VISITOR CENTRE

MOLS BJERGE NATIONAL PARK

MA4-ARK20 //
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PREFACE

The project started as a common wish to design a building within a beautiful landscape in the final stage of the master programme of Architecture & Design. Coincidentally, a competition brief for a new visitor centre in Mols Bjerge National Park matched the wish and opened up for the mutual interests in tectonic design and the sensibility of architecture.

A special thanks to the supervisors Claus Kristensen and Lars Damkilde whose knowledge and drive has contributed to reach the best possible result. Also a warm thanks to Ida Skall Sørensen who revised the report.

ABSTRACT (DANISH)

Dette afgangsprojekt i Arkitektur og Design omhandler designet af et velkomstscenter til Nationalpark Mols Bjerge. Afsættet er en konkurrence, som blev udstedt af bestyrelsen for nationalparken sommeren 2016, hvor flere hold af tegnestuer blev inviteret til at komme med et bud på udformningen af en helhedsplan for velkomstscenteret. Specialet er et akademisk forslag med basis i temaerne: Tektonisk design & arkitekturens sanselighed. Bevæggrunden for netop denne opgave, er den oplagte kobling til de nævnte tematikker, og samtidig projektets overskuelige omfang, der muliggør en væsentlig grad af detaljering.

Gennem studier i stedets særegne karakter, er det blevet visionen at skabe en indgangsportal til nationalparken. I højsædet er naturen, kulturen og et landskab med tydelige spor fra istiden. Med sin tilstedeværelse vil velkomstcenteret styrke turismen i forbindelse med nationalparken, og give de lokale noget yderligere at være stolt over.

Der er tale om et bakket landskab ud mod Kalø Vig og en slotsruin fra middelalderen. Det nye velkomstcenter skal være en attraktion i sig selv, men samtidig respektere landskabet og det tilstødende hus af Hack Kampmann, der bevares som en del af projektet. Denne balancegang er udforsket gennem projektet og præsenteret i det endelige forslag.

CONTENT

Ill. 06.1. The landscape of Mols Bjerge

INTRODUCTION

Ill. 08.1. A family visit to the National Park

PROLOGUE

Mols Bjerge is an attractive tourism spot with over 150.000 visitors registered each year. The large number of visitors has a positive impact on the national park, but it also calls for more resources and an increased capacity to manage tourism in the area.

The board of the national park has decided that a new visitor centre next to Kalø Slotsruin would be appropiate to match the position as a location of great tourism. The visitor centre will function as a gateway to the national park, promoting the culture and nature, while boosting the local community life.

COMPETITION

A number of drawing offices was invited by the board of Mols Bjerge in the summer 2016, to make a proposal for the new visitor centre.
The master thesis takes its point of departure in the brief that was composed in relation to the closed competetion.

MOTIVATION

The project of designing a visitor centre for Mols Bjerge National Park is an opportunity to come across interesting design fields and explore topics such as tectonic design and the sensibility of architecture. The careful placement of a building in an area of great nature and landscape qualities is a challenging task, which also is a motivation factor.

GUIDE OF READING

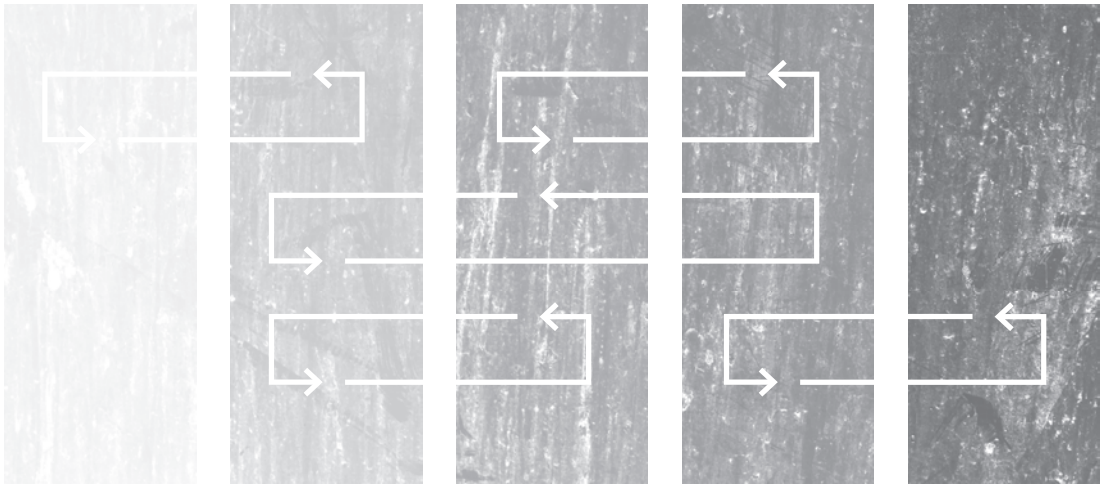
The report is divided into a number of chapters, which starts from "the outside" and moves towards the design proposal. After the introduction, the theoretical framework is stated, providing the background for further analyses.
The analyses moves from a more general level, exploring aspects of Mols Bjerge National Park, to the more specific site and micro climate.

Following the analyses, the presentation shows the qualities of the design proposal through visualisations, descriptions and drawings.
The chapter about the design process is a way of explaining how the projected was developed, while conclusions and reflections are collected in the epilogue. Supplemental material is included in the annex.

The references and list of illustrations are made according to the harvard style.

In addition to this report, there is a drawing folder containing measurable plans, sections and details for the design proposal.

METHODOLOGY



Ill. 11.1. The five phases of the integrated design process.

The complex task of designing a visitor centre calls for a holistic approach. Accordingly, the methodology of the master thesis is based on the integrated design process as defined by Mary-Ann Knudstrup [Knudstrup, 2004].

The integrated design process consists of the five phases: problem/idea, analysis, sketching, synthesis and presentation (ill. 11.1). The phases are not to be viewed strictly chronological, but allow the designer to move back in earlier phases.

Shifting between the different phases by making iterations ensures a higher coverage of problems and a more holistic project.

PROBLEM / IDEA PHASE

The starting phase of the integrated design process is called the problem or the idea phase. Here, initial ideas are made, and the entire framework for the project is defined.

ANALYSIS PHASE

The second phase deals with different analyses having the purpose of reaching a common understanding and setting a basis for qualified decisions throughout the design process. The analyses include both quantitave and qualitative studies and are based on a hybrid between computional and analogue mediums.

SKETCHING PHASE

The third phase is the sketching phase. Now the problems and ideas are being solved through the use of both analogue and digital drawings, models and the dialogue between the group members.
A concept is found, argumented by both the analyses from the previous phase and the qualities extracted from the sketches. It is often necessary to go a step back and make further analyses to back up the current status qou.

SYNTHESIS PHASE

The fourth phase is the synthesis phase in which the building reaches its final state.
Every aspect from the previous phases are synthesized into an integrated whole, and loose ends are finished.

PRESENTATION PHASE

The final phase is the presentation phase and is all about presenting the project in a way that points out its qualities.
A good balance between visualisations, text, diagrams and drawings is necessary to make the project comprehendable and also convince the reader.

APPROACH & FOCUS

TECTONICS
ARCHITECTURE & PSYCOLOGY
SUSTAINABILITY

THE MAIN FOCUS OF THE PROJECT IS THE TECTONIC DESIGN OF A VISITOR CENTRE IN MOLS BJERGE.

IN ORDER TO LEAD THE DESIGN IN THE RIGHT DIRECTION, STUDIES ON THE ARCHITECTURAL ASPECTS SUCH AS TECTONICS, PHENOMENOLOGICAL SENSATIONS AND SUSTAINABILITY ARE MADE.

IT IS ESSENTIAL KNOWLEDGE AND PRELIMINARY FOR FURTHER STUDIES AND THE DESIGN.

TECTONICS

Approach & Focus

Ill. 14.1. Peter Zumthor.

Tectonics aim to enhance the perception of architecture by the aesthetic expression, materiality and fine work of details. The word 'tectonic' comes from the ancient Greek term 'tekton', which means carpenter or builder. (Frampton, 1995, p.3).

Juhani Pallasmaa describes tectonics as an important instrument for the perception of architecture by stating:

"The authenticity of architectural experience is grounded in the tectonic language of building and the comprehensibility of the act of construction to the senses."
(Pallasmaa, 2005, p.64).

Back in the 19th century, Gottfried Semper introduced the modern world to the tectonic term in his book "The Four Elements of Architecture" (1851), and later in his paper "Style in the Technical and Tectonic Arts" that earned him the role as the protagonist of architecture.

Semper proclaims that a design needs to establish a connection to its structural proportion and provide visual stability in the given space to achieve sensible comfort for the users. According to Semper, buildings simplistically consist of four key components: the hearth, the earthwork, the enclosure and the roof. (Frampton, 1995)

Kenneth Frampton himself, a British architectural theorist, would later on refine the definition of tectonics in his book "Studies in Tectonic Culture" (1995) where he refers to Semper's work. He draws a distinction between the heavy mass components, that are refered to as stereotonics, and light framework components that are associated with tectonics.

Frampton sees tectonics as a tool to achieve a deep, meaningful atmosphere and a way for people to comprehend the construction and ultimately establish a link to the spatial understanding. In this connection, he describes tectonisc as "the poetic language of construction".

"Tectonic becomes the art of joining. "Art" here is to be understood as encompassing 'tekne', and therefore indicates tectonic as assemblage not only of building parts but also of objects, indeed of artworks in a narrower sense. With regard to the ancient understanding of the word tectonic tends toward the construction or making of an artisanal or artistic product." (Frampton, 1995, p. 4)

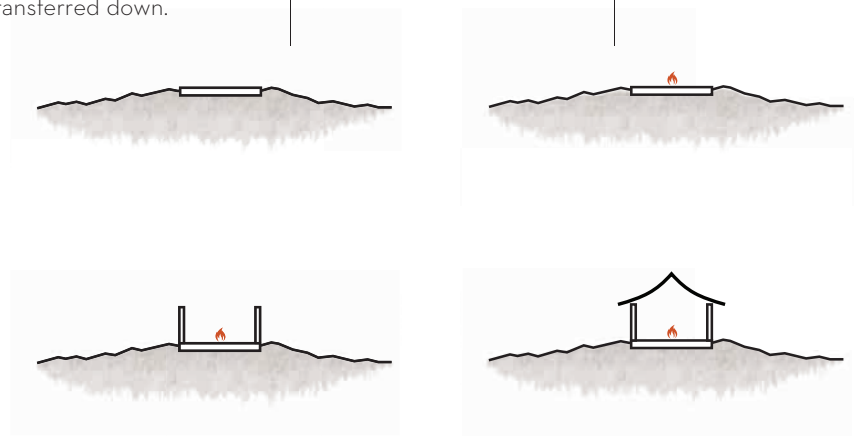
According to Frampton's statement, the assemblance of the construction elements and the considerations of the

EARTHWORK

The foundation of the building. It draws the connection between the human-made structure and the local terrain. The foundation is the first step towards creating architecture. It provides the physical attachment to the ground, so the loads from other elements can be transferred down.

HEARTH

Back in the ancient times, the hearth was a place for humans to gather around and finding warmth and comfort beside the open flame. In more modern times, the hearth represents the social center of building.



ENCLOSURE

The protective skin of the building.
Semper distinguishes the wall in two different typologies, die Mauer, which is associated with a solid wall, and die Wand, which is a lightweight screen.
The lightweight screen serves as a room separator, while the solid wall is an extension of the earthwork and provides protection.

ROOF

Protection against the weather.
It provides shade from the strong sun and prevents rainwater from entering the building.

Ill. 15.1. The four elements of architecture.

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material properties play a crucial role in understanding the building as a whole.

In the investigation of assembling details, Marco Francari goes further into the topic with his book "Tell-the-tale Detail".

The following quote by Marco Francari is about the main features in the art of detailing and the qualities it bring to a design.

"The art of detailing is really the joining of materials, elements, components, and building parts in a functional and aesthetic manner. The complexity of this art of joining is such that a detail performing satisfactorily in one building may fail in another for very subtle reasons." (Francari, 1987)

The definition of tectonics gets even clearer by looking at its counterpart, which is atectonic. Frampton describes atectonics as a term for designs that does not provide a visual understanding of the construction mecanics, and the way loads are transferred through elements. The construction is hereby visually neglected and obscured. (Frampton, 1995)

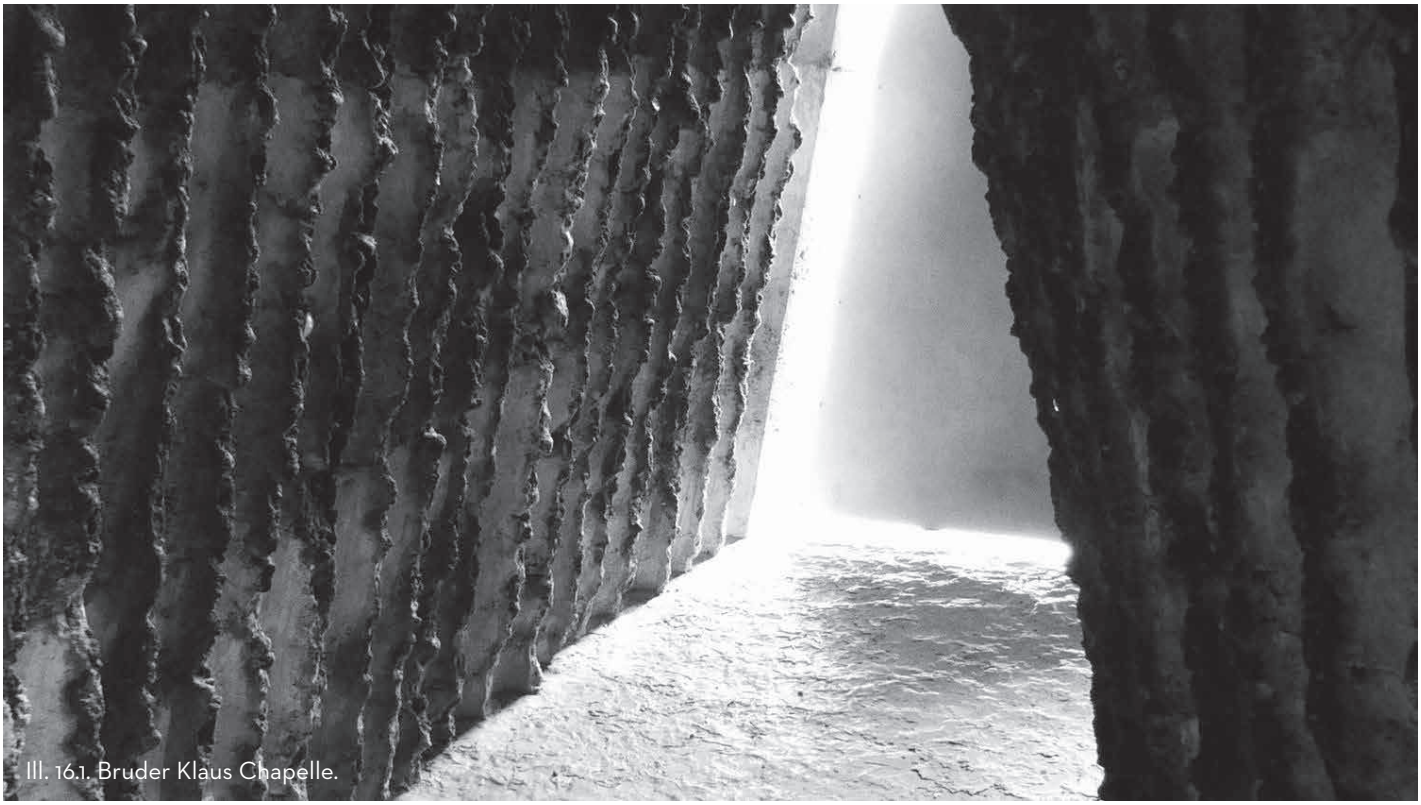
Frampton proclaims that the contemporary architecture has a tendency to deprecate the fine work of details in favor of a strong overall image.

The tectonic approach requires interactions of different design fields, which bring forth the qualities of sensibility and unites the conceptual form language with technical aspects. By implementing tectonic principles as a tool for designing the visitor centre, it should be possible to create a unique experience of the spaces.

Ill. 15.2. Saint Benedict Chapel

ARCHITECTURE & SENSABILITY

Approach & Focus



Ill. 16.1. Bruder Klaus Chapelle.

SENSIBILITY OF ARCHITECTURE

When working within the study field of tectonic design, it is difficult to avoid the sensibility of architecture.

Our senses are an instrumental tool for us to perceive architecture and get a grasp of its eccentric expression. Juhani Pallasmaa argues in his book "The Eyes of the Skin" (1996) that architecture needs to address all our senses simultaneously to achieve a multi-sensory experience. The qualities of space, matter and scale in architecture should be measured equally by eye, ear, nose, skin, tongue, bones and muscle. Only through these can people allow themselves to fully engage themselves in their dreams, imaginations and desires through architecture. Pallasmaa is concerned about the negative tendencies in modern architecture, that the building only speaks to our visual sense, but fails to stimulate our other senses – hearing, taste, smelling and touch – because architects are too focused on the visual appearance.

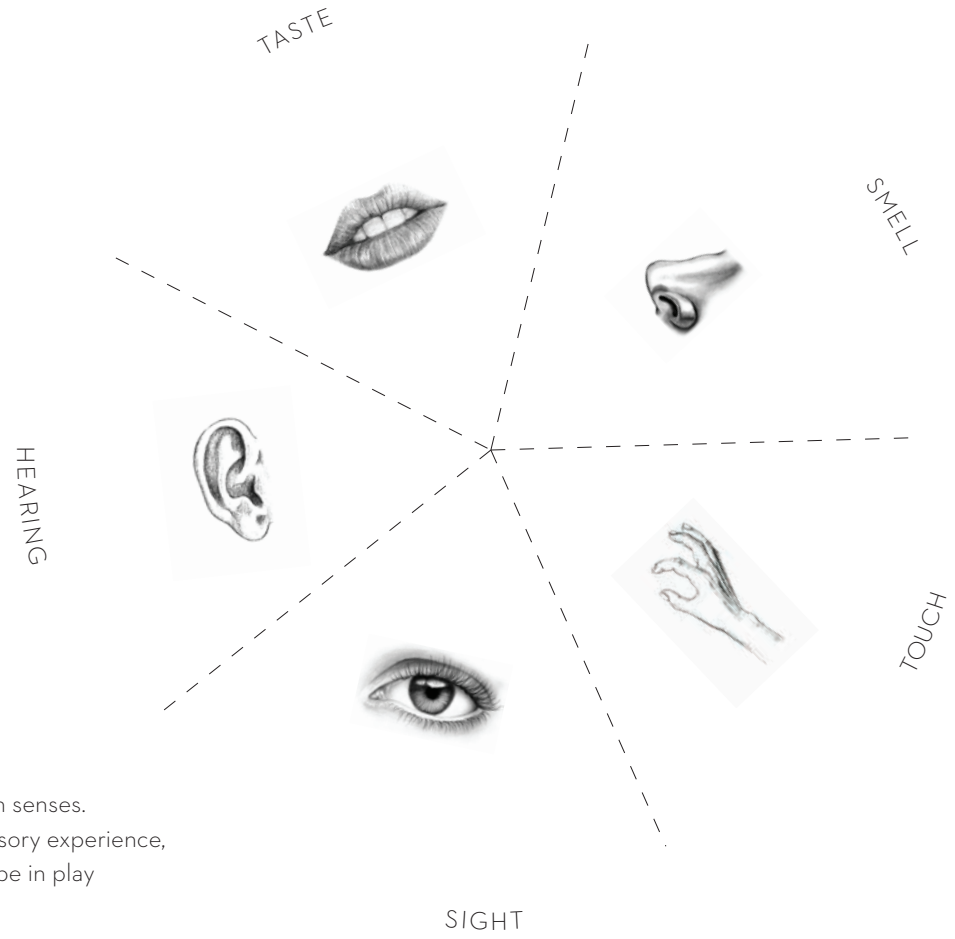
Although Pallasmaa critisises the obsession with the visual image, he acknowledges the importancy of vision. The sense of sight allows us to determine the distance and separate things apart, while the touch represents intimacy, nearness and affection. (Ill. 17.1). Tactility in materials invites you to touch and experience architecture through your skin. It can also tell a story about how it was produced or changed in time.

While Pallasmaa clarifies how people capture the atmosphere through their senses, Swiss architect Peter Zumthor highlights nine key features for a building in terms of architectural sensibility.

Peter Zumthor's key features are:

- SYNERGY OF MATERIALS
- ACOUSTIC PROPERTIES
- THERMAL CONDITIONS
- INTERPLAY BETWEEN SCALE AND SPACE
- TENSION BETWEEN EXTERIOR AND INTERIOR
- FLOW OF THE BUILDING
- SURROUNDING OBJECTS
- LIGHT CONDITION
- ORGANISATION OF SPACE

By treating these nine key features with care, it is possible to achieve a multi-sensory experience. It is desired to achieve this eccentric atmosphere in the visitor centre.



Ill. 17.1. The five human senses.
To obtain a multi-sensory experience, several senses must be in play simultaneously.

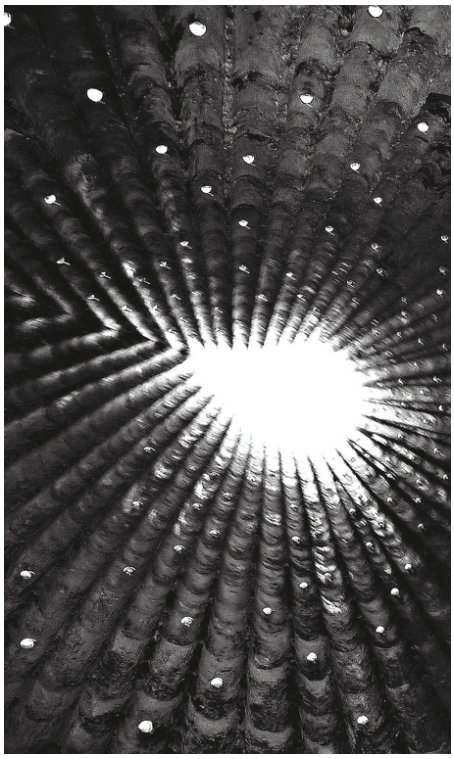
Zumthor's ability to implement the theoretical knowledge about sensibility in actual design solutions is widely acknowledged. The design of Bruder Klaus Field Chapel (ill. 16.1) is one of his greatest accomplishment in terms of achieving the multi-sensory experience. This is done through the quality of details, the composition of the materials and the inner space, which presents itself as a negative volume inside the heavy concrete mass.

The building has a clean monolithic look from the exterior while the interior walls has a characteristic tactility as a result of casting the concrete with a log construction form. This gives the spectator an experience of stepping inside a cave. In this way, there occurs a tension between exterior and interior. This tension creates a distinquished contrast and adds a unique atmosphere to the building.

The light condition inside the chapel plays an important role for the spectator's perception of the space. Peter Zumthor's idea of installing 300 small light shafts inside the solid concrete mass displays a beautiful result, where the small light rays pierce though the dark cave wall and give an aesthetic experience of light.

(Schwartz, 2017, p. 282-288).

> Ill. 17.3. The light piercing through the roof and wall of Bruder Klaus Chapel, creating a unique atmosphere.



SUSTAINABILITY

Approach & Focus

Ill. 18.1. Inujima Seirensho.

People have become more aware of sustainable thinking in the modern society where the fundamental idea is to ensure all decisions and actions made by us does not pose any threat to the environment, to protect the future living conditions on earth.

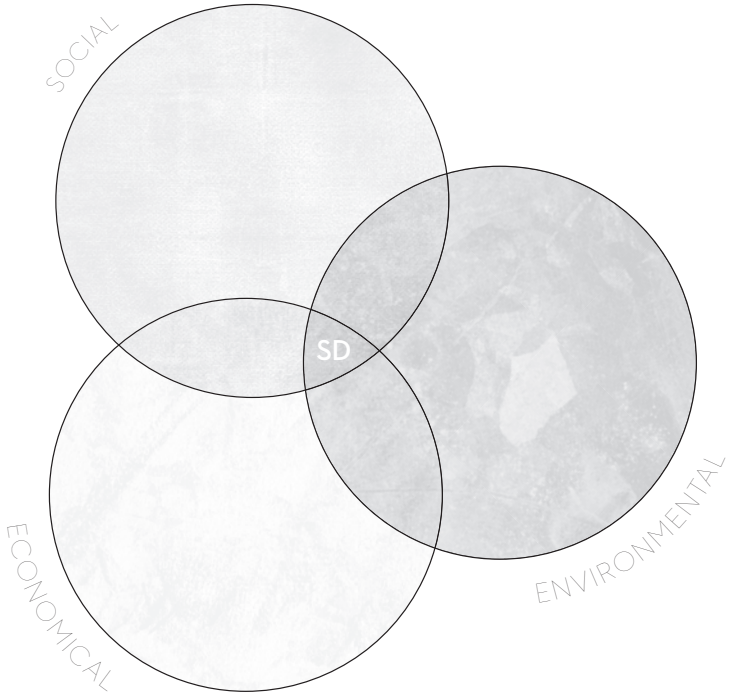
Even though the aspect of sustainability is not the head focus point in this project, the sustainable subjects will be taken into consideration in the development of the visitor centre.

Sustainable design consists of the three main aspects: social, environmental and economic sustainability (Berardi, 2013).
The visitor centre will consider for environmental issues in the design while the social and economic will only be dealt with to a limited extent. The environmental aspect is usually the one people refer to when talking about sustainability. The purpose for creating a sustainable environment is to reduce the CO_2 emission and protect the global resources by reducing energy consumption, applying renewable energy and using sustainable material for buildings.

The visitor centre will incorporate basic principles for reducing transmission loss to reduce the energy consumption. The building materials for the visitor centre will be selected based on durability, recyclability, attachment to the local region and the CO_2 emission under production to ensure sustainable solutions.

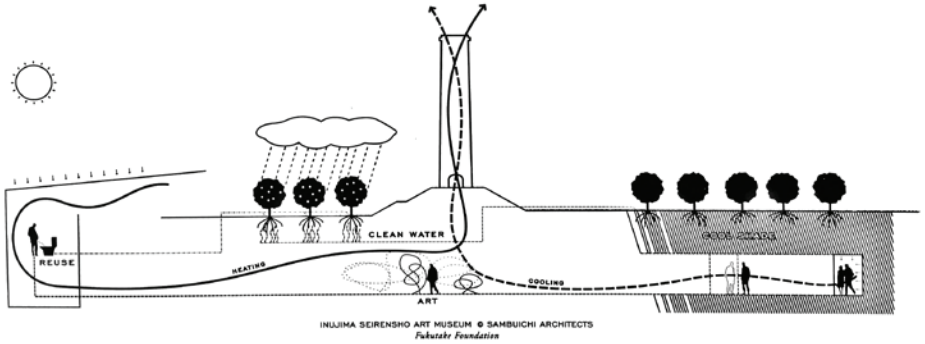
The site has access to the local power stations but not to district heating. That means the visitor centre needs to rely on renewable sources for heating up the rooms.

Ill. 16.2. When the architects inhabited the site on Inujima, they kept the stones from an earlier oil refinery. The stones are charred and black, but they are nonetheless beautiful and tell a story about the island by their presence.

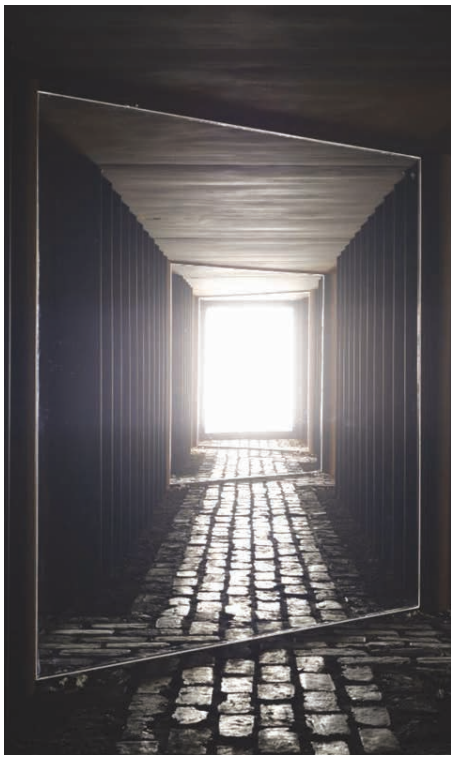


Ill. 19.1. The three aspects of sustainable design.

Ill. 19.2. A diagram of the sustainable principles of the Inujima Seirensho Art Museum. It is explained how the art is located below the ground level where the room temperature is regulated by the cool shade of the earth and heat generation from panels above ground level, when necessary. Everything is reused; Rainwater is filtrated to clean water, and toilet visits become nutrition for trees. The ventilation is exhausted through the large pipes.



Ill. 19.3. A picture of the underground channels of the museum. Daylight is reflected into the space by the use of rotated mirrors. The effect is an optical illusion that simultaneously confuses and teases the curiosity for understanding what is going on.



MOLS BJERGE

HISTORY & CULTURE
LANDSCAPE
NATURE
POINTS OF INTEREST
INFRASTRUCTURE

THIS CHAPTER FEATURES A SERIES OF STUDIES ABOUT THE CULTURAL AND HISTORICAL BACKGROUND OF THE NATIONAL PARK MOLS BJERGE.

THE LANDSCAPE HAS A GREAT SIGNIFICANCE FOR THE AREA, AND THE ORIGIN OF THE LANDSCAPE IS INVESTIGATED ALONG WITH THE VARIATING NATURE.

IMPORTANT SIGHTS ARE MAPPED AS POINTS OF INTERESTS, WHILE THE WAY TO GET AROUND IS EXPLORED IN THE SUBCHAPTER OF INFRASTRUCTURE.

HISTORY & CULTURE

Mols Bjerge

16000 B.C.

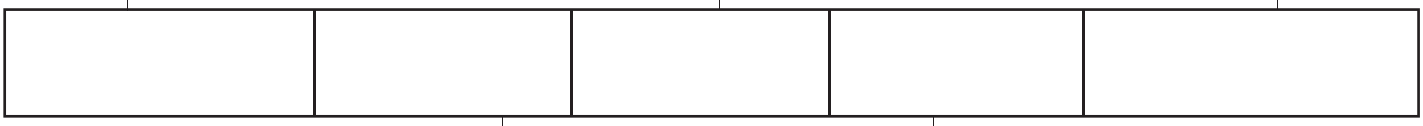
The ice has waved back and fourth during the last ice age and has reshaped the landscape each time. The last push forces its way and creates the terminal moraines that today are Mols Bjerge.

3300 B.C.

Poskær Stenhus was raised about this time of the Stone Age.

1300

The castle of Kalø was erected by king Erik Menved.



6000 B.C.

The level of the Stone Age ocean was two to three meters higher than today. Eventually, the land raised so that the old ocean bottom became earth.

1800-1000 B.C.

The large Bronze Age mounds were founded as burial places in Mols Bjerge.

1800-1000 B.C.

The large Bronze Age mounds were founded as burial places in Mols Bjerge.

Ill. 22.1. Historical timeline.

FROM LAND TO NATIONAL PARK

The land of Mols Bjerge has gone through a series of changes during the past 100,000 years. It is especially the ice age that has been the big contributor, shaping the landscape and, in certain periods, creating favourable conditions for humans to inhabite the land. In warm periods, hunter-nomads thrived, living of the land that provided animals such as mammoths, steppe bisons and reindeers.

Approximately 10,000 years ago, the last ice age ended. Several findings suggests how the Stone Age people lived and died. Enourmous stones have been moved and placed in dolmens as the one of Poskær Stenhus. The top stone weighs 12 tons and is split from a larger piece. The other part lies at the Grovlegårddyssen and is the major one, weighing 19 tons.
The marks from the Bronze Age are very significant. Burial places are placed high up in the landscape on the tallest hills, including Trehøje and Agri Bavnehøj.

During the Middle Ages the land has presumably been good for agriculture, because of the nutritious topsoil from deforestation. But as the earth gradually became exhausted, the conditions for farming deteriorated to a great extent. Instead the earth was covered with grass and heather for pasture.

In the later half of the 19th century, a societal revolution greatly improved the conditions for the farmers thorugh a new co-operative movement. As the emergence of the railways made it easier for people to travel outside the cities of Aarhus and Copenhagen, the new technology contributed to the progress of tourism becoming an increasing part of the life of Danish people. It became popular to

Ill. 22.2. Poskær Stenhus. The largest dolmen in Denmark, raised as a burial place about 3300 B.C.

1688

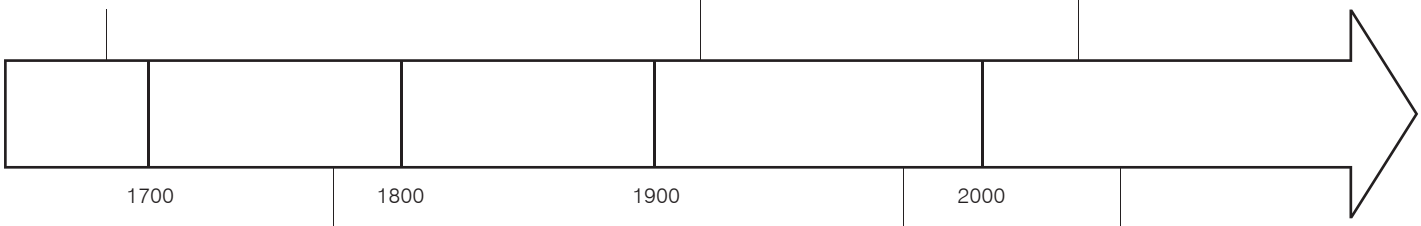
Christian 5 implements the big land register in agriculture. It is a type of tax reform which, after a thorough survey, determines the farmer's tax according to how good the land is for farming and livestock. For the agriculture in Mols Bjerge it means that that their tax ability is very low.

1907

Architect Hack Kampmann wins the second price in an architectural competetion for worker's homes and his Strandhuset in Kalø Vig is built. (Bestyrelsen for Molsbjerge, 2016)

2008

Mols Bjerge is elected as the second national park of Denmark.



1780

Doctor Christian E. Mangor publishes the oldest preserved collection of Molbo stories.

1984

The northern part of Mols Bjerge is preserved as a whole. 10 years later the southern part follows.

2016

The board of Mols Bjerge announces the competetion for a visitor center at Kalø Vig.

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visit Mols Bjerge and enjoy the landscape, history and culture. Later followed the idea of identifying the area as a national park.

(Naturstyrelsen.dk, 2017)

"The national park is a cooperation between the public sector, the landed proprietors and the private associations."

(Søren Iversen, principal of Højskolen på Kalø, 2017)

THE MOLBO STORIES

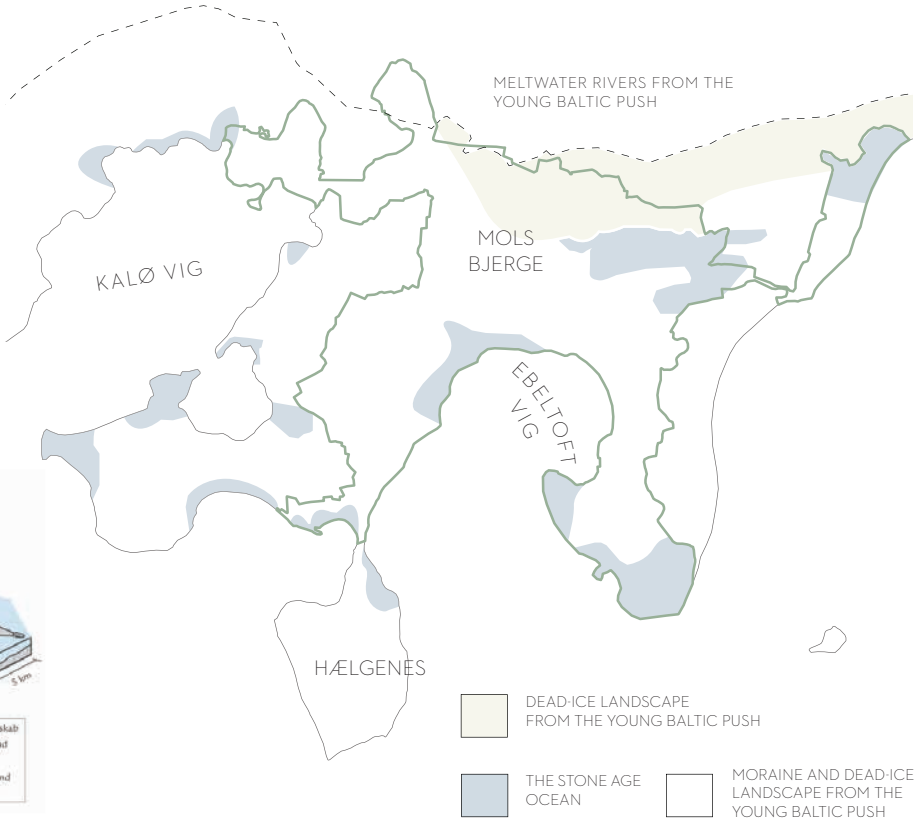
The Molbo stories tell about the incessant stupidities of the Molbos. The isolated location of Mols has probably resulted in the stories, since the local community may have seemed ignorant to the city dwellers of Aarhus.

^ Ill. 23.1. The story about the farmers and a stork. Once, the Molbos were concerned about a stork which stepped on their crops. They came up with a plan that one of them should chase away the stork. But then the Molbos realised that the plan would not work at all, because the man would step down the crops himself. Their solution was nothing less than genious: Together, they carried him so he could chase the stork without stepping down the crops.

^ Ill. 23.2. The story about the church bell. Once, the Molbos had returned from Aarhus without their rifles. In fear of being unarmed in case the enemy attacked, they decided to hide their most precious items. The first thing that came in mind was their church bell. So they loaded the church bell onto a boat, sailed far out and dropped it. But how to find it again? The smartest Molbo pulled a knife and made a cut in the side of the boat, and they all went home happy.

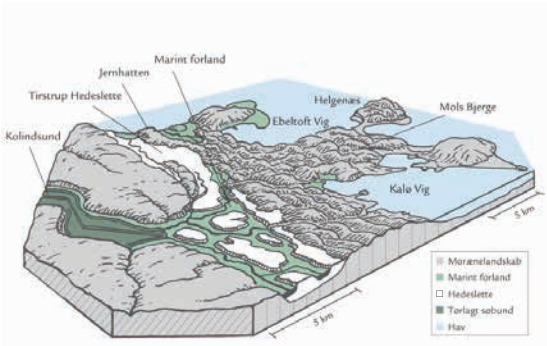
LANDSCAPE

Mols Bjerge



> Ill. 24.1. Geological map of the landscape left behind by the withdrawal of the ice. The areas, where the Stone Age ocean was, are flat today.

> Ill. 24.2. Model of how the landscape was shaped by the ice. The terminal moraine landscape is characteristic for the area of Mols Bjerge.



FORMED BY ICE AND WATER

The hilly landscape of Mols Bjerge tells a story about a fierce period in the geological history of Denmark, where massive ice sheets covered the land in several turns.

During the last 2.6 million years (the Quaternary Period), intense shifts in the climate has resulted in a change between cold glacial periods and intermittent warm periods called "interglacials". The glaciers of Scandinavian highland grew larger in the glacial periods and began to cover the lower regions, including Denmark.

The current landscape is formed gradually by the ice, which reshaped the landscape in every glacial period without entirely obliterating the preceding landscape. Moraine landscapes were created at the bottom of the ice, where the terrain is cladded with elongated small ridges in the direction of the ice flow. The high terminal moraine are the most distinctive features, where material is pushed together by the ice. In places where the melt water streamed in front of the ice towards the sea, flat and sandy river plains were created.

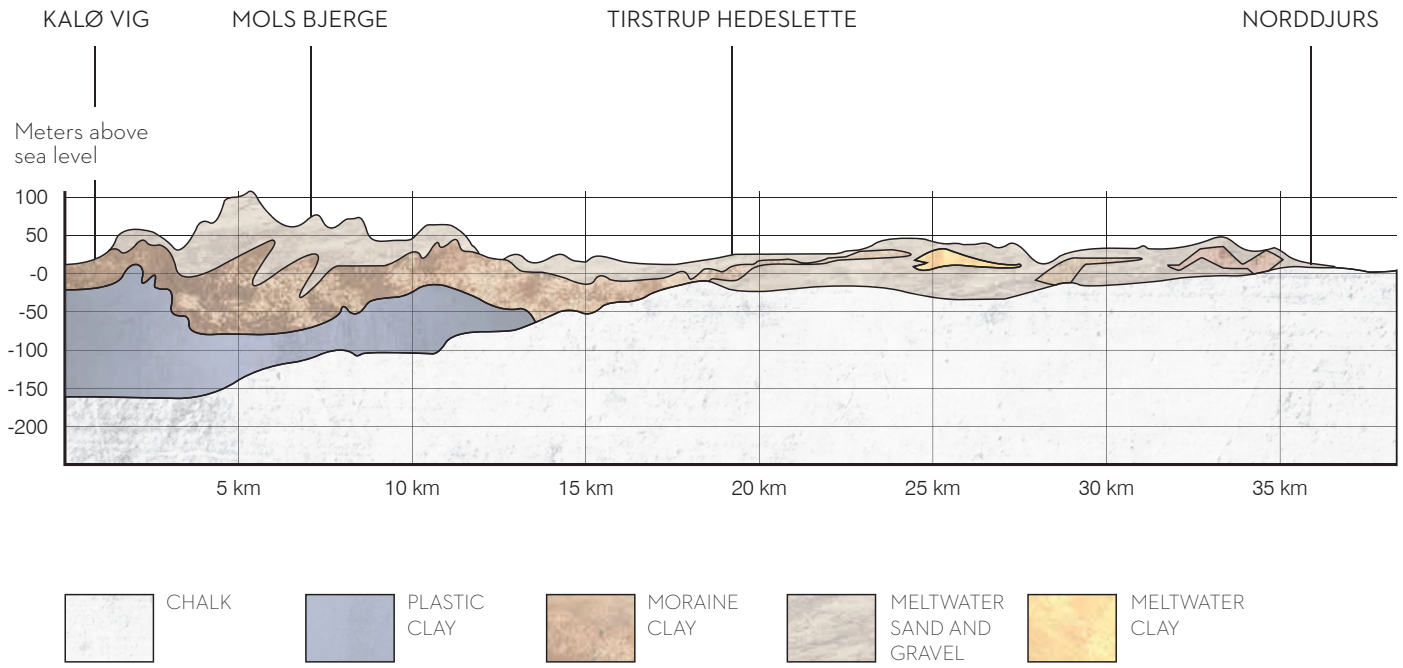
The warmer climate of the interglacials caused the ice to melt, and the vegetation had a chance to grow until the next glacial period. It was first the pioneering forest, and later a dense deciduous forest. The variation between a tundra landscape with arctic flora and periods of ice sheets resulted in a landscape where mammoths were able to live in Denmark.

At the end of the last ice age, approximately 20 000 years ago, the edge of the ice had withdrawn to Helgenæs, the area of Rønde and Mols Bjerge. A series of terminal moraines were created by materials pushed together by the glaciers, and the final form of Kalø Vig and Ebeltoft Vig were created.

(Bestyrelsen for Mols Bjerge, 2017)

Features of the variated landscape of the nationalpark of Mols Bjerge include

- Impressive terminal moraines in the landscape around Kalø Vig and Ebeltoft Vig
- A flat meltwater plain at Tirstrup Hedeslette
- Dead-ice landscapes in Mols Bjerge, the peninsula of Ebeltoft and towards Tirstrup Hedeslette



Ill. 25.1. Historical timeline.

BELOW THE SURFACE

"The geological knowledge that we have about the subsurface of the national park Mols Bjerge is based partly on drillings and modern geophysical examinations and partly on sheets from the deep layers, which the ice has brought up to the surface, so they can be seen in coastal cliffs of the area."

(Bestyrelsen for Mols Bjerge, 2017)

As seen on the geological section (ill. 25.1), the majority of the subsurface consists of chalk. It is the remains of dead alga and chalk-shelled organisms that sank to the bottom when Denmark was covered by ocean for approximately 66 million years ago.

In the area of Kalø Vig, the layer of chalk lies deep underneath a distance of 150 meters below sea level. Rising towards the surface, it can actually be seen above sea level in the northern part of Djursland.

In the area of Kalø Vig or more generally, the southern part of Djursland, a layer of plastic clay is found above the chalk. The plastic clay also originates in the time when Denmark was covered by ocean, where it settled on very deep water.

Some of the plastic clay was situated on land, but was eroded by the moving ice. A part of the explanation behind the height of the terminal moraines in Mols Bjerge is that the plastic clay functioned as a slide for the glaciers. On the geological section (ill. 25.1) you can see how the subsurface layers have been push up along displacement plans.

(Bestyrelsen for Mols Bjerge, 2017)

Ill. 25.2. The plastic clay that is found about 25 m below the site has relatively unfavourable strength properties and is prone to derformation. If the layer of plastic clay was further up, special considerations in the design of the foundation should be included. (Geo.dk, 2017)

Ill. 25.3. The moraine clay just below the site is fairly firm and is considered a good solid earth type for building foundations. (Larsen et al, 1995)

NATURE

Mols Bjerge

Ill. 26.1. The flora of the different nature types within the national park.

A DIVERSE NATURE

The nature of the Mols Bjerge National Park is highly divirse. Due to the landscape and the ground left by the ice age, and also the humans who have been cultivating the earth for millennia, there exists a number of different nature types. Stone reef covers a part of the ocean floor, while sea meadows lie by the coasts. Pasture is old fields that became too exhausted for agriculture, and therefore reassigned as areas for livestock to graze during the summer. Deciduous forest is original to the national park, but pine forest has been introduced in spots over the last couple of centuries.

Flora and fauna is often associated with specific landscape types, where the species thrive (ill. 26.1).

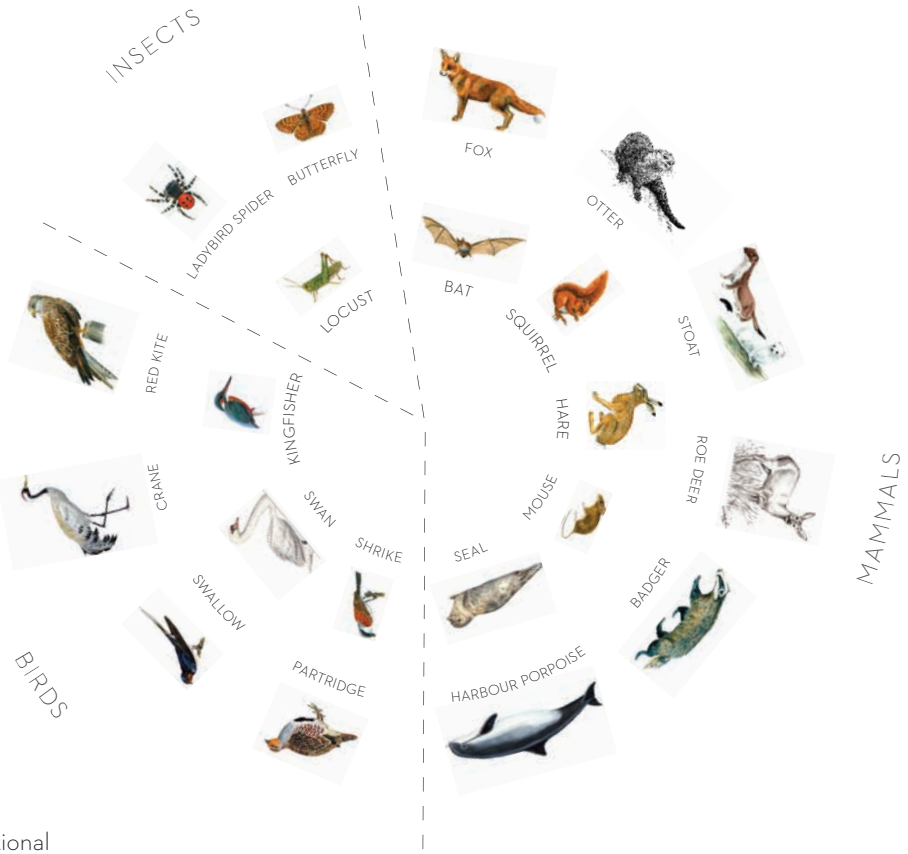
FLORA

The plants, and the animals for that matter, have unusal living conditions at the sea meadows, due to variating degrees of flood. Nearest to the ocean you find plants such as the sea milkweed and sea wormwood.
Going further into the land, you find red fescue and saltmarsch rush. In the back of the sea meadow, goose tongue and thrift can be found.

Characteristic plants for the pasture include calluna, cowslip, woodsorrel and tormentil. These plants thrive on the grassy, warm and dry earth of the pasture.

For the dry heath and scrub, which is also present in Mols Bjerge, characterestic plant species include blueberry, sloe, wavy hair-grass and hawthorn.

Ill. 26.2. A typical sea meadow



Ill. 27.1. The fauna of the national park, divided in animal classes.

FAUNA

The mammals of Mols Bjerge National Park include the most common species of Denmark. Deer is perhaps the most conspicious, because of its prominent size and movements on open areas. However the largerst preditors are the fox and the badger, which can be seen in forrest, field and nature areas. Moving down in size, we have the stoat. The stoat is associated with areas with a high population of mice. In general, the small rodents are an important feeding basis for preditors and birds of prey. The mammals of the national park also include otter, hare, squirrel, harbour seal and eight of the 17 bat species in Denmark (ill. 25.1).

As for bird species in Mols Bjerge National Park, more than 200 are registered. Out of them, 100 are breeding in the national park, and half of them are not native to Denmark. The red kite (ill. 27.1) is listed by the Danish Minister of Environment, as a bird that Syddjurs Municipality has a special responsibility to protect.

Registrations by the Laboratory of Mols have indicated a vast amount of insects, spiders and species associated with soil, counting more than 1000. Rare insect and spider species include the Glanville frittalary and the ladybug spider (ill. 27.1).

(Nationalparkmolsbjerge.dk, 2017)

Ill. 27.2. A hare.

POINTS OF INTEREST

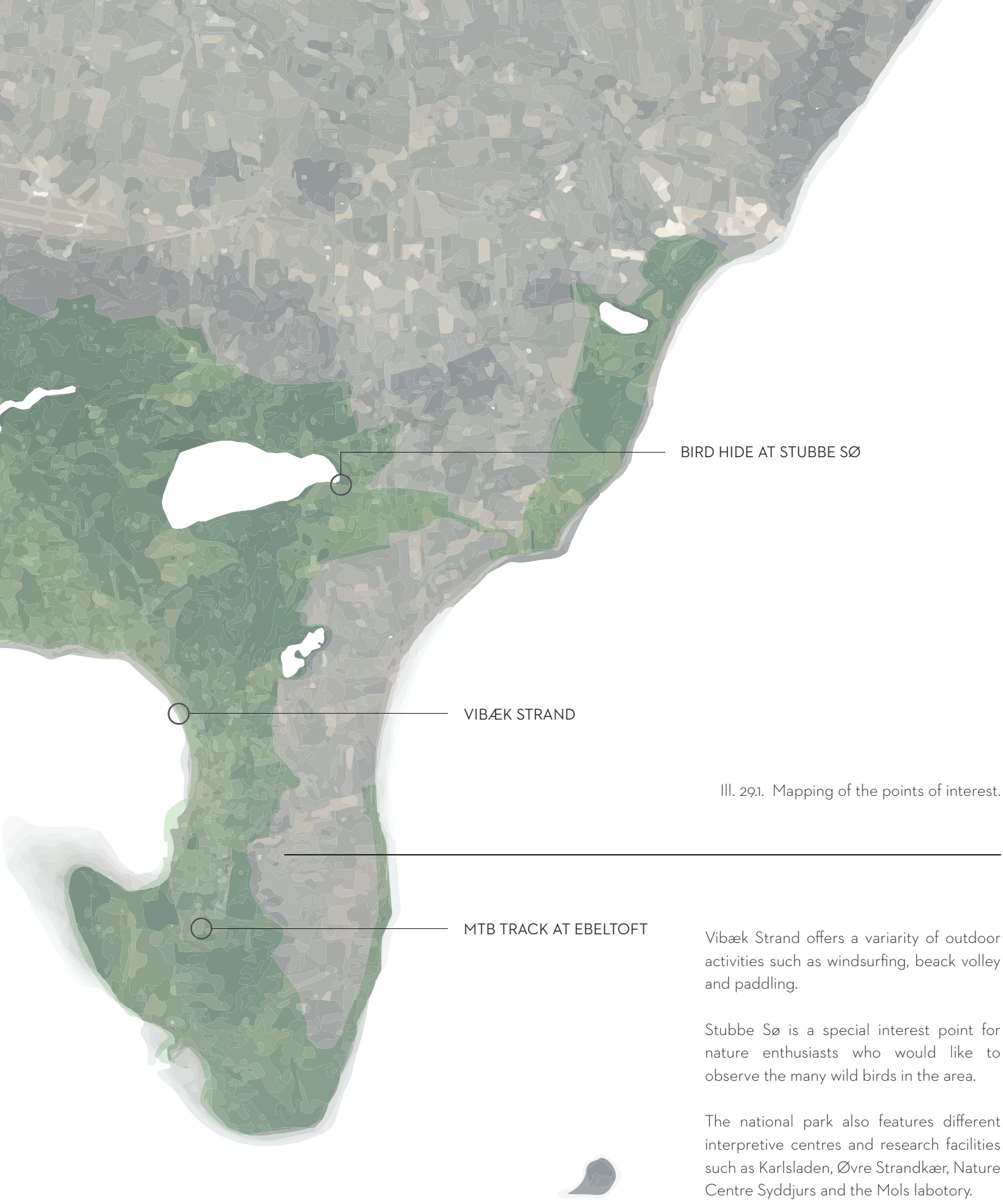
Mols Bjerge

The locations in Mols Bjerge, such as Kalø Slotsruin, Trehøje, Poskær Stenhus, Vibæk Strand and Stubbe Sø, are famous tourism attractions in the region.

Trehøje is a great view spot, where it is possible to see both Aarhus and Ebeltoft. The area is recognised for its three mounds and has a high historic value.

Poskær Stenhus is a famous monument, characterised by its massive rock formation that was arranged by the Stone Age people.

Kalø Slotsruin is one of the most well-kept ruins in Denmark and attracts a large number of visitors to the national park for its historical background and scenic placement in the landscape.



Ill. 29.1. Mapping of the points of interest.

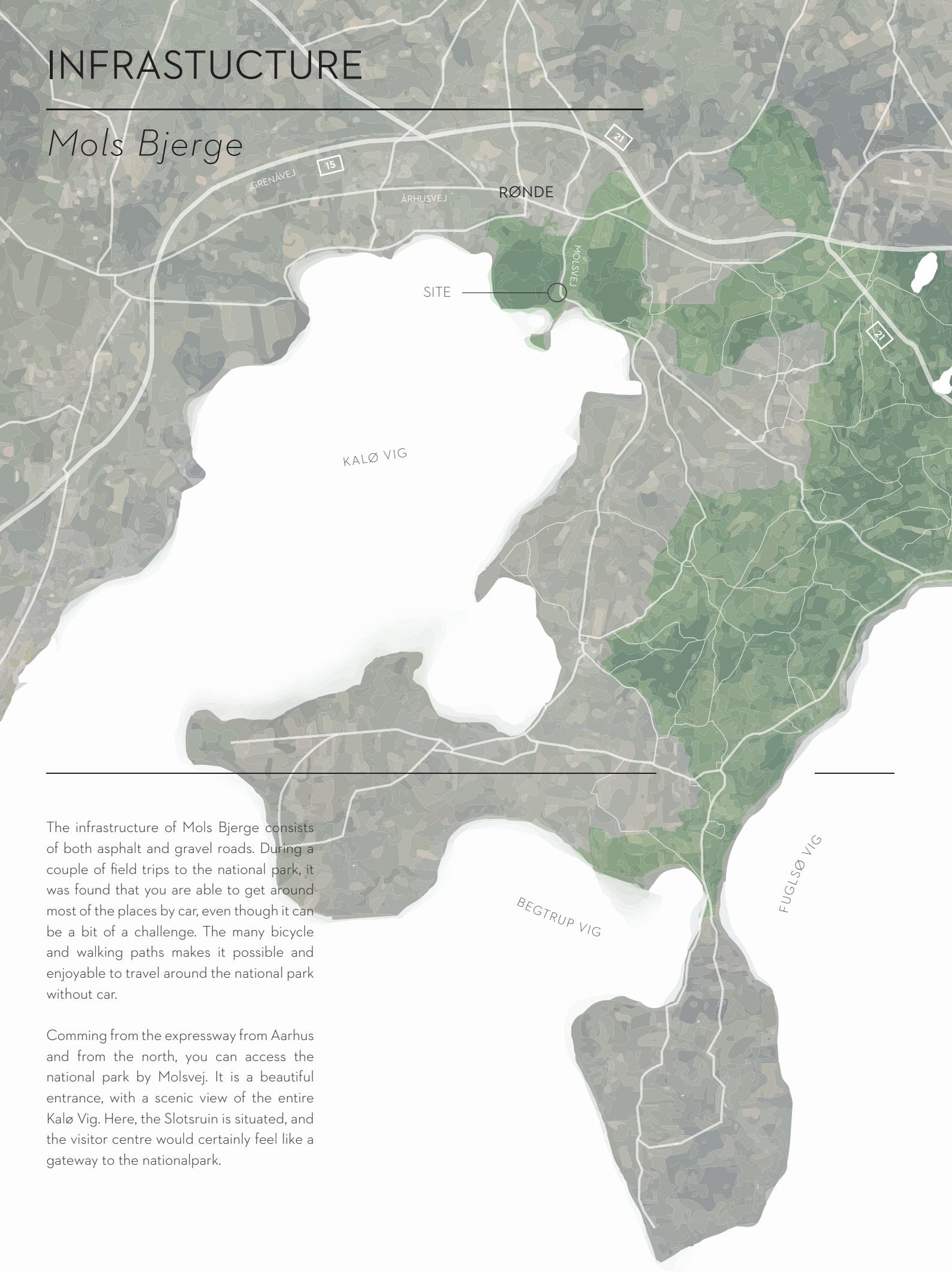
Vibæk Strand offers a variarity of outdoor activities such as windsurfing, beack volley and paddling.

Stubbe Sø is a special interest point for nature enthusiasts who would like to observe the many wild birds in the area.

The national park also features different interpretive centres and research facilities such as Karlsladen, Øvre Strandkær, Nature Centre Syddjurs and the Mols labotory.

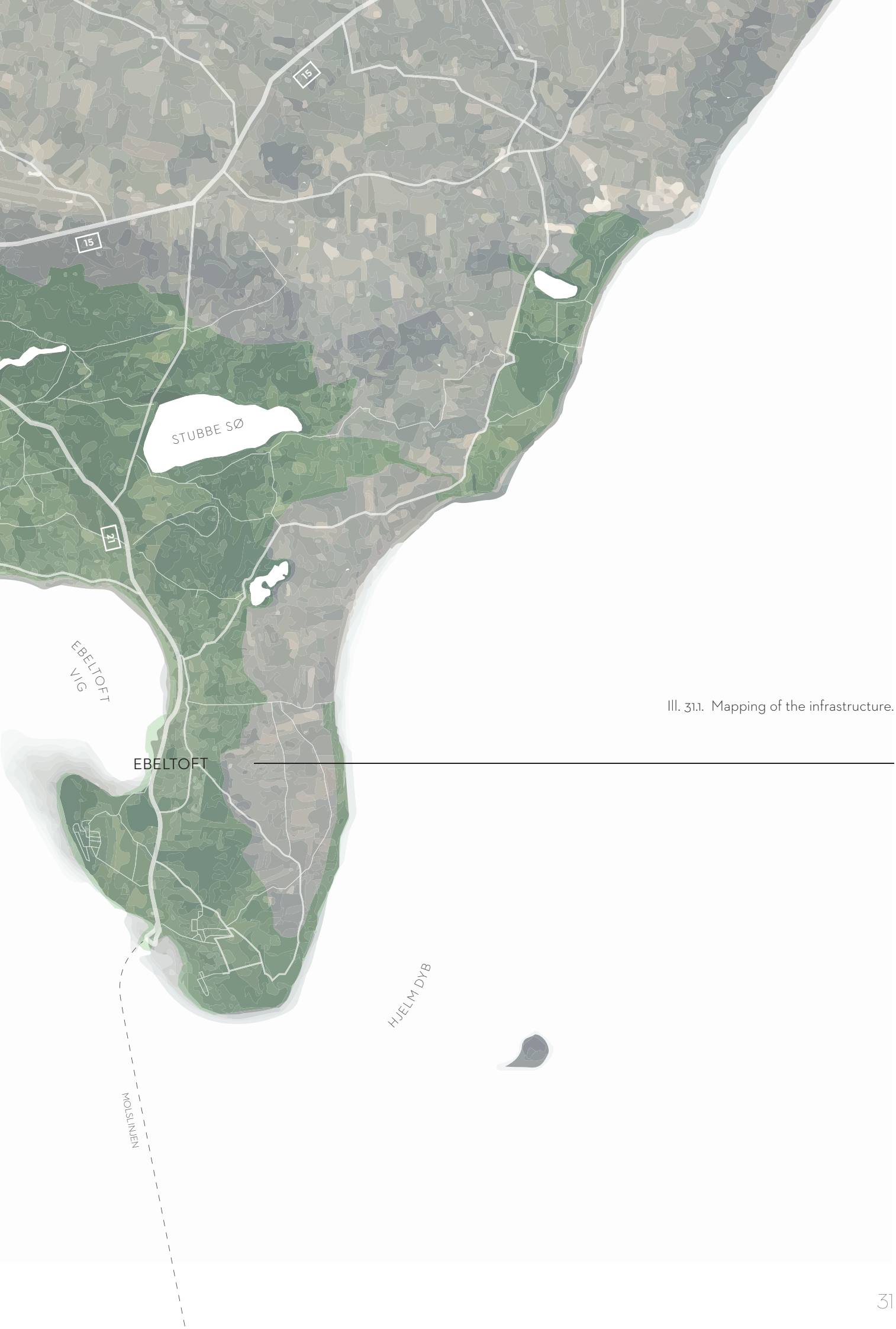
INFRASTUCTURE

Mols Bjerge



The infrastructure of Mols Bjerge consists of both asphalt and gravel roads. During a couple of field trips to the national park, it was found that you are able to get around most of the places by car, even though it can be a bit of a challenge. The many bicycle and walking paths makes it possible and enjoyable to travel around the national park without car.

Comming from the expressway from Aarhus and from the north, you can access the national park by Molsvej. It is a beautiful entrance, with a scenic view of the entire Kalø Vig. Here, the Slotsruin is situated, and the visitor centre would certainly feel like a gateway to the nationalpark.



Ill. 31.1. Mapping of the infrastructure.

PROGRAMME

WHAT IS A VISITOR CENTRE?
CASE STUDIES
TARGET GROUP
SPATIAL PROGRAM
ORGANISATION

THE PROGRAMME TAKES ITS POINT OF DEPARTURE IN THE FRAMEWORK FOR THE VISITOR CENTRE.

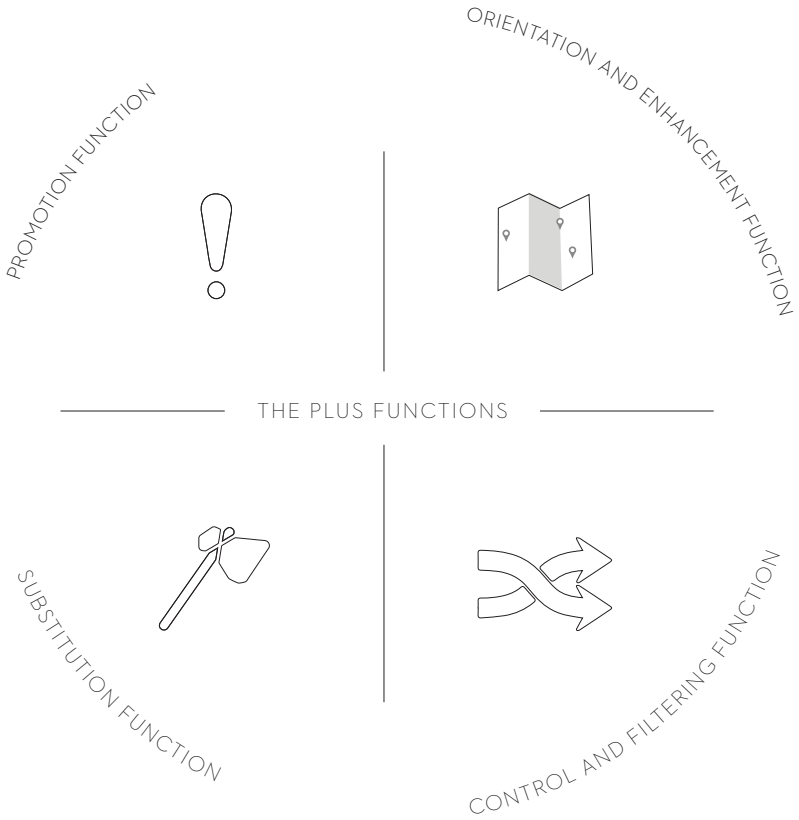
HOWEVER, IT IS IMPORTANT TO EXPLORE WHAT A VISITOR IS OR CAN BE. THIS IS DONE THROUGH THE CASE STUDIES OF SIMILAR PROJECTS.

THE TARGET GROUP IS OF GREAT SIGNIFICANCE, SINCE THEY ARE GOING TO BE THE USER OF THE VISITOR CENTRE, ALONG WITH THE STAFF. IT IS INVESTIGATED HOW THEY WILL INTERACT WITH THE BUILDING.

THE SPATIAL PROGRAM IS STATED, WHICH WILL DIRECT THE ROOMS OF THE VISITOR CENTRE. THE ORGANISATION INFLUENCE THE FLOW OF THE USERS.

WHAT IS A VISITOR CENTRE

Programme



Ill. 34.1. The functions of the visitor centre in principle.

A visitor centre is a multi-functional place, which aims to use and manage tourist attraction resources of the local area.
In smaller towns or in the countryside, a visitor centre plays a major role for the regional tourism promotion and management.

People usually associate visitor centres with local museums because they share many similarities. But while museums primarily focus on highlighting artefacts, visitor centres aims to emphasise the travelers' experience.

According to Philip Pearce's paper "The Functions and Planning of Visitor Centres in Regional Tourism", a visitor centre in most cases contains four core functions: Promotion, Substitution, Orientation and enhancement and finally the Control and filtering. (Pearce, 2004)

The promotion function serves to increase the visitors' expenditure by advertising local accommodation services, products from local retail and other trades where locals can gain economic benefits.

The substitution function is often associated with interpretive centres with the purpose of delivering meaningful knowledge about the natural and cultural heritage of the region, where the visitors would have a difficult time to explore this knowledge on their own during to physical barriers.

The orientation and enhancement function informs the visitors about important spots in the nearby area, which are worth to visit.

The control and filtering function fulfills a necessary task of reducing the pressure in the most crowded moments for a visitor centre. This is done by managing the tourist attraction resources. The function could potentially give visitors alternative destinations or offer other activities like guided tours.

In addition to the other four functions, Pearce introduces the plus function. It accommodate the interest of a social gathering point for the local community to meet, and by offering good conditions for hosting cultural and social events. This helps the visitor centre gain a local recognition, while creating a strong attachment between the locals and the new building.

(Pearce, 2004)

Ill. 35.1. Wild Turkey Bourbon Distillery.

EXCURSIONS TO VISITOR CENTRES

Programme

Ill. 36.1. Exterior of Rebildporten.

REBILDPORTEN

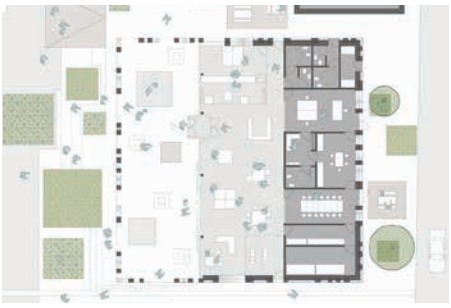
One excursion was to Rebildporten, which is a visitor centre in relation to the nature area of Rebild Bakker and Ravnkilde. The spokesperson was Bodil Christensen who is team coordinator at the visitor centre.

The new visitor centre of Mols Bjerge has many similarities with Rebildporten, which makes an investigation relevant. The size is about the same, and they both function as a gateway to a Danish national park.

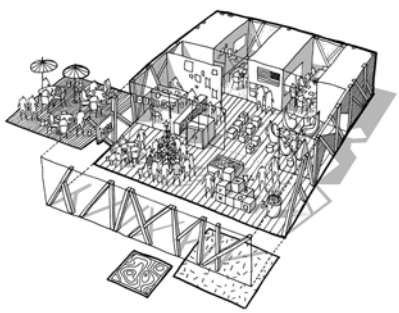
The national park of Rebild Bakker offers many outdoor activities within a beautiful nature. Rebildporten serves as an entrance point, and a place to come and find inspiration for further journey into the national park. The building is a modern take on the traditional half-timbered house, using big logs of beech from the area for the construction. The visitor centre is open all year around, and has around 450.000 visitors (Christensen, 2017). All in all, the visitor centre has been a success for the local community and tourism.

The primar room of the building is the exhibition, where one can learn about the nature and history of the nationalpark. In the same room, there is a tourist centre, where you can have personal service and ask questions about the national park. According to Bodil Christensen, the quality of service is essential for the visitor centre to thrive. The infocentre in the project of Mols Bjerge is thought to have the same functioniality as the one of Rebildporten.

Another signifant part of the of the building is the overhang that marks the entrance. Here, a discrete touch screen is hidden behind an interactive tree.



Ill. 36.2 Plan of Rebildporten.



Ill. 36.3 Diagram of Rebildporten.

Ill. 37.1. Interior of Lille Vildmose Center.

LILLE VILDMOSE CENTRE

Another excursion was to Lille Vildmose Centre. Here, the director Bo Gregersen was interviewed with a view to the operation and development of the visitor centre.

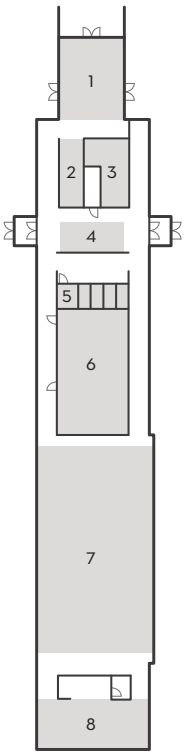
It has been a challenge to make the centre work. In opposition to Rebildporten, which is a municipal project, Lille Vildmose Centre has been realised trough accedences from various funds. The visitor centre has become a success due to the hard work of many volunteers who help in the daily operation. In return, they become a part of the social community, and they are happy to tell visitors about their area.

As seen in the plan (ill. 37.2.), the visitor centre has an elongated course, which results in a very stringent flow. On the contrary, Rebildporten has more a more open and spacious plan, which allow a flexible exhibition. The plan of Lille Vildmose Centre has a higher sense of hierachi and is able to be closed in sections. This is exploited outside the high season, where the exhibition is closed, as a strategic initiative to minimize the heat and energy consumption.

However, this strategy does not seem optimal in the project of Mols Bjerge, where it is wished to have a centre that is open for visitors throughout the whole year. This is due to the wish for having ongoing activities.

Lille Vildmose Centre has a particular focus on the sensibility of nature and hands-on experiences. This set of values is inspirational and not far away from the project vision.

1 Cafe
2 Infomation Centre
3 Kitchen
4 Retail (shop)
5 Toilets
6 Auditorium
7 Exhibition
8 Workshop / Laboratory



Ill. 37.2. Plan of Lille Vildmose Centre.

CASE STUDY | WILD TURKEY BOURBON DISTILLERY

Programme

Ill. 38.1. Exterior of Wild Turkey Bourbon Distillery.

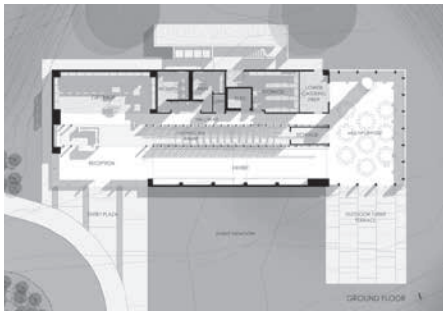
The visitor centre of Wild Turkey Bourbon Distillery is located in the beautiful nature next to the Kentucky River. It has interesting tectonic features, and focuses on giving the visitors a unique experience thorugh the architecture.

The building contains a gift shop and a reception close to the entrance, while a multipurpose room is placed on the opposite side with a view towards Kentucky River (Ill. 38.2). The exhibition area is considered an intimate place, and a long ramp makes the way to the tasting room a special experience. (Archdaily, 2013)

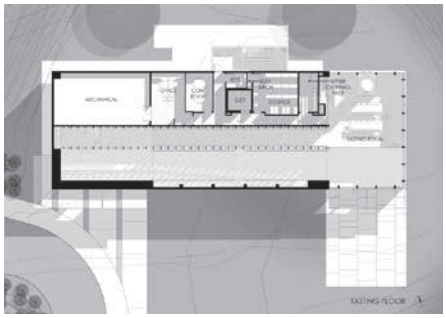
The facades are made of dark wood cladding with a diagonal pattern to give a simple and clean texture on the surface. From the outside, the centre expresses a monolithic look, that is an interpretation on the traditional barn (Ill. 38.1). The simplicity of the exterior is in contrast to the complexity, which lies behind the facades. This creates a tension between the exterior and interior that Peter Zumthor describes as one of the key features for architectural atmosphere.

The construction of the visitor centre is displayed in an honest way. The roof frames for instance gives the users an general impression of the scale by highlighting the height and deepness of the space. The roof profiles have a thin proportion, so they appear more elegant.

Further into the building, there is an inner structure established around the ramp corridoor. The inner structure is made of a frame construction and gives the user a new sense of scale. By walking on the ramp up to the upper level, the visitor gets a closer look on the structure and increases the awareness of details.



Ill. 38.2. Ground floor plan.



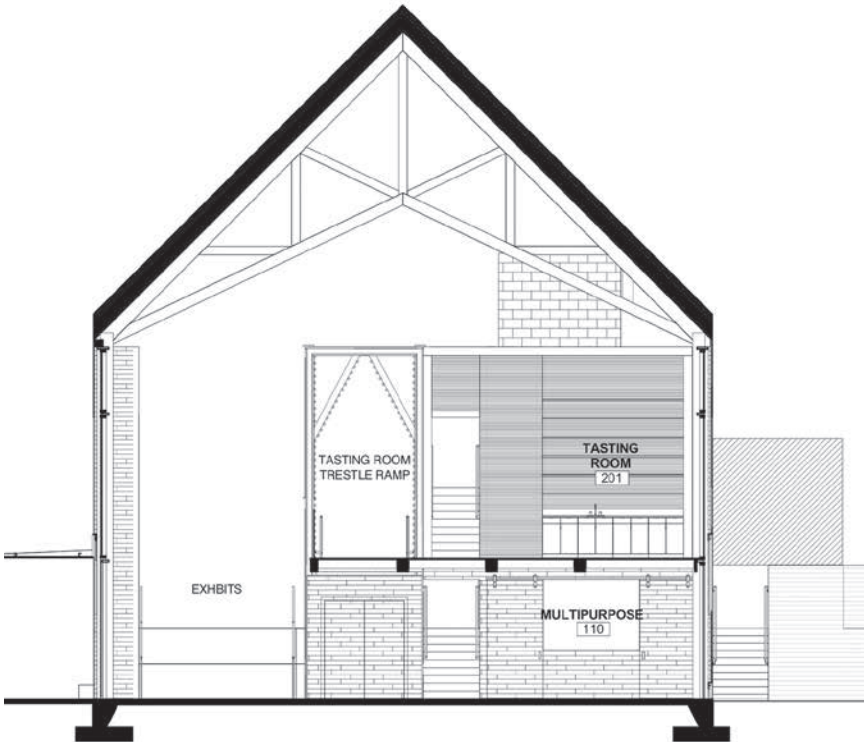
Ill. 38.3. First floor plan.

Ill. 39.1. Interior of Wild Turkey Bourbon Distillery.

The building displays an interplay between scale and space by having a large volume in combination with an inner space created by the inner structure.

In terms of the light condition, the synergy between light and shadow is remarkable. The lights are drawn into the multipurpose room, and the area close to the entrance.

Overall, the light condition suits well for those functions that require good visibility. The central exhibition area and tasting room are covered in shadow to answer the call for an intimate atmosphere.



Ill. 39.2. Cross section.

CASE STUDY | SAINT BENEDICT CHAPEL

Ill. 40.1. Exterior of Saint Benedict Chapel.

St Benedict Chapel is designed by Peter Zumthor in 1988. It is located in the small village of Sumvitg in Switzerland. The chapel is placed on a hillside of a picturesque landscape around the Swiss Alps and blends in with the nature by its oval shape, and by the calm material colour.

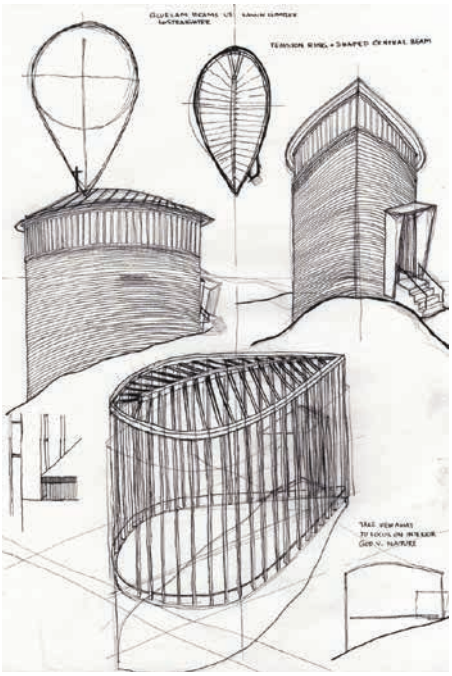
The building is recognised for its beautiful material composition, having the space and materials compliment each other in a simple manner.

The roof is made of a wooden structure that expresses lightness in contrast to the massive concrete wall surrounding the space. The ribbon window in the chapel provides a strong visual effect, which seems to make roof levitate above the space. The inflow of light from the ribbon window provides an atmosphere of intimacy in the oval space.

The construction adds a unique deepness to the space and appears true and honest, by showcasing the joints and the meetings between each element.

The facades are covered in a locally produced material of wooden shingles, that adds a rustic character from the outside. The interior walls have a smooth appearance in polished concrete, so the roof stands out from the space.

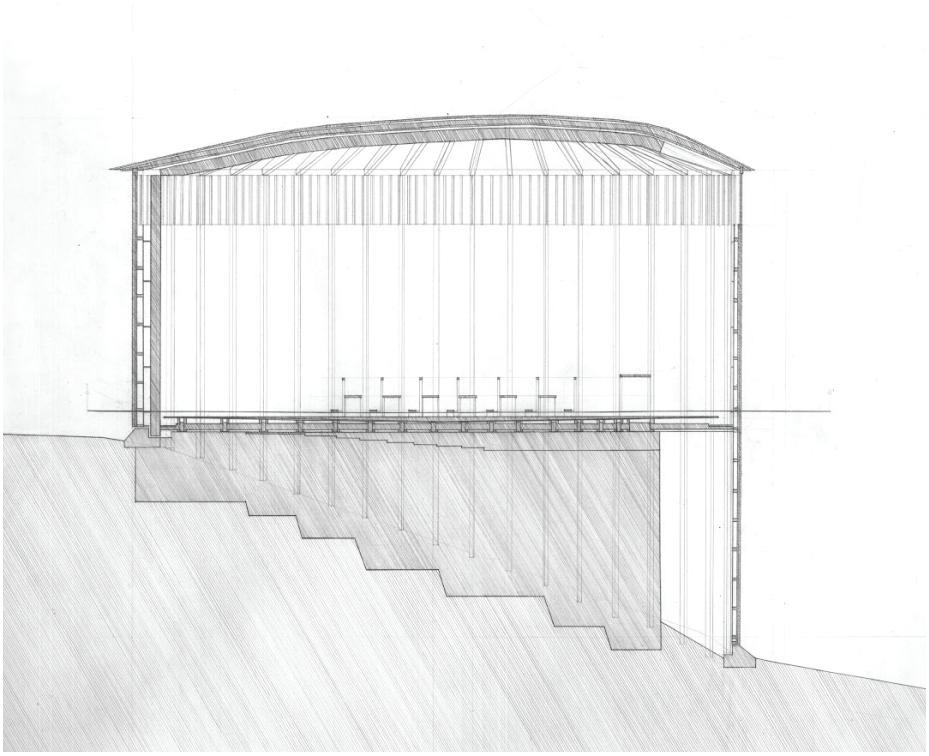
(Archdaily, 2013)



Ill. 40.2. Sketches of the chapel and the structure.

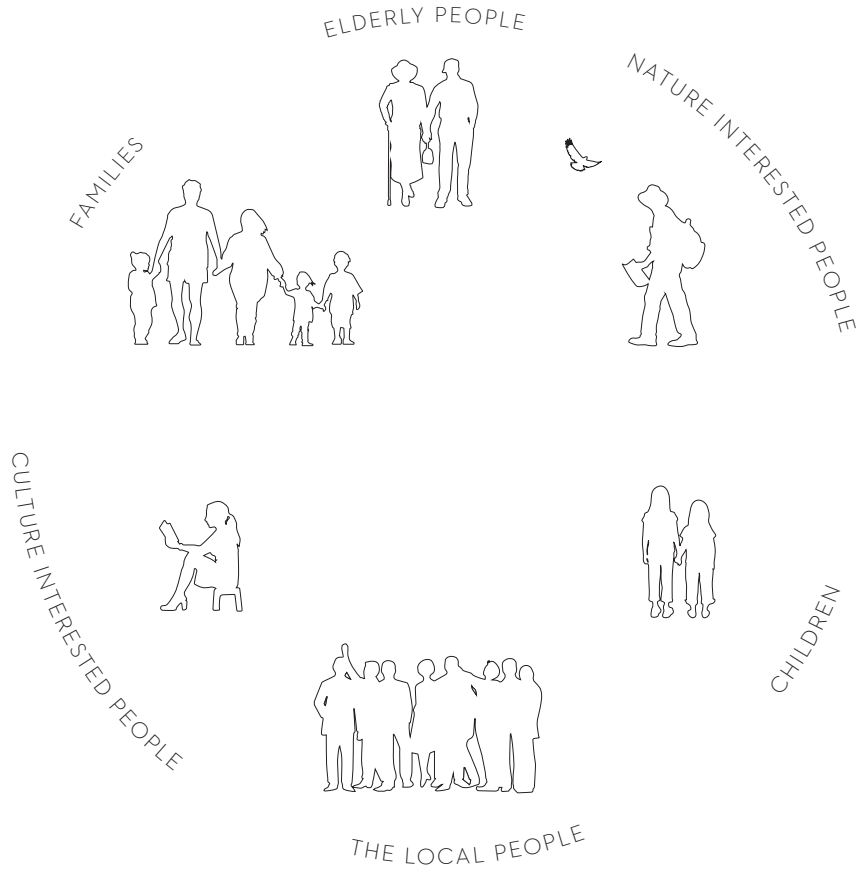
Ill. 41.1. Interior of Saint Benedict Chapel

> Ill. 41.2 The illustration shows a section through the St Benedict Chapel. A large drop in the terrain is solved by a structure that reaches the slooping ground behind the enclosing wall.



TARGET GROUP

Programme



Ill. 42.1. The user groups.

The visitor centre will not only draw local attention, but also expects tourism from countries such as Germany, Norway, Sweden and the Netherlands. The competition committee points on various types of users, forming a very wide target group.

(Bestyrelsen for Mols Bjerge, 2017)

THE LOCAL PEOPLE

Generally, the locals of Mols Bjerge have a strong bond to the area. Experiences such as enjoying an icecream at Kalø Slotsruin are associated with nostalgia. In order for them to appreciate a new visitor centre, they need to be proud of it and be able to tell the story behind it.

FAMILIES

The modern family that visit the national park have often planned their trip beforehand in order to get most out of their qualitity time together. Usually, they come in the weekends and holidays. Their stay at the visitor centre should be an experience in itself, but the urge to go out and explore the national park should be present. Personal service and interactive guiding can help easing the planning process, and "push" families out in the national park.

NATURE INTERESTED PEOPLE

People in all ages with a special interest in nature. It is especially the knowledge sharing of the visitor centre that attracts them, but experiences in the nature are also very important. They come as individuals, but also in groups. A possible scenario could be to meet at the visitor centre and head out. Biology and geography students are included in this usergroup, as well as birdwatchers etc.

SENIORS

Where families often have a tight schedule, seniors generally want to go at a slower pace. They have a lot of time to spend, and they seek to fill their day with joyous activities. The social aspect is important for the seniors. They often come in busses with a pensioneer organisation and enjoy the company of each other.

CHILDREN

Children in this user group are associated with kindergarten and school classes. They come in larger groups, for example on a fieldtrip, and stay for a day or more. Good experiences occur through play and imagination. It is therefore fortunate to have a room in the visitor centre where children can learn and develop through hands-on experience and play.

Ill. 43.1. Diagram of the visitor values.

THE ATTRACTION EFFECT OF THE NATIONAL PARK

Common for all of the user groups, is the attraction towards the unique landscape of Mols Bjerge, accompanied by the culture and many activities within the national park.

SPATIAL PROGRAM

Programme

INFOCENTRE

Function	***Size***	***Functional demands***	***Lighting***
Entrance area	15 m^2	The main entrance should be “transparent”. Sheltered against weather.	
Infocentre	50 m^2	General introduction to the national park. An employee operated area, with the possibility of help for planning a trip in the national park. Shelving units with information material, and touch screens.	Optimal access of daylight, without obstructing the info-technology.
Retail (shop)	25 m^2	The infocentre and shop area should be coordinated. Workstation for 1 secreteriat employee.	
Wardrobe	20 m^2	24 boxes which the visitors can use for personal storage.	
Toilets	30 m^2	3 m/f toilets and 1 HC with changing table. Can be accesed outside business hours.	
Storage	10 m^2	For primarly the shop.	

EXHIBITION & KNOWLEDGE SHARING

Exhibition	200 m^2	A series of various themes concerning the national park. Focus on digital presentations alongside more sensable ones. Possibility of replacing the exhibition over time. Rooms inside the room. For contemplation through multimedia and sensibility.	The daylight condition is adjusted to the function. Views outward are not prioritised in the exhibition.
Auditorium	75 m^2	For lectures and conferences, and also showing films. Seats for a minumum of 60 persons.	
Workshop	85 m^2	Workshops to examine the nature and landscape.	Optimal daylight.
Storage	25 m^2	For the exhibition and knowledge area in general.	

CAFE

Cafe	200 m²	The view to nature is of great importance. Seats for around 100 persons. Flexible transition between exhibition and cafe. Able to function independantly.	Optimal daylight and views outward prioritised.
Kitchen	80 m²	Hot and cold dishes from scratch. Local produced food. Delivery desks, production kitchen and scullery. Access to a small courtyard for goods intake and waste.	
Employee room	15 m²	Room for 6 to 8 employees.	
Icecream / hot dog stand	20 m²	Can be accessed from outside, and thereby not occupies space in the cafe.	
Exterior space	50 m²	A minor area in relation to the visitor centre.	
Toilets	30 m²	3 m/f toilets and 1 HC with changing table.	
Storage	15 m²	Including cold storage	

MISCELLANEOUS

Technical room	30 m²	Ventilation, heating and electricity.	
Archive	25 m²	Room for archives as well as general storage.	
Changing room	40 m²	Changing room and bath for employees (2 x 6 m/f).	

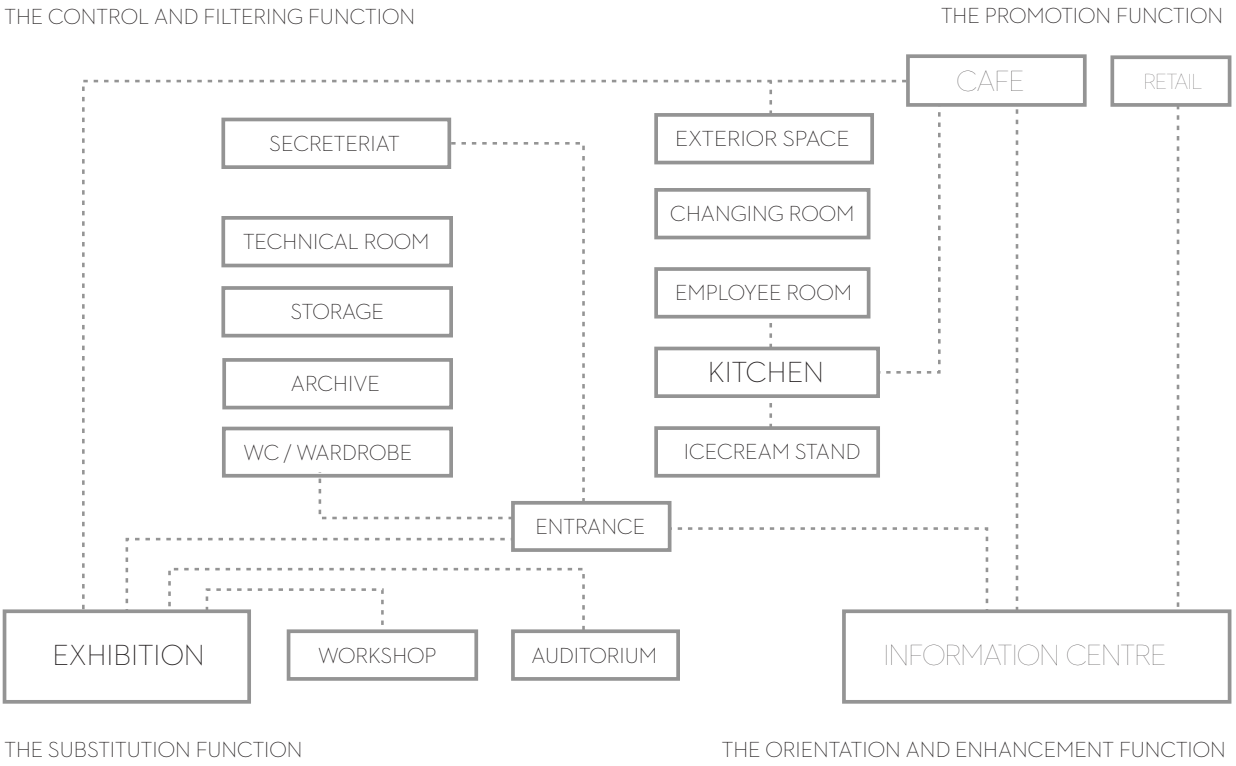
TOTAL: 1040 m²

SECRETERIAT (STRANDHUSET)

Office area	50 m²	Room for 6 employees in an open office plan.	Optimal daylight.
Large meeting room	30 m²	Employee / meeting room. For 8 persons.	Optimal daylight.
Small meeting room	15 m²	Room for 4 persons.	
Toilets	15 m²	Two toilets. Including 1 HC.	
Copy / Technical	10 m²	Printer and copier, space for technical needs.	

ORGANISATION

Programme



Ill. 46.1. The organisation of the visitor centre.

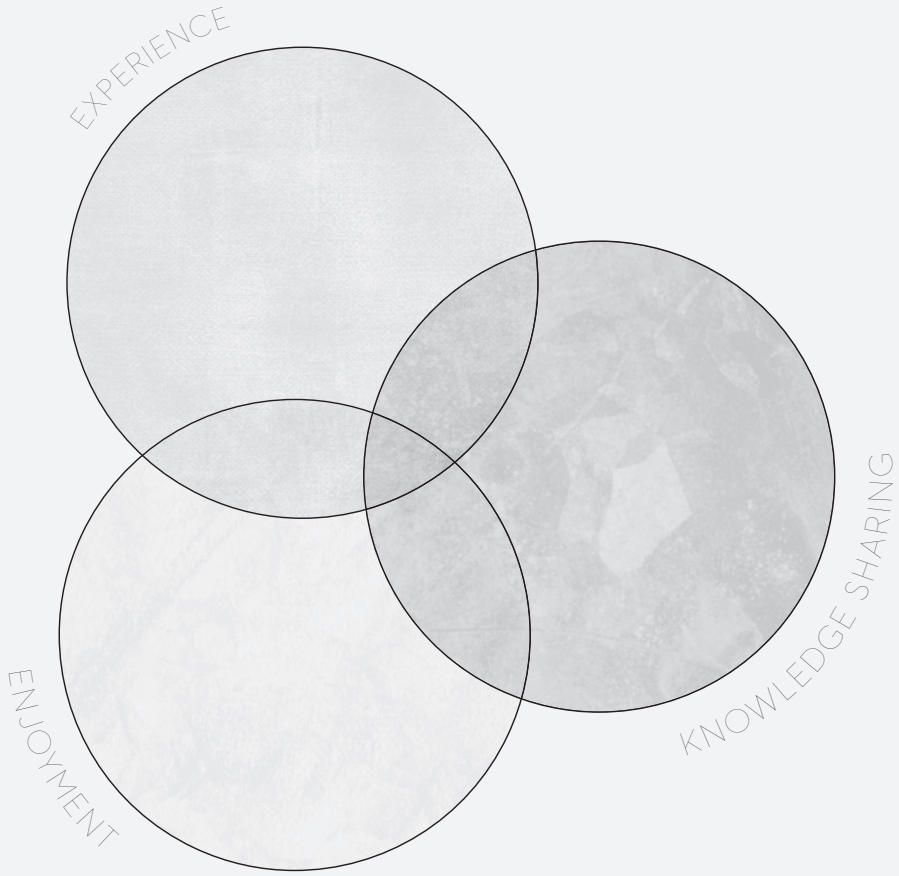
The visitor centre aims to be a stepping-stone for tourists, being an attraction in itself, but also encouraging them to go out and explore the national park. The main functions of the visitor centre are the infocentre, the exhibition and the cafe.

When entering the building, there should be a clear overview of the main functions of the visitor centre. The entrance area should be transparent, to allow a view to the existing building of Hack Kampmann, that is to be adapted to a secretariat. It is also wished to have an easy circulation between the entrance and the new secreteriat. The infocentre should include a shop for promotion of the local retailers . In addition, you should be able to read the location of the other main functions without an excessive use of signage. There should be a level free access around the visitor centre, for the sake of walking-impaired visitors.

The cafe is considered the social gathering point of the visitor centre, and relates to the promotion function as described by Pierce, by serving locally produced foods and drinks. It should be possible to access an outdoor area from the cafe, for sitting and enjoying the nature on a warm day. The kitchen should have optimal working conditions, for both making and serving the food. An adequate stock delivery is also to be considered in the design.

The exhibition area should be designed in a manner that, through its spaciousness, allows fror a certain degree of flexibility. In this way, the exhibition team is able to make theme-based changes throughout the year. The visitor centre becomes more dynamic, and the chance of people comming again, should increase. In relation to the exhibition, there should be a workshop, especially for children to work with the nature, hands-on.

The auditorium, which is for lectures and film clips, should also be adjacent to the exhibition area. An easy movement between the exhibition and the cafe is favourable, to enable an extension of the exhibition.



THE VALUE SET OF THE VISITOR CENTRE

The new visitor centre should offer both experiences, knowledge sharing and enjoyment. The last aspect is to be seen as both a physical and visual enjoyment, meaning that the visitor centre in its architectural expression should appear unique and fitting in the context. The values inherently overlap each other.

Ill. 47.1. The value set in overlapping circles.

SITE ANALYSIS

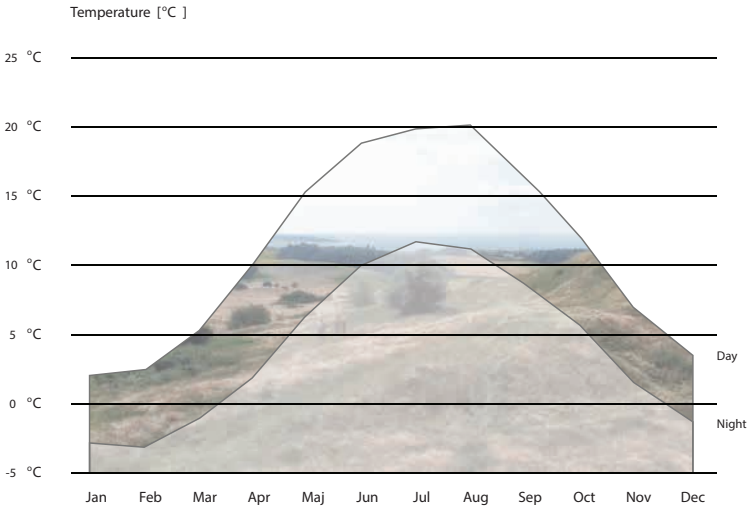
CLIMATE
TOPOGRAPHY
SURROUNDINGS
BUILDINGS
NATURE
INFRASTRUCTURE

THE ANALYSIS IN THIS SECTION INVOLVES THE CONDITION OF THE MICROCLIMATE OF THE SITE, THE TOPOGRAPHY AND MAPPING OF THE SURROUNDING CONTEXT . IT CONTRIBUTES TO THE GENERAL RECOGNITION OF THE LOCAL ISSUES, WHICH SHOULD BE CONSIDERED IN THE DESIGN PROCESS.

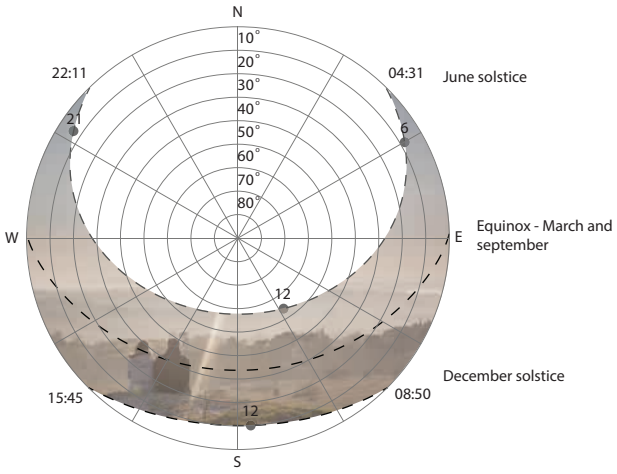
CLIMATE ANALYSES INFORM THE DETAIL OF PRECIPITATION, FLOODING, TEMPERATURE, SUN AND WIND CONDITIONS, WHILE THE TOPOGRAPHY DISPLAYS THE LEVEL DIFFERENCE OF THE TERRAIN.

CLIMATE

Site Analysis



Ill. 50.1. Average monthly temperature.



Ill. 50.2. Position of the sun.

TEMPERATURE

The warmest months in Mols Bjerge are June and July. The average temperatures in these months are around 20 degrees during the day and 12 degrees during the night (ill. 50.1).

The coolest months are January, with an average daily temperature of 2 degrees, and February with an average night temperature of -4 degrees celcius. (DMI, 2017)

Because the site is located close to the nearby sea (Kalø Vig), the coast climate regulates the temperature and prevents it from changing drastically between day and night, and between summer and winter.

WIND DIRECTION

The open landscape near the sea leaves the site exposed to the wind. Consequently, the materials of the building envelope have to deal with the rough weather near the coast. It might be even more important than usual to include the patina of the materials in the design considerations.

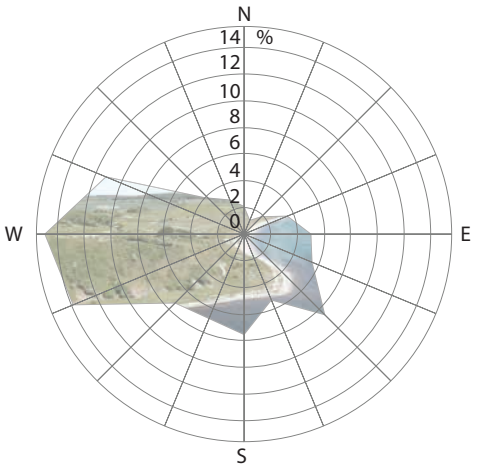
The direction of the wind is primarily from the South and West, depending on the seasons (windfinder, 2017). The wind is constantly shifting and changes the landscape by interacting with the elements of nature like grass, waves and trees.

An outdoor space in connection to the cafe of the visitor centre might be exposed. In this case, it can be a quality if the outdoor area is sheltered against the wind to some extent.

PRECIPITATION

According to the weather data, the season with the lowest amount of precipitation is spring. Here the minimum is 42 mm in April. The amount then increases steadily throughout the year, and reaches a maximum in November with a score of 92 mm. Generally, autumn is the wettest season with the highest amount of precipitation. (DMI, 2017)

Ill. 51.1. Average monthly precipitation in millimeters.



Ill. 51.2. Wind rose.

SUN

Denmark is located far up in the northern hemisphere, and the length of the day varies highly between summer and winter, though less than the Scandinavian neighbours of Sweden and Norway.

In June, the sun rises at 4:31 early in the morning and sets at 22:11. In this month, the sun reaches its highest position at a 68-degree angle to the horizon.

In December, the sun rises at 8:50 in the morning and sets at 15:45 in the afternoon. The sun does not reach above a 10-degree angle in this month. (Gaisma, 2017) The seasonal variation of the sun position affects the interior spaces and how deep the daylight enters.

TOPOGRAPHY

Site Analysis

Ill. 52.1. The space between the building site and Kalø Slotsruin in sections.

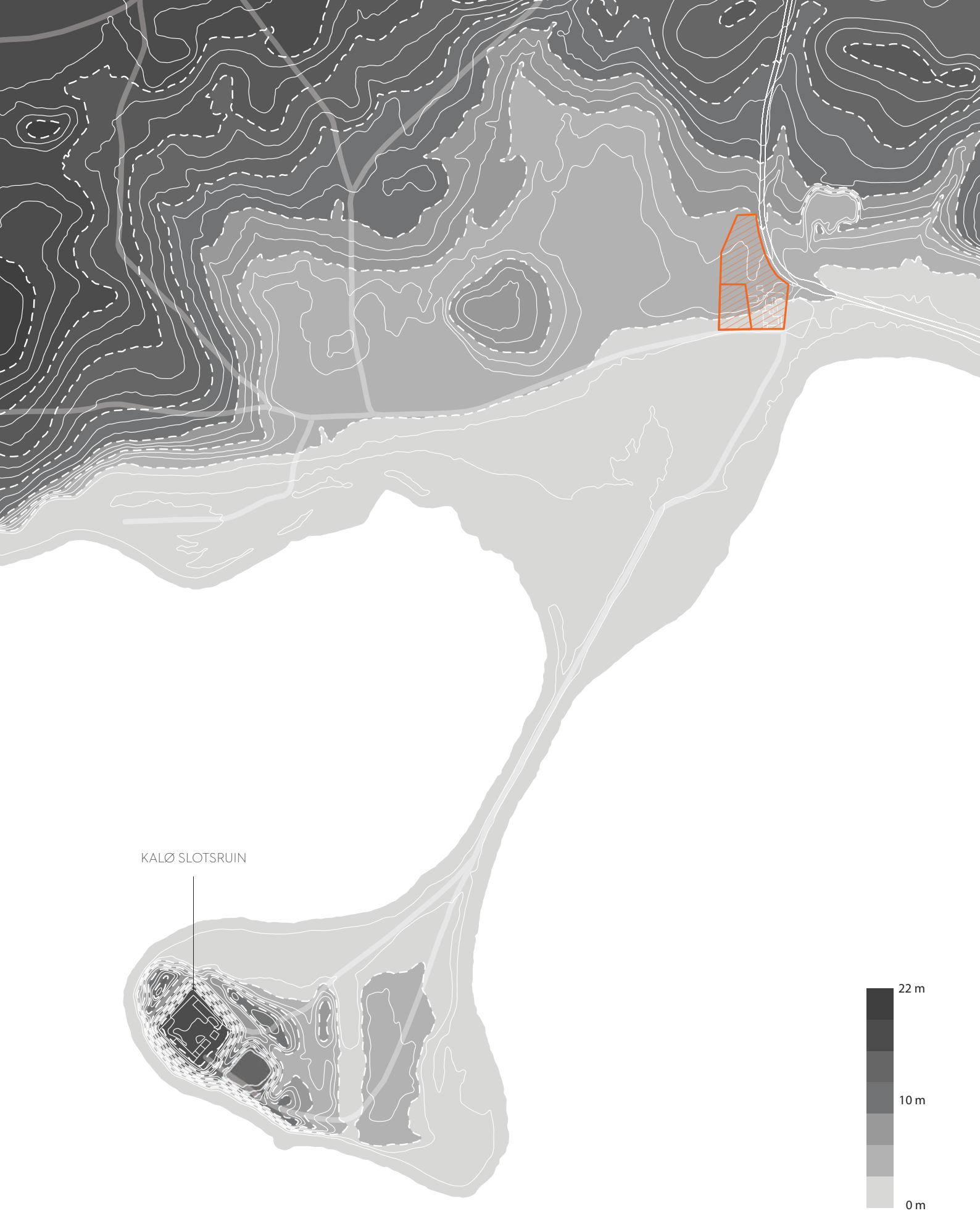
The topography of the building site is mostly even, but slopes down towards the coast at Strandhuset. This slope could be used in favour of the visitor centre, with an entrance at the level of parking area and Strandhuset, an another level below. The height difference is just above 2.5 meter, which works favourable in this manner.

The open landscape of the building site provides good conditions for the visitor centre to access daylight, where it is needed. In order to have a darker exhibition space, it might be a solution to have some of building excaveted into the hill. However, the lack of shelter from the landscape also brings the challenge of weather exposure, including wind from the West and the South. Consequently, the building must be able to meet this rough sea climate. On the other hand, a great view towards Kalø Vig and Mols Bjerge is fully accessible.

The section though the building site is 152 meters wide and has a high difference of four meters from one end to the other. The highest area located on the map is in the northern part of the map, rising 22 meters above sea level. Going further north, beyond the map, the landscape steadily inclines in a hilly landscape.

A remarkable detail on the map is the location of Kalø Slotsruin. The high differences go from 1 meter over the sea level to 18 m above. The ruin is visible from a great distance and is one of the main tourist attractions of the national park. The steep slope at Kalø Slotsruin is manmade for defense purposes.

Ill. 52.2. The Kalø Slotsruin is accessed by a path from the middle ages, and rises significantly in the landscape.



Ill. 53.1. Topologic map of the site context.

WATER LEVEL

Site Analysis

Ill. 54.1. Kalø Vig with the industry of Aarhus in the background.

The increasing water level caused by the global warming could potentially threaten the site, which lays 3 m over the local sea level of Kalø Vig.

Since 199 meteologists have measured the water level worldwide by implying satellite technology. According to the results, the water level is increasing by 3 mm in average per year. In Denmark however, the average increase is 0.5 mm per year. This means that the water level will rise by 5 cm per decade. (Jørgensen, Cappelen, Schmith, and Nielsen, 2016).

Miljøstyrelsen predicts that, under the worst circumstances, the water level will raise by 1.2 m at the end of this century. (Klimatilpasning, 2015)

However, the general increase of water level poses a lesser threat compared high tide and flooding. In Mols Bjerge the impact of tide is very low in comparison to other locations in Denmark. The difference between high tide and the normal water level at the coast of Mols Bjerge is 0.3 m. (Nielsen, 2015). The worst flooding in the area is registred back in 1985, where the water level reached 1.6 m above the current one (Rambøll, 2017).

Based on the acquired data on water level, floodings and high tide, there is a minimal threat for the site, but there has been a few occasions where a flooding has come close to the site. The visitor centre might have to develop a flooding strategy, which can be thought in, already in the design process.

Ill. 55.1. Map of the water level affected by tide and flooding.

Site Analysis

Ill. 56.1. The worn-by red brick of Kalø Slotsruin

STRANDHUSET

Inside the plot lies Standhuset, which was designed by architect Hack Kampmann and completed in 1902. Today this house is listed for its architectural quality. The house has a traditional thatched roof with wooden cladding in the gables and walls consisting of stones and clay.

Ill. 56.2. Strandhuset.

KALØ SLOTSRUIN

Kalø Slotsruin is one of the largest attractions in Mols Bjerge. The construction of the castle started in 1313, when king Erik Menved defeated the local rebellious army of farmers. To display his power, he forced them to build the castle for him. When the Kalø Slotsruin was one of the largest strongholds in Denmark.
The walls are made of traditional redbrick and the foundations consist of many cobblestones. (Naturstyrelsen, 2008)

Ill. 56.3. Kalø Slotsruin

SLOTSKROEN

In the 18th centuries was a brickyard, until it was inhabited by Strandhuset and Slotkroen, which over the years has been developed into a combination between a pub and a kiosk. (Hansen, 2012)

The building has the look of an old wooden cabin and its black painting cladding. The board of Mols Bjerge has decided that it will be demolished to make room for the new visitor centre.

Ill. 56.4. Slotskroen.

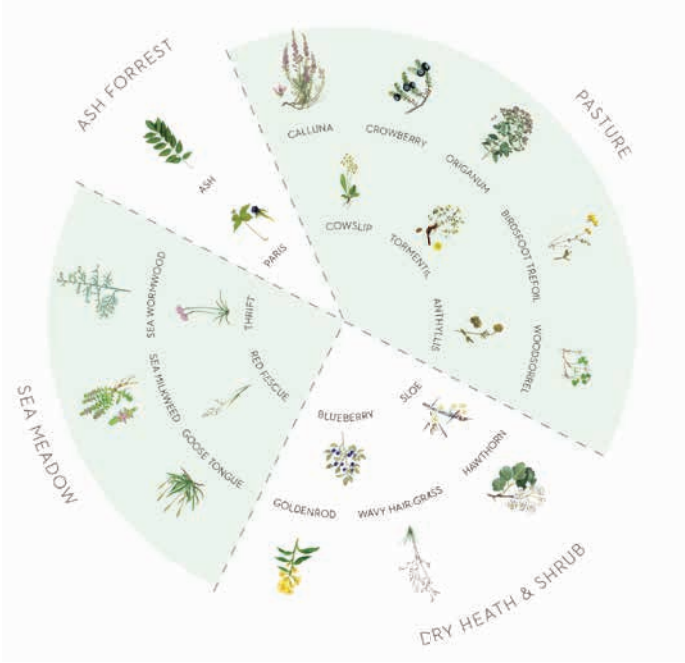
Ill. 57.1. Mapping of the nearby buildings.

Site Analysis

Ill. 58.1. Nearby pasture and a drone for aerial photos.

NATURE TYPES

The two nearby forrests, which respectively surround the site to the East and the West, are Hestehave Skov and Ringelmose Skov. Otherwise the project site is located in an area of pasture and sea meadow (ill. 58.2). Pasture is a grass field that, as mentioned earlier in the report, was originately used for agriculture. When the soil was exhausted, it became a grazing field for cows, and the warm and dry fields gave rise to a certain type of ecosystem. On the other hand, the sea meadow south of the project site, towards Kalø Vig, consists of plants that withstand some degree of flooding (ill. 58.1).



Ill. 58.2. The nature types.

Ill. 59.1. Mapping of the nature types.

Site Analysis

Ill. 60.1. Picture of the Middle-age path towards Kalø Slotsruin.

In order to reach the site is by car, visitors have to drive by Molsvej. Comming from north, the road leads by the city of Rønde. Going down a drop in the landscape, the road descends towards Kalø Vig, where the project site is situated in a bend towards east. There is a cycle path flowing along the road, which also makes it easy for cyclists to stop by the visitor centre.

Molsvej is easy to access from the main highway E45, which connects the major cities in Denmark such as Aalborg, Aarhus, Kolding and streches all the way down through Europe. It is also fairly reachable from the city of Ebeltoft.

In relation to the site, there are a couple of paths that must be considered as the entrance to the nearby nature. To the West, there is a path that leads to the forrest, Hesthave Skov, while a path originating from the Middle-ages leads to Kalø Slotsruin. The trip to the castle ruin is about one and a half kilometre, and takes about 20 minutes.

To travel further into the national park by car is bit difficult, because many gravel roads. However, it is certainly not impossible. Travelling by walking or by bike is on the contrary highly convenient due to the many paths in the national park.

Ill. 61.1. Mapping of the infrastructure.

SUMMARY

Ill. 62.1. The hills of Mols Bjerge with Blackthorn in the front.

While the theoreticians within the field of tectonics have different focus points, they have a common ground to some extent. This concerns the fine work of joining the elements, the visual display of structure and honesty to the nature of the materials. The most important contribution to the project are the four elements of architecture, as defined by Semper. Designing the visitor centre with focus on the earthwork, roof, hearth and enclosure, will be an essential part of the project.

According to Juhani Pallasmaa, the perception of architecture is the experience though the five human senses. By addressing all the senses, rather than just the visual, the atmosphere of the building is enhanced. Peter Zumthor highlights the nine key features in architecture which are influential for the architectural atmosphere. The key features make the sensibility aspects in architecture more comprehensive to implement in the design parameters.

As for the sustainability, the visitor centre is taking the standpoint of Inujima Seirensho, incorporating basic principles for reducing transmission loss to reduce the energy consumption. The building materials for the visitor centre will be selected based on durability, recyclability and local accessibility.

Mols Bjerge have a diverse nature and a distinctive, hilly landscape, evidently formed by the massive forces of the last ice age. As for the nearby context, there is a listed house, Strandhuset by architect Hack Kampmann, and also Kalø Slotsruin, whose presence must be considered in the design proposal. Through studies of the infrastructure and the context, the placement of the visitor centre, which was layed out by the board of the national park, seems adequate. It is perfect as gateway to the national park.

What regards the investigations of the key functions of a visitor centre, it is found that a visitor centre should be able to promote the local life, among other things. In order for the locals to accept the visitor centre, they need to able to tell the story about it with pride.

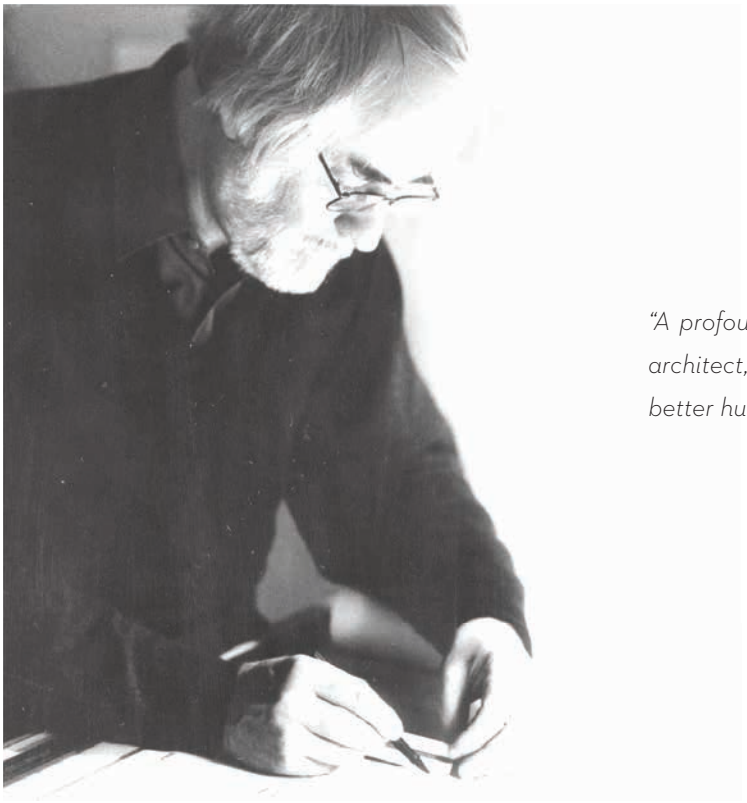
By visiting two existing visitor centres in Denmark, Rebildporten and Lille Vildmose Center, some interesting issues were identified. It was learned that the quality of service is essential for the visitor centre to work, and that the amount of guests should be considered carefully, also for the different seasons. By having the visitor centre open all year around, it is a statement of the ongoing activities, and always being avaible for the visitors of the national park.

VISION

To design a visitor centre that becomes a gateway to the National Park Mols Bjerge. Communicating the chararectestic nature and culture. Becoming an attraction in it self, but give also giving something back to the local community. A distinctive architecture, that also compliments the landscape without dissappearing into it.

Ill. 64.1. A family visiting the national park.

DESIGN CRITERIA



"A profound design process eventually makes the patron, the architect, and every occasional visitor in the building a slightly better human being."

– Juhani Pallasmaa

Ill. 66.1. The master.

DETERMINING THE DESIGN CRITERIA

The design criteria for designing the visitor centre are determined by a combination of the framework, established by the theoretical themes of tectonics and the atmosphere of architecture, studies of the context and functions of a visitor centre, and also the wishes from the board of the national park.

AESTHETIC

An architecture that affects more senses than just vision, promoting a multi-sensory experience.

A visible and comprehenable structure.

A distinctive architecture, that also compliments the landscape without dissappearing into it.

Contrast by the relationship between massive and transparent.

The choice of materials should be influenced by the context and the patinating of the harsh sea environment.

An appropiate and discrete parking area.

"Dialogue" with Hack Kampmann's house.

FUNCTIONAL

Contact between the visitor and the staff when entering the building.

The infomation centre and the shop can be handled simultaneously to reduce the cost.

Connection between the visitor centre and Hack Kampmann's house. However, it should not be a physical attachment to the house.

A good overview of the functions: Exhibition & knowledge sharing, infocentre & cafe.

Accessibility to interest points such as the ruin, through walking paths.

Step-free access between the main functions.

Flexibility in the exhibition area. Posibility of having themebased exhibitions and having changes over time.

Access to public toilets outside the opening hours of the visitor centre.

Flexibility in the exhibition area. Posibility of having themebased exhibitions changing over time.

The visitor centre should be open throughout the whole year. This is to promote the ongoing activities in the national park in the different seasons.

Access to public toilets outside the opening hours of the visitor centre.

80 parking spaces (inclusive handicap parking).
40 parking spaces for bicycles and motorbikes.
Four parking spaces for busses.

TECHNICAL

Balance between daylight and artificial light. Optimal daylight for working areas, darker spaces for the exhibition and considerations of info-technology.

Overall good acoustic conditions. An auditorium that is good for speech alongside electronically produced sounds.

Sustainability on a principal level, including considerations of materials in a simplified life-cyclus assessment.

A good indoor environment with an appropiate ventilation strategy. Considerations of the building envelope in relation to the microclimate.

A rational structure optimised towards durability and the strength characteristics of the materials.

PRESENTATION

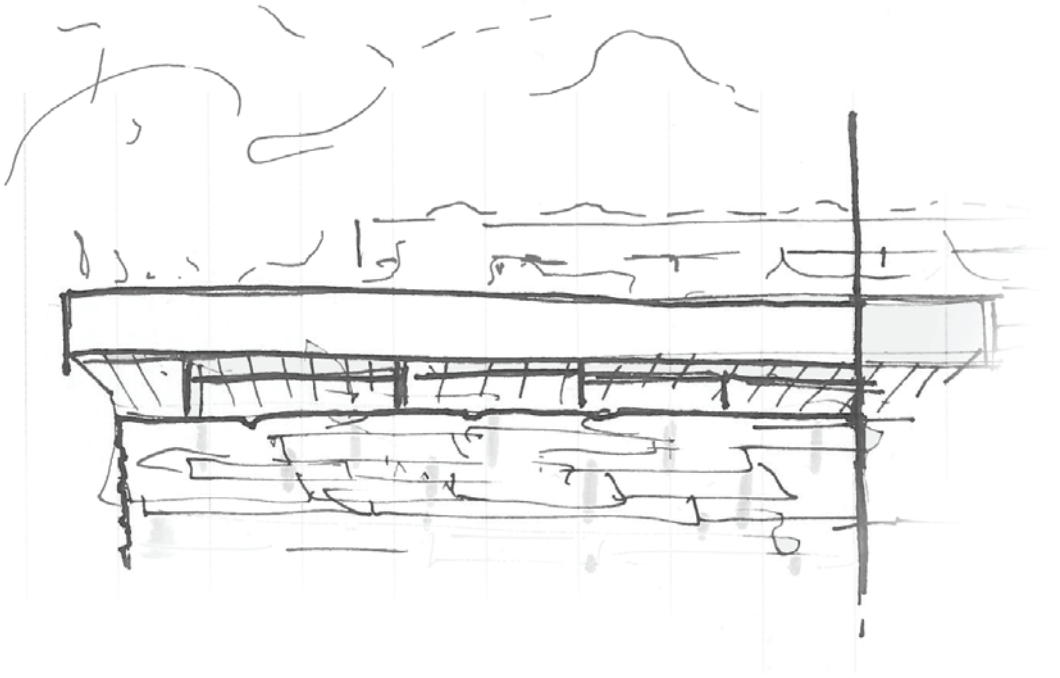
CONCEPT
MASTERPLAN
APPROACH
OVERVIEW
ABOVE / BELOW GROUND
INFOCENTER
EXHIBITION
CAFE
FACADES
SECTIONS

IN THIS CHAPTER, THE PROPOSAL FOR THE NEW VISITOR CENTRE IN MOLS BJERGE IS PRESENTED.

THIS IS DONE THROUGH VISUALISATIONS, DESCRIPTIONS AND DRAWINGS, EXPLAINING THE CONCEPT AND QUALITIES OF THE PROJECT.

THE PRESENTATION STARTS FROM THE OUTSIDE AND ZOOMS FURTHER IN, AND ENDS UP SHOWING THE DETAILS.

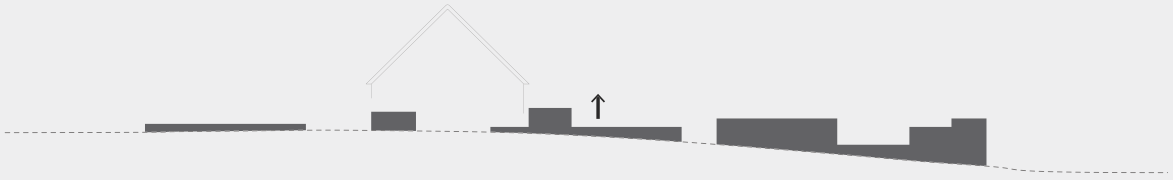
CONCEPT



Ill. 70.1. Conceptual sketch of the building elements: The concrete base, wooden structure and floating roof.

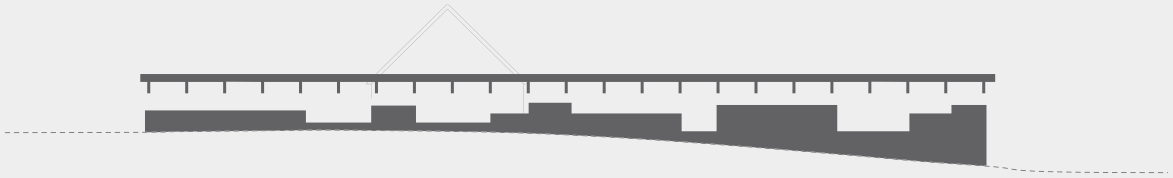
A SLEDGE IN THE LANDSCAPE

The concept of the visitor centre is a base of concrete, growing out of the landscape. It is a modern take on the traditional way of having a heavy base – as seen in Strandhuset – but also a ressemblance to Kalø Slotsruin. Floating above the base, is a roof of large glue laminated rafters, held up by a slender construction behind the glass.



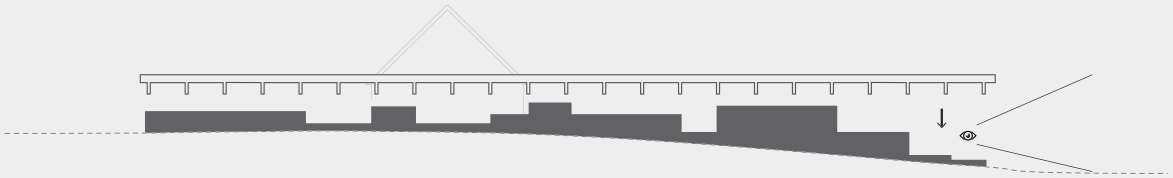
GROWING OUT OF THE LANDSCAPE (ILL. 71.1)

The upward arrow indicates the base of the building growing out of the landscape. A part of the building is excavated into the hill, for a dark exhibition area.



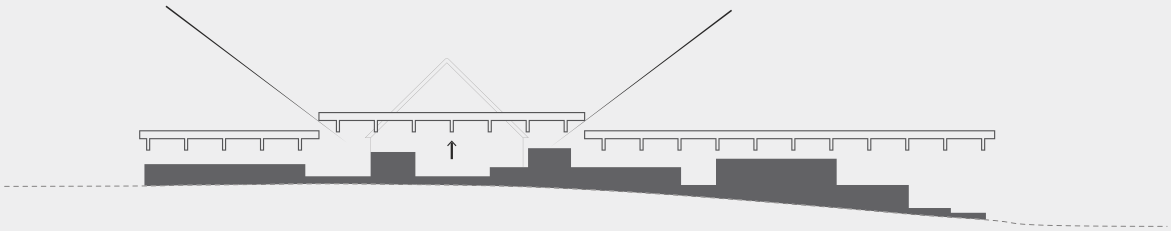
COVERING THE HEAVY BASE WITH A LIGHT ROOF (ILL. 71.2)

The base is covered by a roof consisting of large glue laminated rafters. These rafters are visible both inside the building, but also from the outside.



CREATING A SCENIC VIEW OF KALØ VIG (ILL. 71.3)

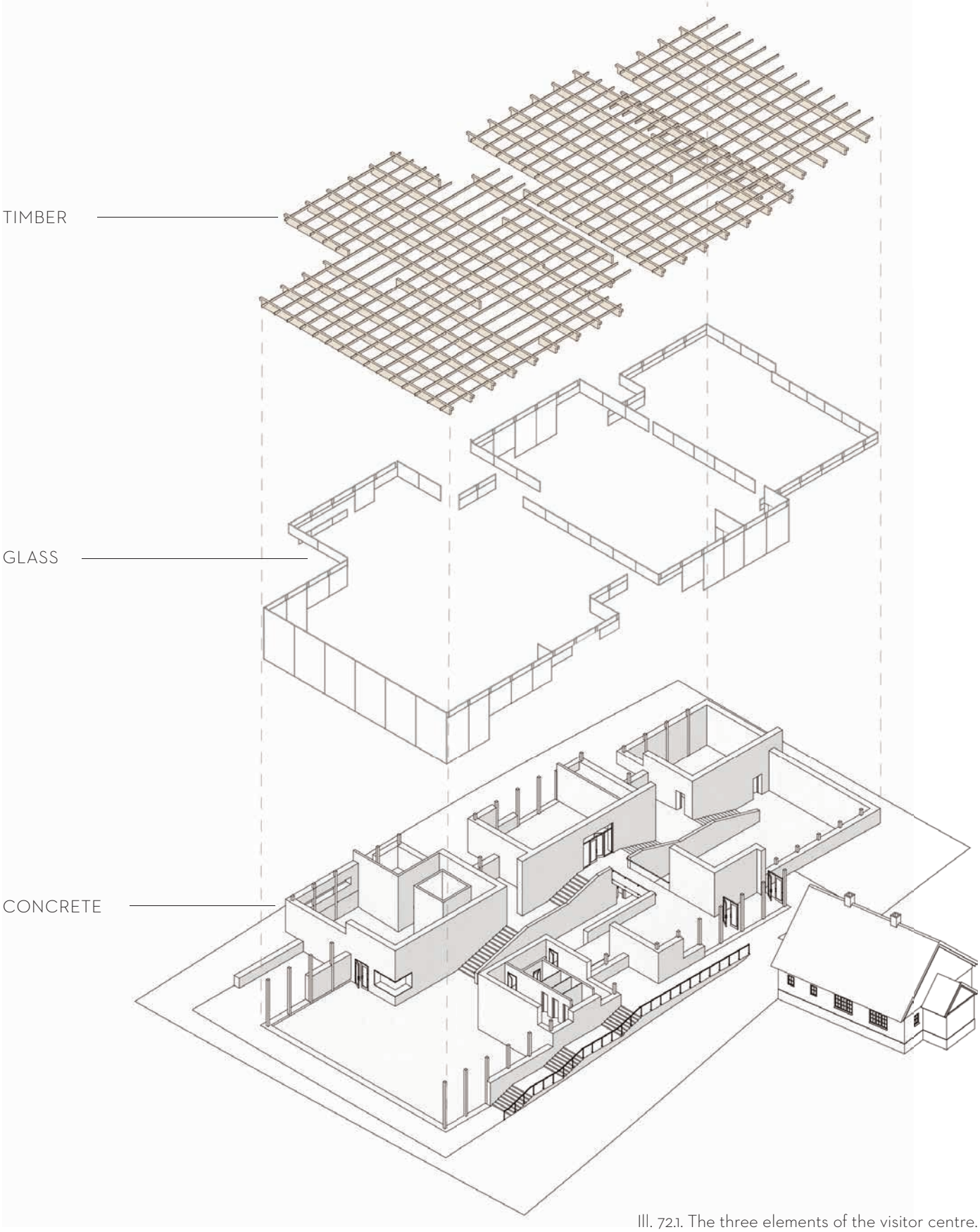
In the opposite side of the exhibition, there is opened up towards Kalø Vig. This creates a scenic view for the cafe, that is located here.



OPENING UP FOR LIGHT (ILL. 71.4)

The roof is raised to meet Strandhuset, creating a natural entrance, and also letting light in for the middle of the visitor centre.

CONCEPT

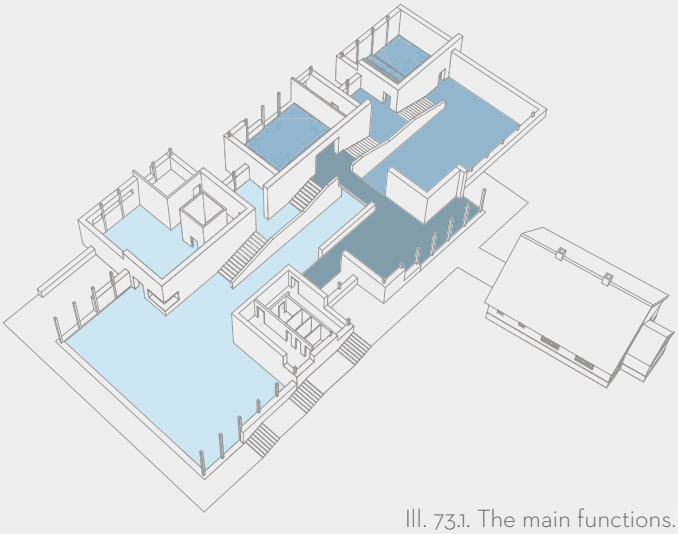


Ill. 72.1. The three elements of the visitor centre.

THREE MAIN FUNCTIONS

The three main functions of the visitor centre are placed, so they have the suitable conditions for light and flow.

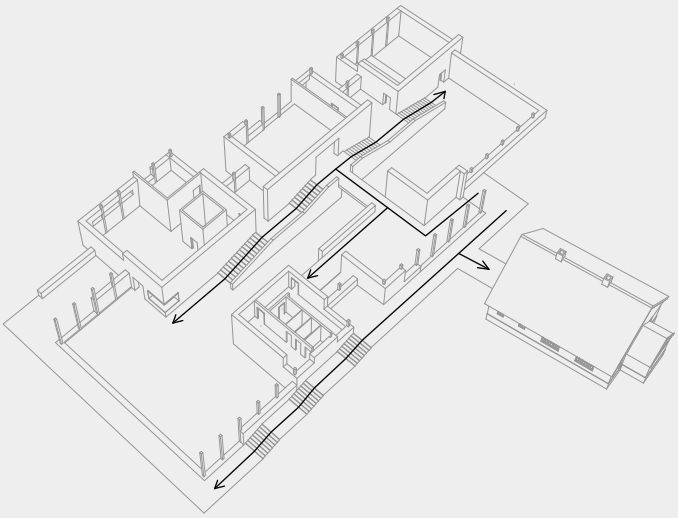
- INFOCENTRE
- EXHIBITION
- CAFE



Ill. 73.1. The main functions.

FLOW & CONNECTING STAIRS

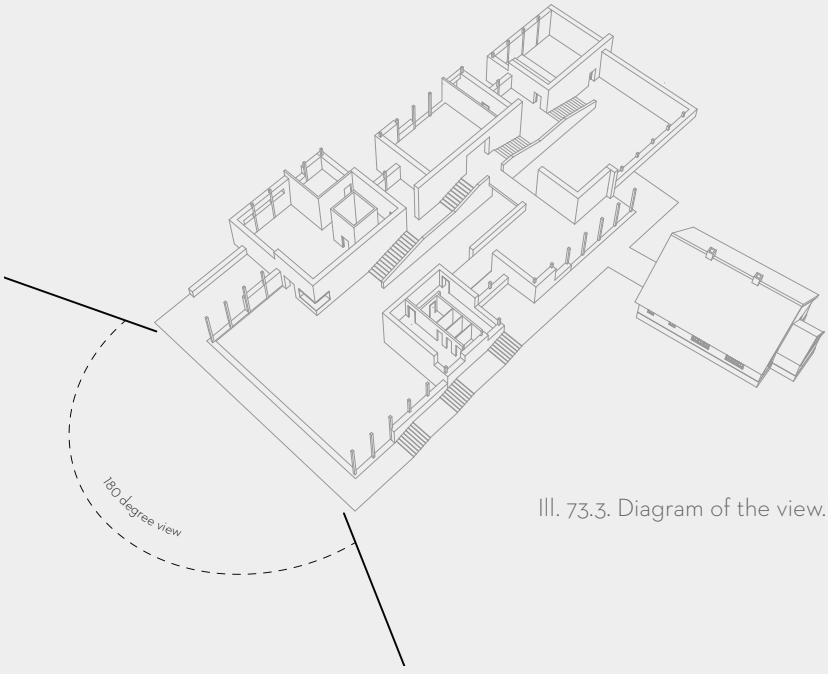
The flow of the building is based on the grand stairway, located centrally in the building. The cafe and exhibition are connected under the "bridge". When entering the infocentre, it is also possible to reach the lower floor by a spatious lift, allowing step-free access to all of the main functions.



Ill. 73.2. Flow diagram.

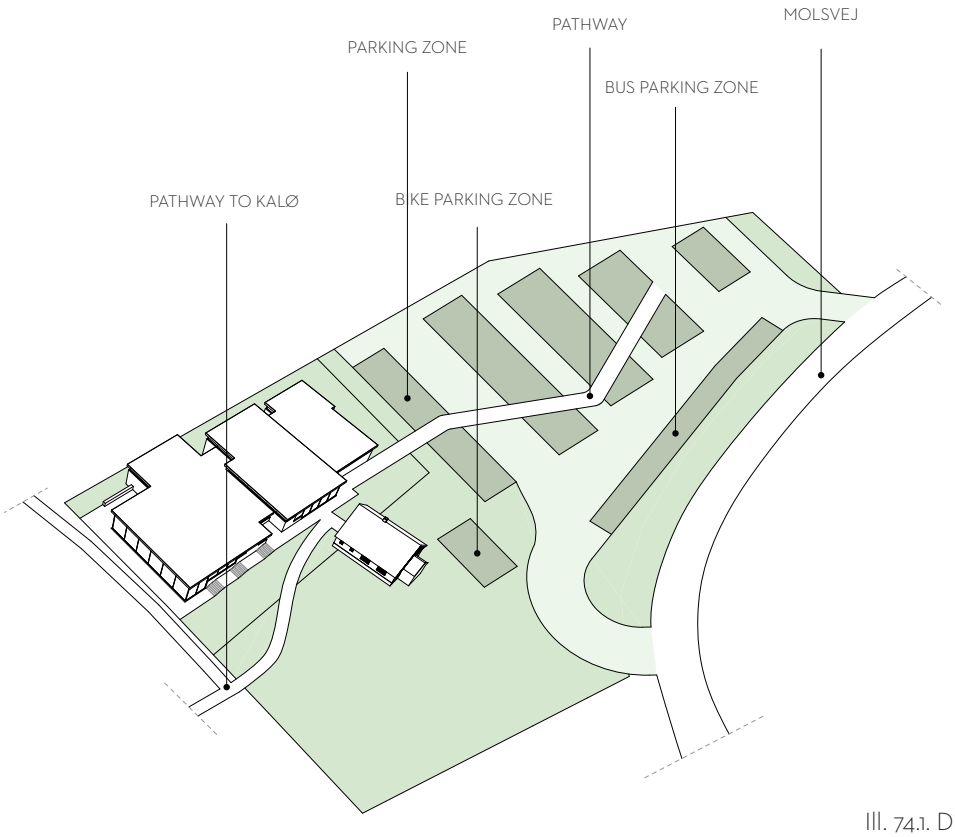
THE SCENIC VIEW

The facade of the cafe is opened up to create a 180 degree view of Kalø Vig, which includes Kalø Slotruin.



Ill. 73.3. Diagram of the view.

MASTERPLAN



Ill. 74.1. Diagram of the master plan.

THE HOLISTIC PLAN

The masterplan considers the approach to the building by a pathway through the parking area. It is considered a "green" parking area, without an excessive use of asphalt in the vulnerable nature. Instead, carefully arranged parking lots and reinforced grass ensures a good entrance to the visitor centre with a connection to Kalø Slotsruin.
All in all, there are 83 parking lots for cars (inclusive 3 HC), 4 parking lots for busses and a parking zone with enough space for 50 bicycles.

Ill. 75.1. Masterplan.

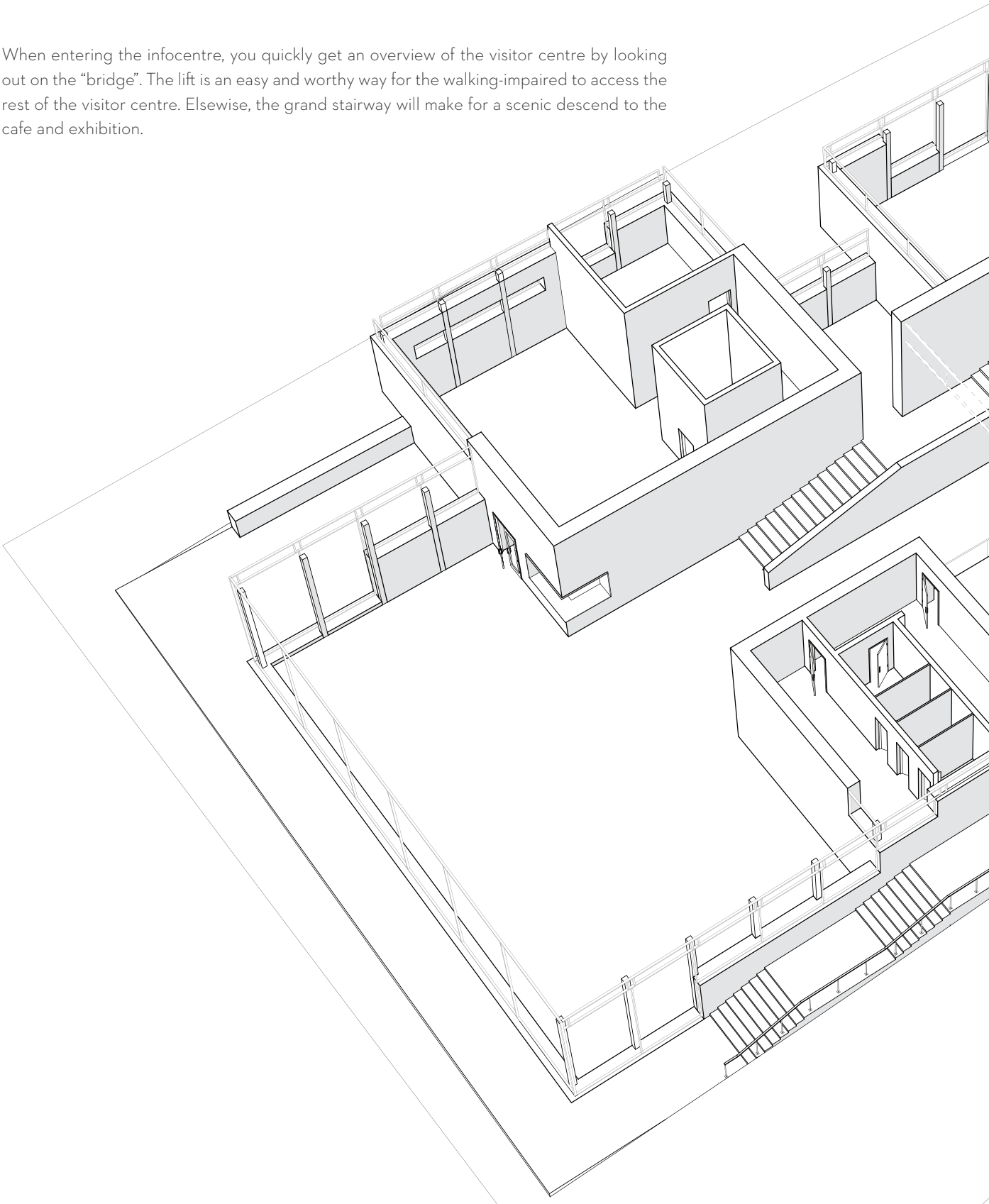
ARRIVAL

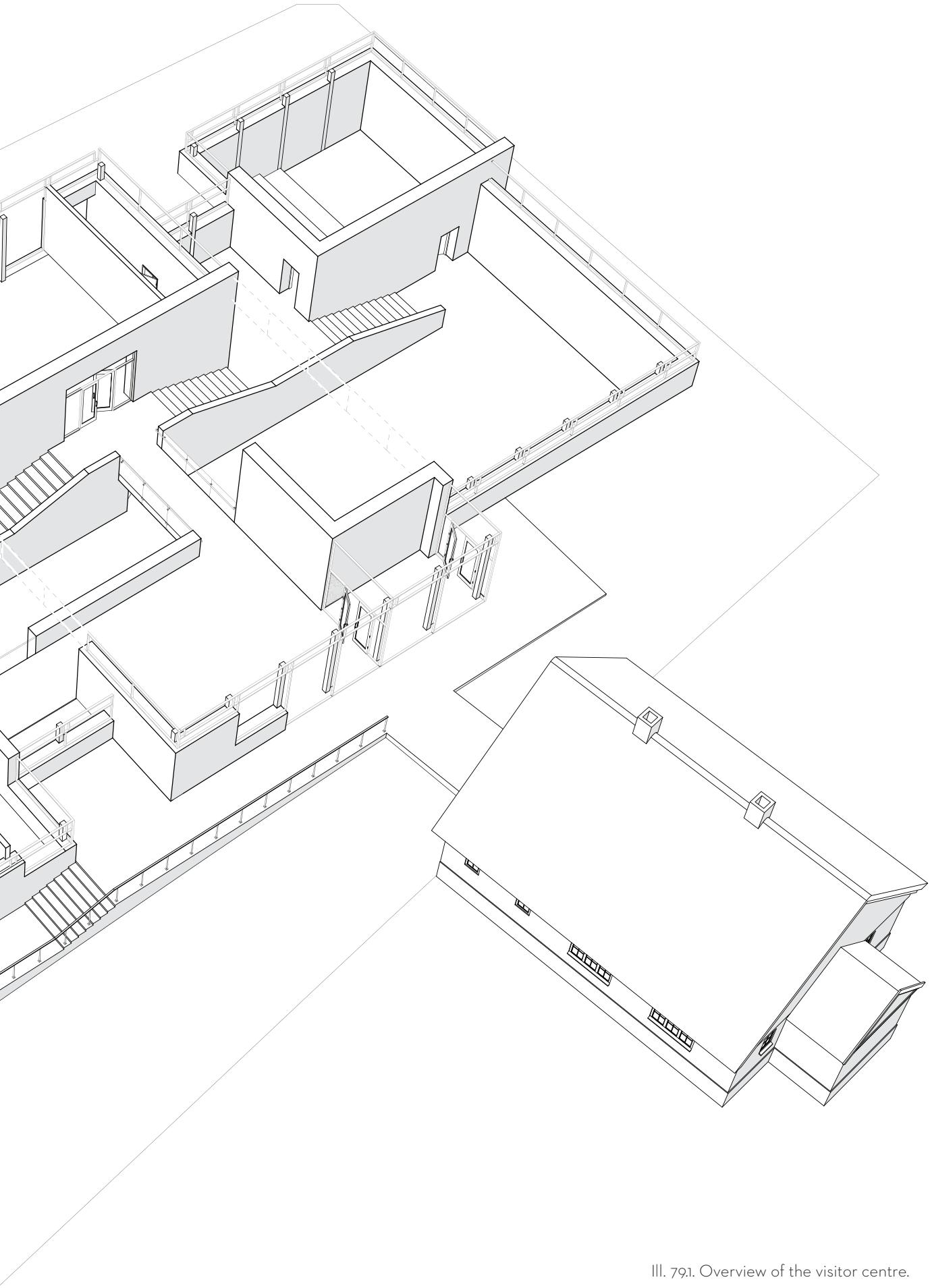
Walking towards the visitor centre, you get a glimpse of Kalø Vig between Strandhuset and the new building. Functioning as a gateway to the Mols Bjerge Nationalpark, you are invited in to experience the unique culture and landscape. The visitor centre rises up towards Strandhuset. Here is the main entrance, where you are greeted in the infocentre.

Ill. 76.1. Arrival to the visitor centre.

OVERVIEW | THE BUILDING

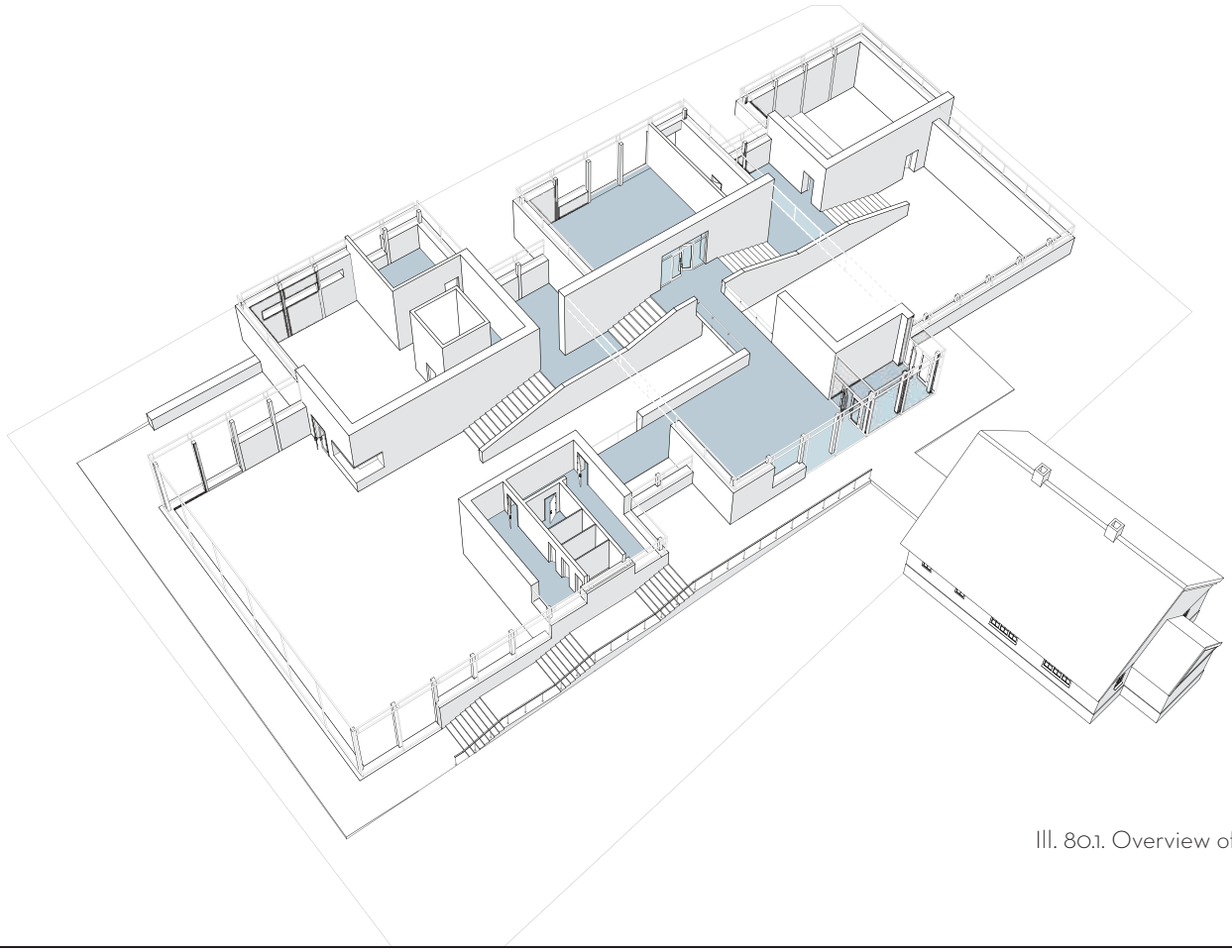
When entering the infocentre, you quickly get an overview of the visitor centre by looking out on the "bridge". The lift is an easy and worthy way for the walking-impaired to access the rest of the visitor centre. Elsewise, the grand stairway will make for a scenic descend to the cafe and exhibition.





Ill. 79.1. Overview of the visitor centre.

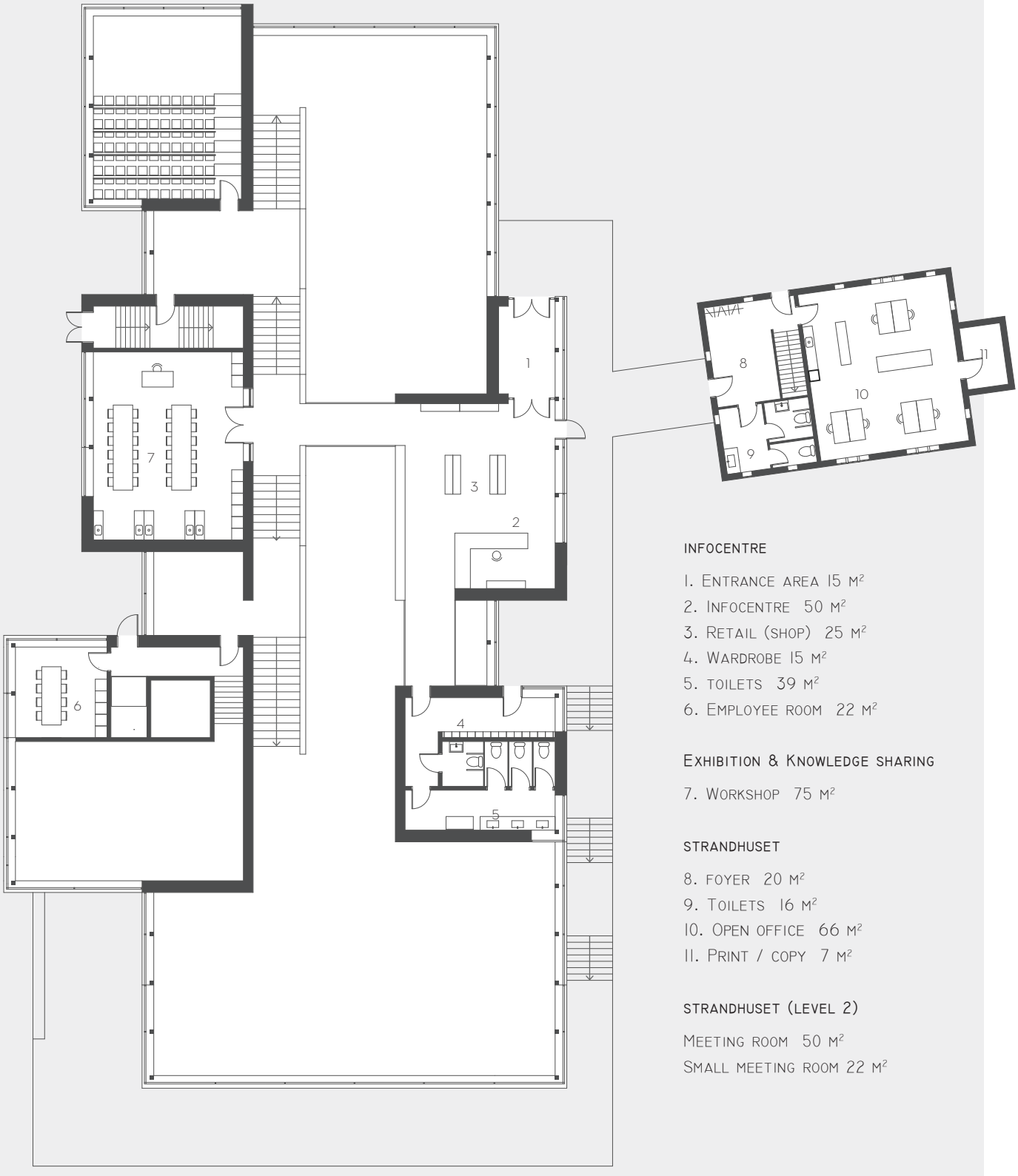
ABOVE GROUND | LEVEL 1



Ill. 80.1. Overview of level 1.

ENTERING THE VISITOR CENTRE

When entering the visitor centre, you arrive in the infocentre. The entrance is transparent, which provides daylight and a visual connection with Hack Kampmann's house. Here, you can have personal service, or plan your route into Mols Bjerge by yourself. There are lockers in the wardrobe, if you are just passing by on your bicycle to visit Kalø Slotsruin. Toilets are also available, even after closing time. Soon you discover the overview of the entire visitor centre, that you have when you stand on the "bridge". You are not forced to go in one direction, but can choose whatever path you like. The visitor centre invites you to go down the scenic stairway.



Ill. 81.1. Plan (level 1)

INFOCENTRE

1. Entrance area 15 m²
2. Infocentre 50 m²
3. Retail (shop) 25 m²
4. Wardrobe 15 m²
5. toilets 39 m²
6. Employee room 22 m²

Exhibition & Knowledge sharing

7. Workshop 75 m²

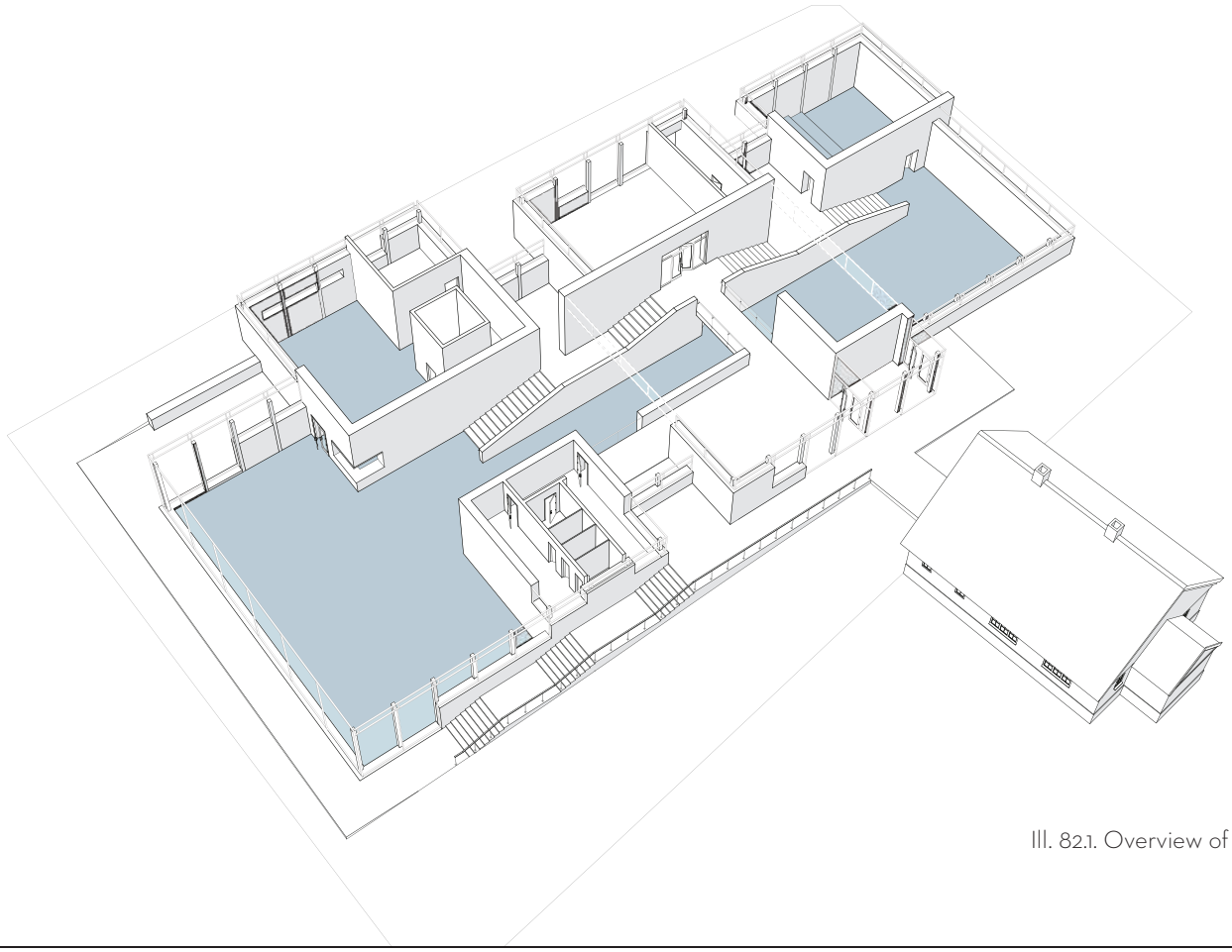
STRANDHUSET

8. foyer 20 m²
9. Toilets 16 m²
10. Open office 66 m²
11. Print / copy 7 m²

STRANDHUSET (LEVEL 2)

Meeting room 50 m²
Small meeting room 22 m²

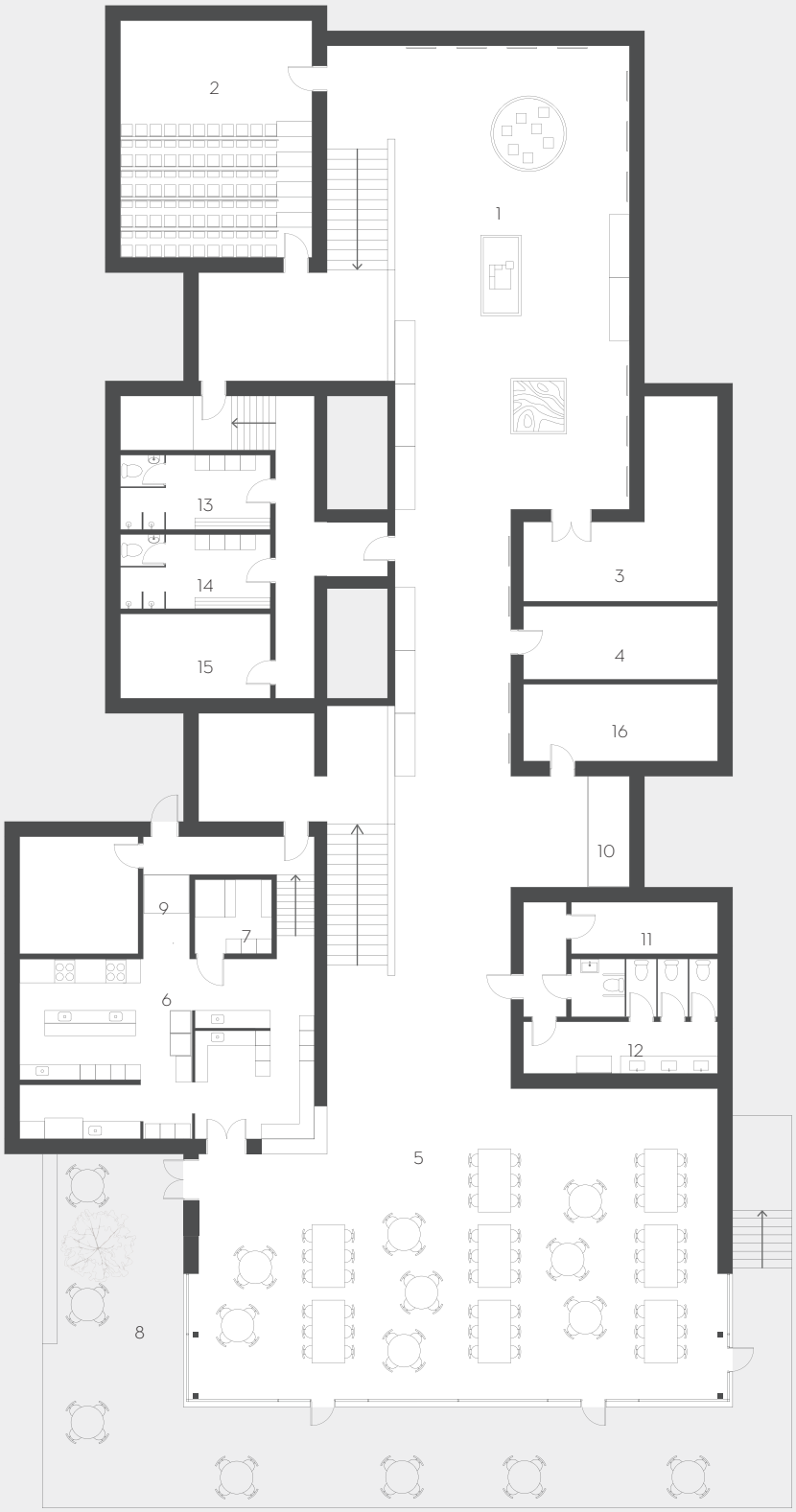
BELOW GROUND



Ill. 82.1. Overview of level 0.

EXPLORING THE EXHIBITION / ENJOYING THE CAFE

Going down the stairway, you can either go to the cafe or the exhibition.
The cafe has a large open facade towards south with a 180 degrees view of Mols Bjerge and Kalø Vig, including the nearby Slotsruin. The food and drinks are made from locally produced ingredients with a focus on organic food and sustainability. An outdoor area connected to the cafe allows visitors to go out and sit. All in all, the cafe has a capacity to guest around a 100 visitors.
The exhibition is situated in the darker end of the visitor centre. Here, there is space to explore the nature, landscape & culture of Mols Bjerge. The room is flexible in the sense that the exhibition can be changed throughout the year. In the auditorium, lectures can be delivered and movies displayed.



Ill. 83.1. Plan (level 0)

Exhibition & Knowledge sharing

1. Exhibition 185 m²
2. Auditorium 72 m²
3. Storage 39 m²
4. Archive 22 m²

Cafe

5. Cafe 235 m²
6. Kitchen 85 m²
7. Cold storage 9 m²
8. Outdoor area 52 m²
9. Lift 4 m²

Miscellaneous

10. Lift 7 m²
11. Cleaning storage 12 m²
12. Toilets 30 m²
13. Female changing room 18 m²
14. Male Changing room 18 m²
15. technical room 20 m²
16. Technical room 23 m²

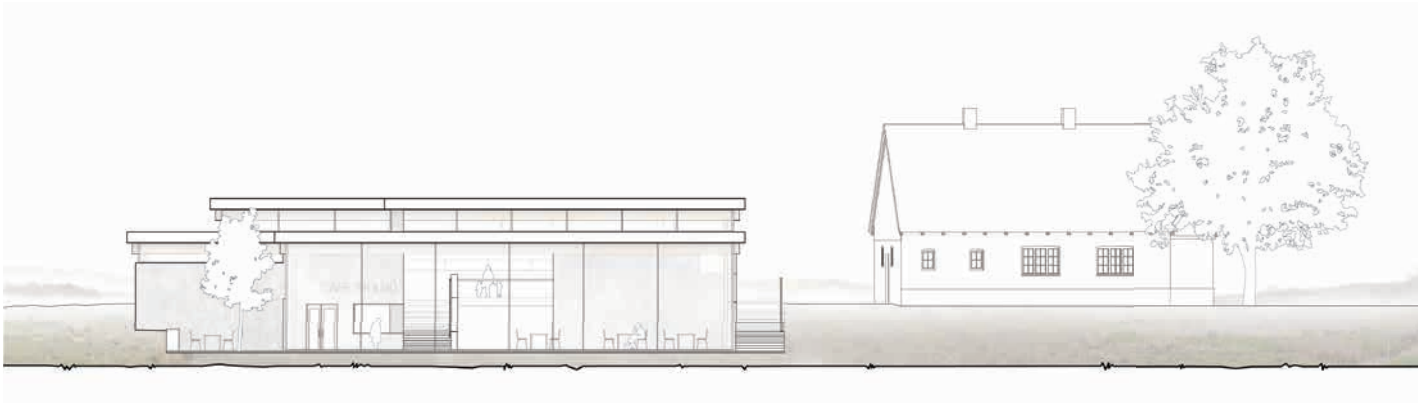
CAFE

Ill. 84.1. The cafe with a 180 degree view towards Kalø Vig

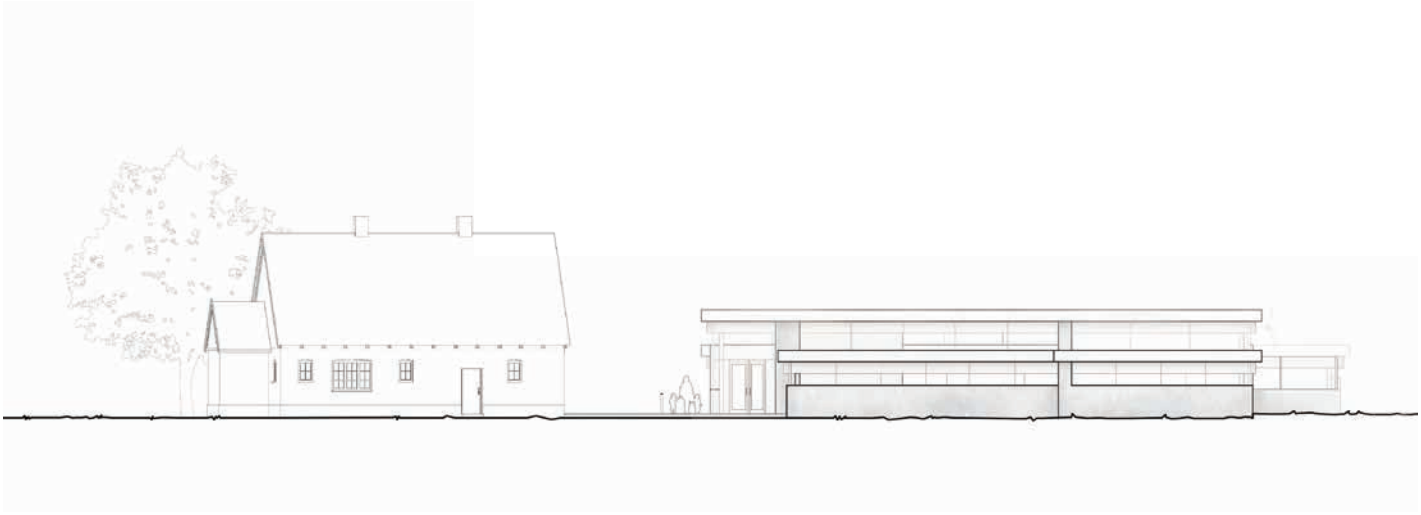
Sitting in the cafe, you have a 180 degree view of Kalø Vig. In the background you can see Kalø Slotsruin, and silhuettes of people who are walking on the slender path between mainland and the small island of the castle ruin. The cafe serves organic food and drinks, which are made from local and sustainable ressources. There is a good amount of daylight, and you can sit outside on a warm day,

FACADES

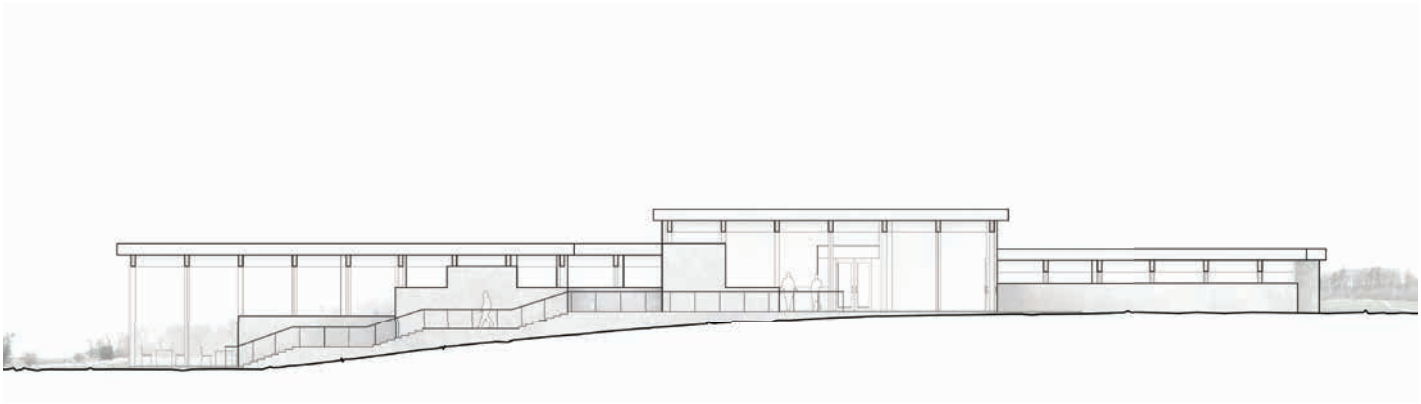
Ill. 86.1. Facade west.



Ill. 86.2. Facade south.

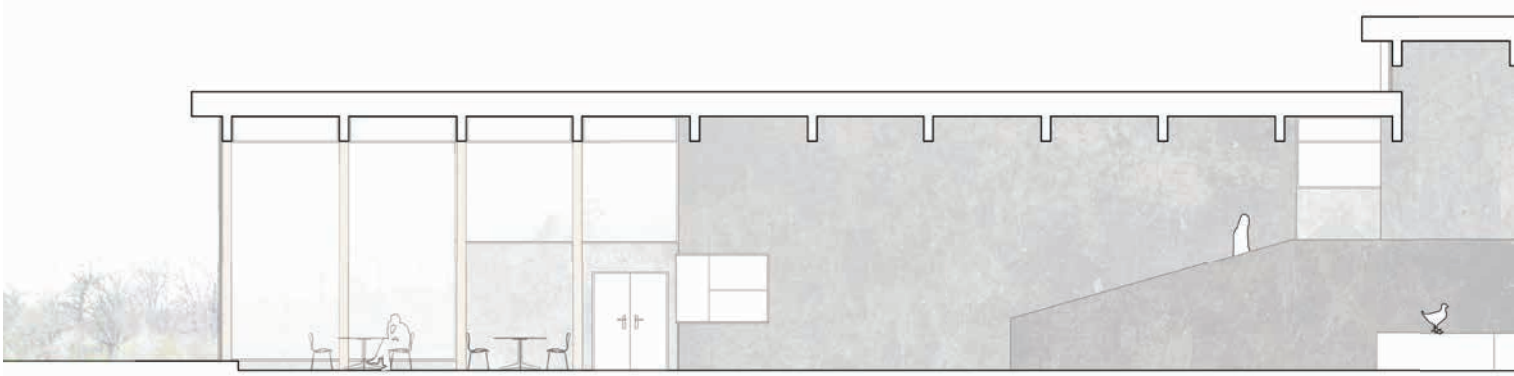


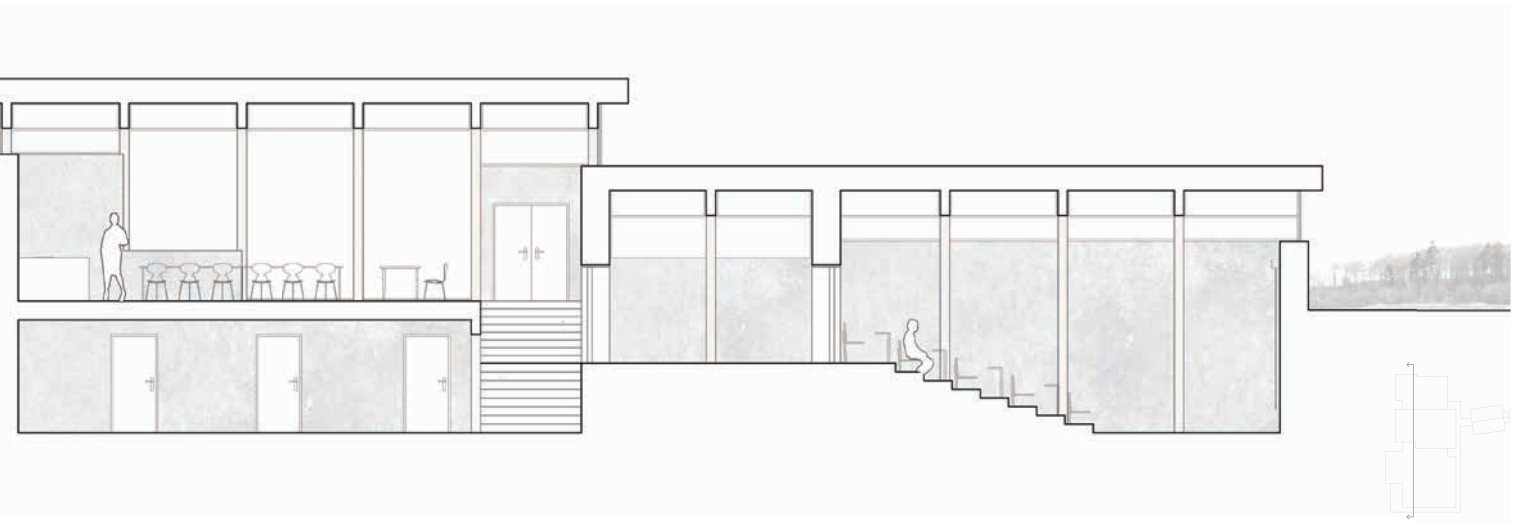
Ill. 87.1. Facade north.



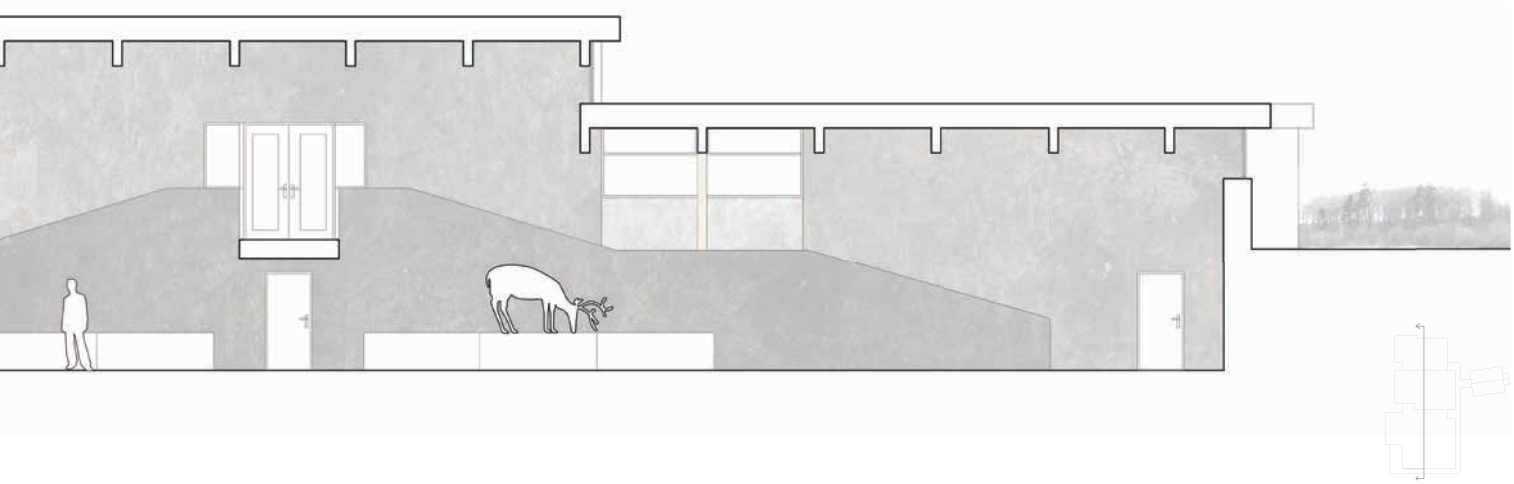
Ill. 87.2. Facade east.

SECTIONS | EXHIBITION & CAFE



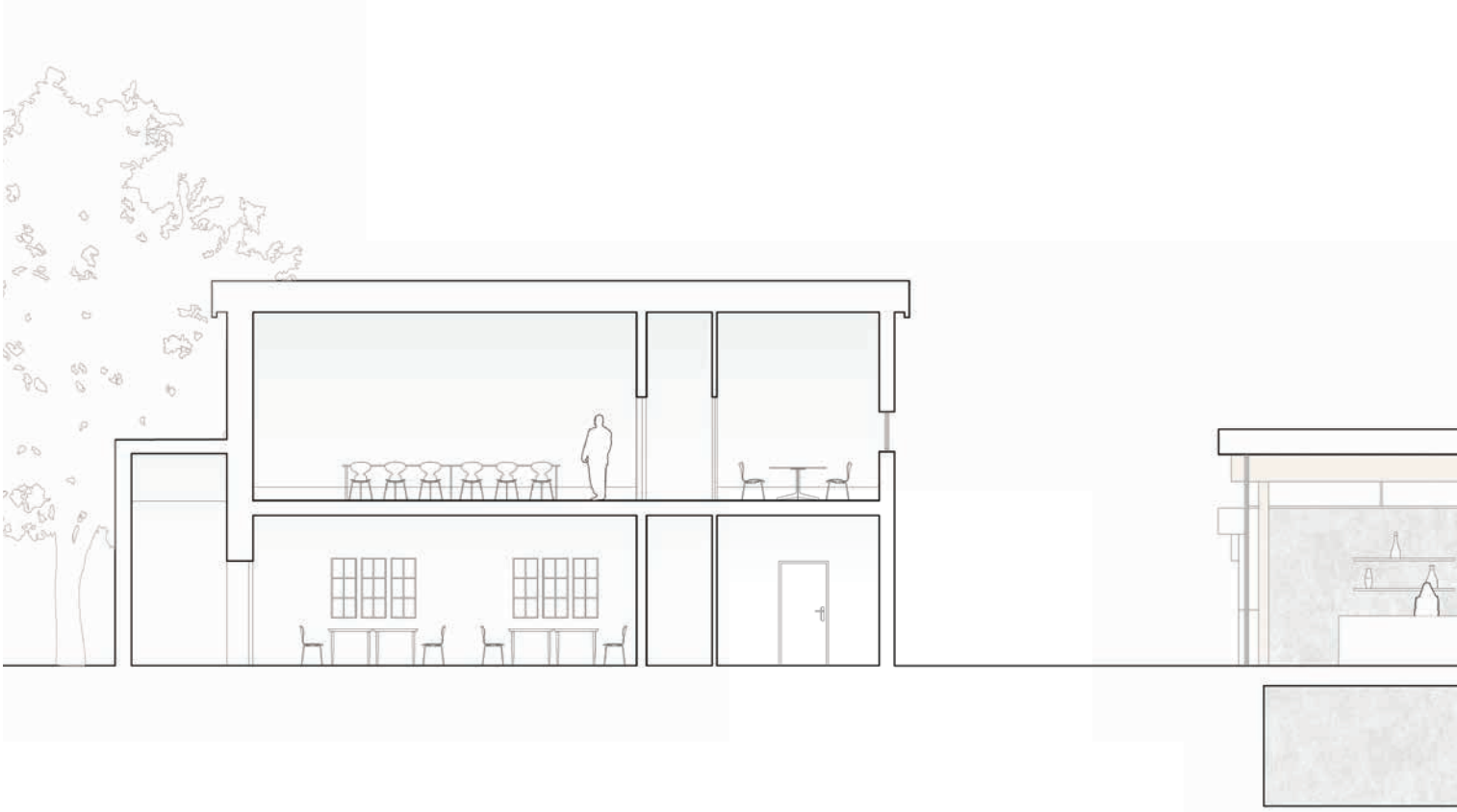


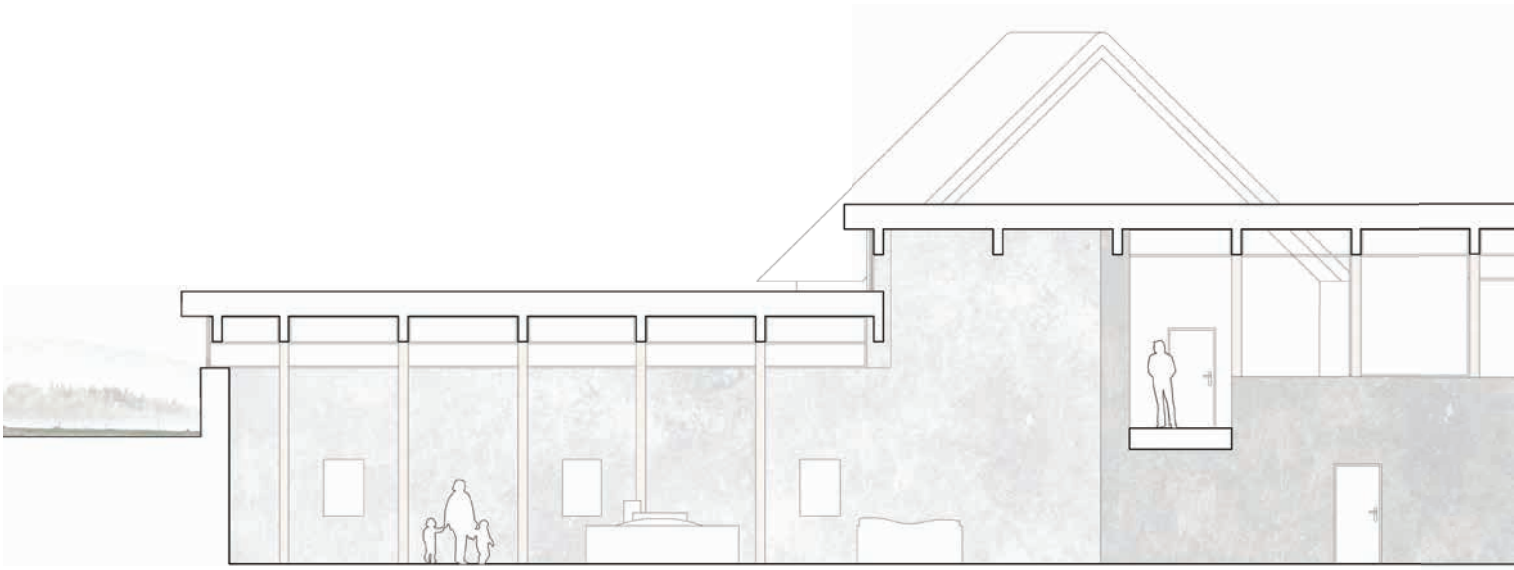
Ill. 89.1. Section A-A.

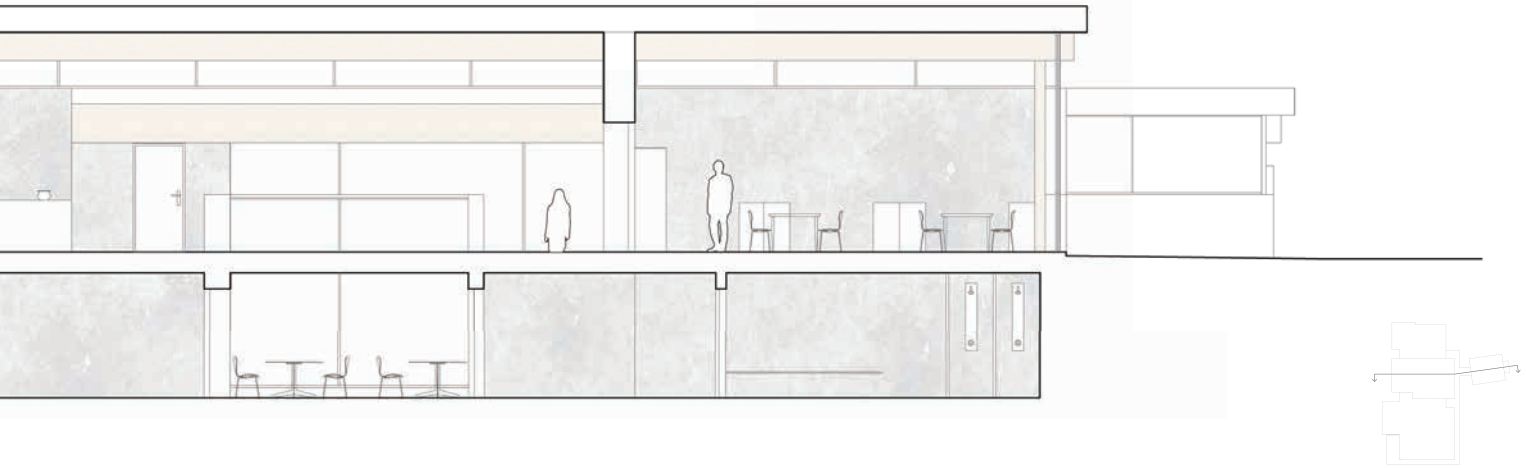


Ill. 89.2. Section B-B.

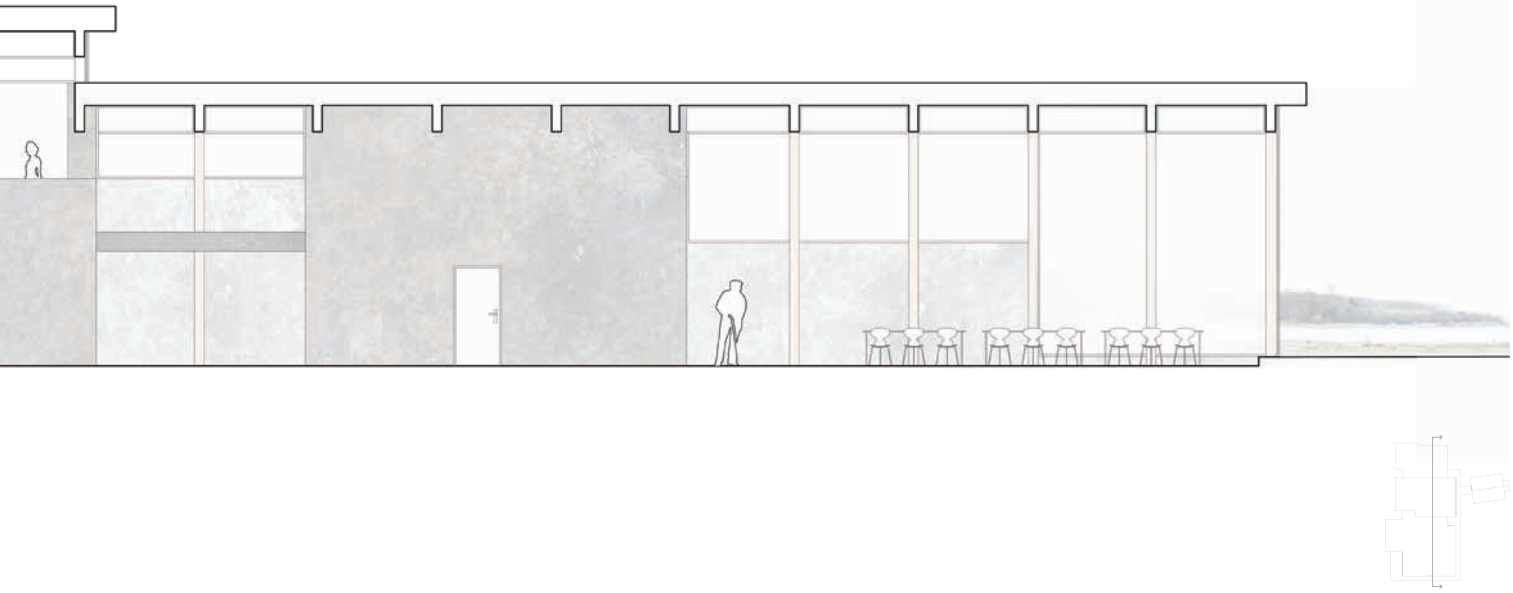
SECTIONS | INFOCENTRE





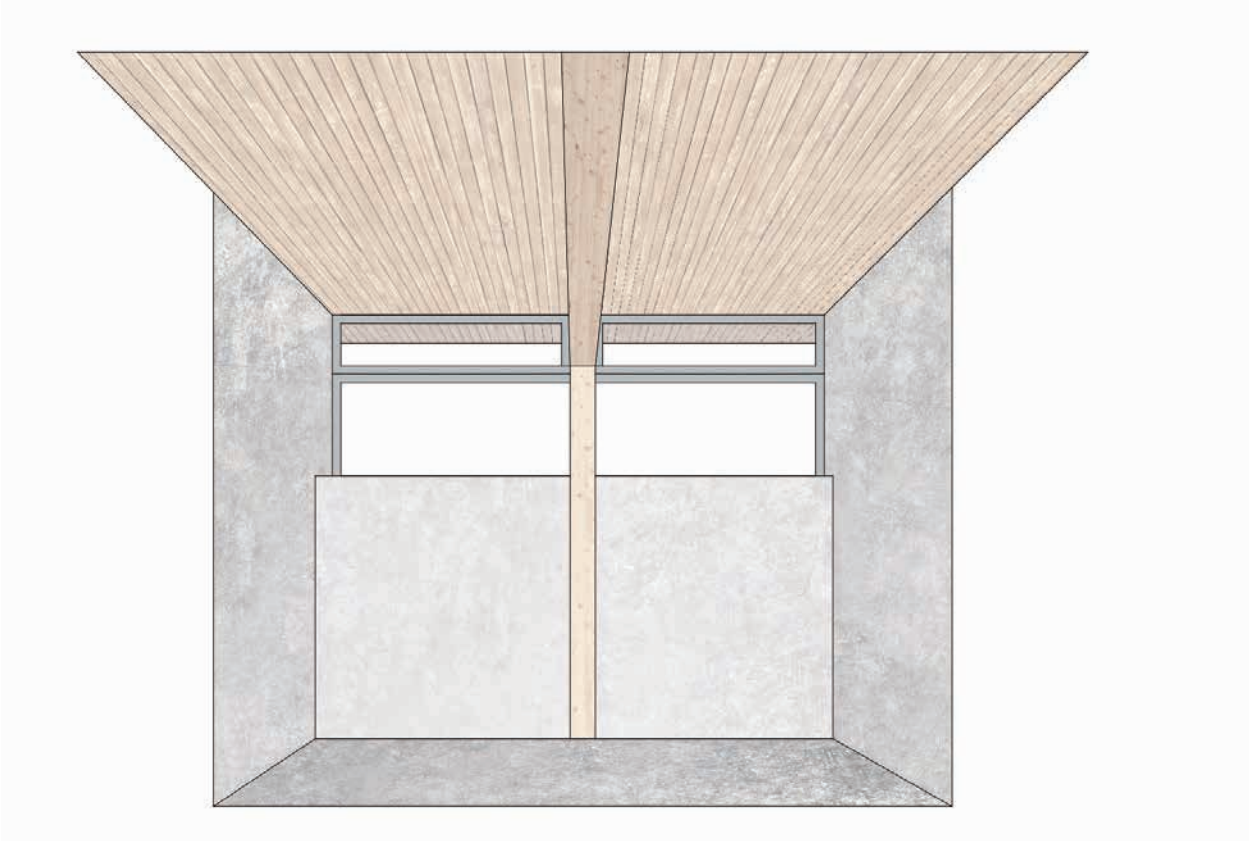


Ill. 91.1. Section C-C.



Ill. 91.2. Section D-D.

MATERIALS



Ill. 92.1. Materials of the visitor centre.

CONCRETE, TIMBER & GLASS

The materials chosen for the design are based on the idea of having the base express heaviness with the use of concrete. In contrast, the roof and load-bearing structure have a lighter appearance in glue-laminated timber and thin pine boards covering the ceiling, which create an interplay with the light.

The harsh environment of the nearby Kalø Vig calls for durable materials to make the design long-lasting and sustainable. The concrete and pinewood fulfills the demand, by being able to withstand the natural conditions. These materials are accessible resources within the region.

The board-formed concrete on the wall brings out the tactility of the surface with its shifting pattern, interacting well with the heavy expression of the base. The simple polished concrete on the floor stands in contracts to the rough texture on the wall.

The edge of the roof is covered in white fiber-reinforced concrete, in order to make a clean finish for the roof, while providing a sharp and elegant look and enhance the idea of the floating roof.

Ill. 93.1. Polished concrete.

Ill. 93.2. White fiber-reinforced concrete (FRC).

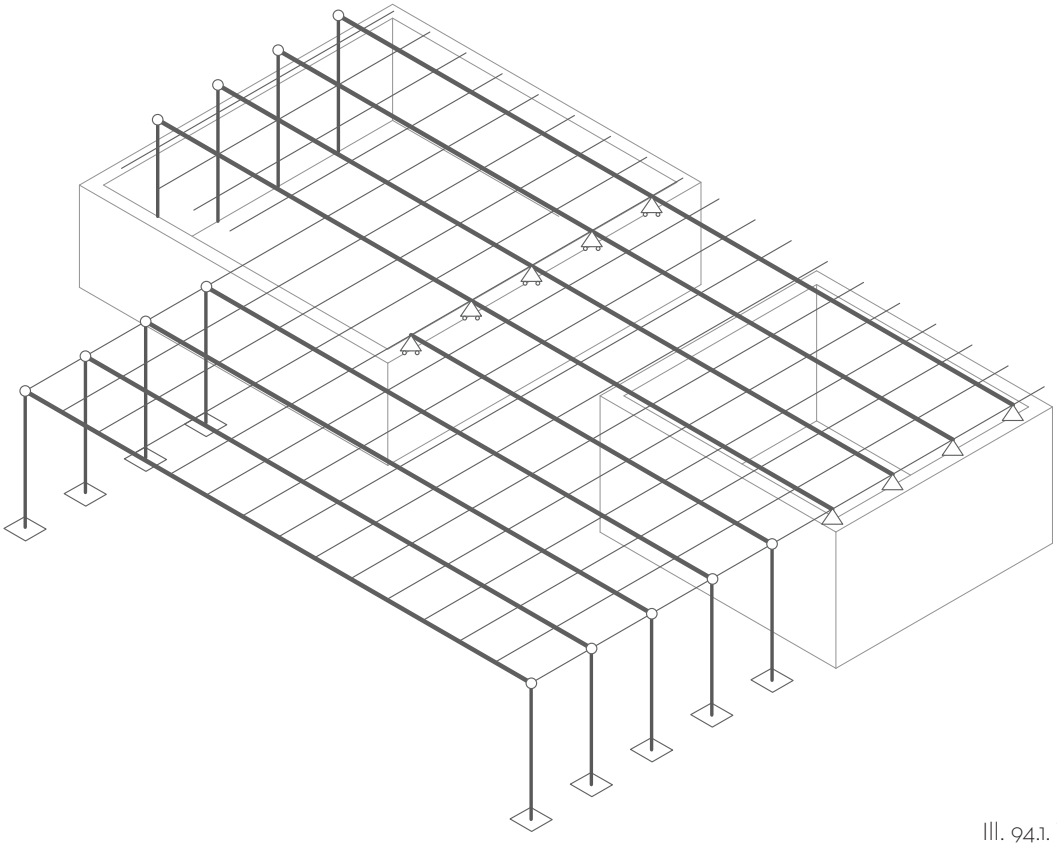
Ill. 93.3. Glue laminated timber (GL32h).

Ill. 93.4. Board formed concrete.

Ill. 93.5. Pine boards.

Ill. 93.6. Glass.

STRUCTURAL PRINCIPLE

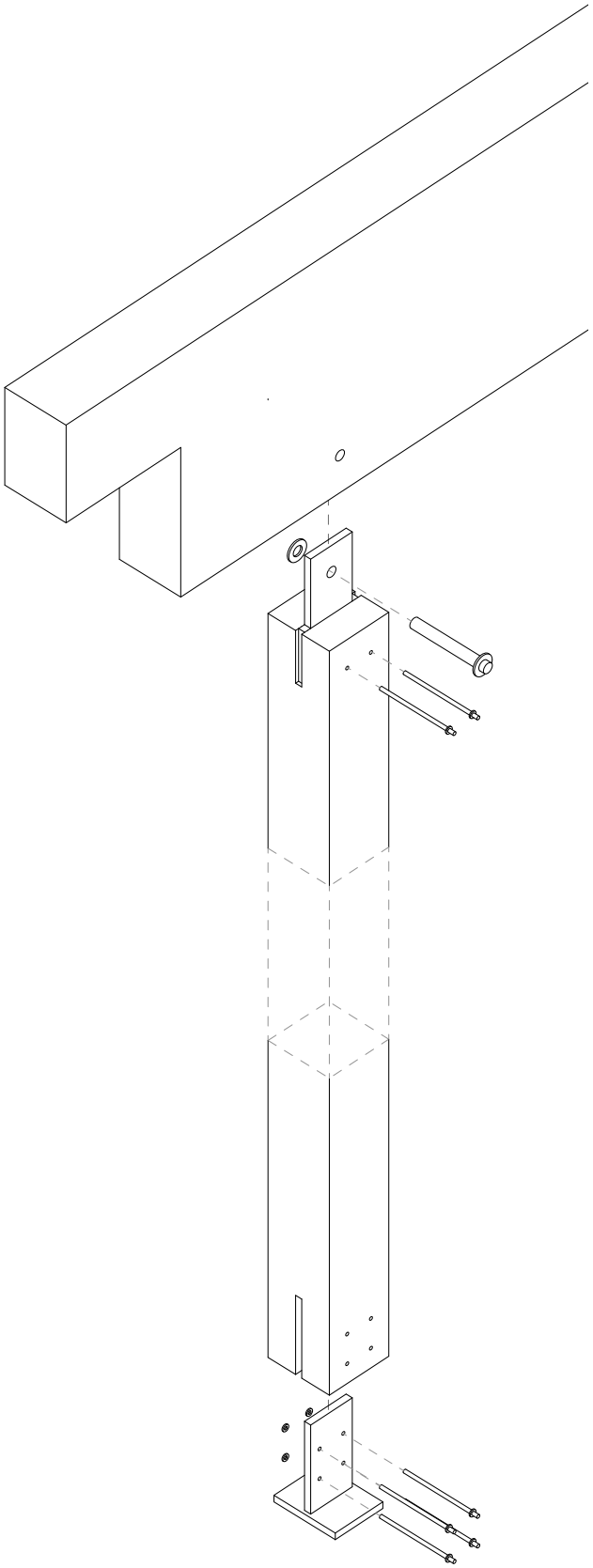


Ill. 94.1. The statical system.

CHARNIÈRE IN THE TOP / FIXED IN THE BOTTOM

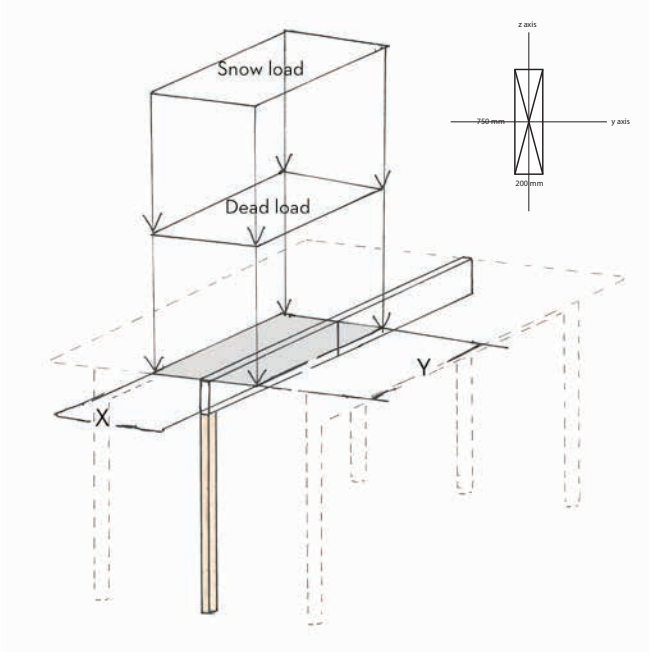
The roof is supported by several charnière frames in glue-laminated timber and by concrete inner walls. A charnière frame is considered a rafter supported by two columns. The frames are attached to the floor with fixed joints to prevent the structure from moving apart or tilting, while the upper joints between the column and the rafter are hinged to avoid the columns from obtaining bending stress that will decrease the bearing strength of the frame. The load from the roof would transition down to the rafter as bending moment, while the column would primarily be affected by the normal force from the weight of the roof and the rafter.

The ill. 94.1. shows the meeting between the rafter and the column. The rafter is attached to the column by a single large metal bolt to allow the rafter to displace without transferring bending stress to the column. An alternative solution for designing a hinge joint could also be to place a couple of metal bolts close to each other instead of a single large bolt.
The column is attached to the ground by a large steel bracket with four metal bolts placed far from each other in order to restrain the construction from rotating or moving.

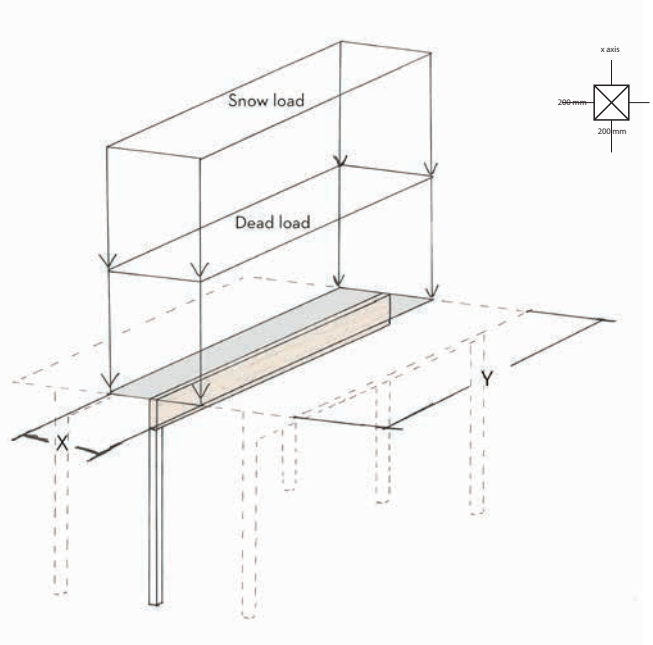


Ill. 95.1. The joints of the beam, floor and rafters.

DIMENSIONS



Ill. 96.1. Load affecting the column.



Ill. 96.2. Load affecting the rafter.

The following calculations verify the dimension of a single rafter and a single beam for the ultimate limit state in the most critical section of the building, which is considered to be the cafe area with a span of 22 m. The ultimate limit state calculation confirms whether the construction can carry the load or will collapse.

This calculation is based on the assumption of the load from the roof is distributed evenly over the entire roof. The frame is made of glue laminated wood class GL32h and the distance between the frames is 2.5 meters.

The first calculation step is to verify the rafter with a cross section height of 0.75 meters and width of 0.2 meters.

The tension must not exceed the strength capacity of the material. (Teknisk Ståbi, 2014, p 292).

$$\frac{\sigma}{fm,y,d} \leq 1$$

The tension is determined by the maximum moment divided by the cross section moment resistance W.

$$\sigma = \frac{Mmax}{W}$$

The moment on the rafter is calculated as a simple supporting construction with an equally distributed load. (Teknisk Ståbi, 2014, p 33) The surface load is multiplied by 2.5 m, which is the distance between the frames, to convert it to a uniform load.

$$Mmax = \frac{1}{8} \cdot q \cdot l^2$$

The moment resistance W for a rectangular profile can be determined with this equation (Teknisk Ståbi, 2014, p 33)

$$W = \frac{1}{6} \cdot h \cdot b^2$$

The results of the tension does not exceed the material strength with the utility factor of 0.7. This indicates that the rafter is capable of withstanding the load.

The next step is to verify the column with a cross section of 200 mm x 200 mm.

$$\frac{\sigma}{kc \cdot fc,0,d} \leq 1$$

$F_{c,0,d}$ is the calculated compression strength along the material.

The tension is determined.

$$\sigma = \frac{q}{A}$$

Where q is the load and A is the area of the cross section.

$$\lambda rel,y = \frac{(krel \cdot ls,y)}{B}$$

$l_{s,y}$ is the column length. The column is fixed in the bottom and hinged in the top, which means the column length needs to be divided by 0.7.

K_{rel} is 0.057 for Gl32h (Teknisk Ståbi, 2014, p 297)

B is the width of column profile.

The column has a square profile, which means the slenderness value is identical in the y and z axis.

The results of the tension do not exceed the material strength with the utility factor of 0.15. This indicates that the column is capable of withstanding the load from compression. The calculation of dead load and snow load can be found in annex page 132-133.

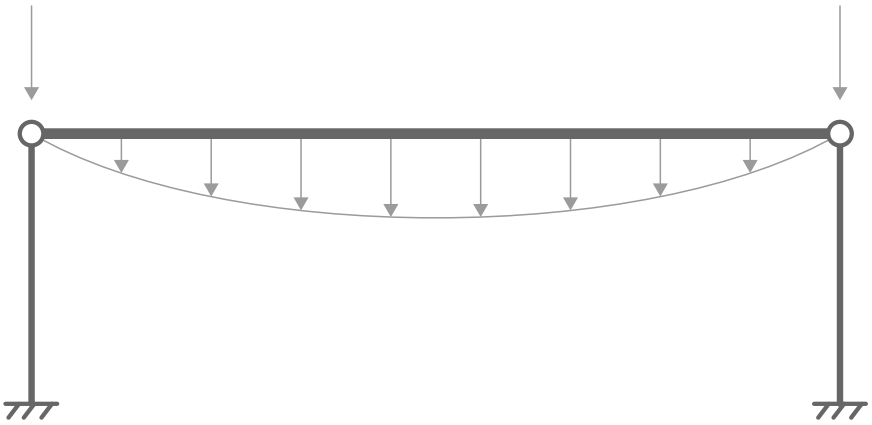
ULTIMATE LIMIT STATE FOR A BEAM

ULS	q	moment	W moment resistance	σ Tension	f,mk Mpa	kd	fm,d	utilization ratio
	kN/m	kNm	m^3	Mpa	Mpa		Mpa	
permanent load	1,95	117,975	0,019	6,3	32	0,462	14,78	0,43
short term	4,8	290,4	0,019	15,49	32	0,692	22,14	0,7
instantaneously	0,67	40,535	0,019	2,16	32	0,846	27,07	0,08

ULTIMATE LIMIT STATE FOR COLUMN

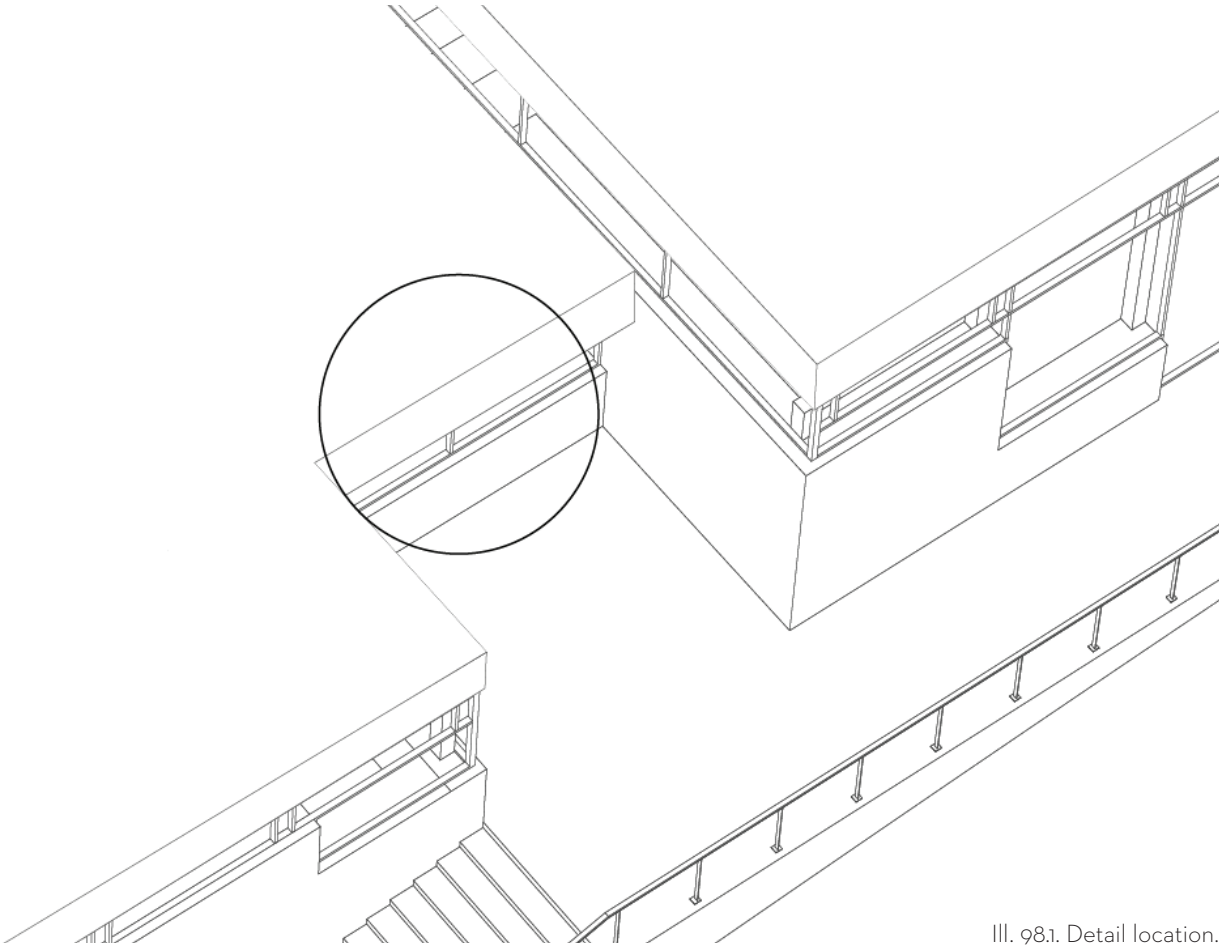
ULS	q	krel	λrel slederness value	kc	σc,d Tension	fc,0,k Mpa	kd	fc,0,d Mpa	utilzation ratio
	kN				Mpa				
permanent load	34,7	0,057	1,425	0,462	0,87	32	0,462	14,78	0,13
short term	61,9	0,057	1,425	0,462	1,55	32	0,692	22,14	0,15

Ill. 97.1. ULS.



Ill. 97.2. The forces being transferred down vertically at the charnière joints.

DETAILS



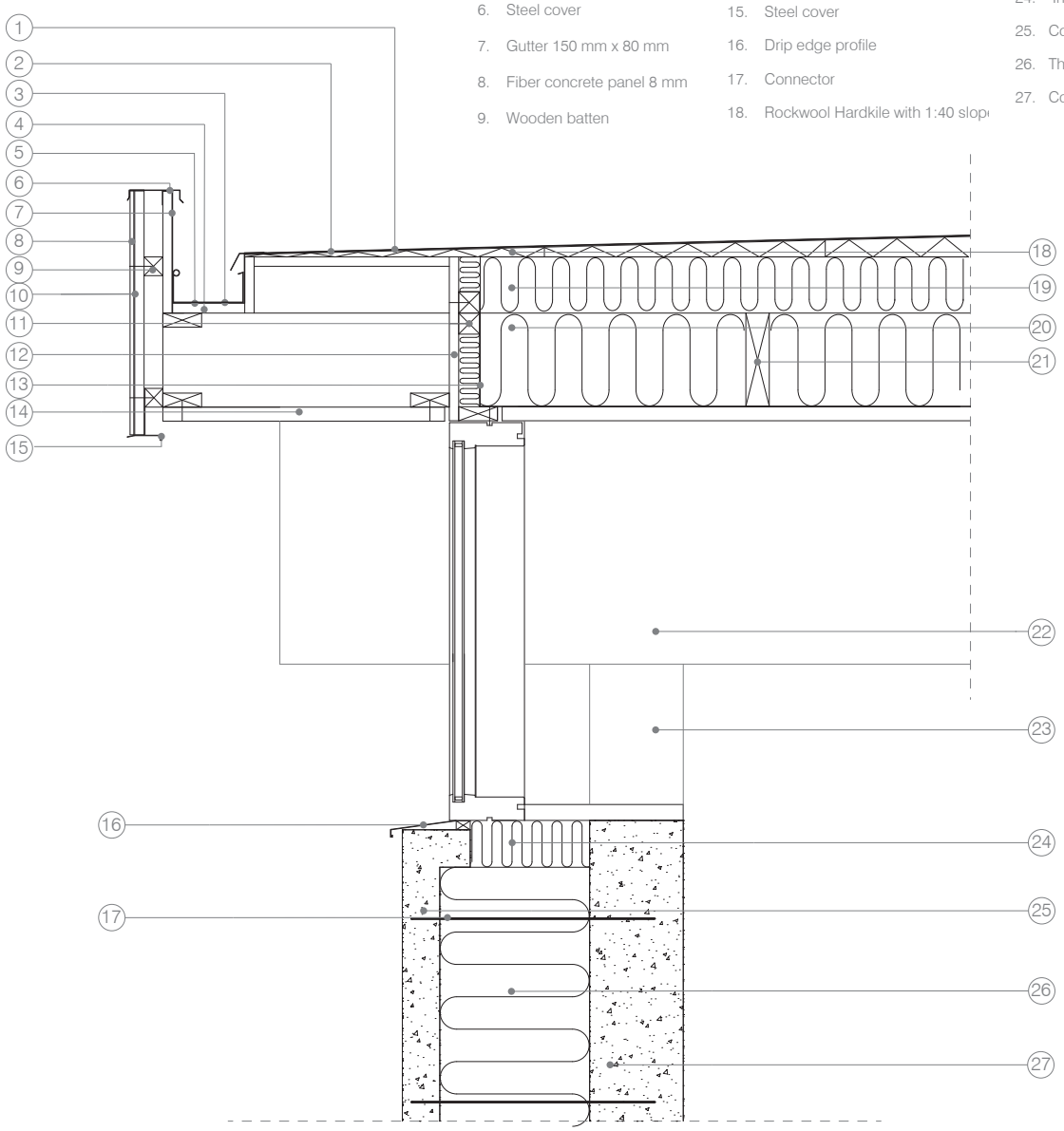
Ill. 98.1. Detail location.

MEETING BETWEEN WALL, WINDOW AND ROOF.

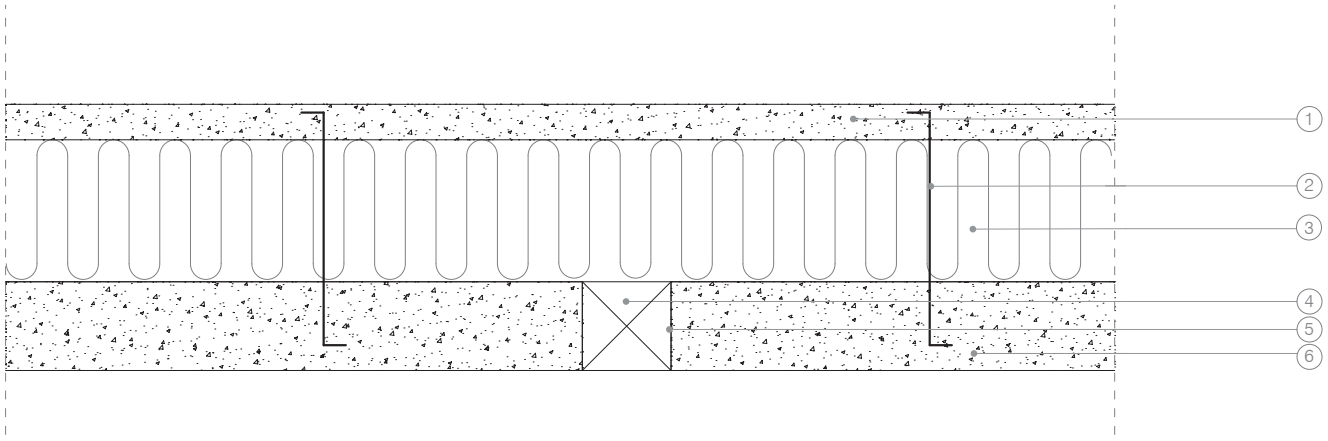
The meeting between the concrete wall, window and roof is shown in ill. 98.1. The roof has a slope of 1:40 to lead the rain water off the roof construction. The roof is covered by asphalt roofing, and by a layer of waterproof membrane to prevent leaking.

The exterior wall (99.2) consists of a two layers of concrete, with insulation between the layers. The columns are placed within the inner concrete wall with a finishing layer of grout joint in-between, which marks a sharp edge between the contrasting materials.

1. Asphalt roofing
2. Water proof membrane layer
3. Gutter 65 mm x 150 mm
4. Box gutter 20 mm
5. Asphalt roofing
6. Steel cover
7. Gutter 150 mm x 80 mm
8. Fiber concrete panel 8 mm
9. Wooden batten
10. Plywood 20 mm
11. Wooden batten 45 mm x 45 mm
12. Wind barrier
13. Vapor barrier
14. Wooden cladding 30 mm
15. Steel cover
16. Drip edge profile
17. Connector
18. Rockwool Hardkile with 1:40 slop
19. Thermal insulation 120 mm
20. Thermal insulation 200 mm
21. Purlins 200 mm x 50 mm
22. GL32h rafter 750 mm x 200 mm
23. GL32h column 200 mm x 200 mr
24. Insulation 150 mm
25. Concrete 80 mm
26. Thermal insulation 320 mm
27. Concrete 200 mm



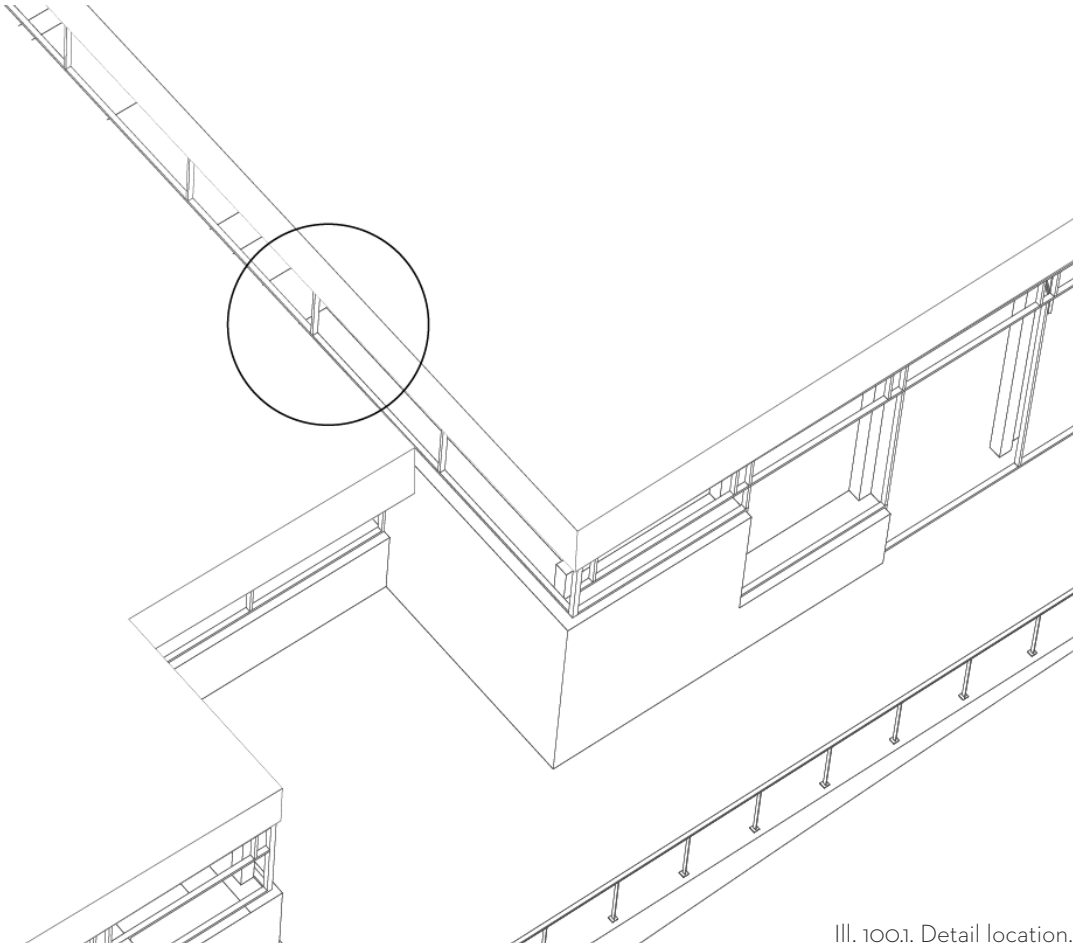
Ill. 99.1. Wall / window / roof detail.



1. Concrete 80 mm
2. Connector
3. Thermal insulation 320 mm
4. GL32h column 200 mm x 200 mm
5. Grout joint
6. Concrete 200 mm

Ill. 99.2. Wall detail.

DETAILS

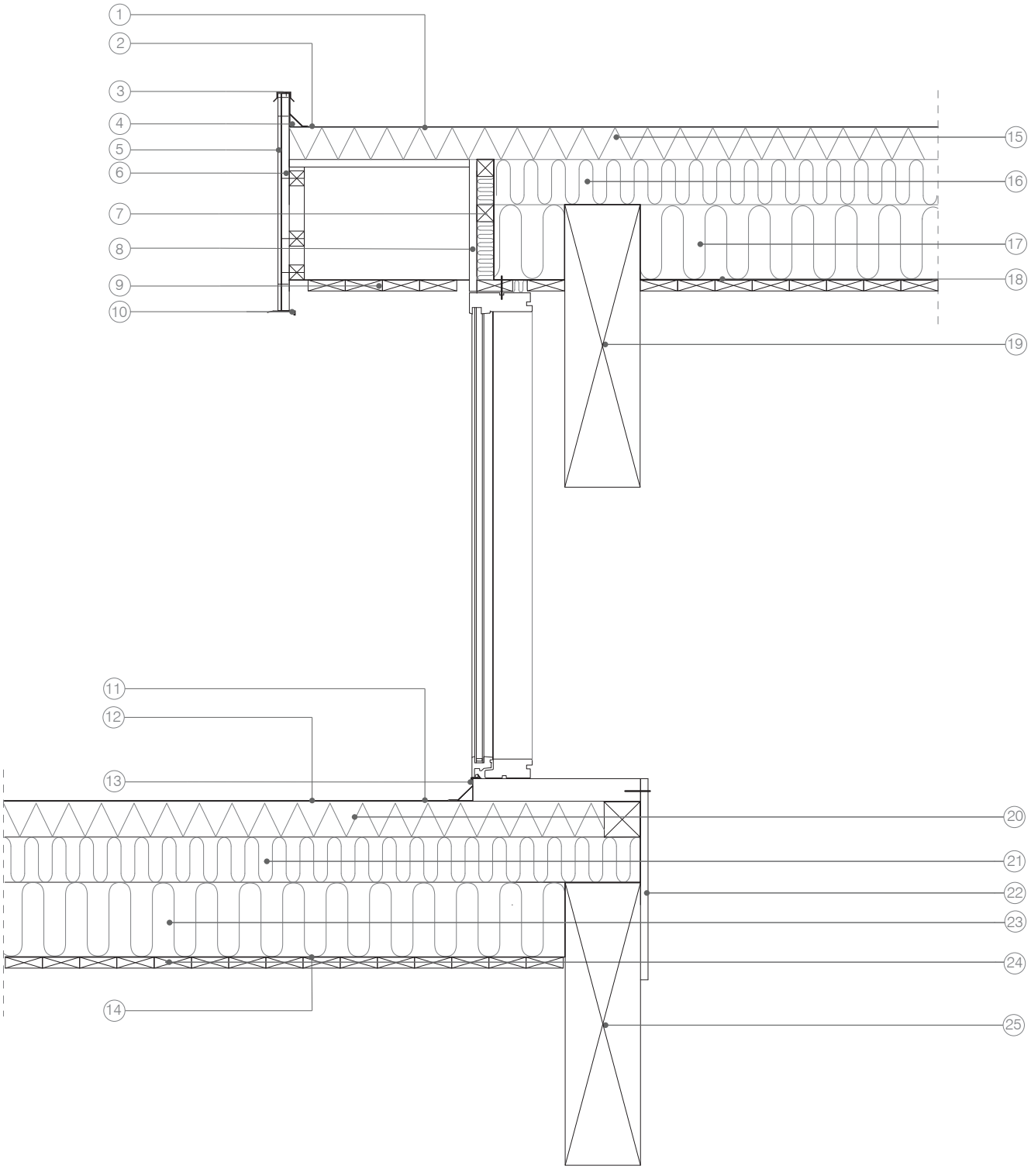


Ill. 100.1. Detail location.

MEETING BETWEEN TWO ROOFS.

Ill. 101.1. shows a solution to the meeting between two roofs. The raised roof of the infocentre area is cantilevered over the other part of the roof, with a strip of window between them. Wooden cladding is placed alongside the rafter, visually continuing between the interior and exterior.

1. Asphalt roofing
2. Water proof membrane layer
3. Steel cover
4. Triangle batten
5. Fiber concrete panel 8 mm
6. Plywood 2 mm
7. Batten 45 mm x 45 mm
8. Wind barrier
9. Wooden cladding 30 mm
10. Steel cover
11. Asphalt roofing
12. Water proof membrane layer
13. Drip edge profile
14. Vapor barrier
15. Rockwool Hardkile
16. Thermal insulation 120 mm
17. Thermal insulation 200 mm
18. Vapor barrier
19. GL32h rafter 750 mm x 200 mr
20. Rockwool Hardkile
21. Thermal insulation 120 mm
22. Plywood 20 mm
23. Thermal insulation 200 mm
24. Wooden cladding 30 mm
25. Rafter in GL32h 750 mm x 200



Ill. 101.1. Roof / roof detail.

DESIGN PROCESS

PRELIMANARY PHASE

PHASE 1 | **EARTHWORK**

PHASE 2 | **ROOF**

PHASE 3 | **ENCLOSURE**

THE DESIGN PROCESS STARTS WITH A PRELIMINARY PHASE IN WHICH INITIAL FORM STUDIES AND PLANS ARE EXPLORED IN RELATION THE FUNCTIONS.

INSPIRED BY THE FOUR ELEMENTS OF ARCHITECTURE BY SEMPER, THE DESIGN PROCESS IS THEN DIVIDED INTO EARTHWORK, ROOF AND ENCLOSURE. THE HEARTH HAS NOT BEEN A SIGNIFICANT PART OF THE DESIGN PROCESS, WHICH IS WHY IT IS HAS BEEN LEFT OUT.

PRELIMINARY PHASE | FORM

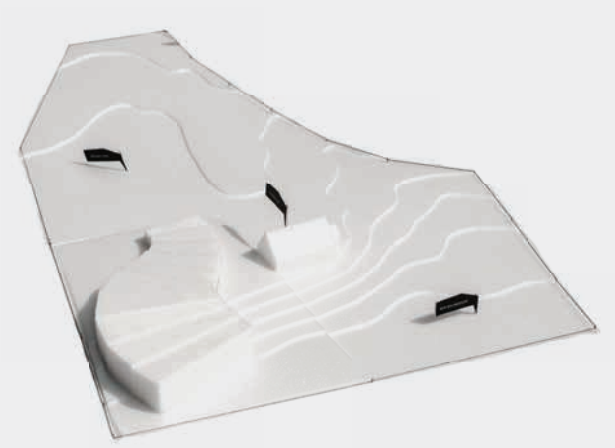
MASSIVE / LIGHT (Ill. 104.1)

The design process began with the investigation of different forms on the building plot. It was explored how the forms interacted with the surrounding landscape and Strandhuset, through psysical models in scale 1:200.

To make a fair comparison between each design it was a design parameter that the form should have a ground area of 1000 m^2, which was the approximate area determined in the spatial programme (page 44-45).

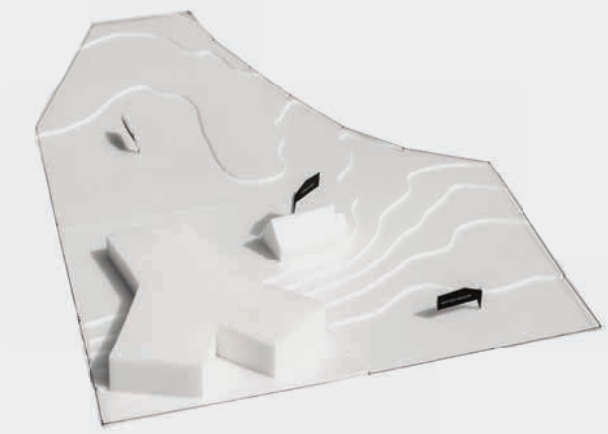
Overall, the study shows how the size of the building takes up a large area of the building plot for most of the cases. This could potentially lead to a tight and narrow space inside the plot. While having a terrain slope of 2.5 meter within the site, the option of placing some functions below the ground level to decrease the size of the building plot could be relevant.

In the Massive / Light model (ill. 104.1), there is a delicate balance between the form of making its own mark, while still responding humbly to the nature.



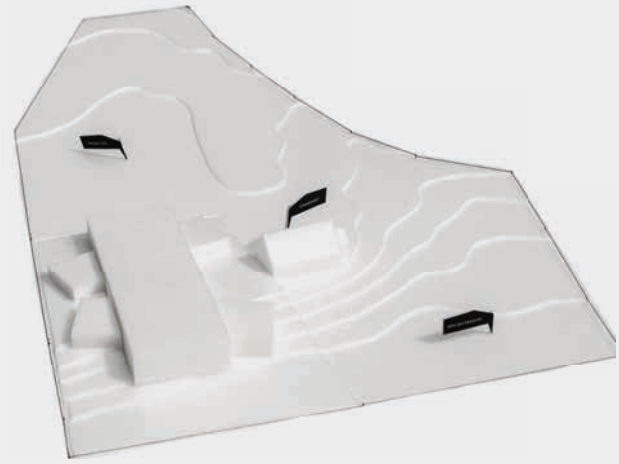
THE ORGANIC ADAPTION (Ill. 105.1)

The model was an iteration of an organic form. The form mimmics the soft curves of the landscape but lacked synergy with the adjecent building Strandhuset.



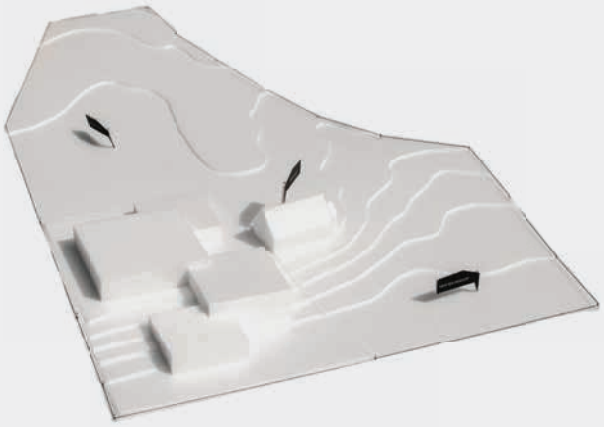
THE Y-FORM (Ill. 105.2)

While the idea of having the building oriented in different directions is a very interesting concept. The form struggles to interact with the surrounding landscape, which would make it a challenge to carry on.



THE TURTLE (Ill. 105.3)

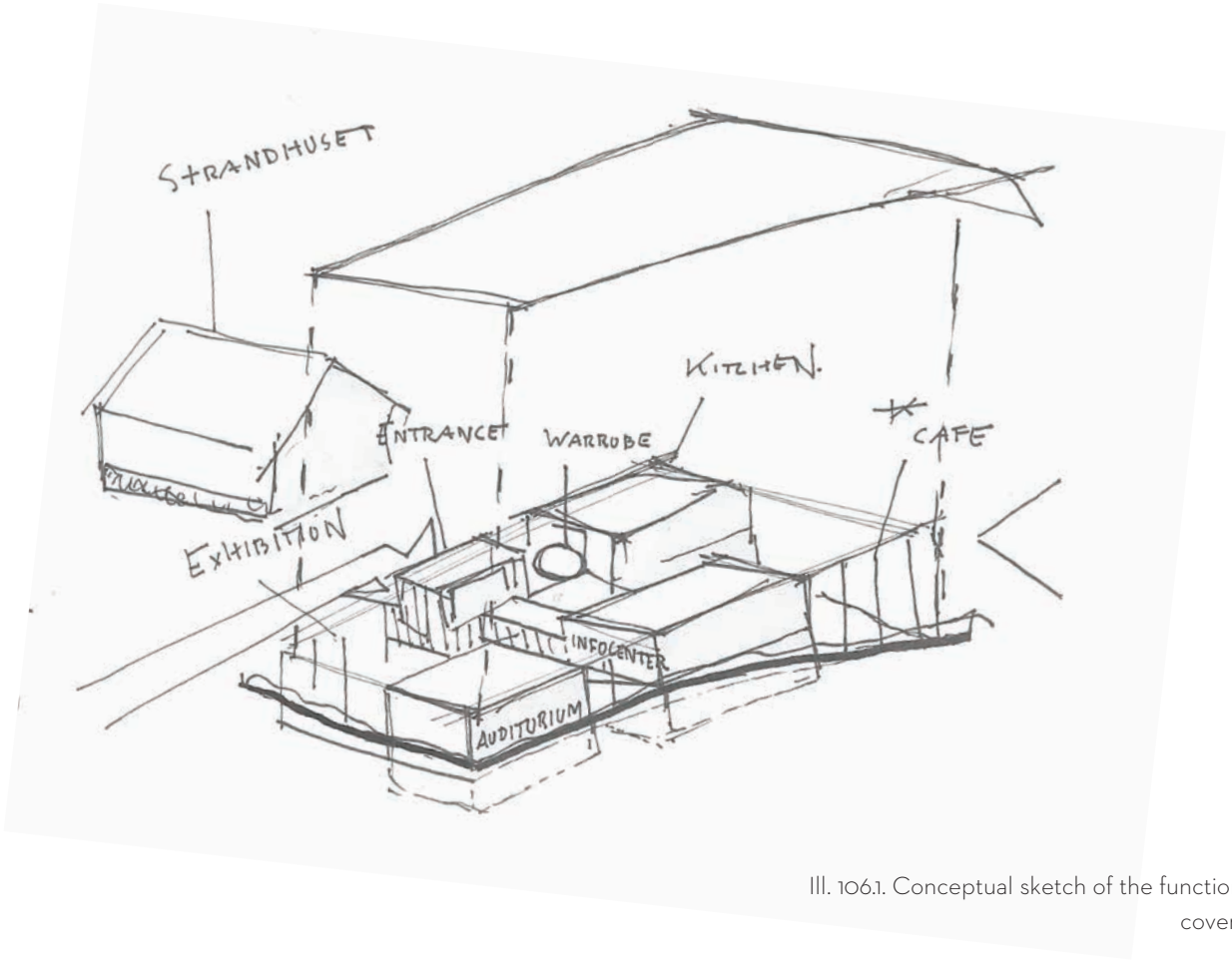
The idea behind "the turtle" is also to have views in different directions, while focusing on the space between the visitor centre and Strandhuset.



THE CUBES (Ill. 105.4)

The idea of this form is to have visitor centre spread out into smaller volumes to make it less massive. This principle can be incorporated in many ways and makes a strong connection between the inner and outer space.

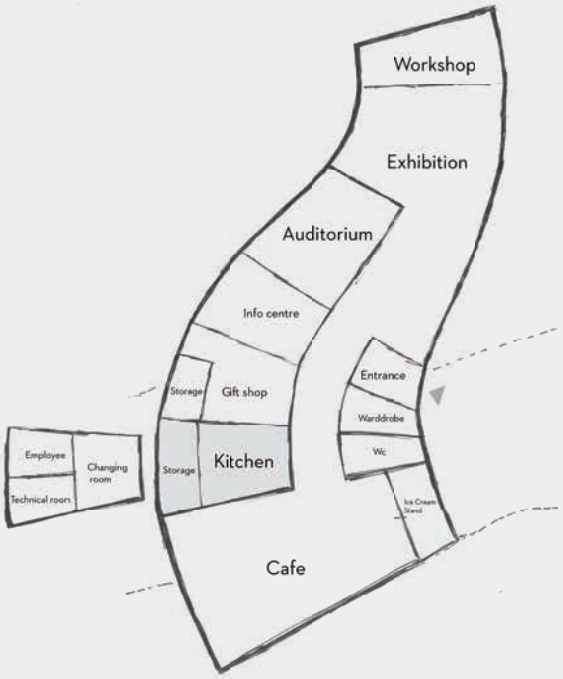
PRELIMINARY PHASE | PLAN

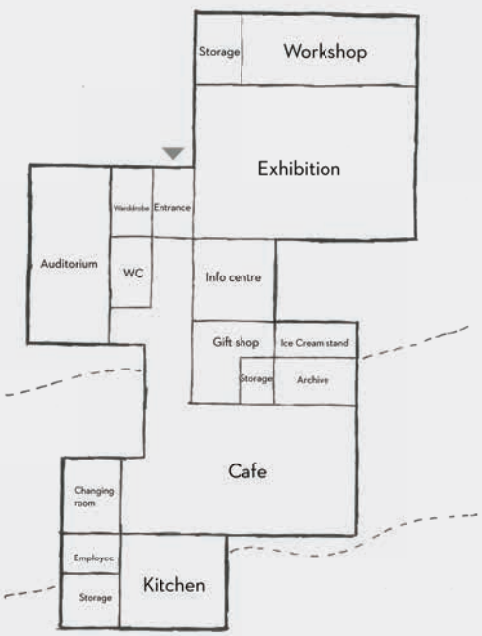


Ill. 106.1. Conceptual sketch of the functions with a covering roof.

The development of the plan is highly influenced by the previous form study. Now the forms are converted into rooms with a functional purpose. The different arrangements of the functions and the flow established within the building are examined in this process.

In the early stage of the planning phase, the placement of the different functions became evident, based on the demands from the room program. The idea was to have the knowledge & sharing function placed in the northern part of the building – excavated into the hill – and the cafe area orientated towards Kalø Vig. The infocentre is placde in a relatively central spot of the visitor centre, close to the entrance area.



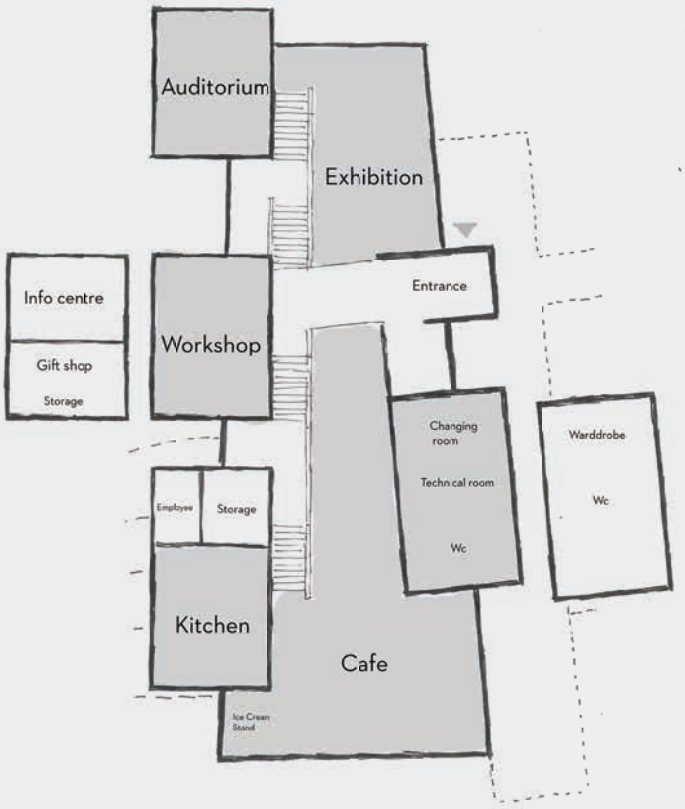


THE ORGANIC ADAPTION (Ill. 107.1)

While the organic adaption showed great potential back in the previous stage, the concept struggles to meet the functional criteria, during to the difficulty of incorporating the rooms into the organic shape.

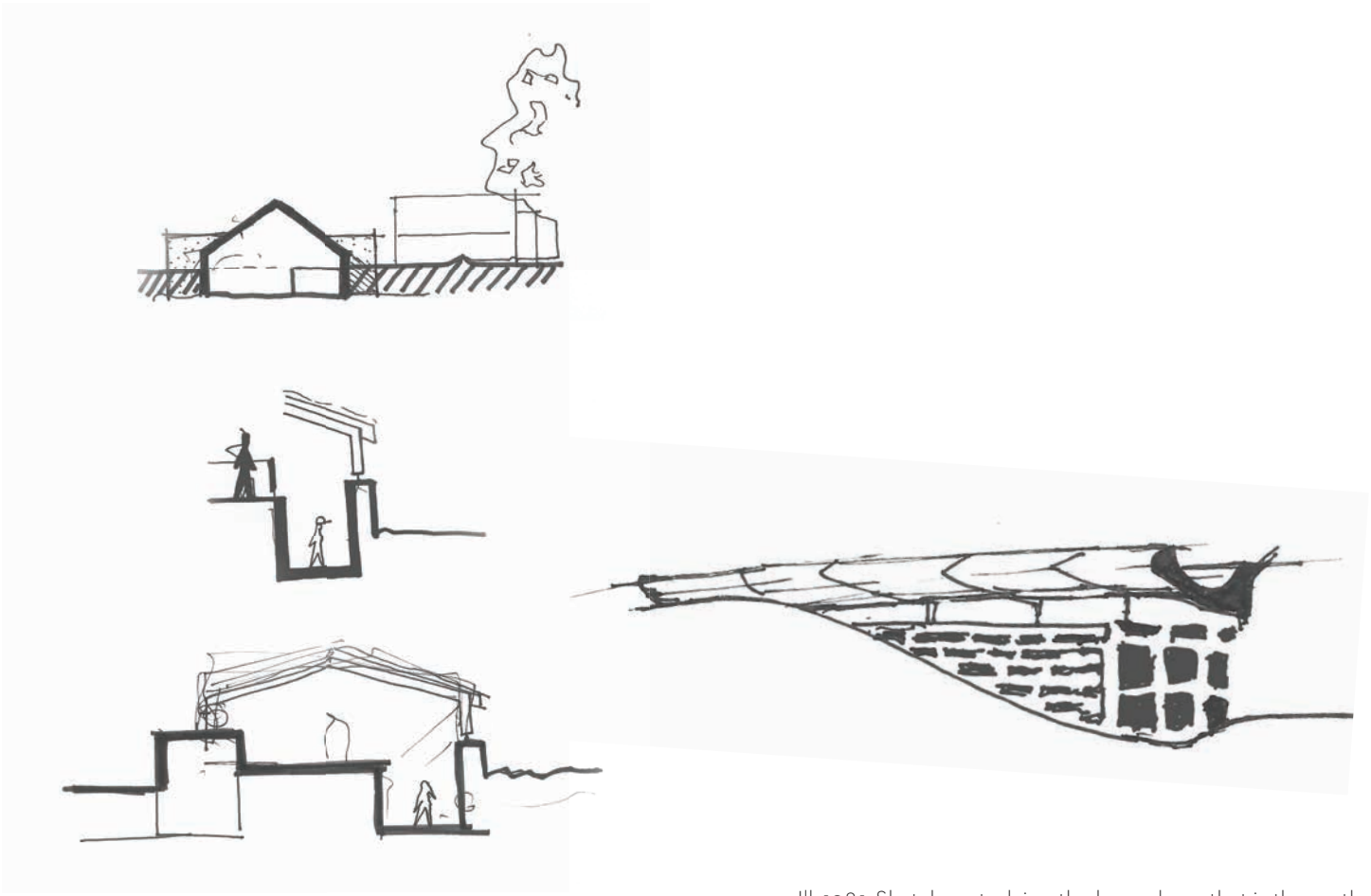
THE CUBES (Ill. 107.2)

The cubes display a good potential for achieving good daylight conditions for most of the functions, and the relation between interior and exterior space seems interesting. A drawback in the design could be the limitation of the flow, where the long narrow hallway reduces the movement option for the user.



MASSIVE / LIGHT (Ill. 107.2)

The last plan takes inspiration in the contrast between light and massive. The idea of pulling secondary functions like the workshop, the kitchen and the auditorium apart from the main volume turns out to be a strong conceptual principle that stages the main functions of the visitor centre.



Ill. 108.1. Sketches studying the heavy base that is the earth work or the "stereotonics" of the vistor centre.

STEREOTONICS

An important part of the design is the heavy base of the visitor centre. The vision for base is to seem like it is growing out of the landscape, and also resembling the nearby castle ruin. The term 'stereotonics' is described in the analytic framework on pages 14-15. This is meeting with the ground, and first step of creating the visitor centre. The different ways of interacting with the ground of the site are explored in sections (ill. 109.1-4).

THE CANTILEVER (Ill. 109.1)

This section displays how the building could cantilever over the small slope, creating a visual effect. However, it does not seem like an appropiate solution.

RAISED ABOVE GROUND (Ill. 109.2)

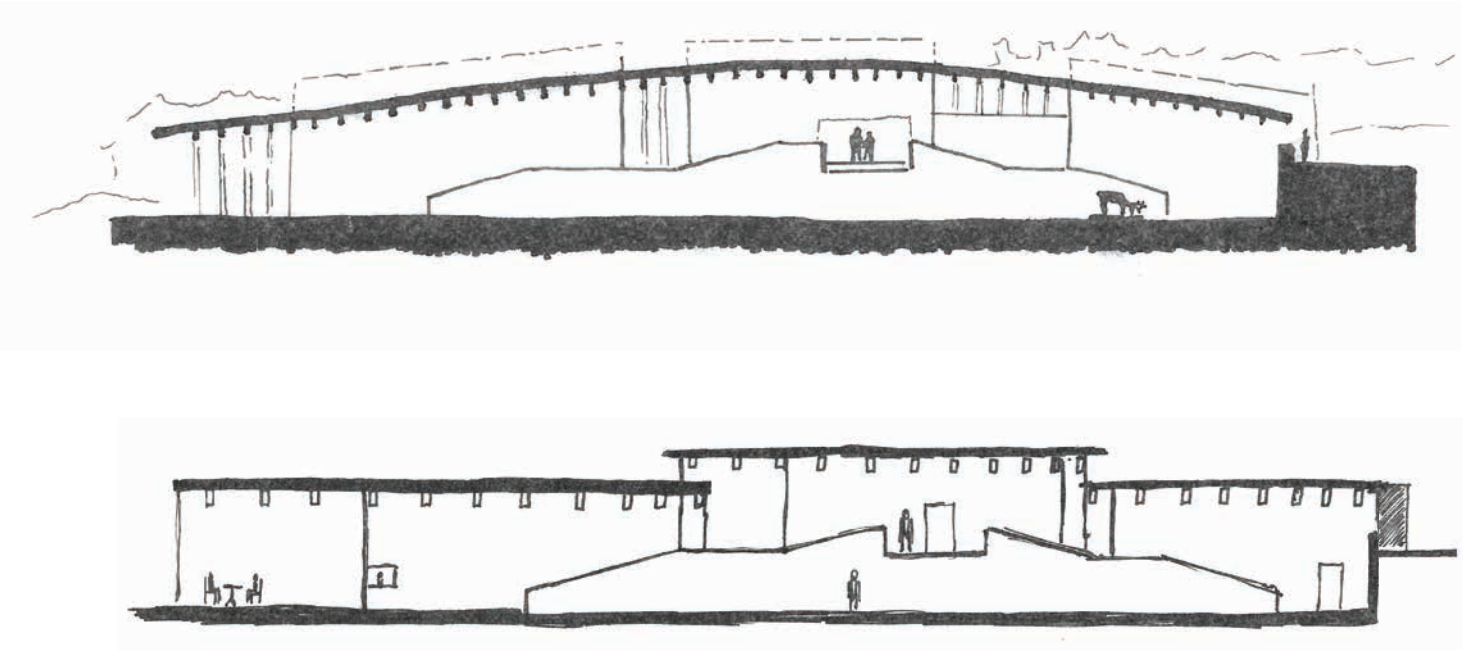
The deck in this section is lifted above the ground, in order to have one flat plan that expresses lightness. The lack interaction with the earth does not fit the vision of stereotonics.

BUILDING INTO THE SLOPE (Ill. 109.3)

The building is excavated into the slope, which gives a higher room, the possibilty to work with different levels and an interaction with the landscape.

THE CONNECTION (Ill. 109.4)

The final section shows a possible connection between the upper and the lower floor, while defining different zones in the visitor cenre.



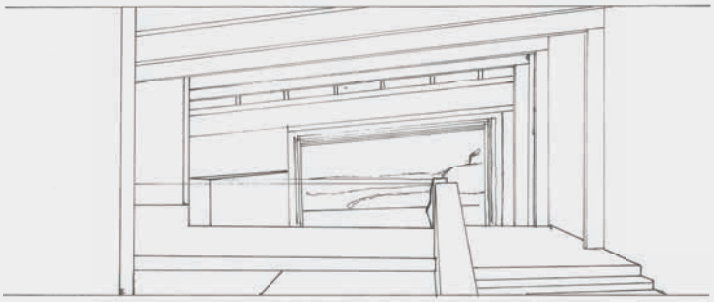
Ill. 110.1. Sketches of different ways to raise the roof towards Strandhuset.

INVESTIGATING THE FORM OF THE ROOF

Where stereotonics apply to the earthwork, the roof belongs to the work of tectonics. The vision for the roof is to have it distinquished from the heavy base by appearing lighter, almost floating above the heavy base. The form of the roof should have some degree of interaction with the landscape and Strandhuset.

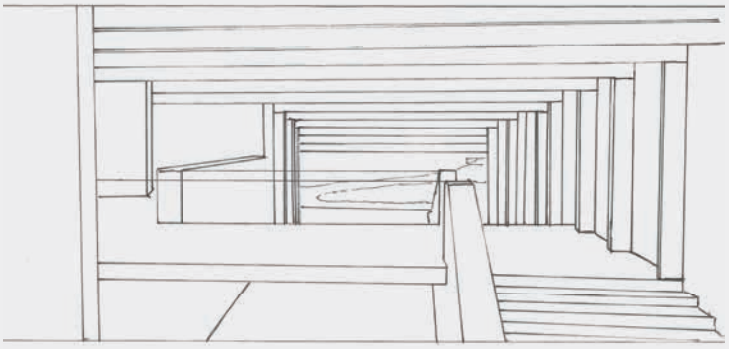
SLOPING / VISIBLE COLUMNS (Ill. 111.1)

The ceiling is interesting, showing the large wooden rafters spanning between the walls and columns meeting the floor. However, the interiour space seems a bit imbalanced, not following the horisontal lines of the rest of the visitor centre.



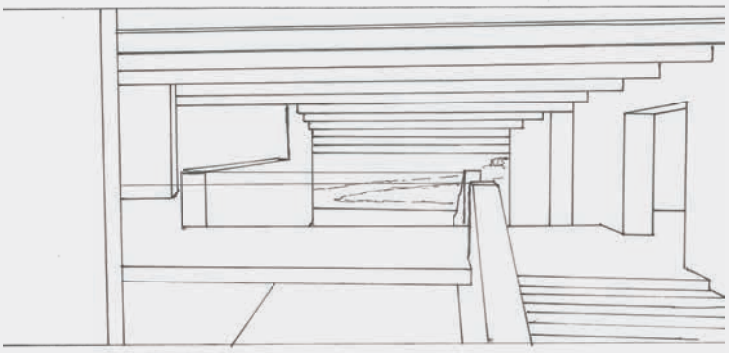
FLAT / VISIBLE COLUMNS (Ill. 111.2)

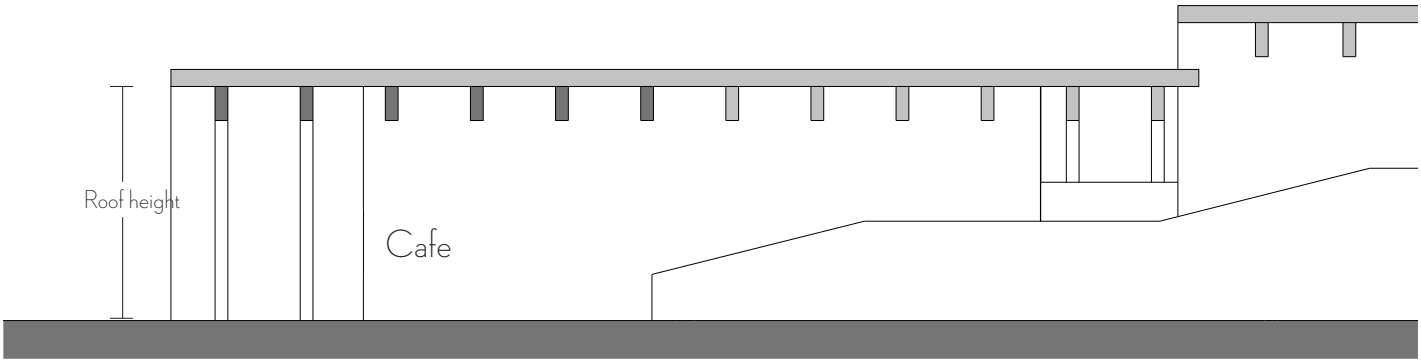
The rafters are now alligned as flat elements. The effect is a more balanced room, stressing the horisontal lines of the interior space, but also making a more scenic view outwards. Still, the columns disturb the picture, seeming structurally redundant and taking focus from the stereotonics of the building.



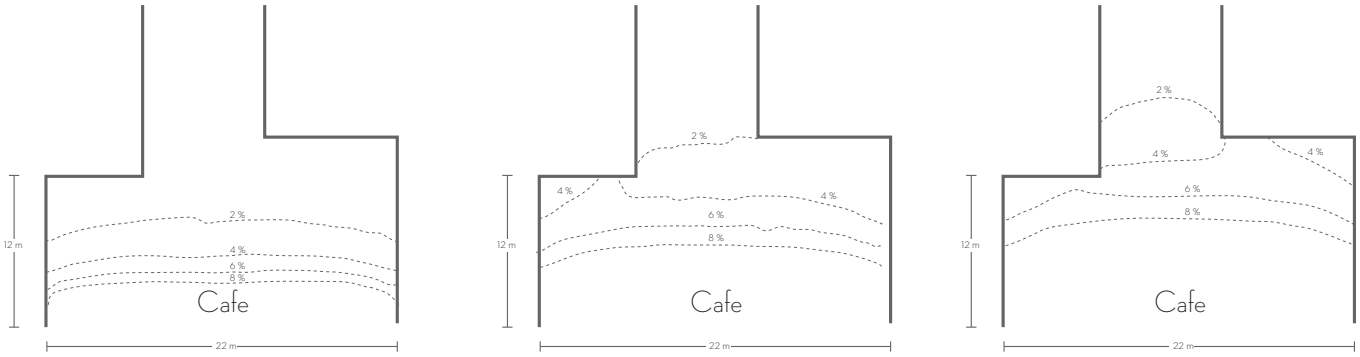
FLAT / HIDDEN COLUMNS (Ill. 111.3)

The last iteration has flat rafters and no disturbing elements in the picture. There seems to be a clear division between the stereotonics below and the tectonics above, which makes for the desired balance between the massive and the light.





Ill. 112.1. Section through the cafe.



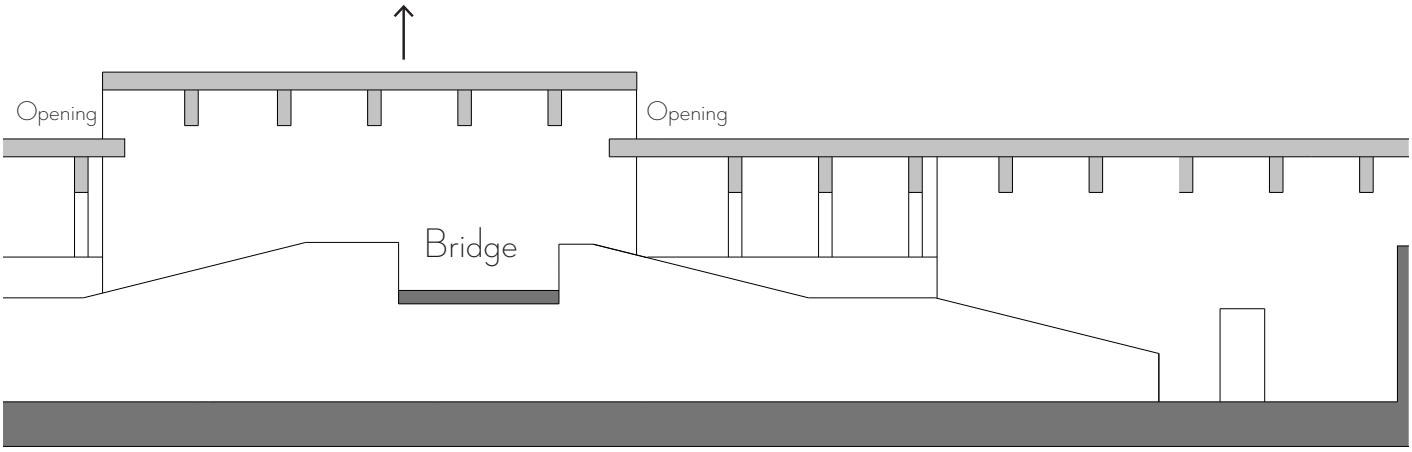
Ill. 112.2. Velux simulations of the cafe.

DAYLIGHT INVESTIGATION FOR CAFÉ AREA

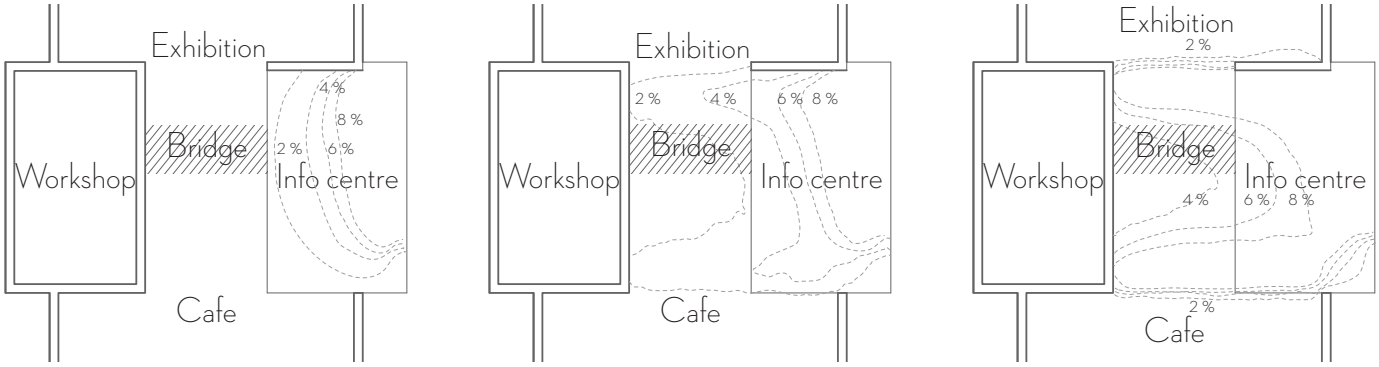
The cafe is one of the main functions of the visitor centre, and the light intake is an important factor for this area.

During this iteration, different heights for the façade opening towards the South were simulated in Velux Daylight Visualizer for the daylight factor. Each simulations is performed one meter above ground level with concrete material assigned to the floor and the pine wood assigned to the roof.

The aim is to reach a decent daylight factor of 2 % in most of the cafe area.
The results from Velux Daylight Visualizer show that the opening height of three meters does not provide enough light, while an opening height above six meters is too much. The most optimal height for opening of the cafe area would be about five meters in terms of the daylight condition.



Ill. 113.1. Section through the infocentre.



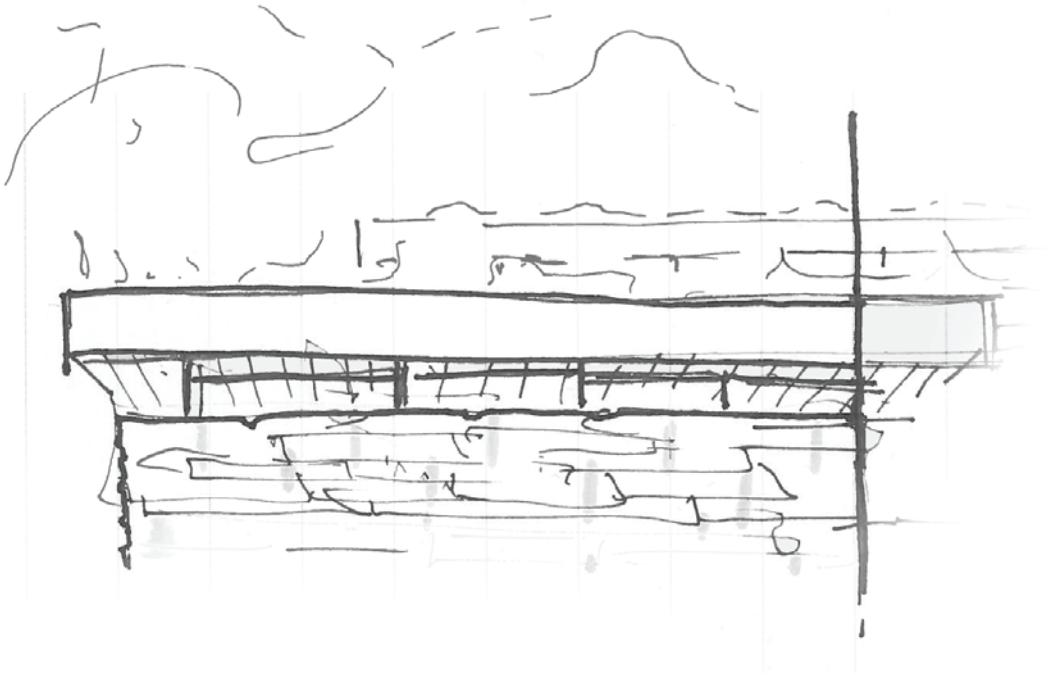
Ill. 113.2. Velux simulations of the infocentre.

DAYLIGHT INVESTIGATION FOR INFOCENTRE

The bridge that connects the infocentre to the stairway has a limited access to daylight. By lifting the roof in the middle section of the building, and inserting windows, the daylight condition in this zone improves. The light intake for this area is also investigated through Velux Daylight Visualizer in the cases of no openings, openings of 0.5 meters and openings of 1.5 meters.

Each simulation is performed one meter above floor level for the infocentre with concrete material assigned to the floor and the pine wood assigned to the roof.
The first result with no openings indicates the critical problem for the area with the daylight only covering the infocentre. The second result with openings of 0.5 meters show a decent performance of daylight intake that covers most of the area.

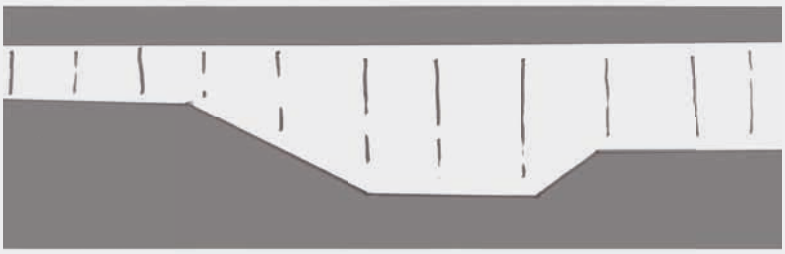
The daylight factor for the last result with openings of 1.5 meters displays a strong light density in the area that could be overwhelming or exceedin into the exhibition area.



Ill. 114.1. The illustration shows how the building here is almost entirely closed, but not having the concrete touching the roof.

OPENINGS IN THE MASSIVE BASE

The vision for the enclosure is to have the visual expression of the heavy base, while also having the transparent glass as a transition to the floating roof. There has been a lot of work in the design process to make the facade fit the vision for the enclosure, so it does not become either too massive or too light, but expresses balance.

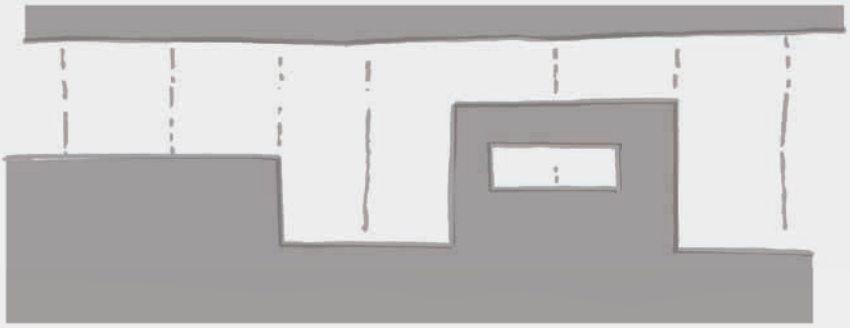


THE DIAGONAL BASE (Ill. 115.1)

This drawing of the enclosure shows an iteration of diagonal lines. They give a dynamic expression, but the meeting between the base and the glass is not appropiate.

RHYTHM (Ill. 115.2)

This iteration shows a strong rhythm in the base of the enclosure, but the rhythm becomes too much in the long facade, not adapting to the spaces within or the external landscape.



RESEMBLING THE RUIN (Ill. 115.3)

This iteration takes inspiration in walls of Kalø Slotsruin, moving up and down, but never reaching the roof.

EPILOGUE

CONLUSION
REFLECTION

REFERENCES
ILLUSTRATIONS

IN THE EPILOGUE, THE FINAL CONCLUSIONS OF THE PROJECT ARE COLLECTED, TOGETHER WITH THE REFLECTIONS UPON THE PROCESS OF WORKING.

REFERENCES AND ILLUSTRATIONS ARE MADE ACCORDING TO THE HARVARD STYLE.

CONCLUSION

The project of designing a visitor centre for the national park Mols Bjerge is an answer of the wish for a gateway to the national park. Through the deliberate planning of the main functions – exhibition & knowledge sharing, infocentre and cafe – the visitor centre offers a new attraction, welcoming visitors to the national park. The building itself is excavated into the slope next to Strandhuset, a listed house by the architect Hack Kampmann. This move is due to the idea of having a darker exhibition, while maintaining a direct flow to the cafe, which is opened up towards Kalø Vig with a 180 degree view of the bay and Mols Bjerge. The design criterion of having a step-free access to the main functions of the visitor centre was met by having a spatious lift adjecent to the infocentre. The lift is for both walking-impaired visitors, but also for moving items down to the exhibition and cafe.

The form language of the visitor centre is like a sledge in the landscape. Having a heavy base, that almost seems to be growing out of the earth, is a reference to the traditional style of raising the building on a solid base, but it is also a reference to the nearby Kalø Slotsruin, where almost only the thick outline of the old castle is left. The idea of then having a light structure, and a roof of long and large glue laminated wooden rafters, gives a mystical atmosphere. The roof of the infocentre is raised to meet Strandhuset, which makes a natural entrance while providing light for the middle of the visitor centre.

Aesthetically, the visitor centre follows the idea of an architecture that stimulates more senses than just the visual. The tactility of the board-formed concrete, and the embedded wooden structure, teases the sense of touch and reveals how the materials were put together. In contrast to the heavy base, the roof seems to float above it. The glue laminated rafters has a large profile to accommodate for their long span through the building. From the outside, the rafters are also visible, piercing the through the facades, while the slender construction is withdrawn to the interior. This adds to the mystical expression of the visitor centre. The glue laminated timber gives a warm contrast to the hard concrete, while adding a nice smell to the visitor centre.

REFLECTION

Reflecting on the working process of designing the visitor centre, there are things that can be worked further with, or could have been handled differently during the project. For starters, there has been a lot of work on the aesthetical expression of the visitor centre, which has been prioritised highly in the design process. Looking back the approach could have been performative in exploring the different aspects such as daylight and acoustics. It is not to be understood, that the project has ignored the aspects, but a more schematic and parametric driven analysis could have informed the project in a perhaps favourable way in terms of optimisation through alternate forms of the rafters and other building elements. The cantilevers could have been more extreme to challenge the engineering aspect of the project, which could also push the architectural expression of the visitor centre. The structural elements of the building have been optimised through robot and hand calculations, and through rational load diagrams.

There is an awareness of the risk of overheating in the cafe area, due to the open facade and the extensive use of glass, which is caused by the large view to the nature. This could perhaps be solved by a larger overhang, a lower roof or an integrated facade of lamella. The project solution is to have long curtains that run behind the wooden columns as seen on the cafe visualisation (ill. 84.1). As for the ventilation strategy, it is also an aspect to work on with. It is the intention to have the top strip of the windows around the visitor centre to be opened automatically for natural ventilation. Furthermore, mechanical ventilation is thought implied, working with displacement in the large open areas of the cafe and exhibition, and dilution in rooms such as the kitchen and workshop.

The roof of the visitor centre is a chapter in itself. Working with a green roof has been a highly discussed matter. While perhaps being more gentle to the natural environment, it also increases the height of the roof edge, the load on the roof and raises the question of maintainance. Working with heat pumps and sun cells in the matter of sustainability is an aspect that could have been developed further.

All in all, it has been a very interesting and challenging task to design a visitor centre for Mols Bjerge National Park. It is the first time for both of the authors to work on a larger project with only two members in the group. In this case, it has lead to a quick decision making in some parts of the design process, where earlier groups of five team members have led to long discussions with a vague output. The quick decisions can be both positive and negative, but in times of hurry they are necessary. Working together as two team members has been favourable, since one could keep the spirits up, while the other was down. The engagement and shared dedication has kept the team going in both times of distress and excitement.

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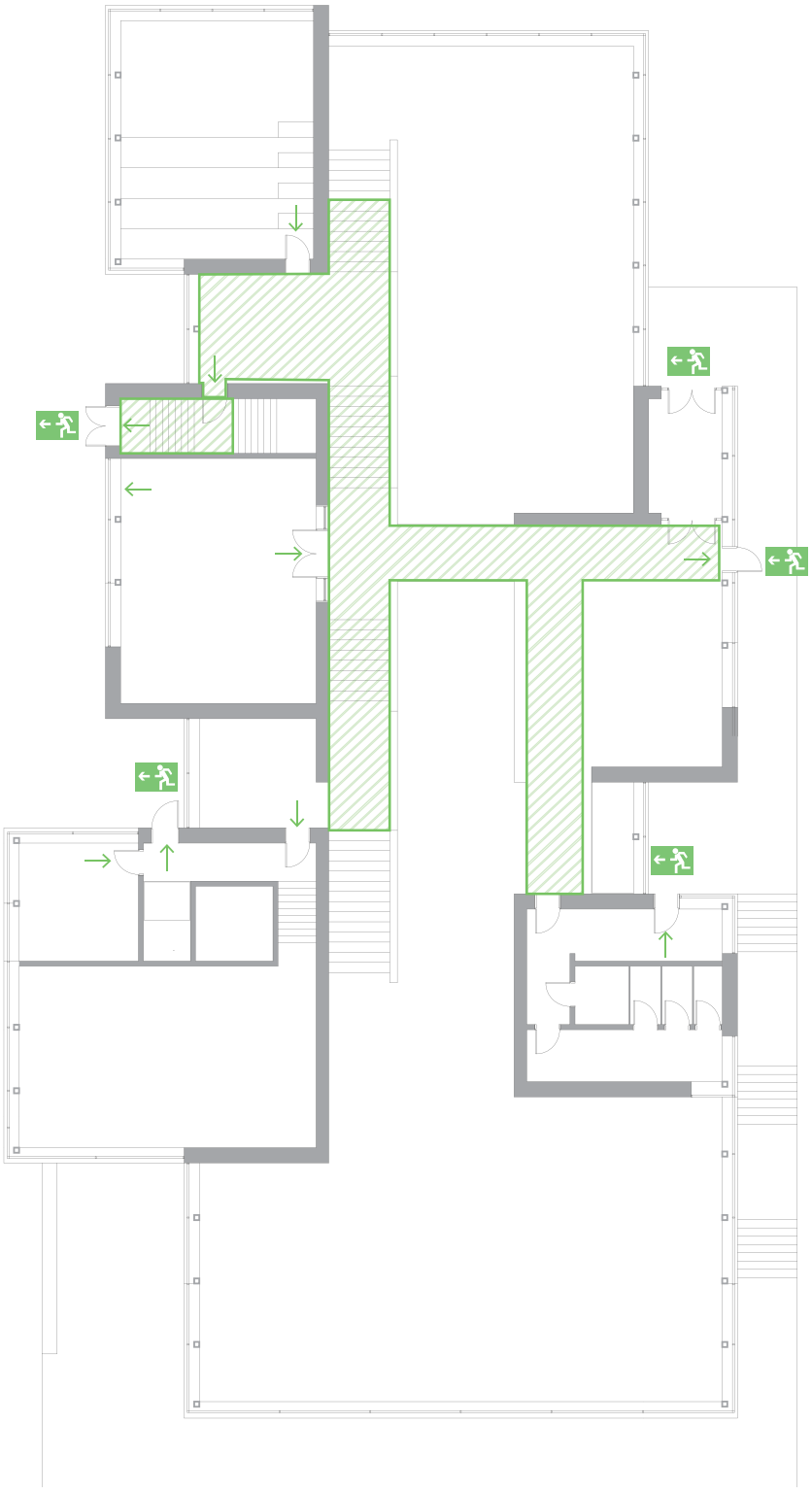
ANNEX

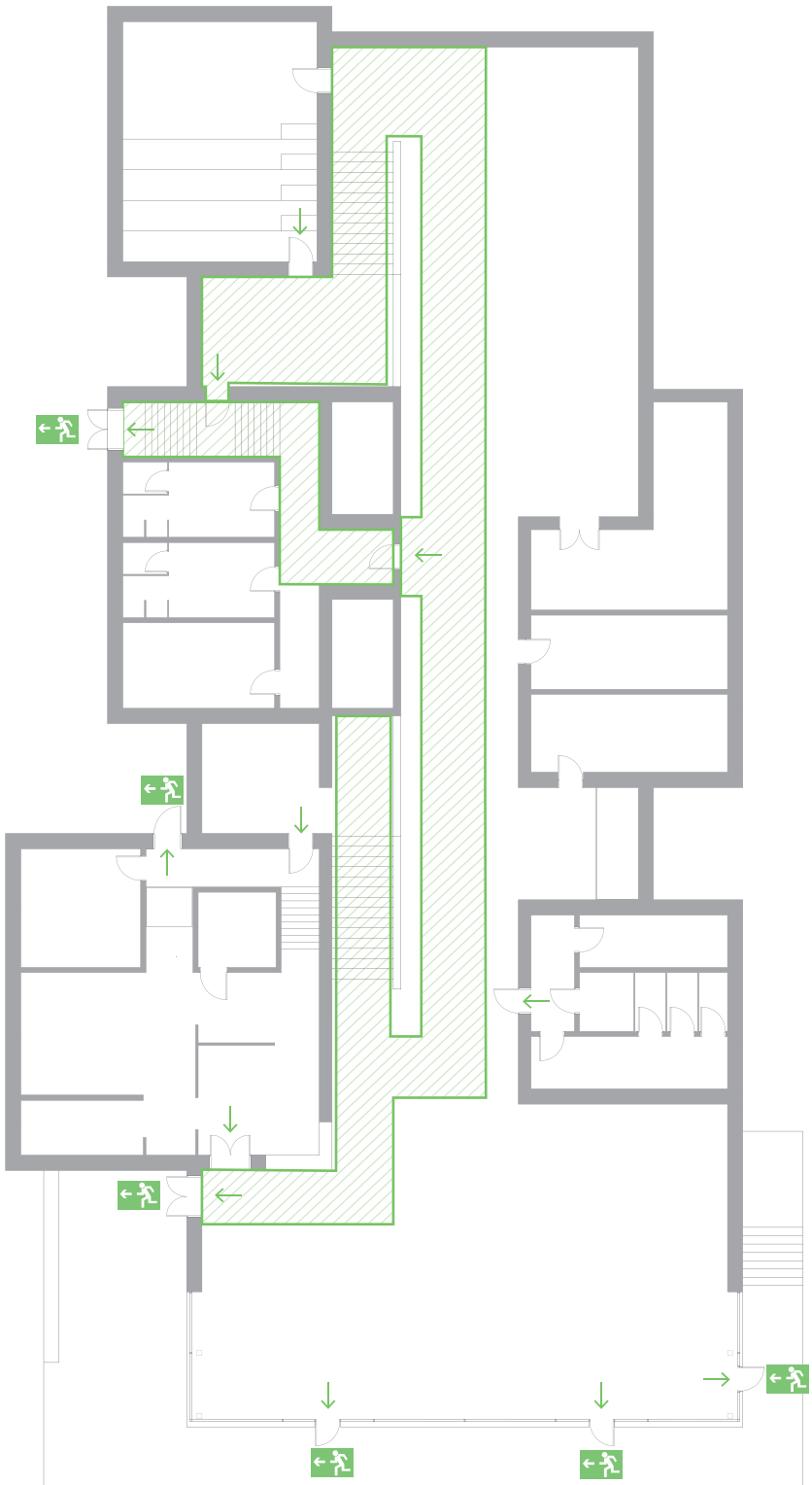
ESCAPE ROUTES
DAYLIGHT CONSIDERATIONS
LOAD CALCULATIONS

THE ANNEX CONTAINS ADDITIONAL MATERIAL TO THE REPORT.

ESCAPE ROUTES

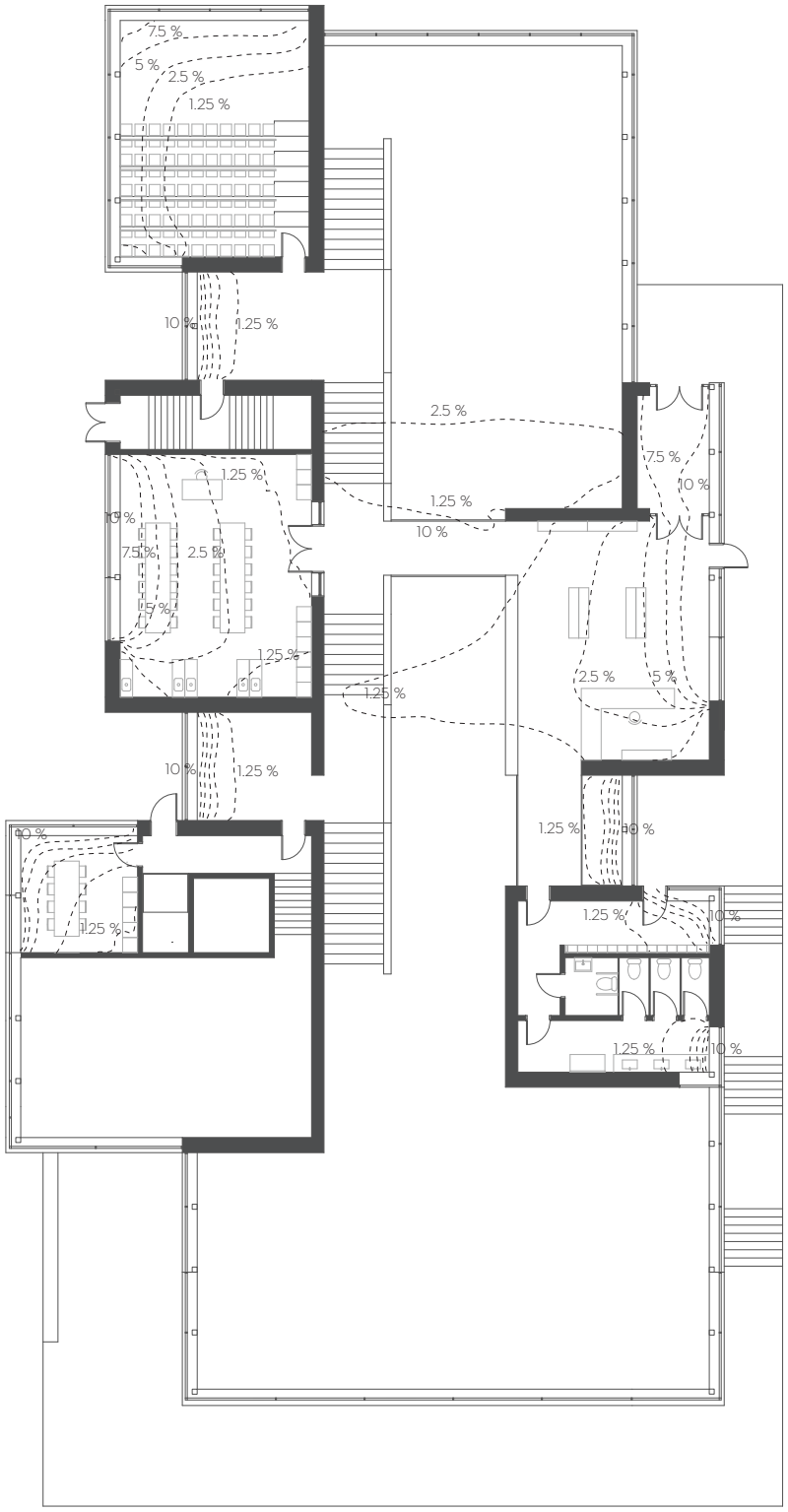


Ill. 128.1. Escape route for level 1.

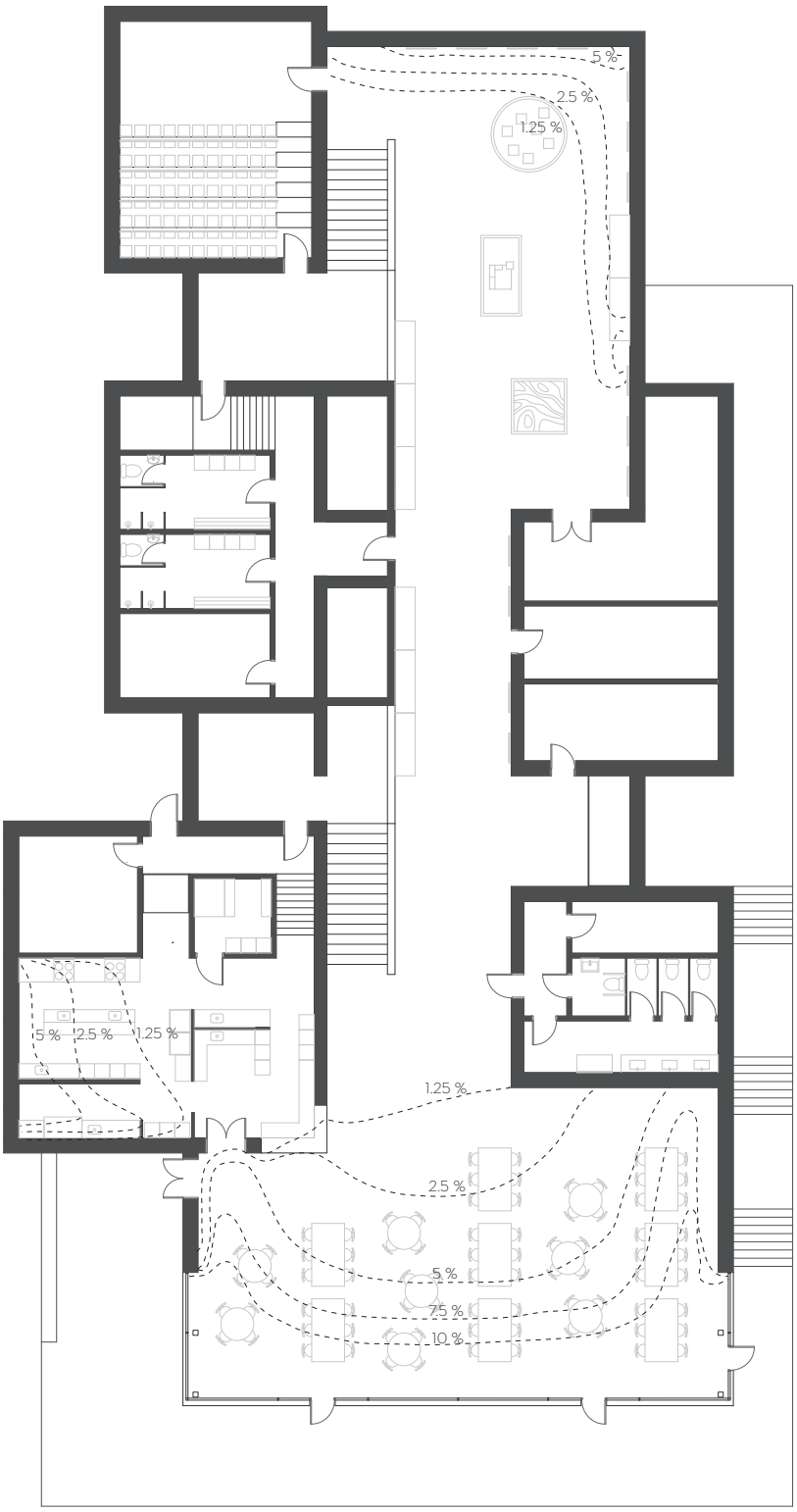


Ill. 129.1. Escape route for level 0.

DAYLIGHT SIMULATIONS



Ill. 130.1. DF simulation of level 1.



Ill. 131.1. DF simulation of level 0.

LOAD CALCULATIONS

SNOW LOAD

		Surface load	Distance between beam	Uniform load
	factor	kN/m^2	m	kN/m
μi	0,8			
Ce	1			
Ct	1			
Sk		1		
		0,8	2,5	2

S= μi · Ce · Ct · Sk

μi is the form factor depending on the slope of the roof that is set to 0.8 for 0°<α<30°

Ce is exposion factor set to 1

Ct is a thermal factor set to 1

SK is the characteristic snow value set to 1.0 kn/m^2 according to national index

WIND LOW

The wind load comes from the wind peak velocity calculation, which is depende on mean wind velocity and turbulence intensity.

qp(z)=(1+(7/(lv(z))·1/2·ρ·vm(z)^2

vm(z) is the mean wind velocity

ρ is the air density set to 1.25 kg/m^3

Iv(z)is turbulence indensity

With basic wind velocity, the mean wind velocity can be found

Basic wind velocity

Vb = Cdir · cseason · V,b0

Cdir is direction factor

cseason is factor based on season of the year

V,b0 is set to 24 m/s as a standard value for the wind in Mols Bjerge.

MEAN WIND VELOCITY

vm(z)= Cr(z) · Co(z) · vb

vm(z) is the mean wind velocity set in height z

z is the high of the building set to 5 m

C0(z) is the orography factor set to 1

Cr(z) is the roughtness factor depending on roughtness lenght.

Cr(z) = kr · ln(z / z0)

where z is the height of building and z0 is roughness lenght.

The terrain category is set to be in category II for area with low vegetable and few trees.

z0 is 0.05m for The terrain category II (Teknisk Ståbi, 2014, p 131)

z is the high of the building set to 5 m.

kr is the terrain factor based on roughtness length.

kr= 0.19 · (z0 / (z0 , II))^0.7

z0,II is roughness lenght for terrain category II and z0 is 0.05 m

TURBULENCE INTENSITY

Iv(z)=σv/vm(z)

σv is turbulence standard variation

σv = kr · vb · k1

kr is terrain factor set to 0.19

k1 is turbulence factor set to 1

vb is basic velocity at 24 m/s

Basic velocity V,b0	24	m/s
z0 for terrain category 2	0,05	m
building high z	5	m
Mean wind velocity vm(z)	22,12	m/s
Turbulence intensity lv(z)	0,216	m/s
Wind peak velocity qp (z)	0,43	kN/ m^2

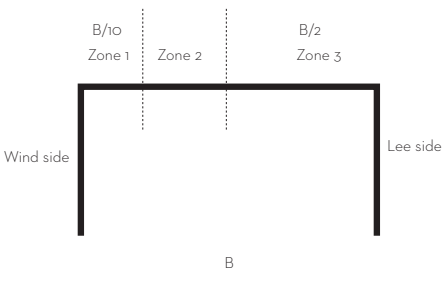
WIND PRESSURE ON SURFACE

we = qp(ze) · Cpe

we is wind pressure pushing the surface.

Positive value mean external presure and negative value means internal presure

	Cpe	We kN/m^2
Cpe wind side	0.8	0,344
Cpe lee side	-0,5	0,215
Cpe roof zone 1	-1,2	-0,516
Cpe roof zone 2	-0,7	-0,301
Cpe roof zone 3	0,2 + -	0,086 + -



DEAD LOAD

	Density	Weight pr square meters	Thickness	High	% Coverage	Surface load	distance between beam	Uniform load
	kg/m^3	kg/m^2	m	m		kN/m^2	m	kN/m
Thermal isulation	40		0,32		100	0,125		
Hardrock insulation	40		0,125		100	0,05		
Asphalt roofing		5.5			100	0,054		
Purlins	490		0,05	0.2	10	0,049		
Pine wood ceiling	500		0,03		100	0,15		
					Total	0,428	2,5	1,07

	Density	Width	High	uniform load	span	Load of rafter
	kg/m^3	m	m	kN/m	m	kN
Rafter GL32h	490	0,2	0,75		22	
				0,735		16,17

	Density	Width	High	Length	load
	kg/m^3	m	m	m	kN
Column GL32h	490	0,2	0,2	5	
				Total	0,98

LOAD COMBINATION

ULS	Gkj,sup	Qk,1	Qk,i	Load reduction factor for wind	Load reduction factor for snow
Permanent load	1,2 · KFI	-	-	-	-
Short term	1 · KFI	1,5 · KFI	1,5 · KFI	0,3	-
Instantaneously	1 · KFI	1,5 · KFI	1,5 · KFI	-	0

Load combination (Teknisk Ståbi, 2014, p 125)

KFI is set to 1 for consequence class 2