One of the key reasons for going from a hospital to a hospice, is getting away from the hectic and busy environment and to stay in a peaceful environment. This is why many hospices are designed to have a quiet and homely atmosphere (Illu. 10). It must be a comfortable space to live in, which is run by a large team of interdiciplinary people with several different functional requirements - that must be met.

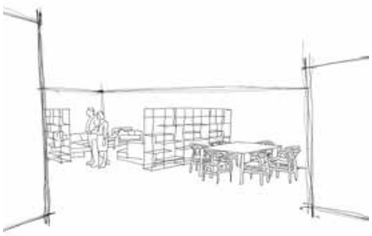
A unique part of staying at a hospice is the social aspect: Common spaces are bringing the different families, patients, and relatives together in spontaneous meetings. This helps nurture a feeling of support, by having a network of fully understanding and empathetic people surround the individual, who can share stories, experiences, and tips (Nissen et al., 2009).

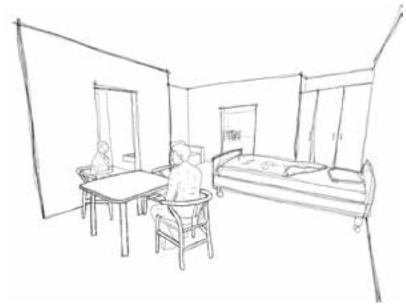
This is echoed by children’s hospice manager Lisbethh Højer in an interview conducted by students from Aalborg University:

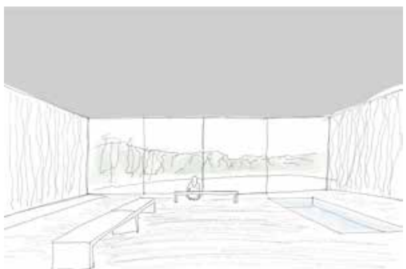
“Part of the hospice philosophy is that people are together: Staff, patient, and relatives. The space must manage that requirement”. (Højer et al., 2023)

An important aspect is striking a good balance between functionality and atmospheric architecture. Here spatial sequencing is highlighted as a vital point, giving an intimate atmosphere while structuring the building to give a good work-flow for the staff (Nissen et al., 2009) (Illu. 9). The challenge is to arrange small clusters of apartments to form manageable social spaces, while avoiding spreading staff members between several floors or long distances. This becomes increasingly challenging as the program increases. An example is to use the storage space and the cleaning functions throughout the building as separators of space. This makes the building feel smaller and more intimate to better emulate a feeling of home.

The people staying or visiting are going through an unimaginable mental pain - as well as physical pain. Therefore, a space for contemplating life and coming to terms with an imminent death must be made available. These special spaces must be incorporated focusing on meditation and spirituality, to help all involved parties stay in healthy mental spaces (Illu. 11). These should not have a specific religious tone - to avoid offending or discriminating - as people have vastly different beliefs (Nissen et al., 2009). These must be calming and dignified spaces, to frame the soothing feeling expressed by the staff.


Illu. 9 - Spatial Sequence


Illu. 10 - Homely Feeling


Illu. 11 - Room for Mindfulness

Palliative care

Palliative care is a multidisciplinary medical treatment form, which seeks to increase the quality of life for patients with terminal illnesses. It encompasses physical pain relief through opioids, psychological and spiritual relief, as well as bereavement help through counselling and various forms of therapy. This is achieved through multidisciplinary teams of doctors, nurses, psychologists, various therapists, social workers, and spiritual guides. These staff work together to maximise the quality of life for patients and helping their relatives coping with the idea of death and saying good-bye to a loved one (Holtslander, Peacock and Bally, 2019) (Nissen et al., 2009)(Illu. 12).

There is varying access to palliative care, with children's palliative care amongst the most overlooked groups of any globally. However, palliative care is meant for everyone; both patient and close relatives, who might spend time in the hospice, to help them live their lives to the fullest - regardless of age (Holtslander, Peacock and Bally, 2019).

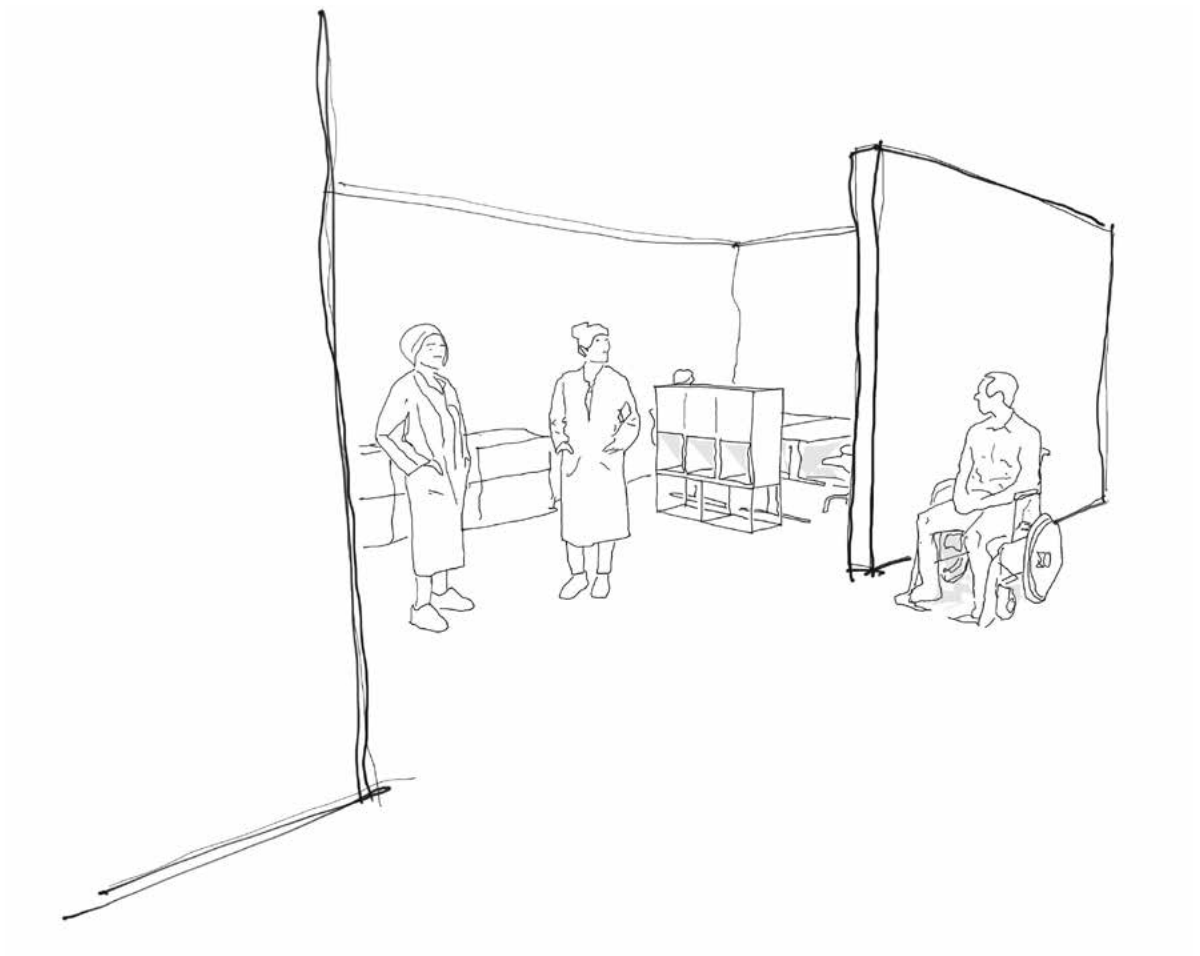
Staff

Hospices differ from hospitals in the tempo and time assigned to each patient; A key part is that each patient is feeling more prioritised because all nurses can spend more time and give more attention to each patient (Nissen et al., 2009). This is mirrored in the design, where nurses, doctors, therapists, and other personnel do not have closed of workrooms; The work rooms are visually open niches which highlights the open, approachable, and friendly atmosphere surrounding the personnel's relations to all patients and relatives (Illu. 13).

Illu. 12 - Time for Each Other

One of Denmark's most contemporary hospices is the Strandbakkehuset Children's hospice, built in extension of Djurs hospice. In an interview with the department leader of Strandbakkehuset - conducted by students from Aalborg University - Lisbeth Højer talks about the importance of making the staff appear as available to all families staying at the hospice. She highlights that they spend a great deal of time with all families - even dining together with all users of the building:

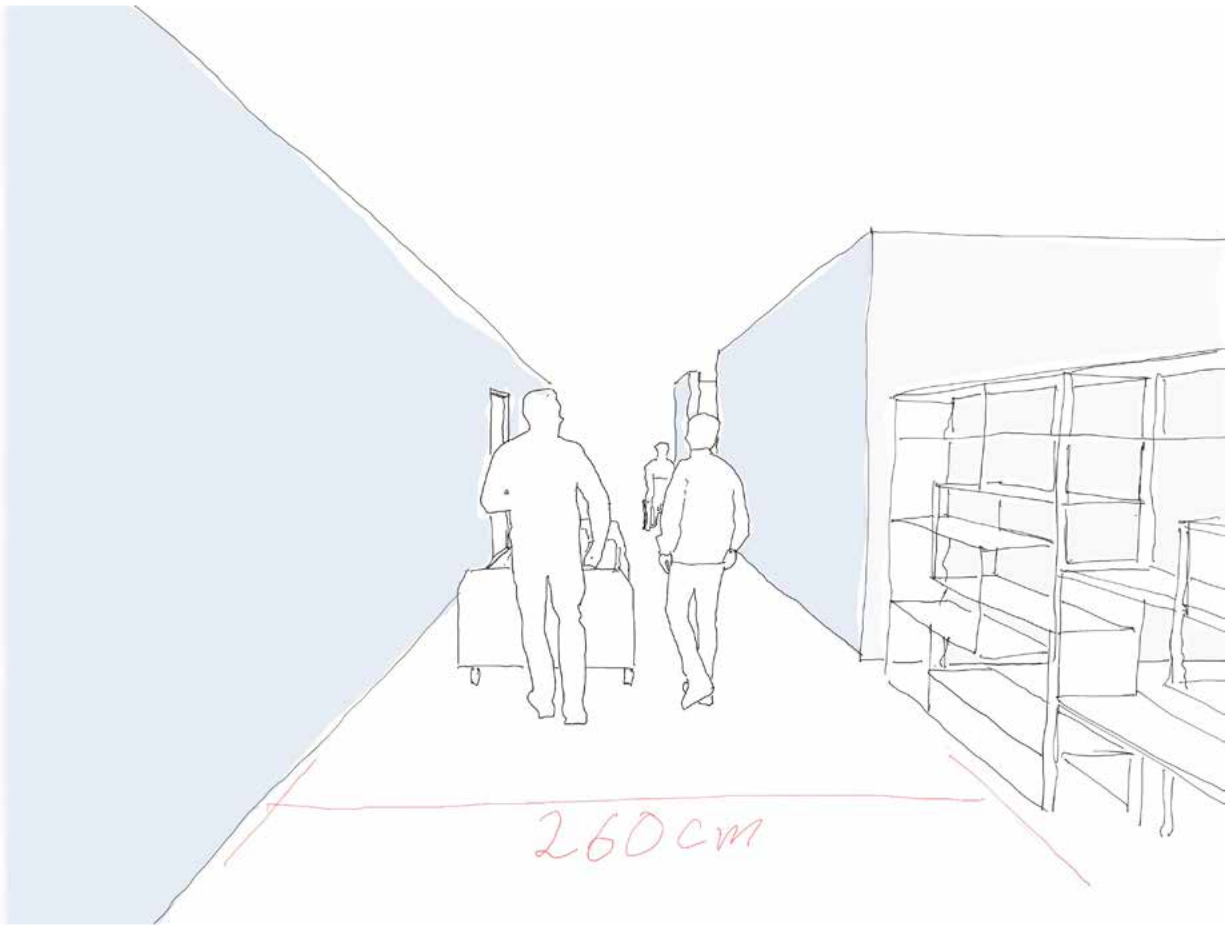
"The common room has one large, shared kitchen. We deliberately chose to not have any kitchenettes, to gather the families together in the shared common room. A special dynamic is established between the families, which is noticeable when only one family stays in the hospice. The lack of banter and shared play between family members. And obviously, a large part of the building's atmosphere is when people have each other. So, the kitchen must work even if several families are cooking and staying there at once. They are given their individual refrigerator and drawers for various victuals. Otherwise, the kitchen is arranged like a family house's kitchen, where they can have their belongings. The hot meal is made in the industrial kitchen next door in hospice Djuursland, then families cook the other meals themselves. That way we take the responsibility for one of the meals away from families. But originally, families were supposed to cook all meals themselves, but we noticed that they could not handle it. So, we have tried to help, by preparing one meal for them. And then everyone eats in the common room - even the staff".



Illu. 13 - Open Wardroom

"As staff we do not particularly have a private space. This tiny office is the closest we get to privacy when working. It was designed as a therapy room. However, early during COVID-19 we noticed a need for a place to talk with closed doors. You may have noticed we have an open office to front an open and welcoming face to give families a feeling of presence and proximity, and that we are approachable. But sometimes we need to close a door to talk professionally about confidential topics. This therapy room is used for those conversations, but this is not a break room to get away from patients. So, neither we nor Hospice Djuursland have a dedicated staffroom." (Højer et al., 2023).

This is echoed by the Real Dania guidelines, who also highlight of the staff-zone having a certain level of confidentiality, when discussing patient care and journals (Nissen et al., 2009). However, in the interview Højer talks about the difficulties of staying focussed while residents engage in spirited playing: Having a visual openness whilst ensuring an acoustic separation for the confidentiality and sensitivity of the work going on.



Illu. 14 - Space for Everyone

Facilities

Lifts are to be installed in bedrooms, with access to toilets, to relieve nurses of excessive physical labour. In addition, suction machines, and oxygen-masks must be installed to aid with the palliative care. However, to express a homely atmosphere these must be integrated in a discreet manner to avoid the institutional atmosphere from hospitals. (Nissen et al., 2009) One way to achieve this is to build the functions into the walls:

"Beds must be hospital beds to ensure we have a healthy work environment. We have lifts in the ceiling, oxygen, and suction facilities. It must be in every room, which you will notice when we show you a patient room. We have taken all measures to make the amenities as discrete as possible, where it is still convenient to fetch when needed. Otherwise, it is hidden out of sight." (Højer et al., 2023)

Safety

With the conditions facing certain residents of hospices rendering them immobile, the building must be categorised in usage class six according to the Danish building regulations (BR18). A usage class category six building entails occupants who may not be able to evacuate themselves and who are unfamiliar with the building's emergency exits. According to BR18 § 93 this requires the building to have automated fire detection systems, automated sprinklers, and smoke management systems, as well as key specifications of materials to allow others – typically staff members - to perform actions to evacuate these vulnerable occupants (The Danish Building Regulations (Bygningsreglementet), 2018).

Dimensions

As a part of barrier-free-living design goal, a great ambition with the project is to design the building in a way that does not result in an exclusion of any user, even if they are confined to a bed. Families check into the hospice to spend time together, and thus should be limited by any spatial constraint.

Given that the beds used in hospitals and hospices are longer and wider than most normal beds, door and hallways need to be sized adequate to accommodate to the needs.

Doors must be standard M9x21 sized doors for wheelchairs to comfortably pass through them, whereas doors for the hospital beds must be either standard size M12x21 or M13X21 for a bed to fit through (Neufert, 2019). A wider door width gives more tolerance for beds and wheelchairs to pass through making it easier and faster in an emergency. The larger door sizes are preferred for added ease of manoeuvring patients around the building - aiding the social aspects and inclusiveness of barrier-free-living. The hospital beds used in healthcare buildings have a width of 1 meter (Neufert, 2019). Therefore, corridors should have a minimum width of around 2,5 meters to allow traffic to flow around - regardless of whether it is a bed, a wheelchair, or a crowd (Neufert, 2019) (Illu. 14).

Barrier free design

Barrier free design is about recognising the limitation of mobility of some people and designing in a non-discriminatory way to help them feel included. The town of Prince-George in British Columbia, Canada, was investigated in a research paper to understand how traditional design has considered able-bodied people, but left the aging citizens with challenging circumstances (Blewett and Hanlon, 2016): Certain elderly citizens claim to refrain from being a part of society, due to inaccessible buildings and climate, having to rely on extensive aid from strangers or friends, leaving these disabled citizens embarrassed and, in some cases, isolated from the rest of society: Quoting Blewett and Hanlon (2016, p. 53):

"A major reason for recruiting participants to share their experience of disablement is to begin to understand more about how disablement impacts the emotional, psychological, social, and material conditions of persons living with impairment. What we learned from our participants is that able-ism impacts people in several ways, including the escalation of health issues, impediments to autonomy, limits on social participation, and a wide array of emotional dimensions that are often neglected in disability policy and research. We briefly outline some of these impacts here in order to complement our earlier discussion of habitual able-ism. Many participants explained that inaccessibility restricted their ability to be spontaneous and made planning a necessary, but unwelcome, daily routine."

Reflecting upon this article about barrier free design and linking it to hospice design; every user should be allowed to be an active part of the social setting, as it is a key issue in hospice design, where the primary user is often confined to either their bed or a wheelchair. Therefore, unique requirements must be set to the furniture and tectonics: This is to facilitate that no person in the hospice is excluded from any situation by establishing adequate these users into any setting - thereby enabling them to participate in any activity.

"Patient mobility varies a lot: some are in wheelchair or confined to bed. Others are perfectly mobile, so it varies a lot. Those confined to bed usually stay in their room, as they do not have the energy to go through the lift between the floors." (Højer et al., 2023)

Therefore, to avoid discriminating flows, transition zones should be designed to afford every user the same experience when moving through the building, ensuring that no user is excluded due to inaccessibility; This could be achieved by placing stairways and elevator in the same key zones - though ideally avoided (i.e., ideally keeping the building in one floor) to ensure the most equal experience throughout the building. The goal is to give every user a sense of dignity in what in what is the final stage of life for many of them.

Outdoor spaces

Linking to the theme of Barrier-Free-Design, the outdoor spaces must be designed in an inclusive manner, which allows people in wheelchairs or beds to freely move around in the park.

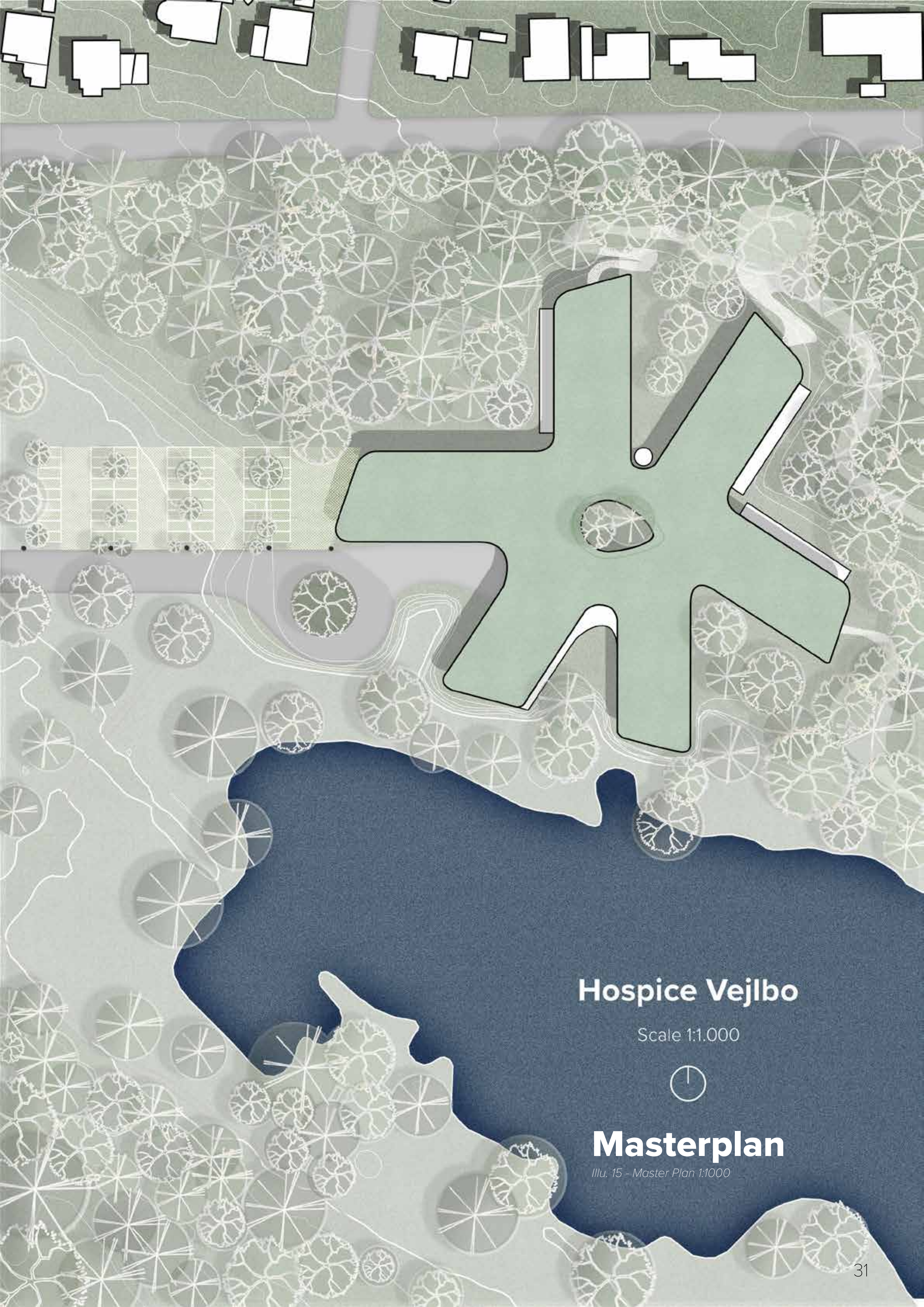
"*I would absolutely prefer to place a hospice surrounded by nature as opposed to an urban setting: "The guide for a good Hospice" describes where to place hospices, which has an impact to the overall experience. There are many different hospices in Denmark; some in cities, but most are in scenic nature dominated settings with views to lakes or other beautiful scenes because it really makes a difference."*

"I believe that peaceful surroundings and the option to calm down has an impact: It certainly makes a meaningful difference in this building (Strandbakkehuset), in the way it has been built and the inherent atmosphere we create here: It is a special calmness the families can truly feel. Some families have described coming from a hospital to here is like coming from a war-zone, which is not a flattering description for hospitals. But those are the conditions in an environment built on efficiency and runs at a completely different pace to here. A hospice is vastly different from a hospital; you can tell how much tension disappears from some families as the enter this place and notice how calm and lovely it is." (Højer et al., 2023)

Another important design aspect of the barrier free design is to make the building easily accessible: Allowing users to feel as autonomous and independent as possible, the building would have to have automated doors, level-free access, and drainage systems to e.g., help people in wheelchairs overcome challenging winter conditions (Blewett and Hanlon, 2016).

One observation made during an excursion to the site was that the paths in many areas became muddy and challenging to go through on rainy days. However, other parts of the paths were covered with fine gravel, which produced a sturdy dry surface, with a natural appearance. This surface treatment would have to be applied throughout the park - except for steep narrow passages at the adjacent 'Almind' lake, as these places would be inaccessible regardless of surface materials. Were those inaccessible paths to be made accessible, the changes would significantly change the character of the park by completely remodelling the terrain.

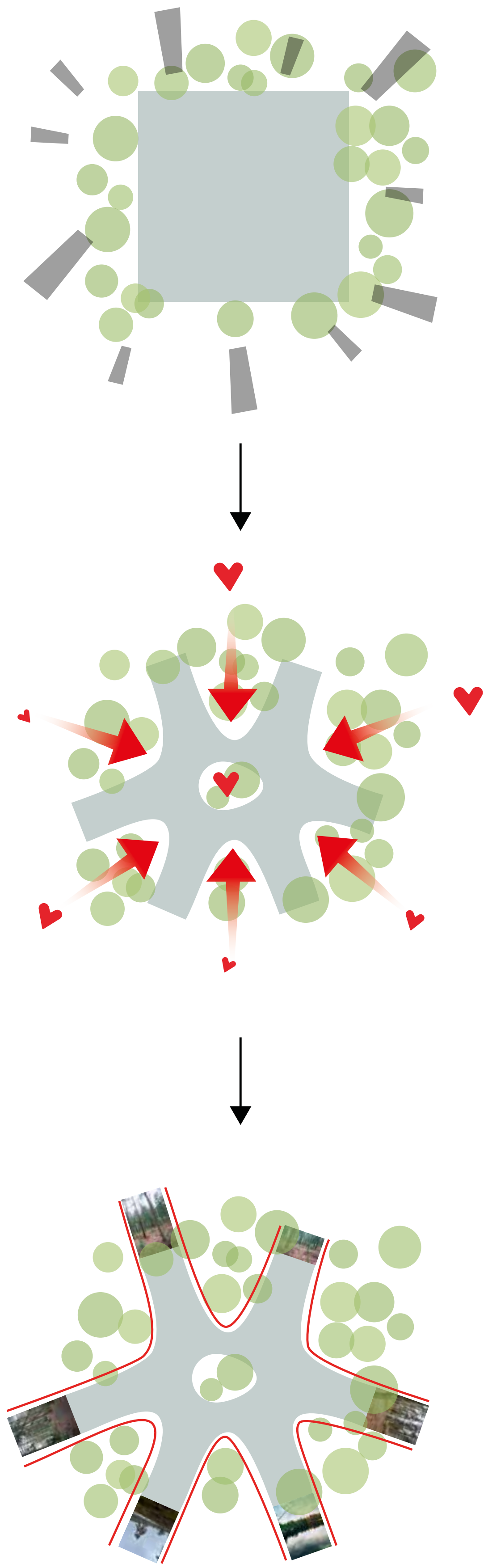
03 PRESENTATION



Masterplan

Illu. 15 - Master Plan 1:1000

Concept



Illu. 16 - Concept Diagram

Illu. 17 - Arrival at Hospice Vejlbo

When arriving at Hospice Vejlbo, one is met by a warm and welcoming environment. The entrance is designed to lead you inside the hospice through its through its dynamic flowing curves almost sucking the visitor in to the entrance. The road is paved to make it easy accessible for all users when left off by vehicle. Some of the trees on site is kept to make the building and the experience of the hospice blend in with its surroundings.

Illu. 18 - Reception

When entering the hospice, one is met by a reception. Here the welcoming staff will guide the resident and its relatives and sort all of the practical tasks of moving in to the hospice.

Illu. 19 - Residential Wing Corridor

As everything is sorted, the patient is taken to their room. The corridors containing the bedrooms are clad with wooden panels, to give the sense of warmth and give the sensation of being in a homely setting. The floor is made of smooth concrete to make access in wheelchairs and hospital beds easy. The corridor is wide enough to for two hospital beds.

Illu. 20 - Patient Bedroom

In the bedroom the flooring changes to wood. This generates a more intimate and personal space which associates to a home. The bedrooms fits a hospital bed and space enough to navigate a wheelchair from both sides of the hospital bed. Additionally, a extra bed can be placed for relatives if they want to stay together.

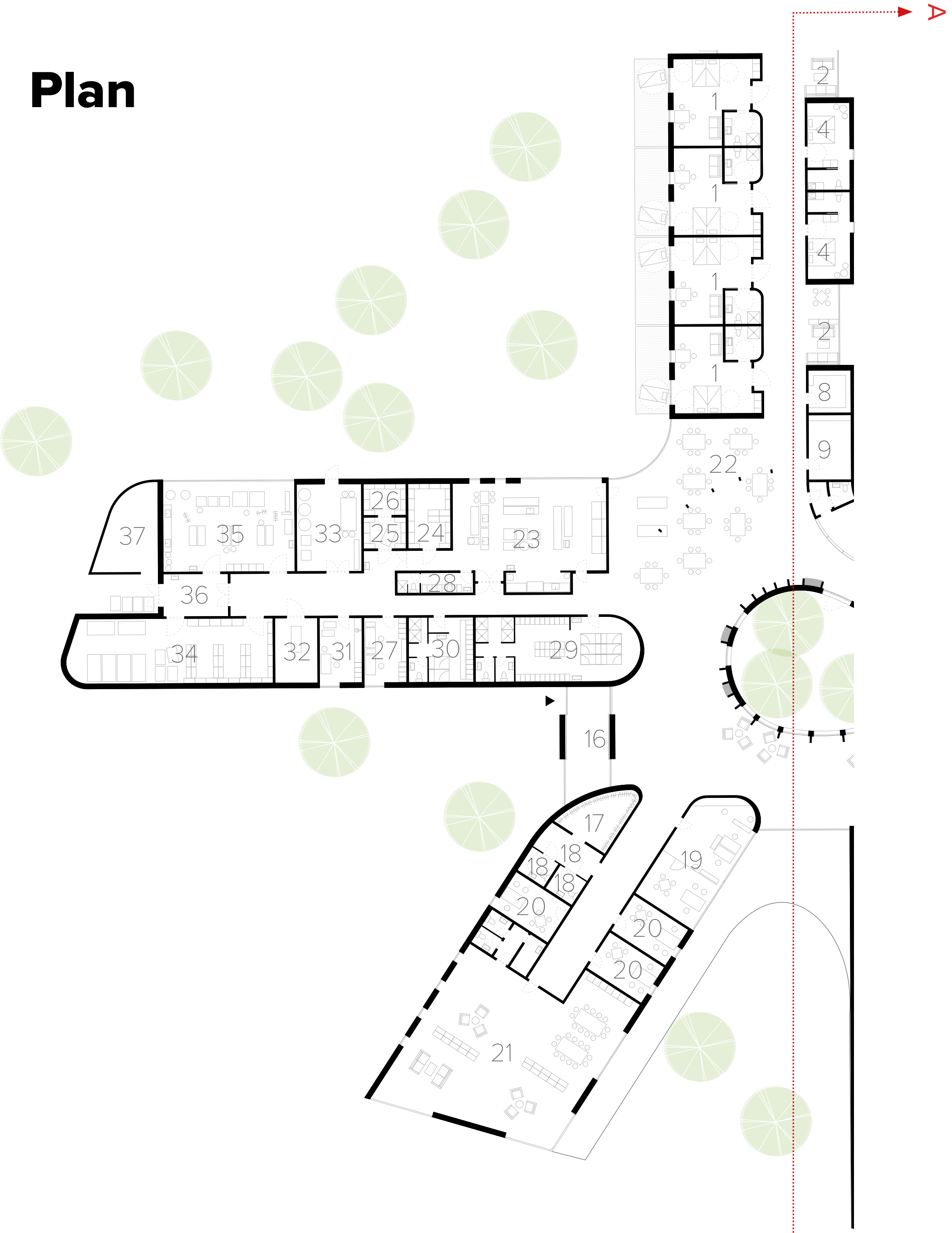
Illu. 21 - Patient Bedroom

The bedrooms have a small living room and individual bathrooms. Also, the equipment needed for palliative care for the individual patients can be stored within the bedrooms.

Illu. 22 - Niche

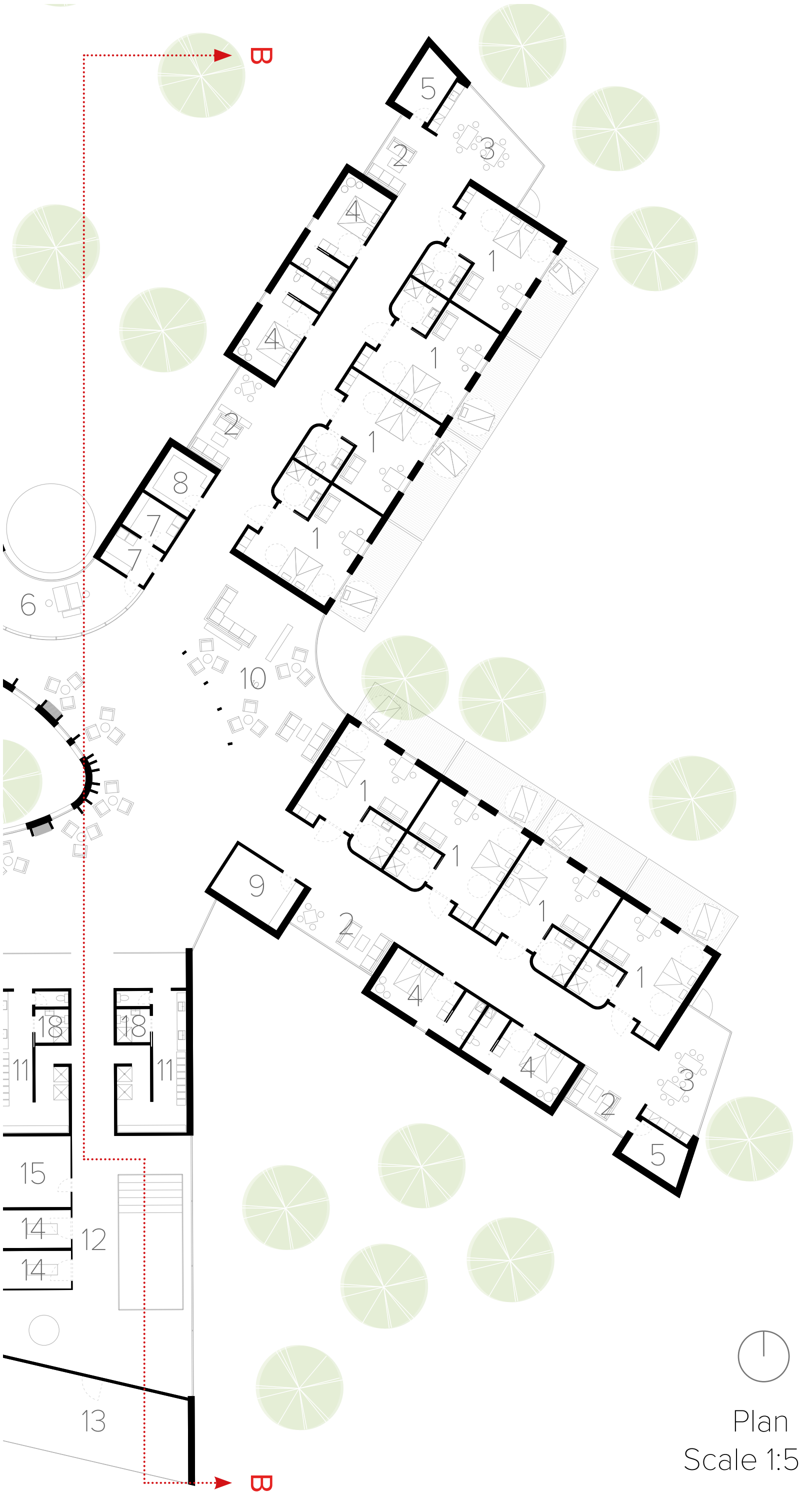
As the resident decides to leave the bedroom, one is met by small niches in the corridors. These niches are for informal meetings and social interaction, where one can enjoy the beautiful scenery of the forest.

Plan



Illu. 23 - Plan 1:500

1	Apartment................46m²	11	Public Changing Room......................43m²
2	Niche.........................15m²	12	Spa..153m²
3	Kitchenette.............29m²	13	Meditations Room................................69m²
4	Guest Room...........23m²	14	Revitalisations room...........................11m²
5	Storage....................10m²	15	Spa Technic Room...............................22m²
6	Ward Station.........49m²	16	Entrance...31m²
7	Medicine Room....17m²	17	Wardrobe...18m²
8	Linen Room............11m²	18	Public Toilets..24m²
9	Nearby Storage.....17m²	19	Administrations Office.......................53m²
10	Lounge Zone........101m²	20	Counselling / Conference Room...17m²



Plan
Scale 1:500

21	Staff Break Room......................192m²	31	Janitor's Office..............17m²
22	Canteen...140m²	32	Morgue...........................17m²
23	Kitchen...103m²	33	Technical Room...........36m²
24	Dry Storage...............................17m²	34	Peripheral Storage.....84m²
25	Cold Storage.............................8m²	35	Sluice and Laundry....77m²
26	Freezer..8m²	36	Goods Delivery...........17m²
27	Kitchen Office..........................17m²	37	Waste Disposal...........28m²
28	Kitchen Changing Room.......9m²		
29	Women's Changing room....66m²		
30	Men's Changing room..........27m²		


Illu. 24 - Integrated Bench

Illu. 25 - Hospice Vejlbo Courtyard Zen-Garden

The heart of the building is open and contains a plateau where residents, staff and relatives can enjoy some fresh air. By looking up they can enjoy the trees catching the wind and the looks of the sky and birds. Some green area in the “heart” has been kept to keep the serenity of the forest and give space for a more exposed meditations place.

Illu. 26 - Kitchen and Dining Area

Around the centre of the building a kitchen and dining area is installed. Here patients can enjoy a meal prepared by the kitchen staff. This enhances a sense of a good life, as patients would not have to worry about buying and preparing several meals a day. The kitchen is placed with a view towards the forest and the core.

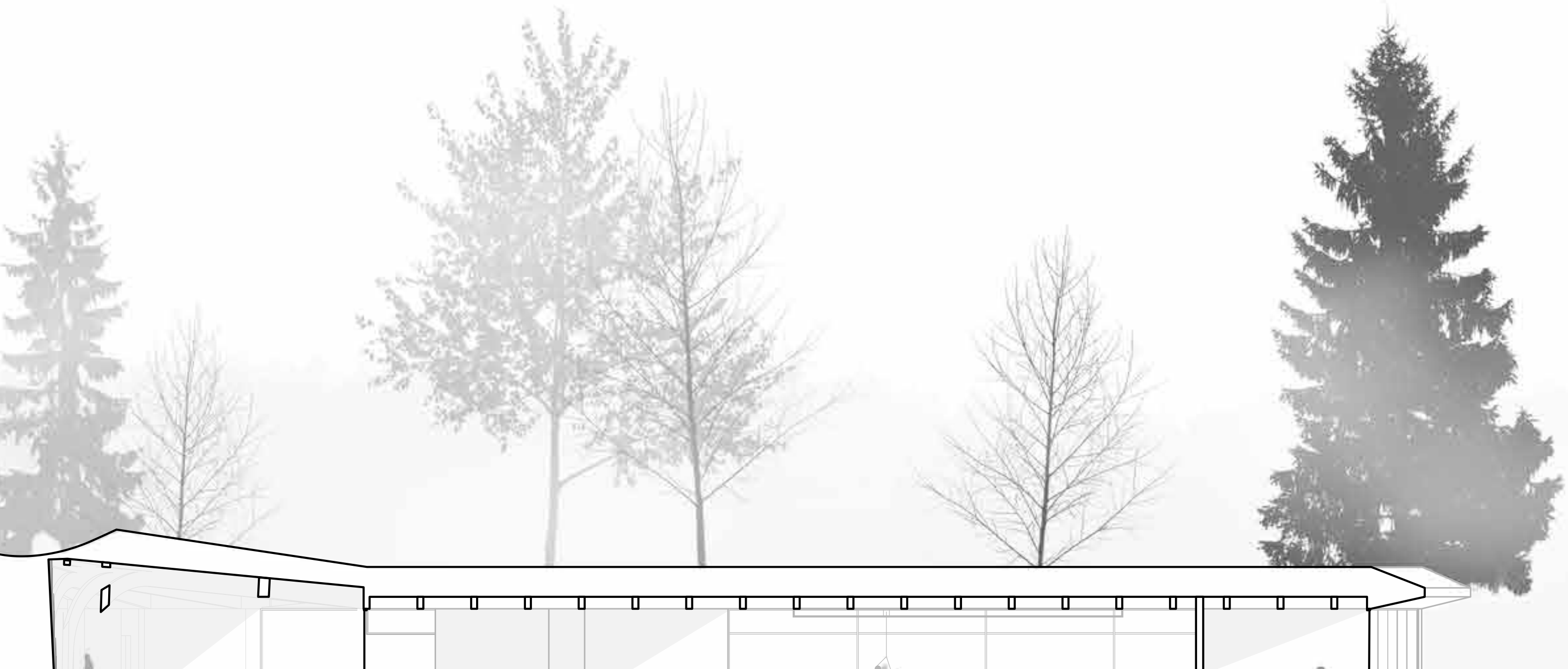
Section AA 1:250

The heart of the building is a gathering place for residents and relatives. Its a place to enjoy yourself or other's company or a place to see what is happening inside the hospice. The heart is an egg-shaped outdoor space, which revolves around trees on the site. The shape clad with wooden slats, which creates the shape of a bench. By this the people inside the hospice can interact with the core.

Illu. 27 - Section AA 1:250

Section BB 1:250

Illu. 28 - Section BB 1:250



Illu. 29 - Private Terrace

Outside the bedroom each patient have their own terrace. For patients with low mobility or in pain, it can become depressing not being able to go outside. The terraces are big enough for the hospital bed to be rolled outside for every patient to have the opportunity to be outside in the fresh air.

Illu. 30 - Private Terrace

The terraces are partially divided with semi transparent lamellas. As some patients might relate to each other, the terraces have not been separated completely as social relationships might grow with the neighbour.

Illu. 31 - Hospice Vejlbo from the Other Side of the Lake

The hospice can be seen from the other side of the lake, where patients and relatives can enjoy a walk at the existing paths in the forest. This way they can enjoy the local outdoor life close to the facility.

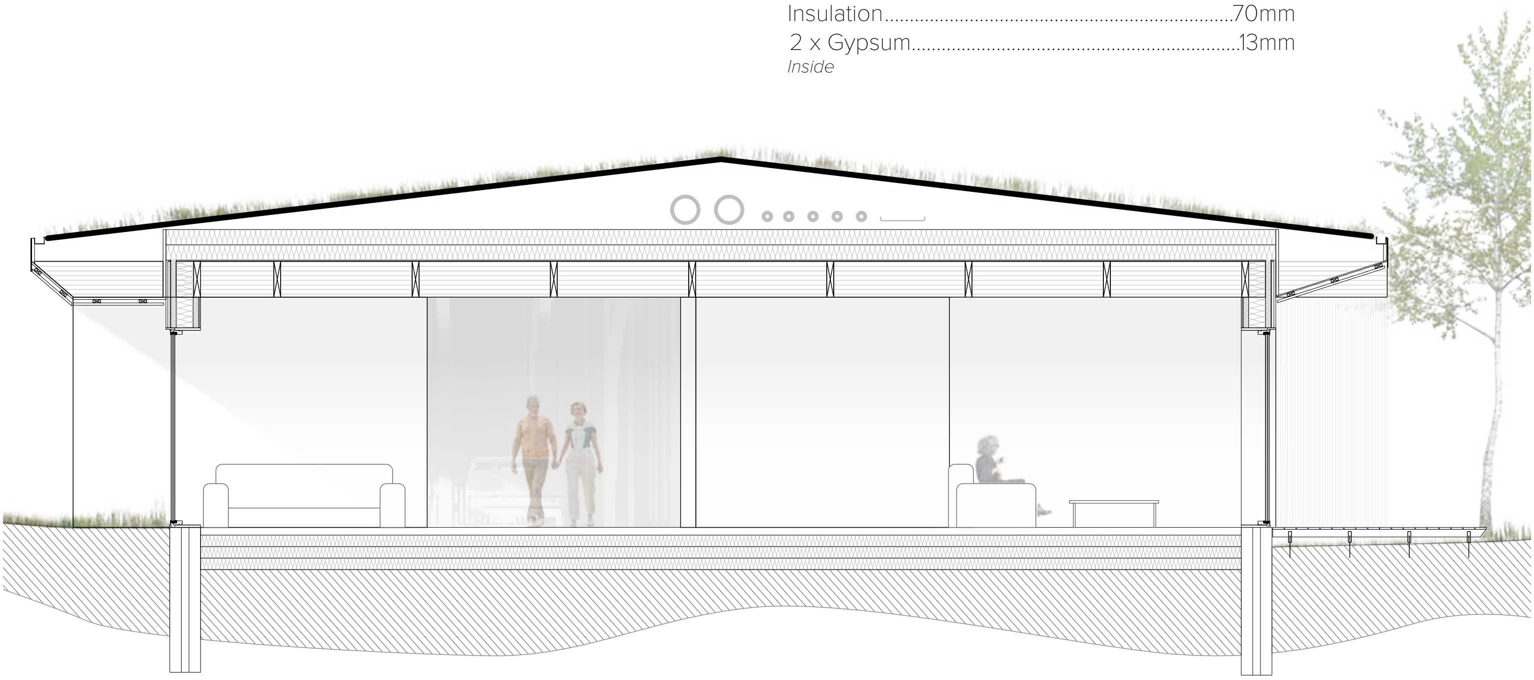
Illu. 32 - Common Terrace

Close towards the middle of the building is one of the shared outdoor terraces. Here patients, staff and relatives can enjoy each other socially in nature. The building shape creates an overhang to shelter from sun or bad weather.

Detail

Roof Construction:
Outside
2 x Pressure resistant insulation....................200mm
Plywood...15mm
Wooden slats..30x50mm
Wooden Beams GL32h..............................467x90mm
Inside

Wall Construction:
Outside
1 x Wooden slats..25mm
Ventilated air gap...30mm
Wind barrier...9mm
Insulation..70mm
Insulation 220mm
Vapor barrier
Insulation..70mm
2 x Gypsum..13mm
Inside



Floor Construction:
Concrete layer..100mm
3 x polystyrene.. 150mm
Leveled sand layer

Illu. 33 - Detail 1:100

Illu. 34 - Spa Facility

The spa facility is for patients who are in a state of pain: The water therapy is a part of the palliative effort. For people with limited mobility, a crane has been installed in the waffle construction. This allows everyone to participate in these facilities. While in the water one can enjoy the look of adventurous forest.

Illu. 35 - Lounge Zone

The hospice offers a variety of zones where the residents can immerse themselves. One of the areas is this lounge area, which offers comfortable furniture, views towards the forest and literature.

Illu. 36 - Kitchenette Zone

In close proximity to the bedrooms small kitchenettes are installed for patients and relatives to cook together, as some patients might want an drop of tea with their relatives with views towards the forest. These zones are part of the small niches scattered throughout the hospice.

Illu. 37 - Meditation Room

When people want to immerse themselves in a more vulnerable space, the hospice has a meditation room. Here the patients and the relatives can sit and practice their spiritual or religious side of life. The meditation room is placed with view towards the lake so that the people using it can calm themselves in the motion and colours of nature.

Elevations

Illu. 38 - North Elevation 1:500

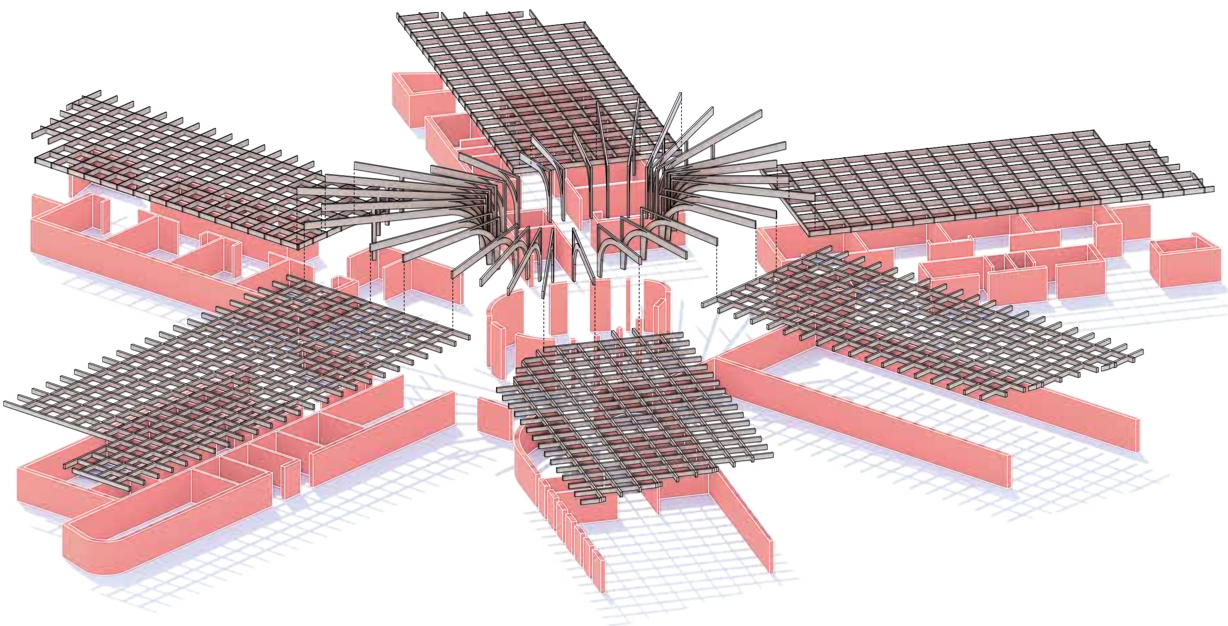
Illu. 39 - South Elevation 1:500

Illu. 40 - East Elevation 1:500

Illu. 41 - West Elevation 1:500

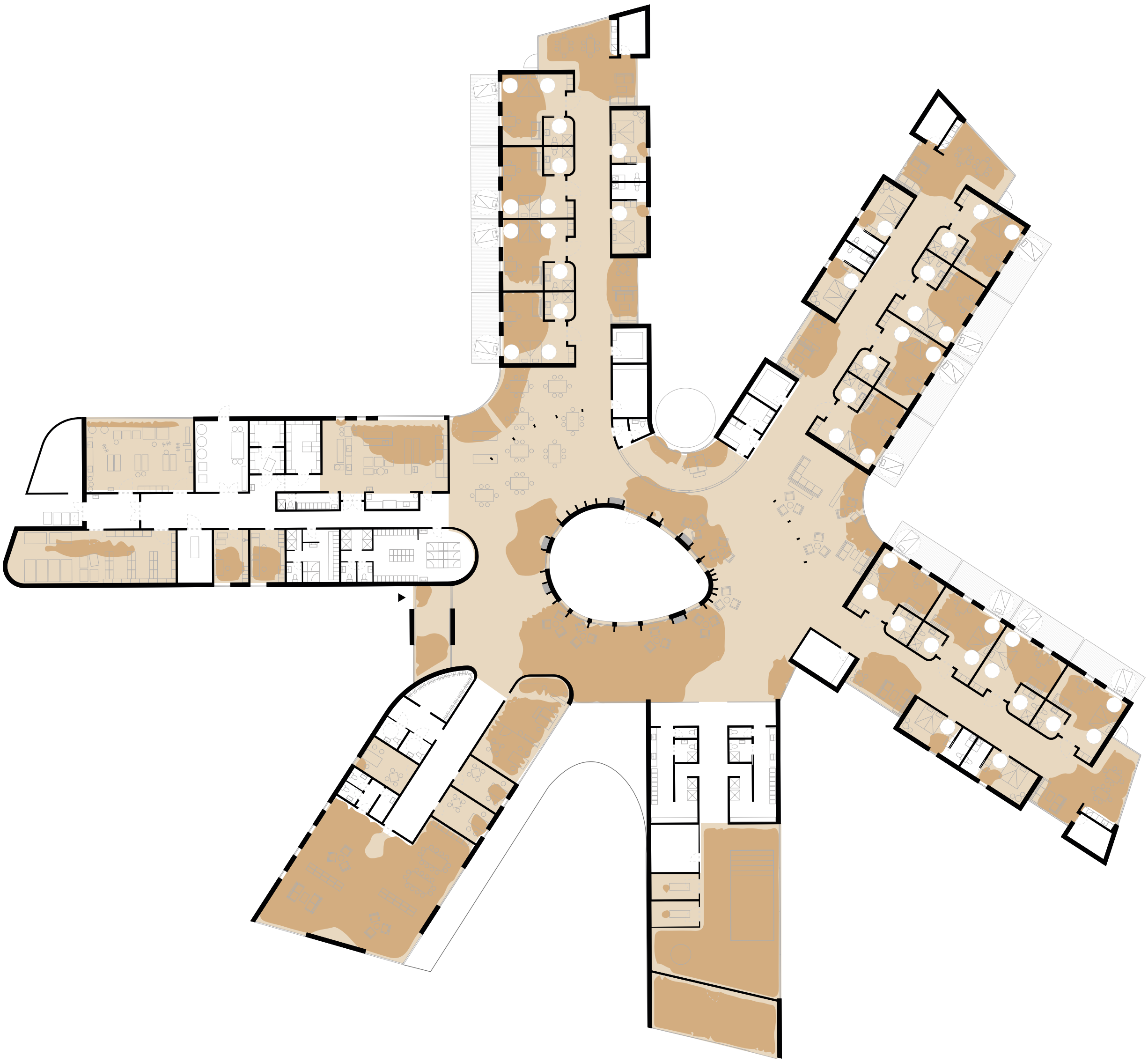
Structural System

The structural system consists of a grid which dictates the plan. The grid transfers its loads to the ground through columns placed in the walls. The walls are a part of creating stability, as they create a “disc” effect. In the centre of the building the structure consists of a combined column and beam structure. The core in the middle creates the stability through its round shape. The structural system supports the narrative of private and shared areas through its variety. The beams in the core area transfers its loads to the meeting with the grid. Additionally some of the beams have a column placed in the middle due to the large span. This column is also a part of creating zones in the core area, both for the dining area close to the kitchen and the lounge area.



Illu. 42 - Structural System

Visual Comfort



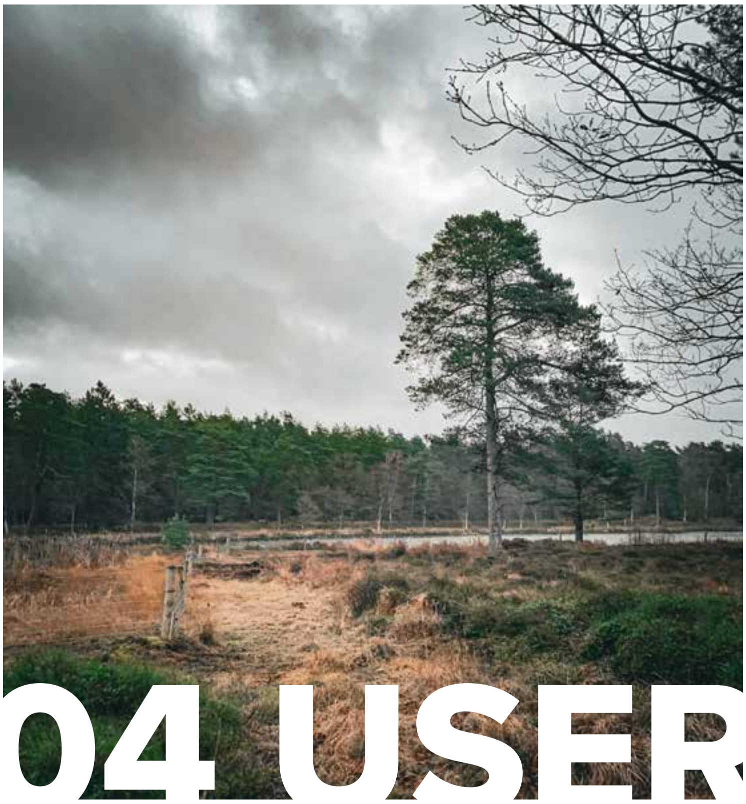
sDA 49,2%

300 lux for at least 50% of occupied hours

Less than 300 lux for at least 50% of occupied hours

Illu. 43 - Daylight

Throughout the design of the building, various daylight simulations where run to ensure the visual comfort in the building complied with the rules of BR18. Simulations were run without trees on the site which fulfilled the requirements. After placing the trees on the site and running the simulation again the sDA was lowered. Therefore skylights where placed in the bedrooms to ensure more daylight. (APPENDIX 5)



04 USER

User Group

"People in the Hospice"

The main function of a hospice is to increase the quality of life for terminally ill people and their relatives, through palliative care and counselling. (Nissen et al., 2009)

The primary user group is the people living in the hospice, i.e., the terminally ill patients with need for palliation and their closest relatives. The user group consist of people from the age of 18+, with a life-threatening disease meaning, that they essentially have received a death sentence. The primary user can be divided into two categories. The first are couples, where the ill patient lives with a partner, and the second is for 'single' patients; These include adults living alone and adolescents, who don't require extensive parental accompanying. (Anbefalinger for den palliative indsats, 2017b)

In 2021, 8261 people received palliative care. These people had an average age of 71, and most of them lived with a spouse and had children (Hansen, Adsersen and Grønvold, 2021). Therefore, it also important to consider the relatives, as they play an important role in the life of the patient. This is from a social, psychological, and physical point of view. That means establishing guest facilities for family members or friends to stay overnight, without having to stay in the patient's living quarters.

The secondary users are the staff who tend to the patients and their relatives. These are nurses, doctors, therapists, kitchen staff, cleaning personnel, and maintenance workers.

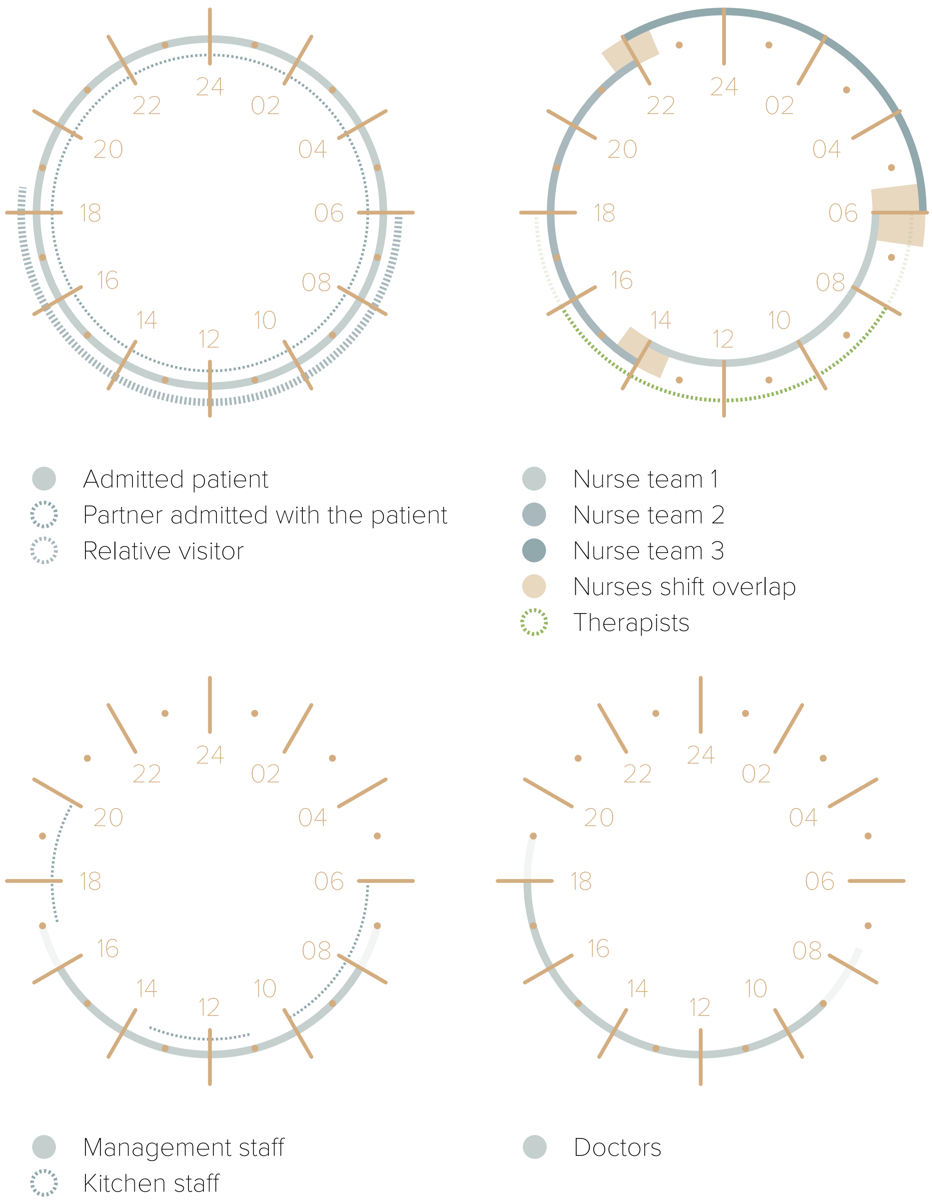
Individual ill people.
People with few relatives, who have lost their partner. These people can have different relationships and relative situations but live alone. As a result, the number of visitors they get varies a lot.

Couples with an ill partner.
Families where the partner is terminally ill. The couple may have children living at home or children who have moved away, depending on the couple's age. The spouse will join the patient during the end-of-life journey, and the kids might stay or visit regularly.

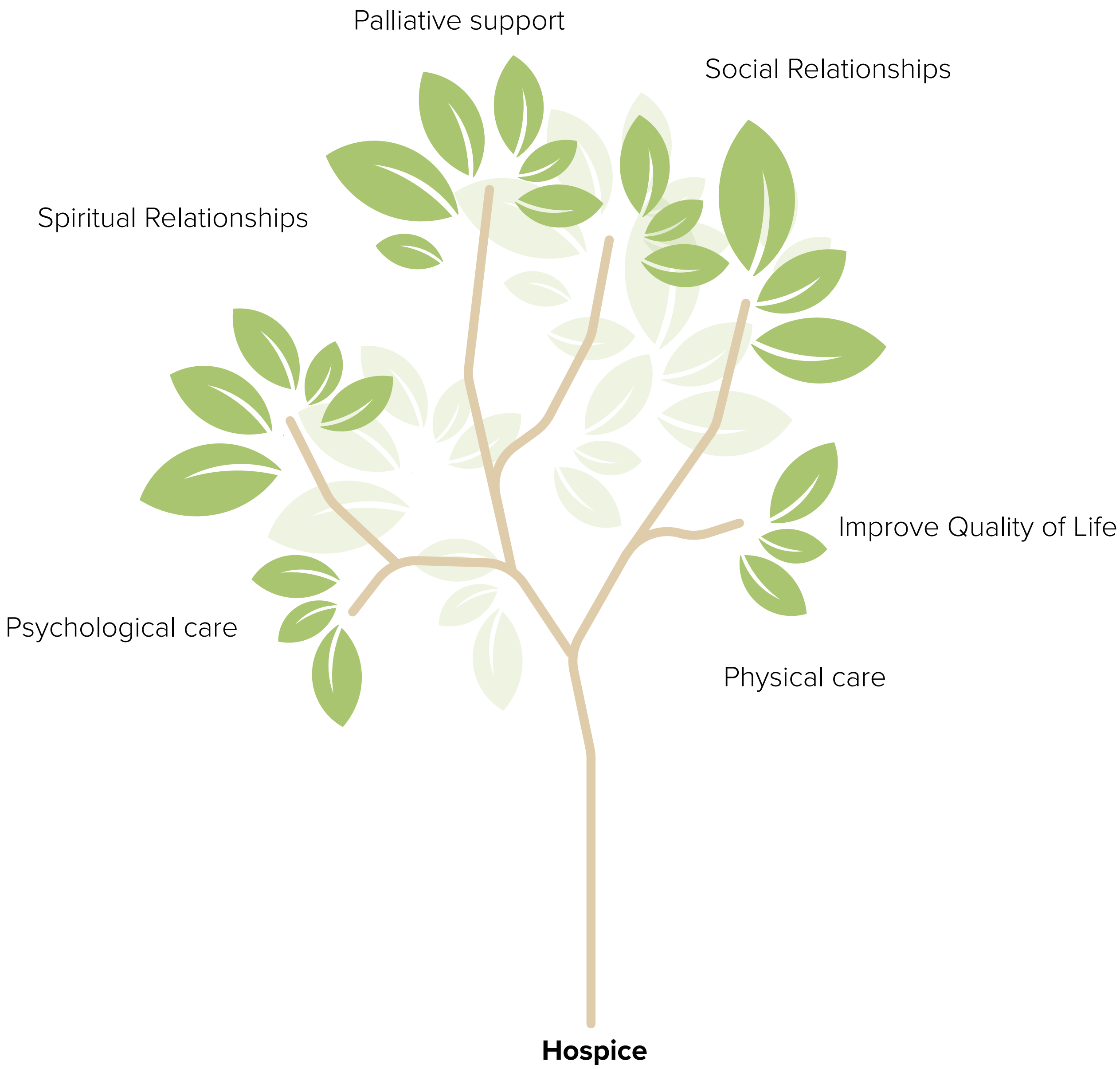
Staff.
These are nurses, doctors, therapists, psychologist, and the administrative board, kitchen and service staff, as well as spiritual guides. These are a part of giving the palliative care and prepare the patient and next of kin for the inevitable.

Illu. 44 - Scenarios

The most crucial factor is to ease the pain of the patients - this will be achieved through sharing knowledge and pooling the staff resources in an efficient way (Nissen et al., 2009; p.7). Giving the staff and personnel good working conditions and facilities will allow the patients' relatives to relax and focus on coming to terms with the hardship and loss they are facing.



Illu. 45 - Occupation Schedule



Illu. 46 - User needs from a Hospice

Story Boards

To articulate a stronger understanding of the different users and give empathy to their situations, some storyboards have been lined up to address various parts of the users' daily routine in their current state of the art Hospice environment. The storyboards will be based on our understanding of the users through analysis and interviews. The AI software "Adobe Firefly" was used to produce the pictures using a specific text prompt (APPENDIX 1).

The Nurse

1. Starting in a morning briefing, the nurse gets up to date on the condition of the patients in her care.

2. She then walks around attending the various patients...

3. ...giving medications or opioids at the assigned times for each patient.

4. By spending so much time amongst her patients...

5. ...she is practically becoming a part of their family.

6. She spends time chatting and hanging out with them...

7. ...making sure they are as comfortable as can be...

8. After a long day of dealing with patients in dire conditions...

9. ...she spends some time reflecting on life and work...

10. meditating to ensure her mental health stays good.

11. Then she finishes her day writing medical reports and records for the patient care

Illu. 47 - Story Board of the Work Life of a Nurse

The Couple

1. The couple start their day with breakfast and tea...

2. ...when the husband suddenly feels ill.

3. After a walk in the park surrounding the hospice...

4. ..The husband goes for a check-up with a doctor while his wife seeks counselling.

5. They meet up again and go to the meditation area to reflect on life.

6. In the evening, they spend time socialising with the other people in the hospice.

Illu. 48 - Story Board of a Day as a Couple at the Hospice

The Psychiatrist

1. The psychiatrist spends time counselling people and giving them tools to deal with the traumatising events they're facing

2. She makes and effort to be available in the common area for talks on difficult issues

3. She also does therapy sessions for individuals or whole families, to help them deal with their loss.

Illu. 49 - Story Board of a Work Day for a Psychiatrist at the Hospice

The Doctor

1. The Doctor’s daily routine starts like the nurses

2. First thing on the agenda is a morning briefing.

3. Noise from the hallway disturbs the meeting in the open office.

4. Following the meeting he goes to see the patients...

5. ...giving them health checks...

6. ... discusses dosages and their prescriptions.

7. Giving them test results...

8. ... and making sure they’re alright.

9. This is how most the day is spent.

10. When all patients have been attended...

11. ...he calls the pharmacists to resupply the various dosages.

12. His day ends with paperwork and patient documentation.

Illu. 50 - Story Board of a Work Day for a Doctor at the Hospice

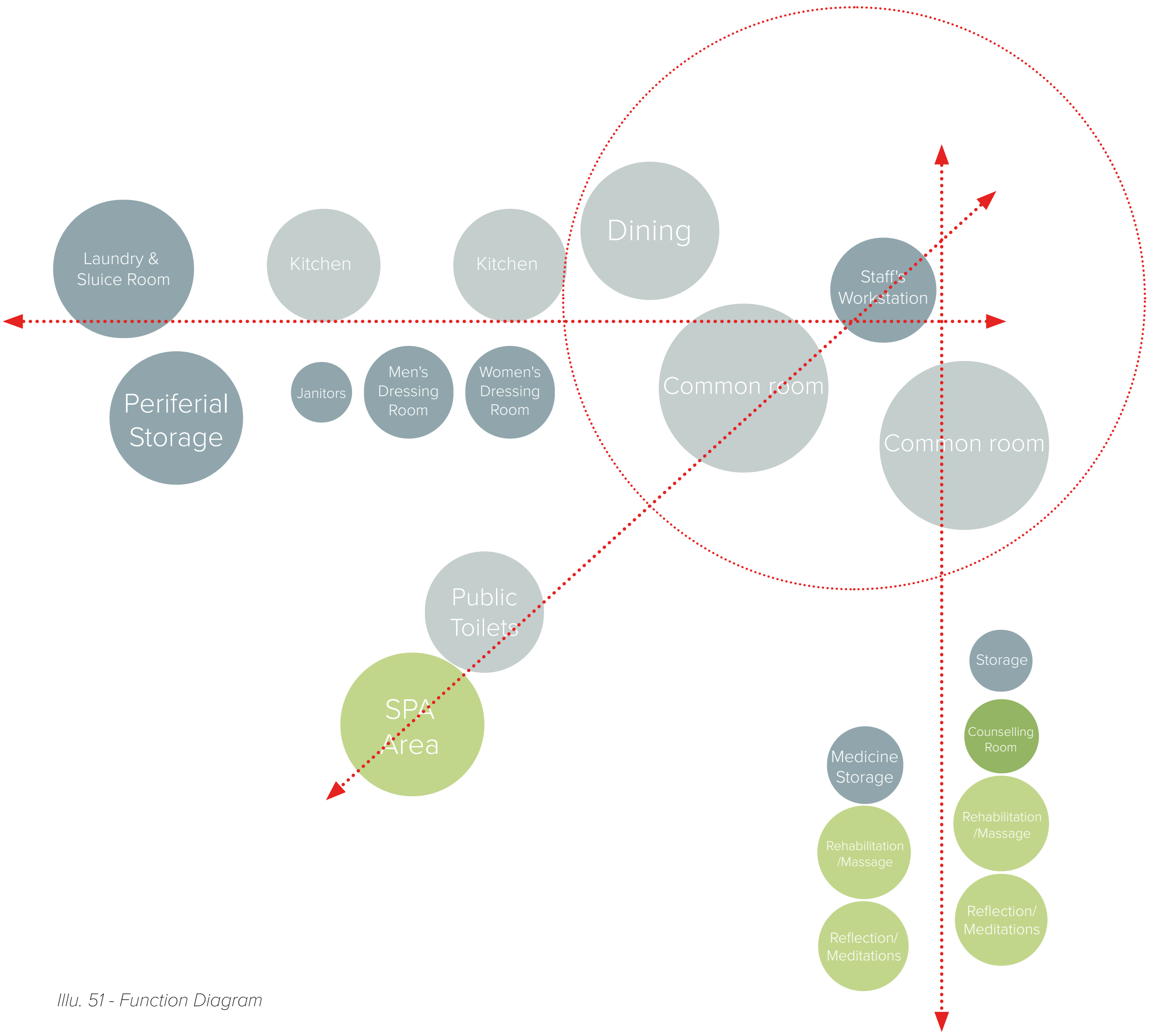
Room Program

	Function	Unit Size (m²)	Amount	Total	Room Describtion
1	**Apartment**	50m²	12	**600m²**	
1.1	Bedroom	20m²			
1.2	Living room	20m²			
1.3	Bathroom	10m²			
2	**Common Area**		1	**790m²**	
2.1	Library	50m²	1		Area for immersion or leisure in litterature
2.2	Gathering room	70m²	3		Smaller living rooms or lounge extension of dining area
2.3	Dining room	80m²	1		Area for eating and socialising
2.4	Kitchen	150m²	1		Industrial kitchen for meal preperations
2.5	Next of kin room	20m²	8		Sleeping area for relatives visiting
2.6	Niches	48m²			Informal breaks/engage in conversation or retreating
2.7	Bathing facilities	80m²	1		SPA area & showers for spiritual and physical healing
2.8	Laying room	12m²	1		For patients feeling unwell
3	**Staff Functions**			**684m²**	
3.1	Consultation room	15m²	3		Room for private converstaions regarding the patients health
3.2	Common staff area	34m²	2		Area for the staff with equipment and documentation
3.3	Reflection room	20m²	2		Room to sit and meditate on mindfulness or spirituality
3.4	Conversation room	15m²	2		Small conference rooms
3.5	Staff/Guest bathrooms	7m²	6		
3.6	Medicine room	3m²	15		Medicine storage
3.7	Rehabilitation	15m²	2		Massage room for revitalising patients
3.8	Laundry room	8m²	3		
3.9	Linnen room	15m²	3		
3.10	Sluice room	15m²	3		Disinfection and disposal of human waste products
3.11	Perifial storage	70m²	2		Storage/washing of beds and heavy duty service of equipment
3.12	Storage	15m²	4		Storage of wheelchairs, lifts, oxygenmasks and other machinery
3.13	Janitors room	10m²	1		Office for tools and utilities
3.14	Womans changing room	40m²	1		
3.15	Mans changing room	20m²	1		
	Total			**2074m²**	
	Gross Area Estimate			**3318m²**	

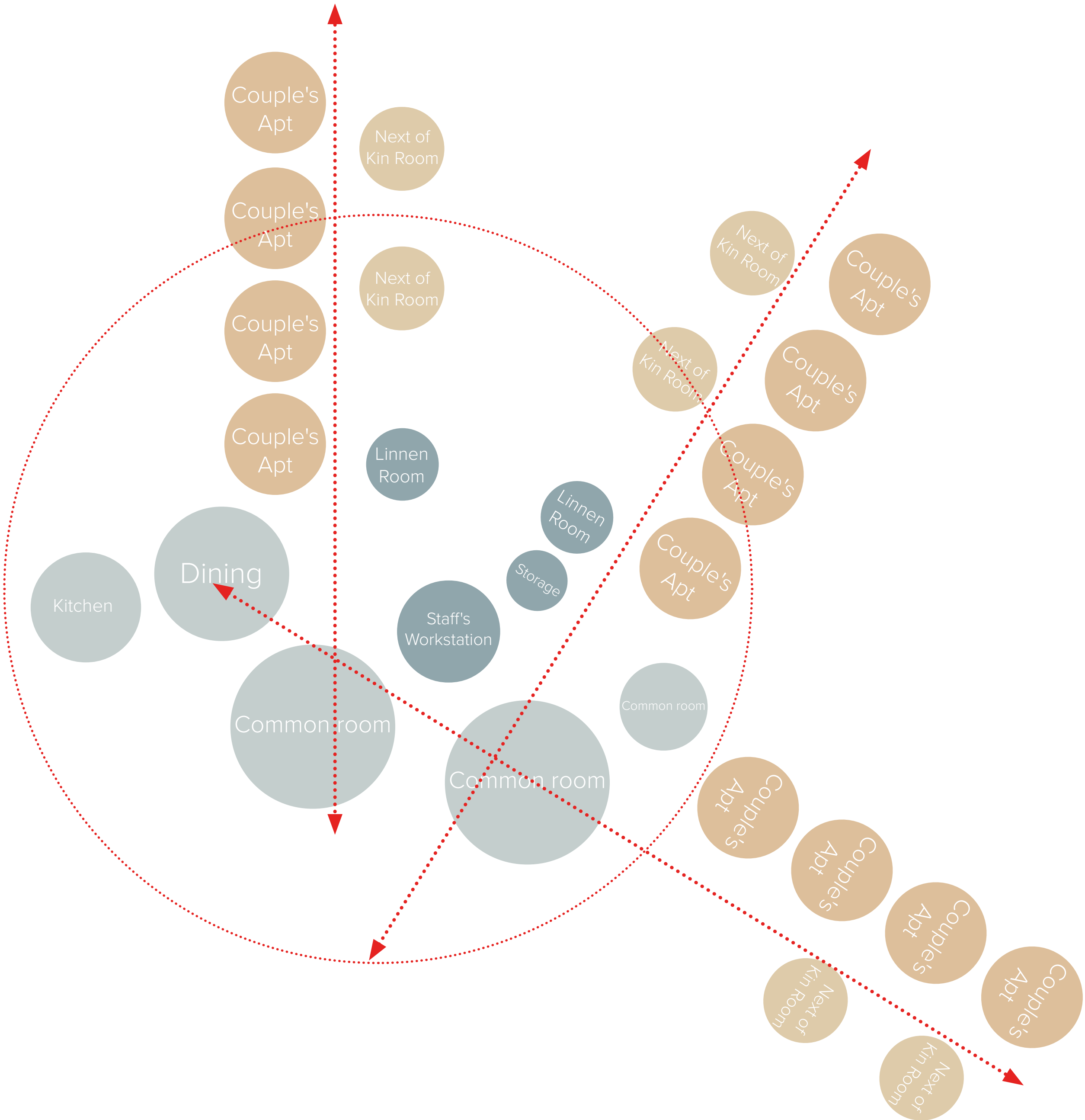
Table. 3 - Room Program

Period of Use	Lighting Source	LUX	Reverbaration (s)	Ventilation Strategy	Activity Level (MET
All day	Natural & Artificial	300	≤0,6	Hybrid	1,2
All day	Natural & Artificial	300	≤0,6	Hybrid	1,2
All day	Artificial	200	≤0,6	Mechanical	1,2
7-22	Natural & Artificial	300	≤0,9	Hybrid	1,2
7-22	Natural & Artificial	300	≤0,9	Hybrid	1,2
7-10, 11-13, 17-19	Natural & Artificial	300	≤0,9	Hybrid	1,2
7-10, 11-13, 17-19	Natural & Artificial	300	≤0,6	Hybrid	2,5
6-9, 10-12, 16-19	Natural & Artificial	300	≤0,6	Hybrid	1,2
All day	Natural & Artificial	300	≤0,9	Hybrid	1,2
9-18	Natural & Artificial	300	≤0,9	Mechanical	1,2
During day time (10-19)	Natural & Artificial	200	≤0,6	Hybrid	1,2
During day time (10-19)	Natural & Artificial	300	≤0,6	Hybrid	1,2
All day	Natural & Artificial	500	≤0,6	Hybrid	1,2
All day	Natural	300	≤0,6	Hybrid	1,2
During day time (10-19)	Natural & Artificial	300	≤0,6	Hybrid	1,2
All day	Natural & Artificial	200	≤0,6	Hybrid	1,2
All day	Artificial	200	≤0,6	Hybrid	1,6
During day time (10-19)	Natural & Artificial	300	≤0,6	Hybrid	1,2
Service hours (8-16)	Artificial	300	≤0,6	Mechanical	1,6
Service hours (8-16)	Artificial	200	≤0,6	Hybrid	1,6
Service hours (8-16)	Natural & Artificial	300	≤0,6	Mechanical	1,6
Service hours (8-16)	Natural & Artificial	200	≤0,6	Hybrid	1,6
All day	Artificial	200	≤0,6	Hybrid	1,6
Service hours (8-16)	Natural & Artificial	300	≤0,6	Hybrid	1,2
During shifts	Natural & Artificial	300	≤0,6	Hybrid	1,2
During shifts	Natural & Artificial	300	≤0,6	Hybrid	1,2

Function Diagram



Illu. 51 - Function Diagram


Couple's Apt
Next of Kin Room
Couple's Apt
Next of Kin Room
Couple's Apt
Couple's Apt
Linnen Room
Next of Kin Room
Couple's Apt
Next of Kin Room
Couple's Apt
Couple's Apt
Couple's Apt
Linnen Room
Storage
Kitchen
Dining
Staff's Workstation
Common room
Common room
Common room
Couple's Apt
Couple's Apt
Couple's Apt
Couple's Apt
Next of Kin Room
Next of Kin Room

05 SITE

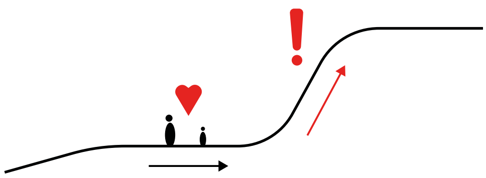
Choosing The Site

After establishing a good understanding of the user group and their needs, the process of finding a good site commenced. The users where carefully considered when choosing the site including the wish for an area with green and blue structures to support healing architecture and biophilic design.

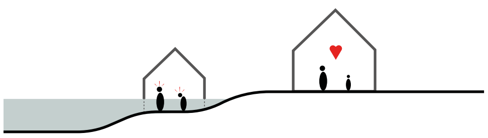
Considering heavy rain was also important when locating a building close to water. The site should also be easy to access for people traveling by public transport, so visitors without a car could come visit. As the users could easily be bound to a wheelchair, it was also found important that the site was relatively flat. Other factors also came into play when choosing the site. These include the geographic location relative to major cities in Denmark and the proximity, to similar facilities.

The choice of Silkeborg was based on analysing at the location of other hospices in Denmark. As shown on illustration 53, a void was around the central region of Jutland, highlighting that Herning and Silkeborg did not have a dedicated local hospice. The decision to design in Silkeborg was based on its famously dramatic landscape and their self-proclaimed title of 'Denmark's Outdoors-Capital', which ties the town's identity neatly to the intention of extensively incorporating biophilic design into the hospice proposal.

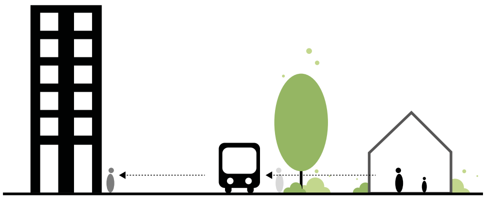
1. The site should be surrounded by trees and water.



2. The site should be relatively flat.



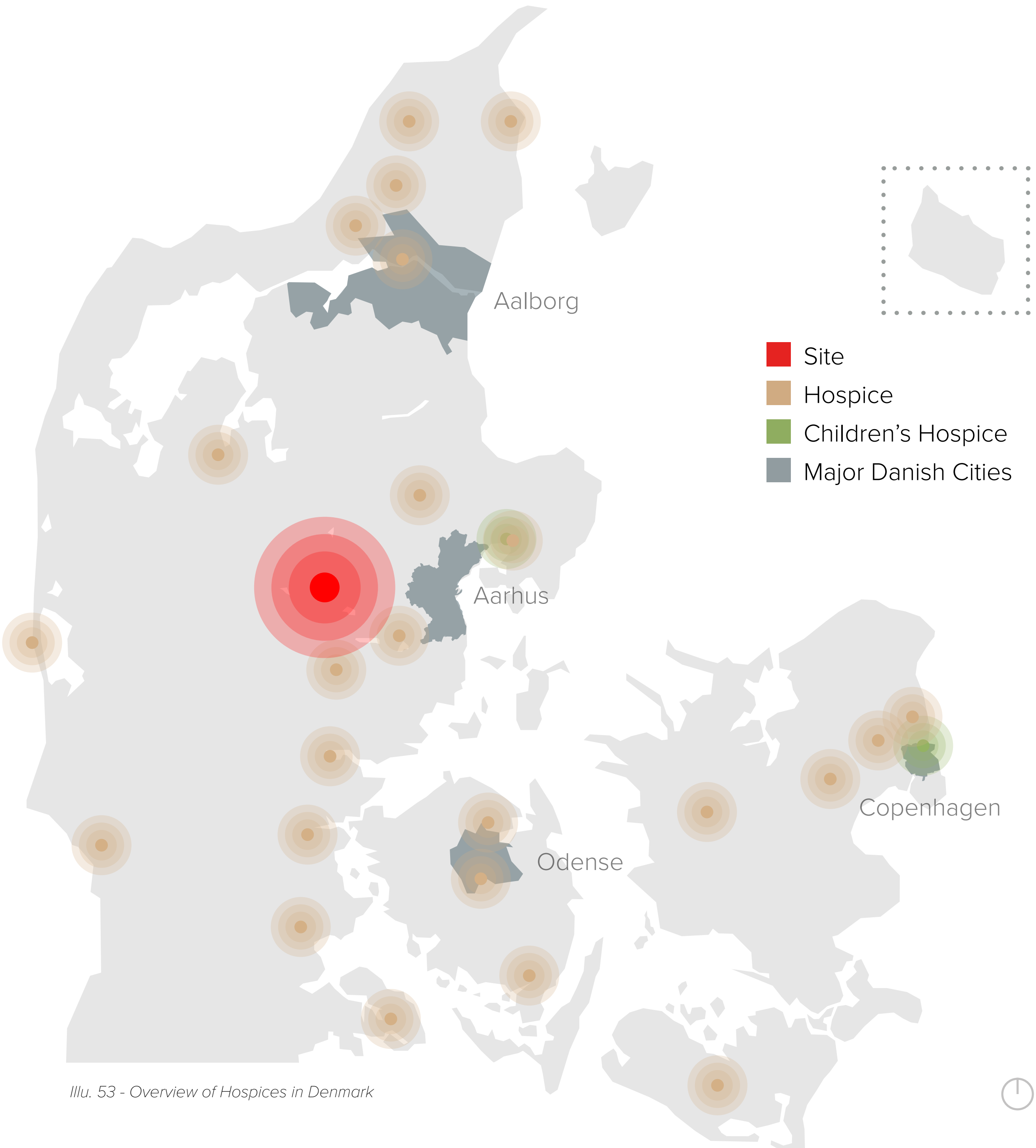
3. The site should be protected from flooding.



4. The site should be close to public transport and a city.

Illu. 52 - Site Criteria

Proximity to Hospices



Illu. 53 - Overview of Hospices in Denmark

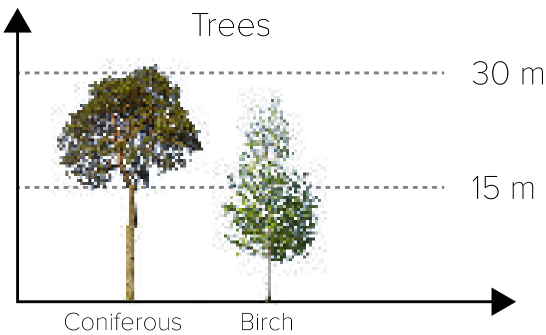
Location

Illu. 54 - Location, Silkeborg 1:20.000

Trees and Vegetation

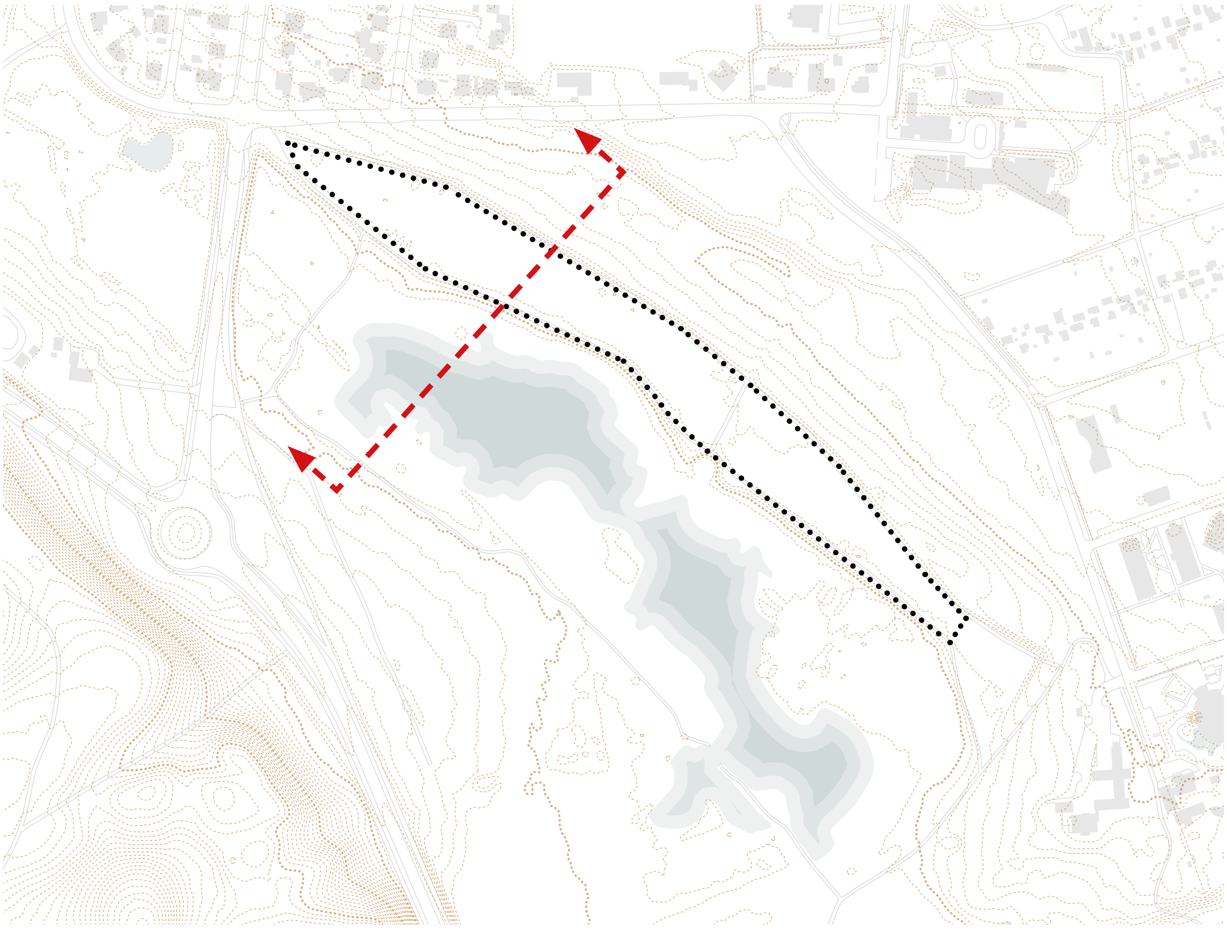
Illu. 55 - Recreative Areas 1:5.000

The site is close to an area of great interest to the Danish Nature ministry (Naturstyrrelsen). One of the considered site locations is in a NATURA2000 area, meaning a conserved area, containing different rare plants and animal (Natura 2000-plejeplan for Naturstyrelsens arealer i Natura 2000-område nr. 57 Silkeborgskovene, 2012). Therefore, a different nearby site was chosen as to not disturb or damage the local biodiversity.



Illu. 56 - Trees on Site

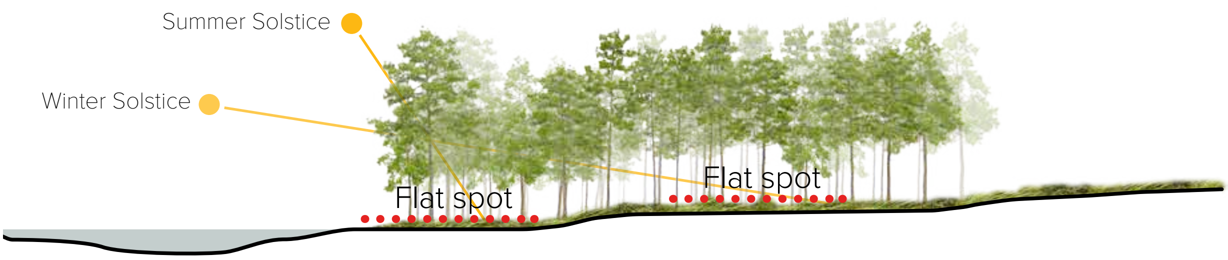
Topography



Illu. 57 - Topography 1:5.000

Silkeborg is a city with a very undulating landscape. This kind of landscape can make it difficult for people with limited mobility to access the building. The building program can also be hard to implement into this kind of landscape in terms of universal design. The choice of the site has therefore also put emphasis on a green area with appropriately low inclines.

Looking at the topography map (Illu. 57) it is apparent that a large flat piece of land is located along the river This spot is chosen to fit in the building program, as well as its proximity to the town and its specific topographic property.



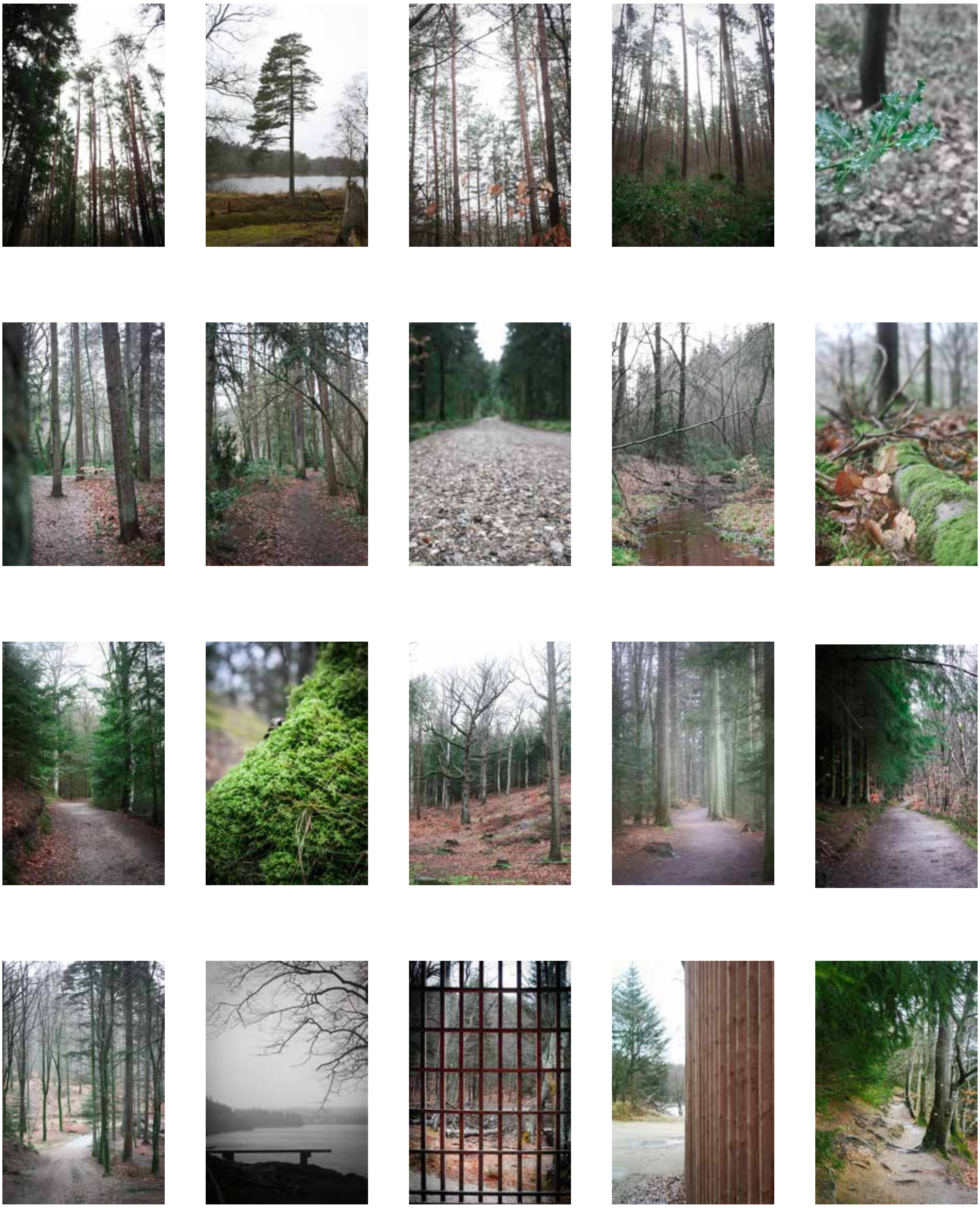
Illu. 58 - Sun and Terrain

Public Transport

Illu. 59 - Public Transport 1:10.000

Genius Loci

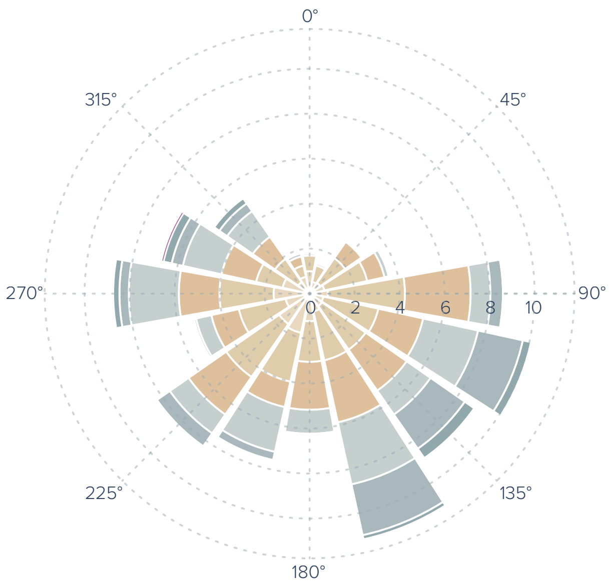
"Identity of the site"



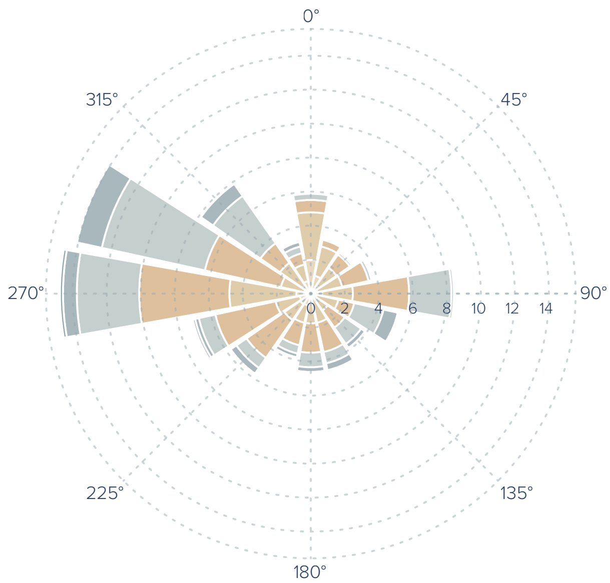
Illu. 60 - Series of Pictures from the Site and its Surroundings

Wind

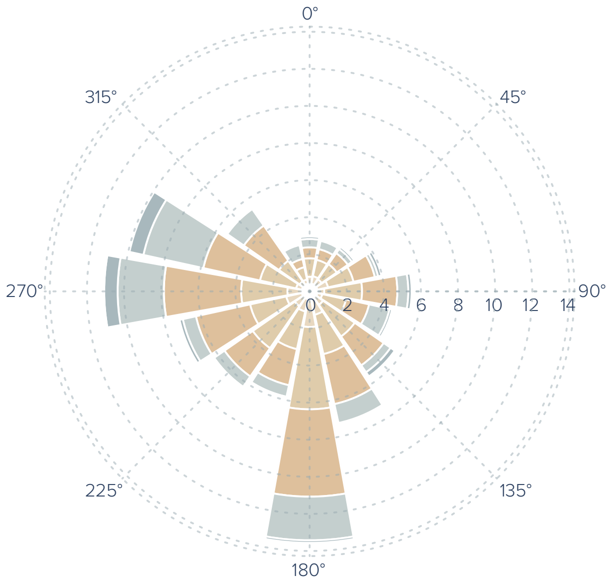
"Annual wind on site"



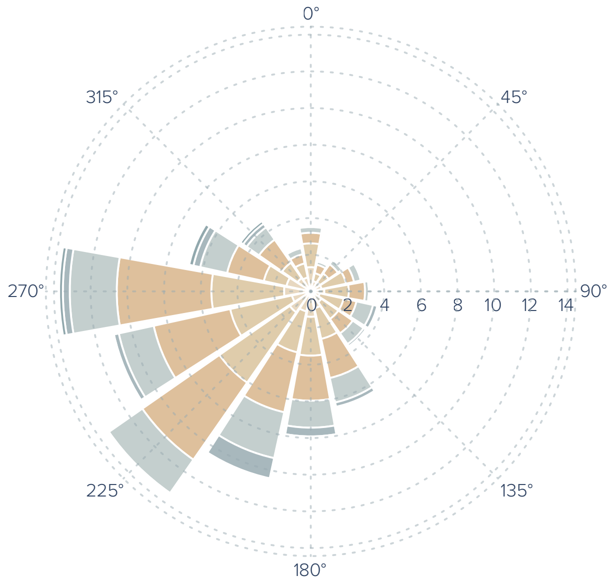
Illu. 61 - December to February



Illu. 62 - March to May



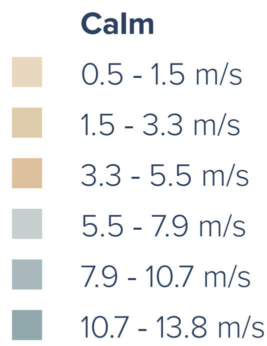
Illu. 63 - June to August



Illu. 64 - September to November

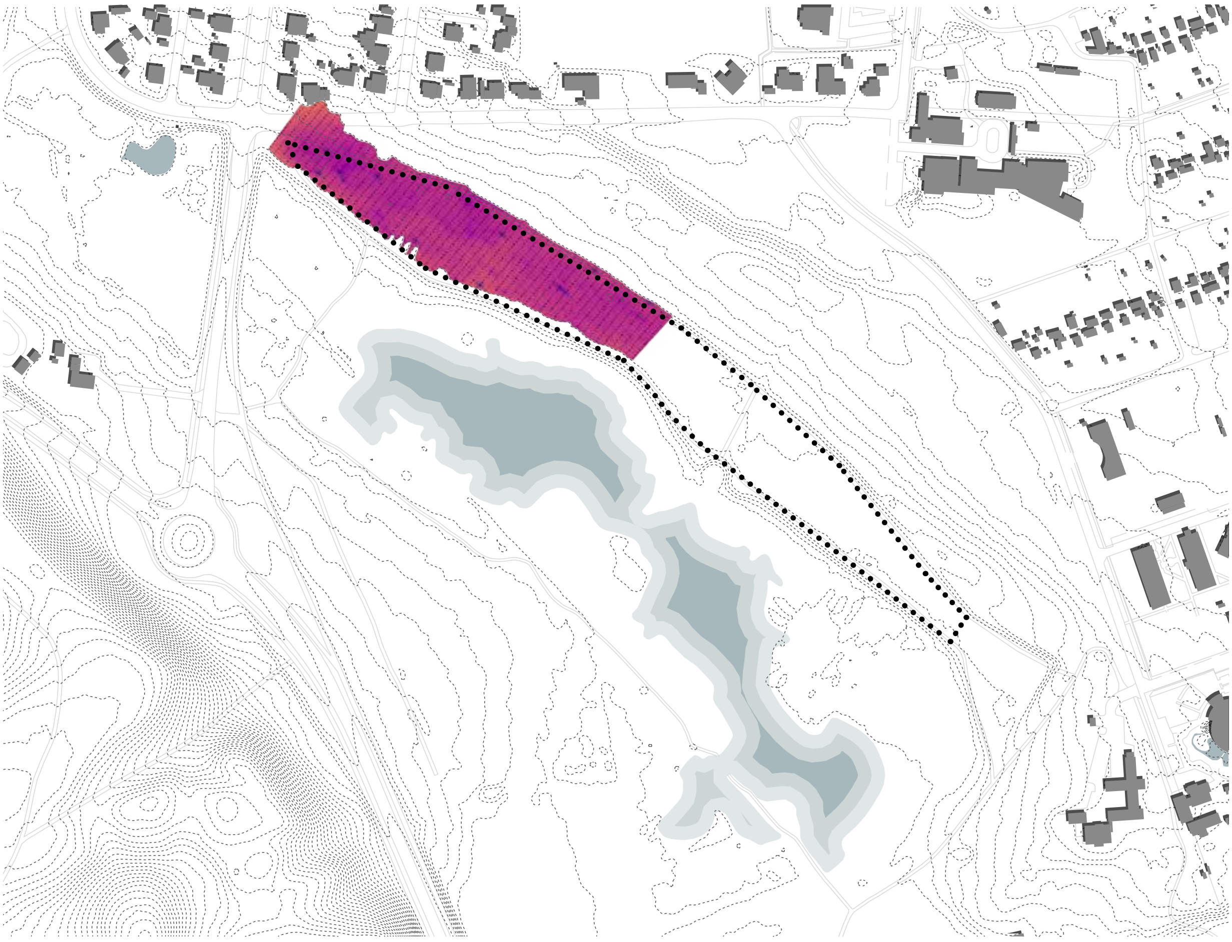
Looking at annual wind roses it is clear to see that the wind throughout the year is mainly coming from the South or Southwest. Although through December till February the site will also be exposed by wind coming from Southeast (Betti et al., 2022).

The trees on site can disrupt and slow the winds' airflow a lot: During our excursion to the site, we were having winds coming at 9,4m/s and gust of wind hitting at 20,2 m/s coming from Southwest (DMI, 2023). Our experience that day where that the winds on site were barely noticeable in contrast to more open areas we also visited.



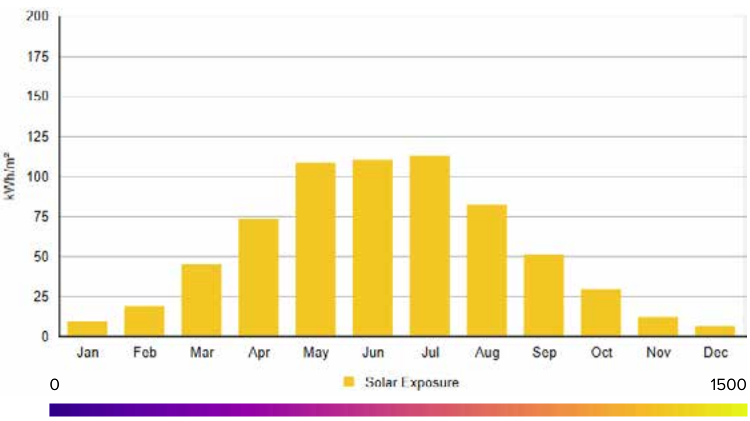
Illu. 65 - Wind Speed Legend

Solar Exposure



Illu. 66 - Incident Radiation 1:5.000

As the site is full of trees it can become difficult to comply with the rules of daylight access as well as thermal comfort. Having made a radiation analysis with trees places on the site this does not seem to cause any issues. This is partially because of the Douglas trees on the site, which grow leaves remarkably high up, leaving an area underneath for light to enter. The trees also enable the possibility to utilise the possibility for passive strategies, to keep the heat out in the summer.



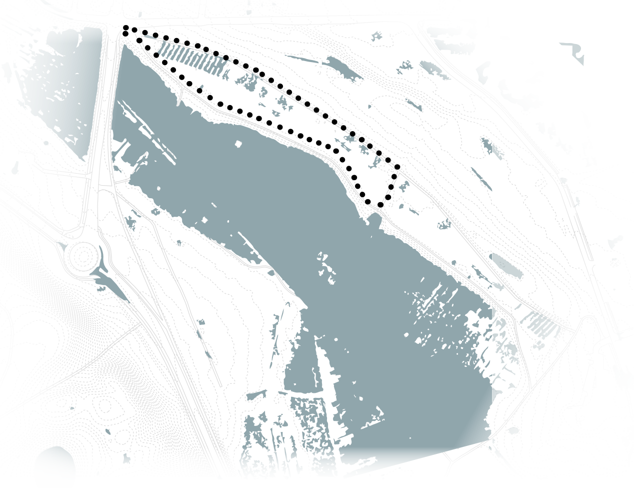
Illu. 67 - Incident Radiation Legend

Rain and Bluespots

Normal water level

15 mm rain

45 mm rain



120 mm rain

Illu. 68 - Bluespot at Different Rain Intensities

Studying data published by the Danish Meteorological Institute, a trend discloses that the annual average rainfall is increasing by 0,06mm per year in the period 1938-2019 (Cappelen, 2021;p 21).

Since weather recording began in 1874 the driest year was 1947 with 466 mm rain the entire year. The wettest years were 1999 and 2019 with 905 mm and 905,3 mm rain respectively throughout the year.

Studying blue-spot maps to see the effect of torrential rain of 120 mm shows that water levels could rise up to the conservated marsh-area below the planned building area. This amount of rain correlates to a '100-year rainfall-event' in the period of 2070-2100: This period is chosen for analysis to ensure that the building is climate resistant in the future as the predicted climate change will make the weather more extreme - and extreme weather more frequent - in the coming century. The building must be able to cope with such conditions throughout it's lifetime.

The most severe rain event recorded in Danish history was 168,9mm rain in a 24 hour period. This downpour was recorded the 8th and 9th of July in 1931 (Cappelen, 2021; p 5)

06 DESIGN PROCESS

Design Process

The design process started once most of the analyses and theories had been concluded. At first it was about making some general functions and mapping them on site to get an idea of the scope of the building. These tests are elabortaed in the apartment, volumetric placement, and concept sections.

Generally, some generic shapes were investigated while the last site analyses were finished. Then some wider building compositions were investigated, inspiring some concepts and kick-started the concept phase. In the middle of the concept phase an intense sketching phase was undergone to hone the concepts. This is elaborated upon in the section about the *Re-imagined Branch concept*.

Throughout the design process, increased effort was put in to gather people together, to share their emotional experience and to support each other. The early concepts had many clusters, but challenging building sizes and a difficulty arranging all apartments in a dignified way lead to the program gradually shrinking - and improving the social situation.

A lot of the effort in the design process was put into solving the plan and establishing some good relationships between the many complex functions and the site. At times, the plan geometry was extruded to give a first-person impression of the spaces created in the plans to evaluate the phenomenological experience.

The following sections are representing the design process in chronological order.

Apartments
"Iterations"

At the beginning of the design process, some basic apartment units were designed, to give an idea of the area required on site and in the building. These units could then be arranged in clusters and small communities during the concept development. The requirements were accessibility and manoeuvrability.

Manoeuvrability was regarding floor space to manoeuvre beds in and around the room and balconies, without having to constantly move other furniture.

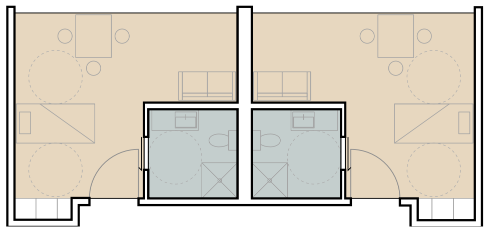
Accessibility in the case of residents meant good handicap access for people in wheelchair or even in bed, few or no stairs, and wide spaces anyone could enter. Accessibility for staff meant nurses being able to enter the patient room without disturbing other members of families and having a small hatch in the corridor for replenishing linen and towels. This was during the phase when families with ill children were part of the program. A decision was made in the middle of April to remove the children's wing from the program, due to its size and added complexity.

Some of the design iterations for the singles' and couples' apartments are shown on the right: Here it was discussed whether the bathrooms should occupy facade space (Iteration 1) or not (Iteration 2) (Illu 69). It was decided that they should not take facade space as the room would become too narrow and deep with such a composition, and it would create a discrepancy where some had natural lighting in the bathroom, and others did not.

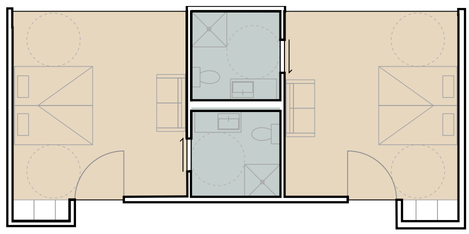
All design iterations for the generic apartments can be seen in Appendix 2.

Single Apt. Iteration 01

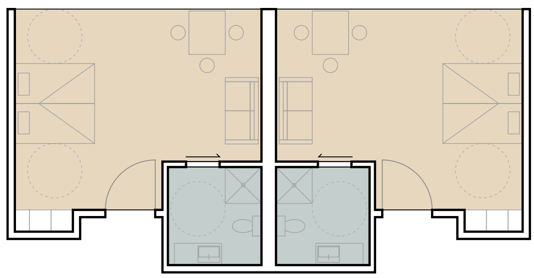
Single Apt. Iteration 02



Couples Apt. Iteration 01



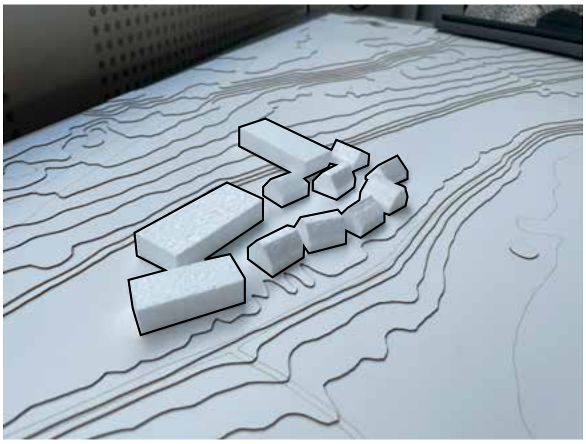
Couples Apt. Iteration 02



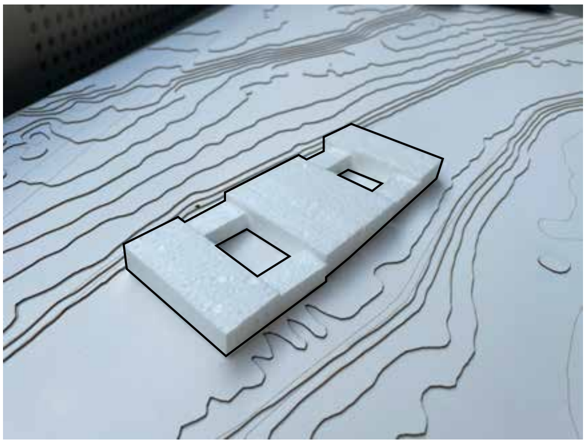
Illu. 69 - Some hospice specific room designs

Volumetric Placement
”Iterations”

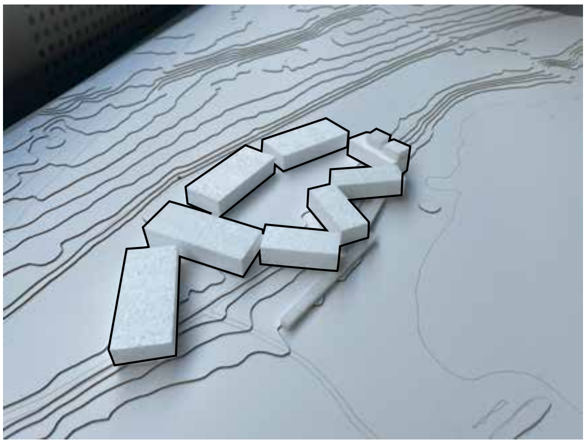
As the apartments where programmed and designed in an accommodating size, these were used to define some foam shapes to place on a physical model. As a part of the design process this initialised various design iterations. These studies were conducted to evaluate relationships between various functions, and their relationship to the site.


Illu. 70 - Iteration 1.

Iteration 1.
The first iteration consisted of some detached housing units, with some bigger and more dense units serving staff and the shared functions. In this concept every family would have their own individual housing unit, and older patient groups would share cottages. The aesthetic of small cosy cottages seemed suitable for the forest environment. However, the detached volumes would be an inconvenience for the nurses, especially during seasons of cold and poor weather.


Illu. 71 - Iteration 2.

Iteration 2.
The second iteration was a dense building volume. Here the idea was to create two big courtyards, so the residents would have the serenity of the site up close. This way some private and quiet gardens were established for the residents. It was influential in the inspiration for the *Park Courtyard* concept.


Illu. 72 - Iteration 3.

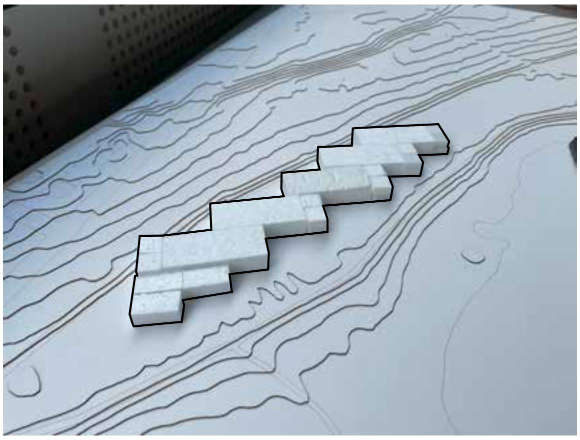
Iteration 3.
The third iteration consisted of some “arms” that would scatter the view towards the lake and the forest. This concept was interesting as it created various departments within the building and created multiple centre points of views to look at. This also inspired the early interpretations of *the branch* concept.

Iteration 4.
The fourth iteration was based on displacements of the facade. This was to create private terraces towards the lake for the residents. This concept was also considered to be a two-story building. But as this went against our thoughts of inclusive design and easy access, the idea was scrapped.

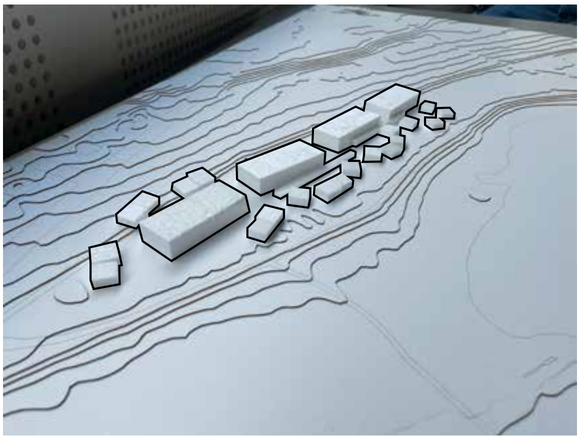
Iteration 5.
The fifth iteration was based on creating clusters of smaller communities. This idea was later refined and combined with the third iteration to become *the 'Pre-Sketching phase Branch* concept'.

Iteration 6.

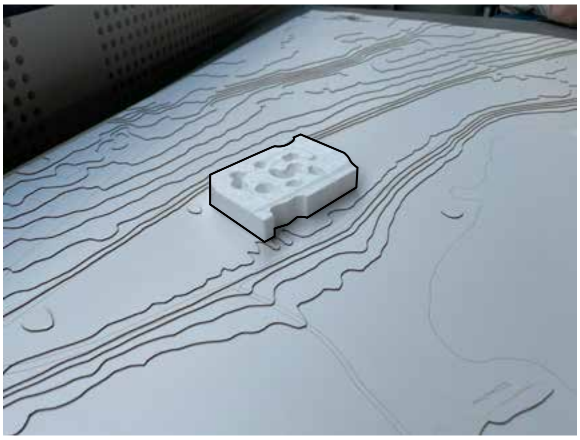
To try out something radically different, a massive compact volume was placed with small courtyards to salvage trees. Although an interesting concept, most of the forest would not be very visible, and many odd spaces would have to be solved. It was also considered unsuitable for several strangers living in such proximity, with clear views into others' personal spaces.



Illu. 73 - Iteration 4.

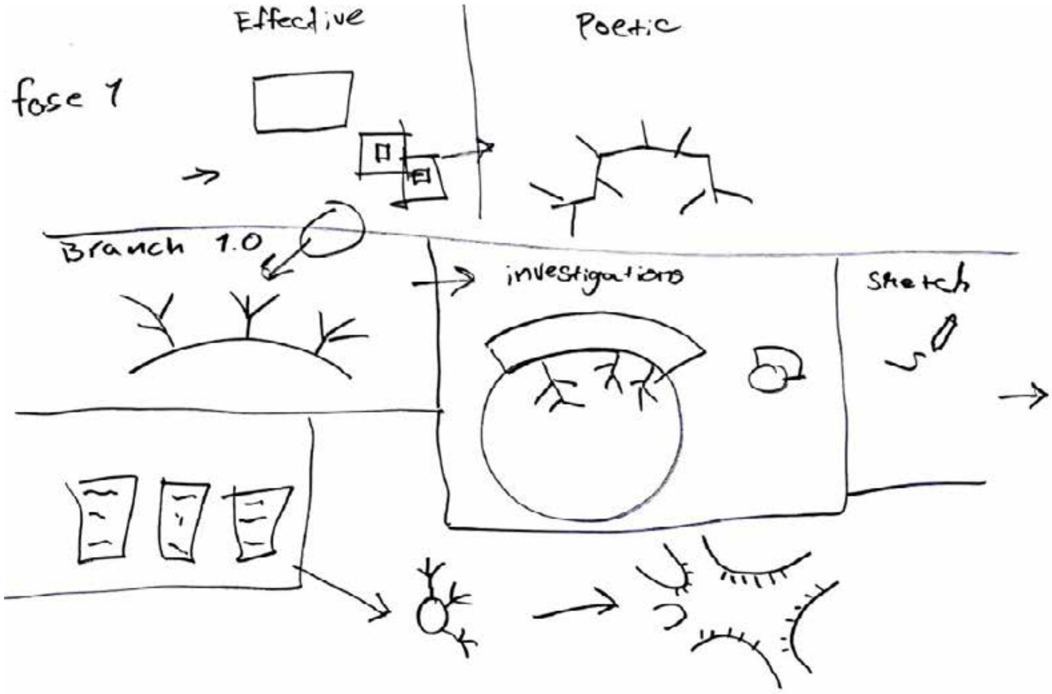


Illu. 74 - Iteration 5.



Illu. 75 - Iteration .6

Concepts



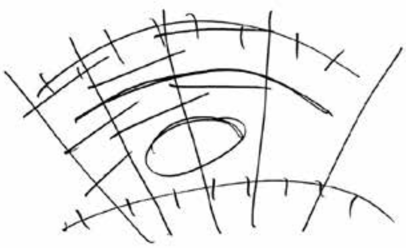
Illu. 76 - Rough Time-line Sketch

During the early sketching phase some different ideas and concepts were tested. Using the apartments and clusters, and discussing different placements these concepts are:

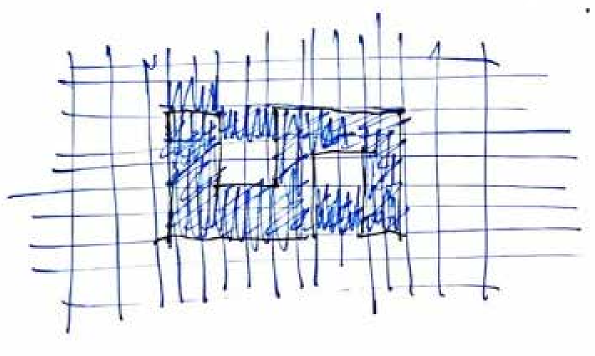
The traditional 'pragmatic institution', 'the mini skyscraper', 'the frame', and 'the snake/ branches', 'the flying carpet', 'the tree trunk', and 'the re-imagined branch'.

Illu 76 displays a rough sketch of the design process' time line up until the early iterations of the re-imagined branch.

Throughout the design process, all concepts' constructive principles were considered to have an idea of each concept's general structural system. Despite many dynamic building shapes, most concepts built on regular grids or constant curvatures, allowing a simple variation of a waffle shape to embody the buildings' footprint and roof. The waffle structure was principally always supported and stabilised by a combination of discs and slanted columns (illu. 77 and 78).

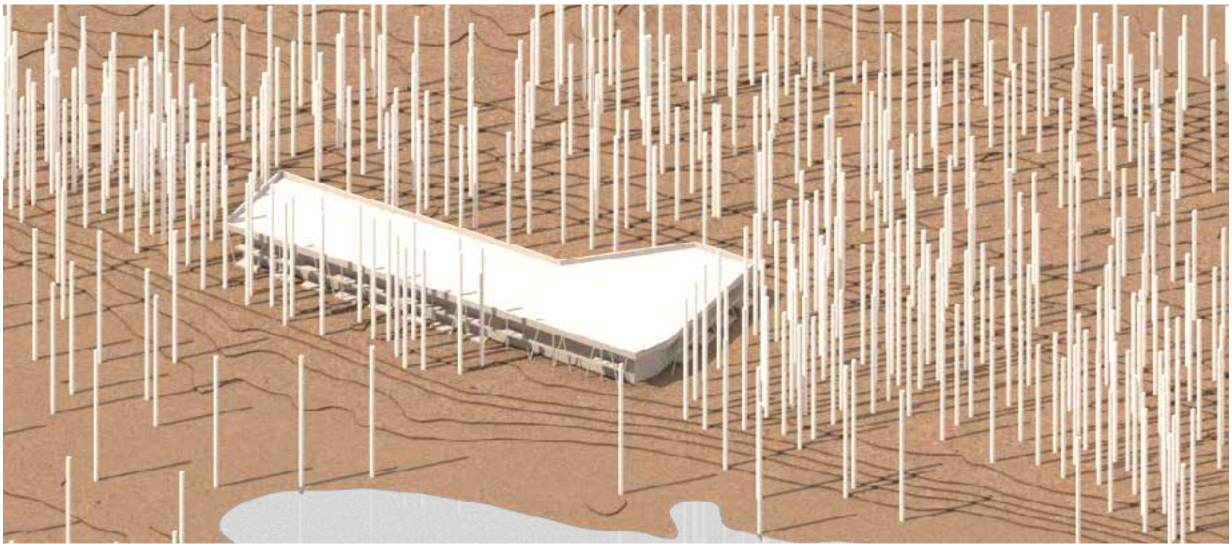


Illu. 77 - Waffle Grid Construction in a Curved Building



Illu. 78 - General Grid Structure

The Pragmatic Institution



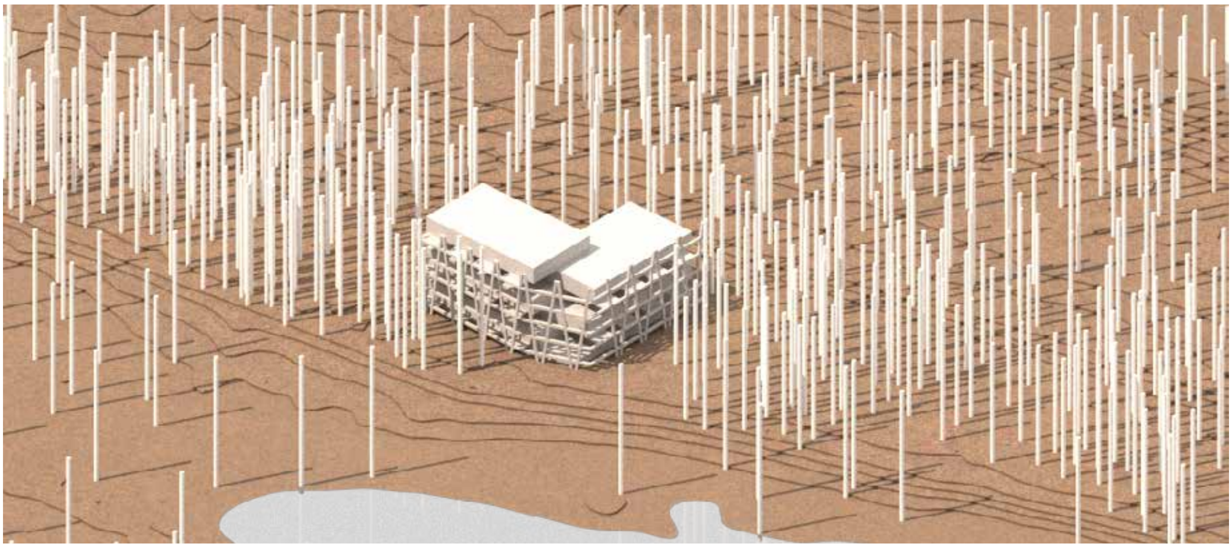
Illu. 79 - The Pragmatic Institute Placed North of the Lake

This concept was made as a compact and efficient building, in which all apartments face south to the view of the lake. Common spaces would be facing north, putting less emphasis on the view, as it is meant to bring people together in conversation, rather than leading the gaze out, and away from the social setting.

This could be placed north or north-east of the lake, being lightly surrounded by trees, and having a column composition to help the building blend into its surroundings (Illu. 79). The two places have pros and cons regarding the facility's entirety and its poetry: North of the lake was a lightly wooded area close to the road going into Silkeborg, which could impact the park to a lesser degree (which made the idea for the frame) and help with the parking facility. The other area was in denser wood, which made for a more poetic setting, and a more difficult approach.

Challenges in this concept were to make staff zones easily accessible, because of the various clusters being mixed throughout the building, and creating good flows across the various floors.

The Mini Skyscraper

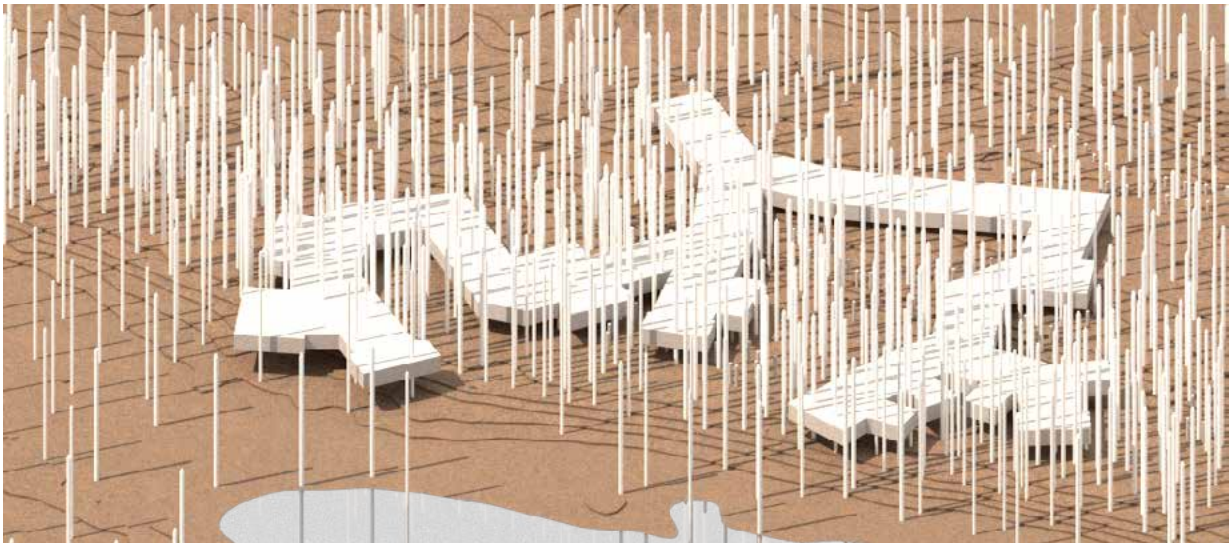


Illu. 80 - The Mini Skyscraper Placed North of the Lake

As an investigation into how to shorten the corridors in the institution concept, a radical reshuffle to the arrangement of clusters was made, resulting in the mini skyscraper. This would rise in height to meet the scale of the surrounding trees, removing the perceived voids amongst tree canopies produced above the building (Illu. 80). The concept was investigated using the same placement conditions as for the pragmatic institution, with the same properties for coordination and atmosphere.

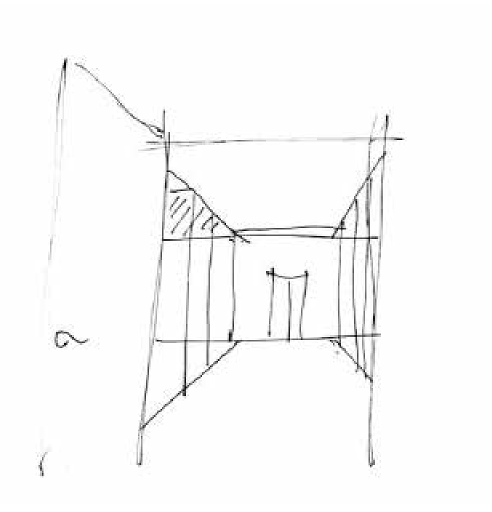
The tall structure created a disconnection between the residents of the building and the many paths in the park, demotivating people to actively use the surrounding area by placing a ‘distance barrier’ between apartment clusters and access doors to the park.

The Snake/Branches

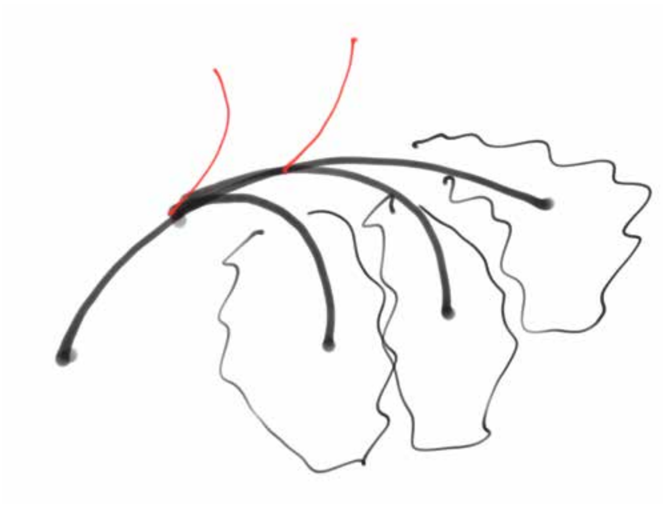


Illu. 81 - The Branch Weaving Through the Woods

Having tried several conservative volumes, The Snake was a bolder take on a hospice building: Using a script to map the distances between tree trunks to define some gaps (APPENDIX 3), a winding shape based on either a snake or a tree branch would flow between the trees, creating a dynamic building form (Illu. 81). It was desired to create a fairytale like feeling of running through the woods and utilising the poetic properties of the site (illu. 82).



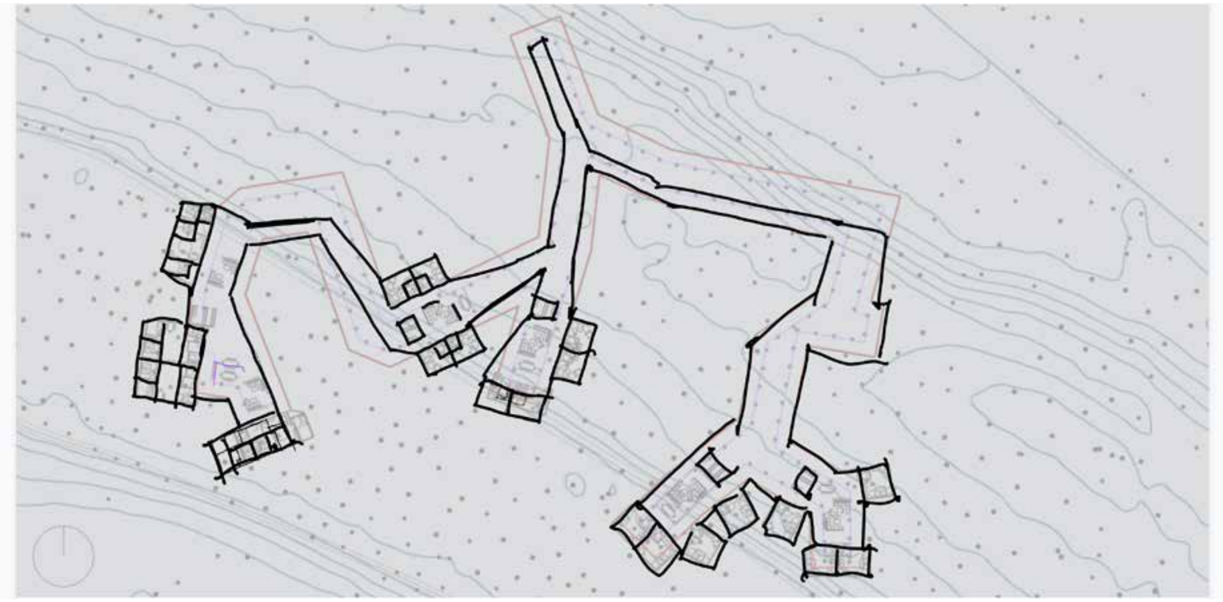
Illu. 82 - Perspective Sketch of the Fairytale Atmosphere



Illu. 83 - Concept Sketch Post Mid-term Review

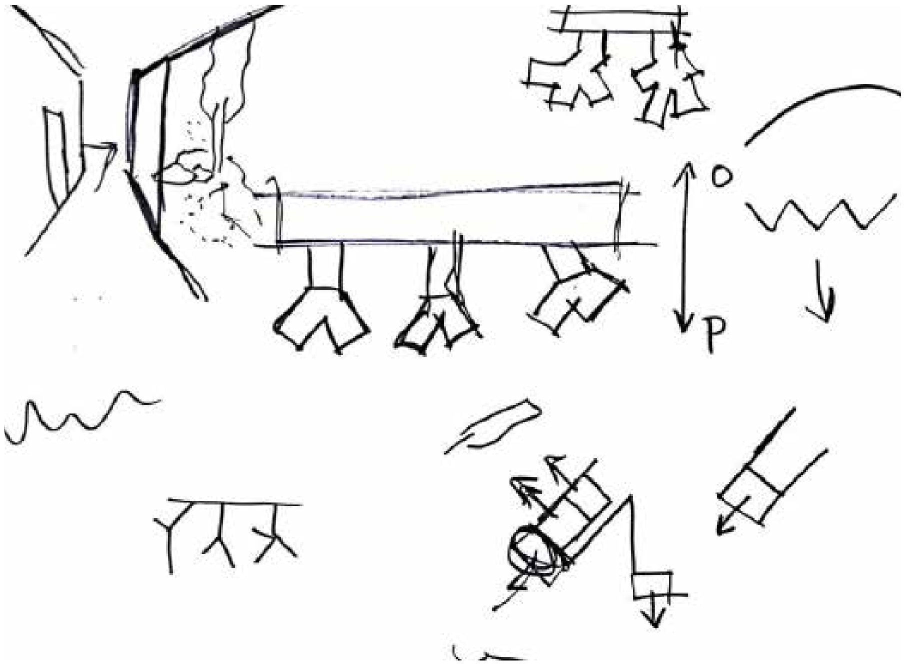
The first iteration was a 15m wide building lying at the northern part of the forest. Branching out to different wings provided some intimate spaces for unique clusters of apartments. This iteration was presented and discussed at the midterm review, highlighting a need to weave more closely through the woods, and following the terrains undulations, allowing residents to exit onto a terrace on the ground, and moving more easily out into the forest. Another topic of discussion was the width of the building varying depending on the functional structure.

After the midterm review, an attempt was made to lead the entrance to the area designated for parking and placing the apartment as leaves in the opposite end of the building (Illu. 83).



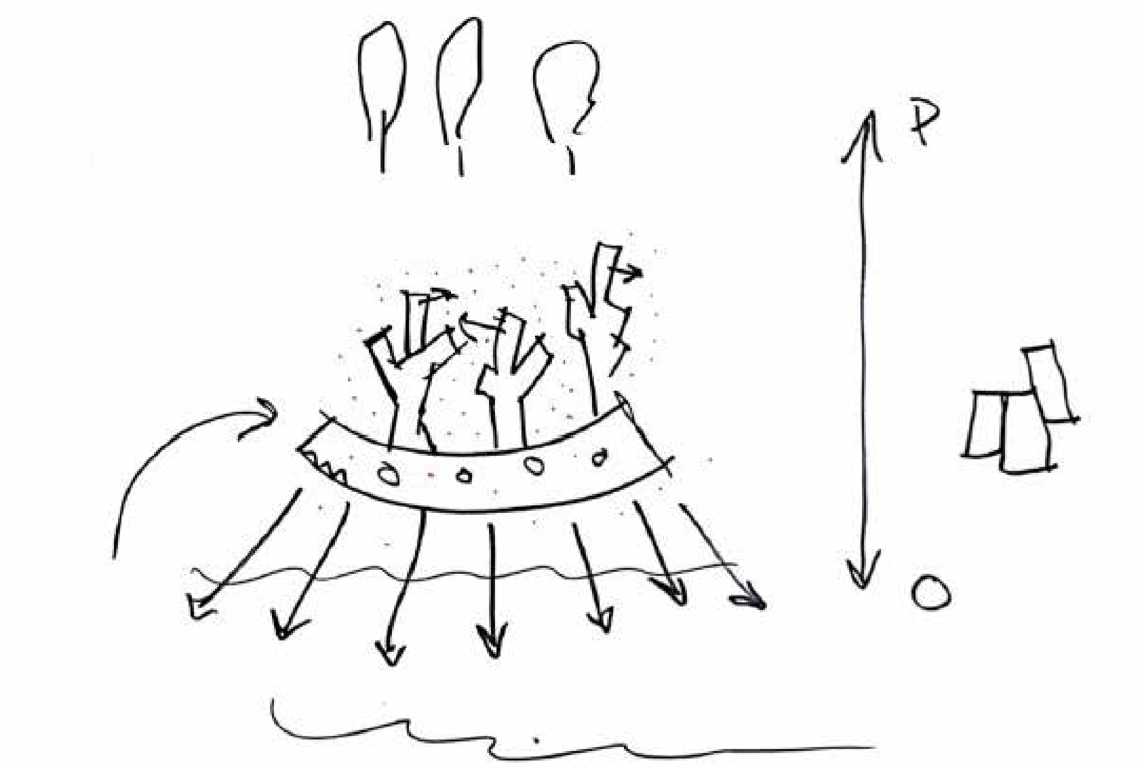
Illu. 84 - First Iteration Branch Plan

The snake interpretation of the concept typology was discarded upon reflecting on the buildings' usage: User's need for intimacy, dignity, and privacy coupled with long walking distances for staff meant that the concept would be impractical in day-to-day usage. Guest and staff would have to travel directly through the various clusters intimate areas or departments to get to their destination, as seen on parts of the middle cluster on illu. 84. This was deemed unsuitable for the users.



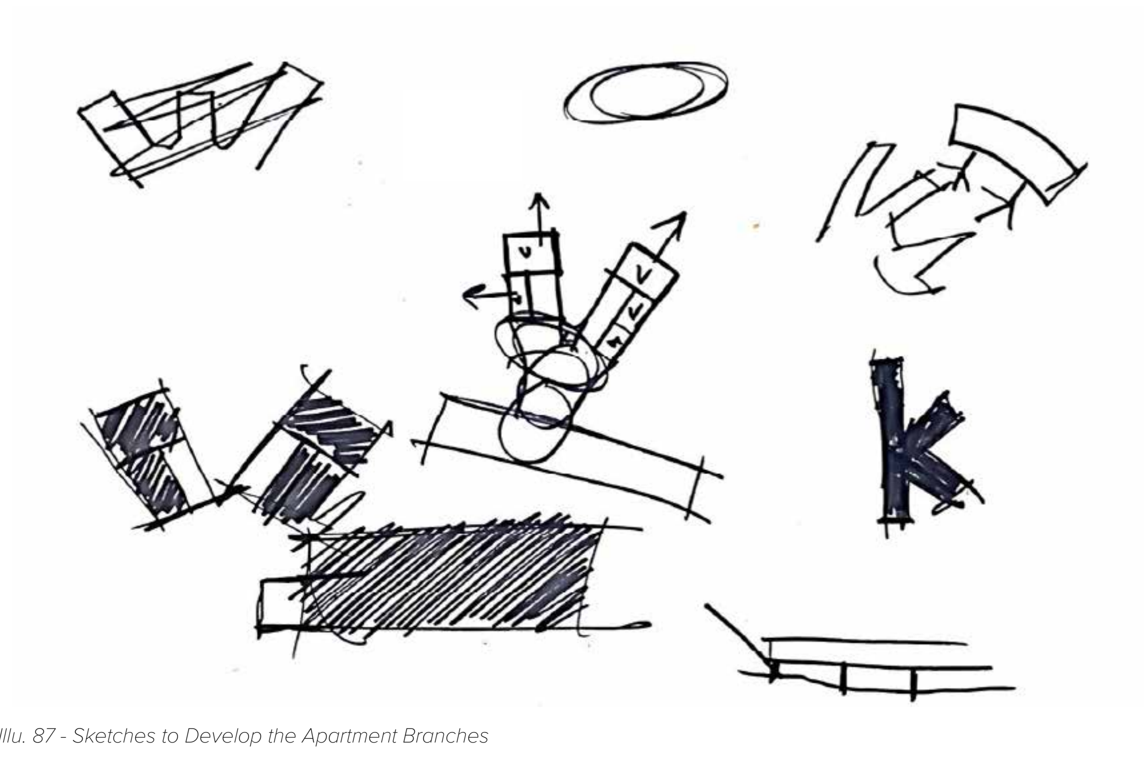
Illu. 85 - Early Branch Concept Sketches

The apartments were originally facing the south in the early concept and iteration (Illu. 85). But to encourage more social interactions and shared experiences, they were moved to face into the forest, allowing them to become more private as the dense forest obscured views in from the outside world (Illu. 86). Another benefit of the reorientation was that apartments were kept from overheating during summer.

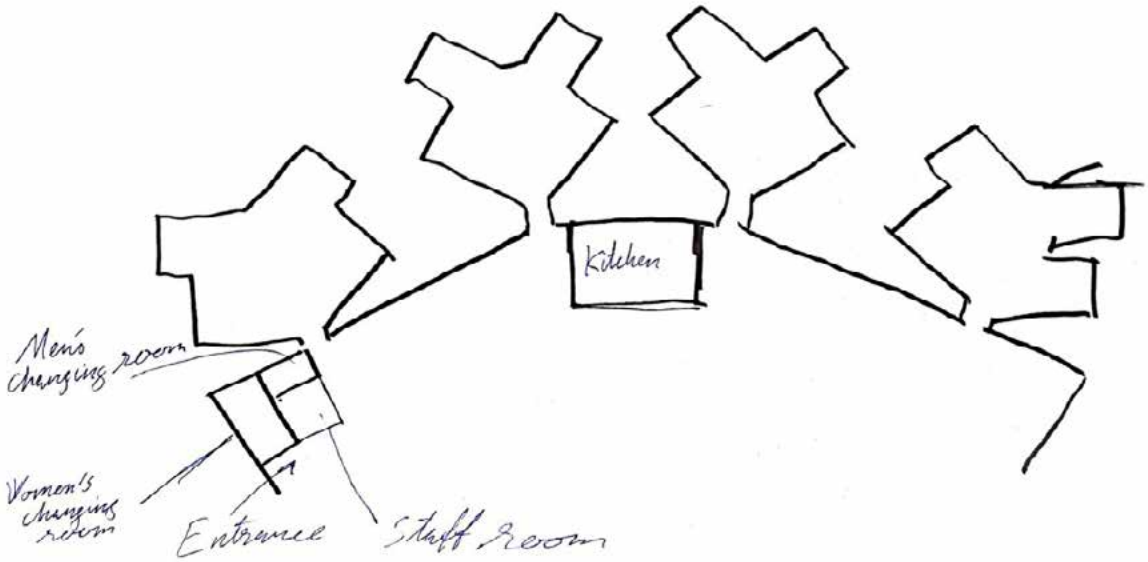


Illu. 86 - Re-Orientation of the Building with Sliding Privacy

After the midterm critique, a lot of effort was put into making the building more compact, efficient, and intimate (Illu. 87). This was a challenge, as the winding shape often made apartments face each other, thus compromising privacy. As the concept developed, it morphed into a main service building branching out into the forest. With apartments placed in clusters, the clusters had to be arranged in a way that there wasn't any visual connection between apartments. The service building was arched to reach towards the least tree dense part of the forest, where it was planned to have the parking facilities.

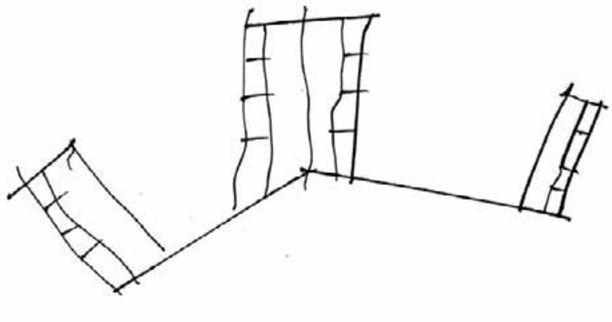


Illu. 87 - Sketches to Develop the Apartment Branches

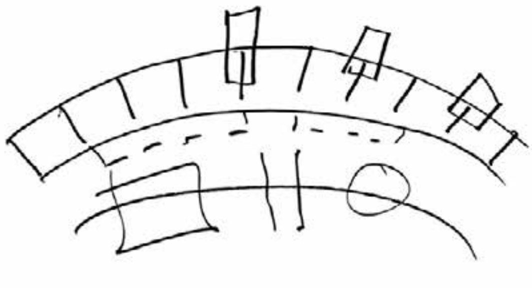


Illu. 88 - Notes on Function Placement in Branch

An important aspect of the branch's aesthetic was to keep all geometries slim. This proved to be difficult in the clusters, whose proportions looked off compared to the main building (illu. 88). Many designs were investigated to find an attractive solution, changes to the main building geometry (Illu. 89) and different shaped cluster branches (Illu. 90) to find some better geometric harmonies.

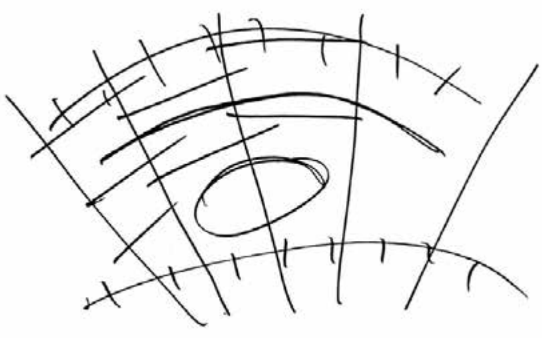


Illu. 89 - Variation of the Service Building Geometry



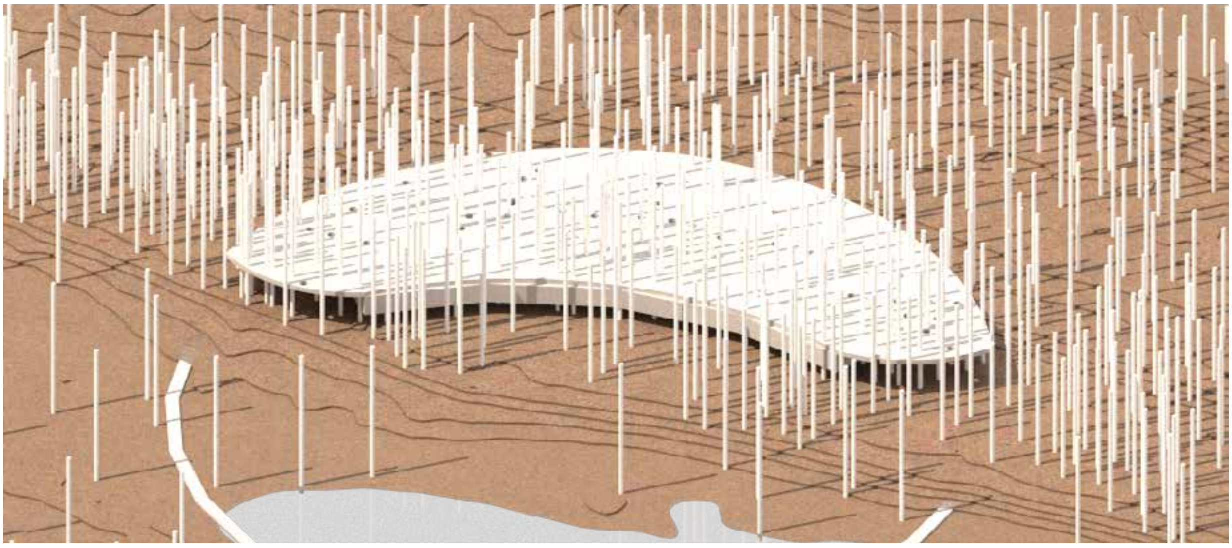
Illu. 90 - Variation of the Branch Geometry

The structural system was in principle a curved timber waffle in the main building linking the branches or clusters with a straight waffle grid (Illu. 91). It would be supported by some disks in the main building and in the clusters, with columns articulating the travel through the forest.



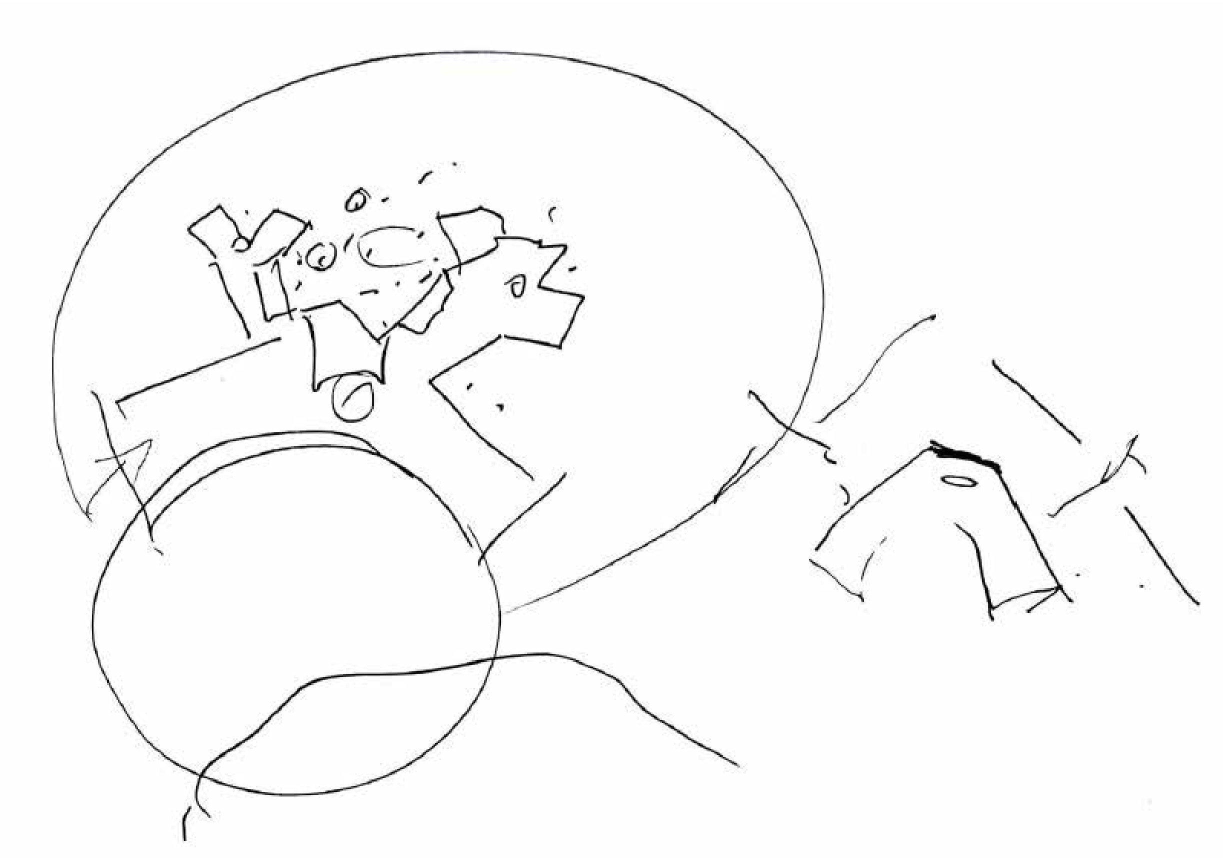
Illu. 91 - Branch Service Building Construction Grid

The Flying Carpet



Illu. 92 - The Flying Carpet Including Circular Bridge

As an alternative interpretation of the Branches, the Flying Carpet would be an expansive roof covering a similar structure (Illu. 92). The conceptual idea was to puncture the roof or 'Carpet flowing above the building' with holes for protruding trees and to place skylights. This building would appear as a wide mass but would consist of slim volumes flowing in the covered space under the roof adding an additional layer of intrigue for the dynamic and unintelligible building form.



Illu. 93 - Concept Sketch Adapting the Branch into the Flying Carpet

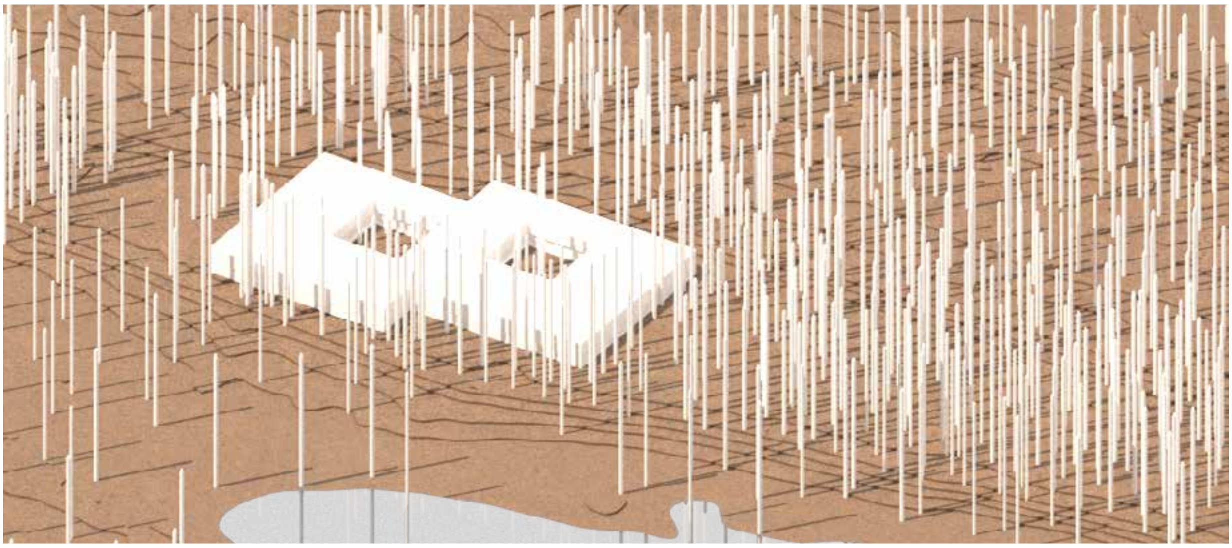
Illu. 94 - View from an Apartment in the Branch

Illu. 95 - View from an Apartment in the Flying Carpet

The roof was drawn as a significant part of a circle. To close the circular shape, a bridge spanning across the river was established to articulate the geometry (Illu. 93).
Placing an expansive roof over the branches created a unique and interesting space, as seen when comparing illu. 94 and illu. 95.

The concept was abandoned as it was considered wasteful to erect such a large roof structure simply for creating a unique atmosphere.

"Park Courtyard"

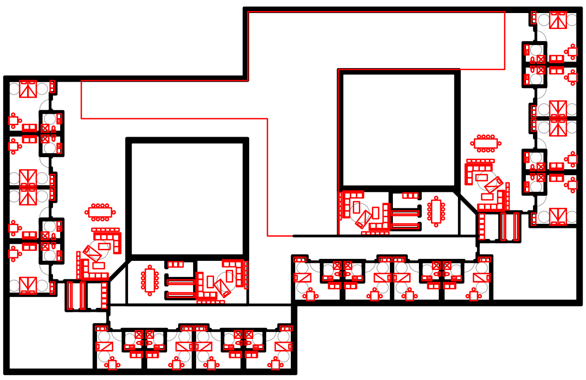


Illu. 96 - Park Courtyard Concept Placed North of the Lake

An alternative interpretation of the flying carpet is the "Park Courtyard." A rational composition, placing apartments along the outer southern edges of two squares, and a large courtyard in the middle . Staff functions have been placed in the northern part of the building. In the south-eastern and south-western corners of the building, two staff zones are placed, respectively. These include space for discussions, meeting-rooms, and general desk places for paper-work and administrative-work.

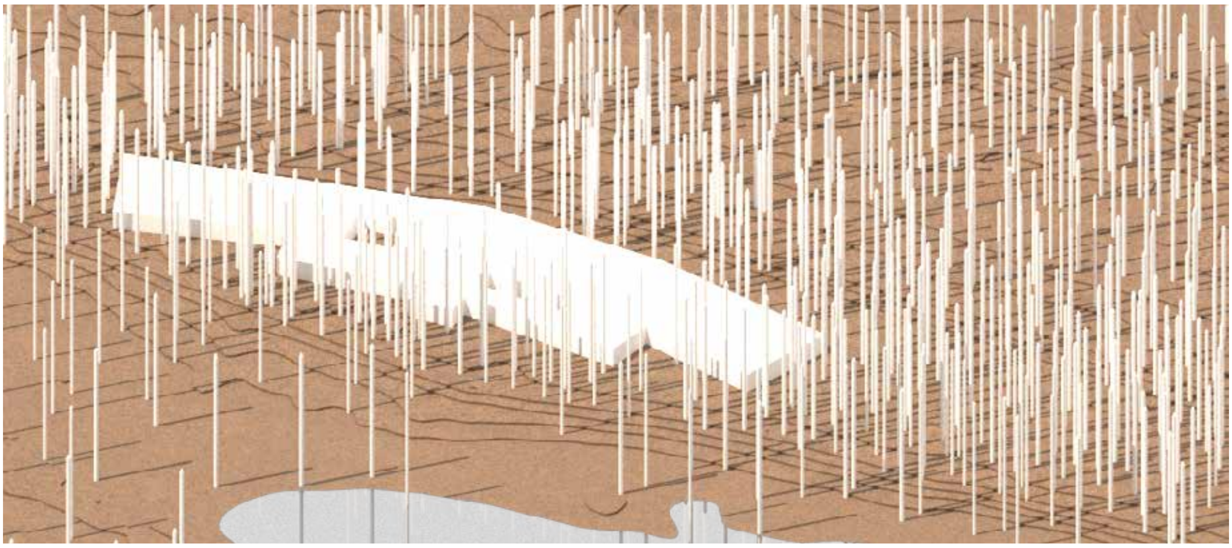
In the heart of the building, a large common kitchen has been placed, which is sized to serve 60 people. This ensures space for all staff and residents and enables catering for large unique events.

The main entrance will be placed along the north-western face of the building Along with administrative functions – which will double as the reception. A private section with alcoves for therapy sessions and a spa area were placed in the north-eastern part of the building.



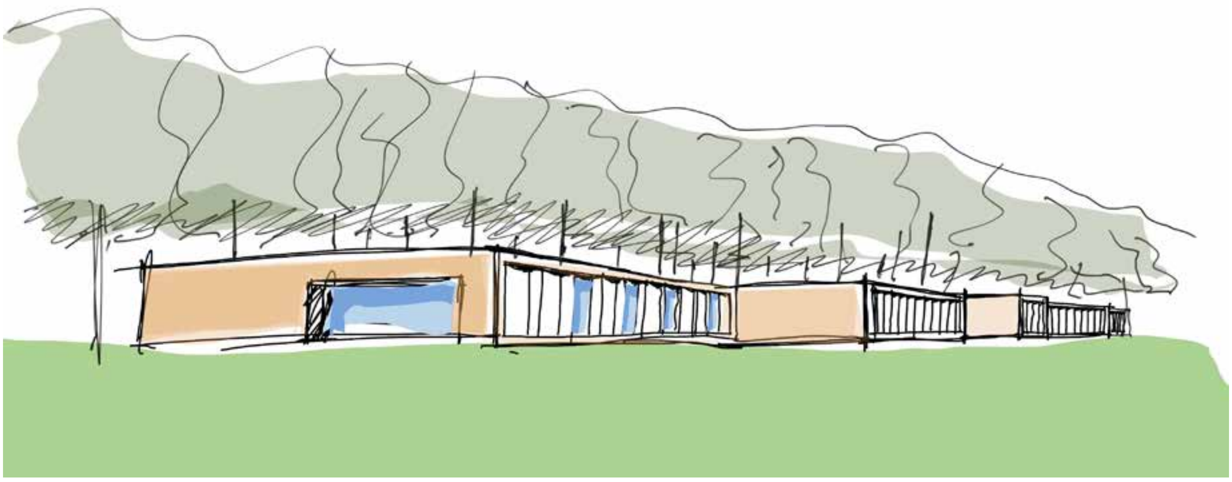
Illu. 97 - Rough Plan Drawing of the Park Courtyard Complex 1:1.000

Tree Trunk



Illu. 98 - Tree Trunk Concept Placed North West of the Lake

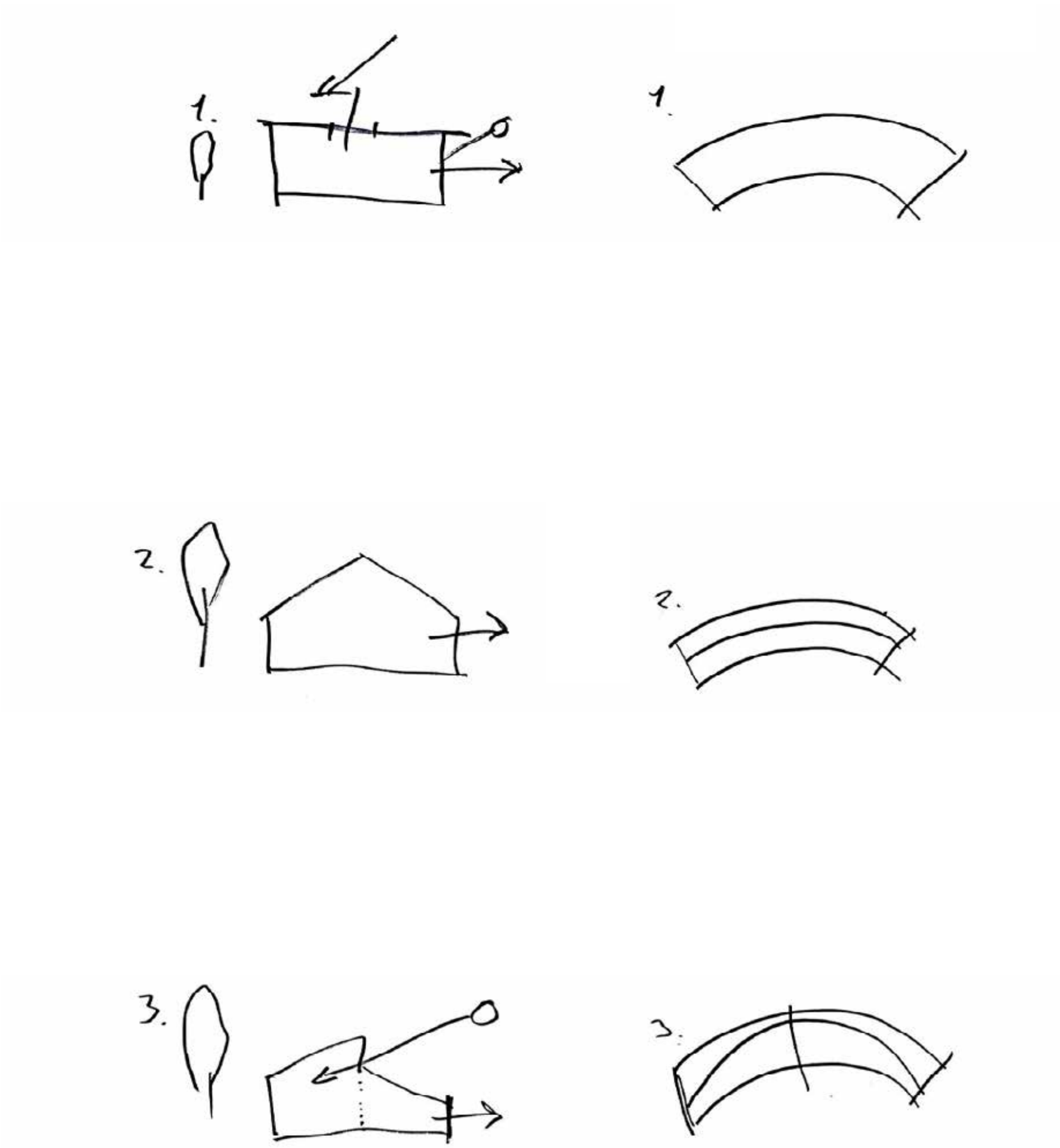
Simplifying the expression of the Flying Carpet concept resulted in the Tree Trunk. Different variants were being explored changing the geometry of the concave part of the arc and testing other arch shapes e.g., an ‘S’ shape. The final concept geometry was based on a cut-out from a circle (Illu. 98). The circle would then be completed like that of the flying carpet (Illu. 92)



Illu. 99 - Sketch of the Tree Trunk with Shading Principle

This design direction was considered due to the branches or protrusions on the convex geometry of the *“branch concept”* was difficult to aesthetically incorporate with the arc. Putting ‘branches’ on inside of the arc would place the branches too close to each other, causing clear views into apartments in opposite branches – thereby limiting privacy and diminishing the visual comfort from within the apartments. As a result, the apartments were arranged along the northern outer edge of the building.

One consideration regarding the expansive glass wall facing South was to make some linear panels with small windows facing east and west to avoid letting the intense sunlight enter and create overheating issues (Illu. 99). These panels could also double as niches to sit in.



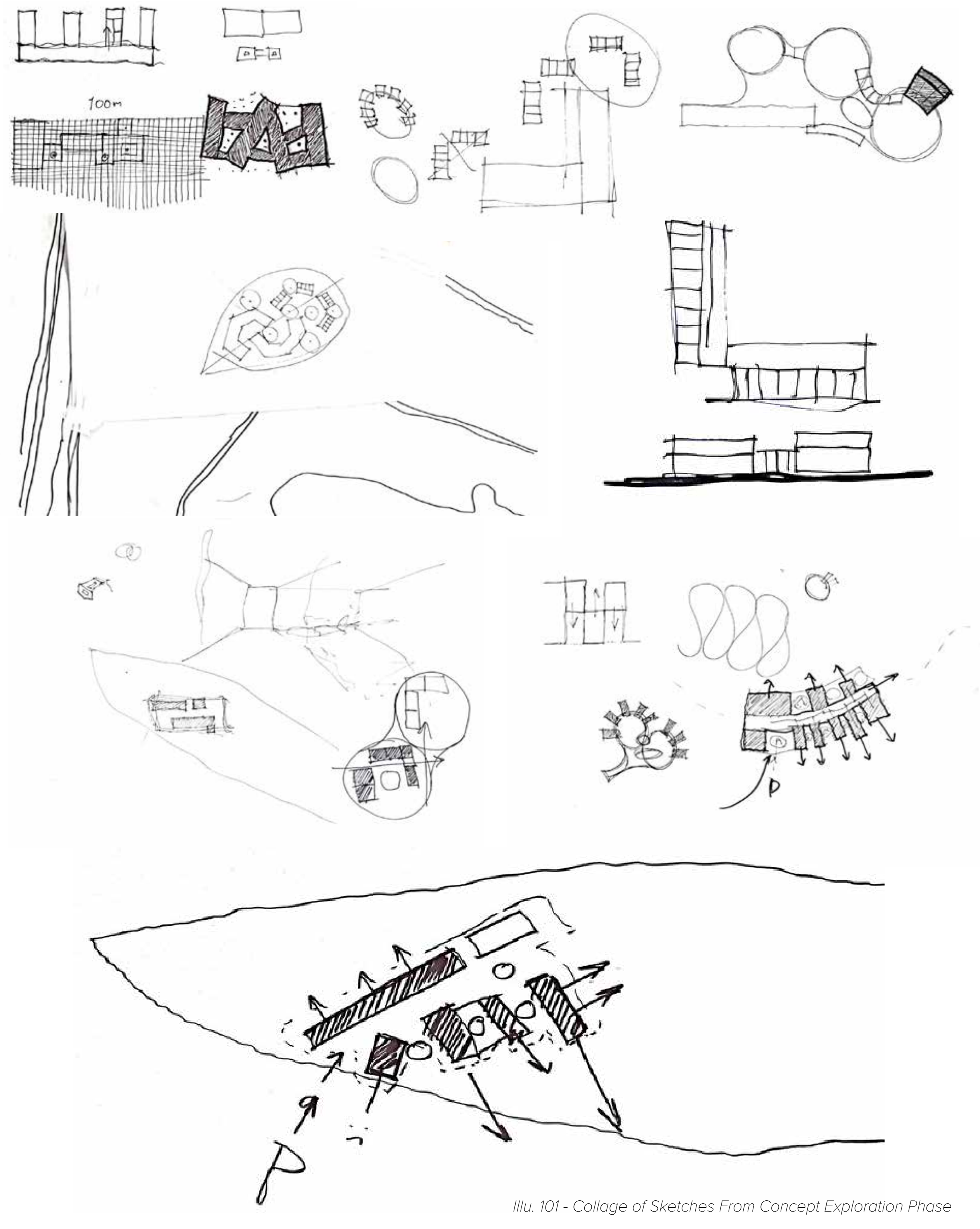
Illu. 100 - Roof Shapes and Building Profile in Section

With the building body becoming very deep, certain principles for adding sky lighting and spatial experiences were developed (Illu. 100).

The concept was ultimately scrapped like the Park Courtyard as its geometric shape seemed out of place in the wild forest.

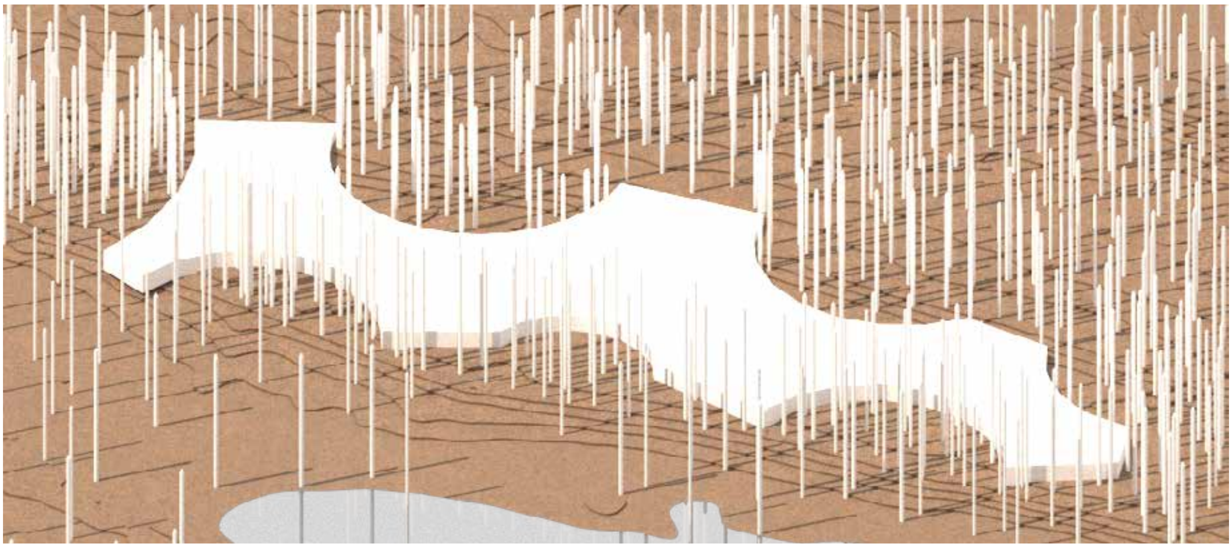
The Re-imagined Branch

As stated earlier in the branches paragraph, the branch concept had aesthetic challenges. Coupled with a difficulty to find an alternative concept with the atmospheric and poetic relevance to the site, a period of exploration came upon the project. To further the project, an intense sketching phase was initiated (Illu. 101 and 102).



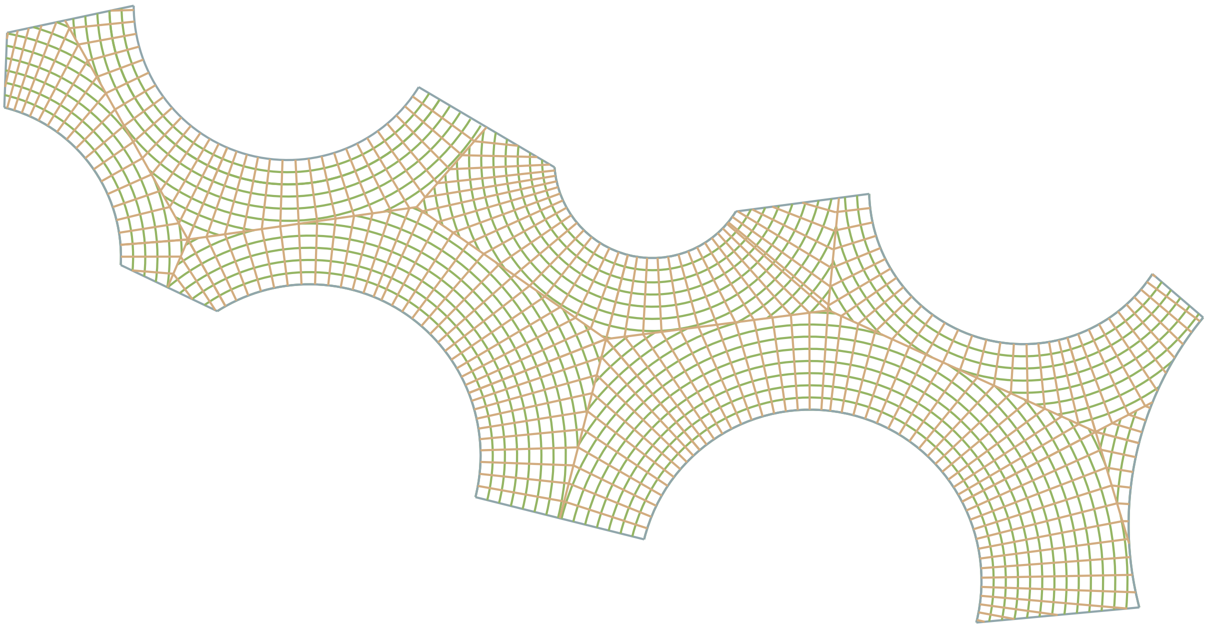
Illu. 101 - Collage of Sketches From Concept Exploration Phase

Illu. 102 - More Sketches from the Concept Exploration Phase



Illu. 103 - Initial Re-design of the Branch Concept

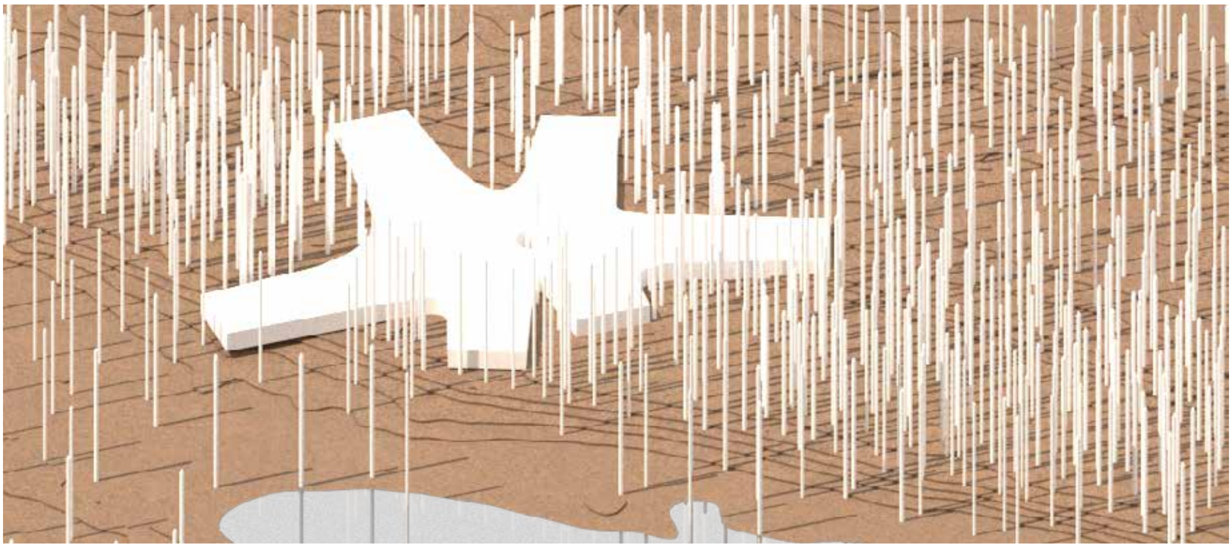
Following the sketching phase to find a concept development direction, an idea came up to reinterpret the branch concept: Simplifying the branches themselves and using soft curve segments to join the geometric branches together created a more aesthetically pleasing building expression (Illu. 103).



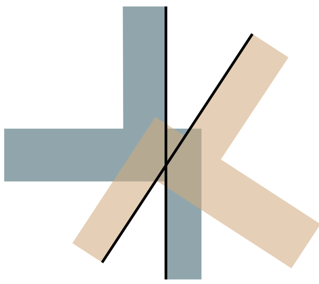
Illu. 104 - Grid from Circular Triangulation

The construction was created using the circle centre of each curve segment joining at the triangulation from the nearest adjacent circles (Illu. 104).
By returning to an older understanding of the concept, both living units and service functions were placed in grids that branched out from a central gathering area. The overall building shape changed dramatically from the first and second interpretations: the third building shape was made to shorten the building reducing the energy needed to participate in the social activities (Illu. 110).

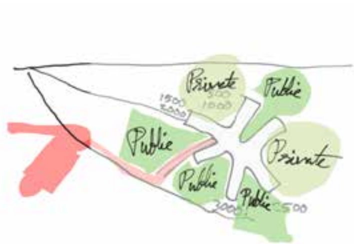
The concept is composed of two grids rotated around two centres (Illu. 106), with apartments or guest rooms placed perpendicular to each other in two L-shaped grids – to



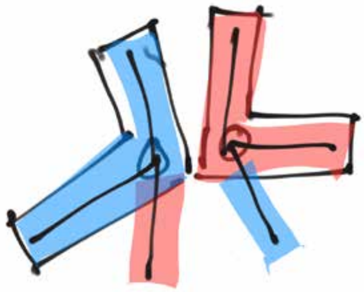
Illu. 105 - Shorter and Wider Interpretation of the Branch Concept



Illu. 106 - Overlap Diagram

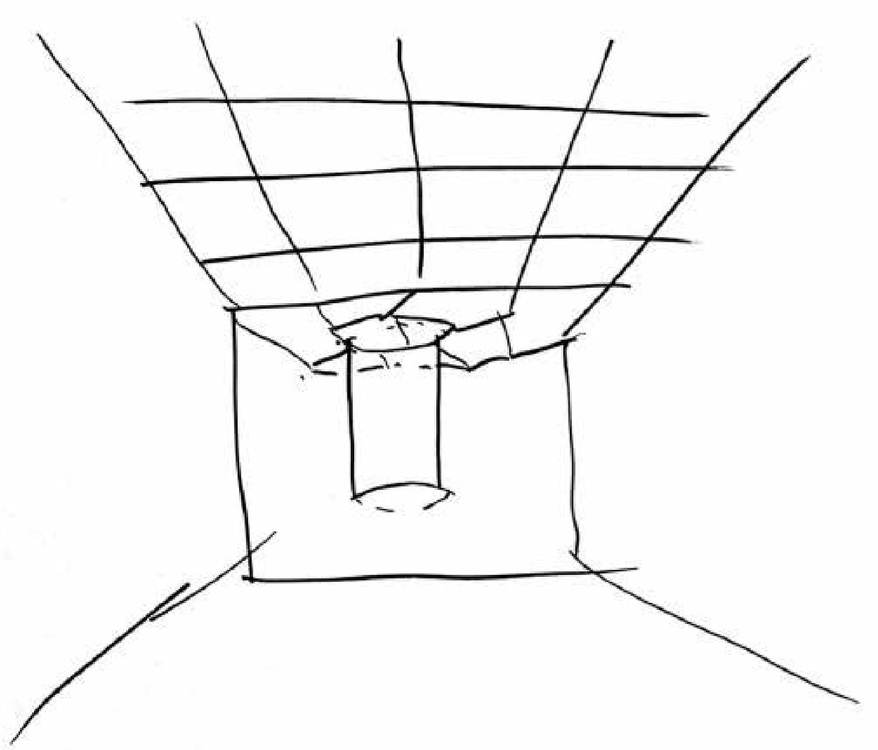


Illu. 107 - Access and Privacy Map



Illu. 108 - Independent Spacing Principle

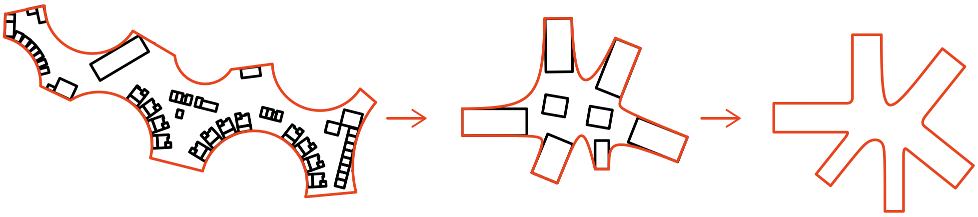
establish privacy in the 'residential' wings (Illu. 107). These residential grids would then be angled relative to each other to make room for the other service branches (Illu. 108).
The two wings intersection and overlap were then managed to create a central gathering



Illu. 109 - Glass Column Motif from Residential Corridor

zone framed by two glass columns, which would light up the building core and display the forest wrapping around the building (Illu. 109).
This was later switched to one glass column to avoid condensed and exposed zone between the columns.

The original concept idea shown on page 84 (Illu. 81 and 82) used a lot of glass panels. To lower the GWP and to avoid overheating, this was changed into the closed of facade,

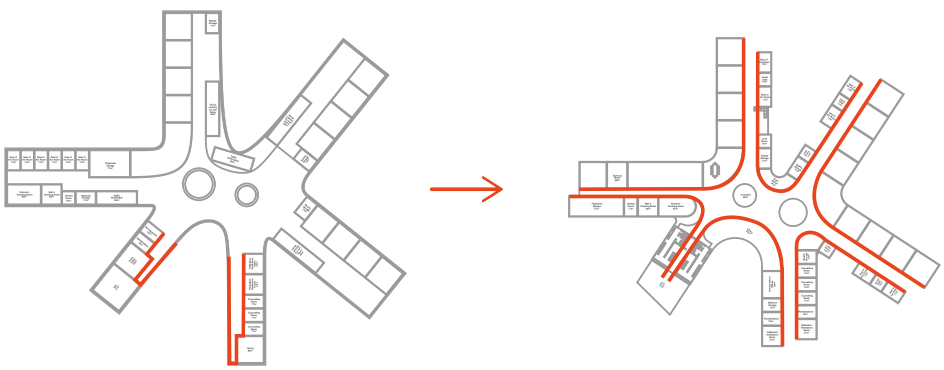


Illu. 110 - Changes to the Shape of the Branch Concept 'Post-sketching Phase'

with different shading principles and cantilevering expressions discussed to make outdoor spaces usable in all seasons of the year; patients with a terminal diagnosis might only get to experience the building during one season. (See Shading section page. 99)

To shorten walking distances, the new building shape was wider than the initial idea for the concept, but overall distances were shortened significantly. The building shape and program dispositions were investigated and changed throughout the design process, with rooms and wings being moved, reorganised, or changed altogether, to better the overall usability and design. This process is elaborated on for each function later in Appendix 4.
The program and functions were resized to fit the building grid and placed in groups depending on relevance and usage: functions that were rarely used were placed at the far ends of the building, allowing users to be closer together most of the time. The early iterations of room placements paid little attention to the aesthetics of the plan, producing some weird and slim spaces.
Initially the grid was made of segments sized 3,5 meters, which was the closest whole number to the preliminary apartment designs' size. The grid's measurements were enlarged to 3,6 based on recommendations by Neufert (Neufert, 2019, p. 541) and to accommodate standard measurements in the building sector, leading to some more generously sized rooms.

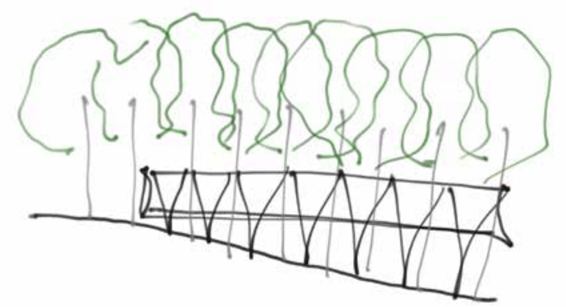
With the grid size determined, all functions were reshaped and scaled to fit the grid with an area close to the recommended numbers in Real-Danias Hospice guide (Nissen et al., 2009, pp. 37-42) to create aligned and flowing spaces (Illu. 111).



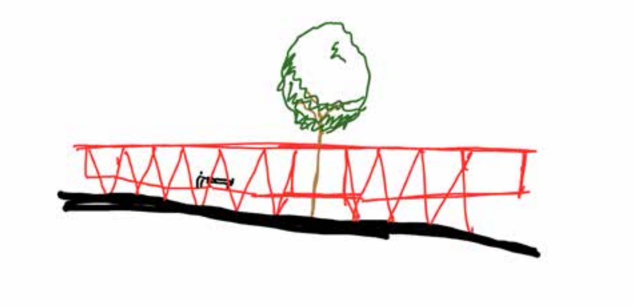
Illu. 111 - Functions and Lines Getting Aligned

Touching the Ground

One of the very important parts of placing the building in a forest was to be delicate with the ground and preserving the trees' roots: Initially the plan was to elevate the building with ground screw piles, which could be carefully placed to avoid severing the tree root and thereby killing the trees. Initially tested with a flat building floor, it was discovered that the building would cantilever three meters above ground, making some long and dark spaces beneath the building, where wind would be compressed, establishing an uncomfortable micro-climate around the building (illu. 112). Later when the functions had been placed, the spa area ended in a cantilevered section. The columns carrying those cantilevering wings would have to be big to support the loads from the pools as well as wind loads. As a result, other options were considered to shorten the columns below the building.



Illu. 112 - Flat Plan Cantilever



Illu. 113 - Undulating Ramp Following the Terrain

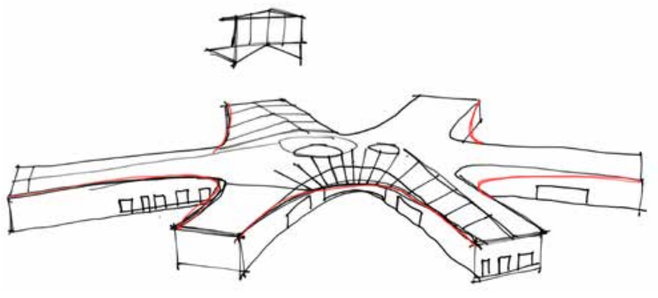
One way of achieving this was to use ramps to let the building float above the undulating terrain (illu. 113). This would almost eliminate the unattractive spaces beneath the building. However, the ramp principle turned out to be undesirable: When it was tested in a residential corridor the ramp had to be very steep to even come close to the level of undulation in the terrain. Furthermore, the floor geometry to enter the intimate niches also became awkward and steep, making it difficult to enter in a wheelchair or in a bed. The idea was scrapped to ensure a democratic user experience for all levels of mobility.

Through the design process it was also recognised that the building had to have some wide volumes which would rob all organic life under the building from its vital solar nutrition.

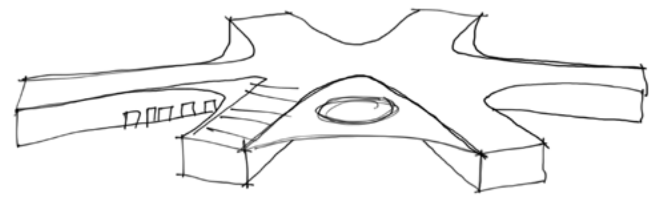
As a culmination of the obstacles posed by ramps in certain areas and the unlikelihood of wildlife surviving under the building with no light, it was decided to manipulate the ground directly below the building, to maximise the building usability and minimise the impact of the surrounding forest.

With the building touching the ground, a decision was made for the floor to become a concrete slab to gain some thermal mass to store heat which improved energy efficiency. This in turn allowed for more use of glass which strengthened the link between inside and outside.

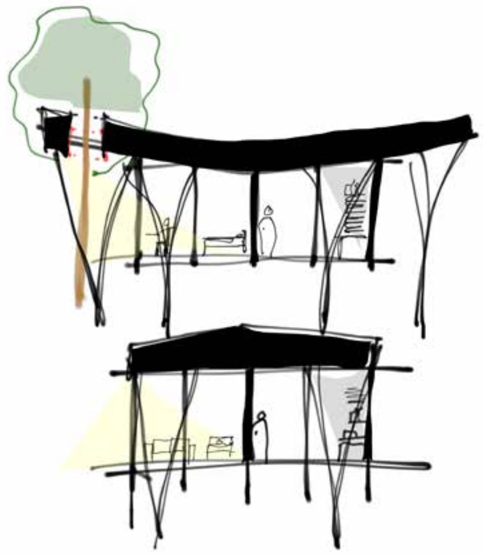
Shading



Illu. 114 - Wall and Roof Curvature Differing to Make Shading



Illu. 115 - Hole for Southern Terrace



Illu. 116 - Sections Discussing Nature, Terraces and Roofs

When the building detailing started, a discussion was initiated about the general building shape and the roof: When the building was a solid mass in the 3D sketching some concern about overheating and integrating the roof were investigated in 3D and in section: Different shapes and interpretations of the building parts were considered: One idea was to allow the curvature of the walls and roof to differ, see illustration 114. An extreme version of this idea was to carve a hole to cover parts of the terrace of the building (illu. 115). However, this idea would block the sunlight during wintertime.

Another topic of investigation was the shading of terraces and the integration of the roof geometry: Patients are expected to live less than six months, meaning that the functions of the building must function as if it were the best time of year. The roof had to strike a good balance between giving sunlight and avoiding overheating during summer, at shielding from rain and snow, without blocking the sunlight. This had to be considered in tandem with the terrace, and how close you come to nature. Illu. 116 shows some considerations of whether to let trees grow through the terrace, or whether to avoid an overhang, and let nature come all the way up to the building facade. To avoid putting obstacles on the terrace it was decided to choose a middle ground, the trees don't go through the terrace, but where the terrace is placed right up to the trees.

In the end it was decided to break the building volume into three pieces: the terrace, the roof and a retracted facade.

The roof corners were later filleted to articulate the soft organic dynamic of the building, making it look more inviting.

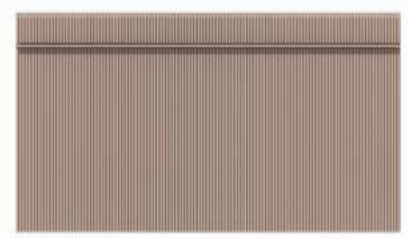
Facade Expression

The facade expression was investigated to find a subtle, yet interesting pattern, which gives the building exterior some excitement and dynamic, while keeping a generally understated and natural appearance.

The depth, shading and patterns, as well as the overall composition was investigated to make the building look inviting and exciting, without compromising the calm atmosphere, and the feeling of privacy and dignity. As shown on illustrations 117 and 118 different orientations and detailing of the cladding affects how the looks of the building. The vertical cladding (illu. 121) was chosen as to not over emphasise the length of each building wing.
To add some intricacy to the pattern, some dividing lines were made to move moisture away from the construction, and to hide the track for the sliding shutters. They would align with the window divisions, where the top of the doors meets the bottom of the fixed windows These details would add a dynamic layer to the shadows on the facade (illu. 119 and 122).

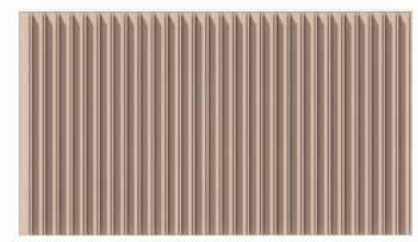
Illu. 117 - Sheet Wood Cladding

Illu. 118 - Horizontal Wood Slat Cladding



Illu. 119 - Wooden Detail for Shutter Tracks

Illu. 120 - Simple Opening With Vertical Cladding



Illu. 121 - Vertical Wood Pattern

Illu. 122 - Small Slats Divided Over Door

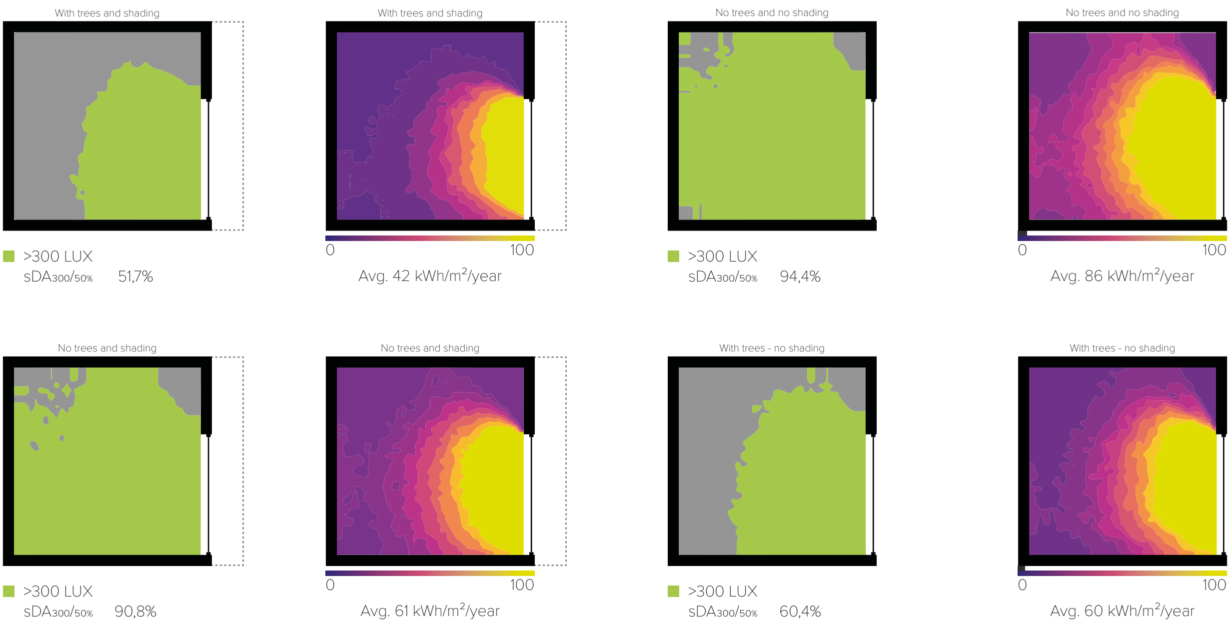
Illu. 123 - Window Divided by Horizontal Ribbon

Illu. 124 - Model Placing Window Ribbon Between Waffle Beams

To make the roof appear lighter an investigation was conducted looking at placing a ribbon of windows between the protruding beams (Illu. 124), or below them. To let in more light, the windows were placed below the construction, as the view out would be partially obscured by beams placed in front of the beams. These window ribbons were placed along the changing rooms, storage rooms, massage rooms, and the morgue.

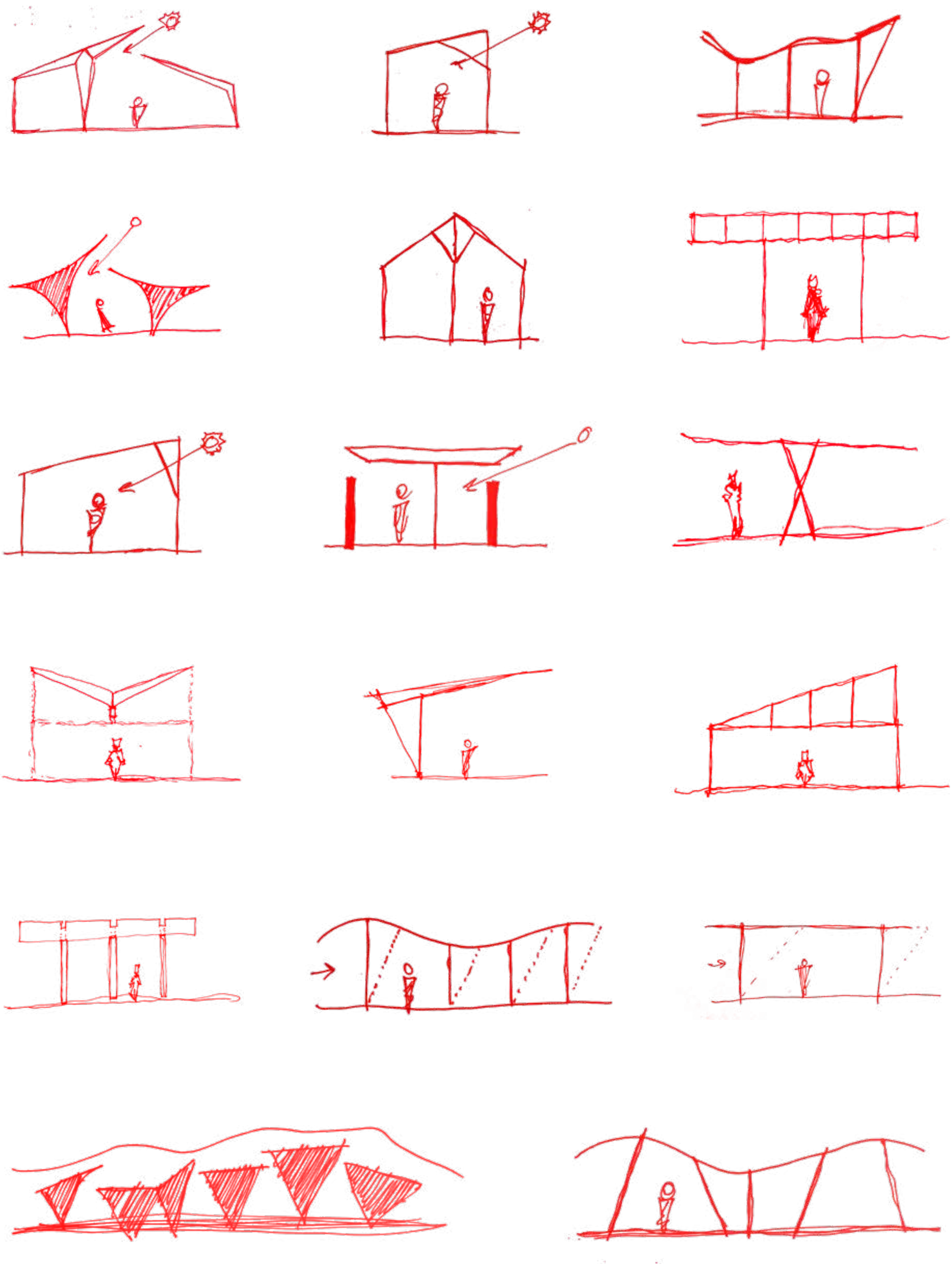
Lighting conditions

At certain times in the design process, 'Daylight Availability Simulations' were performed to ensure that the building complied with the Danish Building Regulations' paragraph 379 with regards to visual comfort (The Danish Building Regulations (Bygningsreglementet), 2018). Appendix 5 contains a detailed analysis of the lighting conditions.



Illu. 125 - Apartment Lighting Simulations

Construction

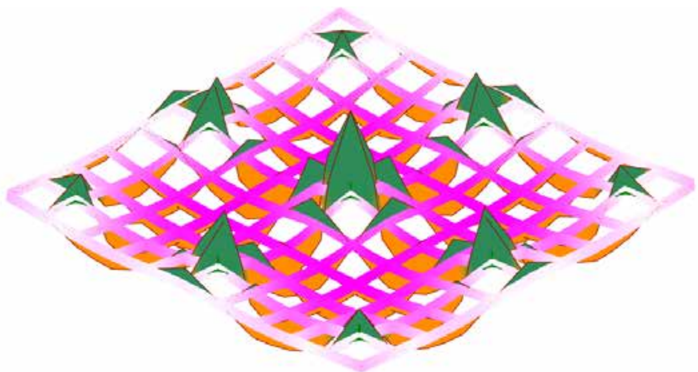


Illu. 126 - Construction Process

The ”Waffle”

As the grid defining the waffle construction is a set of rules used to define the rooms and spaces in the building, it is important to understand its gesture along with it having the right dimensions to handle the loads applied to it. This was investigated in” Karamba”, a FEM tool for grasshopper. Here, different cross sections, spacing and support placement was investigated along with visualisations of the gesture it added. The cross sections investigated are industry standards so that the elements would be easy to construct.
To accommodate the user and the user needs, the grid has been investigated with spacings that add up to the number of 3600mm.

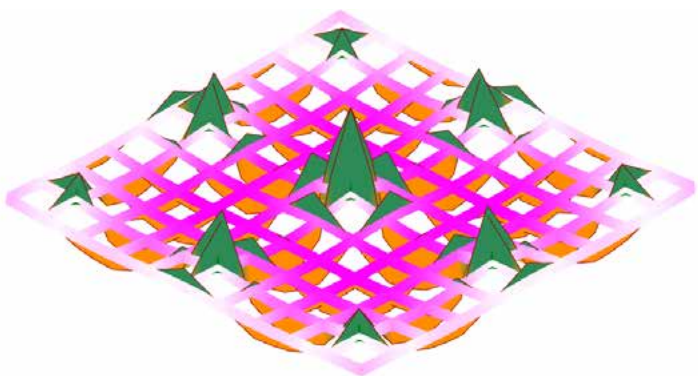
1800x1800mm
Glulam Timber GL32h
Cross Section 500x65
Displacement = 2 cm
Allowed displacement = 1.8 cm



Illu. 127 - Moments and Deformations Affecting a 1.800 x 1.800mm Grid of 500 x 65mm Beams

The first iteration had a displacement that exceeded the allowed displacement. Therefore, the width of the element was increased to strengthen the elements.

1800x1800mm
Glulam Timber GL32h
Cross Section 500x115
Displacement = 1.2
Allowed displacement = 1.8

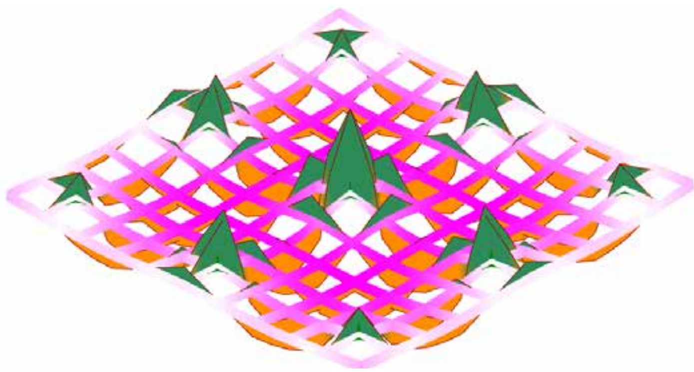


Illu. 128 - Moments and Deformations Affecting a 1.800 x 1.800mm Grid of 500 x 115mm Beams

For the second iteration, the displacement of the elements did not exceed the maximum allowed. Therefore, the construction was visualized to articulate the spatial gesture. The structure has the desired appearance which are thin elements in relation to the structure's height. As the displacement threshold was not exceeded, the cross section of the beam was decreased to lower material usage in the construction.

Illu. 129 - Phenomenology of a 1.800 x 1.800mm Grid with 500 x 115mm Beams

1800x1800mm
Glulam Timber GL32h
Cross Section 467x90
Displacement = 1.79
Allowed displacement = 1.8

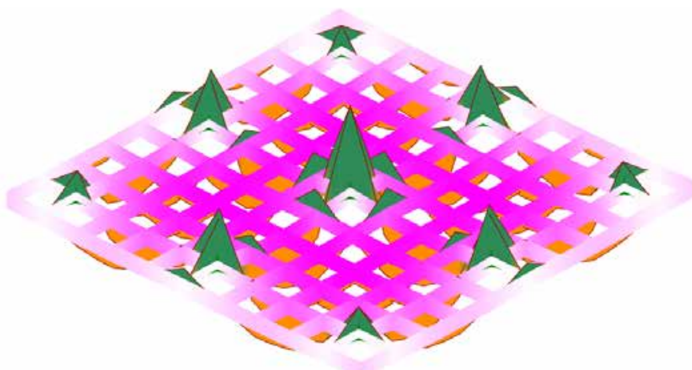


Illu. 130 - Moments and Deformations Affecting a 1.800 x 1.800mm Grid of 467 x 90mm Beams

As the cross section was lowered, the displacement of the construction did still not exceed the allowed but was very close to the maximum allowed. As the visual expression did not change much from the first iteration, a more radical change was made to investigate the gesture of the construction. As increasing the cross section also meant that the material would be over utilized, the material strength was lowered for the next iteration.

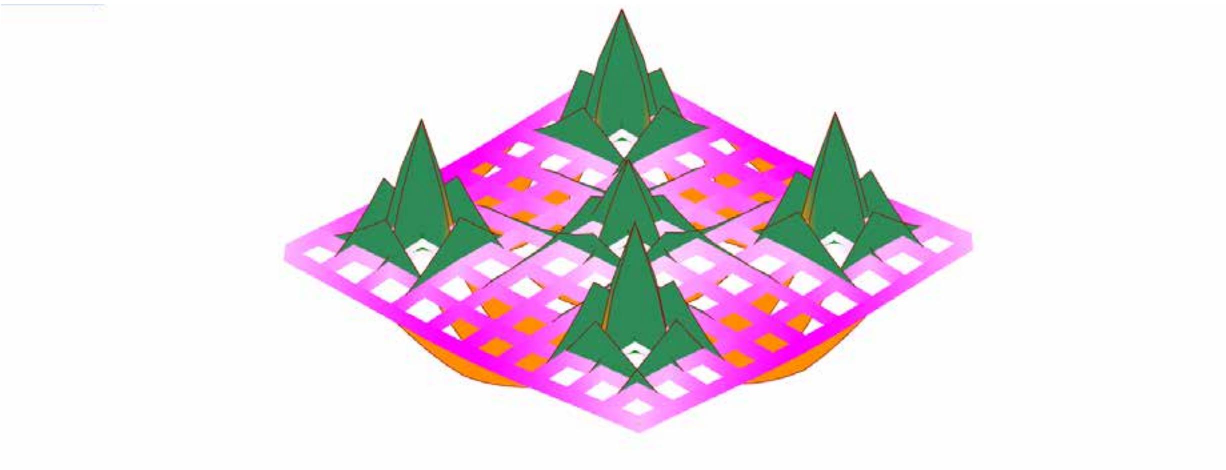
Illu. 131 - Phenomenology of a 1.800 x 1.800mm grid with 467 x 90mm beams

1800x1800mm
Glulam Timber GL24h
Cross Section 767x90
Displacement = 0.66
Allowed displacement = 1.8



Illu. 132 - Moments and Deformations Affecting a 1.800 x 1.800mm Grid of 767 x 90mm Beams with 9 Supports

Still, by lowering the strength of the material the construction is still over utilizing the material. This meant that the material could spare some of the defined supports.
By removing 4 supports the displacement is raised to 1.6, which utilizes the material much better in terms of displacement. However, this will place greater demands on the columns transferring the loads to the ground.

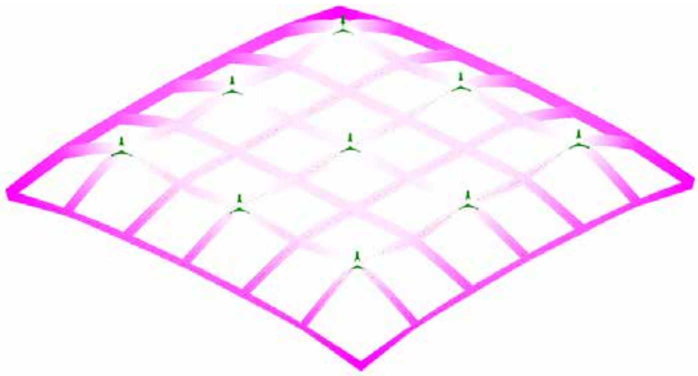


Illu. 133 - Moments and Deformations Affecting a 1.800 x 1.800mm Grid of 767 x 90mm Beams with 5 Supports

Looking at the visual appearance of the construction, it still has a great aspect ratio between its height and width and achieves this “slenderness” which is wished. However, the construction makes the room feel cramped, as it comes too close to the ground floor.

Illu. 134 - Phenomenology of a 1.800 x 1.800mm Grid with 767 x 90mm Beams

3600x3600mm
Glulam Timber GL32h
Cross Section 500x65
Displacement = 4.5
Allowed displacement = 3.6



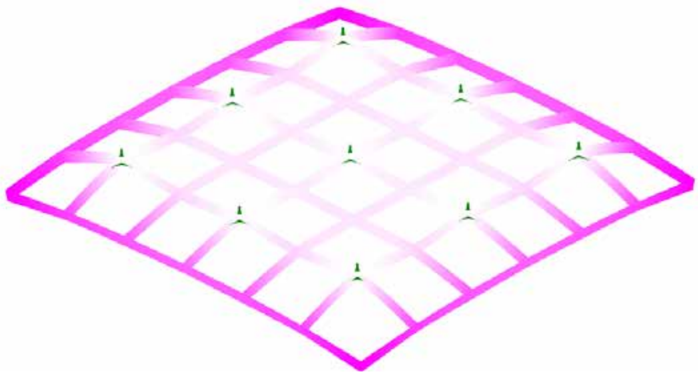
Illu. 135 - Deformations Affecting a 3.600 x 3.600mm Grid of 500 x 65mm Beams

Spacing the beams with 3600mm creates a new gesture in the room. The roof is much more exposed than in the earlier iterations. The spacing means that the allowed displacement changes, as the span increases.

Looking at the first cross section, it is not dimensioned in an extend where the displacement of the beams complies with the maximum displacement.

Illu. 136 - Phenomenology of a 1.800 x 1.800mm Grid with 500 x 65mm Beams

3600x3600mm
Glulam Timber GL32h
Cross Section 500x90
Displacement = 3.4
Allowed displacement = 3.6

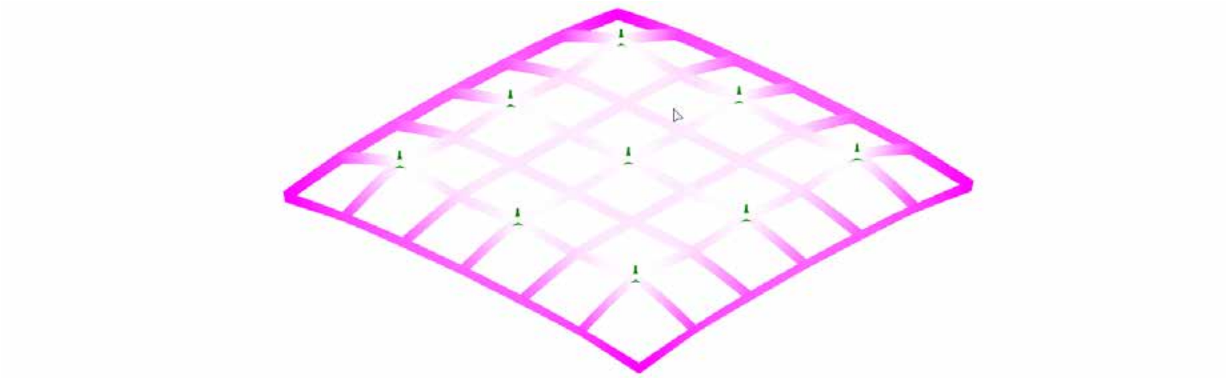


Illu. 137 - Deformations Affecting a 3.600 x 3.600mm Grid of 500 x 90mm Beams

To accommodate the displacing in the beams, the width of the beams was increased, as a bigger height than 500 mm made the space feel too cramped. By increasing the width to 90 mm the construction did not displace above the threshold. It created the same spatial gesture as the iteration before but complies with the threshold.

Illu. 138 - Phenomenology of a 3.600 x 3.600mm Grid with 500 x 90mm Beams

3600x3600mm
Glulam Timber GL32h
Cross Section 467x115
Displacement = 3.34
Allowed displacement = 3.6

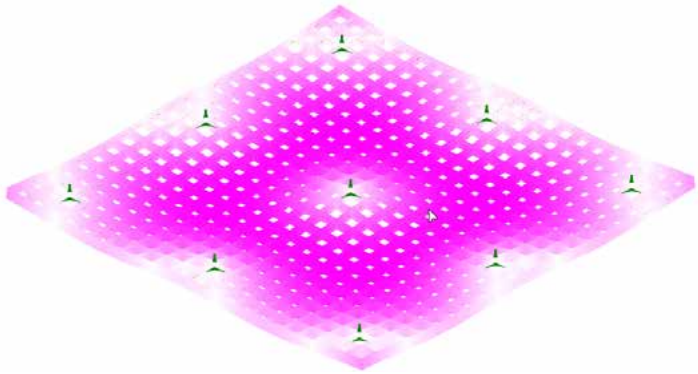


Illu. 139 - Deformations Affecting a 3.600 x 3.600mm Grid of 467 x 115mm Beams

To investigate a lower height with this spacing, the width had to be increased. Tweaking the parameters in Karamba, the construction would go beyond the threshold with a lower height than 467mm. This didn't change much in terms of visual appearance which meant that the room was perceived in the same way as the earlier iterations.

Illu. 140 - Phenomenology of a 3.600 x 3.600mm Grid with 467 x 115mm Beams

900x900mm
Glulam Timber GL32h
Cross Section 500x65
Displacement = 1.25
Allowed displacement = 2

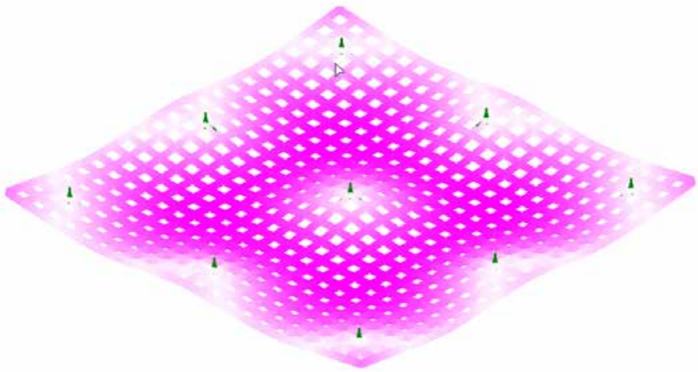


Illu. 141 - Deformations Affecting a 900 x 900mm Grid of 500 x 65mm Beams

Spacing the beams with 900 also changed the room perception, more drastically than the others. The construction does not reveal any of the roof, creating some curiosity within the room. However, the pattern does feel too repetitive and can be perceived as confusion. This type of spacing does allow for very slender profiles where even thinner elements could be investigated.

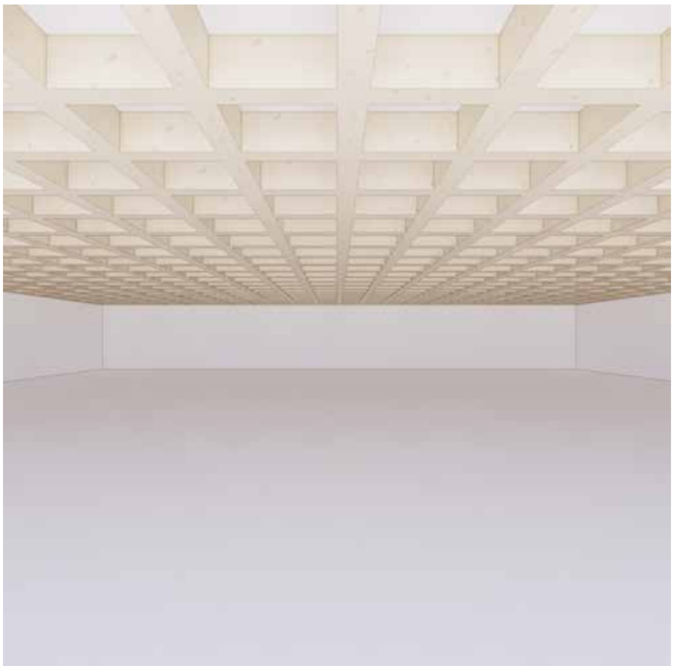
Illu. 142 - Phenomenology of a 900 x 900mm Grid with 500 x 65mm Beams

900x900mm
Glulam Timber GL32h
Cross Section 300x185
Displacement = 1.89
Allowed displacement = 2



Illu. 143 - Deformations Affecting a 900 x 900mm Grid of 300 x 185mm Beams

For the last iteration a new type of profile was investigated. This type of profile is squarer which in this very small spacing reveals the roof. The height has been decreased and the width increased to obtain this square form. This heightens the displacement of the construction, as the moment of inertia is not utilized fully. This composition did not create the desired spatial gesture, as the elements did not have this slenderness.

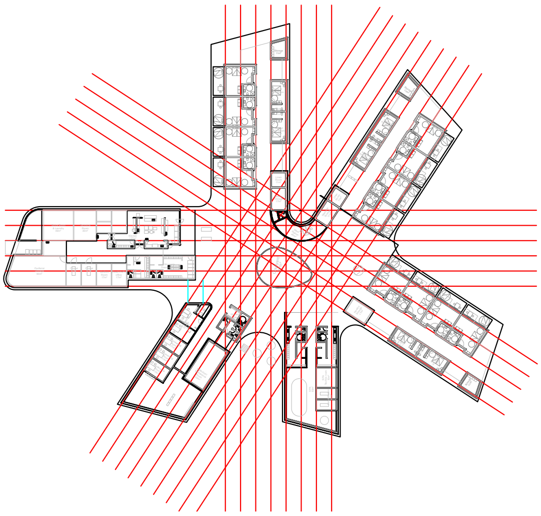


Illu. 144 - Phenomenology of a 900 x 900mm Grid with 300 x 185mm Beams

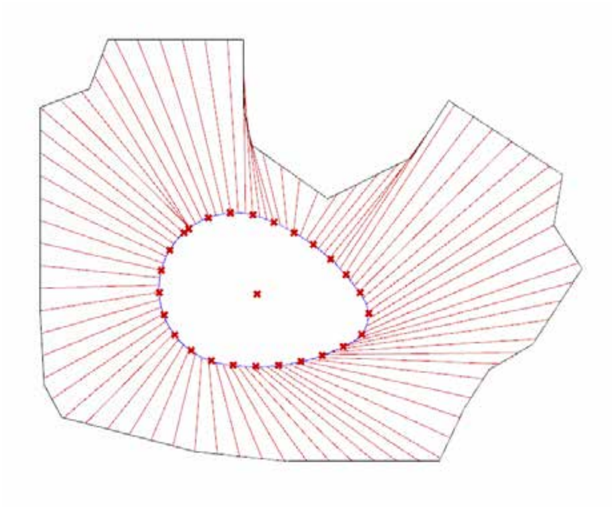
Core structure

The dynamic building shape of the new branch concept resulted in challenges for the core's construction structure: It was anticipated that the triangulated grid could be applied to the new shape (Illu. 147). However, during the development of plan layout, a test was conducted by investigating the way the two grids interacted with each other (Illu. 145). Having a rational building structure meeting an organic shape showed to be difficult, and therefore another type of construction was needed in the middle to obtain this translation. Several different construction types were investigated (illu. 146 and 148):

Various types of grids were tested but were incompatible with the asymmetric building core, leading to structural misalignments (Illu. 146).



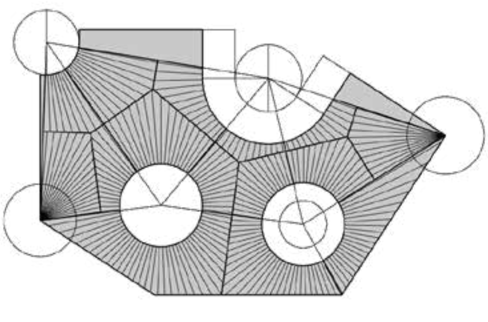
Illu. 145 - Lines from Waffle Grid



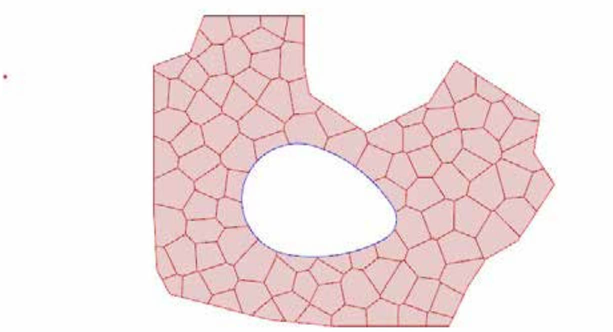
Illu. 146 - Lofting Inner and Outer Core Geometry

Grid Structures

To try a more dynamic and irregular grid type, the Voronoi structure was investigated. This was because it had the ability to merge with the grid structure and create more organic shapes towards the middle of the building. This also supported the vision of the construction; Having a grid where space is tightly defined through structure in the grid and the heart of the building becoming a more organic, undefined space that the residents can define on their own (Illu. 148). However, due to the difficulties or defining the joints and element segments, it was later disregarded for a simpler principle.



Illu. 147 - Circle Triangulation Structure

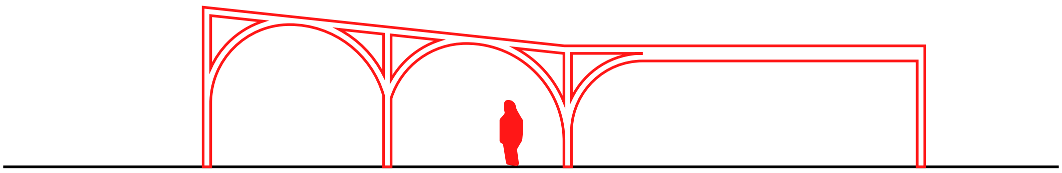


Illu. 148 - Voronoi Grid Structure

Rampant Arches

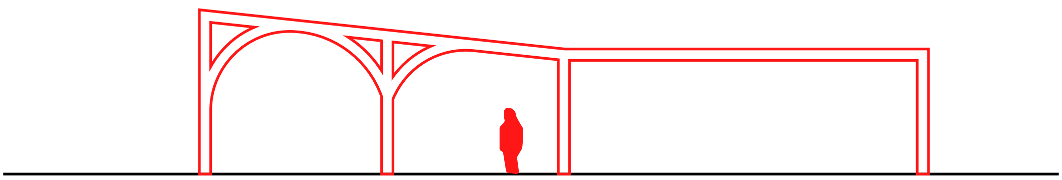
To simplify the structure, a system of beams and columns were tested to span from some carefully placed support structures. After the columns were placed, a critical span of 18,7 meters was found and investigated: To avoid getting to large beams a method to shorten the span was discussed.

One idea was to establish rampant arches to articulate the rising hierarchy growing into the central courtyard. The design and geometry of the rampant arches were designed using the graphical construction described in the study of the ideal geometry of rampant arches (Velilla et al., 2019) (Illu. 149). Upon testing the principle in a render model, the forest of arches and columns were deemed to interrupt the flow in the building centre and looked overwhelming (Illu. 150 and 153).



Illu. 149 - Double Rampant Arch

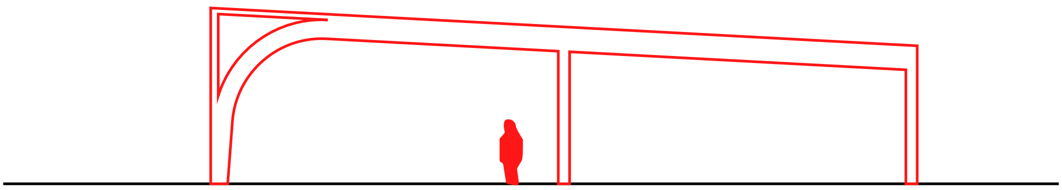
Illu. 150 - Phenomenological Sketch of Rampant Arch from central Lounge area



Illu. 151 - Single Rampant Arch

Illu. 153 - Phenomenological Sketch of Rampant Arch from Canteen

The arch had a good poetic symbolism, and simplifying the beams to only arch from the centre gave an expression like branches sprouting from the trunk of a tree, articulating the overall building concept, and giving the impression of walking beneath a flower (Illu. 154). Beams with a span exceeding 10 meters were given a supporting column to avoid getting too big beams and keeping a feeling of light weight in the room.

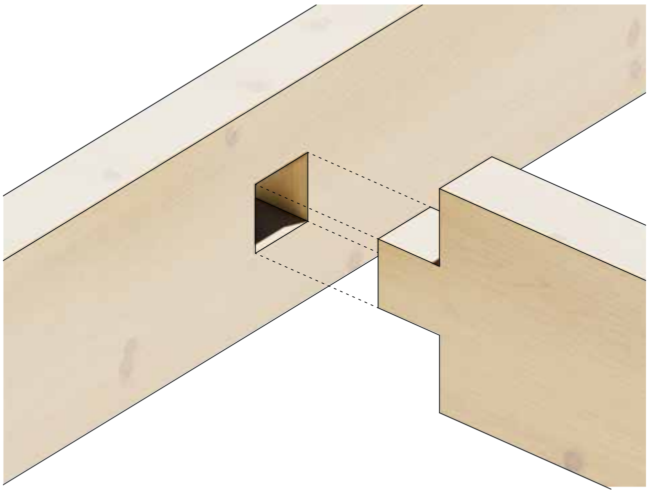


Illu. 154 - Simplified Beam Arch

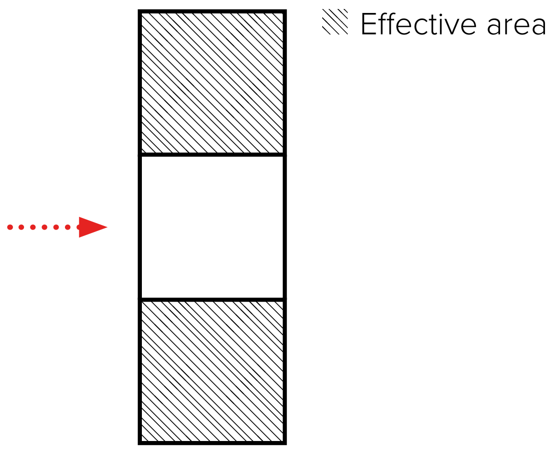
Joints and Details

For assembling the waffle, various iterations have been made to investigate the meeting between the beams. When assembling the structure, it is important to judge the assembly from an aesthetical and a constructable point of view. For these iterations, looking at the effective area and visualising the assembly gave us the tools to pick the best iteration.

In the first iteration the joint between the beams is invisible. This is achieved by cutting a hole and a corresponding profile in the elements. The issue with this type of joint is removing a large amount of the effective area that distributes the loads as well for the beam that receives the loads (Illu. 155 and 156).

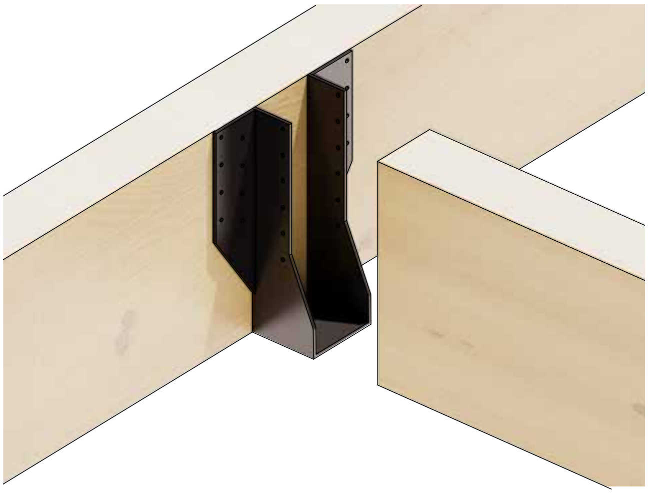


Illu. 155 - Joint Iteration 1

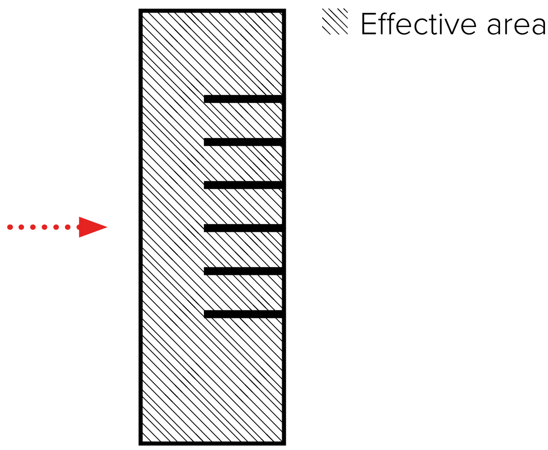


Illu. 156 -Joint Iteration 1 Effective Area

The second iteration consists of a joist hanger. The hanger is very visible, as it surrounds the beam that it supports. Unlike the first iteration this does not remove much of the effective area, as the joist is screwed onto the beam. The beam that it supports can be laid onto the hanger joist leaving it intact. Although this is a more effective joint, the aesthetics of it are not pleasing, as it would dominate too much in a repetitive pattern (Illu 157 and 158).

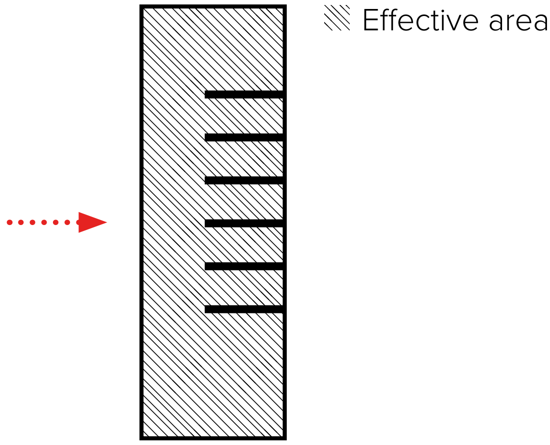


Illu. 157 - Joint Iteration 2



Illu. 158 - Joint Iteration 2 Effective Area

The last iteration is cutting a slot into the beam with space for a plate that is then screwed on to the other beam. This iteration can be partially or fully hidden to obtain the aesthetics wanted. This iteration removes more effective area than the second iteration, but less than the first one. The holes can be filled with wood hiding the screw holes to obtain a fully covered look (Illu. 159 and 160).



Illu. 159 - Joint Iteration 3

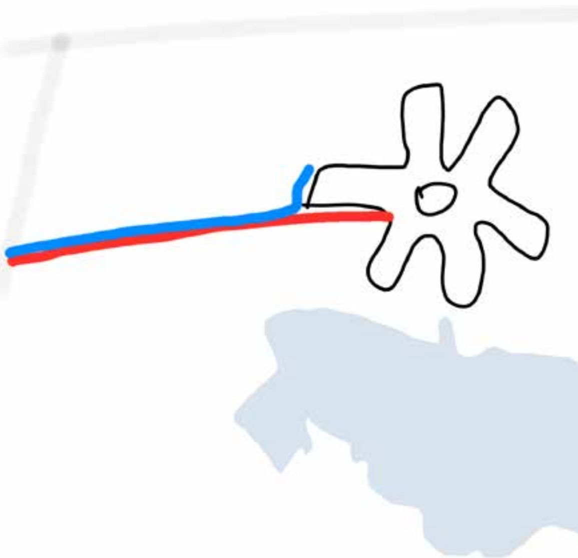
Illu. 160 - Joint Iteration 3 Effective Area

When evaluating the joints from an aesthetical and construction point of view, the last iteration is the preferred one, due to the low impact on the material cross-section and the subtle visual appearance.

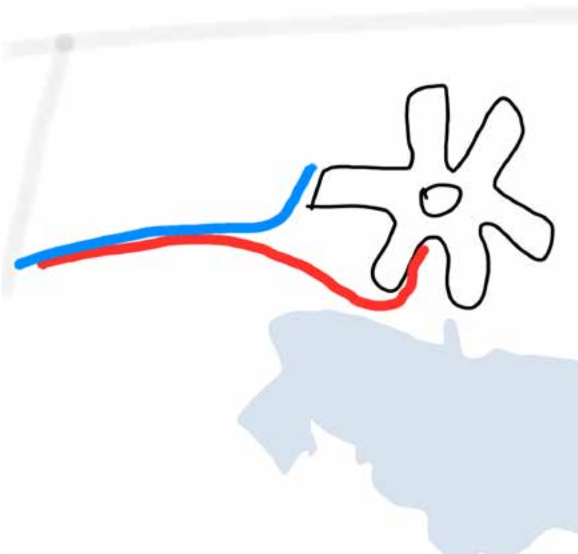
Access and Approach

Upon designing the plans, two locations were discussed for the building entrance: On the west side and on the south side: The two locations had certain pros and cons: The west side, while allowing easy and close access to the building was in the dominant direction for the micro-climatic wind (Illu. 161). On the south side, the entrance would be shielded from the wind (Illu. 162). However, the walk to the building would become exceedingly long, and as the terrain tapered away from the building, a new structure had to be defined, which could harmoniously de-laminate from the building terrace.

Considering both options, the west facing entrance became preferable, as its issues could be solved easily through precise placement of vegetation. Its beneficial logistical possibilities were also more suitable for the primary user group’s physical condition.



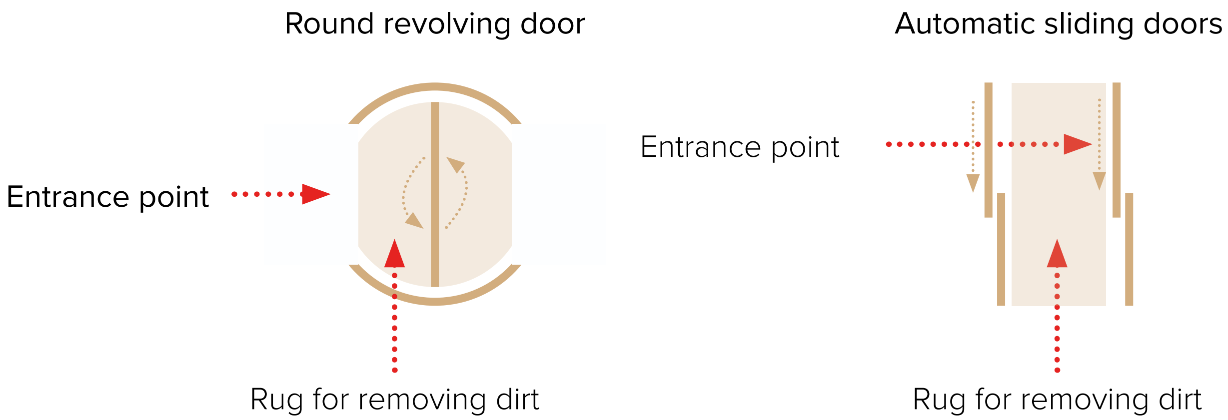
Illu. 161 - Access and Main Entrance on West Side



Illu. 162 - Access and Main Entrance on South Side

Investigating the Entrance

As the plan and the overall concept came closer to its final form, some questions about the arrival and the entrance occurred. The entrance is an important part of a design and should be very clear so that people understand where to enter. Having a user who might arrive in a wheelchair, the access to the hospice should be made easy. Therefore, automatic doors were discussed within the group. As the environment in a hospice also should be - as much as possible, sterile, a short buffer zone for dirt to fall off was also discusses. These ideas where then investigated in 3D.



Illu. 163 - Entrance Door Considerations

Iteration 1

The first iteration was a round revolving door with a short overhang. This idea was initially thought as a strong concept for the entrance, as the round shape would fit the building curvature well. As it was visualized, we realised that the round entrance countered the shape, and the short overhang didn't define that entrance point as wished. A round revolving door would also demand constant movement when entering, which can be a challenge for ill and weak people.

Illu. 164 - Entrance with Revolving Door

Iteration 2

This iteration consists of two automatic sliding doors with a short overhang. Again, this doesn't frame the entrance point as wished, but the two flat and parallel doors make it easier for people with limited mobility to enter as it creates a zone in between with space for resting if needed. Therefore, the ongoing iterations will be based on this type of door.

Illu. 165 - Entrance with Short Overhang

Iteration 3

For the third iteration, the overhang has been made bigger. This was to frame the entrance more and make it more dominant. As an addition, the overhang has been cut for trees to stand through it. This was to blend the space with its surroundings.

Illu. 166 - Large Overhang with Cut-out for Trees

Iteration 4

For this design, the overhang has been scaled up even more. This was to investigate if the space underneath became dark and unwelcoming. Here, columns have been added to highlight the entrance and mimic the forest surroundings.

Illu. 167 - Massive & Supported Overhang

Iteration 5

For the fifth iteration, the investigation was based on the ceiling construction inside the house continuing outside underneath the overhang. This was to create a connection between inside and outside when patients, staff and relatives enter the hospice.

Illu. 168 - Exposed Waffle Overhang

Iteration 6

The last iteration is a hybrid of the previous investigations. As the overhang felt too dark in the fifth investigation, it has been scaled down. The structure in this iteration now meets at an angle, and some of the squares created from this structure have been cut to make space for trees to enter through. The cuts also make the space less dark. To make the space blend in with its surroundings, some columns have been added to again, mimic the trees.

Illu. 169 - Overhang with a Combination of All Previous Iterations

Conclusion

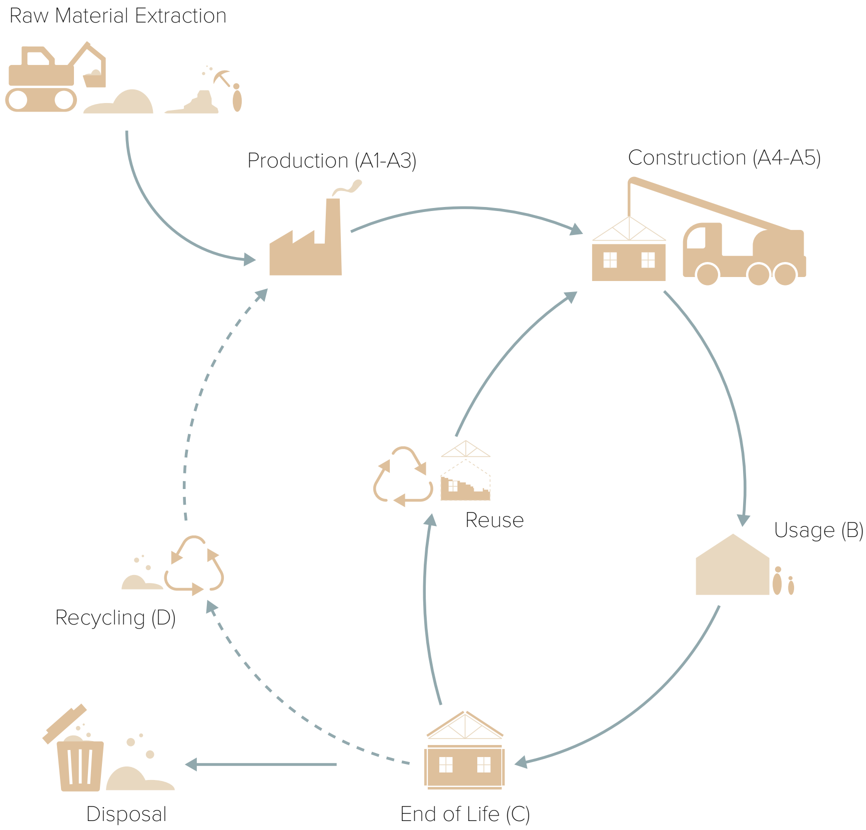
The chosen entrance became the third one. This is because the trees become a part of the arrival and blends in with the building. The columns and the construction seemed to “pasted on” and gave a messy look which is not the intention of a entrance which should feel welcoming.

LCAM

Life cycle assessment is a tool used to evaluate the environmental impact of building materials through their entire life cycle. Due to the increasing amount of CO_2 in the atmosphere, it is therefore important to consider, to lower the total greenhouse gasses. Life Cycle Assessment and materiality (LCAM) is an extended version of the tool. It takes the materials aesthetic appearance and tactility into the account, and the perception of the material in relation to its context.

From 2023 the Danish building regulation demands a life cycle assessment of buildings over 1.000 m^2, with a threshold of 12 kg CO_2 pr. m^2 pr. year. The period in which the building is considered operating is 50 years, therefore all aspects of the materials are considered within a 50-year life span. The phases that should be included are A1-A3, B4, B6, C3, C4 and D. A1-A3 is estimating the harvesting of resources, transportation to the manufacturing and the manufacturing. B4 and B6 is considering the maintenance and replacement of the material at the end of their lifetime and the energy usage for operating the building. C3 and C4 is pre-treatment of waste and disposing the materials. D accounts for the potential of re using the material after end of life or serve new purposes. (The Danish Building Regulations (Bygningsreglementet), 2018)

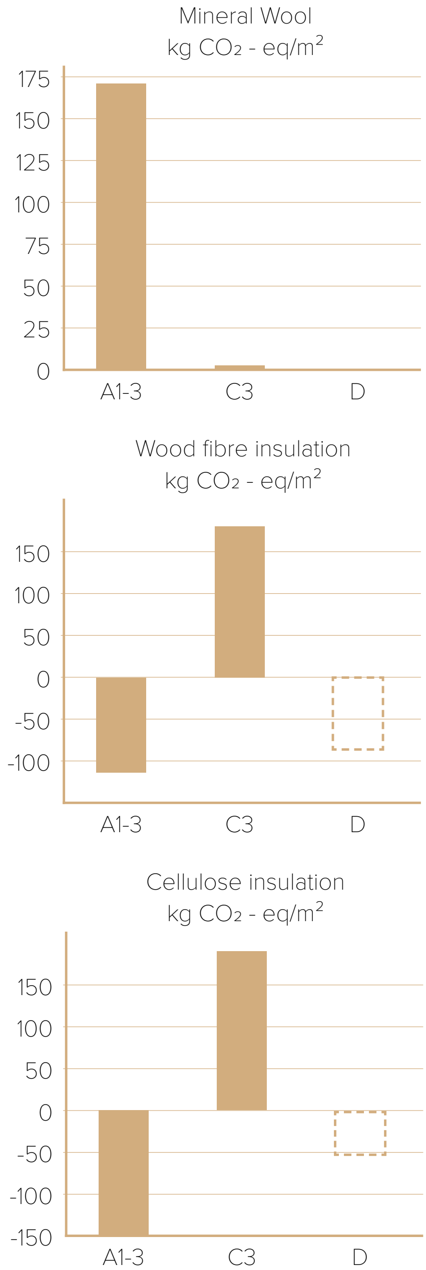
To get a better understanding of the pollution of different construction building parts, the program LCAByg was used to investigate the Global Warming Potential (GWP) for different materials, calculated on 1 m^2 of the building. This was to get a quick understanding of which building materials pollute the most in similar construction elements compared to other materials, and to make it an easier tool to use in the integrated design process, to avoid constructing an entire building for every comparison.



Illu. 170 - Phases in Life Cycle Assessment

As LCAM also considers the materiality, these calculations will focus on the wall construction, its GWP, materiality and U-values. The first thing was comparing the insulation types. This will only investigate for the GWP because it isn't a visible part of the construction, meaning the materiality is irrelevant.
The first insulating material is the mineral wool. The mineral wool is widely used in the Danish building business, as it is cheap and quick to manufacture. Looking at the phases it easy to see that most of the pollutants are from the production and material extraction. Also, the material does not have much potential for reuse after the material's end-of-life cycle, meaning there isn't an offset for the D phase.

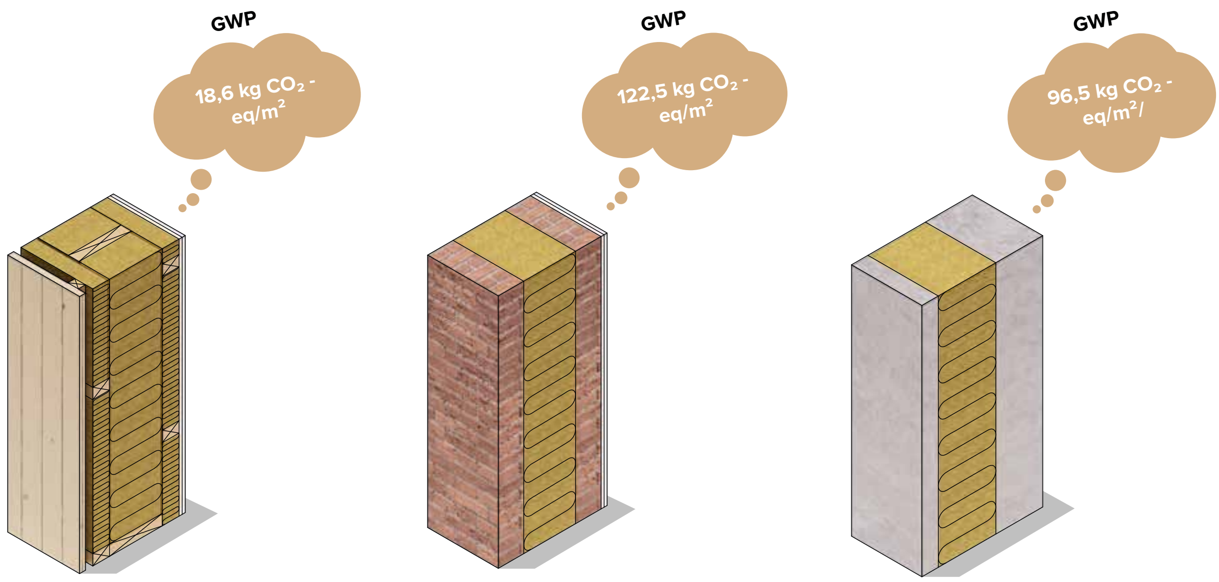
The two other materials are wood fibre and cellulose insulation. In the A phases both have negative values. This is because they both are developed from wood which during its lifetime stores CO_2. When this wood is harvested a new tree can be planted and therefore it will be included in the free CO_2 cycle. These materials are also fit for being reused which will leave the CO_2 bound. If it is burnt, the CO_2 will be released.
Comparing all three materials the cellulose insulation has the overall lowest CO_2 pollution during its lifetime. The materials have almost similar insulating properties which means that the cellulose is the choice to go for.



Illu. 171 - Comparison of GWP in Insulation Materials

Illu. 172 - Side by Side Comparison of Insulation Materials

The Program was also used to investigate the differences in all the wall construction layers. The walls there were compared was a wooden wall with gypsum interior, a brick wall with gypsum and a fully concrete wall construction. All of them were compared using the cellulose insulation as the middle layer. As expected, the wooden construction showed the lowest GWP value, as the tree stores CO_2. It is also important to consider that the tree used for the building would be partially trees cut on site. This would also mean a non-existent transportation distance which the LCA does not consider. As the calculation is done for a lifetime of 50 years, it is also important to consider the building structure's life expectancy. For instance, the wooden structure has a life expectancy of 50 years, the brick 80 years and the concrete 120 years. This means that the wood would have to be replaced or treated up to almost 3 times as often as the concrete. The concrete also has a better thermal mass than wood, meaning it can store heat better. This would allow for a lower energy consumption as the concrete would store the heat absorbed throughout the day and radiate it to heat the building passively throughout the night.



U-Value
0,10 W/m^{2}K

Thickness: 441 mm
25 mm Pine cladding
30 mm ventilated air gap
Wind barrier
70 mm insulation
220 mm insulation
Vapour barrier
70 mm insulation
2 x 13 mm gypsum boards

U-Value
0,14 W/m^{2}K

Thickness: 462 mm
108 mm brick
220 mm insulation
108 mm brick
2 x 13 mm gypsum boards

U-Value
0,15 W/m^{2}K

Thickness: 515 mm
70 mm concrete facade element
245 mm insulation
200 mm insulation

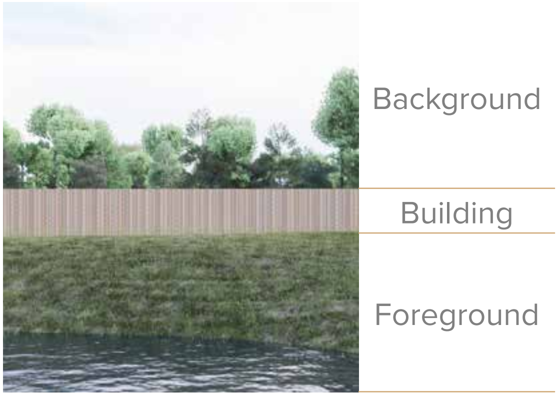
Illu. 173 - Constructions GWP Value for Entire Life Cycle and U-value

To test the materials in the context of a forest environment, a quick 3D model was made to visualize the investigated materials. This was to get a better understanding of how the material is perceived in relation to its surroundings.

From this investigation and based on the LCA calculations the wood was found to be the best material as it is the most sustainable material and is suitable to the surrounding forest.

To link to the forest atmosphere and the theme of biophilia, materials are generally kept to a raw or rustic appearance. The general building materials are concrete or wood for the floors, wood or gypsum for walls. The ceiling will articulate the exposed structure of the wooden waffle construction throughout the entire building.

One other surface will be clad with wood to match the ceiling in all spaces, with the material composition depending on the situation in the room: The bedrooms will be detailed with wooden floors and ceilings to create a familiar warmth. The wooden floors also give a soft and compliant feeling when walking in the apartment. The walls in the apartments will be white to allow patients and residents to personalise their living space with personal items and furniture. That way the room will express their character and make their stay more homely and comfortable.



Illu. 174 - Wooden Facade in Relation to the Forest

Illu. 175 - Brick Facade in Relation to the Forest

Illu. 176 - Concrete Facade in Relation to the Forest

Corridors:
The walls in the corridors are made from sheets of wood coupled with smooth con-crete
floors to contrast the warm wood surfaces on walls and the ceiling and to generate a gen-eral light atmosphere.
The concrete is ground smooth to make a beautiful and durable glossy surface, and to minimise noise from wheelchairs, carts, and beds. The thermal mass of the concrete is also used to store energy, thus making the thermal indoor climate more stable.

The building centre has some large wooden beams sprouting from the courtyard. In the zones with many supports, curved walls with slats sculpted into benches frame the glass looking into the Zen-garden courtyard.

Offices
The offices :and staff rooms have materials like the apartments', giving a compliant and ergonomic surface to work on. The offices and counselling rooms will have glass walls, to give an airy and transparent feeling to the staff wing.

Industrial Kitchen:
The kitchen must have durable sturdy sur-faces that are easy to clean and maintain to meet health and safety requirements. That means a concrete floor, tiles on the wall, and steel tables.

Storage spaces:
The storage area's main requirements are durable materials for storing, cleaning, and maintaining heavy equipment. Therefore, the storage area is clad similarly to the kitchen

Illu. 177 - Material Sample from Corridors

Illu. 178 - Material Sample from Apartments and Offices

Illu. 179 - Material Sample from the Kitchen

07 EPILOGUE

Conclusion

When one is in the last moments with their loved ones, no one can tell whether this is the last moments of consciousness or not. The importance of time spent together may first be noticed when the loved one has passed away. Creating an environment where everyone can participate in all exciting or mundane activities becomes of infinite value, to really show the deep appreciation for each other, and coming to terms with not seeing each other again.

Hospice Vejlbo is a warm and inviting place, where no one is excluded from any activities. The wide and open spaces leave plenty of room for people to interact whether they are ill or well. Having views and access to nature is also a vital part of this kind of building typology: The psychological and physical effects help increase the quality of live for all residents in the hospice, and helps layering the level of exposure and privacy, from open spaces to dense closed off areas for introspective reflection and relaxation. This was made possible from combining dense materials with very efficient insulation and flexible structures.

The rational yet dynamic building shape articulates the forest setting and allows users to be submerged in the dynamic greenery, watching trees move in the wind, seeing how the light and shades move, feeling and smelling the fresh air, and hearing the birds sing and leaves rustle. These sensory sensations are unique to the forest environment. Having a flat site in a forest environment with the views and experiences present at Vejlbo in Silkeborg is rare. It has enabled the building to attain all the architectural and human qualities: Using the versatile structural principles allowed the building to weave closely between the trees without creating extreme internal distances. The relationship between openness, privacy, and connectedness has been a driving factor in the design exploration of this hospice design: Having private and secluded apartments and exposed and inviting gathering spaces allows users to place themselves in an appropriately social situation depending on their energy level and mental state.

The number of apartments has gradually decreased, bringing the various clusters closer together and bettering the overall community within the hospice. The final number of twelve apartments comes with a similar unit running cost as having twenty apartments. Therefore, it was considered a good balance between economic viability and the social interactions.

Upon studying the theory of hospice design and the community and atmosphere linked to a good hospice, the question of: *"how can the people in a hospice live such open and social lives with people they have only recently met?"* We believe that it is because they are going through the toughest and most emotional times of their lives, and those around them are in the exact same situation. Coupled with the way the program shrunk during the design process, a realisation was that hospices need to be intimate: You spend the last moments with a loved one, you share and support moments with people, whom you create strong bonds to. The specialist facilities, and the spirituality surrounding the hospice are too small to not be occupied by more than one family at times, meaning that relationships must be at a certain level to focus on the emotions. Understanding this gives an idea of the extraordinary community that is in a hospice.

Hospice Vejlbo is a take on how to use a poetic setting and a dynamic building form to create a strong internal community between patients, relatives, and personnel.

Reflection

The many functions in a hospice are complex in their own rights, and the original ambitions to have more than twenty apartments and three types of users really challenged what the typology and topography had to handle.

The design proposal you have just seen was placed in densely forested area, with a very flat terrain, given the site's proximity to a lake. But even though the terrain had little undulation, it was still challenging to get a high number of apartments packed close together, creating a community of people capable of showing each other empathy and support. The wings spreading out from the central space gave everyone similar walking distance and was done to remove as many obstacles and barriers as possible. We believe this was a good design compromise, despite affecting the forest floor more than originally intended.

Paths and access points (Outdoor spaces)

Although the small niches in the residential wings have access to the pathways in the park, it would be preferable to keep them private and secluded from people accidentally strolling up to the hospice back door. Addressing this would require a substantial reworking of the main area, adding another entrance between the spa and the lounge area in the gathering zone. Having the paths as a more integral part of the concept would have made accessing the paths easier from a more appropriate semi-public zone, rather than the intimate semi-private niches in the residential wing.

Context versus Tabula Rasa

Designing in a forest has posed certain challenges: It gave us the freedom to design a poetic building shape, which has added a lot of symbolic meaning to the project. However, the lack of a clear patterns or volumes in the context or other bottlenecks to the design language has made choosing a concept harder; As shown in the design process, many unique design approaches were considered and tested before settling on the final concept. The concept exploration was a major setback to the project time-line, leading to certain parts of the design not being investigated to the desired degree.

Balancing Architectural and Engineering Considerations

As mentioned, and shown in appendix 4, a lot of effort was put into solving the functional aspect of the plan. This focus on the Vitruvian Utilitas has led to some of the spaces with the highest influence on Venustas being underdeveloped: The design of the spa and meditation space should have been prioritised much more. The features were discussed extensively. However, few iterations were thoroughly tested for features, atmospheres, and architectural quality. The meditation function at times felt like any other normal function, and its complexity underestimated.

Venustas was a key topic for several of the concepts, with some iterations of the branch lacking in the department, whereas other iterations had too severe shortcomings in the utilitas category of the design. Many aspects of the final plan solution were a combination of venustas and utilitas, where the firmitas considerations felt partially neglected: Firmitas design considerations were only really initiated at the later stages of the Utilias design.

Here challenges with the building core geometry created challenges, which would send the design process a step back – if there was more time – to make another iteration where the shape of the core in relation to the structure of the wings had been considered more carefully.

Geometry of the core

As mentioned in the design process, some difficulties were encountered when merging the grids in each wing of the building with the core. The text addresses the naive approach to the core, and had the concept been conceived in the final guise instead of the longer interpretation mentioned in the *Re-imagined Branch* section, then a more cohesive system would have been planned from the start. This is evidenced in the concept phase, where most of the concepts were shape driven (Firmitas + Venustas), whereas the final concept's design was driven by function (Utilitas + Venustas).

Size and Shape of the hospice

During the research and early sketching phase, the ambition was to include 28 apartments in the design, with 4 family apartments, eight couple apartments, and 16 singles apartments. In the end there were 12 apartments mixing singles and couples. As described in the design process, the apartments were being spread out with people unlikely to interact across clusters. The hospice would have to be in several different departments spread far apart to make room for the required privacy. With limitations to the flat part of the forest in Silkeborg, such compositions would not have been feasible, hence the changes to the initial program.

Indoor environment

Had there been more time to do so, some simulations would have been carried out to verify the quality of the indoor climate. This would have been carried out in critical rooms, like the meditation space, the staff break room, an apartment and the core of the building. In rooms like the staff break room and the meditation space, a lot of glass has been placed facing south, which might cause overheating in the rooms. However, given the views, it has been desirable to frame and showcase as much nature as possible.

Story Boards

The AI generated storyboards were an interesting aspect of the user understanding: Writing prompts to describe the users' situation, and getting visual representations was a quick and efficient way to highlight some of the emotions. As images generated by Artificial Intelligence is a new phenomenon, it took some effort to correlate characters, to make a cohesive look. With technological advancements, it may become a very good tool for articulating emotions and depicting reactions to various spaces, sequences and situations caused by architectural elements. Furthermore, the limited back catalogue for the AI engine used resulted in some images having limited quality, and styles having to vary to tell a continuous story with certain characters.

Ceiling height

Throughout the design process, some additional space had been reserved for ventilation and beams size ‘wiggle-room’. During the presentation phase it was noticed that the actual ceiling height is at 3,4 meters – nearly a full meter over a normal residential ceiling height. The waffle construction and ceiling height should have been lowered by somewhere between the beam height of 467mm or 500mm, to avoid rooms from becoming too tall and industrial. This oversight was noticed too close to the hand in to fix. It is a mistake from the habit of generally working in multiple floors levels with suspended ceilings and needing the additional overhead space.

The ceiling height could be utilised to implement efficient displacement ventilation, however, this would have to be investigated in detail, as cold air low in the room might cause discomfort among users, who perceive it as an unpleasant draft.

Not visiting a hospice

An Interview has been referenced in the theory section, describing the daily routine and usages in a state-of-the-art hospice. Hospices serve a vital role in the efforts of palliative care, hence why only a select few were allowed to visit and interrupt one day. It is unclear how much such a visit would have affected our understanding of the users and hospice design in general, as we weren’t able to experience the atmosphere attributed to a genuine hospice as described by others.

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Tables

Illustrations

08 APPENDIX

As a tool to convey our understanding of the various users' complex emotions and the sensory and atmospheric influences, a series of storyboards were created. These were made using Artificial Intelligence to visualise a text prompt. The final images were made with the Adobe Firefly Program, with some earlier iterations created using the MidJourney generative AI program.

Below are listed the storyboards made, starting with those featured in the main report, along with their respective text prompts and other images made with the same or similar prompts.

Initially it was attempted to make complete story boards in one go. These however proved to be superficial. Therefore, images were made individually and lined up to make a cohesive story arc for each individual user. Some characters might seem stereotypical. However, in the process of making the storyboard, getting consistent character appearances was difficult.

Staff:

Nurse:

1. Care for patient, Text prompt:
A nurse is attending a middle-aged patient in a modern Scandinavian apartment, in a pine forest

General patient interaction, Text prompt:
A Caucasian brunette female nurse with a hair knot is hanging out with some old people in a modern Scandinavian living room, in a pine forest

Text prompt draft:
A nurse is hanging out with patients in a modern Scandinavian apartment, in a pine forest

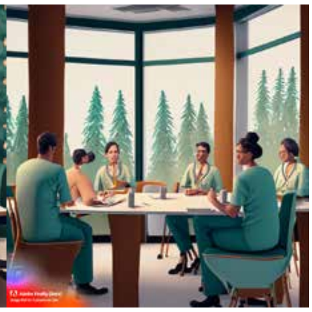
Writing reports, Text prompt:
A nurse is writing patient reports in a modern Scandinavian office, in a pine forest


Meeting/Debriefing with other staff, Text prompt:
A nurse is in a meeting with the other nurses in a modern Scandinavian conference room, in a pine forest

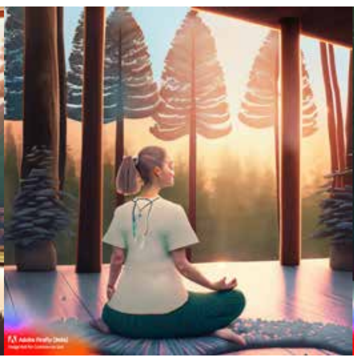


Bloopers:



Meditation/Reflection (Quiet alone time (e.g., in park or meditation space)), Text prompt:
A nurse is meditating in a Japanese style meditation centre, in a pine forest at sunset

Doctor

Briefing, Text prompt:
A blond Caucasian male doctor without beard sits down for a morning briefing in a conference room in a modern Scandinavian building in a pine forest

Draft text prompt:
A blond Caucasian male doctor sits down for a morning briefing in a conference room in a modern Scandinavian building in a pine forest,

A brunette female doctor with a hair bun sits down for a morning briefing in a conference room in a modern Scandinavian building in a pine forest

A doctor sits down for a morning briefing in a conference room in a modern Scandinavian building in a pine forest







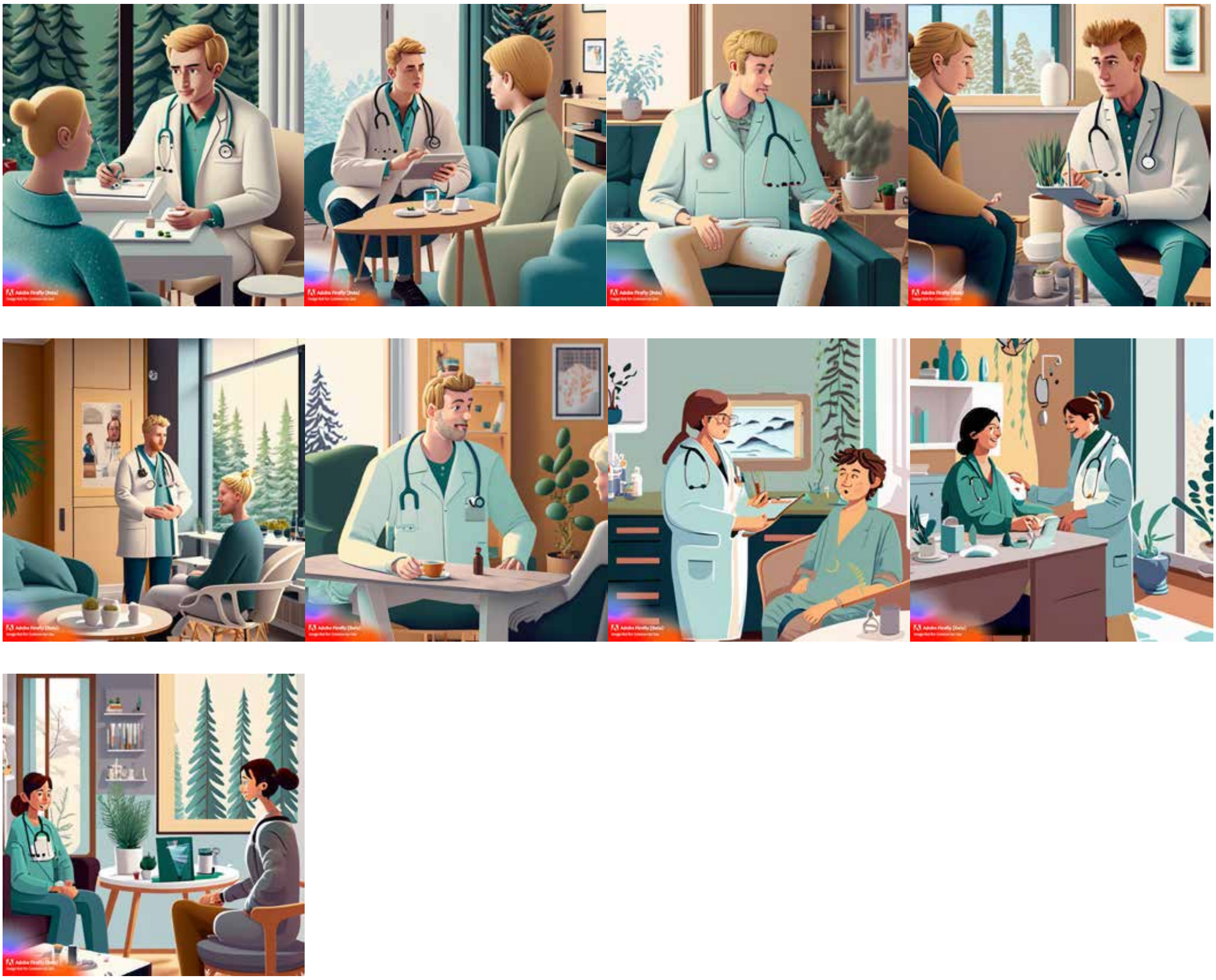


Check-ups, Text prompt:
A blond Caucasian male doctor has a discussion with an ill patient in a modern Scandinavian apartment in a pine forest.

Draft text prompt:
A brunette female doctor with a hair bun has a conversation with a patient in a modern Scandinavian apartment in a pine forest

A female doctor makes some routine check-ups on a patient in a modern scandinavian apartment in a pine forest

A female doctor has a conversation with a patient in a modern scandinavian apartment in a pine forest



Phone calls, Text prompt:
A blond Caucasian male doctor sits in his office in a modern Scandinavian building in a pine forest, making phone calls to get prescriptions for some patients

Draft text prompt:
A brunette female doctor with a hair bun sits in his office in a modern Scandinavian building in a pine forest, making phone calls to get prescriptions for some patients

Blooper :

Noise from the hallway
A doctor is annoyed at some noise from the hallway during a meeting with some nurses

Walking through the hallways, Text prompts:
A blond Caucasian male doctor walks through the hallways of a modern Scandinavian building in a pine forest

Debriefings, Text prompt:
A young blond Caucasian male doctor and some nurses debrief in a conference room modern Scandinavian building in a pine forest

Text prompt draft:
A blond Caucasian male doctor and some nurses debrief in a conference room modern Scandinavian building.

Writing report, Text prompt:
A blond Caucasian male doctor sits in his office in a modern Scandinavian building and writes journals

Therapist
One-on-one session, Text prompt:
A therapist is having a session with an old woman to help with the Bereavement process in a modern Scandinavian office in a pine forest

Informally hanging out with patients, Text prompt
A brunette Caucasian female therapist with a hair knot is casually chatting with some people in a modern Scandinavian living room in a pine forest

Family therapy, Text prompt:
A brunette Caucasian female therapist with a hair knot and round spectacles is having a family session to help with the Bereavement process in a modern Scandinavian office in a pine forest

Old Couple

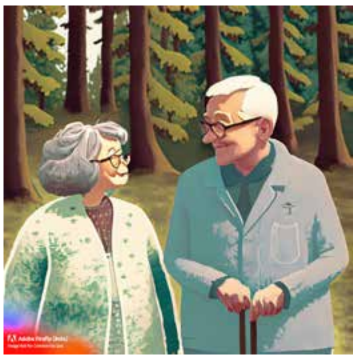
This storyboard was initially intended to depict a wife, with an ill husband. However, because they spend so much of their time together, the storyboard was changed into a shared arc between the two of them.

Spending time together, Text prompt:
an elderly wife spends time with her ill husband drinking tea in a modern Scandinavian apartment in a pine forest

Caring for ill partner, Text prompt:
an elderly wife spends time with her ill husband and takes care of him in a modern Scandinavian apartment in a forest

Walk in the park, Text prompt:
An elderly woman walks with her husband through a pine forest park





Grief counselling, Text prompt:
An old couple go to see a therapist for grief counselling to calm the ill husband in a modern Scandinavian living room, in a pine forest

Meditating & revitalisation, Text prompt:
An old couple go meditate at a peaceful modern Scandinavian meditation centre in a pine forest

Hanging out with other couples, Text prompt:
An elderly man and woman go and drink tea with other couples in the common space of a modern Scandinavian building

1.2 APPENDIX

Other iterations made with MidJourney, Text prompt:

Make a storyboard where an elderly wife spends time with her ill husband and takes care of him in a Scandinavian apartment in a forest. They go to see a therapist in a peaceful Japanese style meditation space in a forest. Later they go and drink tea with other couples in the common space of a modern Scandinavian building.

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Other storyboards not featured in the report. These were made during the analysis phase or before reducing the program:

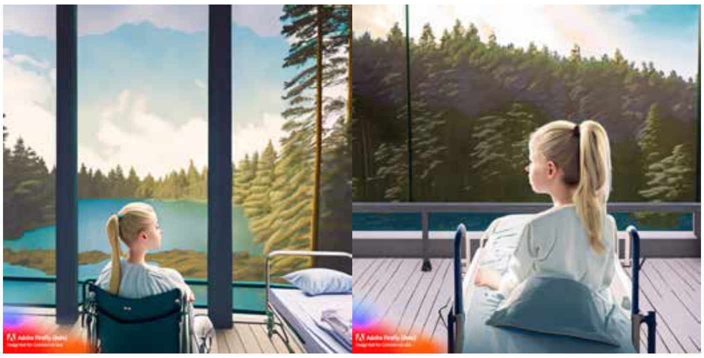
Children
Confined to a bed in her bedroom, Text prompt:
A young blond girl confined to a bed in a bedroom of a modern Scandinavian building in a pine forest

Lack of appetite, Text prompt:
A young blond girl with a ponytail, confined to a hospital bed who has no appetite in the dining room of a modern Scandinavian building in a pine forest.

Play time with family, Text prompt:
A young blond girl with a ponytail confined to a hospital bed in the kitchen dining room of a modern Scandinavian apartment in a forest plays boardgames with her mom, dad, and brother.

Check up, Text prompt:
A young blond girl with a ponytail confined to a hospital bed gets a visit by a nurse; The nurse does some medical checks on the girl's health.

Fresh air, Text prompt:
A young blond girl with a ponytail confined to a hospital bed is outside on the terrace of a modern building in a pinewood forest looking at a lake



Some iterations were also attempted using MidJourney, Text Prompt:
A story board about a young girl confined to a bed in a bedroom of a Scandinavian building in a forest. She is moved to the dining room in her bed and refuses to eat. After that plays charades with her parents and older sister. Later, a doctor comes to make a check-up. Then her bed is put onto a terrace, and she enjoys some fresh forest air with her parents.

1.2 APPENDIX

Text Prompt:
A story board about a young girl confined to a bed in a bedroom of a modern Scandinavian building in a pine forest, is moved to the dining room while in bed and refuses to eat. She then plays charades with her parents and older sister. The doctor comes to make a check-up. Then they move her bed onto a terrace and enjoy some fresh forest air. Realistic style. Volumetric lighting.

1.2 APPENDIX

1.2 APPENDIX

Parents

Spending time with whole family, Text Prompt:
A Caucasian family is eating breakfast together in a modern Scandinavian apartment. One family member is a teenage boy in a wheelchair

Text prompt draft:
A family is eating breakfast together in a modern Scandinavian apartment. One family member is a teenage boy in a wheel chair



Meetings and debriefs with care-taking-staff, Text prompt:
A man with light brown hair and a woman with dark hair are having a discussion with a nurse in a modern Scandinavian apartment in a pine forest


Rest, Text prompt:
A man with light brown hair and a woman with dark hair are sleeping during the day in a modern Scandinavian bedroom in a pine forest

Draft text prompt:
A couple sleeping during the day in a modern Scandinavian bedroom in a pine forest


Two siblings playing video games in a modern Scandinavian living room, Text prompt:
A brunette teenage girl in a wheelchair with a small hair knot and a boy with light brown hair is playing video games in a modern Scandinavian living room

Alone time with other children (Homework/'Grief-management'), Text prompt:
A mother and father sit down to help their two children with their homework in a modern Scandinavian apartment in a pine forest

Draft text prompt
A man with light brown hair and a woman with dark hair are talking to a boy with light brown hair in a modern Scandinavian apartment

Cooking with family, Text prompt:
A man with light brown hair and a woman with dark hair are cooking dinner with a brunette teenage girl in a wheelchair with a small hair knot and a boy with light brown hair in a modern Scandinavian kitchen

Bedtime for kids, Text prompt:
A woman with dark hair is tucking a brunette teenage girl in a wheelchair in bed in a modern Scandinavian bedroom


Alone time with partner, Text prompt:
A man with light brown hair and a woman with dark hair are talking and relaxing on a couch in the living room of a modern Scandinavian apartment in a pine forest

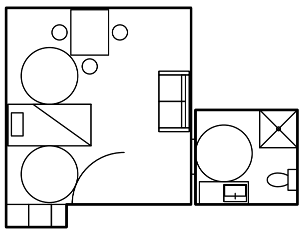
Kitchen staff
Made with MidJourney, Text prompt:

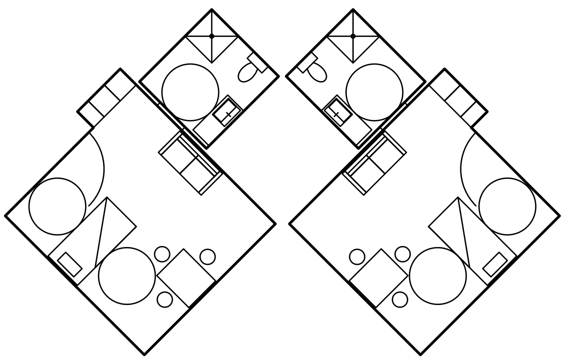
A storyboard about some kitchen staff in a modern building get up to make breakfast at sunrise. After the breakfast session they talk while doing the dishes. They then prepare a lunch buffet with rye bread and various spreads. It’s a child’s birthday and a special request for the staff is to make Lasagne for dinner and a cake after that. Later a different family goes into the kitchen to make a late-night-snack with their kids and the kitchen staff.

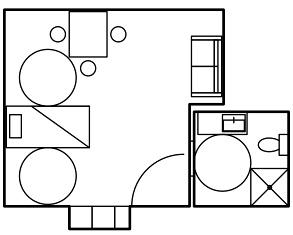
2.1 APPENDIX

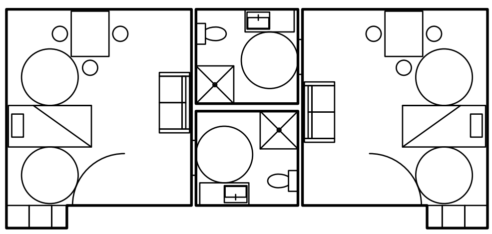
As mentioned in the report, some generic apartments were made to have a modular apartment to establish some spaces and voids to form. The chronological order of design iterations is first top to bottom, then left to right: On pages with two columns of iterations, the left columns is earlier than the right.

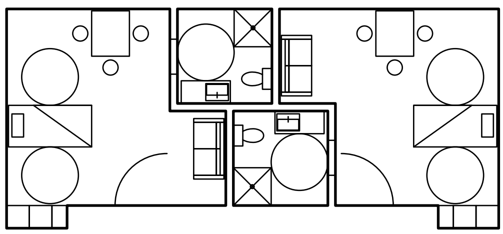
The goal of this exercise was to establish some compact liveable spaces for each user type included at the time: People living alone, people living with a partner, and families.

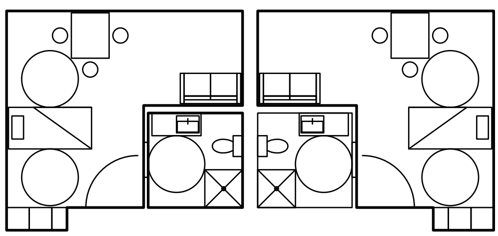








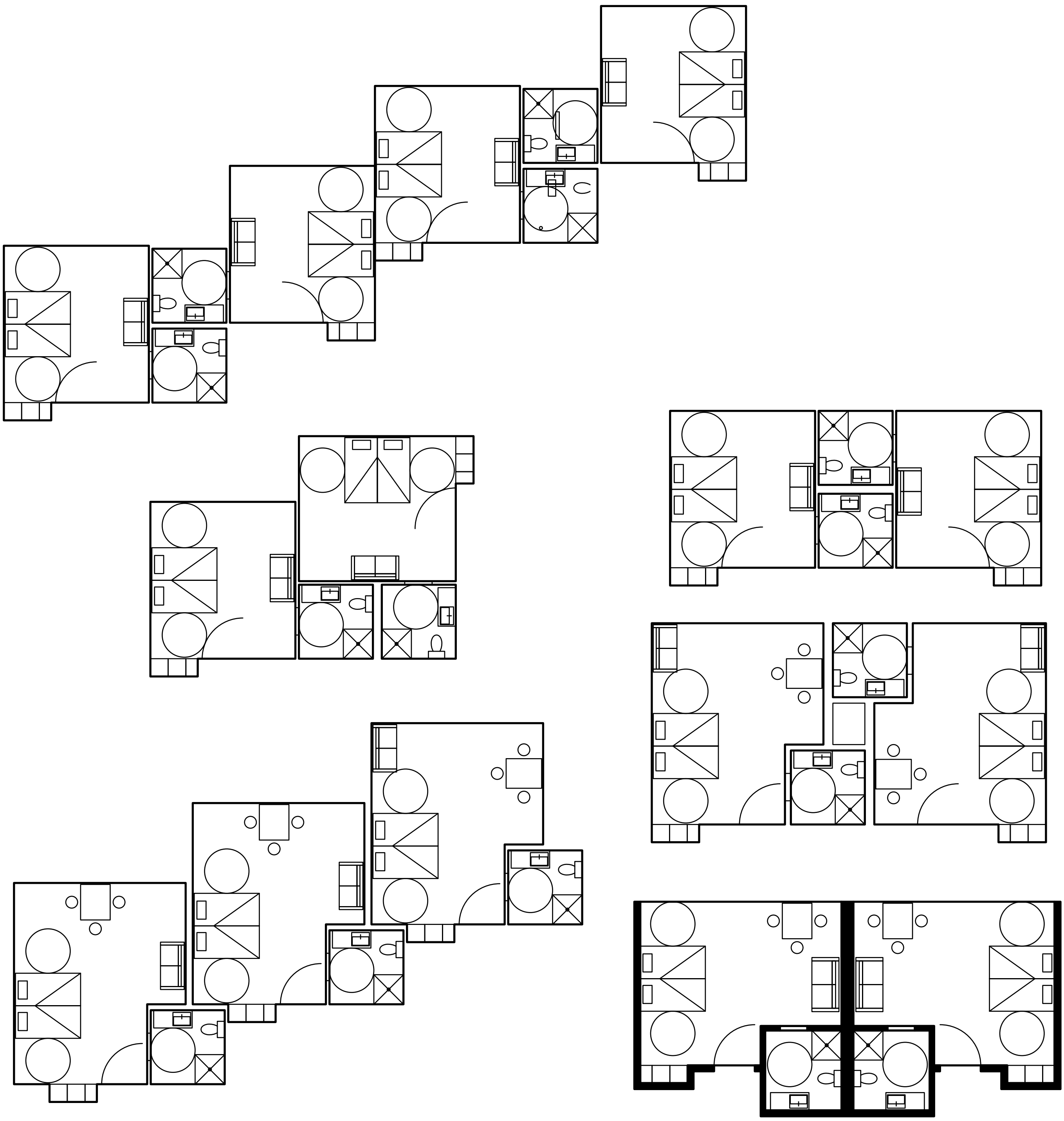




2.1 APPENDIX

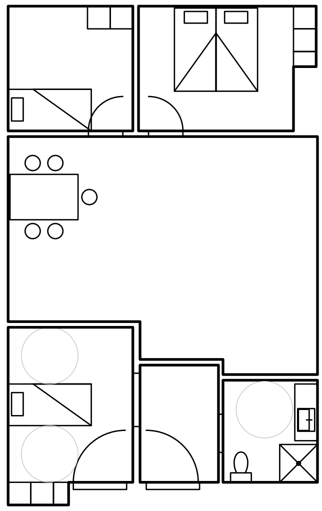
Early Sketching Phase: Generic Apartments

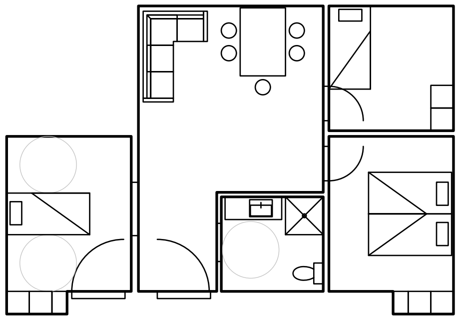
Some of the early single and couple apartments were attempted to arrange to make some edges, that would frame a private balcony for each apartment. It was considered to take too much facade space, and a more conventional composition was designed instead.

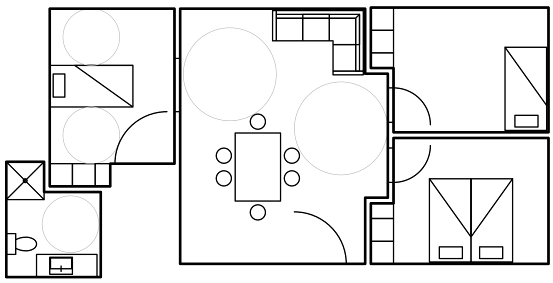


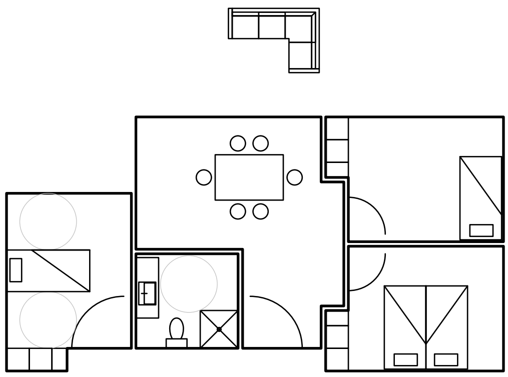
The family-apartment-unit proved to be particularly challenging, due to the requirement of windows in all rooms elongating the individual apartments. Also, it was challenging to establish sensible access and flows from bedrooms to the living room as corridors and other open areas were required, making some dark transition spaces that served no other purpose.

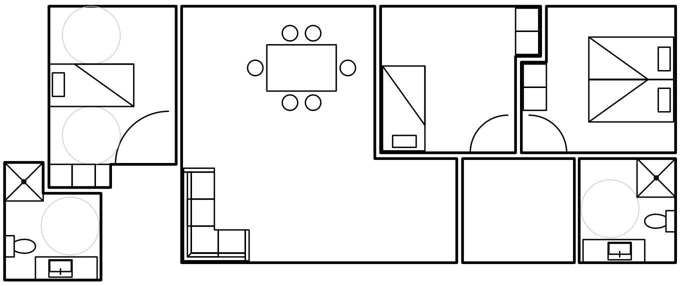
Notice that in some of the earliest iterations, one of the bedrooms were not given any facade space, and therefore had no natural light. The idea was to allow parents to go into a room to rest or sleep at any time. When we remembered that a window is mandatory as an emergency exit, the idea was scrapped, never to be considered again.

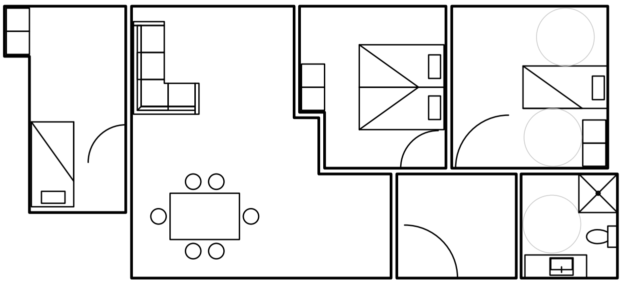


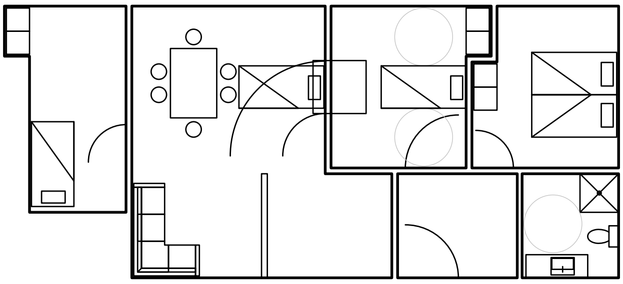


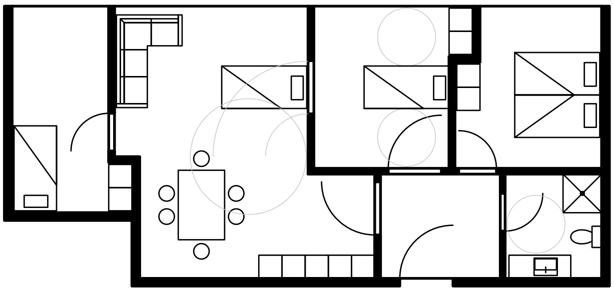


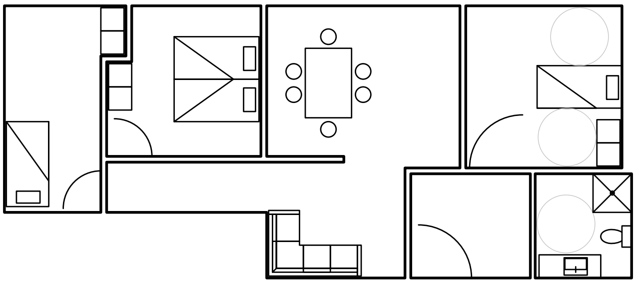


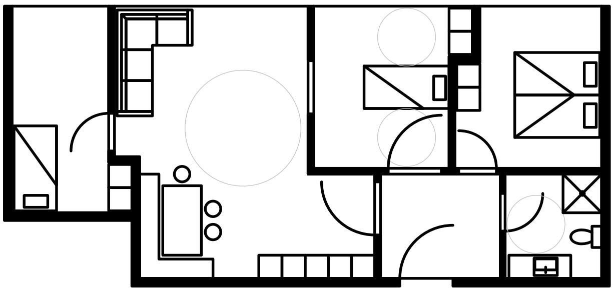


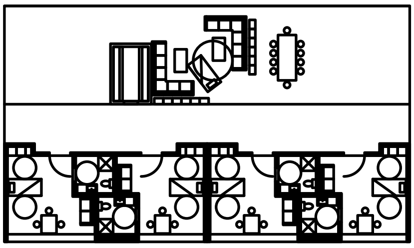




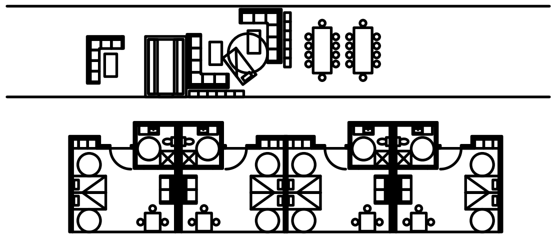


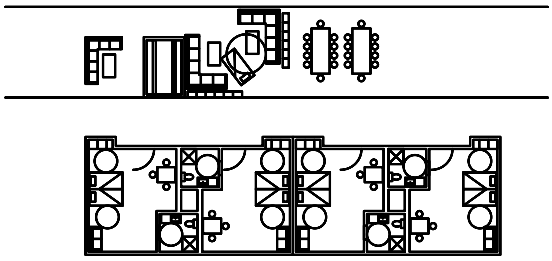


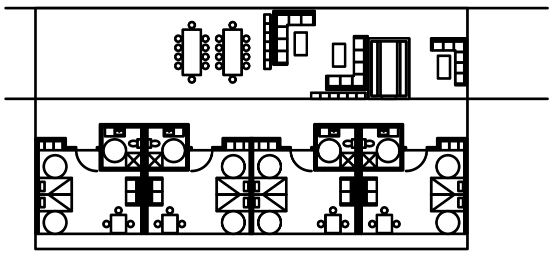


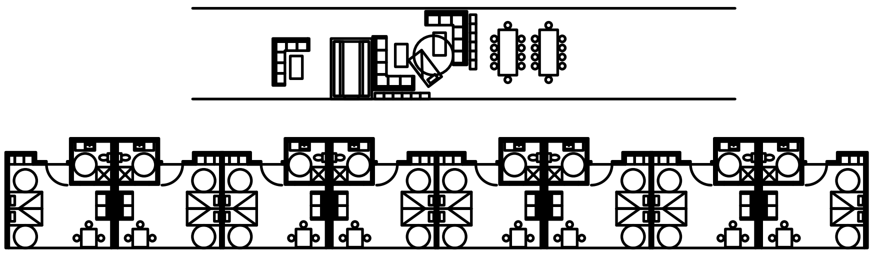


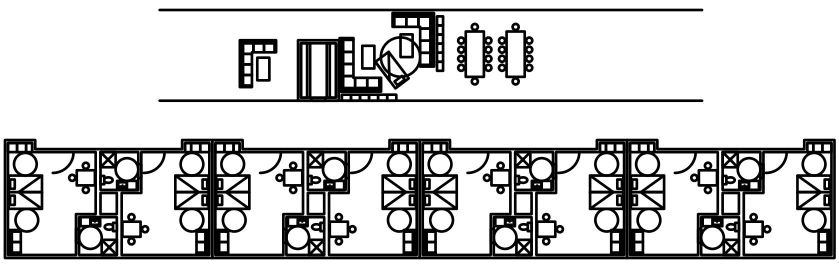
Some clusters were also arranged, to establish some internal communities. Due to the high number of apartments in the program at the time, the plan was to make small intimate clusters, living independently of the others. This idea was dropped in favour of creating a stronger internal connection across the different apartments.

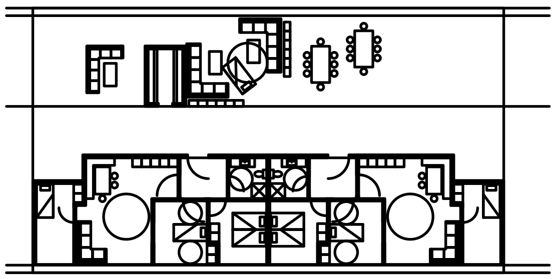


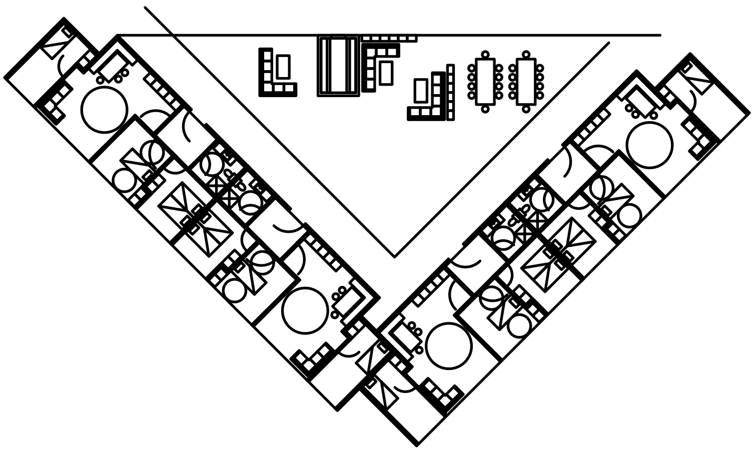


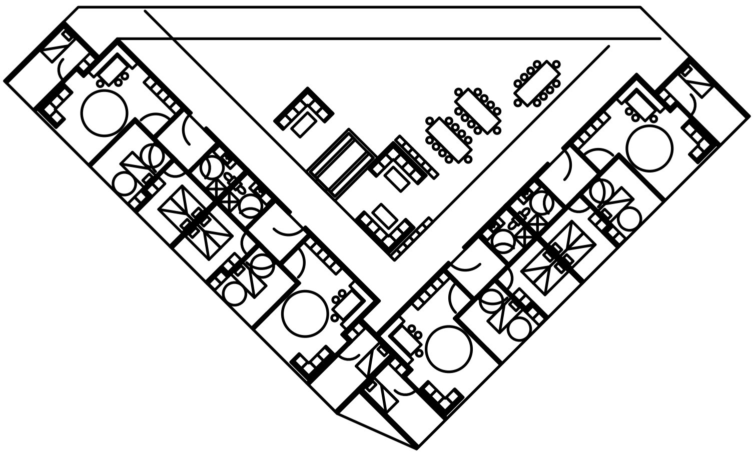






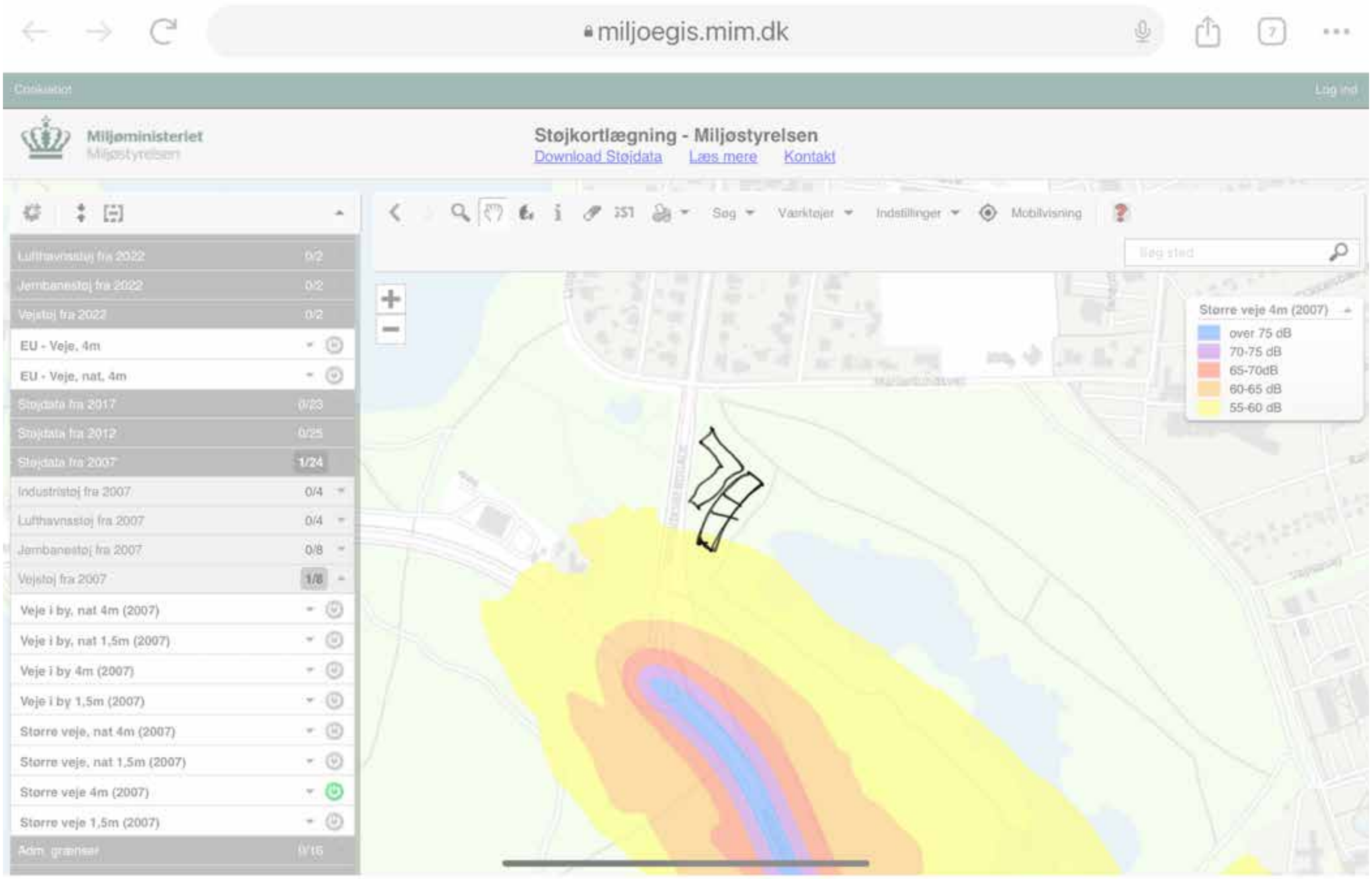






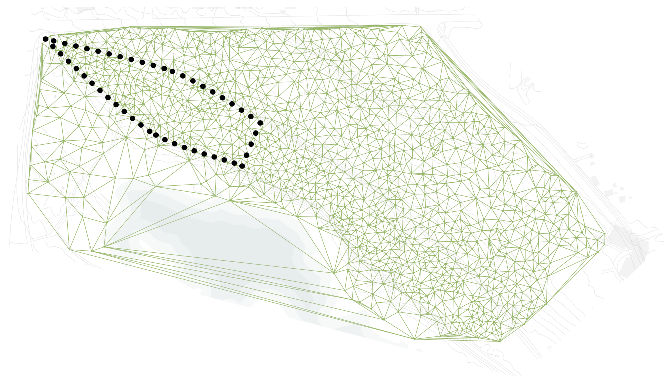
The Frame was a development of the Pragmatic Institution concept: Analysing the micro-climatic conditions from the nearby highway, The Frame was designed as an acoustic barrier between the noisy road and the park. Being placed perpendicular to the end of the lake, the building composition frames the entire forest park while shielding the park from road noise. The concept would require a long building volume, resulting in several corridors, which would be an inconvenience for the staff, who would have to walk great distances throughout the work shift. This increased horizontal distance would also disconnect the various clusters, making social gatherings more difficult to occur naturally.
This concept proposal was only an idea phase, and was discarded to focus on the branch concepts.

The noise map is from Miljøgis.dk

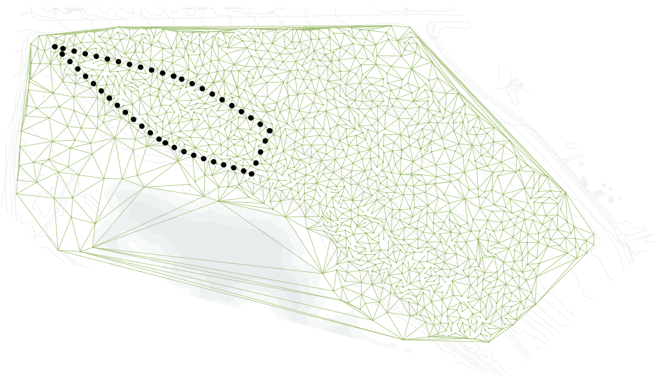


The following maps shows the trees on site with different distances between them. The maps were made to analyse where to build without having to cut any trees. This was to make a site-specific design that respected the surrounding nature.

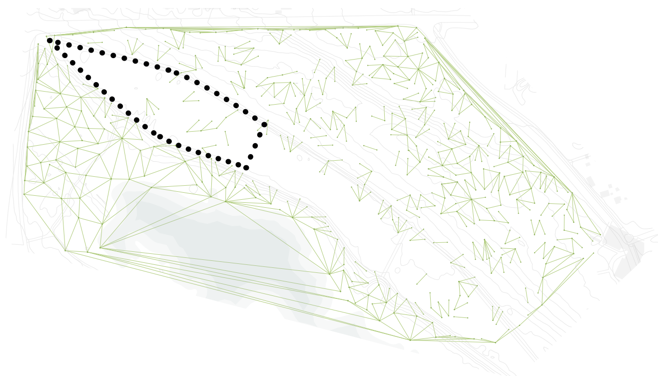
The trees were mapped using a LIDAR scan of the site and placing points where the trees are. This was to get a very accurate placement of the trees.



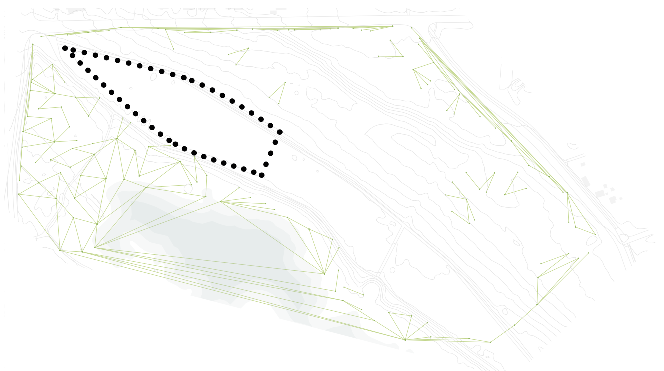
Density at 0m



Density at 6m



Density at 12m



Density at 18m

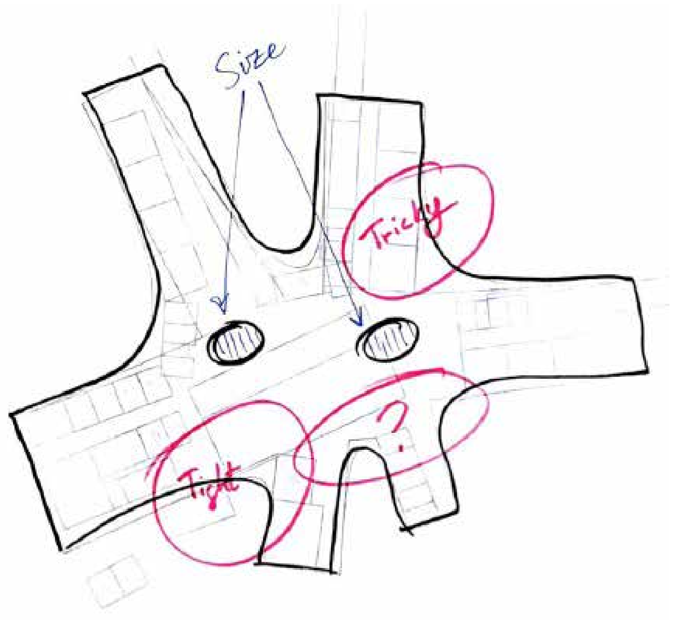
Spatial Disposition

The new building shape was made wider than the initial idea for the concept, but overall distances were shortened significantly. The building shape and program dispositions were investigated and changed throughout the design process, with rooms and wings being moved, reorganised, or changed altogether, to better the overall usability and design. This process is elaborated on for each function later in the chapter.
The program and functions were resized to fit the building grid and placed in groups depending on relevance and usage: functions that were rarely used were placed at the far ends of the building, allowing users to be closer together. The early iterations of room placements paid little attention to the aesthetics of the plan, producing some weird and slim spaces.

Initially the grid was made of segments sized 3,5 meters, which was the closest whole number to the preliminary apartment designs' size. The grid's measurements were enlarged to 3,6 based on recommendations by Neufert (Neufert, 2019, p. 541) and to accommodate standard measurements in the building sector, leading to some more generously sized rooms.

With the grid size determined, all functions were reshaped and scaled to fit the grid with an area close to the recommended numbers in Real-Danias Hospice guide (Nissen et al., 2009, pp. 37-42) to create aligned and flowing spaces.

To impact the forest as little as possible the building was designed as compact as possible. However, during its development a need for the building to grow resulted in some alterations to the terrain, to create enough space for the building.



Illu. 1 - Notes from early 'New Branch' shape

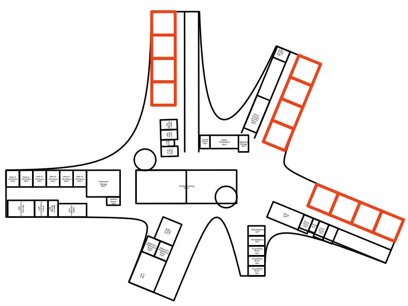
Core: Walls, Lines, and Flow

During the development of the plan, a way to merge the different wings together was to join the walls with curving walls. This caused some shifts in the placement of certain rooms to tighten the lines direction, making each curved wall purposeful. By de-laminating the grids in the building core, the different angles could be joined creating a beautiful dynamic space in the heart of the building. In some cases, the purposeful lines were difficult to incorporate at first, leading to some weird and overcomplicated wall designs. Through different iterations these walls were tightened to give a cohesive feeling to the plan.

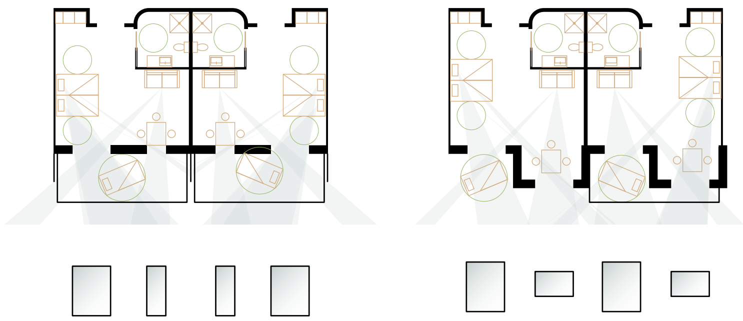
As the diplomatic centre of the hospice, most common functions and gathering rooms were placed as close to the core as possible, with functions that required privacy being moved away from the core. The core's key functions were the common dining area, the lounging zone, and the courtyard.

Apartments

Each apartment was designed with a terrace to allow patients to be outside privately (Illu. 2). The terrace had to comfortably have room for a bed with room to manoeuvre it around. To ensure privacy dividing panels were considered as an extension from the roofs overhang to separate each terrace from neighbouring terraces. An alternative dividing principle was to use bay window to frame the terraces and create privacy (Illu. 3). This had the benefit of creating a dynamic element to the facade and incorporating the division naturally through the building form. The dividing panels were chosen to ensure that the terrace was usably large, without having to enlarge the building footprint, and to avoid obscuring windows with interior walls.



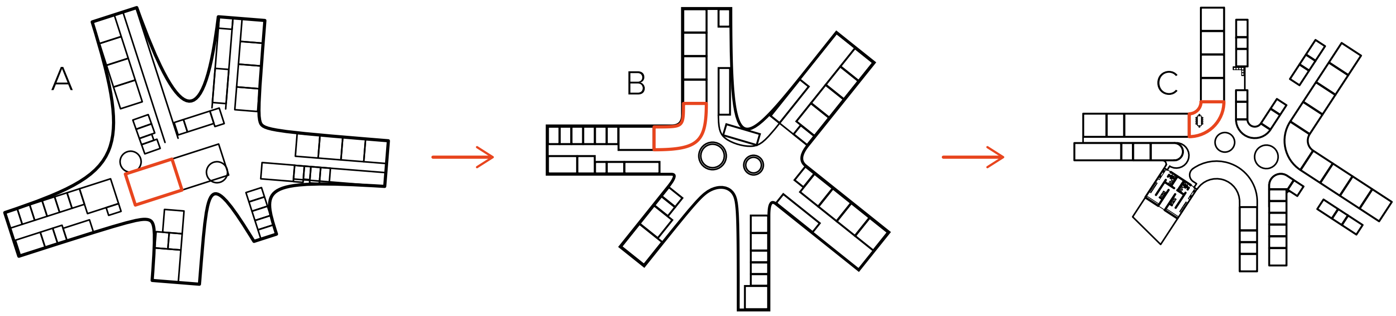
Illu. 2 - Placement of Apartments



Illu. 3 - Sight-lines through windows from key spots

Kitchen

In an early iteration of the plan, the kitchen was placed firmly in the heart of the building as a core (Illu. 4a). However, due to the kitchen's size, the core started to become heavy while the common gathering space became difficult to program. As a result, the kitchen was moved into the corner between the then staff wing and the most western residential wing (Illu. 4b): The idea was to have the kitchen workspace flow into the core allowing staff and residents to utilise the kitchen to cook themselves, if they wanted to. However, the placement limited the view to the north-western part of the forest. Logistically this was a

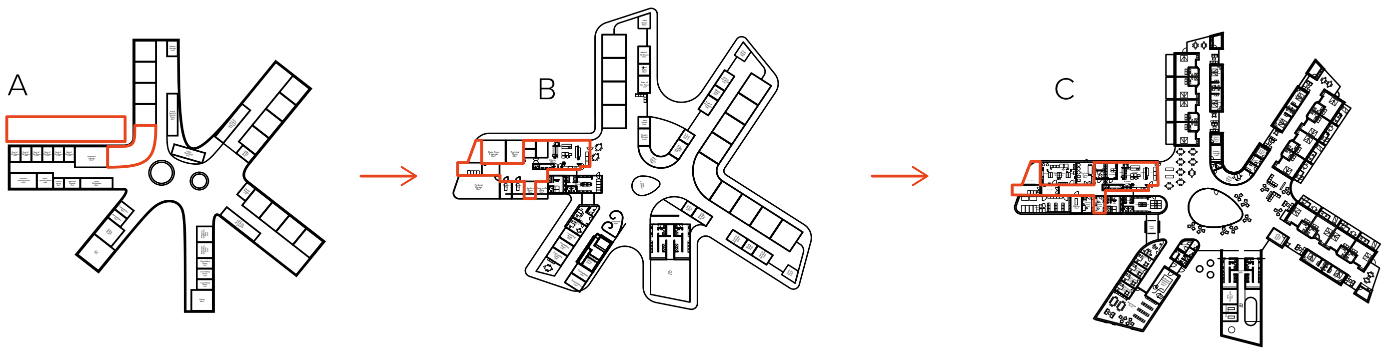


Illu. 4 - Kitchen placement A, B, and C

suboptimal placement, with goods delivery needing to be handled in the main entrance, with no distinct area for waste disposal.

The kitchen was moved deeper into the west wing when it was reorganised to be the technical wing (Illu. 4c). A benefit of the placement was that the kitchen got closer to the building access road, allowing for a better and more discrete solution for replenishing the stock of goods by creating a distinctive backstage area in the building (Illu. 5c).

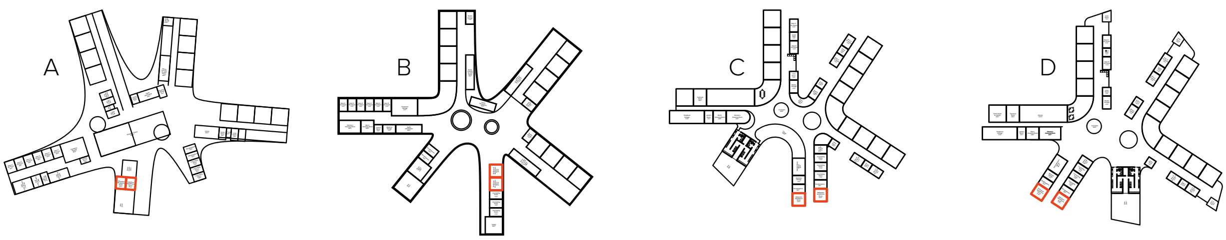
During the design of outdoor spaces, the logistics linked to the kitchen were discussed to create a discrete and practical area to deliver goods and handle waste disposal (Illu. 5). By having a ramp between the peripheral storage and the laundry facility, a small space was established to handle deliveries and remove packaging. The waste disposal would be stored in a shed north of the ramp, keeping it out of sight for people arriving to the hospice (Illu. 5b and 5c).



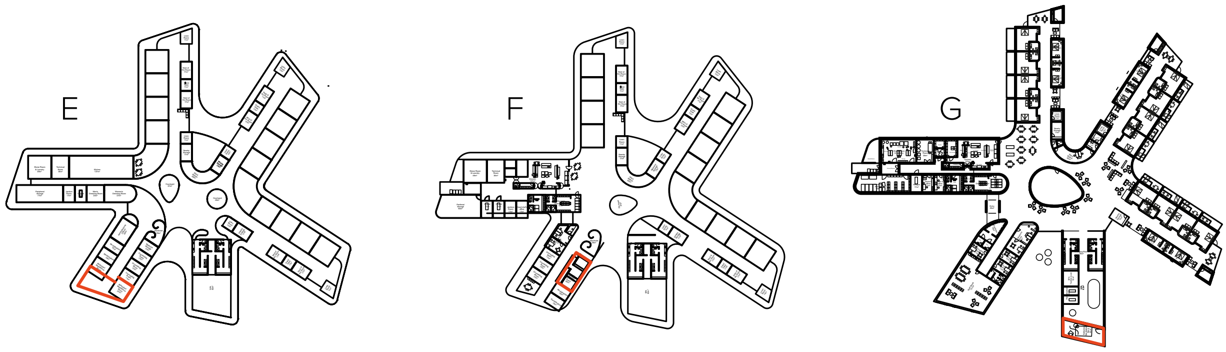
Illu. 5 - Kitchen delivery and logistics A, B, and C

Meditation

As a quiet room for reflecting, prayer, and meditation, the meditation rooms were initially placed next to the SPA area, to create an architectural experience and some atmospheric drama through the flow and spaces (Illu. 6a). For a brief period, it was moved closer to the counselling rooms to create a zone for mindfulness in the staff wing (Illu. 6b). First at the end of the staff wing (Illu. 6c, 6d, and 7e), but the moved closer to the centre to make it more accessible for patients (Illu. 7f).
In the end, it was moved away from the core to establish a certain level of peace. The need for serene and spiritual atmosphere placed large emphasis on the architectural quality in the room, and lead to it being placed towards the dramatic views of the lake and forest. As a result, it was placed at the end of the spa facilities, to frame arguably the best view in the area (Illu. 7g).



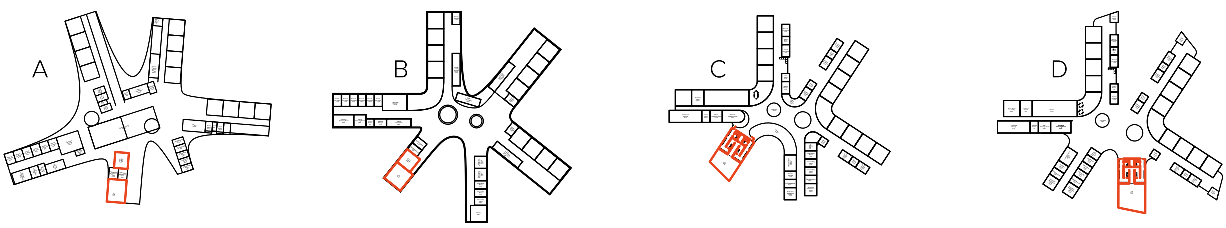
Illu. 6 - Meditation room placement A, B, C, and D



Illu. 7 - Meditation room placement E, F, and G

SPA + Public Toilets

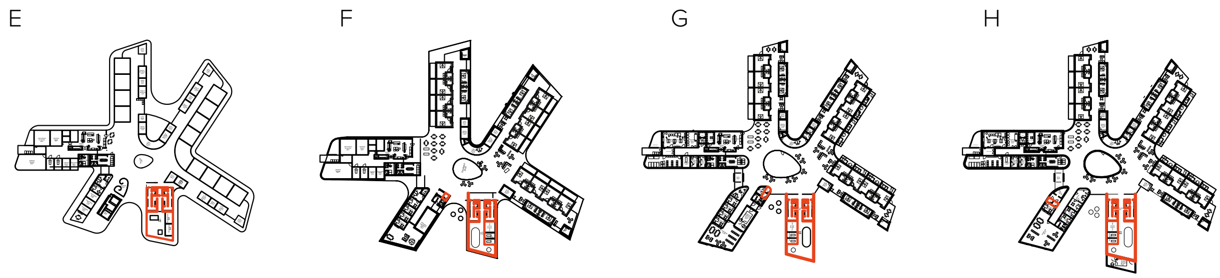
The SPA and the public toilets were grouped together to serve as public toilets, public showers, and changing rooms for the SPA (Illu. 8 and 8b). Originally placed next to the main entrance in the southwest wing (Illu. 8c), they were switched to the southeast wing,



Illu. 8 - SPA and toilets A, B, C, and D

as the terrain did not taper away under the south-eastern wing to the same extent as it did under the southwest wing (Illu. 8d and 9e).
With the establishing of a wardrobe, an additional public toilet was placed closer to the entrance, making it easier for visitors to find, placed across from the reception (Illu. 9f, 9g, and 9h).

The Spa has one long hot water basin inside for both lounging and swimming short distances. It also has a tub with an ice bath. A central bypass corridor allows users to enter the spa directly, for easy and quick access.
The corridor is wide enough for a bed to enter, and a traverse is along the centre of the spa to help mobility impaired users to utilise the facility. A large window looking southeast gives those bathing a stunning view of the lake and forest.

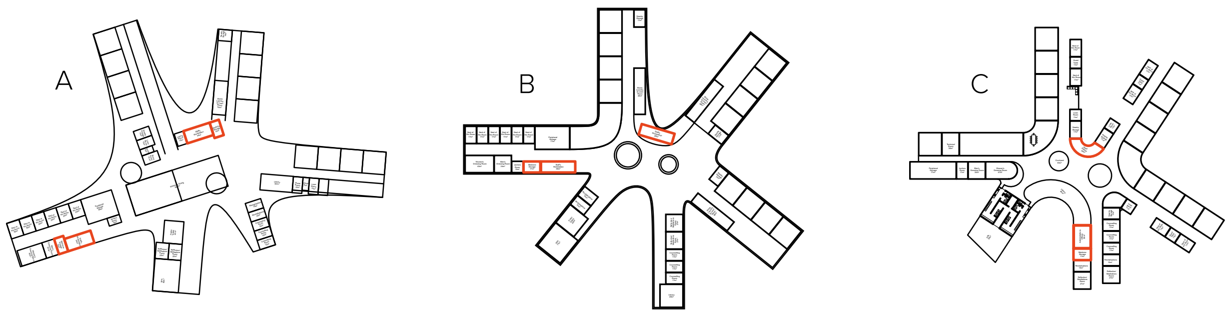


Illu. 9 - SPA, Toilet and Wardrobe E, F, G, and H

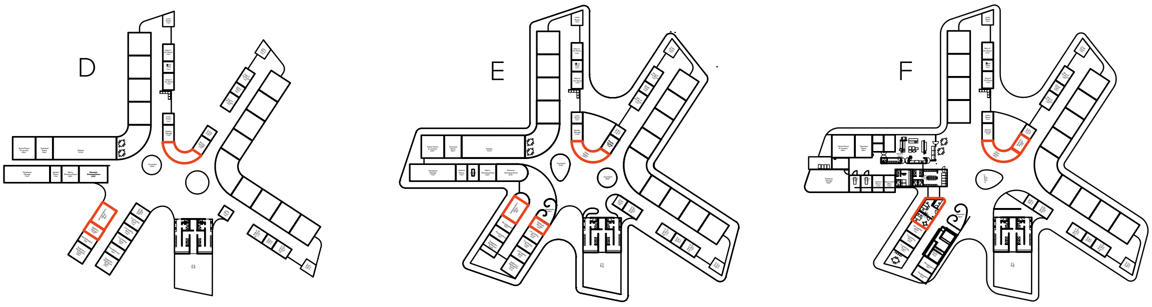
Ward Station

The ward station is the area for concentrated work and documentation for doctors and nurses. It is placed centrally between the residential wings (Illu. 10a and 10b), and is designed as a visually open space, that allows residents to easily approach nurses or doctors when needed. Being in the core of the building, the room is acoustically closed off with glass to help the staff to stay focused when doing the necessary paperwork. In extension of the wardroom, a medicine storage houses all the various patients' prescription drugs (Illu. 10a, 10b, and 10c): This room is divided into an open storage and a closed: The closed storage stores the rare, expensive, or especially dangerous drugs to avoid theft or abuse.

Originally an additional wardroom was placed at the entrance to house the secretary and reception, with an additional medicine storage (Illu. 10a and 10b). The added medicine



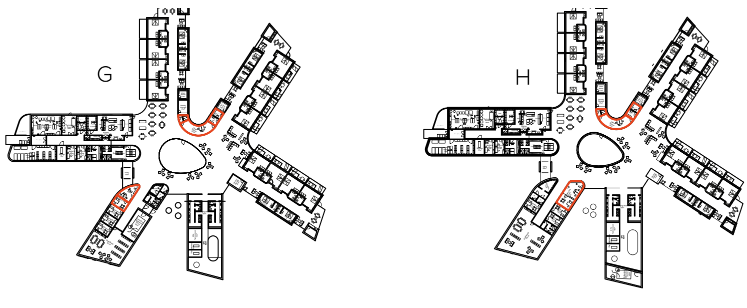
Illu. 10 - Ward Station and Medicine room placement A, B, and C storage was considered an unnecessary redundancy, and the secondary wardroom was adapted into an administrative office.



Illu. 11 - Wardroom, Medicine room and Administration's Office D, E, and F

Administration

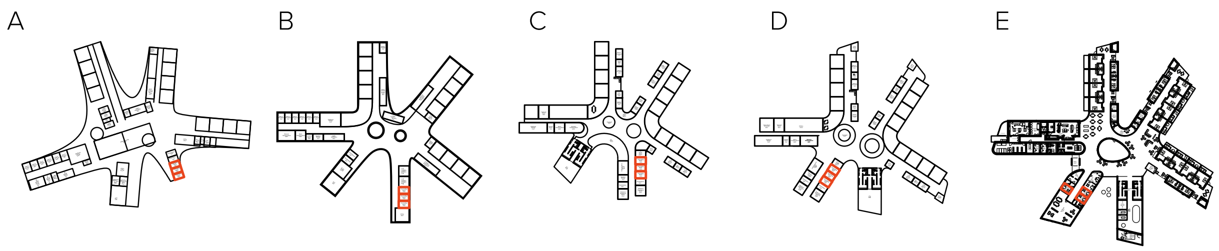
Although originally planned to be a part of the wardroom, the administrative office was moved to a separate room, allowing the two functions to serve different purposes (Illu. 11d): The wardroom is as mentioned in the previous paragraph an open landscape to be always readily accessible for any patient. Therefore, it was important to place it centrally in extension of the residential wings.
The administration was carefully placed next to the main entrance to double as a reception, which can welcome guests and new patients, and help them find their way in the hospice (Illu. 11e). Furthermore, the core was designed to create a visual contact with the wardroom and the reception for easy non-verbal communication (Illu. 11f).



Illu. 12 - Administration's placement and geometry

In the early iterations of the plan the administration was placed with all counselling facilities on the southeast wing to maintain balanced building proportions. At that time, the entrance was expected to be between the two south wings; the considerations regarding the entrance are explained in detail later. When the spa and staff wings were swapped, it came to a more suitable and logical position right by the entrance. The shape of the administrative office was altered to open the entrance and making it more inviting by creating a soft accelerating curve that draws people into the building (Illu. 12g).
Three zones were established in the administration's office: a zone for the hospice man-

ager, a room for the secretary and reception, and one for the accounting personnel. The placement of the reception was originally out of sight when you entered the building. To solve this, it swapped places with the wardrobe and the public toilets, to establish a firm visual connection with the entrance (Illu. 12h). Initially the three zones were divided by glass walls, but as the geometry of the reception became highly irregular, the wall separating it from the general office space was removed to make one open staff for the accountant, secretary, and receptionist.



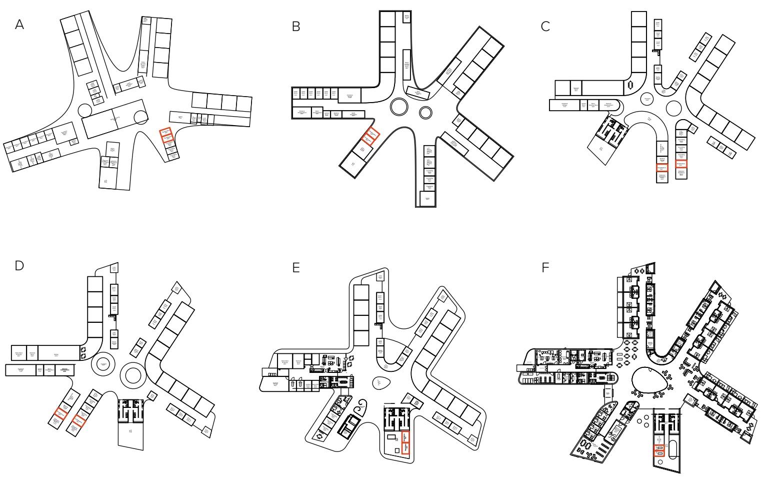
Illu. 13 - Placement of Counselling Rooms

Counselling rooms

The counselling rooms were placed in the staff wing, to establish privacy, and to double as conference rooms, to better utilise the space within the building (Illu. 13). This decision was based on the information gathered in the interview with a hospice manager, stating that their open office landscape made it difficult to have private professional conversations (Højer et al., 2023).

Revitalisations rooms

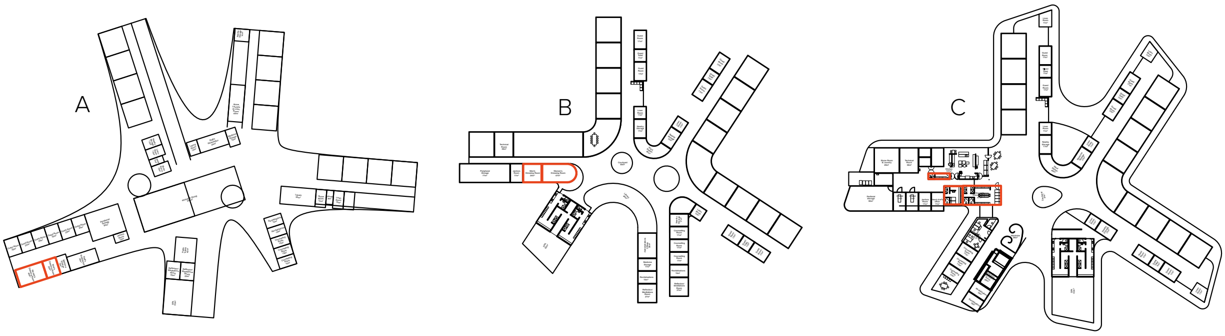
These rooms for massaging and revitalising the patients physically was placed by the meditations room on the staff wing to avoid over-sizing the SPA wing. However, it was later decided to place them inside the spa, to gather all bodily treatments' facilities in one cohesive zone.



Illu. 14 - Placement of Revitalisations rooms

Dressing rooms

The sizes of the staff's dressing rooms were originally taken form Program for det Gode Hospice (Nissen et al., 2009) (Illu. 15a). Upon furnishing the two dressing rooms, the women's facility had to be enlarged to house an adequate number of lockers and establish an entry that ensured privacy (Illu. 15b). Both genders' dressing rooms are equipped with

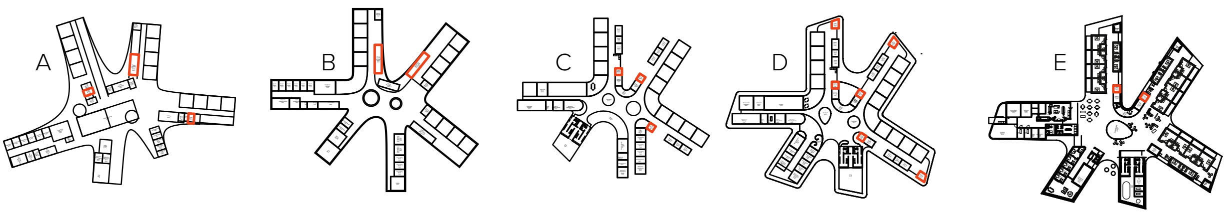


Illu. 15 - Staff changing facilities placement

changing booths, to further the feeling of privacy. For cleanliness, the kitchen staff were given a dedicated changing room (Illu. 15c).

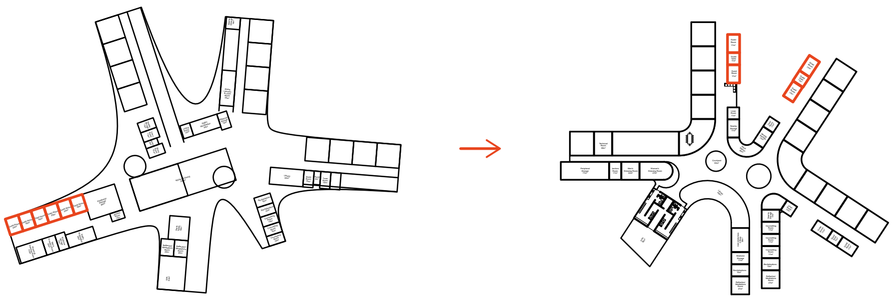
Linen room

The linen rooms are placed on every residential wing for quick and easy replenishment of bedlinen, towels, etc (Illu. 16a). They were spread out to be in convenient locations and for framing the spaces along the corridors (Illu. 16b and 16c). As the plan developed, the



Illu. 16 - Placement of Linen Rooms

number of linen rooms were decreased, as it seemed redundant one in each end of all residential wings (Illu. 16d). The final placement of the linen rooms is along the residential corridors close to the core, for shortened walking distance for the personnel cleaning and restocking after the laundry. One eastern most wing shared the linen room with the middle wing (Illu. 16e).



Illu. 17 - Guest rooms

Guest Room

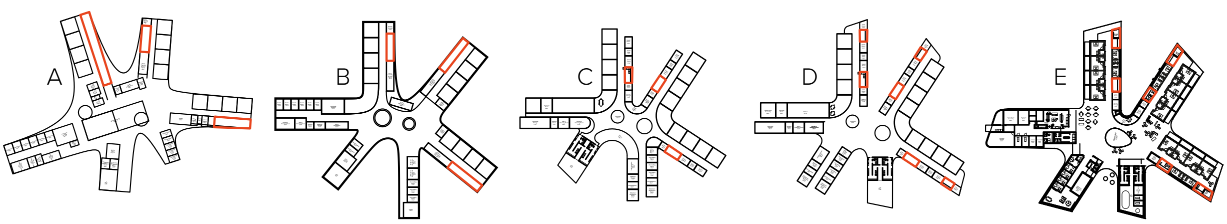
Next-of-kin rooms are the guest bedrooms for visitors staying the night. They were initially placed out in the distance of the building, as they are expected to only be used at rare occasions (Illu. 17 left). When restructuring the program disposition, the guest rooms were moved out of the technical wing, to occupy the space freed by establishing one central sluice and laundry room, with a dedicated bathroom added to the function (Illu. 17 right).

That way the guests could be closer to the relatives, bettering the social situation when patients have visitors.

Cluster lounge area

Some small niches have been established in the corridors of the residential wings. These are meant for small social gatherings with visitors or others living in the same wing (Illu. 18a).

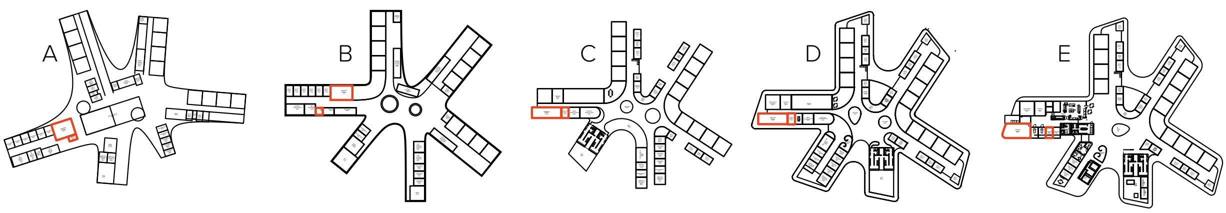
Originally one large space for each wing (Illu. 18b and 18c), another niche was established by offsetting the storage spaces and guest rooms (Illu. 18d), making the wings more dynamic and intimate. A small kitchen was added to the lounge area at the end of each wing, to allow patients and relatives to cook small meals and dine privately (Illu. 18e).



Illu. 18 - Niches

Peripheral Storage & Janitor's room

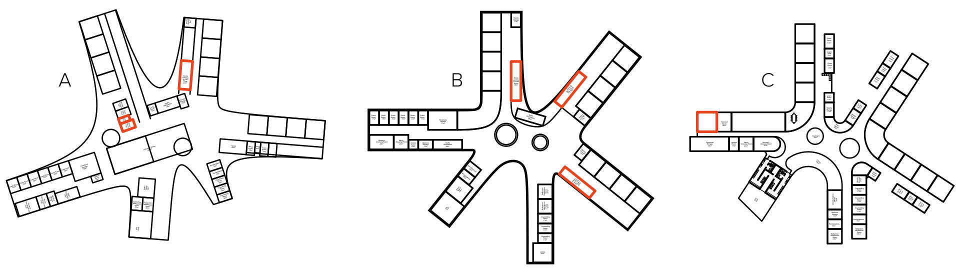
The peripheral storage is the large storage room, for cleaning and maintaining major equipment and beds. In the first iteration of the new branch, it was placed 'behind' the kitchen just outside the central court of the building (Illu. 19a). As the name suggests, its placement was intended to be de-central, and was gradually moved further away from the core (Illu. 19b), before ending up in the technical wing of the building (Illu. 19c). The janitor's room has been placed close to the peripheral storage and has been moved in tandem with the storage room (Illu. 19a, 19c, and 19d). In the later iteration it was moved closer to the changing facilities, to make room for the morgue (Illu. 19e).



Illu. 19 - Placement of Periferial Storage and Janitor's office

Sluice and Laundry

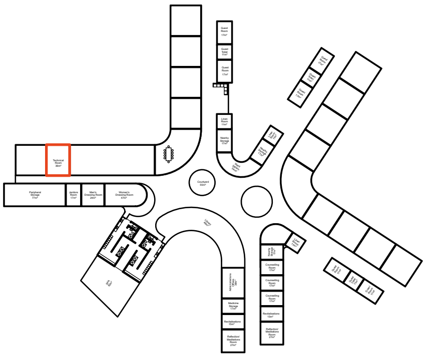
The Laundry and sluice were originally placed on each wing with the linen room, to keep all cleaning and storage local on each wing (Illu. 20a and 20b). Upon reflection, it was considered unnecessary to have three cleaning locations, leading to a separation of cleaning and storage. When it was decided to only have one laundry and sluice the function was placed in the technical wing, next to the ventilations room, to handle elevated levels of humidity and filtering the various chemicals (Illu. 20c).



Illu. 20 - Laundry and Sluice room process

Technical room

The technical room was sized from an estimated airflow requirement for the building. It was generously sized to accommodate a large ventilations unit, the heat pumps, and the various fuse boxes. It is placement between the kitchen and laundry was to channel the intake pipes to remove the polluting functions' air, thus establishing a cleaner atmospheric environment (Illu. 21).

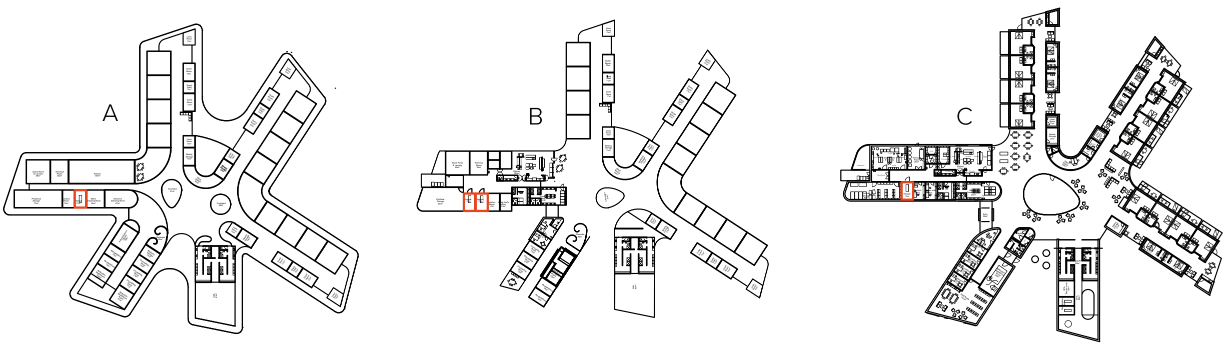


Illu. 21 - Placement of the Technical Room

Morgue

When patients succumb to their illness, they will be placed in cold storage in the morgue before being moved to the location of the funeral (Illu. 22a).

The two storage rooms are placed next to the peripheral storage and were offset to give more manoeuvring space in the corridor when moving the coffin (Illu. 22b). The morgue is large enough to have a small gathering or ceremony for the closest relatives. It is placed in between the product delivery entrance and main entrance, for logistical purposes: If the relatives do not wish to carry the coffin to the hearse, a shorter more direct route is made available (Illu. 22c).



Illu. 22 - Morgue Design Process

Some Daylight Availability analyses were run in ClimateStudio to verify the level of daylight inside the hospice: One without trees on site (5.1), and one with trees on site (5.2).

The Danish Building Regulations require a lighting intensity of at least 300 LUX in 50% for of floor space, half of the time when the room is occupied.

The rooms in question are Work rooms, living spaces, and dining rooms. This means that niches, offices, and bedrooms are included in these requirements.

The simulation without trees concluded that 59,2% of the general floor area was above 300 LUX for the required time, having an average lighting intensity of 610 LUX. The number should most likely have been higher as two guest rooms appeared to receive no light. The most likely reason for this malfunction is that the window surfaces in the analysed model were flipped inwards.

The analysis also showed that some rooms suffered from glare, with least 1000 LUX entering 10% of the floor area for at least 250 occupied hours.

The five rooms with the most glare in descending order were:

The meditations room, the staff break room, the southernmost kitchenette, the Spa, and the administrative offices. Some of the bedrooms also suffered from some glare.

The room most affected by glare was the meditations space. The large panoramic window allows a lot of light to penetrate the space. Because it isn't a room where specific work will be done, and it is meant to be experienced as being outside, the glare in this instance was accepted. The intense light will have a dramatic effect on the interior's atmosphere, giving it a particular warmth.

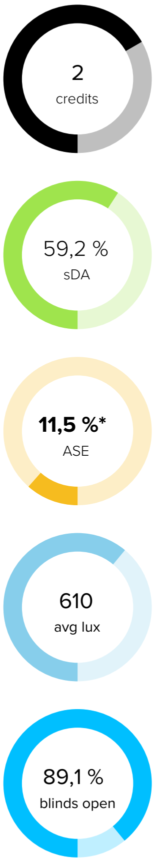
Although the spa only had glare registered along half of the 'hot tub', the water would be mirroring the light into the room causing the glare to go deeper in the space, making the spa an uncomfortable space during morning hours.

The analysis was run again with the trees on site. The analysis conclusion was technically a failure with 49,2% of the area having adequate light. This is because many of the corridors and transition spaces were included, where the threshold was below 300 LUX in half the occupied hours. However, as these are not part of the relevant floor, they adversely affected the actual headline result.

A detailed analysis of the simulation with trees on site concluded that trees eliminated issues with glare in all rooms, bar the meditation space and the staff break room. These are the two rooms facing directly south in the least dense part of the forst.

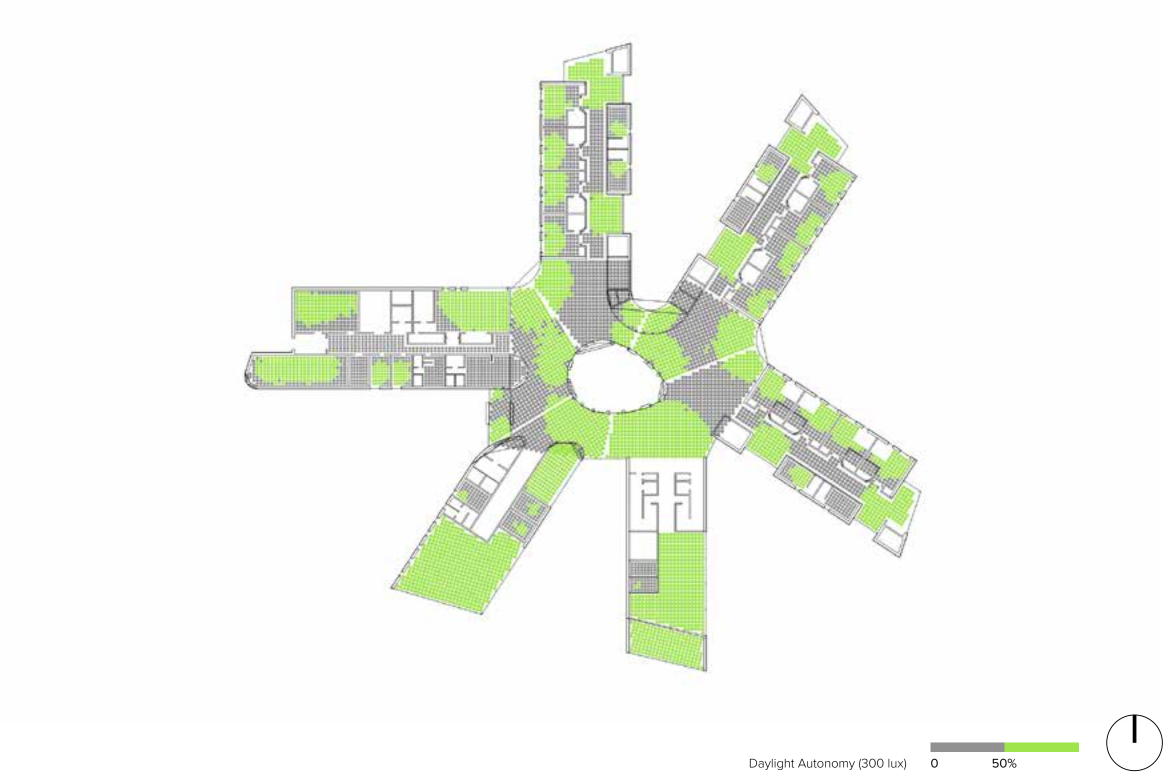
Glare in the meditations space can still be accepted, as it is a room where the relation between inside and outside is meant to be dissolved.

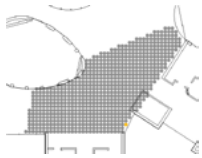
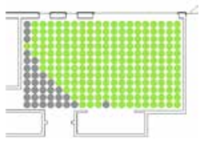
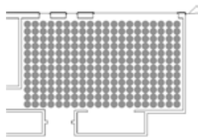
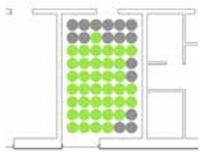
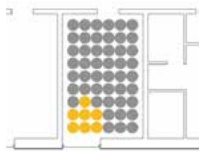
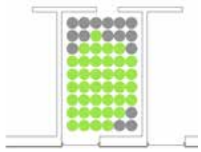
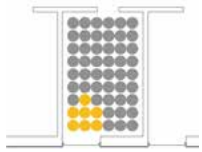
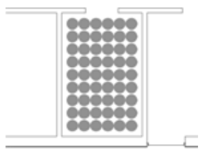
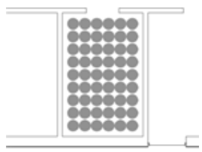
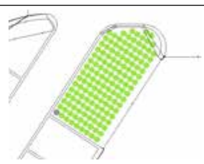
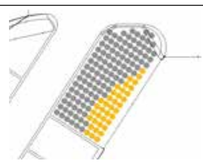
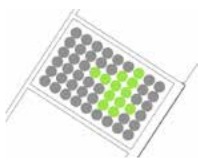
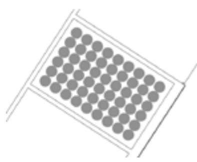
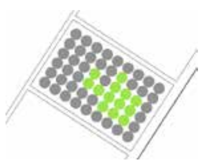
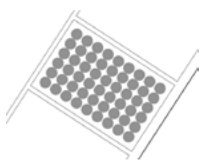
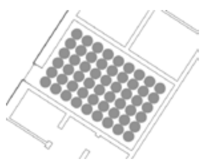
Glare in the staff break room has been significantly reduced from 53% of the floor area to just under 16% of the floor area.

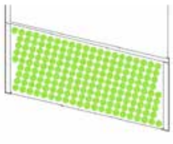
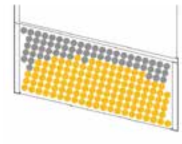
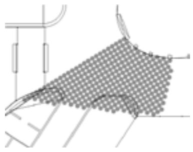
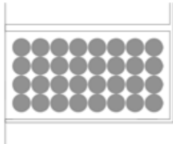
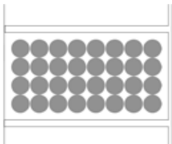
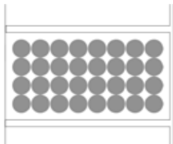
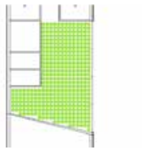
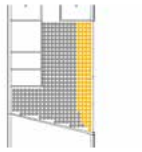
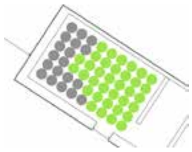
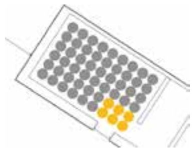
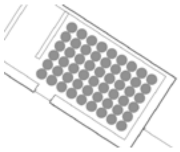
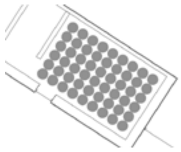
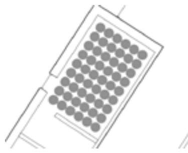
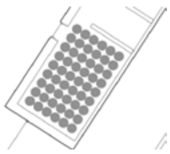
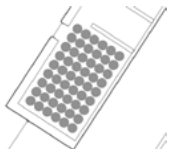
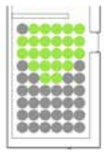
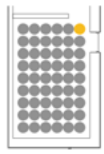


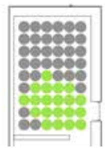
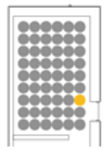
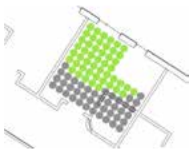
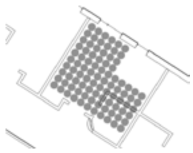
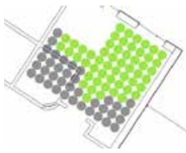
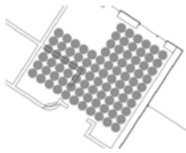
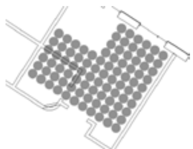
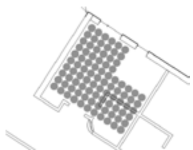
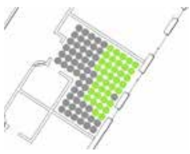
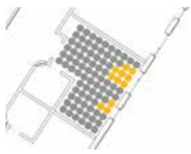
* ASE > 10% in one or more spaces. The design addresses glare in these areas as follows:

By giving the occupants the opportunity to regulate light themselves through blinders.

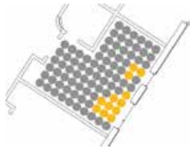
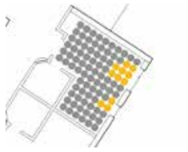
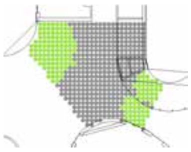
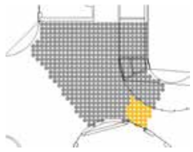
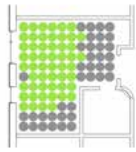
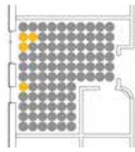
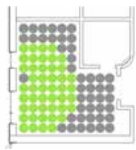
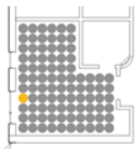
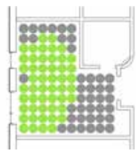
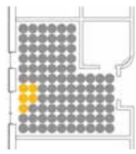
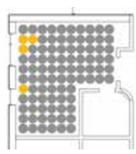
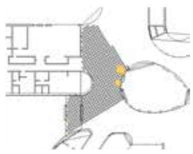
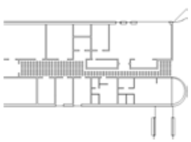
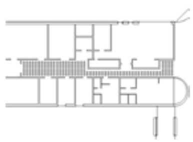


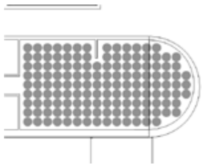
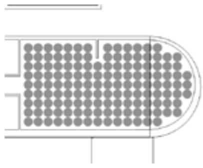
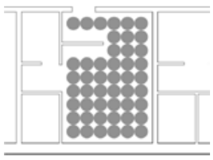
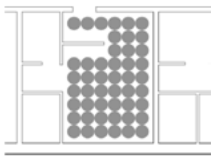
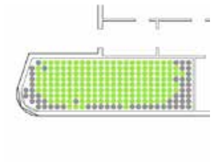
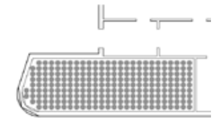
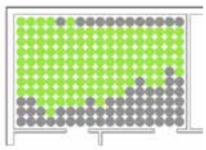
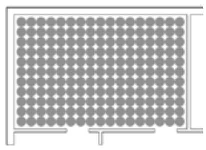
Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
1	2957 ft²	2,0 ft	Y		62,92 %		0,14 %
10	941 ft²	2,0 ft	Y		85,83 %		0,00 %
11	190 ft²	2,0 ft	Y		70,37 %		12,96 %
12	190 ft²	2,0 ft	Y		70,37 %		12,96 %
13	190 ft²	2,0 ft	N		0,00 %		0,00 %
14	575 ft²	2,0 ft	Y		99,33 %		24,83 %
15	190 ft²	2,0 ft	Y		22,22 %		0,00 %
16	190 ft²	2,0 ft	N		24,07 %		0,00 %
17	190 ft²	2,0 ft	Y		16,67 %		0,00 %
18	2173 ft²	2,0 ft	Y		100,00 %		53,23 %

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
19	734 ft²	2,0 ft	Y		100,00 %		67,76 %
2	1363 ft²	2,0 ft	Y		69,35 %		0,00 %
20	127 ft²	2,0 ft	Y		9,38 %		0,00 %
21	127 ft²	2,0 ft	N		0,00 %		0,00 %
22	1634 ft²	2,0 ft	Y		100,00 %		26,20 %
23	190 ft²	2,0 ft	Y		64,81 %		11,11 %
24	190 ft²	2,0 ft	Y		0,00 %		0,00 %
25	190 ft²	2,0 ft	Y		51,85 %		0,00 %
26	190 ft²	2,0 ft	Y		0,00 %		0,00 %
27	190 ft²	2,0 ft	Y		42,59 %		1,85 %

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
28	190 ft²	2,0 ft	Y		37,04 %		1,85 %
29	1749 ft²	2,0 ft	Y		58,71 %		33,99 %
3	2305 ft²	2,0 ft	Y		52,25 %		12,97 %
30	1749 ft²	2,0 ft	Y		64,89 %		0,28 %
31	1749 ft²	2,0 ft	Y		60,96 %		9,27 %
32	395 ft²	2,0 ft	Y		53,33 %		0,00 %
33	395 ft²	2,0 ft	Y		58,89 %		0,00 %
34	395 ft²	2,0 ft	Y		53,33 %		0,00 %
35	395 ft²	2,0 ft	Y		50,00 %		0,00 %
36	395 ft²	2,0 ft	Y		41,11 %		12,22 %

5.1 APPENDIX

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
37	395 ft^2	2,0 ft	Y		45,56 %		10,00 %
38	395 ft^2	2,0 ft	Y		42,22 %		13,33 %
39	395 ft^2	2,0 ft	Y		53,33 %		12,22 %
4	2232 ft^2	2,0 ft	Y		32,28 %		5,38 %
40	395 ft^2	2,0 ft	Y		58,89 %		4,44 %
41	395 ft^2	2,0 ft	Y		51,11 %		1,11 %
42	395 ft^2	2,0 ft	Y		55,56 %		5,56 %
43	395 ft^2	2,0 ft	Y		62,22 %		4,44 %
44	2332 ft^2	2,0 ft	Y		52,59 %		2,96 %
5	838 ft^2	2,0 ft	N		0,00 %		0,00 %

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
6	533 ft²	2,0 ft	Y		0,00 %		0,00 %
7	200 ft²	2,0 ft	N		0,00 %		0,00 %
8	909 ft²	2,0 ft	N		76,07 %		0,00 %
9	799 ft²	2,0 ft	Y		64,71 %		0,00 %
Totals	33052 ft²				59,18 %		11,52 %

Software: ClimateStudio v1.9.8389.21977
Engine: Radiance 5.3
Weather: DNK_HS_Copenhagen-Kastrup.AP.061800_TMYx.2004-2018.epw
North Offset: 0°
Ambient Bounces: 6
Passes Completed: 100
Primary Ambient Samples: 6400

Layer Materials

Layer	Objects	Material	Rvis	Tvis
Ydervæg	586	Wood Maple	35,9 %	0,0 %
Indervægge	1014	Wall LM83	50,0 %	0,0 %
Indervægge::Ekstra lag (Kun til render model	114	Wall LM83	50,0 %	0,0 %
Tage	4	Ceiling LM83	70,0 %	0,0 %
Gulv	108	Floor LM83	20,0 %	0,0 %
Vinduer::Glas	95	Atlantica - Clear (Argon)	10,2 %	58,6 %
Vinduer::Ramme	1040	Aluminium Window Mullion	67,6 %	0,0 %
Vinduer::Kant materiale	240	Wall LM83	50,0 %	0,0 %

Window Groups

ID	Space ID	Area	Material	Tvis	Shade Material	Operation	Blinds Open
0	30	343 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	96,82 %
1	30	101 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,23 %
2	30	225 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,37 %
3	25	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	96,82 %
4	26	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
5	37	75 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	81,86 %
6	36	75 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	80,36 %
7	38	75 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	79,67 %

8	39	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	80,08 %
9	43	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,01 %
10	42	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	88,47 %
11	40	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,10 %
12	41	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,56 %
13	31	343 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	88,36 %
14	31	101 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,53 %
15	31	225 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
16	27	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,00 %
17	28	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	88,79 %
18	29	343 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	75,15 %
19	29	101 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
20	29	225 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	82,11 %
21	24	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
22	23	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	78,14 %
23	35	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,07 %
24	34	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,63 %
25	32	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,07 %
26	33	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,58 %
27	18	145 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,42 %
28	18	472 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	64,16 %
29	18	401 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	78,77 %
30	17	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,21 %
31	2	98 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
32	2	82 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
33	2	55 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
34	2	109 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
35	2	67 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
36	4	116 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	72,60 %
37	1	100 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
38	1	200 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
39	1	226 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,64 %
40	1	96 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
41	1	96 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,10 %
42	1	114 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,92 %
43	1	209 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,82 %
44	44	74 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	88,93 %
45	44	65 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	83,64 %
46	44	288 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,01 %
47	3	191 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	77,01 %
48	3	488 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
49	3	219 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
50	10	248 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
51	19	393 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	70,63 %
52	20	63 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,64 %
53	15	56 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,93 %
54	14	289 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	80,63 %
55	22	536 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	86,41 %
56	6	68 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
57	11	31 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	80,82 %
58	12	363 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	80,71 %
59	9	90 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %

Appendix

Occupancy

Space ID	Occupancy Schedule
1	8am-6pm with DST
10	8am-6pm with DST
11	8am-6pm with DST
12	8am-6pm with DST
13	8am-6pm with DST
14	8am-6pm with DST
15	8am-6pm with DST
16	8am-6pm with DST
17	8am-6pm with DST
18	8am-6pm with DST
19	8am-6pm with DST
2	8am-6pm with DST
20	8am-6pm with DST
21	8am-6pm with DST
22	8am-6pm with DST
23	8am-6pm with DST
24	8am-6pm with DST
25	8am-6pm with DST
26	8am-6pm with DST
27	8am-6pm with DST
28	8am-6pm with DST
29	8am-6pm with DST
3	8am-6pm with DST
30	8am-6pm with DST
31	8am-6pm with DST
32	8am-6pm with DST
33	8am-6pm with DST
34	8am-6pm with DST
35	8am-6pm with DST
36	8am-6pm with DST
37	8am-6pm with DST
38	8am-6pm with DST
39	8am-6pm with DST
4	8am-6pm with DST
40	8am-6pm with DST
41	8am-6pm with DST
42	8am-6pm with DST
43	8am-6pm with DST
44	8am-6pm with DST
5	8am-6pm with DST
6	8am-6pm with DST
7	8am-6pm with DST
8	8am-6pm with DST
9	8am-6pm with DST

Glossary

sDA: Spatial Daylight Autonomy: Percent of space receiving at least 300 lux for at least 50% of occupied hours. Calculation includes dynamic shading if modeled.

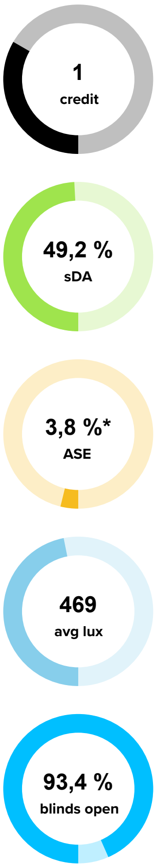
ASE: Annual Sunlight Exposure: Percent of space receiving at least 1000 lux direct sun for at least 250 occupied hours. Calculation excludes dynamic shading.

Avg Lux: Mean workplane illuminance during occupied hours. Calculation includes dynamic shading if modeled.

Blinds open: Percent of occupied hours blinds are open (or dynamic glass is in clearest state). Building total is window-area weighted.

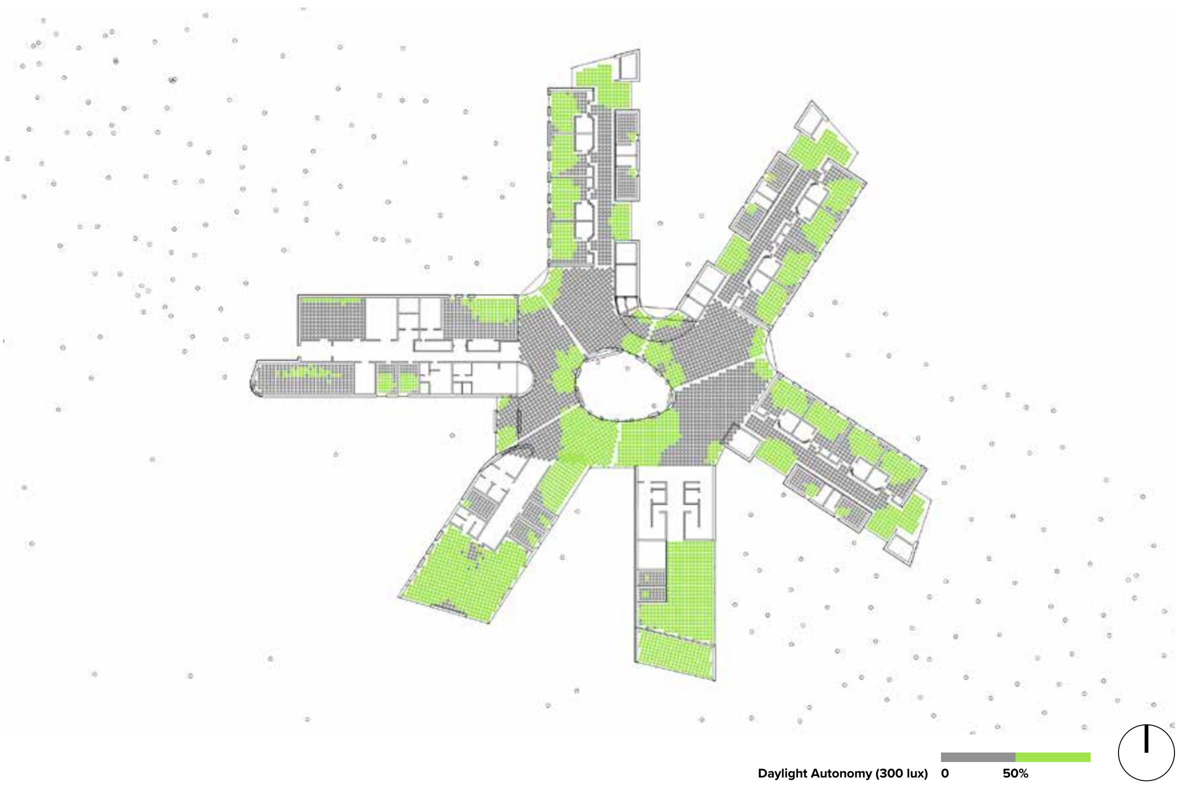
Shading: (Y/N) Does the space have dynamic blinds or dynamic glazing? If yes, shading operation affects sDA but not ASE.
The value must be yes for all perimeter spaces -- otherwise an explanation must be supplied via written addendum.

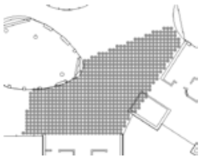
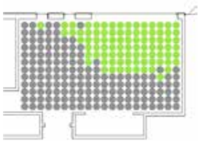
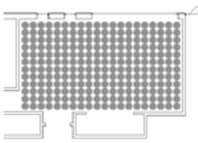
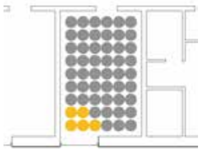
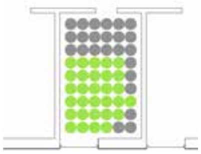
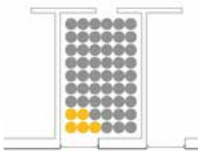
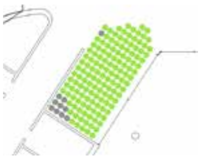
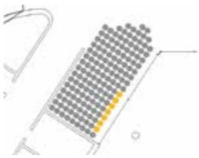
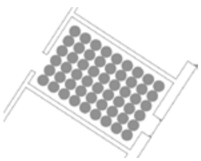
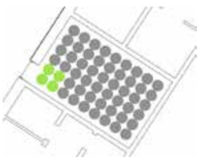
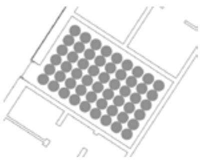
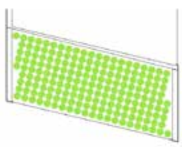
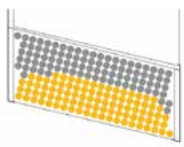
Daylight 21

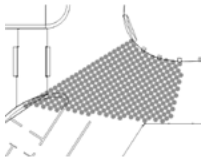
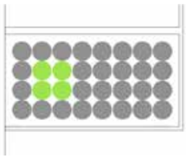
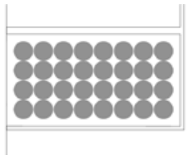
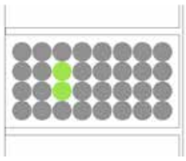
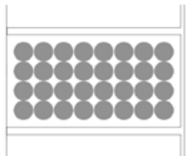
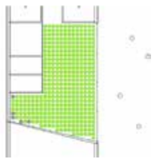
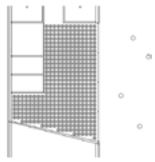
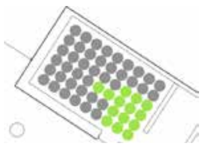
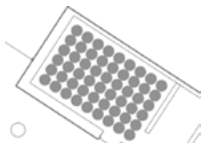
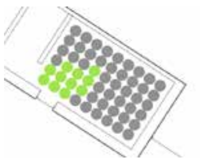
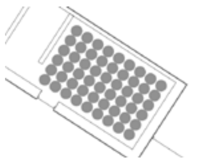
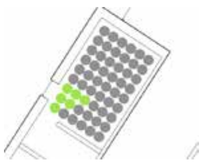
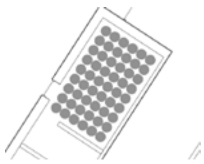
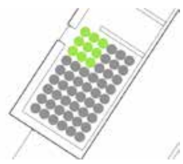
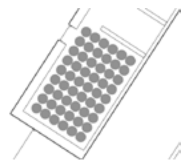
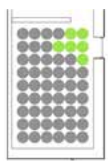
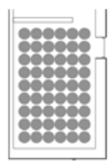
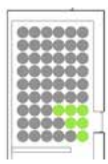
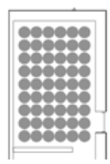


** ASE > 10% in one or more spaces. The design addresses glare in these areas as follows:*

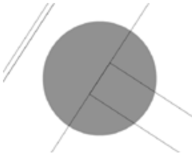
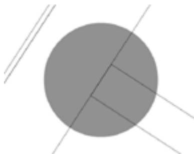
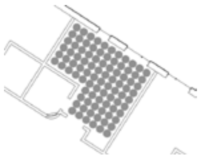
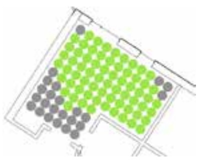
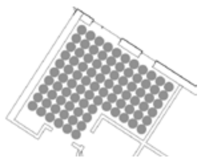
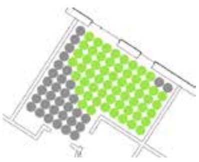
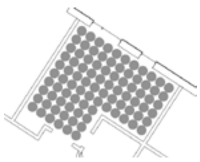
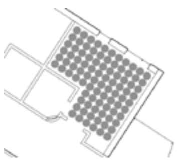
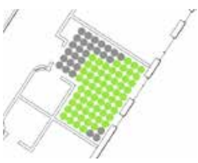
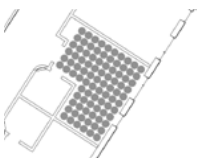
Using automated blinds to diffuse the most intense glare, or using passive shutters.

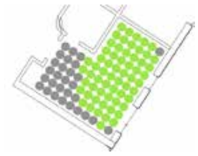
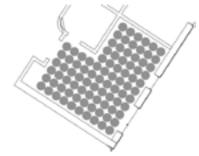
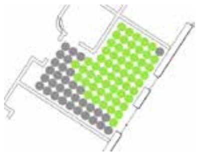
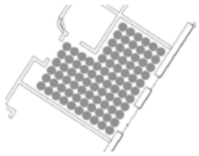
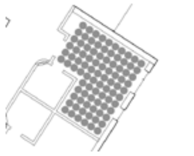
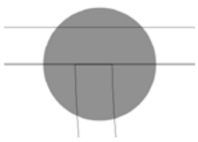
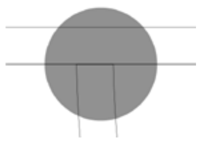
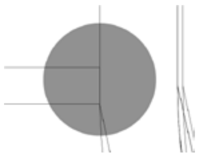
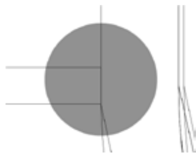
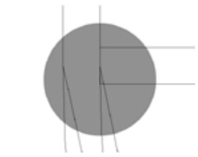
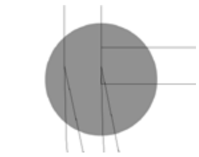
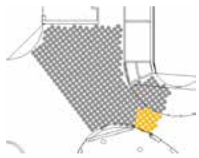
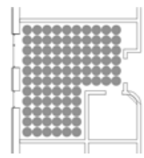
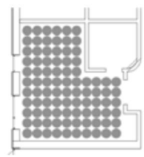
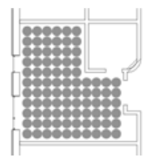


Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
1	2957 ft^2	2,0 ft	Y		34,55 %		0,00 %
10	941 ft^2	2,0 ft	Y		36,25 %		0,00 %
11	190 ft^2	2,0 ft	Y		61,11 %		9,26 %
12	190 ft^2	2,0 ft	Y		55,56 %		9,26 %
14	575 ft^2	2,0 ft	Y		93,29 %		4,70 %
15	190 ft^2	2,0 ft	Y		14,81 %		1,85 %
16	190 ft^2	2,0 ft	Y		20,37 %		0,00 %
17	190 ft^2	2,0 ft	Y		7,41 %		0,00 %
18	2173 ft^2	2,0 ft	Y		93,15 %		15,85 %
19	734 ft^2	2,0 ft	Y		100,00 %		50,82 %

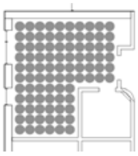
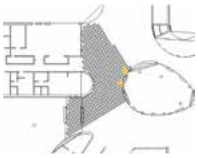
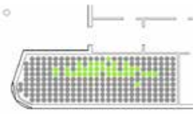
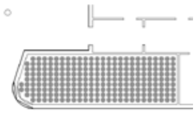
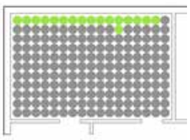
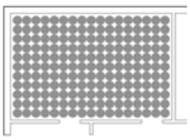
Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
2	1363 ft^2	2,0 ft	Y		65,81 %		0,00 %
20	127 ft^2	2,0 ft	Y		12,50 %		0,00 %
21	127 ft^2	2,0 ft	N		6,25 %		0,00 %
22	1634 ft^2	2,0 ft	Y		98,74 %		0,00 %
23	190 ft^2	2,0 ft	Y		25,93 %		0,00 %
24	190 ft^2	2,0 ft	Y		20,37 %		0,00 %
25	190 ft^2	2,0 ft	Y		11,11 %		0,00 %
26	190 ft^2	2,0 ft	Y		16,67 %		0,00 %
27	190 ft^2	2,0 ft	Y		11,11 %		0,00 %
28	190 ft^2	2,0 ft	Y		11,11 %		0,00 %

5.2 APPENDIX

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
29	1749 ft^2	2,0 ft	Y		48,31 %		3,09 %
3	0 ft^2	2,0 ft	N		0,00 %		0,00 %
3	2082 ft^2	2,0 ft	Y		23,54 %		9,26 %
30	1749 ft^2	2,0 ft	Y		48,03 %		0,00 %
31	1749 ft^2	2,0 ft	Y		44,66 %		0,00 %
32	395 ft^2	2,0 ft	Y		76,67 %		0,00 %
33	395 ft^2	2,0 ft	Y		73,33 %		0,00 %
34	395 ft^2	2,0 ft	Y		63,33 %		0,00 %
35	395 ft^2	2,0 ft	Y		70,00 %		0,00 %
36	395 ft^2	2,0 ft	Y		68,89 %		0,00 %

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
37	395 ft²	2,0 ft	Y		67,78 %		0,00 %
38	395 ft²	2,0 ft	Y		63,33 %		0,00 %
39	395 ft²	2,0 ft	Y		68,89 %		0,00 %
4	0 ft²	2,0 ft	N		0,00 %		0,00 %
4	0 ft²	2,0 ft	N		0,00 %		0,00 %
4	0 ft²	2,0 ft	N		0,00 %		0,00 %
4	1911 ft²	2,0 ft	Y		17,03 %		5,46 %
40	395 ft²	2,0 ft	Y		80,00 %		0,00 %
41	395 ft²	2,0 ft	Y		70,00 %		0,00 %
42	395 ft²	2,0 ft	Y		70,00 %		0,00 %

5.2 APPENDIX

Space ID & Description	Area	Spacing	Shading	0 50%	sDA	0 250 hrs	ASE
43	395 ft²	2,0 ft	Y		74,44 %		0,00 %
44	2332 ft²	2,0 ft	Y		25,74 %		1,67 %
8	909 ft²	2,0 ft	N		14,96 %		0,00 %
9	799 ft²	2,0 ft	Y		9,09 %		0,00 %
Totals	30747 ft²				49,16 %		3,82 %

Appendix

Software:	ClimateStudio v1.9.8389.21977
Engine:	Radiance 5.3
Weather:	DNK_MJ_Aarhus.AP.060700_TMYx.2004-2018.epw
North Offset:	0°
Ambient Bounces:	6
Passes Completed:	100
Primary Ambient Samples:	6400

Layer Materials

Layer	Objects	Material	Rvis	Tvis
Ydervæg	552	Wood Maple	35,9 %	0,0 %
Indervægge	1012	Wall LM83	50,0 %	0,0 %
Indervægge::Ekstra lag (Kun til render model	114	Wall LM83	50,0 %	0,0 %
Tage	52	Ceiling LM83	70,0 %	0,0 %
Gulv	108	Floor LM83	20,0 %	0,0 %
Vinduer::Glas	8	Atlantica - Clear (Argon)	10,2 %	58,6 %
Vinduer::Ramme	1051	Aluminium Window Mullion	67,6 %	0,0 %
Vinduer::Kant materiale	231	Wall LM83	50,0 %	0,0 %
Træstammer	1174	Wood Pine	36,6 %	0,0 %
bl	4695	Oak Leaf	5,6 %	0,0 %

Window Groups

ID	Space ID	Area	Material	Tvis	Shade Material	Operation	Blinds Open
0	12	363 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	83,73 %
1	35	30 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	93,12 %
2	35	75 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
3	34	30 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,18 %
4	34	75 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
5	32	30 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	94,05 %

Appendix

ID	Space ID	Area	Material	Tvis	Shade Material	Operation	Blinds Open
6	32	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
7	33	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	88,19 %
8	33	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
9	37	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	96,79 %
10	37	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,25 %
11	36	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	81,18 %
12	36	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	93,53 %
13	38	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,11 %
14	38	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,47 %
15	39	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	87,75 %
16	39	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	93,29 %
17	41	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	94,63 %
18	41	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	91,10 %
19	40	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	83,15 %
20	40	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,97 %
21	42	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,55 %
22	42	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,23 %
23	43	30 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	83,29 %
24	43	75 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,41 %
25	3	219 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
26	3	488 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
27	3	191 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	77,10 %
28	1	209 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
29	1	114 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,04 %
30	1	96 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,95 %
31	1	96 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
32	1	226 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,78 %
33	1	200 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
34	1	100 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
35	2	67 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
36	2	109 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
37	2	98 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
38	2	55 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
39	2	82 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,51 %
40	44	356 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,64 %
41	44	65 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,07 %
42	44	74 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	91,86 %
43	9	90 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
44	11	31 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	84,19 %
45	22	536 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,10 %
46	14	289 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	87,23 %
47	20	63 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,56 %
48	19	393 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	75,97 %
49	29	225 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,68 %
50	29	101 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
51	29	343 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	85,81 %
52	31	225 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
53	31	101 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
54	31	343 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,77 %
55	30	225 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,34 %
56	30	101 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	99,78 %
57	30	343 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	96,88 %
58	10	248 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
59	17	24 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	98,19 %
60	18	97 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
61	18	238 ft^2	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	85,23 %

Appendix

ID	Space ID	Area	Material	Tvis	Shade Material	Operation	Blinds Open
62	18	278 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	74,22 %
63	23	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	89,07 %
64	28	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	96,14 %
65	27	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	95,95 %
66	25	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	97,84 %
67	4	116 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	76,77 %
68	24	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	91,07 %
69	26	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	100,00 %
70	16	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	92,49 %
71	15	24 ft²	Atlantica - Clear (Argon)	58,6 %	sheerWeave 2410 Performance + P12 Oyster	Default (LEEDv4 2% Rule)	90,27 %

Occupancy

Space ID	Occupancy Schedule
1	8am-6pm with DST
10	8am-6pm with DST
11	8am-6pm with DST
12	8am-6pm with DST
14	8am-6pm with DST
15	8am-6pm with DST
16	8am-6pm with DST
17	8am-6pm with DST
18	8am-6pm with DST
19	8am-6pm with DST
2	8am-6pm with DST
20	8am-6pm with DST
21	8am-6pm with DST
22	8am-6pm with DST
23	8am-6pm with DST
24	8am-6pm with DST
25	8am-6pm with DST
26	8am-6pm with DST
27	8am-6pm with DST
28	8am-6pm with DST
29	8am-6pm with DST
3	8am-6pm with DST
3	8am-6pm with DST
30	8am-6pm with DST
31	8am-6pm with DST
32	8am-6pm with DST
33	8am-6pm with DST
34	8am-6pm with DST
35	8am-6pm with DST
36	8am-6pm with DST
37	8am-6pm with DST
38	8am-6pm with DST
39	8am-6pm with DST
4	8am-6pm with DST
4	8am-6pm with DST
4	8am-6pm with DST
4	8am-6pm with DST
40	8am-6pm with DST
41	8am-6pm with DST
42	8am-6pm with DST
43	8am-6pm with DST
44	8am-6pm with DST
8	8am-6pm with DST

Appendix

Space ID	Occupancy Schedule
9	8am-6pm with DST

Glossary

sDA:	Spatial Daylight Autonomy: Percent of space receiving at least 300 lux for at least 50% of occupied hours. Calculation includes dynamic shading if modeled.
ASE:	Annual Sunlight Exposure: Percent of space receiving at least 1000 lux direct sun for at least 250 occupied hours. Calculation excludes dynamic shading.
Avg Lux:	Mean workplane illuminance during occupied hours. Calculation includes dynamic shading if modeled.
Blinds open:	Percent of occupied hours blinds are open (or dynamic glass is in clearest state). Building total is window-area weighted.
Shading:	(Y/N) Does the space have dynamic blinds or dynamic glazing? If yes, shading operation affects sDA but not ASE. The value must be yes for all perimeter spaces -- otherwise an explanation must be supplied via written addendum.

6. APPENDIX

Nøgletal, kWh/m² år

Renoveringsklasse 2

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
95,6	0,0	95,6
Samlet energibehov		23,2

Renoveringsklasse 1

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
71,7	0,0	71,7
Samlet energibehov		23,2

Energiramme BR 2018

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
41,3	0,0	41,3
Samlet energibehov		23,2

Energiramme lavenergi

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
33,0	0,0	33,0
Samlet energibehov		23,2

Bidrag til energibehovet

Varme	0,0
El til bygningsdrift	12,2
Overtemp. i rum	0,0

Netto behov

Rumopvarmning	8,4
Varmt brugsvand	0,0
Køling	0,0

Udvalgte elbehov

Belysning	0,0
Opvarmning af rum	0,0
Opvarmning af vbv	0,0
Varmepumpe	2,6
Ventilatorer	9,6
Pumper	0,0
Køling	0,0
Totalt elforbrug	39,7

Varmetab fra installationer

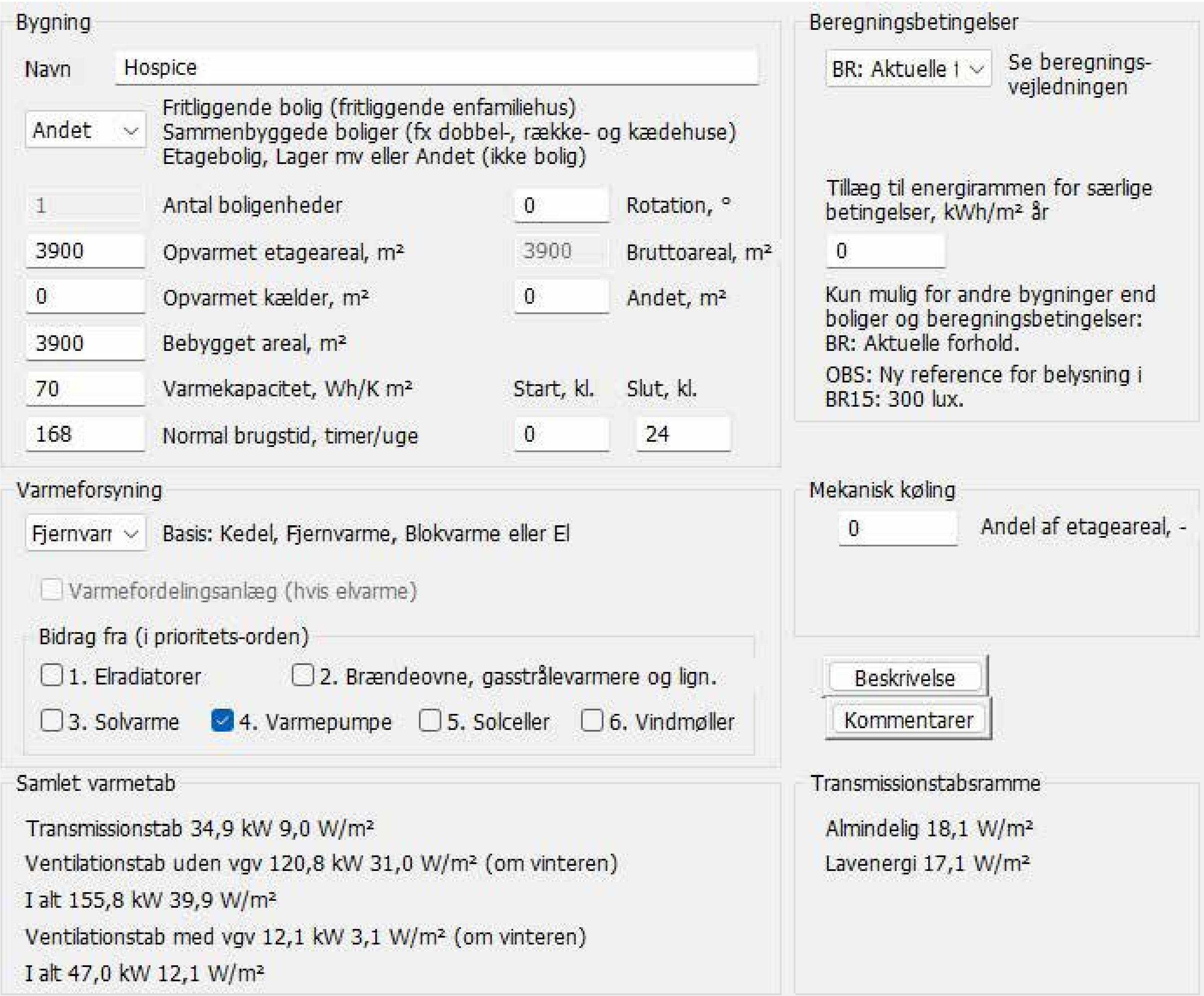
Rumopvarmning	0,0
Varmt brugsvand	0,0

Ydelse fra særlige kilder

Solvarme	0,0
Varmepumpe	8,4
Solceller	0,0
Vindmøller	0,0

	MWh	Januar	Februar	Marts	April	Maj	Juni	Juli	August	September	Oktober	November	December	I alt
	Varmebehov													
+1	Trans.- og vent.tab	22,42	20,50	24,06	14,48	9,86	6,48	2,58	2,46	6,13	11,86	18,66	22,42	161,91
2	Vent. VF (total)	0,00	0,00	0,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,21
3	Vent. VGV nedreg.	-0,19	-0,11	0,00	-1,93	-3,23	-3,87	-4,99	-5,02	-3,95	-2,75	-0,92	-0,19	-27,15
4	Varmetab	22,61	20,61	23,85	16,41	13,09	10,35	7,57	7,48	10,08	14,60	19,58	22,61	188,85
5	Solindfald	3,43	6,43	12,95	17,44	20,46	19,44	21,13	18,69	14,80	10,09	4,36	2,74	151,97
6	Internt tilskud	13,02	11,76	13,02	12,60	13,02	12,60	13,02	13,02	12,60	13,02	12,60	13,02	153,30
7	Fra rør og VVB konst.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
8	Samlet tilskud	16,45	18,19	25,97	30,04	33,48	32,04	34,15	31,71	27,40	23,11	16,96	15,76	305,27
9	Rel. tilskud, -	0,73	0,88	1,09	1,83	2,56	3,10	4,51	4,24	2,72	1,58	0,87	0,70	
10	Del af rumopv.	1,00	1,00	0,79	0,00	0,00	0,00	0,00	0,00	0,00	0,11	1,00	1,00	
11	Variabl. varmetilsk.	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
12	Tot. tilskud	16,45	18,19	25,97	30,04	33,48	32,04	34,15	31,71	27,40	23,11	16,96	15,76	305,27
13	Rel. tilskud, -	0,73	0,88	1,09	1,83	2,56	3,10	4,51	4,24	2,72	1,58	0,87	0,70	
14	Udnyt. faktor	0,87	0,81	0,73	0,51	0,38	0,32	0,22	0,23	0,36	0,57	0,82	0,88	
15	Varmebehov	8,26	5,82	3,78	0,00	0,00	0,00	0,00	0,00	0,00	0,15	5,68	8,69	32,39
16	Vent. VF (centralvarme)	0,00	0,00	0,21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,21
17	I alt	8,26	5,82	3,99	0,00	0,00	0,00	0,00	0,00	0,00	0,15	5,68	8,69	32,60

6. APPENDIX



Bygning

Navn: Hospice

Andet — Fritliggende bolig (fritliggende enfamiliehus) Sammenbyggede boliger (fx dobbel-, række- og kædehuse) Etagebolig, Lager mv eller Andet (ikke bolig)

1	Antal boligenheder	0	Rotation, °
3900	Opvarmet etageareal, m²	3900	Bruttoareal, m²
0	Opvarmet kælder, m²	0	Andet, m²
3900	Bebygget areal, m²		
70	Varmekapacitet, Wh/K m²	Start, kl.	Slut, kl.
168	Normal brugstid, timer/uge	0	24

Beregningsbetingelser

BR: Aktuelle f — Se beregnings-vejledningen

Tillæg til energirammen for særlige betingelser, kWh/m² år: 0

Kun mulig for andre bygninger end boliger og beregningsbetingelser: BR: Aktuelle forhold.

OBS: Ny reference for belysning i BR15: 300 lux.

Varmeforsyning

Fjernvarr — Basis: Kedel, Fjernvarme, Blokvarme eller El

☐ Varmefordelingsanlæg (hvis elvarme)

Bidrag fra (i prioritets-orden)

☐ 1. Elradiatorer ☐ 2. Brændeovne, gasstrålevarmere og lign.

☐ 3. Solvarme ☑ 4. Varmepumpe ☐ 5. Solceller ☐ 6. Vindmøller

Mekanisk køling

0 — Andel af etageareal, -

Beskrivelse

Kommentarer

Samlet varmetab

Transmissionstab 34,9 kW 9,0 W/m²

Ventilationstab uden vgv 120,8 kW 31,0 W/m² (om vinteren)

I alt 155,8 kW 39,9 W/m²

Ventilationstab med vgv 12,1 kW 3,1 W/m² (om vinteren)

I alt 47,0 kW 12,1 W/m²

Transmissionstabsramme

Almindelig 18,1 W/m²

Lavenergi 17,1 W/m²

A BE18 investigation was performed to benchmark the energy efficiency of the building.

During the design process, the construction and thermal mass of the building was discussed to determine the pros and cons of maintaining a light structure in the floor that ramped along the terrain or switching to a heavy construction. As concluded in the design process, ramps were not viable, and letting the building plainly cantilever would create some uncomfortable spaces beneath the building.

By increasing the thermal mass, the overall building efficiency was increased at the expense of the GWP. This was deemed an acceptable compromise, as it allowed the window area to increase, which strengthened the visual connection to nature and natural light. Concrete is also more moisture resilient than wood; Using a concrete foundation removes the possibility of the foundation rotting from moisture.

6. APPENDIX

Beskrivelse: New heat pump

Varmepumpe

Funktion	Andel af etageareal, -
Kombineret	1

Varmtvandsbeholder

Volumen 0 liter

Rumopvarmning	VBV	
145	145	Nominel effekt, kW
4,6	4,6	Nominel COP, -, Inklusive pumper, ventilatorer og automatik
0,9	0	Rel. COP ved 50% last, -
Test-temperaturer, °C		
0	0	Kold side
43	43	Varm side
Jordslange	Jordslange	Kold side: Jordslange, Aftræk, Udeluft eller Anden kilde
Varmeanlæ		Varm side: Rumluft, Indblæsning eller Varmeanlæg
0	0	Særligt hjælpeudstyr, W, som ikke er med i nominel COP
40	40	Automatik, stand-by, W, (konstant drift)
Varmepumper tilknyttet ventilationen		
0	0	Temp. virk.grad for vgv før VP, -
20		Dim. indblæsningstemperatur, °C
0	0	Luftstrøm, m³/s

Beskrivelse: Nyt solcelle anlæg

Solceller

40	Panel areal, m²
2	Peak Power (RS), kW/m²
1	System virkningsgrad (Rp), -

Orientering og skygger

S	Orientering, S, SØ, Ø, ... eller grader, S=180
35	Hældning, °, 0, 10, 20, 30, ...
0	Horisont afskæring, °
0	Skygge til venstre, °
0	Skygge til højre, °

	Ydervægge, tage og gulve	Areal (m²)	U (W/m²K)	b	Ht (W/K)	Dim.Inde (C)	Dim.Ude (C)	Tab (W)
		9000		CtrlClick	681			18924
+1	Ydervæg	1200	0,08	1,00	96	21	-12	3168
2	Tag	3900	0,08	1,00	312	21	-12	10296
3	Terrændæk	3900	0,1	0,70	273	21	7	5460
4								

	Fundamenter og samlinger ved vinduer	l (m)	Tab (W/mK)	b	Ht (W/K)	Dim.Inde (C)	Dim.Ude (C)	Tab (W)
		1816		CtrlClick	88,976			2847,23
+1	Ydervægsfundamenter	616	0,086	1,00	52,976	20	-12	1695,23
2	Samlinger omkring kompletering	1200	0.03	1.00	36	20	-12	1152
3								

	Vinduer og yderdøre	Antal	Orient	Hældn.	Areal (m²)	U (W/m²K)	b	Ht (W/K)	Ff (-)	g (-)	Skygger	Fc (-)	Dim.Inde (C)	Dim.Ude (C)	Tab (W)	Ot
		42			296,32		CtrlClick	177,792			CtrlClick				5689,34	0/1
+1	13M glasdør lejlighed øst	4	ø	90	5,46	0,6	1,00	13,104	0,8	0,63		1	20	-12	419,328	0
2	Smalt vindue lejlighed øst	4	ø	90	2,6	0,6	1,00	6,24	0,8	0,63	Skygger staff	1	20	-12	199,68	0
3	13M glasdør lejlighed vest	4	v	90	5,46	0,6	1,00	13,104	0,8	0,63	Staff vest udh	1	20	-12	419,328	0
4	Smalt vindue lejlighed vest	4	v	90	2,6	0,6	1,00	6,24	0,8	0,63	Staff vest udh	1	20	-12	199,68	0
5	13M glasdør lejlighed nord	4	n	90	5,46	0,6	1,00	13,104	0,8	0,63		1	20	-12	419,328	0
6	Smalt vindue lejlighed nord	4	n	90	2,6	0,6	1,00	6,24	0,8	0,63		1	20	-12	199,68	0
7	tekøkkenvindue med dør i vest	1	v	90	8,84	0,6	1,00	5,304	0,8	0,63		1	20	-12	169,728	0
8	Endevindue tekøkken	2	n	90	18,98	0,6	1,00	22,776	0,8	0,63		1	20	-12	728,832	0
9		1	ø	90	8,84	0,6	1,00	5,304	0,8	0,63	Skygger staff	1	20	-12	169,728	0
10		1	ø	90	18,98	0,6	1,00	11,388	0,8	0,63	Skygger staff	1	20	-12	364,416	0
11		1	n	90	8,84	0,6	1,00	5,304	0,8	0,63		1	20	-12	169,728	0
12		2	ø	90	2,625	0,6	1,00	3,15	0,8	0,63	Skygger staff	1	20	-12	100,8	0
13		2	v	90	2,625	0,6	1,00	3,15	0,8	0,63	Staff vest udh	1	20	-12	100,8	0
14		2	s	90	2,645	0,6	1,00	3,174	0,8	0,63	Skygger syd s	1	20	-12	101,568	0
15		1	ø	90	13,95	0,6	1,00	8,37	0,8	0,63	Skygger staff	1	20	-12	267,84	0
16		1	v	90	13,95	0,6	1,00	8,37	0,8	0,63	Staff vest udh	1	20	-12	267,84	0
17		1	s	90	13,95	0,6	1,00	8,37	0,8	0,63	Skygger syd s	1	20	-12	267,84	0
18		1	ø	90	19,5	0,6	1,00	11,7	0,8	0,63	Skygger staff	1	20	-12	374,4	0
19		1	v	90	19,5	0,6	1,00	11,7	0,8	0,63	Staff vest udh	1	20	-12	374,4	0
20		1	s	90	19,5	0,6	1,00	11,7	0,8	0,63	Skygger syd s	1	20	-12	374,4	0

	Vinduer og yderdøre	Antal	Orient	Hældn.	Areal (m²)	U (W/m²K)	b	Ht (W/K)	Ff (-)	g (-)	Skygger	Fc (-)	Dim.Inde (C)	Dim.Ude (C)	Tab (W)	Ot
		37			381,3		CtrlClick	234,002			CtrlClick				7488,08	0/1
+1		1	s	90	24	0,6	1,00	14,4	0,8	0,63		1	20	-12	460,8	0
2		1	v	90	16	0,6	1,00	9,6	0,8	0,63		1	20	-12	307,2	0
3		1	n	90	43	0,6	1,00	25,8	0,8	0,63		1	20	-12	825,6	0
4		1	ø	90	13	0,6	1,00	7,8	0,8	0,63		1	20	-12	249,6	0
5	Vinduesbånd Syd	1	s	90	40,4	0,6	1,00	24,24	0,8	0,63	Skygge vindu	1	20	-12	775,68	0
6	Køkken vinduer	1	n	90	24,8	0,6	1,00	14,88	0,8	0,63		1	20	-12	476,16	0
7	Staff vest vinduer	7	v	90	2,62	0,6	1,00	11,004	0,8	0,63	Staff vest udh	1	20	-12	352,128	0
8	Ovenlys	17	n	0	2,56	0,72	1,00	31,3344	0,8	0,63		1	20	-12	1002,7	0
9	Staff syd vindue	1	s	90	25,8	0,6	1,00	15,48	0,8	0,63	Skygger syd s	1	20	-12	495,36	0
10	Sluise room	1	n	90	9,54	0,6	1,00	5,724	0,8	0,63		1	20	-12	183,168	0
11	Staff vest vinduer	1	ø	90	21,9	0,6	1,00	13,14	0,8	0,63	Skygger staff	1	20	-12	420,48	0
12	Syd vindue midte	1	s	90	21	0,6	1,00	12,6	0,8	0,63	Skygge midte	1	20	-12	403,2	0
13	Spa vinduer vest	1	v	90	17	0,6	1,00	10,2	0,8	0,63	Staff vest udh	1	20	-12	326,4	0
14	Spa vindue syd	1	s	90	36	0,6	1,00	21,6	0,8	0,63	Skygger medi	1	20	-12	691,2	0
15	Spa vindue øst	1	ø	90	27	0,6	1,00	16,2	0,8	0,63	Skygger staff	1	20	-12	518,4	0
16																

	Skygger	Horisont (°)	Udhæng (°)	Venstre (°)	Højre (°)	Vindueshul (%)
+1	Default	0	0	0	0	0
2	Skygger syd staff	0	21,6	0	0	10
3	Skygger meditation	0	21,6	0	0	10
4	Skygger staff øst gavl	15	21,6	90	68	10
5	Skygge midter syd vindue	0	55	6,5	38,53	10
6	Skygge vinduesbånd syd	0	51,2	2,3	0	10
7	Staff vest udhæng	0	21,6	0	2	10
8						

	Ventilation	Areal (m²)	Fo, -	qm (l/s m²)	n vgv (-)	ti (°C)	El-VF	qn (l/s m²)	qi,n (l/s m²)	SEL (kJ/m³)	qm,s (l/s m²)	qn,s (l/s m²)	qm,n (l/s m²)	qn,n (l/s m²)
	Zone	3900		Vinter			0/1	Vinter	Vinter		Sommer	Sommer	Nat	Nat
+1	Total building Estimate	3900	1	0,8	0,9	18	0	0	0,006	1,8	0.3	3.2	0.3	0.3
2														

	Internt varmetilskud	Areal (m²)	Personer (W/m²)	App. (W/m²)	App.nat (W/m²)
	Zone	3900,0	5850,0 W	13650,0 W	3900,0 W
+1	Whole house	3900	1,5	3,5	1
2					

BE18 lights:

Because a majority of the hospice is used as a temporary home for patients and their families, energy consumption for artificial lighting was disregarded, as it would be impossible to accurately predict when and how long lights would be on. Therefore, the building was considered as a residential building, where energy consumption for lights isn't part of the energy frame.