Where art meets nature

Skagen Odde Visitor Centre

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Where art meets nature

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Abstract

The paper represents the entire process of designing a proposal for Skagen Odde Visitor Centre. Skagen Odde, described by many as a top of Denmark, is a place associated with one of the most precious and unique natural heritage sites in the whole country. Being visited by millions of tourists every year, Skagen Odde still misses proper facilities that could help the visitors to better understand and experience the place. Our main objective when designing a visitor centre is to improve the way of visiting Skagen Odde by facilitating access to the whole area for tourists. At the same time we would also like to improve the protection of natural landscape and influence visitors' apprehension of the place.

Figure 1: Skagen on the map of Denmark

Content

Figure 2: Skagen Odde

Introduction

Prologue

Presented work is a Master Thesis Project developed by the group number 32 at 4th semester of Architecture M.Sc. program at Architecture and Design, Aalborg University. The paper presents the entire process of developing the design of Skagen Odde Visitor Centre, including analyses, design process and presentation of the project.

The motivation when deciding upon the topic of the project were our own experiences while visiting Skagen. As Skagen is one of the biggest attractions in Northern Jutland, it was one of our main destinations that we wanted to visit as tourists. Our trips had always looked similar - with the focus on Grenen. In our opinion while tourists are enforced to drive and leave their cars so much into the north of Skagen Odde, they miss many great attractions and values of the area. There is no proper tourist information neither in Grenen nor Skagen and thus their potential is not well exploited. The situation could be improved by creating a place like a visitor centre - a building that could help the tourists understand and get familiar with Skagen Odde as well as serve as a cultural centre for local society.

Competition

Conceptual part of the project has been submitted as a proposal for Nordisk Akademi i Skagen competition organised by Skagen Odde Natur Center. The project has been chosen as one of the five finalists and has been exhibited in Skagen Odde Natur Center from May until August 2016 when the winning proposal is going to be announced.

Guide of reading

The report starts with a section where main objectives and focal aspects are described. In this section we are trying to state our motivation and present the approach to architecture. Next part of the paper is focused on wide scope analyses of the theme and framework of the project where we are trying to explore the spirit of the site. Problem formulation is the next chapter that leaded us to the choice of specific plot. Having the knowledge from framework exploration, enriched with further plot analyses, helped us to come to the main concept. The following chapters are presentation of the final project and the part showing design process. The paper ends with the reflections and appendix with all technical considerations.

Objectives

Our main objective is to create the building that could influence and improve the way of visiting Skagen Odde. We would like to help finding the balance between development and conservation of the area, as we believe that it is possible to let the visitors experience Skagen Odde and in the same time keep the natural qualities safe. To achieve it the tourists should be preliminary informed about all the values and peculiarity of the area and properly planned visitor centre building could help it.

In the project we would like to use the knowledge gained through the last two years of education at Aalborg University as well as our own experiences as architects. The main focus of the project is put on tectonics. The timber structure is a crucial aspect in the designed building. Another focal points in the project are the identity and relation with the place. In the project we work with light conditions, acoustics and try to apply basic assumptions of sustainability.

Figure 3: Det Grå Fyr

Methodology

A complex architectural task, such as designing a visitor centre, needs a holistic approach where intuitive considerations should be merged with scientific research. The framework of the project has been based on "The Integrated Design Process" described by Mary-Ann Knudstrup [Knudstrup, 2004]. This method ensures academic approach, by it's ability to integrate aesthetic, functional and technical aspects.

The Integrated Design Process' main goal is to create a systematic approach to the problem, rather than introducing something radically new. The process results in highly efficient, interdisciplinary concept by the act of including broad range of analyses and knowledge from different specializations from the very beginning.

It is important to note that Integrated Design Process do not ensure aesthetic or sustainable solutions - it is just a platform that makes it easier to control many different parameters of the project [Knudstrup, Hansen, 2004]. This is why a strong architectural, aesthetic or theoretical concept is often needed to create a holistic building.

The focus will be placed on creating a strong conceptual design that will become a basis for the functional and technical aspects of Integrated Design Process - correlating with the three points of the Vitruvian Triangle: venustas – beauty, stating that architecture should be beautiful, firmitas – firmness, stating that architecture should be structurally sound and utilitas – usability, stating that architecture should have a practical function.

The process consists of five different phases that overlay each other, approaching closer and closer to the final solution. The process is not chronological but consists of numerous loops between each phase of the process. This results in constant discussion between different scientific and theoretic methods in the field of architecture and engineering.

The result should ultimately create a design that is a synthesis between aesthetic and technical parameters. First phase is Problem Phase; this is the time when the general constraints are being clarified and the task is being formulated. This definition of "Problem Statement" serves as the basis for further work.

Second phase is Analysis Phase that serves as the basis for creating an universal understanding of the design conditions. The knowledge obtained in the process of consecutive analyses form the basis for the concept and its further development. In this phase relevant tools like creating physical models of the site, mapping, creating diagrams and 3d models should be used.

The third step is called Sketching Phase. In this phase different proposals are being sketched and tested. The proposed tools encompass drawings, physical models and 3d representations. Early stage of the phase consists mainly of the iterations of

"Nothing is as dangerous in architecture as dealing with separated problems. If we split life into separated problems we split the possibilities to make good building art."

Alvar Aalto

hand sketching and physical models and when the concept gradually becomes more refined, the tool-set shifts from analogue to digital 3D modelling. Both architectural and technical knowledge attained in the previous phases is used to develop the project.

Next, fourth phase is Synthesis Phase where all the material created during previous phases is being merged to create an interlocking design, incorporating all the important aspects: aesthetics, functionality and engineering. The attained knowledge is being used to ensure holistic approach and final detailing of the project. The projects finally takes form, and all the solutions can be seen.

Fifth and final phase is The Presentation Phase where the final material for the presentation of the project is being produced. The phase is a result of all the previous phases - and it is crucial for the understanding of all the design decisions taken during the whole process.

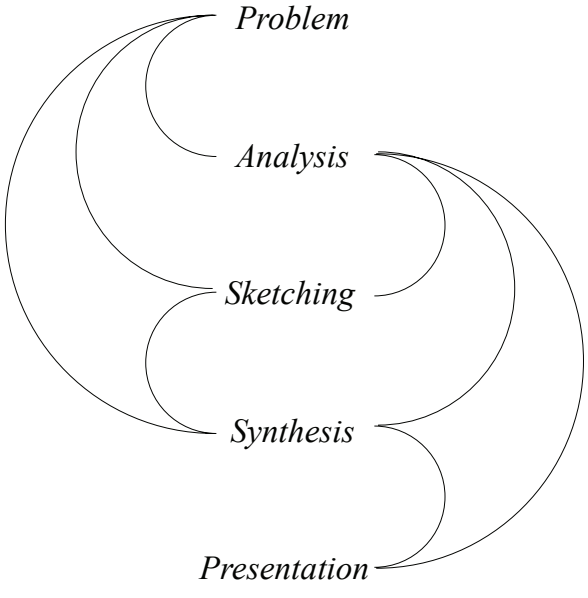


Figure 4: Integrated Design Process - Phases

Approach & Focus

Focus of the project

Tectonics

Nordic Identity

Approach & Focus

In the section we are trying to describe our attempt to the project and reveal all the aspects that will be important for us while designing. They will serve as design criteria to which all the decisions will be referred. Moreover, the section contains detailed description of two main themes of the project: Tectonics and Nordic Identity.

Approach & Focus

Focus of the Project

Searching for a concept

While designing, it will be important for us to find a very clear conceptual idea that would hold the whole project together and fulfill all the design criteria. Through Integrated Design Process all the focal points should be merged into a simple and self-explanatory idea. We believe that project based on a concept happens to generate much deeper feelings in future users. This single concept, that serves as the base for the whole process, unifies it and helps to organise it. The concept serves for the architect as a framework for his actions. The building becomes "one" - a singular instance built from smaller elements.

Local Identity

A project should relate to the context and to the surroundings in the closer and wider scope. Understanding the Nordic Identity is crucial for designing a project in Scandinavia. The Nordic Identity in architecture can be defined as an unique way of relating to the nature, environment and light. At the same time it is important to consider the neighbourhood. We would like the building to be strongly connected with the place and landscape as a visitor centre is a piece of architecture that should tell the story about the area by the usage of materials, selected typologies or relating to the existing context.

Light

We consider light as an important design criterion that we would like to emphasize in the project. Light is part of the identity of Skagen Odde. It is a factor that determines both cultural and natural values of the area as well as it is something that all visitors associate Skagen with. Therefore, light qualities will be important in Visitor Centre building as its main function is to present all best qualities of the area. Through the design process we will try to explore how the spectacular light conditions can be presented through architecture as well as how they can influence the design.

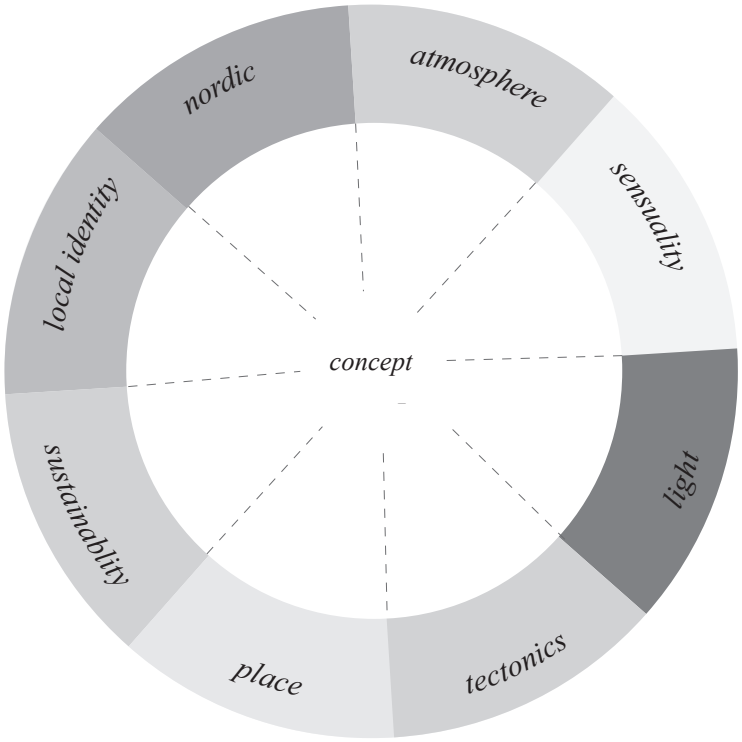


Figure 5: Focal points

Atmosphere & Sensuality

Contemporary world is dominated by sight. [Heidegger, 1997] It is argued that architecture without user does not exist alone. It is the user, that by his contact with the project, recreates it, again and again. The tactile approach means a full approach - the building that influences all of the senses. The building that works not only for the eyes, and not only for the other senses but creates a full experience. [Pallasmaa,2005]

Tectonics

A project realized in a tectonic approach clearly communicates the concept behind it to the viewer. It organizes the whole building process into the iteration of integrated phases. It allows to understand how the building works, how it was designed, how the architect thinks. The building is realized for the users with a great emphasis on the users' experience. A tectonic approach can be a way to introduce the future visitor into the integrated design process by manifesting the conceptual ideas with the physical objects. This creates an unique sensual experience that surrounds the visitor and creates a full unconscious understanding of the space.

Sustainability

Moving towards sustainability means that architects always remember about the sociological, economical and environmental aspects of the projects. This means that during an Integrated Design Process all those aspects will be taken into consideration even if they are not focus of the project.

> *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*
>
> *[Brundtland Commission, 1987]*

Approach & Focus

Tectonics

Tectonics in architecture is typically defined as the science of construction, both in terms of its usage and cultural and artistic values. The word "tectonic" itself has its roots in old Greek 'tektōn', which means builder or carpenter (in the late antiquity, it is often used as a metaphorical "poet"). The first notions of the modern understanding of the word "tectonic" are contributed to Gottfried Semper. In his essay "Die vier Elemente der Baukunst" he tries to simplify the architecture into 4 primary elements: the hearth, the roof, the enclosure and the mound. He separates tectonic, lightweight, linear components and the stereotomic as a form of heavy earthwork constructions. Semper believes that the lightweight structure of the frame creates a spatial matrix with the mass of the stereotomic earthwork, and working together they create the primal building [Semper, 1852]. This theory have been further developed by Kenneth Frampton, by articulating the importance of construction in architecture. He addresses the cooperation between the lightweight and heavy components by comparing lightness to the sky, and heaviness and weight as connection to the earth. He also emphasizes that a building needs to utilize and express the construction to be considered "tectonic".

It is important to note that the architecture is not built only from materials but also from ideas. Only together they form a sense of connection between the creator and the future user. [Bech-Danielsen, Beim, Christiansen, 2012]

This understanding of the term "tectonic", shows a process that should incorporate the technical aspects, aesthetics and functionalities into a single building. That can be interpreted as a modern way of utilising Vitruvian qualities. With the current abundance of different materials, construction techniques and methods, contemporary architecture requires a holistic approach more than ever, and there is a need for a cross-field specialists, architects and engineers - modern master-builders. [Beim, 2004]

The tectonics can be also defined by contrasting it with an 'atectonic' approach - an approach that focuses on something else than structure, than expressing meaning through it or enhancing it. Jacob Voorthuis clearly states that 'tectonic' and 'atectonic' approach have one important thing in common. They behave like stage design - they are "preoccupied with the act of expressing something". While atectonic approach tries to convey message with decor, the tectonic approach manipulates the structure to do the same. But nothing today is how we see it. With complex building codes, environmental requirements, technologies etc. - the buildings consist of many things that can be deemed 'dishonest', 'atectonic' or 'false'. So what we are trying to convey by the usage of tectonics is a suggestion [Voorthuis, 2009].

> *In the experience of art, a peculiar exchange takes place; I lend my emotions and associations to the space and the space lends me its aura, which entices and emancipates my perceptions and thoughts. An architectural work is not experienced as a series of isolated retinal pictures, but in its fully integrated material, embodied and spiritual essence.*
>
> *[Pallasmaa, 2005]*

Figure 6: Swiss Pavilion by Peter Zumthor

The role of the tectonics in a contemporary building could be to convey the concept, the spirit of the place or the desired atmosphere towards the end-user. The designed suggestion, integrated into the holistic design process, could create a spatial experience that not only encompass quantitative considerations of indoor climate, acoustics or light quality, but also qualitative, subjective approach. Nina Rappaport in "Deep Decoration" observed that structural elements can be used as both functional and decorative means. This leads towards an integrated design that cares about all parts of the design process.

The connection between different areas of design and the need to incorporate them from the beginning clearly leads to the integrated design process: a process where construction, functionality and beauty meet, and are created by conscious decisions.

This connection between an idea and the construction, between a conceptual meaning and the materiality of the project, can be seen as a sensory interpretation of the abstract ideas. A tectonic approach can be a way to introduce the future visitor into the integrated design process by manifesting the conceptual ideas with the physical objects. This creates an unique sensual experience that surrounds the visitor and creates a full unconscious understanding of the space.

In the modern building industry nothing is quite what it says it is. It cannot be without rubbishing other far more pressing concerns: building regulations, the drive towards the environmentally friendly, fire safety, complex services, built-in technology, all sorts of insulation, from special paints to thick stone wool blankets have wrapped themselves around everything. The best that can be achieved in a complex building, is the suggestion.

[Voorthuis, 2009]

Approach & Focus

Nordic Identity

Introduction

"The Nordic Identity" is a theoretical expression used to better categorize or specify the presumed uniqueness of architecture in the countries of Scandinavia. Today 'nordic' itself is most commonly associated with the Nordic Council.

The Nordic Way

Nordic countries form only a small fraction of the world population (with only around 25 million of people). At the same time they are constantly being placed on the top in global rankings of happiness, transparency or life quality. "The Nordic Way" - the welfare state is an unique political model developed in Scandinavia, to which many other countries strive to. [Kjeldsen, Schelde, Andersen, 2012]

Natural Environment

Scandinavians have always been deeply connected to the natural environment, but also experienced by its harshness. Strong cold winds, extreme amounts of rainfall, cold temperatures - these natural phenomenons are deeply rooted in the Nordic identity. The light is somewhat special. The long periods of its absence motivated people to celebrate its presence. The Danish term "hygge", translates roughly to "cosiness" and it can be interpreted as the Scandinavian way of fighting with the darkness, as its most common embodiment is the candle light. This is often translated into architecture, which typically commemorates ways the light gets into the building.

Nordic Pavilion

This closeness to the natural habitat has been always an inspiring aspect for Nordic architecture. Sverre Fehn's Nordic Pavilion for the Venice Biennale in 1962 is one of the most recognized example of "Nordic Identity". Fehn replicated Nordic light qualities by creating a filter out of concrete beams. This results in refined, weakened and non directional light, that creates specific atmosphere. The contrast between artificial human-made elements and nature in the form of the 3 trees is amplified by geometrical relation of horizontal - vertical orientation.

Sociology

Sociological aspect of the Nordic Identity has its base in the way the societies evolved. Most people in Scandinavia lived in rural conditions at the beginning of the 20th century. The rapid changes were about to start. Fast urbanization leaded to the development of new social groups, high levels of democracy and transparency. [Egner, 2004]

We live in a world of human spirit, ideas and intentions, but we also exist in a world of matter under the quantities and qualities of the physical world. We have two domiciles that constitute and existential singularity: one in the historicity and continuum of human consciousness and emotion, the other in the world of matter and physical phenomena "how the world touches us" as Merleau-Ponty characterised Paul Cézanne's paintings, and how we touch our world.

[Pallasmaa, 2005]

Genius Loci

The spirit of the place, as described by Norwegian phenomenologist Christian Norberg Schultz, is a regionalistic answer to the popular international style. Identity of the place, geography and local features forms a basis for architectural interpretation. [Norberg-Schulz, 1979]

What is Nordic Identity in Architecture?

Today, we can seek for the Nordic Identity in architecture in an unique way of relating to the nature, environment and light. Furthermore, nordic countries are considered as top examples of egalitarian principles, democracy, public involvement and social justice. We can project this onto architecture and see how this politcial and sociological aspect of "Nordic Identity" is reflected in architectural design. Architecture is open, democratic and public.

Conclusion

One can interpret, that a "Nordic" building would be such creation that forms a structure deeply enrooted in the sense of locality, not forgetting about the sociological aspects.

Figure 7: Kärsämäki Church, OOPEAA

Figure 8: Nordic Pavilion by Sverre Fehn

Framework

History of Skagen

Culture & Art

Natural Qualities

Formal Demands

Tourism

Regional development

Points of Interest

Framework

The section presents preliminary analyses and research that have been made to create better understanding of the problem and set the basis for the future project. Knowledge about history, environment, culture in the area of the whole Skagen Odde will improve the awareness of possibilities and potential for a Skagen Odde Visitor Centre. The section is a preface to problem formulation phase where the conclusions are made.

Framework

History of Skagen

First mentions about the city come from such early dates as first century AD. It was mentioned by Pliny the Elder:

"The promontory of the Cimbri running far out into the seas makes a peninsula, which is called Tastris."

Skagen, with a name sounding similar to the today's, was first mentioned as Skaffuen in 1284 which means narrow promontory. It had always been a town with big aspirations. Basing on its unique location and both natural and cultural values Skagen had always wanted to become 'Verdensbyen' - a town with international meaning. [Skagen Lokalhistoriske Forening, 2014]

The first building built on Skagen Odde is considered to be the house of shepherd Tronder who worked for farmer Thorkild Skarpæ in the 13th century. After the visit of king Valdemar Sejr he received the rights to graze on Skagen mark. Tronder was probably also the first named person to fish in the area of Skagerak. Later it became an important fishing port. To this day Skagen has a street named after the farmer - Skarpæsvej [Nielsen, n.d.]

One of the important facts in the history of Skagen was the act of Erik of Pommern in 1413. It granted Skagen with the status of market town. This act was probably caused by previous actions in the region – the city had already been known as a good trading and fishing point in the region. This resulted in Skagen becoming a largest town in Vendsyssel region, reaching 2000 inhabitants. [Skagen Lokalhistoriske Forening: Tidstavle, n.d.]

The market city status is probably linked to the current situation between Denmark and Hanseatic League. Danish King tried to protect the country's trade from the hanseatic influence by granting many cities the market rights which strictly regulated the trade in the local area. City rights were granted to Skagen around 100 years earlier. [Skagen Lokalhistoriske Forening, 2014]. For the next 150 years the city experienced a rapid growth and could rival with the currently biggest North Jutland city – Aalborg. The beginning of the 17th century brought worse times for Skagen. Herring stocks started to decline. There were also constant problems with sand drifts and flooding. [Skagen Købstad i 600 år, 2014].

On top of that, Skagen has been plundered by Swedish soldiers during the Torstenson War. All these events caused the decline of the Skagen trade city power, and the trade started to concentrate in Aalborg.
Eventually in the end of the 19th century Skagen started to appear on the maps again. The unique location and light conditions attracted artists what soon resulted in establishment of an art colony called Skagen Painters. The unique architectural appearance of Skagen is partially credited to Ulrik Plesner – a Danish architect who designed many of the buildings in the city. He was the architect behind both the Brøndums Hotel and Skagen Museum,both that have close ties to the Skagen Painters.

"The phenomenon of sand drifts made Skagen famous in the world. It is migrating coastal dune between Skagen and Frederikshavn. With the volume of 4 million m3 it is the largest moving dune in Northern Europe."

[Wikipedia: Råbjerg Mile, n.d.]

The next important event that further connected Skagen to the world was the establishment of a railway in 1890. The next years were better and better for the town. City's economy has been improved by the development of a new fishing harbour. Skagen became also an important place for the royal family, who often stopped there for vacations. The king even built a residence for his wife, Klitgården, which today serves as an artist retreat.

All of these events resulted in a rapid growth of tourists. Skagen became an important point on the map of Denmark. New hotels were being opened year after year. October 1938 was a dark date in the history of Skagen tourism. A lightning struck the iconic Skagens Badehotel which had been located on Grenen. The war brought the occupation of the hotel, which was finally demolished in 1943.

Skagen experienced further development after the war – with many new houses and public buildings being built. From the 1960s, it Skagen became a go-to place for the upper-classes to spend their summers. [Lindeborg, Lindkvist, 2013]

Understanding the history of Skagen is the key to understanding the tourist qualities of Skagen.

Figure 9: Skagen town

Framework

Culture & Art

Skagen Painters

Skagen Painters was an informal group of artists, that gathered in Skagen in the last decades of the 19th century. The year 1871 was very important to Skagen. This year Holger Drachmann and the painters Fritz Thaulow and Karl Madsen arrived in Skagen, later to be joined by Carl Locher, Michael Ancher, Peder Severin Krøyer, creating what was later called "Skagen Painters". The group was compromised of Danish, Norwegian and Swedish painters.

Freedom

They have seen Skagen as a retreat where they could break from fixed styles of Historicism and Neoclassicism being enforced by the Royal Danish Academy of Fine Arts and paint freely being highly inspired by Impressionists' movement. [Oakley, 2015] Interesting fact is that most of the works, painted by the Skagen painters, were indeed Realist. They would most often pick subjects like: men at work, genre situations, fishing. Painters recognized also the special light they encountered in Skagen as one of the main attractions - a combination of its location in the far north of Denmark and, by some accounts, the effects of sand in the air [Svanholm 2012].

Figure 10: Painting "A breakfast" Peder Severin Krøyer

Unique qualities of Skagen

Skagen appealed to the painters because of many reasons. Many people notice the amazing light in the area. Being a narrow, flat peninsula Skagen Odde creates unique light circumstances. The light in Skagen is being influenced by the closeness of two seas which act like mirrors. The suspended salt particles additionally makes water glitter in light. Finally, the sand grains in the air act like small prisms. This create a specific light aura over Skagen and this is one of the reasons why the painters chose to settle in Skagen.

Peder Severin Krøyer

He is the best known beloved and undeniably the most colourful of Skagen Painters - an unofficial leader of the group. He was also the husband of Marie Krøyer - another of Skagen Painters. He painted many beach scenes featuring both recreation life on the beach (bathers, strollers) and local fishermen but also in-door scenes depicting everyday life and events.

Christian Krohg

A Norwegian painter that joined the group in 1879, best known for his social realism paintings.

Figure 11: Painting "Harvesters" Anna Ancher

Michael Peter Ancher

Danish realist artist. He joined the group when he was 25 year old. His main focus were paintings of fishermen and other scenes from the Danish fishing community in Skagen.

Anna Ancher (Brøndum)

She was the only one of the Skagen Painters who was actually born and grown up in Skagen where her father owned the Brøndums Hotel. She studied drawing in Copenhagen and later in Paris together with Marie Triepcke (later Krøyer) who would marry Peder Severin Krøyer.

Viggo Johansen

He was the husband of Anna Ancher's cousin Martha Møller in 1880. Martha often served as a model for his paintings. After a big dispute with the Anchers his connection to Skagen greatly diminished.

Oscar Björck

Oscar was the most important Swedish painter, that joined the Skagen Painters. He spent many summers in Skagen attracted by the hospitality of the group. His pictures from Skagen reflected the influence of Peder Severin Krøyer.

Figure 12: Painting "The Lifeboat is Taken through the Dunes" Michael Ancher, 1883

Framework

Natural Qualities

Land in constant movement

Skagen Odde peninsula has been formed around 15 thousand years ago at the end of ice age. It remains in constant motion. The western bank is being eroded while the currents slowly add the material on the other side, causing the whole peninsula to slowly move eastward. [Fredrikshavn Kommune: Skagen Odde og Grenen, n.d.]

This can be observed looking on the houses from the beginning of the 20th century – they were built next to water but today they have over 500m to the shore.

Skagen Odde natural landscape is primarily constituted out of sand. The rather flat area includes also small mounds and valleys. Mounds, being exposed to the extreme winds, are typically dry while the sheltered valleys wet. The specific shape of those features comes from the emergence process. Typically, the peaks are formed by the accumulated stone and gravel material which come from frequent storms. The material is being dumped parallel to the coastline forming characteristic lines. Sand and water are being trapped in the areas between the mounds creating an overlapping structure. [Fredrikshavn Kommune: Skagen Odde og Grenen, n.d.]

Figure 13: Skagen Odde's moors

Light

Light is something that distinguish Skagen Odde from any other place in Denmark. The place is also known as a "Land of Light" basing on its peculiar quality of daylight. It is caused because of specific topography. Skagen Odde is a narrow piece of land surrounded from both sides by water that reflect the sun rays and almost mirror each other. Light condition are also influenced by sandy landscape with runt greenery.

Fauna and Flora

Many scientist consider this area as a real-life land-formation and botanic laboratory as one can observe how the new land is formed by the geological, marine and botanical processes. The pioneer plants, such as creeping bent-grass, cakile and beach grass, constantly "conquer" new territories. [Fredninger.dk: Skagen Gren, n.d.] Skagen Odde region is also the only place in Denmark where one can see so many different species of birds. Grenen is home to the Arctic eyebright, curved sedge, chaffy sedge, Baltic gentian. Dune gentian and dune helleborine can also be found here as well as mushrooms and toadstools, mosses and lichens.

Figure 14: Skagen Odde's dunes

Dunes are hills of sand, that were built by the activity of winds and water flows. Skagen is also famous from moving dunes. Different actions are being taken to stop them from moving. The dune plantation has been established in the end of the 19th century. The plantations consist of moss, trees and bushes.

Due to closeness to the water many regions of Skagen Odde are highly moist. This led to development of the marsh and swamp areas. They are a form of transition between the aquatic and terrestrial ecosystems and are often dominated by grasses, rushes or reeds.

Heaths are characteristic for infertile, acidic soils and are full of low-growing woody vegetation, shrubs and bushes. Dunes at Skagen Odde are often covered with heaths and other plants.

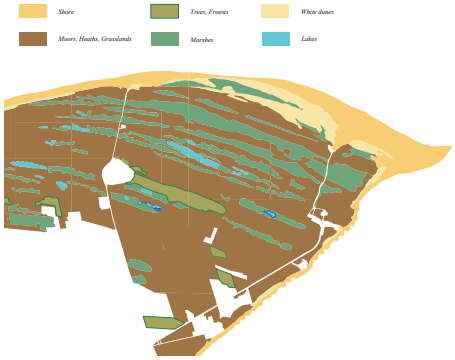


Figure 15: Vegetation Map

Figure 16:Coastal vegetation

Framework

Formal Demands

Importance of Skagen Odde

Skagen Odde has always played an important role for the whole region as it is an unique place in scale of both North Jutland and the whole country. The area of Skagen Odde links many different aspects as it is a place where both historical, biological, cultural, geological, tourist and recreational interests are significant. Considering natural aspects the area should be well protected to avoid detriments in original landscape and wildlife. On the other hand, Skagen Odde remains very popular tourist destination and one of the biggest attraction in the whole country that generates a huge income for both private owners and municipality. [Manto A/S, LBB3 I/S, 2014] It enforce a sustainable and holistic approach in development of the area to compromise both ecological and tourist interests. The municipality of Fredrikshavn, who is in charge of this area, tries to develop a strategy that would help protecting the nature and in the same time support and strengthen the tourist potential of Skagen Odde.

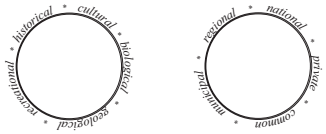


Figure 12: Different interests

Preservation area

Skagen Odde is a part of many different national and European Union's programs which protect an unique natural heritage. First regulation, established in 1940, determined a need to create a protection area covering around 270 ha of Skagen Odde that should remain in its natural state and should not be built on. [Naturklagenævnet, 2007] Nevertheless, the rules allowed to rebuild the remains of burnt Bådehotel and create in its place a private art gallery - Grenen KunstMuseum together with a restaurant which are used till today and what is more, they did not stop people to drive by car into top of Grenen. Through the next decades the tourist interest in the area has been continuously growing and it became necessary to strengthen preservation of Grenen nature. In 2000 a Skagen Odde Nature Centre designed by Jørn Utzon was opened. It was an attempt to focus an attention on natural values of Skagen Odde. The centre was destined to have both an educational and informative character. The biggest impact on the area had a regulation introduced in 2007 about preservation of Skagen Odde and surrounding waters. It was a document that finally prohibited the cars on the top of the cape. The conservation area have been enlarged into 670 ha of Skagen Gren and 1000 ha of sea area around Grenen. The document in the same time established better protection of natural heritage and declared improvement of tourist facilities' condition. The existing Museum & Restaurant building should remain but the actions in order to reduce its visibility and impact on the landscape have been planned. [Fredrikshavn Kommune: Skagen Odde og Grenen, n.d.]

What is more Skagen Odde is protected on the basis of different programs from European Union level like Nature 2000 and LIFE02 NAT/DK/008584. In order protect interest of the real Grenen users a special council board has been created in 2010. It consists of representatives from both municipality, environmental institutions, private owners of Bunker Museum, Kunstmuseum, restaurant etc. Main role of the board is to be a consultant for municipality while working on a future Grenen development.

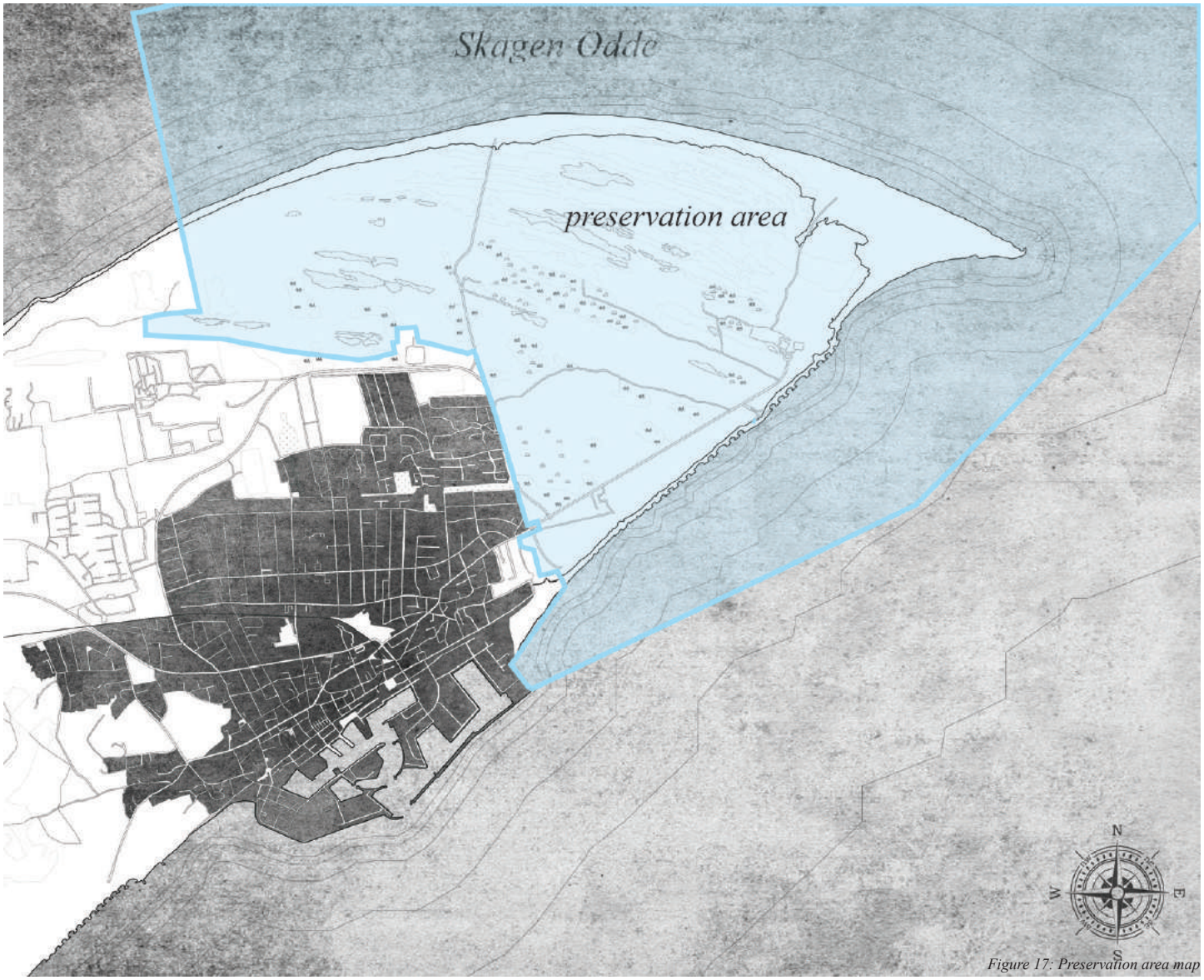


Figure 17: Preservation area map

Framework

Tourism

Tourist potential

Tourism is currently one of four main growth paths for Fredrikshavn Municipality. Therefore, the authorities try to strengthen the position of Skagen as a most popular and leading seaside resort not only in Denmark but in the whole Northern Europe. In order to achieve that the Municipality together with Turisthus Nord,VisitNordjylland and architects have created a Potential Plan that should build a vision for future development of the area. [Manto A/S, LBB3 I/S, 2014]

Skagen has always played an important role as a tourist destination in Denmark. A perfect mixture of sea, landscape, light and cultural values makes the area very attractive for visitors who come to Skagen to spend the holidays. It is considered as proper to have a summerhouse in Skagen and for many Danes it is a kind of ritual to come there every year. Nevertheless, Skagen also remains a popular destination for short term trips. Over 1 million of people every year come just to see Grenen and what is more the number of international visitors is growing every year. In general the area is mainly visited by international tourists from Norway, Sweden, Germany and England. [Manto A/S, LBB3 I/S, 2014]

Why do people choose Skagen

Great advantage of Skagen Odde is its diversity. Possibilities for historical, cultural, artistic and natural experiences highlight Skagen as a great tourist place. The visitors can be attracted by many different aspects like a remarkable kitchen based on fresh local fish as well as on regional products and alcohols. What is more, Skagen Odde is a good place for those who love sport and active life. The Potential plan document considers creating a new system of cycling, walking, jogging trails, that could connect the whole Skagen Odde. [Manto A/S, LBB3 I/S, 2014] Special groups of tourist are painters and people searching for artistic values as well as ornithologists and those who passionate in wildlife or nature. Nevertheless there is always a huge group of people who consider visit on Skagen Odde and seeing the "Top of Denmark" as an obligatory point in their schedule while traveling around the country.

Tourist in Skagen

"For mig er Skagen hav, himmel og kunst"

[Manto A/S, LBB3 I/S, 2014]

Main tourist flow

There is still a lot of visitors, especially among international and short term tourists, whose main destination is Grenen and a point where Skagerak meets Kattegat. They typically travel by car directly from the south up to the parking lot on Grenen. There they leave the vehicle to overcome the rest of the distance by foot. After that people either drive back toward Aalborg or stay in Skagen for a while to walk through main streets. Often the tourists do not have proper information of what are the possibilities and attractions both in the city and on Grenen. That is why the potential of diversity that Skagen Odde offers is not completely exploited. At the same time it creates an imbalance between different parts of Skagen Odde. As the visitors leave their vehicles in the middle of Skagen Odde they often concentrate only on seeing Greenen. Many of them do not even know about other attractions that Skagen Odde can offer f.x. they miss a visit in Skagen Odde Nature Centre, lighthouses etc. Today Grenen and the city of Skagen stand out as two separate areas without any connection. None of them has a good information system or place where the visitors can gain the knowledge about the overall area.

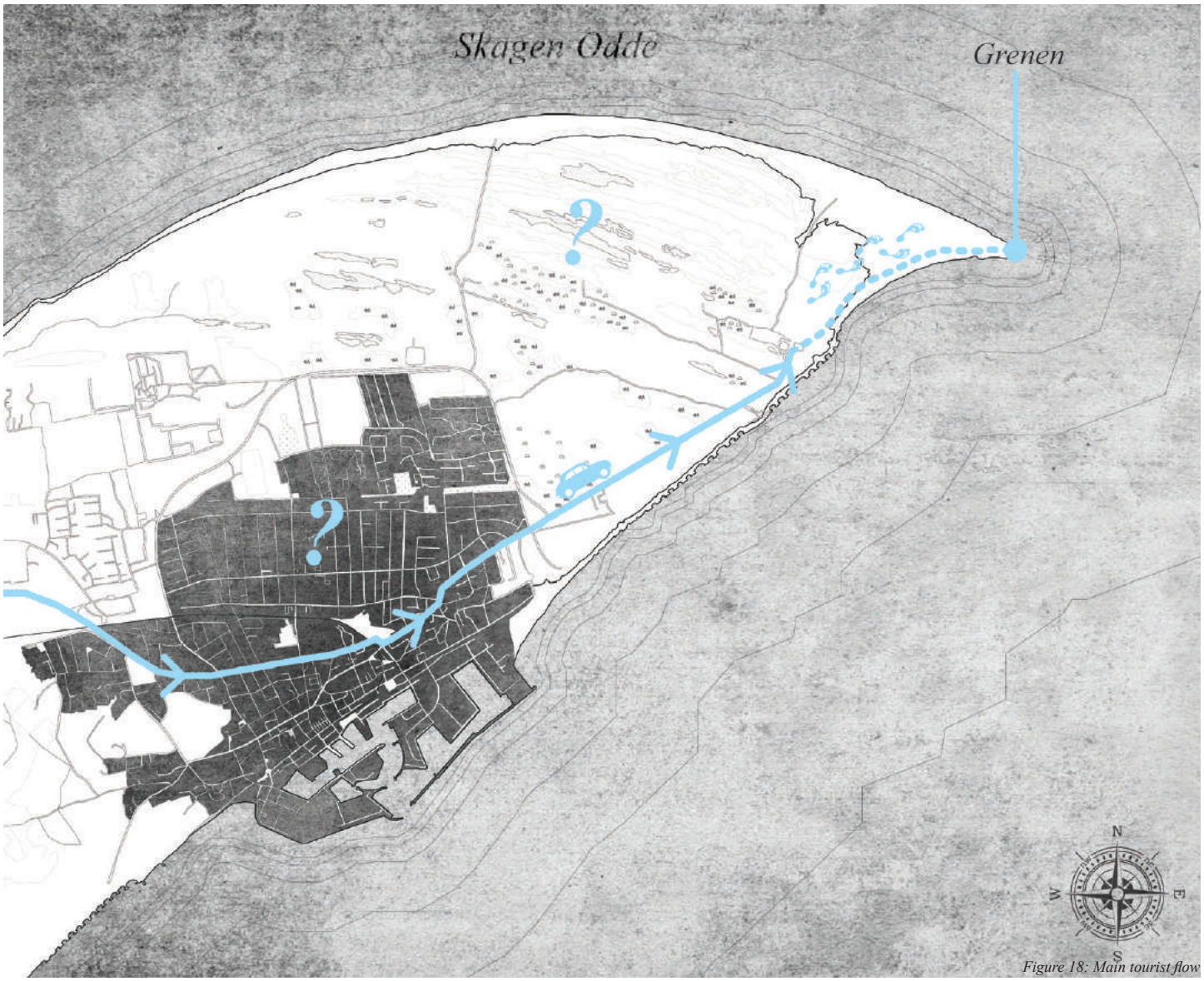


Figure 18: Main tourist flow

Framework

Regional Development

Introduction

The problem of unexploited potential of the whole area of Skagen Odde has been noticed by Fredrikshavn Municipality and after that some new ideas and initiatives have been planned in order to activate tourist traffic in the area. All the actions introduced by the municipality need to be very well-considered to ensure sustainable development of preserved area of Grenen. The kommune has to always keep a balance between development and conservation of Grenen.

Grenensporet

In 2015 the Municipality initiated a new system of paths and trails around Grenen. - Grenensporet. It is a set of four routes that try to catch on all important and interesting spots in the area. The points of interest are marked and highlighted by special boards with brief information about the place. All the trails have different length, some of them are adjusted for disabled people. The trails emphasize both natural, cultural and historical values of Grenen and encourage tourist to see more that just the peninsula. In the same time the initiative is focused on keeping the area well protected. [Egelund,2015]

Potential Plan

In 2014 Fredrikshavn kommune together with other parties and architectural offices prepared "Potentialeplan for Skagen som international kystferieby"- a document that visualises a potential and ambition of Skagen as an international seaside resort. The paper sets the direction in which the development of the area should go and describes some initiatives that could be introduced in both Skagen and Grenen.[Manto A/S, LBB3 I/S, 2014]

KulturNatursti

It is one of the ideas presented in the potential plan documents that correspond sto Grenensporet initiative. KulturNatursti is a cycling, jogging and walking trail that links all important areas on Skagen Odde. It is long route that goes through the city, Grenen and both western and eastern coast. The plan is to equip the trail with some facilities like eating spots, places to rest or lookout points and observation decks. [Manto A/S, LBB3 I/S, 2014]

Seaside facilities

The potential plan includes also some ideas about stimulation the development of the coast around Skagen. The plan is to introduce some places where the tourist could have a safe bath in the sea.

Grå Fyr

Danish Ornithological Society, Turisthus North and Frederikshavn Municipality Nature Agency decided to transform the old Grey Lighthouse in Grenen into a modern nature centre for all bird lovers. It will be a place with exhibition about all the species living on Skagen Odde as the area is one of most important spots in bird migration in the whole Europe. The centre will be next great attraction for all the tourists visiting Grenen and Skagen. [Miljø og Fødevareministeriet Naturstyrelsen, 2015]

International bådehotel

The history of Grenen bådehotel is old and complicated. The building has been burnt and today on its place lays Grenen KunstMuseum. It was a real landmark in the area. Today many people dream about the hotel's return to Grenen. Even though the initiative is mentioned in potential plan document, it would be very hard to make such an investment in the middle of Grenen. Such a big commercial building would violate the natural balance of the area. As the main goal for the municipality is to protect the area, the plan for the hotel is still more like a future dream. [Manto A/S, LBB3 I/S, 2014]

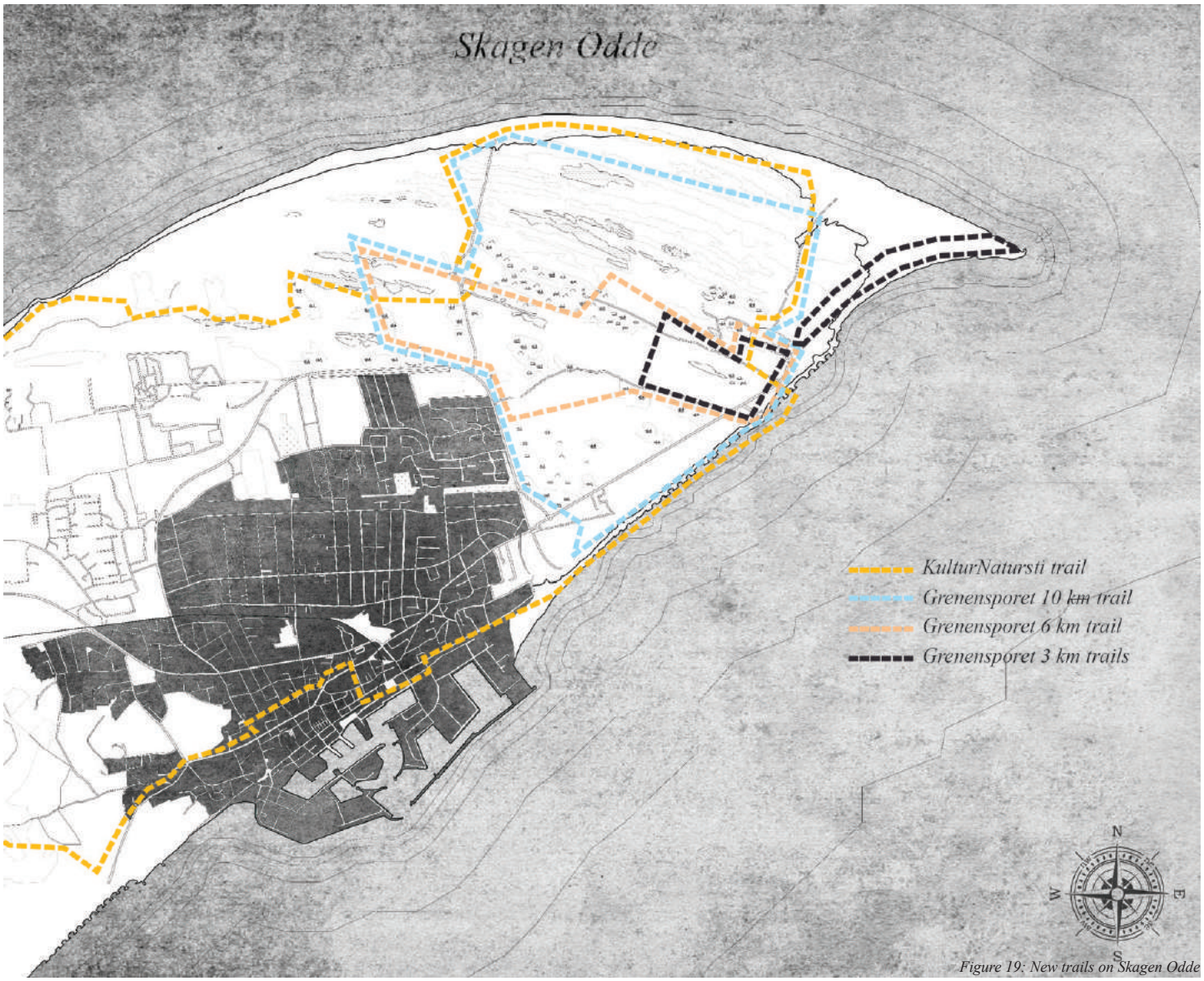


Figure 19: New trails on Skagen Odde

Framework

Points of Interest

City & Landscape

The biggest advantage of Skagen Odde as a tourist destination is its diversity and amount of different places and activities in the area that attract people. In general we can distinguish two main destinations that every tourist want to see - Grenen with a meeting point between Kattegat and Skagerak and Skagen city centre. Nevertheless, there are still many other worth seeing places that are not so visible and obvious for those who come to Skagen Odde for the first time.

Tourist information

Current location of tourist information centre is not the most convenient one as it does not lay on any of mostly used tourist paths. Today main information centre in Skagen is located in southern part of harbour area. In our opinion it should be placed near the point where the visitors start their trip through Skagen Odde. A place like that could be along Oddevejmain road going through the city directly to Grenen. A visitor centre building located in such an area could help the tourists to gain more knowledge about the place and it could influence the way of how they plan the tour.

Attractions on Grenen

Grenen is an interesting piece of land where tourist can experience a great landscape and natural qualities while learning about history. Important points on Grenen's map are the lighthouses as their placement marks out how the land was moving through the centuries. First one is placed just on the border of today Skagen. It is a first lighthouse built in brick in Denmark. Later it was painted white what contributed to its current name "Hvid Fyr". Today it serves as an exhibition space. Second lighthouse is located a little bit further to the north. It is currently working as a bird observatory centre and can be a great tourist attraction. As it was mentioned in previous sections, it will undergo transformation into a ornithological centre. The only lighthouse which is still active is a Vest-Fyr placed in the north-west part of Skagen Odde.

Other significant places scattered around the whole Grenen are Vippefyret, Drachman's Grave, Skagen Odde Nature Centre - a museum designed by Jørn Utzon as well as Bunker Museum with many remains from Second World War or Grenen Kunst Museum, Villa Guldmaj and Villa Klitbo.

Attractions in the city

Skagen is a lovely town filled with small art galleries and lovely restaurants. Biggest museum in the city is Skagen Museum, where many great painting from most famous Skagen painters are exhibited. The museum has been renovated and it is going to be great tourist attraction. In the city centre the visitors can also see a museum of Michael & Anna Anchers which is located in their old house as well as Drachmann's House. A great architectural adventure is also just a walk through the city as its architecture is special and very homogeneous with many old churches and lovely summer villas. While walking it is always good to have a look on shops with local specialities, alcohols and sweets which are very popular in Skagen. Worth visiting is also Skagen's harbour filled with sailing boats. There one may buy the best fresh fish at "Fiskepakhuset" or eat in one of the greatest restaurants in Skagen.

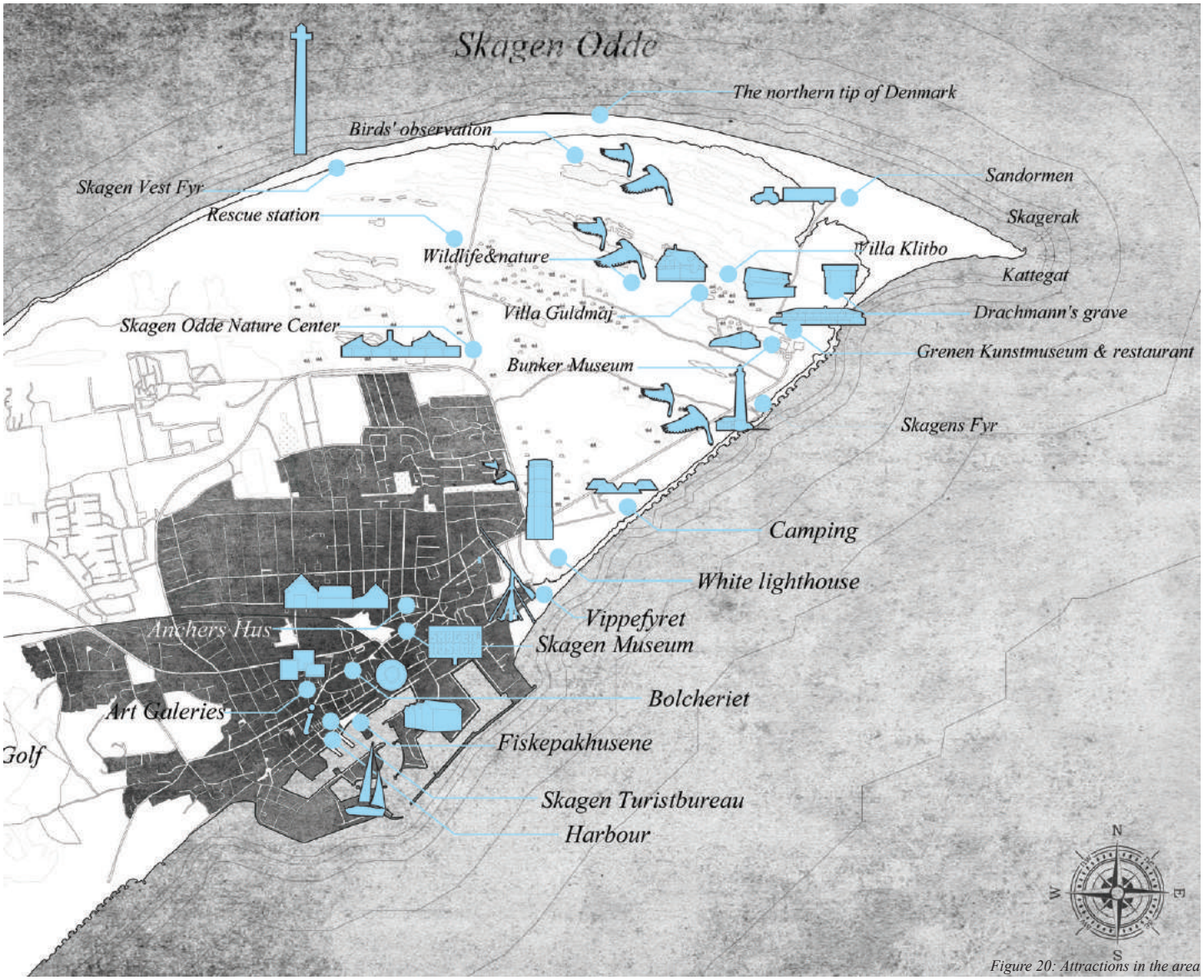


Figure 20: Attractions in the area

Problem Formulation

Potential for a Visitor Centre

Location of the building

Problem Formulation

The section contains reflections and conclusions based on framework analyses. That leads to final problem formulation - where the relevance and main aim of the project are described. We try to answer the question - how the visitor centre building can influence Skagen and Grenen. In the section final decision about the exact location of the building is made basing on the research from framework analyses.

Problem Formulation

Potential for a Visitor Centre

Qualities

Skagen is an important point on the map of Denmark. The natural environment of the area enchants with it's elements. Land and sea, light and shadow, dry dunes and moist wetlands - here we can start to see the dualities that appear everywhere in Skagen. Its unique natural qualities are confirmed by the vast interest of different scientists, fx. geologists, botanists and ornithologists, but also from tourists. Every year millions of people come to see Skagen peninsula and the place where two seas meets. Most of them come by cars, polluting the preserved area of Skagen Gren. We think that with a proper development we could change this behaviour.

Potential

Apart from the famous point where two seas meets, Skagen offers much more. The city's rich history of cultural development is an important factor for many tourists. The story of Skagen Painters should be a strong point of interest. It's a pity that a lot of tourists do not know about vast amount of possibilities on how to spend time in Skagen. Many of them leave shortly after visiting Grenen beach. The potential is enormous - Skagen already has been established as the vacation destination for short and long trips. But the people are often uninformed. The city lacks a clear visitor centre that would direct them to experience all those qualities.

Possibilities for development

New visitor centre will serve the tourists by informing them about rich possibilities in Skagen. The information point should give out brochures, maps and guidance. Permanent and cyclical exhibitions will educate people about the history and natural qualities. An event space will create a possibility for organizing regular festivals that help promoting Skagen. The educational area could be used to organize painting workshops, art classes as well as student trips. The restaurant could serve meals made out of the local products - with local fish and alcohols. The new visitor centre would become a cultural centre for both tourists and local society, with many possibilities of spending their free time.

Connections

The visitor centre should minimize the car pollution on the Skagen Gren. New possibilities for tourists should be created. The tourists should be encouraged to leave their cars at the parking near the visitor centre. The centre will be connected to the currently developed walking paths through Grenen. The bike rental should also allow to choose this way of sight-seeing. Finally incorporating existing common transport should also be considered to allow people to see the whole Grenen without the need of using the cars.

Conclusion

A new visitor centre can greatly influence the way people visit Skagen. It can boost their knowledge and create more varied experiences. The new visitor centre would help to preserve the area of Skagen Odde. With two main locations every tourists want to visit - Grenen with a meeting point between Kattegat and Skagerak and Skagen city centre - the new visitor centre should be placed somewhere in between.

Figure 21: How Skagen Odde should be visited

Problem Formulation

Location of the building

In between

The proposed location of the building lies in between of the two important areas for the tourists. The new visitor centre will be placed on the border between Skagen town area and Grenen - serving as a "gateway" between "nature" and "culture". The location will ensure good communication between both city and Grenen. Chosen plot lays on the border of conservation area - we decided to slightly violate its edge as we believe that in the end positioning the building on the fringe of Grenen could be very beneficial for preservation of natural landscape and qualities.

Figure 22: Det Hvide Fyr

Figure 23: Plot's location

Programme

What is a visitor centre

Case studies

Target group

Spatial program

Exhibition themes

Programme

In the section we focus on establishing the functional frames for the building. Exploration of the meaning and function of visitor centre as well as analysing case studies and gathering knowledge about potential users helped us to formulate the spatial program of Skagen Odde Visitor Centre.

Programme

What is a visitor centre

Figure 24: Diagrams

Visitor centre

Visitor centres are typically tourist's first exposure to everything that the city or place has to offer. They are important public (or sometimes private) buildings that serve a general purposes: to guide the tourists, to educate them, promote the locality and to help them to understand the importance of the site. It is a building that provides tourist information to the visitors who tour the place or area. [Wikipedia: Visitor Center, n.d.]

Multi purpose

This multi purpose character is often reflected by the enclosed functionality - that is often derived from a few different typologies. A museum is an architectural object that is very close to visitor centre in its main functionality. However visitor centres are more directed towards tourists and activities, not towards exhibitions. Tourist destinations should speak to the basic tourist needs - the desire to experience art, culture, history and nature in person, to create an experience they will long remember.

Functions

Main function of visitor centre building is to inform and guide the tourists. The building should introduce the place/attraction to the tourists and present its identity. Being in visitor centre should give some preliminary experiences that could relate the visitors to what they can see later. What is more a visitor centre can be a place for some workshops and art classes.

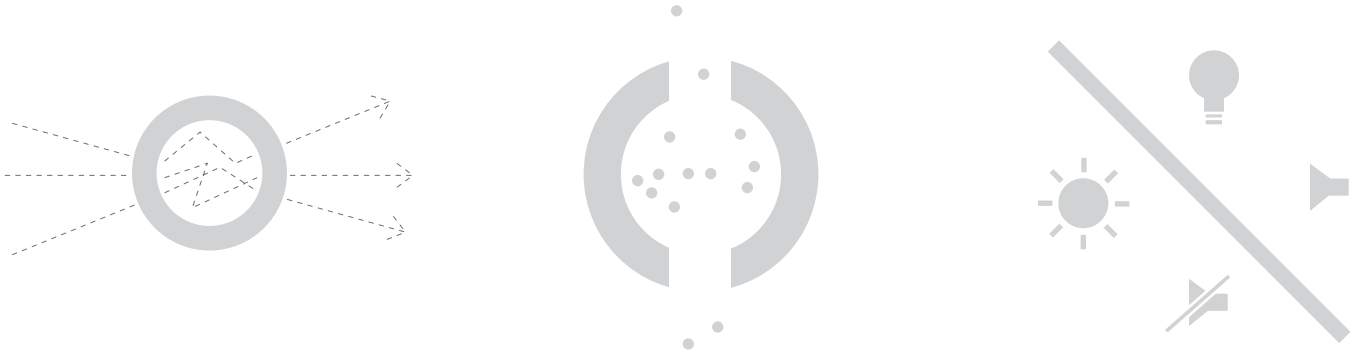


Figure 25: Diagrams

Experiential education

Visitor Centre is a place where the theory and practice is joined. Tourists can gather some theoretical knowledge about the place, nature, culture or locality and then go on tour to see it by their own eyes. The main challenge for the visitor centre is how to communicate all the potential of the site to the tourists to impress them.

Influence

The building architecture can have a strong influence onto the tourists' experiences. Visitor centre is often considered as a local showcase. It should convey the atmosphere of the place. The design should be inviting - encouraging people to come inside. The visitor centre is not only an educational space but it is also a shelter.

Technical requirements

Visitor centre is a building that can expect big amount of people only during some cyclical periods. A visitor centre should set an example for the visitors so incorporating sustainable principles is a must. Apart from that, the visitor centre should have proper acoustic divisions between different functional areas. Proper usage of light is also important - with preference for indirect sunlight in exhibition and workshop areas and direct sunlight in the resting and public areas.

Programme

Case Studies
Tåkern Visitor Centre

Tåkern Visitor Centre
Author: Wingårdh Arkitektkontor AB
Location: Glänås, Sweden
Year: 2008

The Visitor Centre is carefully placed on the border between two worlds: forest and reeds. The architects decided to clad the building with thatch which is the typical cover of the bird-watchers hides. Additionally it provide nesting materials and hiding places for birds, further connecting the project to the surroundings. It is an architecture that tries to blend tradition with modernity by using natural materials on a very geometric shape. The material is the most visible and significant part of the project that in the same time creates identity and connects the building with the surrounding.

"This is quiet architecture, using traditional local materials to break new ground with crystalline geometry,"

[Wingårdh, Edbla, 2012]

Figure 26: Tåkern Visitor Centre

The building is relatively small. Main part consist of entrance, reception, laboratory, exhibition area, auditorium, toilets and staff area. But the architecture goes beyond that and connect the building with a bird-watching tower that is accessible by a long melting into a surrounding ramp.

The purpose of that building is to present and celebrate the qualities of the place. It is a kind of entrance to the area that should tell the visitors story about the place. That is why it is extremely important for visitor centre building to always correspond with surrounding and to emphasize its values. Tåkern Visitor Centre is a good example where the theme of the building - birds an their natural wildlife sanctuary-is visible and emphasized by architectural features of the building. The architects focused not only on interior or shape of the building but they also took into consideration the way people approach the visitor centre. The path to the building also reveals some information about the place.

The centre is a new investment that is also a good example of how to attract people to visit the place. After running the centre the amount of visitors increased significantly with the number of 20.000 people during first month [Bredhe, 2012]

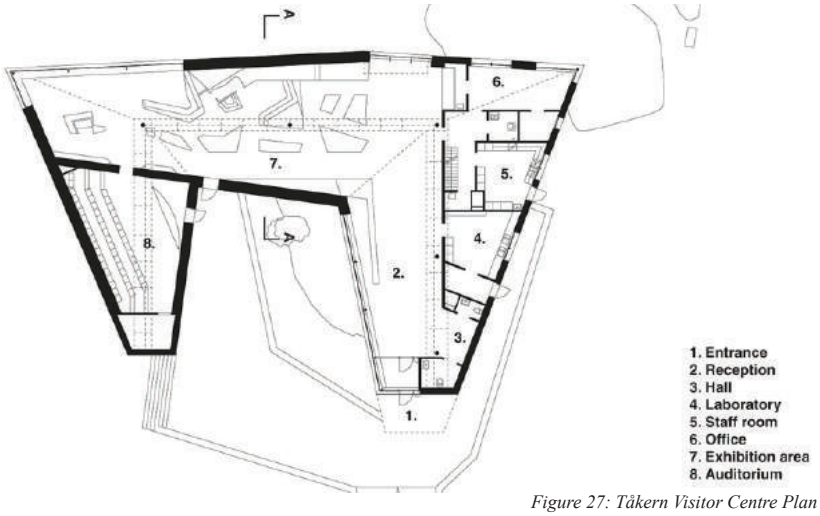


Figure 27: Tåkern Visitor Centre Plan

Figure 28: Facade cover

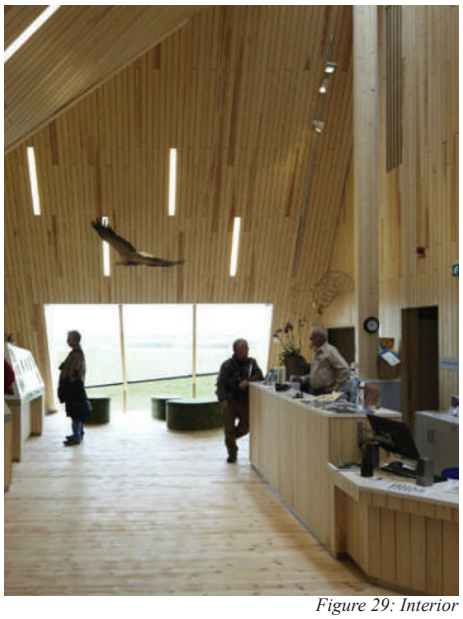


Figure 29: Interior

Programme

Case Studies: Wild Turkey Bourbon Visitor Center

Wild Turkey Bourbon Visitor Centre
Author: De Leon & Primmer Architecture Workshop
Location: Lawrenceburg, USA
Year: 2013

The Visitor Centre is located in the area of Wild Turkey Bourbon Distillery Complex. The purpose of considering the project as a case study is its relation to tectonic. Structure is a very important and interesting element of the project that set the basis for appearance, functional plan and mood of the building. Simplicity of typical barn's shape contrasts with an unique structure and stained wood siding. As a result the building fits into surroundings while being a landmark. It creates a shifting sense of being both simple and complex. The pitched roof buildings strongly imitates the typical agrarian barn. The outer cladding, made out of differently rotated sections of black wooden slats, organized in chevron pattern, create an ever-changing shadow play. The building appears to be really modest from outside, but it completely changes in the interior. The inside of the building reveals a bold internal structure. The tectonics are strongly emphasized throughout the design.

Figure 30: Wild Turkey Bourbon Visitor Centre

Important aspect is prolonging the building into the surrounding. The way the visitors approach the building is included in the project to enhance the experience of the place and its proper understanding. Interior of the building melts with exterior by using open-work wooden structure. The plan is organised around the ramped corridor built up by structural elements. It works as a physical spine that is a centre of a building in both functional and structural sense. It leads the visitors to the elevated tasting room with a great lookout on the Ketucky River. The view is important because the river is the main source of water used for bourbon's production.

Light is another feature emphasised in the project. Structural lattice filters the light and creates spectacular delicate atmosphere that balance between darkness mass. *[Gerfen, 2014]*

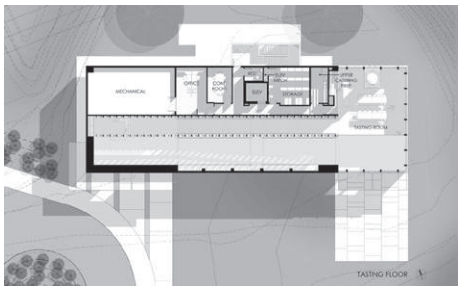


Figure 31. Plans

Figure 33: Interior

Figure 32: internal ramp

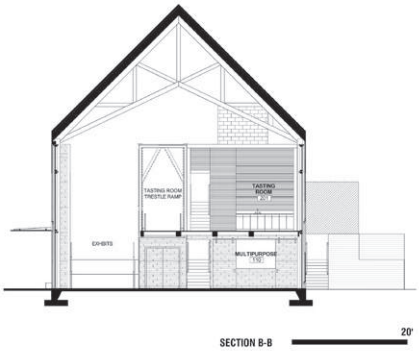


Figure 34: Section

Programme

Case Studies
Brockholes Visitor Centre

Brockholes Visitor Centre
Author: Adam Khan Architects
Location: Preston, Lancashire, England
Year: 2011

The tourists visiting Brockholes Nature Reserve have an opportunity to visit a floating visitor centre. The Brockholes Visitor Centre is a carbon-neutral building on a giant pontoon foundation, which gives unlimited flood protection, and brings the visitor straight to the very special environment of the wetlands. The arrangement of the buildings mimics a small village. Tourists are learning about the qualities of the area while residing in a safe haven in the middle of the lake. Design has been named 'A Floating World' and draws on the rich tradition of wetland dwellings, full of thatch, reeds and willow. The floating This romantic idea of a floating village is underpinned by extensive sustainability study. The complex is compromised out of smaller huts with high hipped roofs, which apart from aesthetic touch, serves as a great way to improve natural ventilation. The designed stack effect additionally improved the building's environmental aspect and resulted in BREEAM excellent rating. The huts hold various functions -

Figure 35: Brockholes Visitor Centre

cafe, shop, information, a large education space and a series of conference rooms, which can generate additional income. The architect put a lot of effort in the material selection process - facades are clad in oak shakes – which would otherwise be burned as waste; copper gutters are long lasting and recyclable, while insulation is supported with recycled newspapers. The building is the RIBA Awards winner in 2012. The main idea for creation of the visitor centre is to educate people about the wetlands. Aside from being home to many species of animals, wetlands help keep ecosystems in check by absorbing excess water during wet periods and releasing it during dry periods – so losing them would be seriously detrimental to the environment. By preserving these wetlands and creating a sustainable visitor centre on them, Brockholes can educate the public about them without adding more stress to this delicate area. [Meinholdt, 2011]

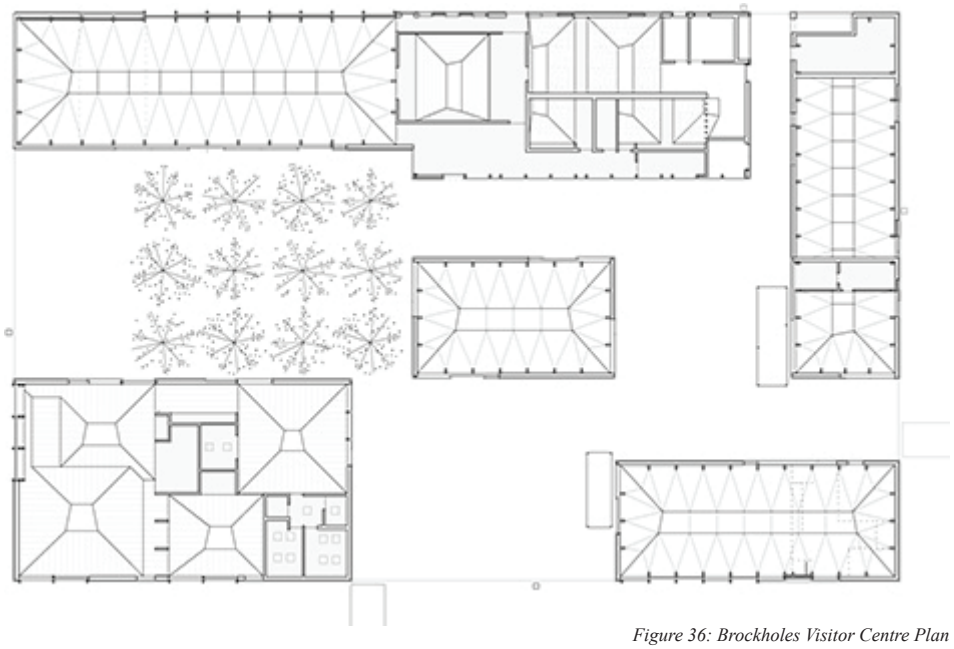


Figure 36: Brockholes Visitor Centre Plan

Figure 37: Interior

Figure 38: Internal Courtyard

Programme

Target Group

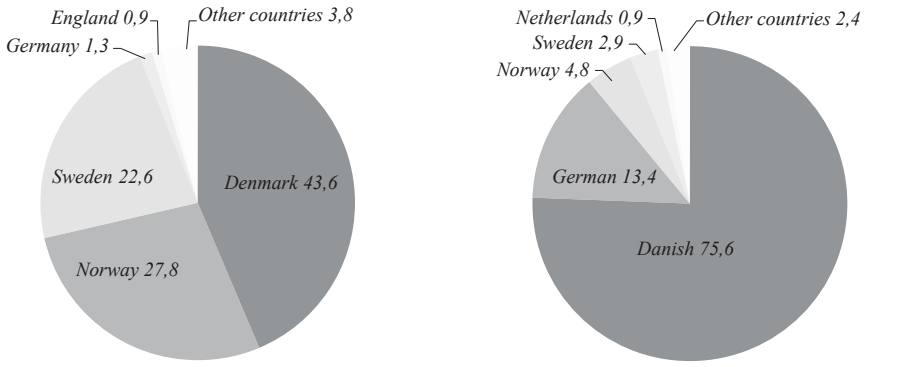


Figure 39:Diagrams presenting the international tourists structure at hotels (left) and campings (right) [MANTO A/S, LBB3 I/S, 2014]

People in Skagen

Skagen is being visited by more than 2 million tourists on annual basis. During summer, there are days when more than 50,000 visitors come to the town and Grenen tip, multiplying the small population of 9,000 inhabitants. [Skagen Historicaly, 2013] Skagen is very popular as a vacation destination for tourists from Sweden and Norway, but also from Germany and Great Britain. Statistics show that tourists from Norway and Sweden together form more than 50% of all the hotel guests in Skagen. As Skagen Odde is known from both its natural and cultural values, it attracts many different kinds of visitors. They can be nature lovers, who come to experience the land, hike through the heaths and coast. They can be also ornithologists coming to observe many kinds of birds living at Skagen Odde. In the same time Skagen is an artistic colony where painters spend a lot of time on trying to catch on the board the beauty of the landscape. Together with them come art-admirers visiting the numerous art galleries located in the town. There is also a group of tourists who come just to see one of the most famous place in the country- the meeting point of two seas. The town is also an attractive stop for seafarers who spend there one of couple of days while sailing. It is also a place where many Danes have their summer-houses.

The number of inhabitants increase significantly during summer period as a lot of people come to Skagen every year for at least couple of weeks during vacations. They already know the land so their main interests are not sightseeing but leisure and recreation.

One of the biggest problem of Skagen is its demographics. Skagen lacks young people and age average increases every year. The municipality is looking for some solutions how to attract young people to the town.

On the following page we are presenting 3 main group of potential Skagen Odde Visitor Centre users.

One day tourists

School groups/trips

Natives/ long stay tourists

Figure 40:Main users

Short stay tourists

The main group of tourists predicted to use the building of visitor centre are tourists who come to Skagen Odde for the first time. They do not know the land and their main aim is sightseeing. They always come to the site from southern direction either by car, bike or walking from the city. For them the building will serve its basic function - a visitor centre that represents the place and familiarise people with the surrounding. It should arouse better understanding of history, and specifics of the land. Main functionalities needed for that group of users are: exhibition space, information, place to have a rest or eat something, restaurant, gift-shop and toilets.

Organised groups & Study trips

The group that we have chosen as a second main user of the building are school or study excursions. Through the whole year a lot of school trips arrive to Skagen to learn about natural and cultural heritage of the land.. For them the building would serve mostly its educational function and the functionality would be enriched with additional workshops, lectures. There is also a big potential for a building in groups of young people, students who could use the building as a summer, artistic academy. Thus the building could help the municipality attracting the young to Skagen.

Local community / long stay tourists

The last group that we decided to consider as a main user of the building is local community. As locals we recognize not only people living in Skagen through the whole year but also seasonal inhabitants who come to the town every summer for holidays. For them the building would serve slightly different functions. It would work more like a cultural centre where lectures, exhibitions and cultural events could take place.

Programme

Spatial Program

Introduction

The case studies and programme considerations served as a basis for understanding the needs of a typical visitor centre. Further studies in the areas of historical, cultural and natural background, as well as sociological aspects, resulted in a holistic image of visitor centre requirements. The aim is to create a multi-purpose visitor centre that will cover needs of different groups of tourists.

Visitor centre

The main function of the visitor centre is to provide guidance and information to the tourists. Information point should be placed in the entrance area. The visitor centre should be characterized by openness and friendliness towards the visitors. The visitor centre workers should function as personal contacts for the tourists and help them with organizing trips, bookings and reservations. The visitor centre should also cooperate closely with local businesses.

Exhibition space

The exhibitions are the vital part of the project. This is the main form of influencing the tourists. The visitor centre should communicate knowledge about 2 main topics: culture and nature. Permanent exhibitions should serve as a basis while additional smaller periodical exhibitions should bring more life into the centre.

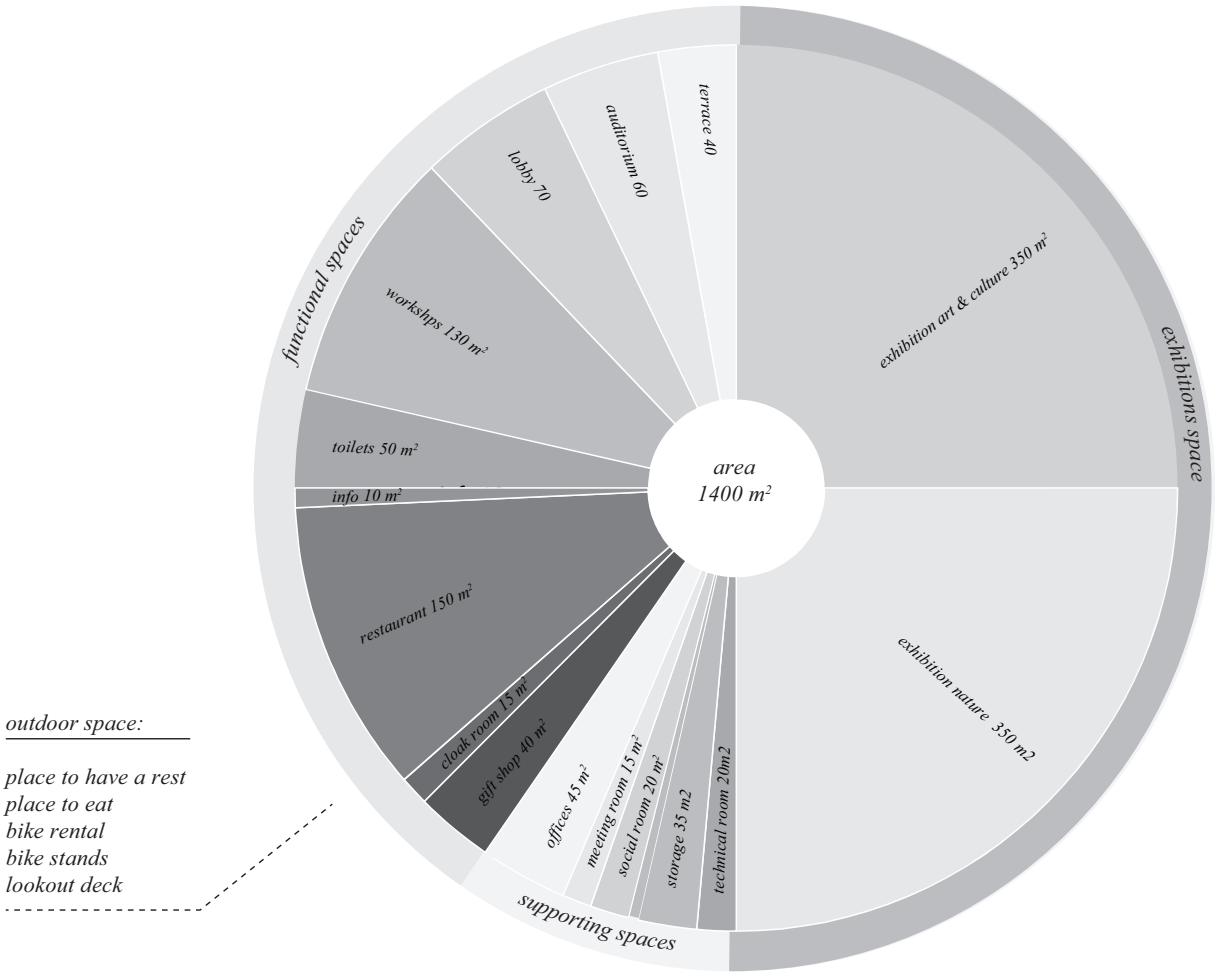


Figure 41:Spatial Program

Education & meeting space

Additionally, the Visitor Centre should actively educate about the features of the locality. It should encompass classrooms for lectures and workshops. The visitor centre should have the possibility to organize events for students from kindergarten to university level. Additionally, the space could also be used for meetings, conferences and other events. With the nature and culture in focus, the meeting space should be open to people that want to organise events like for example art exhibitions or small ornithologists meeting.

Supporting spaces

To operate, visitor centre needs some additional space, not available to the tourists. The building should encompass office spaces for the workers, together with a social room, meeting room for staff and toilet. Additionally it should also have technical rooms and storages.

Program Analysis

The proposed building programme shows the distribution of the areas between different functions. The biggest areas are being taken by public functions - functional space and exhibition space. Some of these spaces need to be closed, but the most of them could be freely accessible from one homogeneous space.

Programme

Exhibition Themes

Themes

The visitor centre focuses on the aspect of meeting of two worlds - art and nature. The proposed exhibition themes should focus on those two subjects.

Figure 42:Exhibition theme - nature

Nature

The exhibition should educate people about the natural qualities of Skagen. The viewers should briefly understand the geological features of Skagen Odde. Models and simulations should introduce them to the complicated process that lead to the peninsula moving constantly. They should learn about the specific natural environment created by wetness of the sea and the dryness of the wind by looking at different examples. They should also learn about the importance of creating preserved areas. Finally they should also learn about the fauna of Skagen Odde - the magnificent amount of birds and other species.

Figure 43:Hip, Hip, Hurrah!" Peder Severin Krøyer, 1888

Figure 44:"The Lifeboat is Taken through the Dunes" Michael Ancher, 1883

Art

The Art exhibition should focus on communicating the rich history of Skagen as artists' colony. The viewers should learn about the beginning of the colony, establishment of the painters society and finally the founding of Skagen Museum. The exhibition should also present non-painterly works of artists connected to Skagen - literature, sculptures, crafts. Finally, some cyclical exhibitions could also present more contemporary painters and artists to show that Skagen still exists as artists' destination.

Plot Analyses

Climate

Terrain

Infrastructure

Surroundings

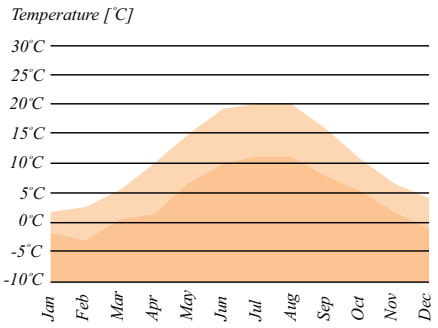
Reflections & Conclusions

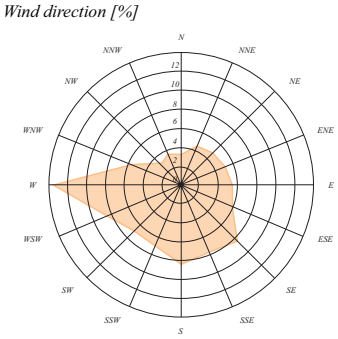
Plot Analyses

The section contains further analyses based on the chosen location of the building. We are trying to develop the understanding of the area and gather the knowledge about local conditions that will help us to develop the project.

Plot Analyses

Climate





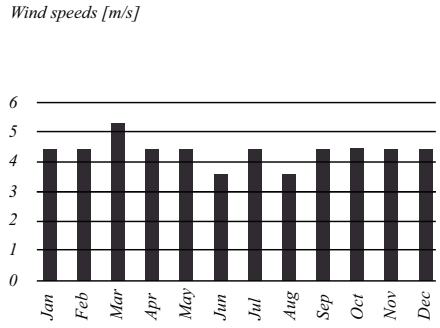


Figure 45:Weather charts

Temperature

The temperatures are being regulated by the closeness to the sea. The Köppen Climate Classification subtype for this climate is "Cfb". (Marine West Coast Climate). The average temperature for the year in Skagen is 8.3°C. The warmest month, on average, is July with an average temperature of 16.1°C. The coolest month on average is February, with an average temperature of 0.6°C.

[Meteoblue: Climate Skagen, n.d.]

Wind direction

There is no other place in Denmark apart from Skagen Odde that is so much dependant on the wind force. Wind and weather influence and change the landscape of Skagen Odde every day so the land is never the same. Wind is a force that cause a constant movement of the land. As main wind direction is west, the peninsula is slowly moving towards east. While weather changes into strong eastern wind the branch's movement turns into north. [Skov, 2014] What is more, the wind force influence not only the shape of the whole land. The constant change is also visible in the moving dunes. This unpredictability and wildness of the landscape is its great value.

Wind speed

As Skagen Odde is a coastal area surrounded from two sides by the water, the average wind speed is quite high. The area is quite windy due to location as well as the flat topography. The land is highly exposed to the wind force. Although the average wind speed values are not exceeding 6 m/s but there are days with extremely intense wind with values up to 17 m/s. [Meteoblue: Climate Skagen, n.d.]

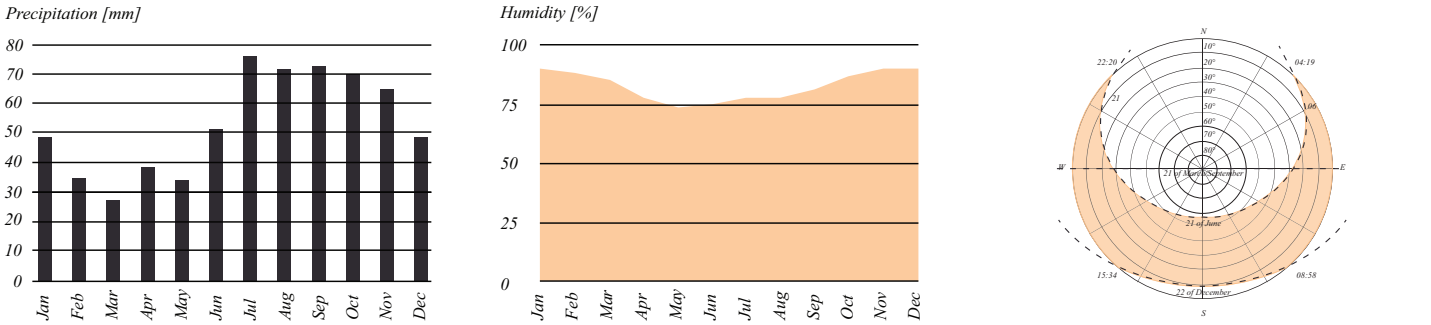


Figure 46:Weather charts

Precipitation

The precipitation levels are highest during the holidays period. According to the weather data, the winter months bring small amounts of snow. In general closeness to the sea and marine climate of the area makes the weather unpredictable. It's generally comparatively humid with high level of precipitation. Precipitation is most likely around December 22, occurring in 75% of days (with higher chance of rain than snow). Precipitation is least likely around May 7, occurring in 50% of days. [Meteoblue: Climate Skagen, n.d.]

Humidity

The humidity levels stay close to the values of 75-90%. The air humidity very rarely go below 35%, but often reaches 100%. The air is driest around May the 15th, and most humid around December the 21st. Humidity levels are indicating the high likelihood of precipitation, dew, or fog. High relative humidity also changes human perception of the temperature, with higher values resulting in higher perceived temperature. [Meteoblue: Climate Skagen, n.d.]

Daylight

Skagen, with it's very northern position, have very varying day length. The length changes from 6 hours in winter, up to 18 hours in summer. This also results in big difference of the sun angles between different seasons. The angle differs between around 9 degrees on the 22nd of December at noon, to around 55 degrees on the 21st of June. Skagen is also the place with one of the largest amount of sun hours per year, reaching on average 233 hours per year.

Plot Analyses

Terrain

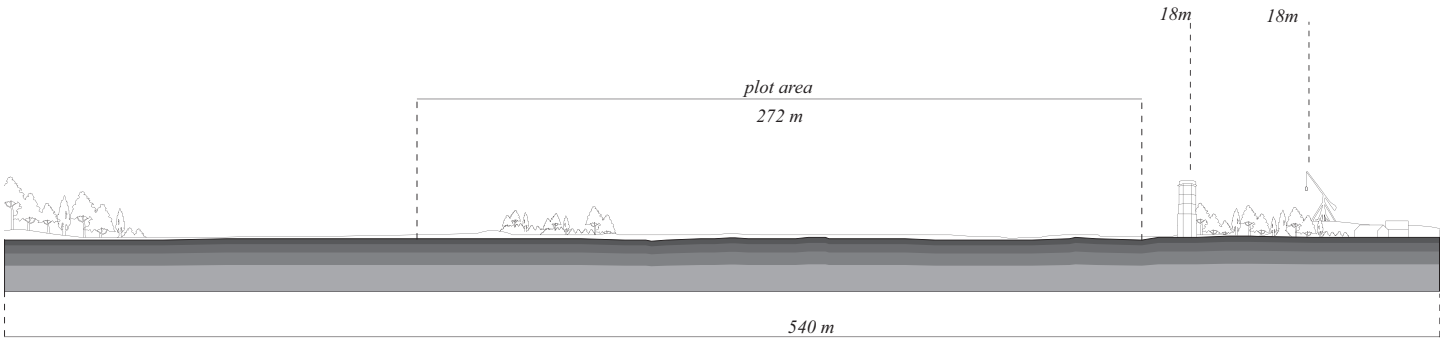


Figure 47:Terrain section B-B

Terrain

The plot lays in a relatively flat area where the differences in height do not exceed 1,5 m. Terrain around the plot is filled with small scattered mounds covered by grass and heaths. The highest spot in the area is a hill with "Vippefyret" that is placed around 120 m to the south from the plot. The terrain rises slightly towards north-east direction. In bigger scale the area is perceived as flat but in smaller scale there are a lot of small terrain fluctuations. The topography implies good light conditions as it does not obstruct daylight.

Terrain influence also wind conditions. The plot is not sheltered from any side and therefore is exposed to quite strong wind.

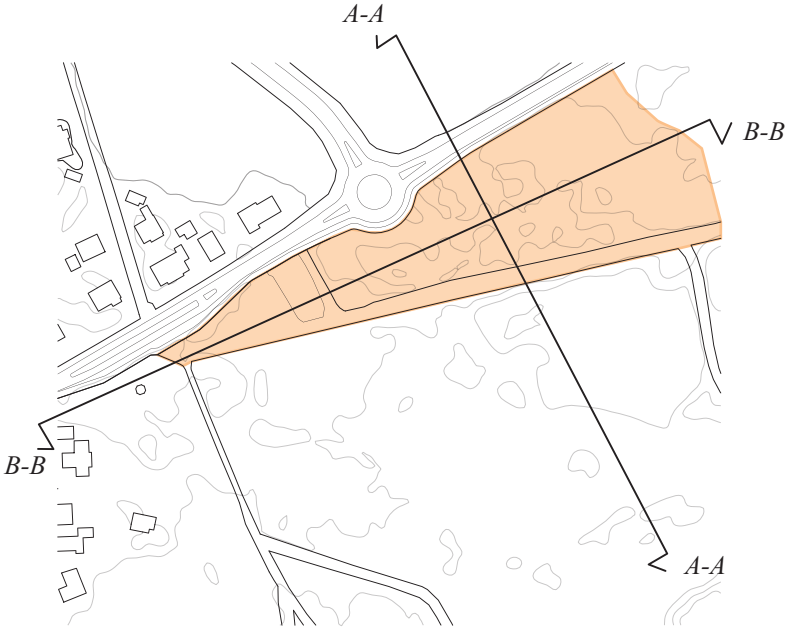


Figure 48:Map of the plot

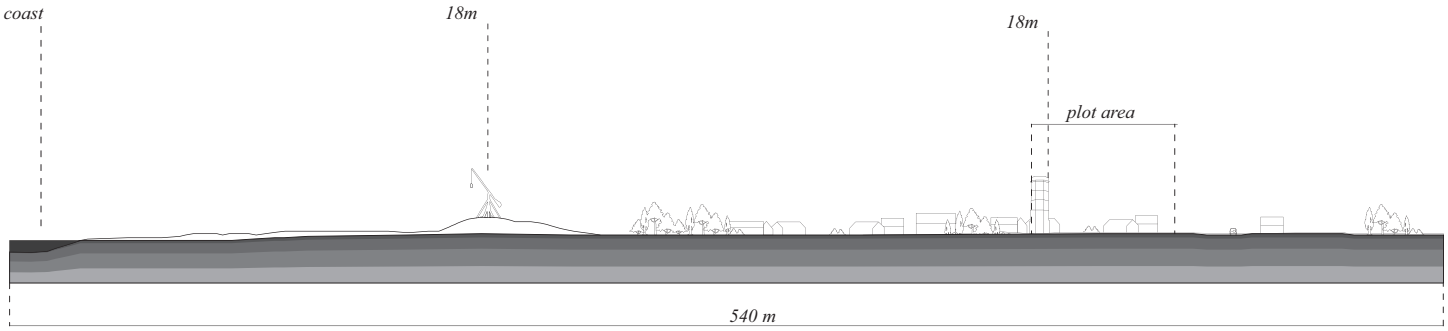


Figure 49:Terrain section A-A

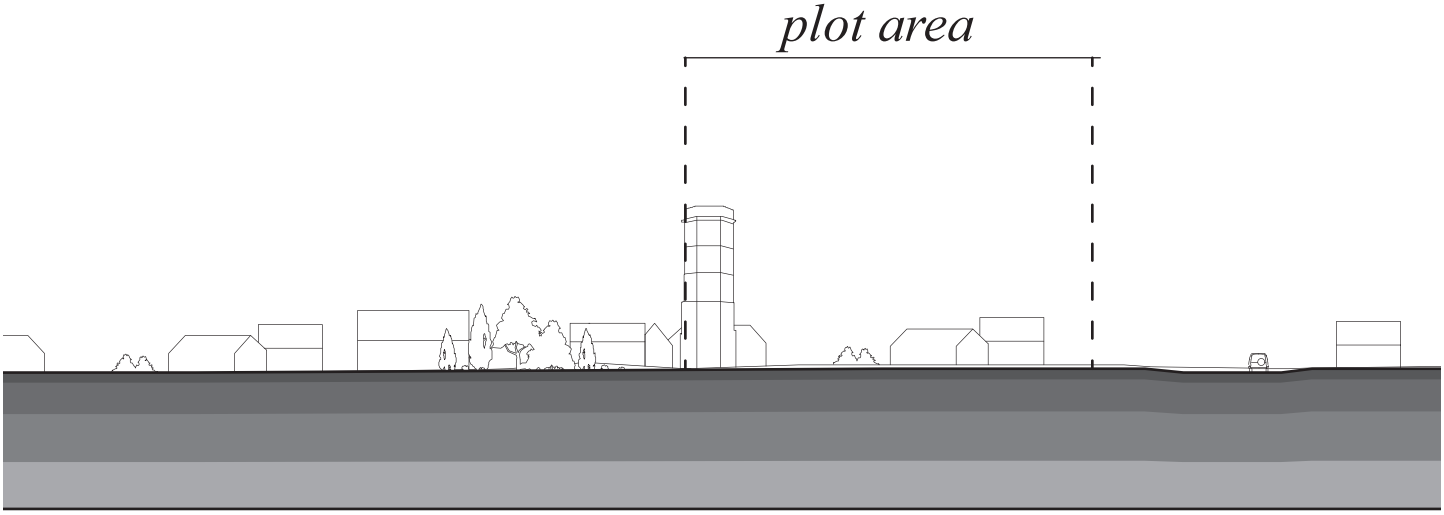


Figure 50:Terrain section A-A close-up

Plot Analyses

Infrastructure

Central point

We have chosen to situate the building in a very special location where many important directions meets together. It is a place where Skagen City spreads into moors and where the lonely, old lighthouse guards the entrance to the town. It is a border between civilised and wild world. The location allows to communicate the visitor centre both with Skagen, Grenen, Skagen Odde Natur Centre and coast with Vippefyret. There is also an infrastructure for cyclist with a bicycle path leading from Skagen to Grenen and camping space located near the plot.

Beginning of the journey

Currently western part of the plot serves as a parking space for tourists visiting both Vippefyret and old lighthouse. It is also a place where some of the tourists leave their cars to continue their trip to Grenen either by bike or foot. For majority of people it is just a passing point while leading from the town to Grenen.

Shape of the plot

The plot lays along the road. In the central point it adjoins a roundabout. The wedge shape corresponds to the axis Skagen -Grenen and would be an important aspect while designing the building. Its shape is very dynamic. From south-eastern direction the plot opens up to a beautiful wild landscape and sea. The estimated area of the plot is 12 000 m^2. It is 240 m long while its width varies from 12 to 85 m.

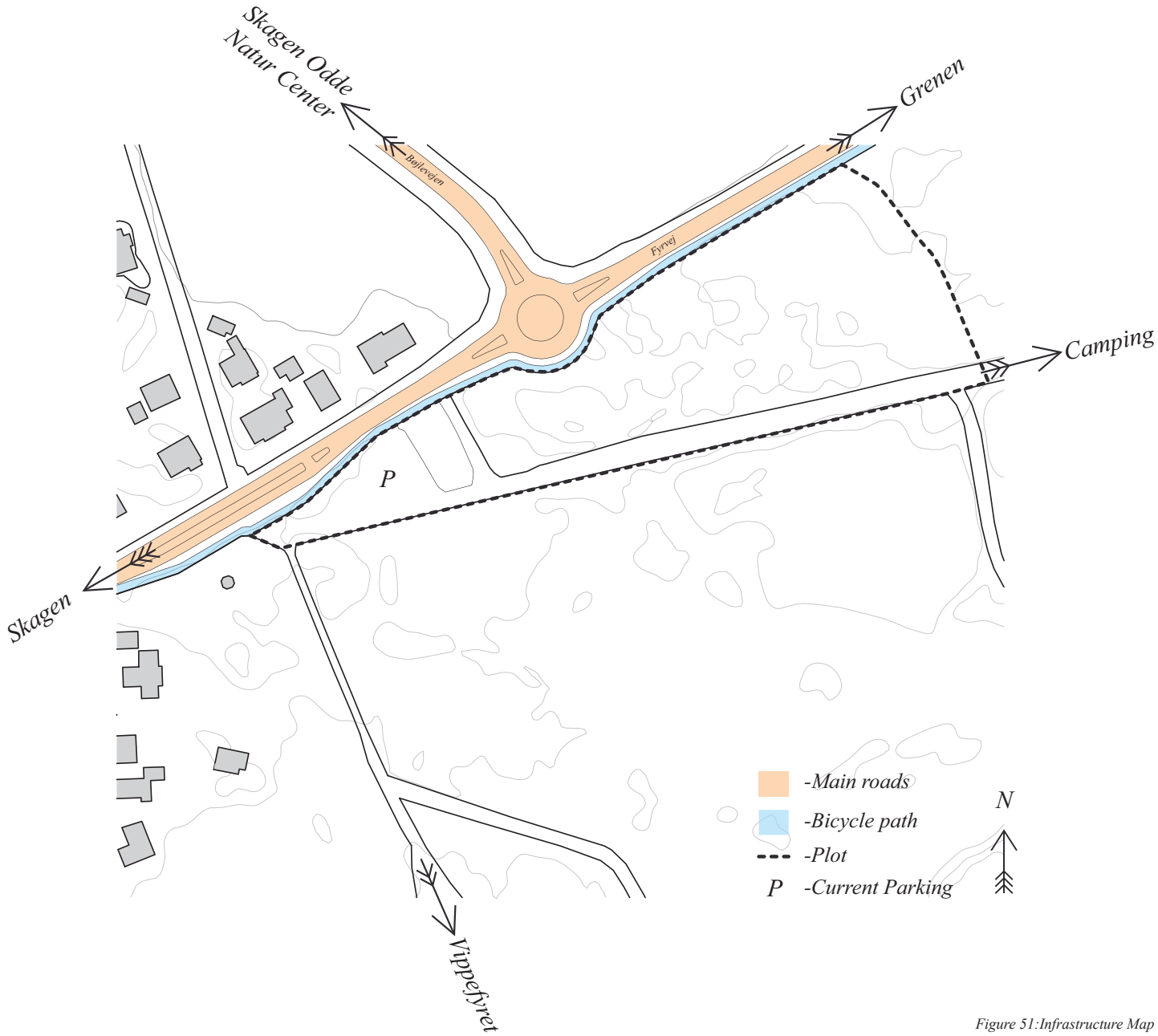


Figure 51:Infrastructure Map

Plot analyses

Surroundings

Heaths
The site is surrounded by vast heaths and grasslands, bordering close to the sandy coast. Terrain fluctuations create a multi-layered scenery consisting of heaths, sand, sea and sky.

Figure 52: Landscape around the plot

Figure 53: View from the plot

Vippefyret

A few important landmarks are visible from the site. One of them is Vippefyret. Vippefyret in English means tipping lantern. It was a type of small navigational aid popular in Denmark in the older days. The vippefyret in Skagen is a reconstruction of the original object which was built in 1626 and was based on the design by Jens Pedersen Groves.

Figure 54: View on the old lighthouse

Det Hvide Fyr

The White Lighthouse has been designed by dutch architect Philp de Lange. It was operational from 1747 to 1858. It the first lighthouse in Denmark to be built of brick. The initial raw brick appearance has been whitewashed at the beginning of the 19th century. Today it serves as a tourist attraction and a lookout point.

Figure 55: Approaching the site

Arrival

When approaching to the plot we see how the town spreads into natural landscape. The view from the street is enclosed by the old lighthouse that is an unquestionably dominant in the area.

Conceptual studies

Spirit of the place

Between nature & art

Structural concept

Conceptual studies

The section presents the conceptual ideas that set the basis for the whole building's design. This presents our approach to the methodology of designing a building where the concept is a primary element of Integrated Design Process.

Conceptual Studies

Spirit of the place

Genius Loci

"Genius Loci" derives from Roman mythology where it was considered as a protective spirit of a place. [Wikipedia: Genius Loci, n.d.] In the modern interpretation, it has been proposed by Christian Norberg-Schultz. Today the term is often used by architects who relate it to the essence and atmosphere of certain location. Every place on the earth has its individual combination of characteristics that portray it and reflect its atmosphere. They form a basis for architectural interpretation. The role of a building is to catch this essence and present it the visitors to strengthen their experience of the place. That is why in the beginning of conceptual studies we decided to explore what is the Genius Loci of Skagen Odde and express it through the architecture of the building.

Spirit of Skagen Odde

First associations when thinking about Skagen Odde are nature and art. Two things that Skagen Odde is most famous from and that create its unique identity. Cultural and wild sides of Skagen are very different and contrasting but in the same time only together they form an unique relationship -a dualism that is the real essence of this place. Natural side of Skagen Odde is very wild. Elements and natural forces like wind, power of the sea, sky and light every day distinctively affect the land. The sea and wind influence the constant movement of the terrain, clear sky and extraordinary light gives an unique effect that gives the atmosphere.

Another important feature of the place is its dynamism. The terrain is constantly moving and changing its shape, light dunes migrating through the land. Finally the two seas fighting with each other. This dynamic effect is enhanced by a strong wind that is typical in Skagen. When being at Skagen Odde one of the most extraordinary experiences is light. It is something that in XIX century brought along to Skagen all the marvellous painters and something that today delights the tourists from all over the world. The spectacular light conditions are caused by the sun being reflected in the water of the seas on both sides of the land.

Another thing associated with Skagen Odde is sky. Flat terrain without bigger forests and obstacles gives a clear view on the sky. Always we can see a definite edge between land and sky - the horizon line.

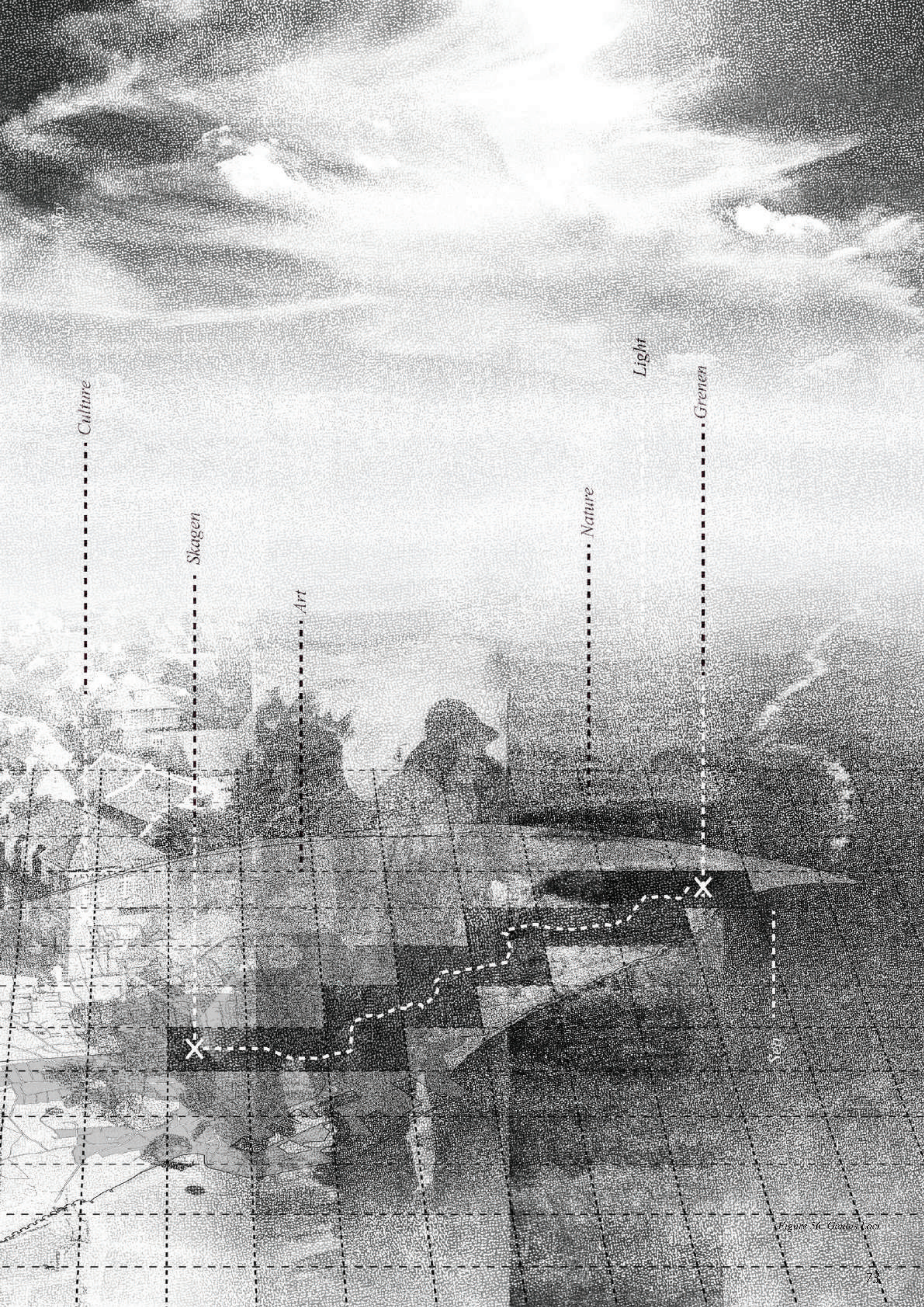


Figure 56: Genius Loci

Conceptual Studies

Between nature & art

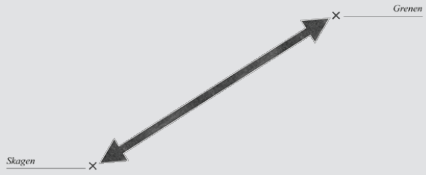


Figure 57: Dualism Skagen - Grenen

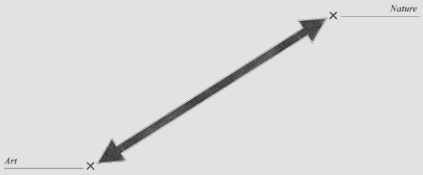


Figure 58: Dualism Art - Nature

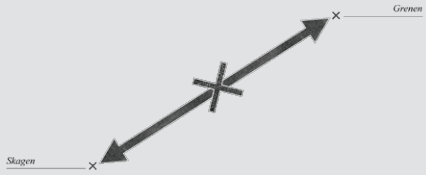


Figure 59: Building "in between"

In between two worlds

We started conceptual deliberations having in mind the importance of both Skagen and Grenen. This unique mixture between natural and cultural values is the biggest attribute of Skagen Odde and creates its special identity. Skagen Odde is a land full of dualisms and contrasts: it is a place of both nature and culture, land constantly fighting with two seas, calm, lasting in almost the same shape from centuries town and wild, dynamic landscape. The relation between nature and culture represented mainly by art is also reflected in connection between Skagen town and Grenen - the most precious natural attraction on Skagen Odde. This relation underlies the concept of the building that should express the axis between Skagen and Grenen and create a link between two worlds. Thus we decided to make the axis a main spine of the building We decided to locate the project almost half way from Skagen centre to Grenen cape and make it serve as a place where people can get familiar with both cultural and natural character of the land.

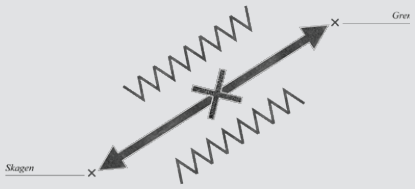


Figure 60: Building interacting with the surroundings

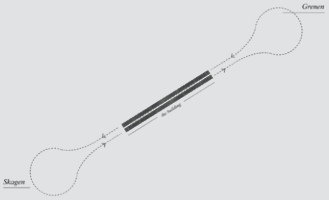


Figure 61: Continous journey

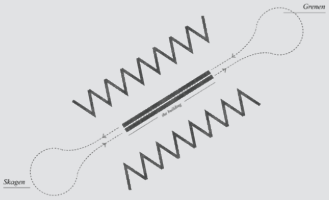


Figure 62: Final concept

Two directional building

While the main shape of the building follows Skagen-Grenen direction we decided that at the same time it should also be well integrated with local surrounding and open up towards the landscape and sea which is on the south-east side of the building. We do not want the building to obscure the view of the water from the road. We have been looking for a concept that could in the same time create a strong visual connection between Skagen and Grenen and that would be somehow transparent in the other direction. Important for us was also making the building a part of longer journey. It would be perfect if the visitor centre was just an introduction for visiting Skagen Odde and the journey was continued. We mixed this idea with the long shape of the building and its position half way from Skagen to Grenen and proposed a visitor centre that could work in both directions. People could first go through the building toward Grenen and gather information about natural values of the land later continuing the trip towards Grenen. After sightseeing they could return to the building and continue the journey through the exhibition about culture & art. In this sense the building becomes a part of a longer journey through the whole Skagen Odde.

Conceptual Studies

Structural concept

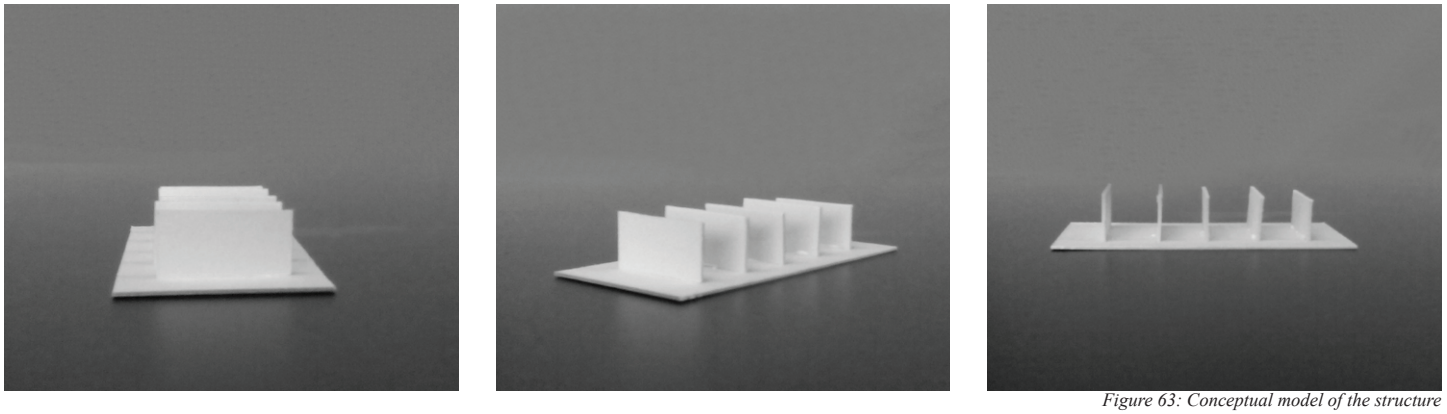


Figure 63: Conceptual model of the structure

A structure that creates a gradient

The development of the concept evoked thinking about the structure of the building. The envisioned structure should emphasize two different directions - Skagen - Grenen, and road - coast. The proposed solution is the arrangement of repetitive frames working in both mentioned directions. The perception of the space depends on the human perspective. While approaching the building from either Skagen town or Grenen area, the visitor can see a closed, massive shape - that is being created by the repetitive structural elements. But as soon as he gets closer, the perspective makes the frames more opened and transparent. The building starts to reveal the surroundings and the views through the building. This relation adds a dynamic aspect to the perception of the building. It is constantly changing giving the visitor different spatial experiences.

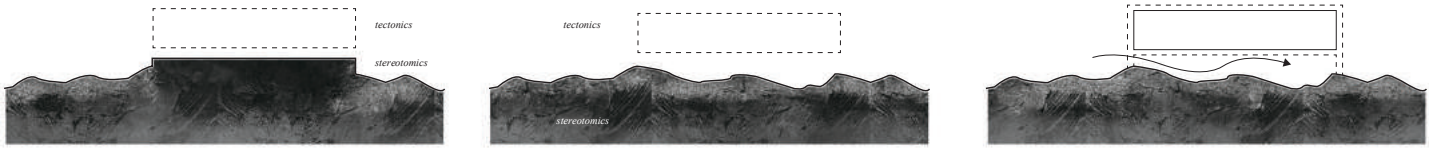


Figure 64: Relation between tectonics & stereotomics

Tectonics in relation to the surroundings

The land of Skagen Odde is very dynamic, constantly changing, moving and fighting with two seas. The land there is not a firm representation of stereotomic earthwork - a stable foundation on which one can rest. The local characteristic is rather opposite. The sky, wind and water are all different representations of lightness. In order to create a tectonic relationship with the surroundings, the building should look for stable foundations deeper underground. The building should by floating over the terrain, that is not a place of rest but a scene of constant change. The border between the Semper's tectonics and stereotemics is moved below the ground - everything on top should represent lightness. Both floor and roof are held by wooden structure.

Presentation

Part of longer journey

Masterplan

Arrival

Plan

Entrance

Revealing the place

Interaction with the surroundings

Cultural Centre

Nordic Academy

Entrance from Grenen

Spatial relations

Details

Exploring Skagen Odde

Facades

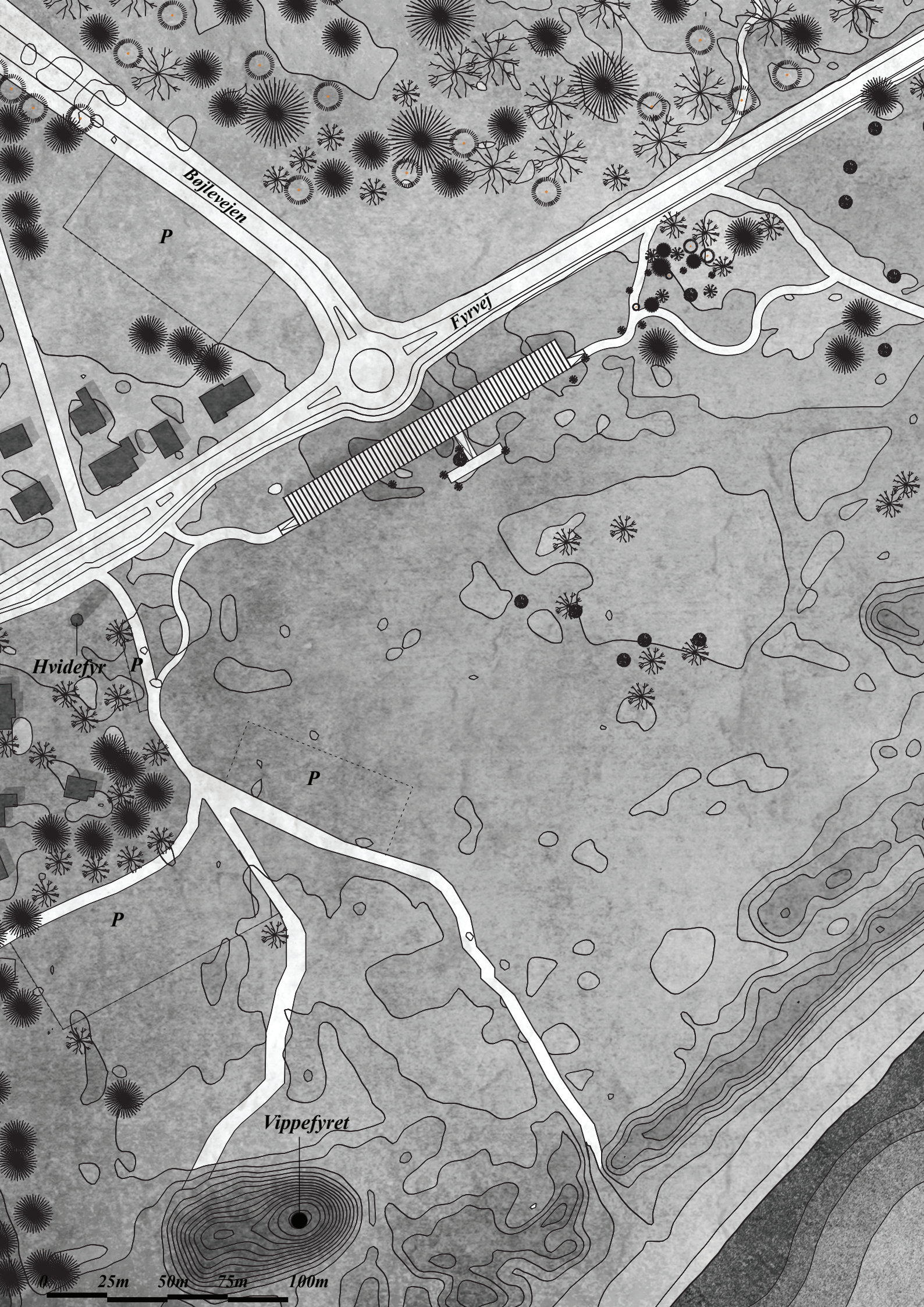
Presentation

The section presents the final design of the building. It consists of both interior and exterior visualisations, plans, sections, facades and detailed drawings in order to present the project in a holistic way and help to understand better the concept of the building.

Part of longer journey

The building creates a passage that connects Skagen with Grenen. The endings of the building are gateways towards the town and nature. At the same time the longer facades open up to the local surroundings.

Figure 65: Part of longer journey


Bøjlevejen
Fyrvej
P
P
Hvidefyr
P
P
P
Vippefyret
0
25m
50m
75m
100m

Master plan

The Visitor Centre creates an alternative way of sightseeing the place. It is bypassing the road leading to Grenen and encouraging people to start sightseeing earlier. The building is connected with local walking trails leading to Vippefyret, Grenen, coast and Skagen Odde Natur Center being the hub point of the area. The parking spaces have been split into smaller spots scattered around the building to minimize the impact on natural landscape. The building is rotated 60 ° from North-South axis opening one of the longer facades toward the beautiful view of the coast.

Figure 66: Masterplan

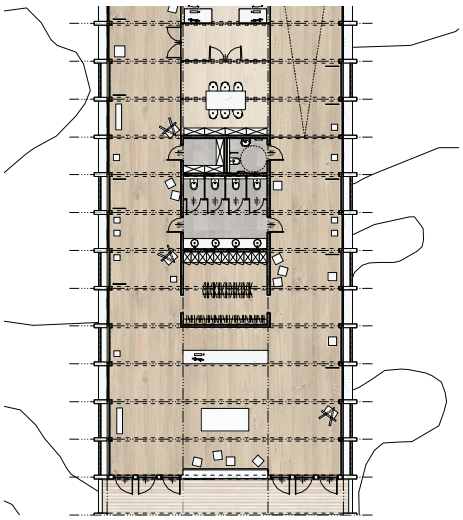
Arrival

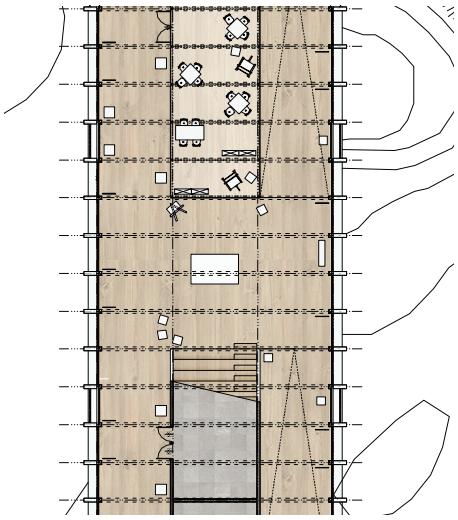
Visitor Centre is fitted into natural landscape of Skagen Odde. Its impact on the ground is minimized to allow the heaths freely grow around. The building is connected with the Fyrvej by a naturally meandering path that emphasizes the continuity of the journey. It meets with the ramps that reach outside the main shape of the building, creating a buffer space between natural terrain and elevated floor. When approaching, the building seems to be a massive form that gradually opens up towards nature.

Figure 67: Arrival view

Presentation

Plan





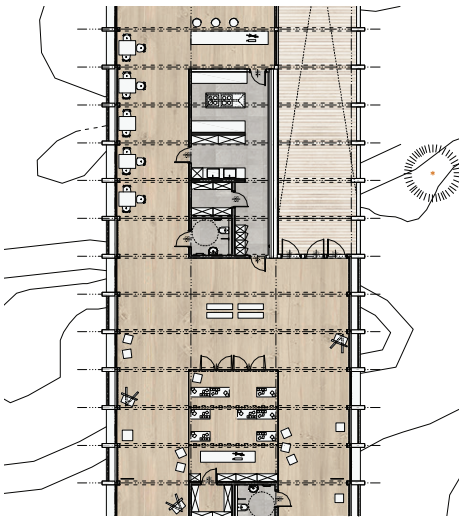


Figure 68: Plan close-ups

Entering from Skagen

The main lobby is placed from city side of the building. It is a place where most of the tourists begin their journey both through the building and through the land. It serves for organizing and getting basic, practical information. The space is equipped with information spot, cloak room, big map of the whole Skagen Odde and toilets. The split into two paths starts there.

Central Space

Central point of the builing is a space where two tracks meet together. It serves as an event space with big open stairs suited to be a comfortable and informal sitting. It can be a place for lectures or exhibition's openings. We decided to keep the auditorium open to the main exhibition tracks as we wanted it to be an inviting and lively space that is not a separated room but a part of the whole building. The important issue was then to control the acoustics what was solved by using special wooden panels both on the walls and ceiling

Entering from Grenen

Visitors entering from the other side have the opportunity to see the cultural exhibition. Typically, they have already visited the Grenen area and have spent a lot of time in the landscape. They can sit in the cafe & restaurant area to have a rest. They can also visit the shop where it is possible to buy gifts, guides and books about Skagen.

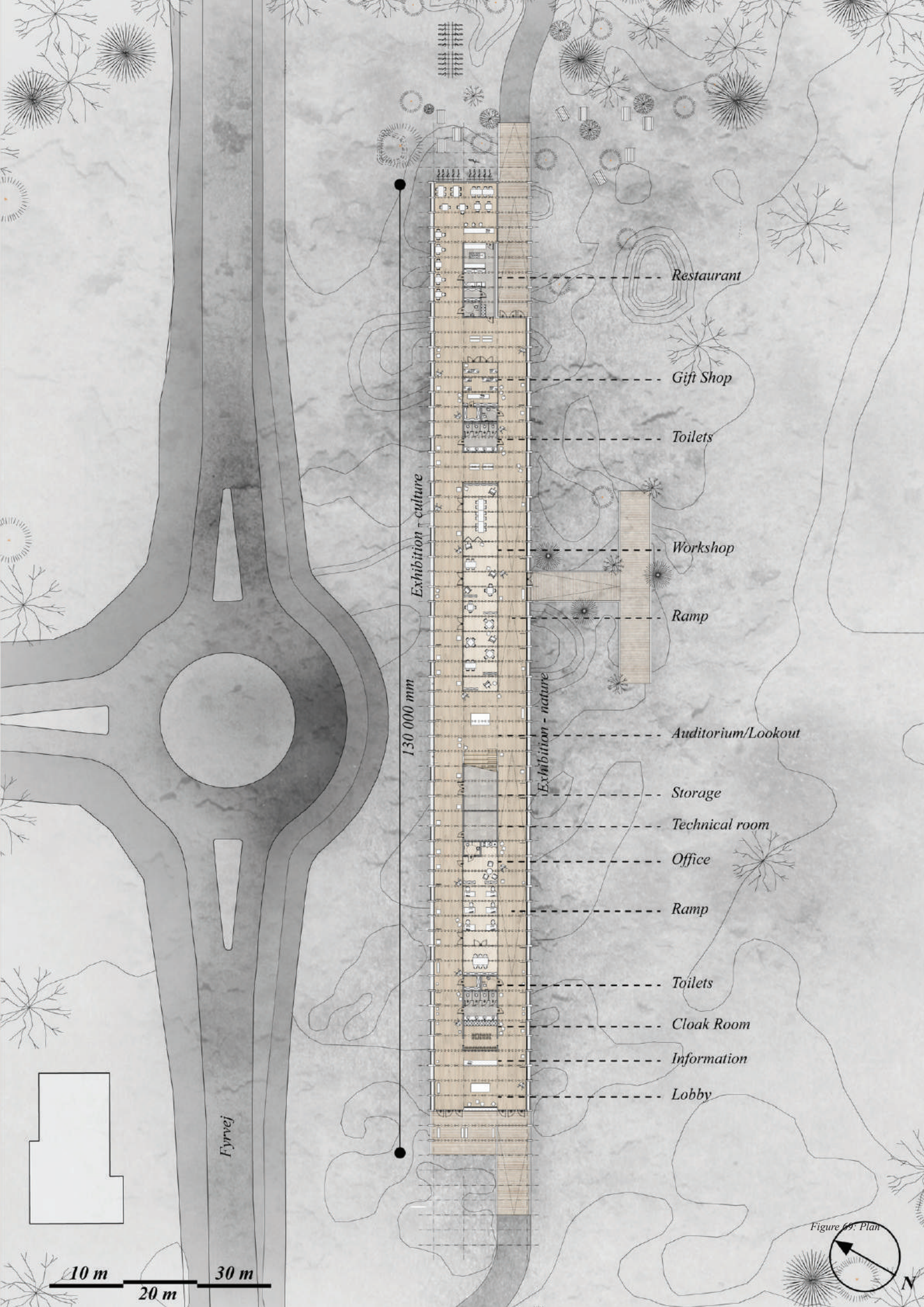


Figure 69: Plan

Entrance

While entering the building, the visitor is leaded towards exhibition about the nature that is equipped with special visual information. Before he enters it, he can use lobby space with information. Enclosed functions contrast with the main exhibition space by the usage of combination between white glossy panels and glass. They also create a visual division into two separated paths of exhibition.

Figure 70: Entrance view

Revealing the place

Viewing the building from the longer facade shows how the perception of the structure changes. Looking perpendicularly to the building, it seems to be completely transparent, allowing the light infiltrate the interior. It also allows to the landscape on the other side of the building. The facade, consisting of glass and wood panels, gradually opens up towards the centre of the building increasing the dynamic effect.

Figure 71: Revealing the Place

Interaction with the surroundings

Where the floor goes down to meet with the ground, an additional entrance has been placed to connect the building with extraordinary scenery spreading behind the south-east facade. The building has been connected with the landscape by a platform that melts into the heaths. It can be used by visitors as an additional exit towards nature, place where they can contemplate the land or as a stand for painters who attend the workshops.

Figure 72: Interaction with the surrounding

Cultural Centre

The building can be also a space for local community where cultural events, exhibitions of young artists or lectures would take place. In accordance to these need, the audit-orium space has been designed. It is a fluid lively space emphasized by big sitting stairs leading to a small mezzanine where lookout and leisure space is located.

Figure 73: Cultural Centre

Nordic Academy

One of the functions placed in the core of the building is a workshop space that can serve as an educational facility. The space has been fitted into fully glazed boxes that ensure proper light conditions and relation with both nature and the rest of the building. The glass has been covered with digital shading film - that allows for easy transparency change of the glass. The effect is shown on the back wall between auditorium and workshop areas.

Figure 74: Nordic Academy

Entrance from Grenen

The two entrances are distinguished from each other by different facilities they are connected to. The entrance from Grenen side is designed close to the restaurant in order to provide a place to have a rest after journey through Skagen. As restaurant is a slightly separated function, it has been positioned at the end of the building to keep its individuality. It also provides a great view for the customers while having a meal.

Entrance space is also connected to the gift shop - a place where tourists can buy souvenirs, gather practical information, or buy basic products.

Figure 7Q5: Entrance from Grenen

Presentation

Spatial relations

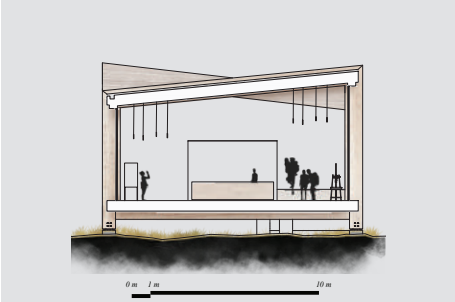


Figure 76; Section A-A

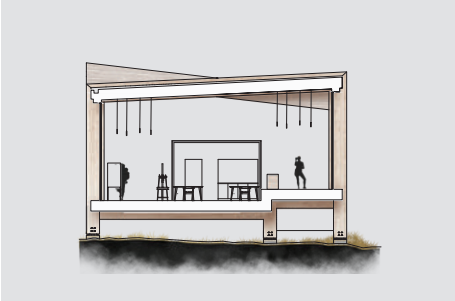


Figure 77: Section B-B

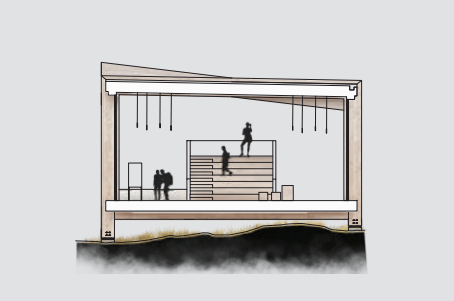
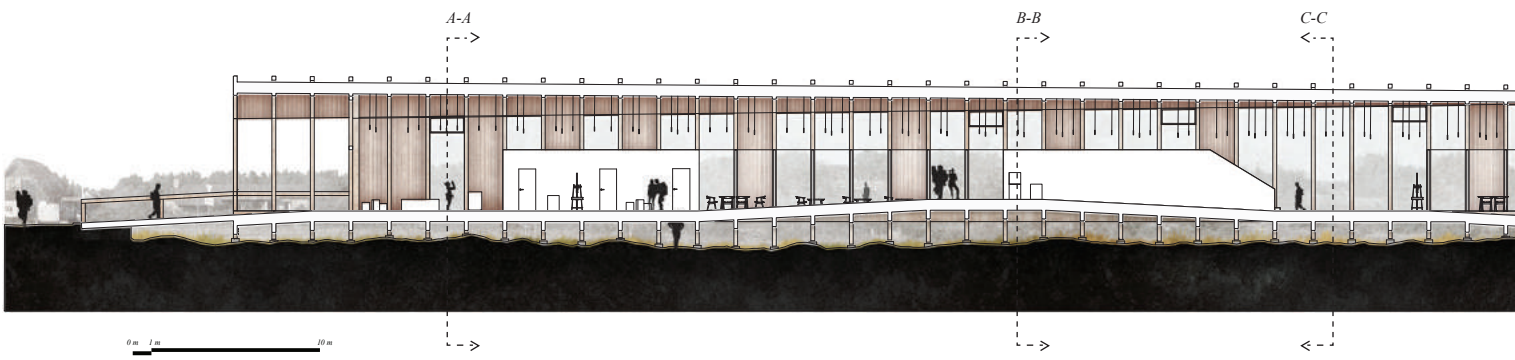


Figure 78:Section C-C

The set of sections presents different spatial relations that the building can offer. Longitudinal section 1-1 shows building's relation to the terrain. The building not only hovers over the ground but one of the tracks additionally changes the levels giving the visitor experience of constantly changing landscape and perspective. At one point it rises 600 mm over the basic level of the floor and sometimes it goes down to meet with the ground. Local differences in levels do not exceed 600 mm but the impression of dynamism is increased as the ramps are going both up and down and the height difference sums up to 1200 mm. Dynamic plan of 'natural' side of the exhibition and flat appearance of 'cultural' part increase the contrast between the two themes and refer to the concept of dualism. The dynamism is also expressed by changing curvature of the roof. The ruled surface changes along the building. Section A-A shows the entrance from Skagen side where the roof gets its maximum hight on south-east facade and minimum height on north - west facade. Coming to the central point of the building, the curvature be-



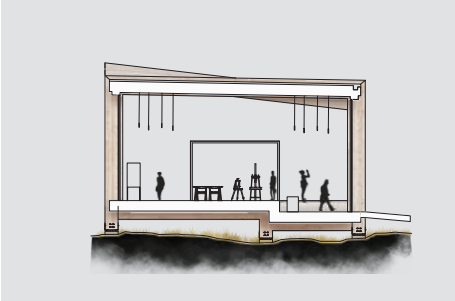


Figure 79: Section D-D

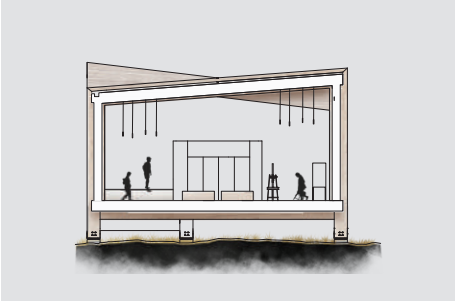


Figure 80: Section E-E

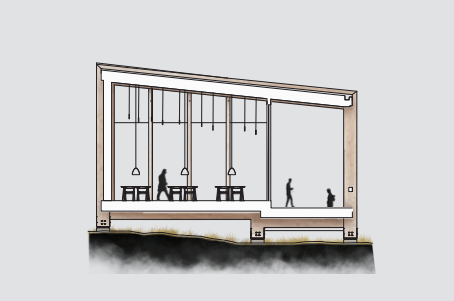


Figure 81: Section F-F

comes flatter and it finally starts growing in the opposite direction. Designed shape of the roof supports acoustic condition, especially in the central, auditorium area. It also stiffens the structure.

All the cross-sections reveal different relations between the three tracks of the building - exhibition spaces about nature and culture and boxes with additional functions that stand in the middle. The boxes are clustered in 4 groups. Some of them are massive, constructed as stud walls with white glossy panels finish. Some of them are fully glazed giving an effect of partial connection between the exhibition tracks. In specific places the clusters of boxes are broken to create wider space that connects the two tracks. Such situation happens for example at the ends of the building (Section A-A and E-E) and in central space. Here the layout merges into one open space, the building becomes the most transparent, without any obstacles in the middle. (Section C-C)

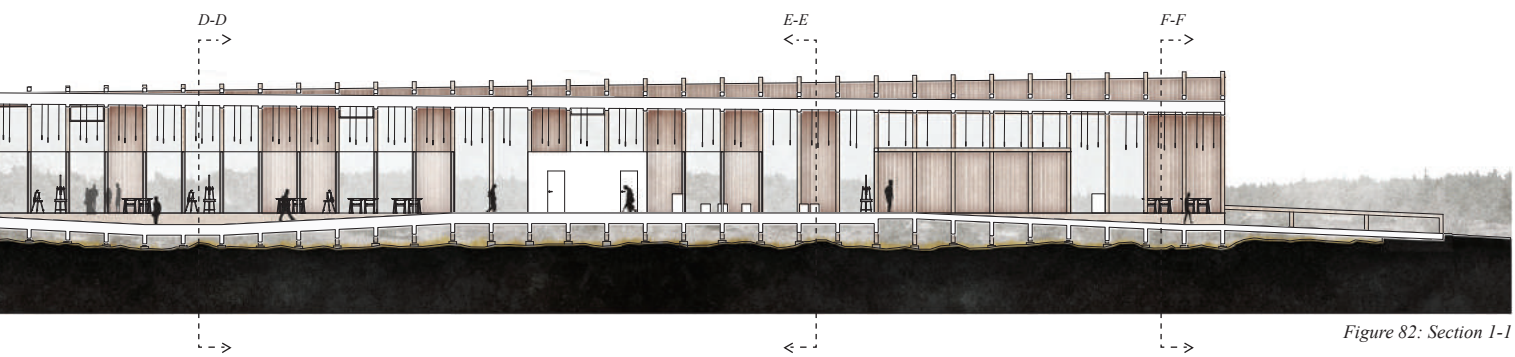


Figure 82: Section 1-1

Presentation

Details

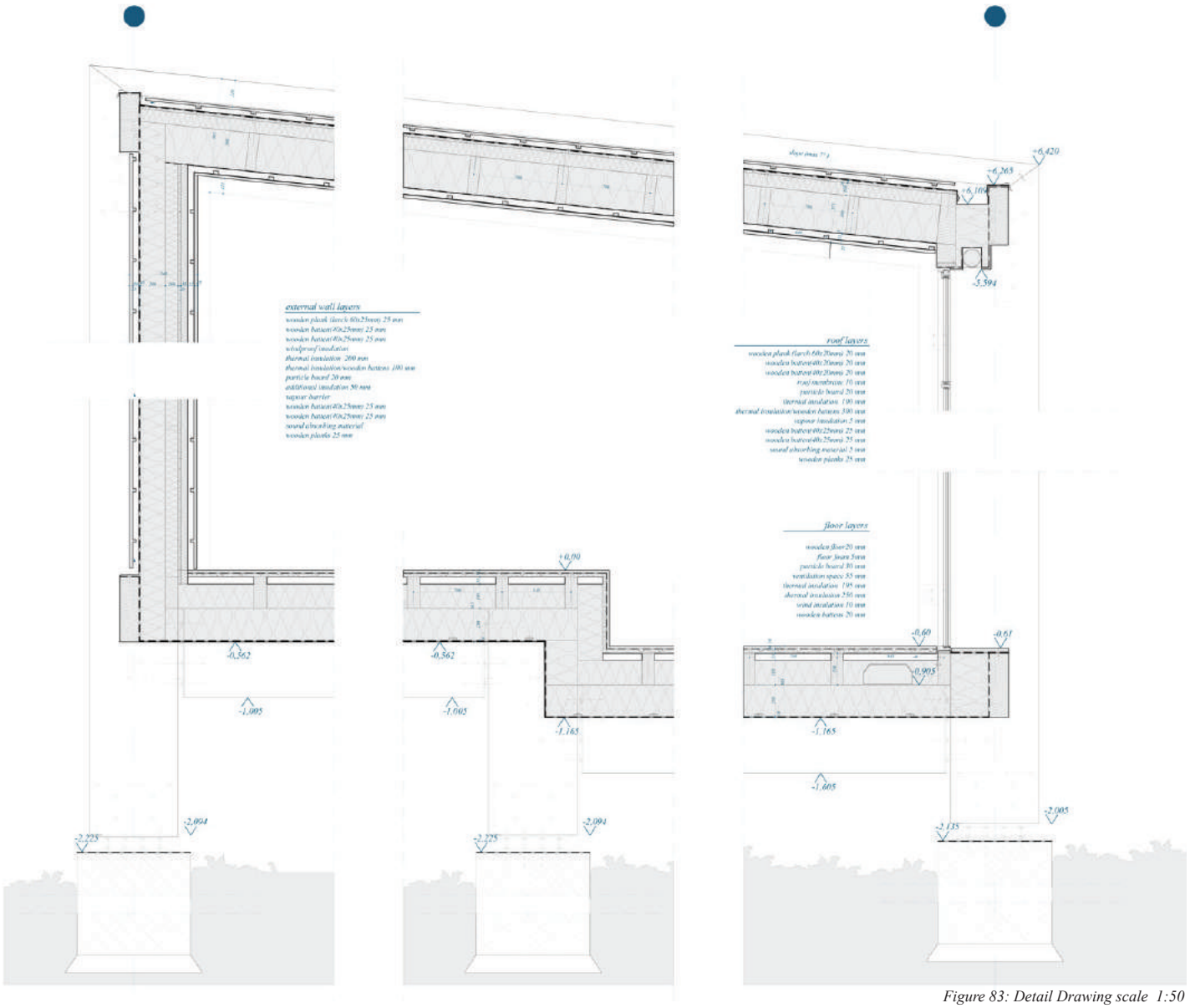


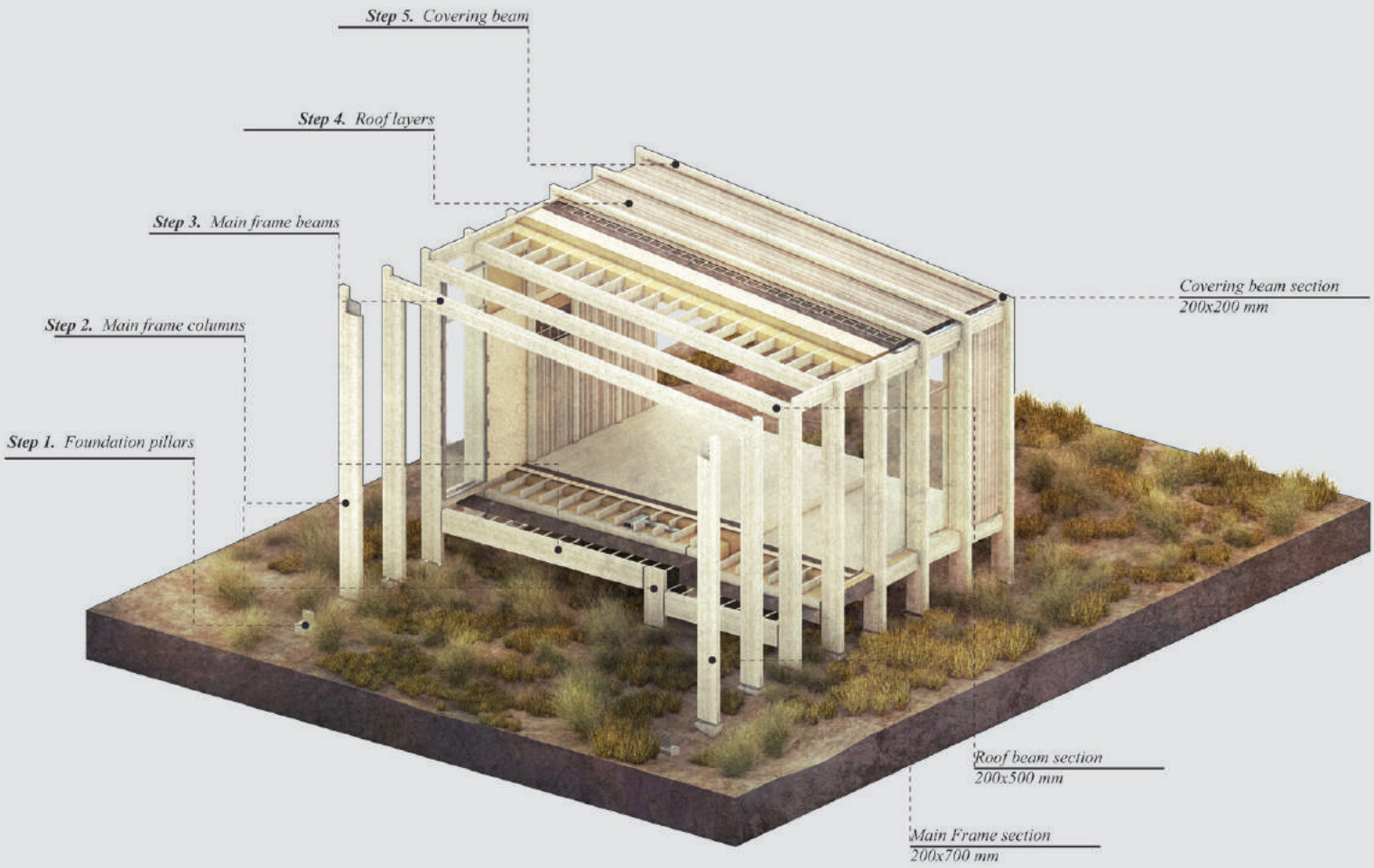
Figure 83: Detail Drawing scale 1:50

Close up. *Window mounting*

Close up. *Ventilation in the floor*

Close up. *Foundation*

Close up. *Drainage system*



Structure of the building consists of a set of wooden frames made from glue laminated larch timber. The material has been chosen due to its resistance. As the structure is an element that shapes the building and creates the effect of gradual transparency, it had to be visible on the outside. Thus the choice of hardwood as a main material was very important. The principle when designing the building was to enhance the effect of the structure and that is why the building's envelope is moved to the inside. Span of the building is 12 500 mm while the distances between the frames are 2000 mm. Optimization of the structural system (see Appendix p. 142-149) let us dimension structural elements so their utilization is most efficient. The 3d detail presents the way of erecting the building with the consecutive stages. All the joints between structural elements have been designed using steel connector plates. The column and top beam of the frame creates a rigid connection while the floor beam is joined to the main frame by a hinge. The top beam has been split into two to ensure a continuity of roof layers that are hidden in between the two beams.

Figure 84: Detail 3d Drawing

Exploring Skagen Odde

As the building is placed in natural landscape, we would like the tourists to be encouraged to explore the place. The land around the building can be used as a place for a picnic, the scenery for painters or a field for natural exploration. At the same time, all these activities can be observed by visitors wandering inside the Visitor Centre

Figure 85: Exploring Skagen Odde

Presentation

Facades

The long facades of the building are exposed to the sunlight. Because of that the final design consists of a mixture between glazed surfaces and solid walls finished with wooden planks. The rhythm and concentration of the walls changes. The building is more massive at the ends and becomes more transparent towards the centre. The arrangement supports the placement of all the functions that need daylight - workshops and offices. The windows, especially in the auditorium space, can be additionally shaded by external roller blinds made of a wire mesh that decrease the amount of daylight but does not obscure the view. The orientation of the building makes the pathway with exhibition about the nature exposed to southern light while exhibition about the culture gets more indirect, northern light that is gives better conditions for presenting for example pieces of art.

Figure 86: Eastern facade

Figure 87: Western facade

Figure 88: Northern facade

Figure 89: Southern facade

Design Process

Design Process

The section presents the design process of the project. Particular studies were not necessarily made consecutively, but often were conducted at the same time. The process reflected the Integrated Design Process strategy - with switching between different aspects of the project.

Design Process

Initial Form Studies

The design process started with investigation of different forms of the building. The considerations have been based on previous analysis of the plot and the surroundings. The main objective while testing different volumes and forms was to find a solution that would reflect and enhance all the most important features of the place. All the proposals have been tested according to their relationship with the local surroundings. Presented phase was very important and supporting during the process of developing the concept of the building.

Very early we have decided that the building should have a longitudinal shape. At the beginning of the process, majority of tested shapes were rather solid and massive. Figure 90 D shows a simple, rectangular shape that is hovering over the ground, with randomly placed pillars. Similarly, figure 90 I is a massive hovering block with a sculptured roof shape that enhances the contrast between lightness and heaviness. Figure 90 H presents a minimalistic rectangular gallery, with a floating roof and visible connection between Grenen and Skagen - the shape starts to open towards surrounding but it is still experienced as an obstacle between the road and the sea. Figure 90 J represents our attempts to break with the longitudinal shape by incorporating a courtyard and a triangular shape, but was soon deemed unfitting as the solution was diminishing the directivity of the building and in the same time it did not support connection in the other direction.

While proceeding with the concept we started to work with more transparent and structural forms. Figure 90 M presents a creased ribbon that connects with the ground and then goes far away from it - that was a solution referring of the lightness of the terrain. Figures 90 K and 90 L show similiar repeating shapes that form a building along the main road - in the first case we can see massive volumes, but the second version shows smaller shapes that start to merge with the surroundings.

Another idea was to create series of smaller buildings somehow connected with each other. One idea was a corridor that could serve also as an exhibition space - figure 90 G. Next proposal was an outside structure that unifies many smaller buildings inside - figure 90 N. This idea was later used to create a basis for the internal rooms.

Finally we have made a conceptual model that became the basis for further considerations - figure 90 S. It shows repetitive shape, which depending on position makes the building open or closed. Starting from this model we began to make variations of the concept - figures 90 T,U,W. The initial form studies finished with considerations about an overall shape of the structure. Different shapes of repetitive elements have been tested to explore spatial relations that they could cause.

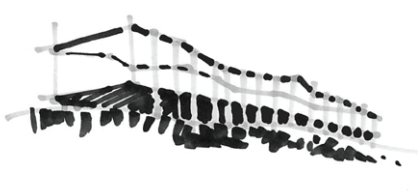


Figure 90 A

Figure 90 B

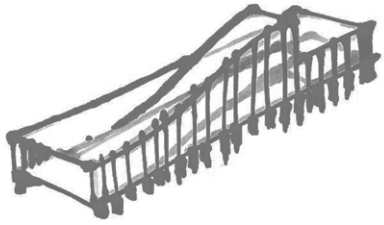


Figure 90 C

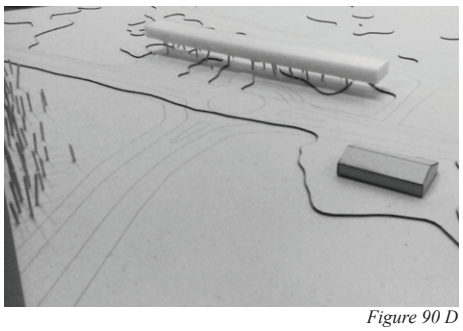


Figure 90 D

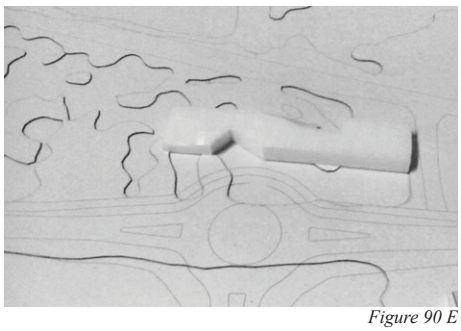


Figure 90 E

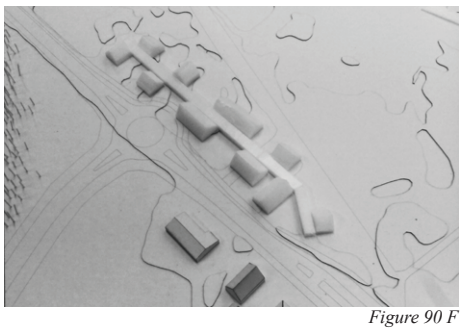


Figure 90 F

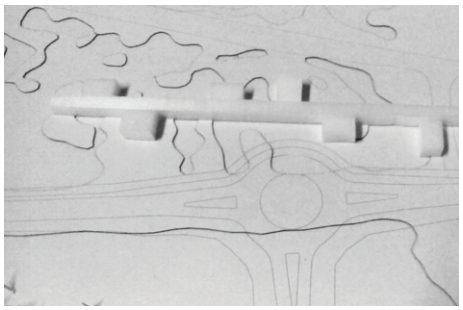


Figure 90 G

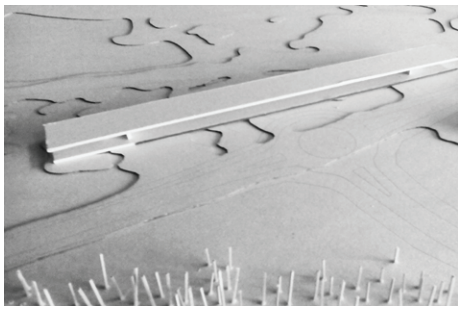


Figure 90 H

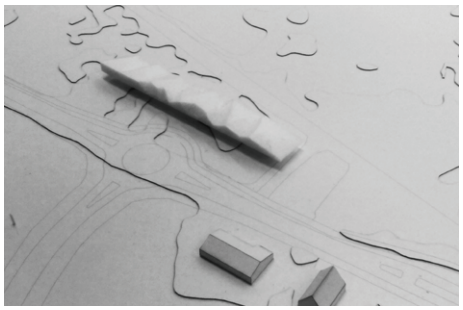


Figure 90 I

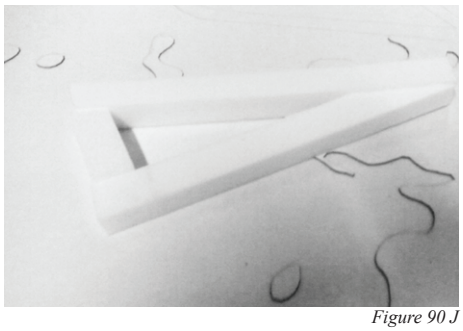


Figure 90 J

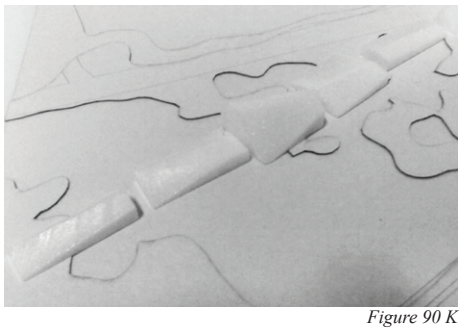


Figure 90 K

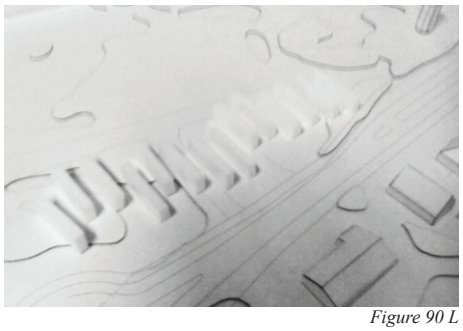


Figure 90 L

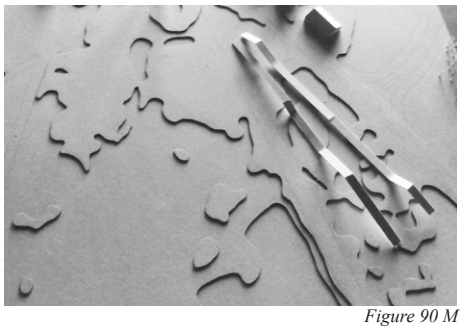


Figure 90 M

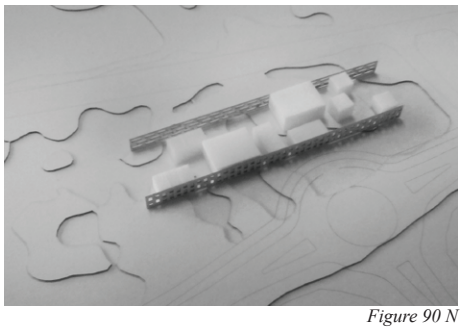


Figure 90 N

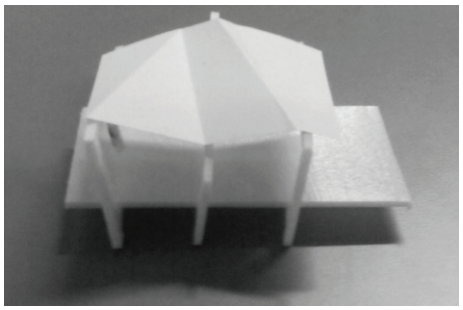


Figure 90 O

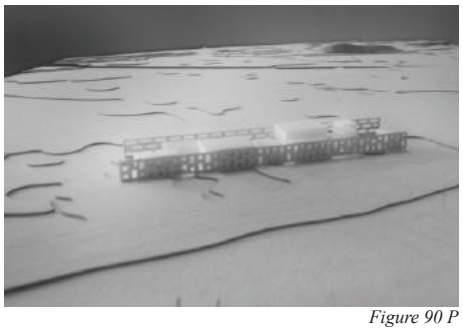


Figure 90 P

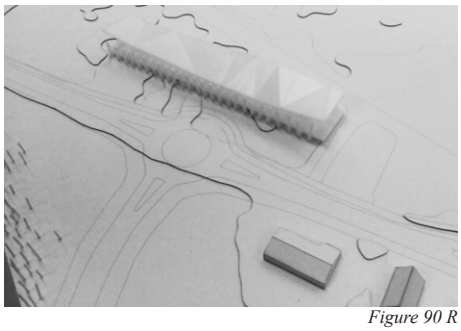


Figure 90 R

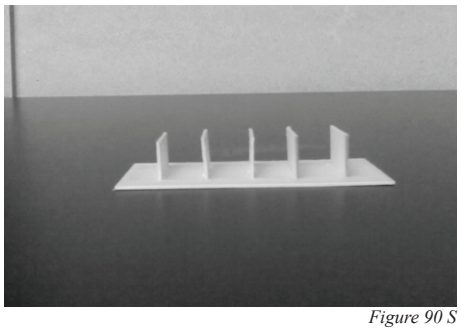


Figure 90 S

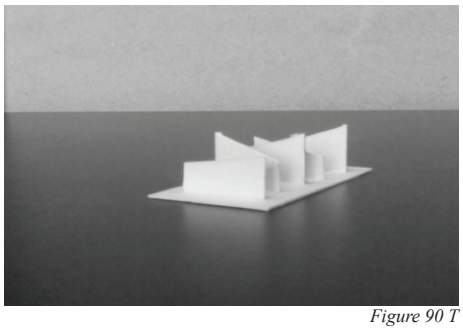


Figure 90 T

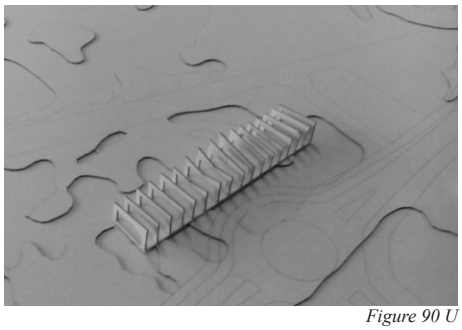


Figure 90 U

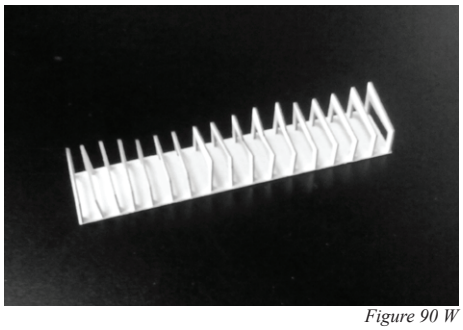


Figure 90 W

Design Process

Further Form Studies

Introduction

The next round of form studies was based on the principle of repetitive elements that create the structure of the building. It was focused on exploring specific aspects like overall shape, spans, distances or density.

Shapes

The first analysed aspect was the overall shape of the building. We have been exploring the variations of flat, curved or more geometric shapes. The system of repetitive frames was giving a lot of freedom while shaping the building, thus we have been experimenting with parametric model in Grasshopper to find the best solution according to aesthetics, structural properties, light conditions and acoustics.

Relation structure - envelope

The next aspect, that has been analysed, was the shape and appearance of the elements and their relation to the envelope of the building. As the structure significantly influences spatial experiences in the building, it was crucial to make decision about its position. We have been exploring variation where the repetitive structure is placed inside the building. Although it is the most common solution, it could diminish the tectonic sense of the structure. Furthermore, an option with the envelope of the building placed in between the structure was tested. It allowed to see the load-bearing system both inside and outside the building but in the same time continuity of building's envelope would be disturbed. Finally, the solution where the structure is an external element has been chosen for further development.

Distances

Having in mind that the structure should enhance the impression of gradual disappearing, different distances between every frame have been tested. First try with the span between frames was too massive and heavy to enhance the concept while the second, with the 4m difference between element, was too open and transparent. The final choice was to use 2 m span which was the most optimal according to reappearance and later structural analysis in Robot. Chosen dimension helps to keep the balance between aesthetics and functionality. It creates great spatial relation which corresponds with the concept.

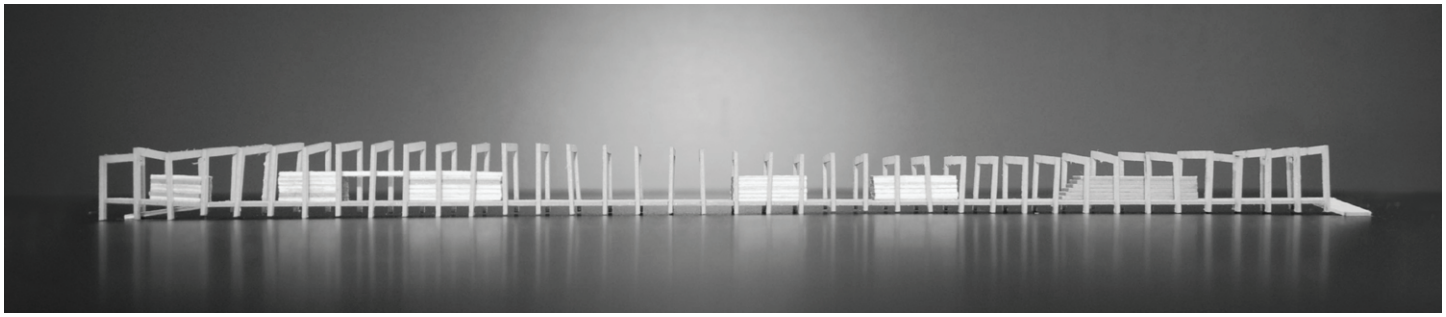


Figure 94: Conceptual model

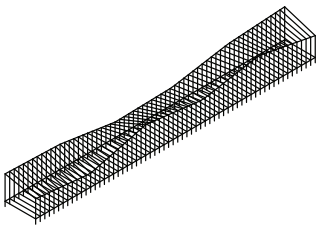


Figure 91 A

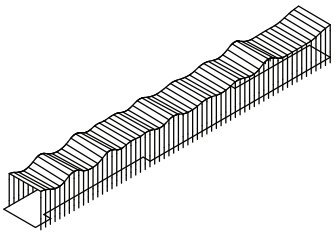


Figure 91 B

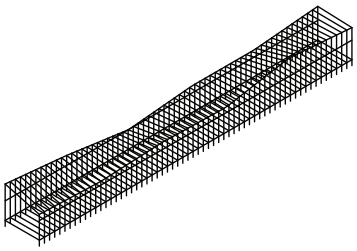


Figure 91 C

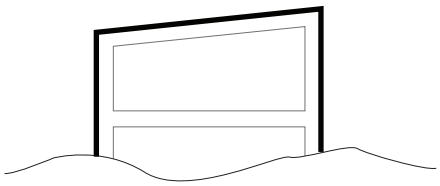


Figure 92 A

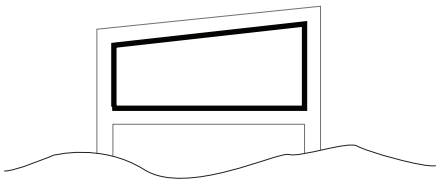


Figure 92 B

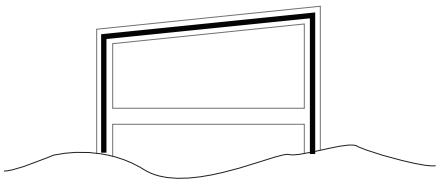


Figure 92 C

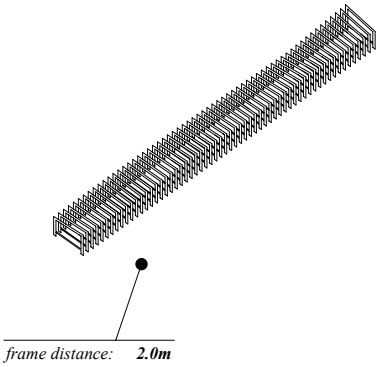


Figure 93 A

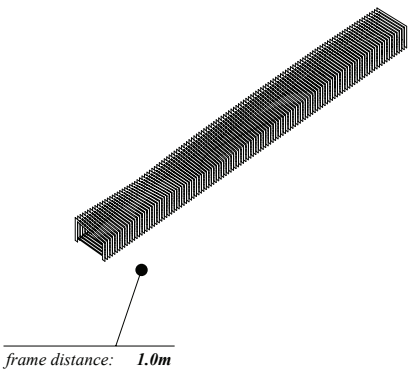


Figure 93 B

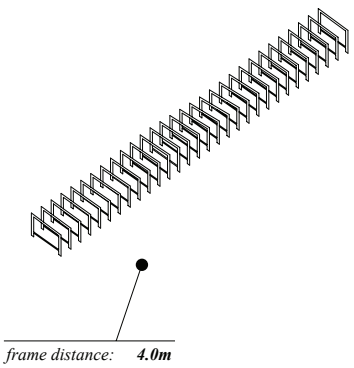


Figure 93 C

Design Process

Plan Studies

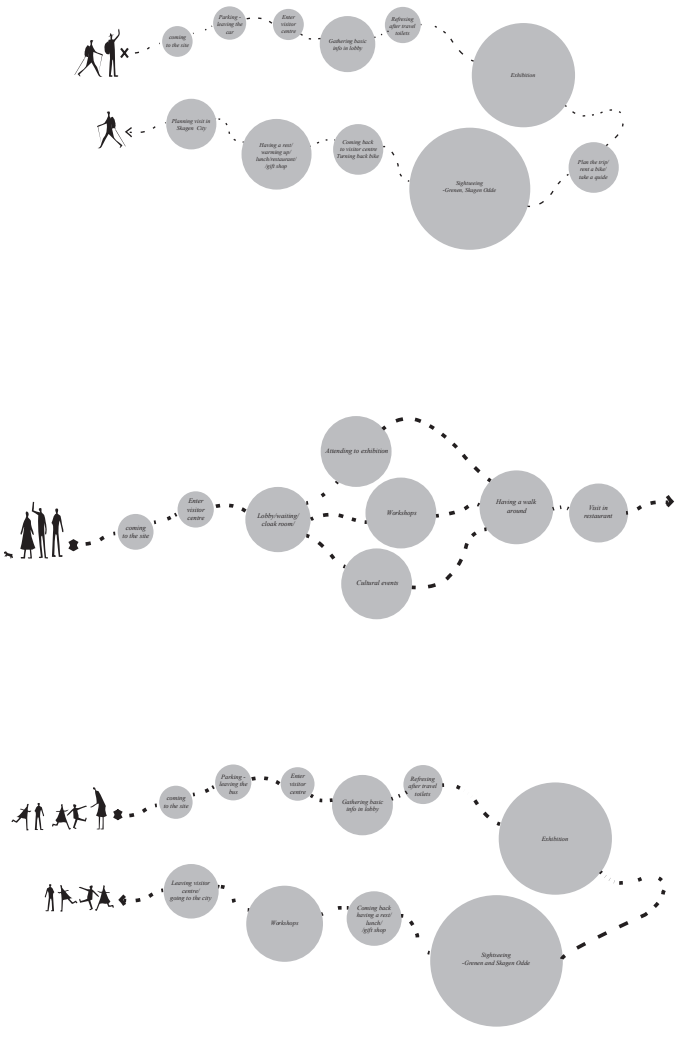


Figure 95: Different scenarios

Three scenarios

Functional scheme of the building is based on the analysis of users' behaviour. As it was stated in Programme section, three main groups of users have been specified -one day tourists, school trips and local community of Skagen. Visitor Centre is a type of a building that should have a clear functional system. Visiting the building is like a journey, there is a set of "check-points" - places that every visitor needs to go through. The three analysed groups of users present the expected scenarios that can happen in the building.

Special focus has been put on the tourists visiting the land for the first time. Coming to Skagen Odde they should learn about both natural and cultural values. Thus one of the important issues while working on the layout was planning the exhibition that could express the dualism of Skagen Odde.

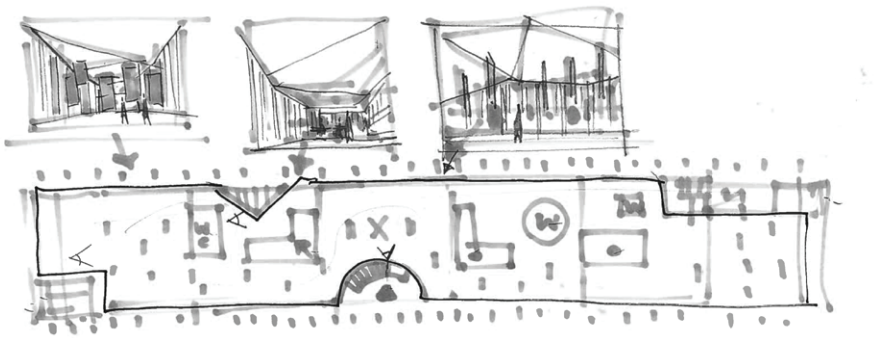


Figure 96: Plan sketches

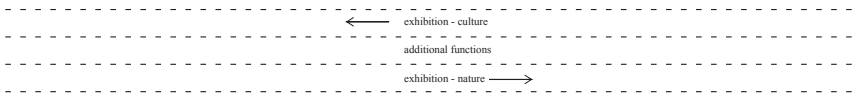


Figure 97: 3 tracks principle

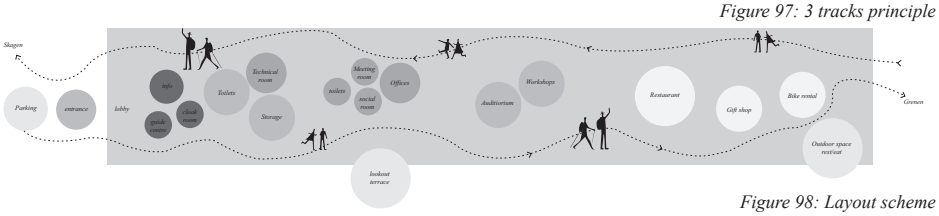


Figure 98: Layout scheme

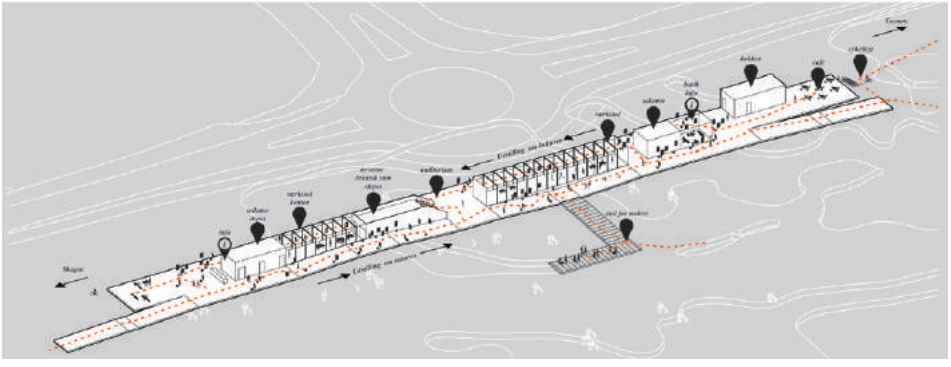


Figure 99: 3d layout diagram

Shaping the layout

The imagined continuous journey through Skagen Odde was one of the determining aspects when designing the plan. The first sketches were based on the longitudinal shape of the building, and the possible interactions with the surroundings. During consecutive steps of switching between plan design and exhibition concept, we have found the main idea of the layout - a principle with three parallel tracks. First one is the route directing the visitors towards Grenen where natural heritage of Skagen Odde is being presented. Second track goes in opposite direction, leading people towards Skagen town and educating about cultural values of the area. Third track is filled with all functional spaces that needed to be incorporated according to the programme .

The next important shaping factor was the exhibition and positioning all closed spaces in the building. We wanted to create a fluid open exhibition space which is shaped and limited by the boxes with different functions. They had to be placed according to the functionality and light conditions. It was crucial especially while designing workshops and offices.

Design Process

Exhibition design

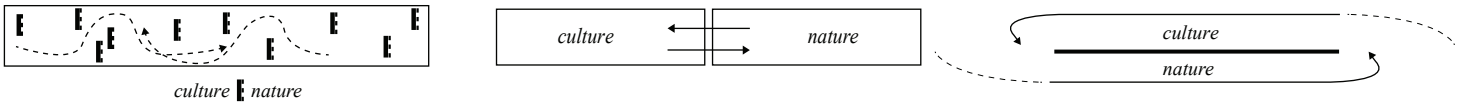


Figure 100: Different exhibition principles

The design of the exhibition was an important part of the design process. The two different but complementary themes: culture and nature should work together to create a holistic presentation of Skagen. The three proposed concepts tried to deal with the contrasting subject in different ways. First proposal creates a fluid space that, based on the direction of the viewer, shows a story about either nature or culture. The visitor decides which exhibition he sees, by moving either in direction of Grenen, or Skagen town. This concept creates very open space, but also lacks an organizing aspect that could be used to order the additional rooms. Next concepts try to organize the exhibition into clearly divided spaces. Second concept creates two exhibitions in two parts of the building. The part close to Skagen town shows some information about culture, while the part close to Grenen the ones about the nature. Dividing a narrow building across the shorter side creates a different flow through the building than desired - visitors stay in one of twosides of the building. Third concept rotates the division and divides the building along it's longer dimension. Therefore people entering building from the town see the exhibition about the nature and can leave the building towards Grenen, while the people entering from the other side the one about the culture and can leave the building to visit the old town. This concept creates long galleries dedicated to two themes - one about the culture - along the road, with a view on the town; and one about the nature, along the view over the moors, grasses and sea. The exhibition becomes a part of a longer journey through the whole Skagen Odde.

Design Process

Interaction with the surroundings

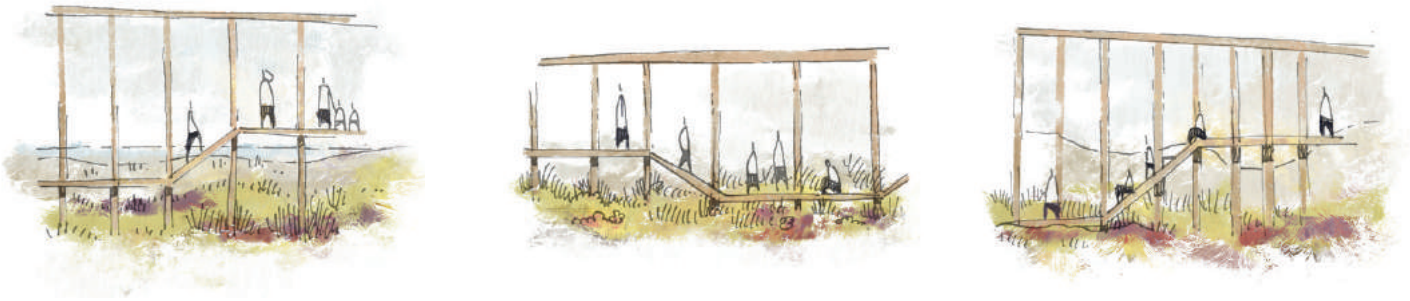


Figure 101: Interaction with the surroundings diagrams

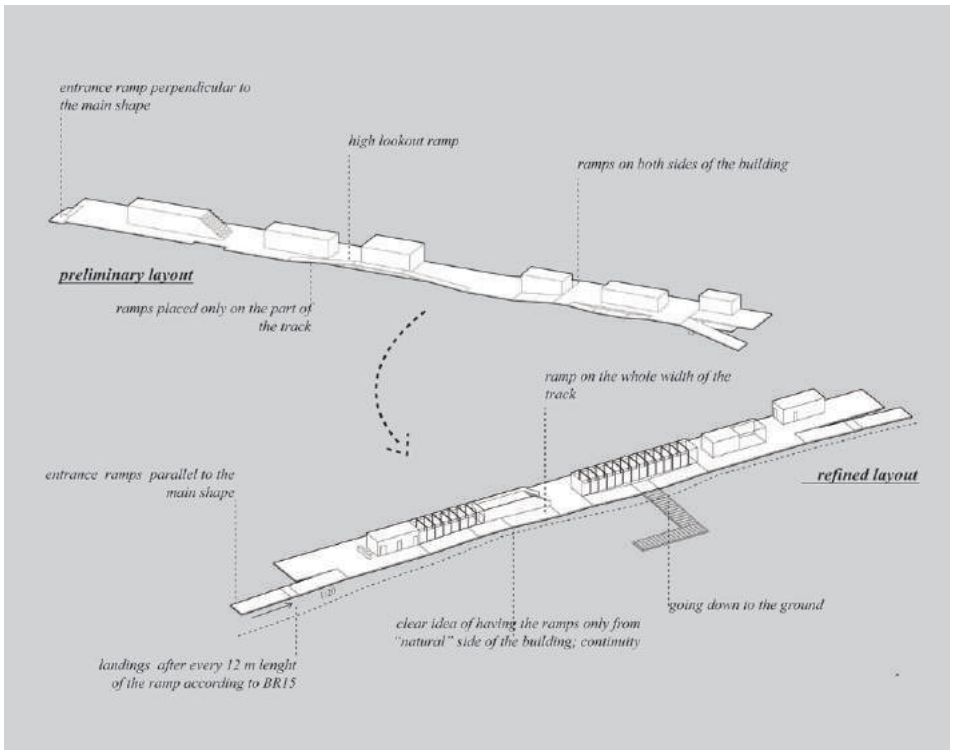


Figure 102: Process of designing the ramps

The idea of enhancing the lightness of the land through changes of the building's levels aroused very early in the process. The combination of vertical changes and concept of continuous journey resulted in the layout with set of ramps that go alongside the building and define the exhibition space. Integrating the ramps could also help the building to better interact with the surroundings. Going down to the ground enables physical contact with the heaths while ascending reveals beautiful view towards the sea. The development of differentiating the levels is shown in the figure 102.

Through the design process the position, length, width and shape of the ramps have been changed. Levelling has been designed according to Building Regulations BR15.

Design Process

Structure Studies

Introduction

To achieve the desired conceptual outcome, the structure needed some refining. It was important to determine the structural system that can bear all the elements, make the building hover over the ground, and allow for incorporation of ramps. The structure needed to work in situation when the bottom beam is divided. Here we present the analysed solutions for that problem. One of the important factors was the relationship with the tectonic concept. The design should clearly communicate the lightness of the structure. Another important aspect has been simplicity - more complicated solutions could hide the initial idea. The viability of the proposed structures was confirmed by analyses performed in Autodesk Robot software.

Finally, the structure with columns from the ground up to the floor level has been selected. The clear floor, without additional columns became one of the main arguments. Additionally, it still creates a light structure that floats over the terrain, without additional use of concrete beside foundations.

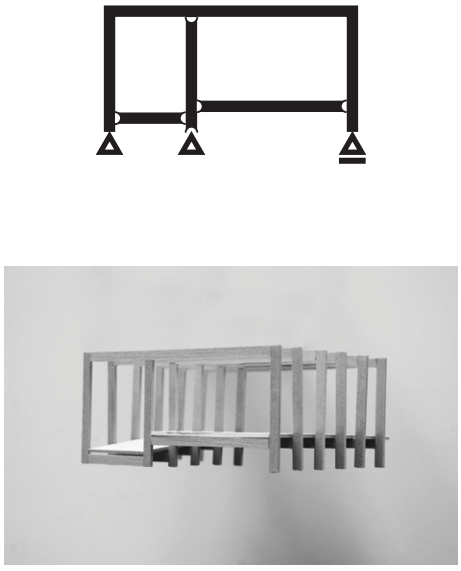


Figure 103: Structure - first proposal

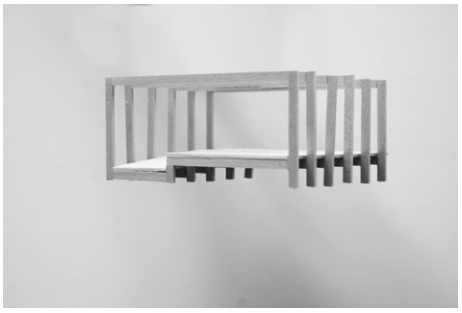
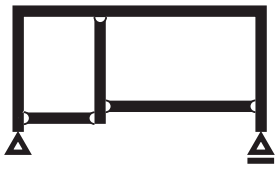


Figure 104: Structure - second proposal

First proposal was a timber structure with additional columns from ground to the ceiling. The additional column clearly divides the section area into simple geometrical shapes. This solution allows for the greatest stresses to be transferred from the structure to the ground.

Second proposal was a timber structure with additional columns just on the bottom. The structural analysis of first proposal revealed that the internal column is necessary only to bear the floor. This solution is the simplest one and do not obstruct the view in the interior. The absence of the columns creates open space that can be used for exhibition.



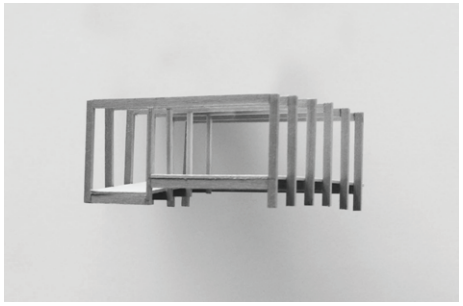


Figure 105: Structure - fourth proposal

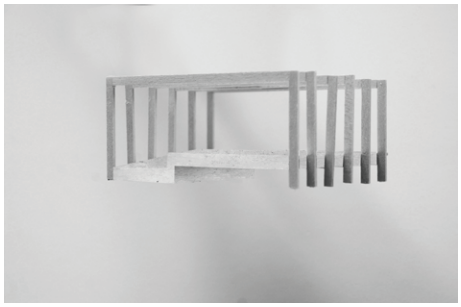


Figure 106: Structure - fifth proposal

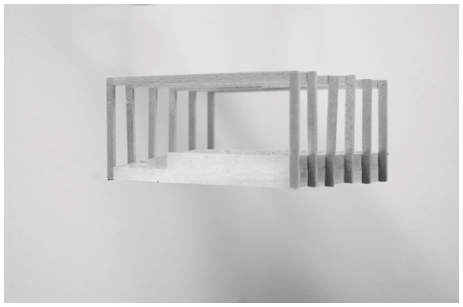


Figure 107: Structure - sixth proposal

Another solution was to create a structure with additional tensile bars in the middle - the whole building would be supported only on the main frame. The floor and the ramps would be supported by the tensile timber columns. Hanging the floor on the columns supports the hovering over the ground idea, and lessens the impact of the building onto the ground cover.

Different approach has been proposed in this concept. A three dimensional concrete plate is being held by timber frames. The concrete plate hovers over the terrain, while the ramps serve not only as a communication space, but are also used as a support for the construction. The complex creased shape of the ramps additionally strengthens the plate.

Last proposal was to detach the floor construction from the timber structure. In this solution the concrete foundation becomes also the floor, and the stereotomic basis of the concept. The clear hierarchy between light and heavy elements becomes visible. Frames becomes just a shelter against the hostile environment.

Framework

Acoustic studies

The proposed visitor centre encompasses big exhibition space. The area should be equipped with appropriate acoustic interior furnishing in order to create optimal atmosphere. Many different age groups will visit the building - from children up to elderly. The exhibition area should be designed in the way to minimize the possible noise. Special measures have been taken to include this problem into the design process.

The visitor centre, apart from holding exhibitions, should be a place where cultural events can happen. Many of those could require a convenient place to make a speech, play music or organize lecture. The designed visitor centre is equipped with an open auditorium in the centre of the building. The interior finishes should work in such way, that the listeners sitting on the stairs would have clear understanding of the speaker. Main aspects considered are reverberation time and clarity. Reverberation time is how long it takes for a sound to decay by 60 dB. Different acoustic publications slightly differ in advised values. We have selected the desired value as between 1.0 and 1.8 seconds [Long, 2006]. Additionally, clarity is also an important factor. It is defined as a measurement of

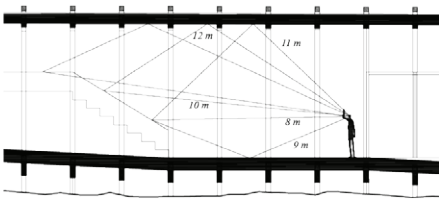


Figure 108: Haas effect

how much different layers of stand will diverge from one another. Lower clarity means that the sound "melts" together [Beranek, 2004]. C-50 is the clarity of the speech, while the C-80 is the clarity of the music. With auditorium which targets primary the speech events, and occasionally music, we have tried to achieve clarity in the range of 0 and 3, while the values between -2 and 4 are still acceptable. It is also important to note that the speech frequency bands are considered mainly to be 250 to 2000 hz. Another acoustic property that can be checked is Haas effect. A time delay less than 50ms can not be registered by a human ear, thus resulting in "unified" sound. The 50 ms correspond roughly to 17 m. Auditorium areas should be designed direct only those rays towards the listener, that have no more than 17 m difference in length.

The considerations about the materials were based on aesthetic, light and acoustic requirements. The process of selecting them was iterative and depended both on

Starting case, applied basic materials, glass windows, no walls on the facade

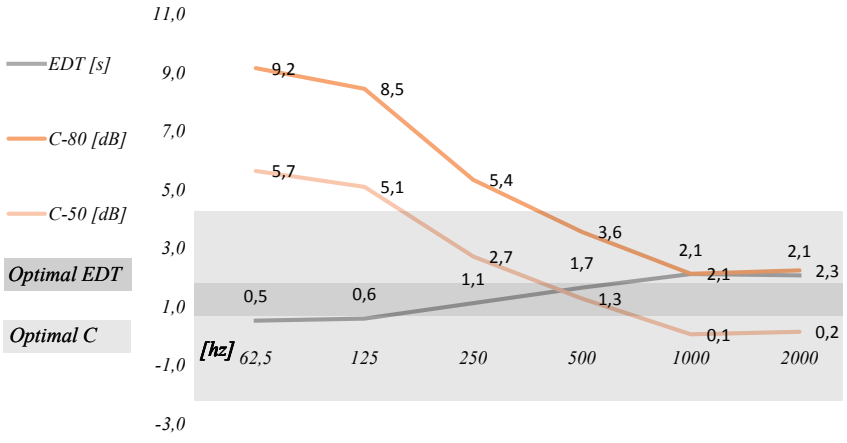


Figure 109a: Acoustic chart - initial design

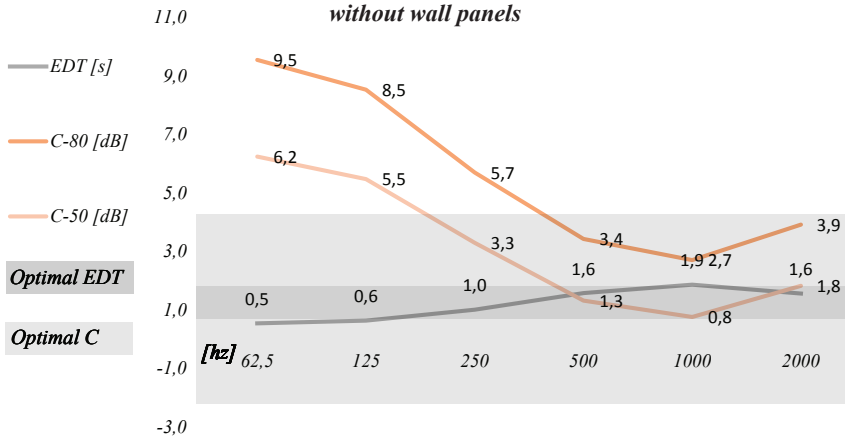
simulations and conceptual principles. The acoustic simulations have been made using Pachyderm Acoustic program, developed by Arthur van der Harten. The calculations depend on the absorption coefficients of the materials, the volume and the shape of the building.

The main idea for achieving the right reverberation time was to develop an acoustic panels that can be used on the ceiling area. Such panels could have a few parametric options that change with the distance from the speaker - for example with higher absorption coefficient on larger distance. This way the panel could remove possible echo and increase clarity. Another solution was to use combination of windows and solid walls around the auditorium to manipulate the acoustic qualities. Tests would reveal the optimal combination for both light and acoustics. The initial results were a good starting point. The analysis shows very good reverberation at the human speech frequencies, but could have longer times in the lower band. Clarity is sufficient for the music (C-80) on higher pitches, while for the low band becomes almost too high. The clarity for human speech is almost optimal, but could be brought closer to the 1,0-2,0 range on all frequencies.

The next analyses showed that absorption ceiling and wall panels are undesired in the auditorium area. The area needed additional acoustic reflections, while the exhibition needed absorption. The solution was to use specifically designed panels, based on existing Kinetics panels.

The auditorium has been analysed using parametric design program - Grasshopper. The panels have been parametrically organized with changing the absorption coefficients depending on the distance from auditorium. This created better qualities in the auditorium, while also enhanced the acoustics in the exhibition area. The results show that the reverberation time is almost optimal for the frequencies of human speech. Also the clarity for human speech is very good, not too low, not too high. The clarity for musical performance is good, but could be a little bit lower to achieve a more "rough" sound. All the charts with data from all the simulations

Ceiling with different panels -reflective in the auditorium area and absorbing in the exhibiton, without wall panels



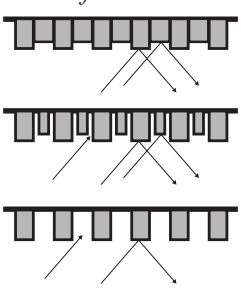


Figure 110 Acoustic panels - diagram

Design Process

Light studies

Light is another important aspect of a visitor centre. If we are creating a building that should communicate the "Nordic" values such as the specific diffused light and the genius loci of place known for extraordinary lighting conditions, the lighting has to be taken into consideration very early in the process.

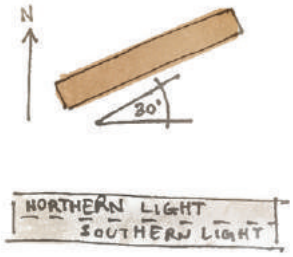


Figure 111: Position of the building

In museums it is often considered that daylight should be omitted, as many exhibitions could be damaged by it. Also, the artificial light can create the most optimal conditions for viewing art and other objects. But visitor centre is not a museum. Visitor centre is a building that should at first introduce the tourists into the local area. The natural light should be incorporated into the design, to profit from it's qualities and lessen it's negative impact.

An example of how architecture can show Nordic light quality can be seen in Venice, in the Nordic Pavilion, designed by Sverre Fehn. The building ceiling is replaced with a three dimensional grid that diffuses the directional light.

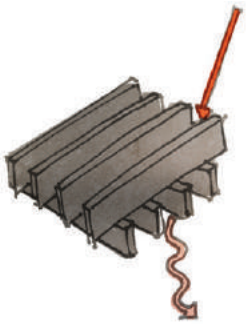


Figure 112: Daylight in Nordic Pavillion

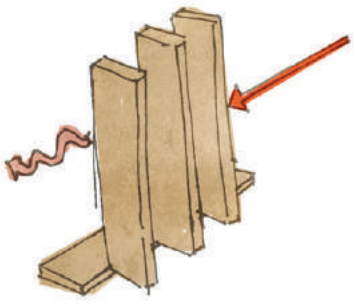


Figure 113: Daylight in Skagen Odde Visitor Centre

The visitor centre in Skagen is placed in Scandinavia, so it already benefits from its specific light qualities. The sun is much lower on the sky and very often is hidden behind the clouds. The early concepts featured longitudinal building placed on the axis Skagen-Grenen. This position situates the longer facades of the building almost on the south-north placement. The rotation from the axis is 30 degrees. Such situation creates very interesting spatial light arrangement. The interior is divided into 2 light areas: one that is lit with northern, diffused light, and the other that is lit with directional, southern light.

The timber structure, that was designed to hold the building above the ground and to create the gradient effect of opening and closing depending on the location of the viewer, becomes a main light controlling element. It is somehow a transformation of Sverre Fehn's light filtering grid - this time, placed in much northern area where sun is typically lower, the light filtering element is placed on the wall instead of the ceiling.

The northern side, which exhibits culture and art of Skagen, is full of diffused light - perfect for appreciation of paintings, images and posters. The southern side of the building is getting more directional light, but still filtered by the timber frames. The visitors can experience two different light qualities depending on which exhibition are they visiting.

The daylight factor analyses have been conducted using VELUX Daylight Visualizer. The appendix presents all the iterations that have been done over the course of the project, while this page communicates the crucial points of the simulations.

The main target of daylight factor analysis is achieving enough daylight - this means Daylight Factor above 2%. This, in case of this building, have been achieved very easily because of it's position, dimensions and design. The only problematic area were the workshops, positioned in the middle of the building, which were getting smaller amount of daylight. Many exhibition areas were getting too much daylight, so the consecutive analyses tried to enhance daylight factor in the problematic workshop area, while decreasing it in the exhibition areas.

First analyses have been done with low transmittance glass both in the facade and in the workshops. Larger structure and walls instead of some windows on the facade helped to balance better the Daylight Factor. The construction of the workshops changed from solid walls with windows to fully glazed - with a high transmittance glass. Later steps included testing different placements of walls to redistribute daylight and changing the plan dimensions to improve the conditions in the workshops. The final results show good light qualities both in workshops and exhibition area. The average value of DF in the building is 5,3 %.

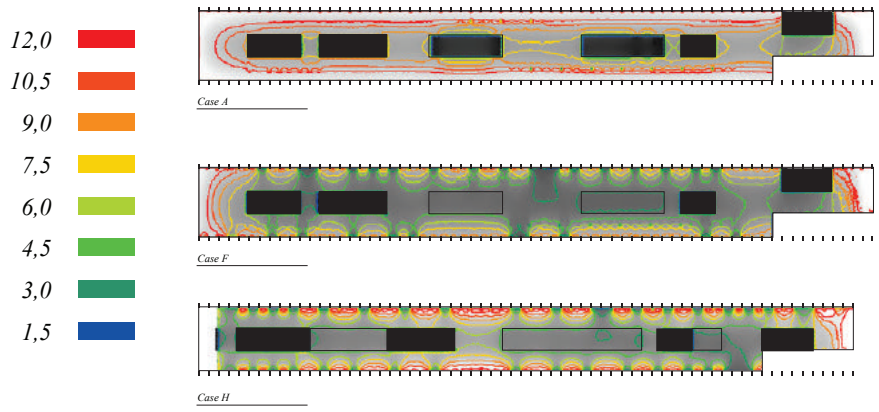


Figure 114: Daylight analysis iterations

Design Process

Sustainable Solutions

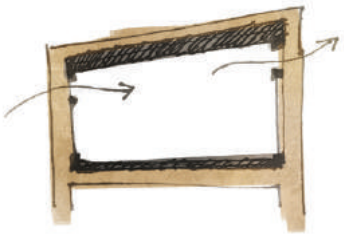


Figure 115: Cross ventilation

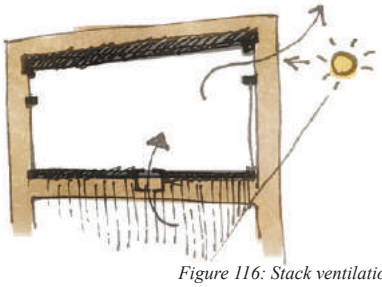


Figure 116: Stack ventilation

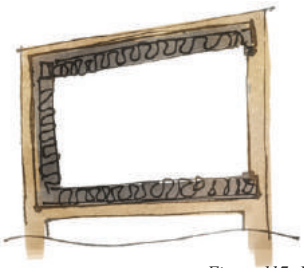


Figure 117: Insulation

Primary sustainable solution is to make the building properly insulated. Adding more insulation reduces the transmission loss through the envelope and can lower the amount of heating needed to keep the thermal indoor climate at a comfortable level.

Next incorporated strategy is to increase the air tightness. The resulting limiting of the infiltration that happens at the joints in the construction will reduce the amount of required heating. It is especially important in light timber construction with many small joints.

The proposed windows are designed with low emission glass, that reflects some of the infrared rays on the outside layer while at the same time reflecting the heat rays back into the room on the interior layer. It is harder for heat to get inside the building, but it also makes harder for it to leave the building. This design decision leads to a better indoor climate with a more stable thermal climate and the transmission losses are kept low due to the low U-value. The external windows have also been equipped with additional textile shades, which slide along the timber frames. An example of the glass that could be used in the project is Pilkington Suncool glass.

One of the features of the designed visitor centre is its perceived openness and transparency. It is achieved by creating a narrow, longitudinal shape, clad with a high percentage in glass. This can however cause some problems. Too much radiation can cause overheating.

The building is designed with a very emphasized structure. One of its functions is light filtering. The massive glue laminated columns and beams should diffuse some of the light and decrease its impact on the interior. This however can be not enough in some specific periods of the year - when the sun angle is not shaded by the frames. Basic solution to this problem would be incorporation of active shades over the windows.

The natural ventilation is designed to improve thermal comfort in the building. Different strategies have been proposed to enhance the natural ventilation. The dominant western wind direction was one of the factors when designing solutions. Taking this into consideration, the cross ventilation will be enhanced by thermal buoyancy. The longitudinal shape is very benefi-

cial to the cross ventilation, which can be introduced almost everywhere in the building. The wind pressure is typically different on the both sides of the long building, which causes the air to flow. The openings are on the both sides of the building, and because of the varying height, the stack effect (the effect of different pressures at different heights) can also be added into the equation. We decided to put flippable 900 mm high windows under the ceiling it every third or fourth glass segment. That solution should provide natural exchange of the air without perceptible drafts.

The fact that the building is floating above the terrain can be used to create a very interesting form of stack ventilation. The lower opening can be placed in the floor. The air would be taken into the building from the area that is always cold, because it is overshadowed by the construction. The higher opening would always be on the top point of the roof, additionally heated by the sun, which would result in very high air flow, both from pressure and temperature difference.

The sustainable aspect of choosing wood is connected with its life cycle. The wood is already beneficial for the environment in the process of its production - trees absorb carbon dioxide as they grow. In the next step wooden constructions store that carbon dioxide. Finally, at the end of life, the wood can be often recycled and used again in another construction.

Wood is one of the most used material in the building. The wooden floor has been designed to become a very light element, that is not distracting viewer from the exhibition. It should not e very reflective to avoid additional glare effect. The most defining material of the building is the one of timber structure. The material has been selected as glue laminated G32h larch. Positioning of the majority of the structure on the exterior side of the building - with an exposure to the rain and sun required selection of Service Class 3 timber.

Floorm	m	λ [W/mK]	R [m²K/W]
wooden floor	20 mm0	,182	0,11
floor foam	5 mm	-	
particle board	30 mm0	,120	,25
ventilation space	5 mm	-	
thermal insulation	195 mm0	,037	5,27
thermal insulation / battens	250 mm0	,049	5,06
wind insulation	0 mm	-	
wooden battens	20 mm-		
		U [W/m2K]	0,08

Wall	mm	λ [W/mK]	R [m²K/W]
wooden plank (larch 60x20mm)	20 mm-		
wooden batten(40x20mm)	20 mm-		
wooden batten(40x20mm)	20 mm-		
wind insulation	0 mm	-	
particle board	20 mm0	,120	,17
thermal insulation	95 mm0	,037	5,27
thermal insulation / battens	100 mm	0,05	1,99
particle board	20 mm0	,120	,17
thermal insulation / battens	45 mm0	,037	1,22
vapour insulation	mm-		
wooden batten(40x25mm)	25 mm	-	
wooden batten(40x25mm)	25 mm	-	
sound absorbing material	5 mm	-	
wooden planks	5 mm	-	
		U [W/m2K]	0,11

Roof	mm	λ [W/mK]	R [m²K/W]
wooden plank (larch 60x20mm)	20 mm-		
wooden batten(40x20mm)	20 mm-		
wooden batten(40x20mm)	20 mm-		
wind insulation	10 mm-		
particle board	0 mm	0,12	0,17
thermal insulation	100 mm0	,035	2,86
thermal insulation / battens	300 mm0	,035	,97
vapour insulation	5 mm	-	
wooden batten(40x25mm)	25 mm	-	
wooden batten(40x25mm)	25 mm	-	
sound absorbing material	5 mm-		
wooden planks	25 mm-		
		U [W/m2K]	0,11

Figure 118: U-value table

Design Process

Detailing

Figure 119: Detailing process

During the design process, a few possibilities of solving main details have been analysed. As tectonic frame was an important part of both the concept and structural solution, the position of the envelope had to be designed in a way that could work together with all the aspects of the building. The detail should be structurally wise, it should provide air tightness, good insulation and minimize thermal bridges.

We have been taking into consideration three main options: positioning the envelope on the external side of the structure, in the middle, or inside the structure. As The first proposal, that is also the most typical one, would blur a tectonic aspect that the structural system adds to the project. That is why it was discarded, and two other proposals were explored in detail in order to find the best solution.

Positioning building's envelope inside the frame would be a very minimalistic approach - the frames could become a clear "scaffolding" for the building. This however would cause many practical problems in the details, especially while trying to achieve waterproofness of the roof. As it required to be suspended under the main frame, it would be hard to keep the waterproof insulation continuous and tight.

Finally the solution with the envelope placed in the middle of the frames have been tested. It gave a lot of freedom on how to form the building components. It allowed for a division of the top beam, that helped improving the thermal and waterproof insulation. Top part of split beam could hover over the insulation layer avoiding damping, while the load bearing part was hidden under the water barrier. What is more the floor could be equipped with 2 layers of insulations, without gaining too much thickness, as part of it is positioned between the structure. Finally this solution has been chosen for the final design.

Design Process

Foundations

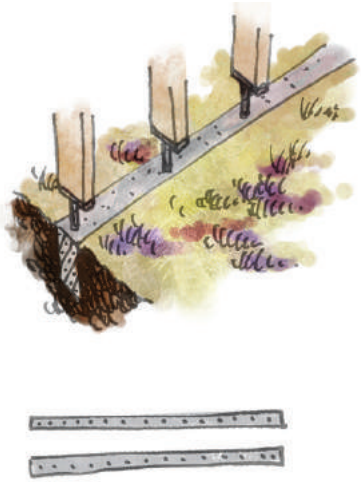


Figure 120: Continuous foundation

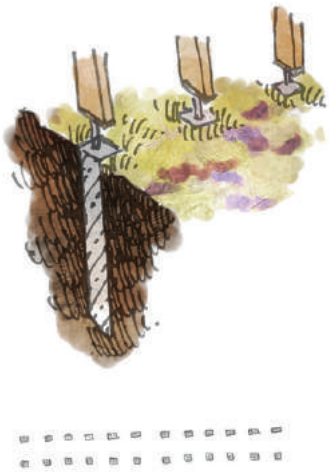


Figure 121: Pile foundation

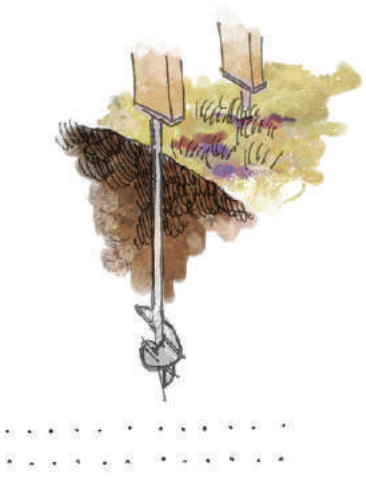


Figure 122: Steel monopiles

The proposed building is being placed in a protected area. Special measures have been taken during design process to ensure that the intrusion into the local natural environment is minimized. The concept envisioned making the building hover over the ground to minimize it's footprint and to allow for natural vegetation also under the building.

Two main versions of the foundations have been analysed. First considered using long concrete foundations under the 2 rows of the main frame columns. Such solution is simple to make, but can be considered as very intrusive. In order to construct the foundations it would be needed to remove a lot of soil in the area of the building, which would destroy the natural habitat.

The second idea was to use pile foundations. They can be constructed form reinforced concrete or steel. One of the benefits of such system is that the soil is only removed in the exact perimeter of the foundation. There is no need to remove any soil around the foundations. The pile foundations can easily transfer load through the weaker top soil levels into the heavier underground layer.
The last decision was to choose between steel micropiles and cast reinforced concrete foundations. The process of installing the micropiles is very simple - they are installed by screwing the drill-looking pile into the soil. During the static analyses however it came out that the micropiles require lower moment values than the ones present at the building frame foundations.
Finally, a reinforced concrete piles were selected as the foundation of the building. A hole with a size of the desired foundation is being drilled. Next, concrete is being poured into the hole, and finally the reinforcement is placed inside. The concrete piles are being connected to the glue laminated frame by galvanized steel connectors.

Design Process

Process reflection

Introduction

Designing a building that tries to incorporate many different analyses is a complicated task. When designing we have been trying to follow the consecutive phases of integrated design process but there was no clear separation between each stage. They have been always overlapping with numerous design loops when some of project's elements had to be modified according to another aspect. At the same time, we have been always trying to use the main concept of the building as a tool to control the changes in order to keep the project coherent.

Problem & Analyses

At the beginning a great focus of the project has been put on the analysis of the place and formulating the design problem. At first, we have been analysing the theme, framework, local conditions and finally we have been searching for a spirit of Skagen Odde. That phase created a basis for the whole concept and design process. It served as a brief for further considerations and was a firm set of assumptions that we always refereed to while designing but we have been trying not to change them.

Sketching

In the sketching phase we were ready to interpret the local area and transfer this knowledge to the building design. A visitor centre should provoke an unconscious act of understanding the surroundings. The sketching began with model studies that tried to analyse the building relationships with the locality. As the concept of the building has been found quite early in the process, we were able to use it as a tool for later analyses. It was our choice, made at the beginning of the project, that the conceptual meaning of the project will be a very important factor to unify and merge together all the conclusions from other analyses. Therefore we have been using a concept as a filter while comparing different solutions through the design process. Sometimes the analyses of specific aspects have been influencing the concept so we have been refining it. The example could be plan and exhibition studies. During the work on the concept the exhibition layout have not been designed yet. We knew that we want to divide it into two themes: nature and culture but the idea of the two tracks leading in opposite directions came later in the process and has been added to the concept.

The sketching phase also consisted of analysing many technical aspects of the building - structural analysis, light studies, acoustic simulations and thermal envelope calculations. The performance aided design was the basis for structural considerations. The analyses could be done in many iterations, thanks to the parametric definition of the structure. This created a result-conclusion-solution loop in many iterations of the analyses. 3d model of the building served as a basis for the detailing process and helped with considerations of build-ability of the specific solutions, while a parametric definition of the building allowed us for many iterations of different studies.

Synthesis & Presentation

Finally, we have moved to the synthesis phase where we could try to combine all the created material together. This process showed us how many iterations of going back and forth are necessary to design a holistic building. At this point we have also attended to the competition mentioned in the beginning of the paper. It occurred to be a great experience and occasion to test how the building looks like 3 weeks before

finishing the project. As the competition required producing some presentation material including a big 1:100 scale physical model, we have been able to reflect on it and apply some final changes to the design. We believe that this experience let us elevate the project to another level and solved all the problems in more detailed way.

Reflection

We realize that many things could be done in another way. If we haf more time we would like to focus more on the acoustics and sustainability of the visitor centre. The acoustic simulations came a little bit late into the process and incorporating them earlier would lead us to more integrated solutions. The sustainability aspect has been considered mainly in sketches and simple hand calculations. The project has also been a good chance to test our group-work skills. As a team we have always been trying to discuss all the problems, but as we used to work together before, we have been sometimes basing on bilateral trust.

Figure 123: Building and landscape

Epilogue

Conclusions

Reflection

Epilogue

The epilogue section tries to conclude on the project and finally reflect upon the design process, final outcome of the project and the knowledge gained through the final master semester. We are trying to assess if the objectives that we had made in the beginning of the process have been achieved. By looking at the project as a finished work we are trying to reflect on the aspects that could be improved if the design process continued.

Epilogue

Conclusions

Introduction

The project of Skagen Odde Visitor Centre tries to satisfy all the assumptions and provide the best possible answer to the problems formulated in initial phase of the design process. It is a proposal of a new facility that could improve conditions for tourism in the area.

Dualisms

The building, positioned on the edge between two worlds, creates a transition between natural and cultural heritage of the area. Ubiquitous references to dualisms integrate the project with the identity of Skagen Odde in as far as the building becomes a living representation of the land.
The concept of the building is based on the deep studies of the qualities and genius loci of the place. All architectural solutions and decisions applied to the project have been weighted with their accuracy in relation to the surrounding.

Constant journey

The shape of the building follows the axis between Skagen and Grenen, creating a fluent passage between natural and urban parts of the land. The layout works bilaterally creating a constant flow of the visitors who are allowed to enter from two ends of the building. The solution assorts with the actual tourists' movement who usually first arrive to Grenen to later take a walk through the town. The building constitutes one section of the whole journey through Skagen Odde.

Exhibition layout.

The dualism and continuity of the movement through the building have been correlated with the presentation of two exhibition themes, nature and culture, that only together determine the actual identity of Skagen Odde. In the building two exhibitions have been split into two paths leading the tourists in the opposite directions. Once the visitor enter the building from Skagen side he can start his spatial journey towards Grenen gathering the knowledge and understanding of natural values of the place. Coming back from Grenen tour he is able to at first retreat and later use the building to move back toward Skagen - walking along second path of the building - the path that leads him through the exhibition about culture and art. Leaving the building the visitor is ready for further journey through the streets of Skagen.

Relation to nature

While main shape of the building emphasizes the broader spectrum of the local quality, interaction with the local surrounding is being presented by another architectural means. The structure of the building becomes a conceptual element that is used to create a specific spatial relation. The load-bearing structure consists of a set of wooden, repetitive frames that create a dynamic facade. The dynamism is related to the perception of the form. While looking parallel to the building it appears to be a massive shape but changing the perspective into more perpendicular the facades become transparent and open a connection between the interior and exterior. The relation with nature is displayed in very dynamic way with reference to the dynamism being one of the most important features of Skagen Odde.

Lightness

Another unique value of the land that was incorporated in the concept of the project is lightness. The building hovers over the ground imitating the behaviour of land filled with light, constantly moving dunes. The building is like a pavilion, placed on unsure terrain , trying not to interrupt

geological movements and letting the wind and air going through.

Significance & functionality

We believe that Skagen Odde Visitor Centre is a project that could greatly benefit both Skagen town and local natural area. The new building would not only change the flow of the tourists, but also attract many new tourists to Skagen. It could introduce the visitors to many hidden features of the area. Moreover, the building could get broader significance serving the students as an academy for art and design and local community as a cultural centre. The new educational facility in Skagen would attract many younger people to the town. This boost of new visitors - tourists, students, hitch-hikers etc. would be really beneficial for the local business owners. The visitor centre, educating about the natural history, would be another strong point on the map of the natural preservation initiatives. An object that would clearly promote the natural features, could easily raise awareness of the need for preservation, care and conservation of the natural environment.

Figure 124: Undulating terrain

Epilogue

Reflection

Introduction

Working on designing a new Skagen Odde Visitor Centre have shown us how many different tasks are needed to be done in order to create a holistic project. It is important to reflect upon every project in order to create a summary. This should lead to better understanding of the process and gaining valuable knowledge for the future work as an architect. This part is vital to ensure that every next project will be undertaken with more experience and with better approach. It is especially important as the project is the master thesis - the work that states our approach to architecture established through the years of education. It is the departure into the mature architectural world where we should present skills we gained through the process of architectural education. The project should show our architectural identity and understanding of the problem.

Our approach to architecture

The architectural approach that is presented through the project is a mixture between the usage of Integrated Design Process and the traditional apprehension of architectural profession as a master builder that derives from old Greek. Many historians assume that the master builder role began to divide into many specific functions in the XVI century. One of the reasons was the significant increase of the availability of paper and pencil, which allowed for detailed drawings, while the other reason is the rapid advances in technology and mathematics. It allowed to develop a new profession of people that specialized in drafting [Pacey, 2007].

Architect's role

Unfortunately, today the architects are sadly often disjointed from the building process. They often focus on drafting the plans and sections and leave many decisions to the other parties. This can lead to many unintended changes and mistakes. We believe that the ancient role of the master builder resembles a movie director nowadays. Today, the architect needs to work with many other specialists but he should always have general knowledge and understanding of more than just architecture. He is a person that is to make the final decisions, and using his own intuition chooses between various solutions. But such a role demands great knowledge and leads to great responsibility. An architect is obliged to know almost everything about the building - only then can he make conscious decisions. Sometimes it is too late to make bigger changes - only incorporating this wide knowledge early into the process we can ensure that everything works together.

Integrated Design Process & Masterbuilder

This leads to Integrated Design Process. An architect that has understanding of both aesthetic, conceptual and technical aspect can design much more freely, but also in a more realistic way. Introducing various analyses from the very beginning allows for an architectural symbiosis between different aspects. Through the project we would like to prove that joining the two approaches and basing both on various data from analysis and architect's own intuition and experience is a possible and proprietorial way of designing the building. It is an attitude which allows to be both an artist and an engineer. The design of Skagen Odde Visitor Centre is very much focused on the conceptual and metaphorical meaning. The concept is a strong element in the whole proposal that holds and unifies the

project. The intention during designing the building was to use the concept as one of design criteria while proceeding with all analyses. It was a hard task as there is always a danger of being too much focused on just ideological expression of the project and sacrificing other analysed aspects. Our objective was to find a perfect balance between the strong and coherent concept and application of objective conclusions from the analyses. Although we believe that the goal has been achieved there is always a space for improvement. In case of Skagen Odde Visitor Centre project some aspect could be analysed earlier in the process and some could be developed more in detail. As the focus of the project has been put on tectonics, the sustainable solutions have been applied just as principles. In our opinion proper analysis of this aspect could greatly influence the project and uplift its quality.

We hope that our final proposal accomplishes all the focal aspects stated in the beginning of the report and fulfils the principles of tectonics, Nordic architecture as well as all the other considered aspects.

Figure 125: Nature

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Appendix

Structural considerations

Acoustics

Light analysis

Fire plan

Detailed drawings

Appendix

The section provides the reader with extended technical material, structural analyses and calculations from Autodesk Robot software. In the appendix we attach extended version of daylight and acoustic analyses as well as brief information about fire safety. The section is finished with additional technical drawings in scale 1:30.

Appendix

Structural considerations

The design process of the building has been accompanied with many iterations of structural analyses. Grasshopper - a parametric modelling software. This tool has been used to test different solutions, by changing values of some parameters. The model has been then each time exported to Autodesk Robot, a structural analysis program. Each iteration has been checked according to the principles of Limited State Design. The two limit states considered were Ultimate Limit State and Serviceability Limit State. Additionally, proper deformations of the structure were considered.

Preliminary tests have been performed on a part of the bigger building - that consisted of ramp and part of floor area. The section of the primary elements has been selected at 60x15cm. The analyses showed us that one of the elements - the floor beams - needed much bigger sections. The other two analyses showed us that the middle column do not help the structure in any significant way - so the decision about it could be done solely based on the aesthetics. The version without the column in the middle, but with column below the ramp has been selected for further analyses.

Next step was creating a structural model for the whole building. The section shape and dimensions were defined according to the analyses - the final structure has been designed with a standard dimension of 70x20cm of GL32h. Some elements have different sections: the top beam, which carries smaller loads and the beams used for stability, that connect the frames in the longitudinal direction have been both dimensioned at 500x200mm. The top beam has also been dimensioned at smaller size, because of architectural detailing - the beam has been divided into two parts, the bottom part holds structural loads, while the top one is mounted on the roof for aesthetic reasons. This division allowed us to make continuous thermal and water insulation, while keeping the visibility of the frame from both outside and inside.

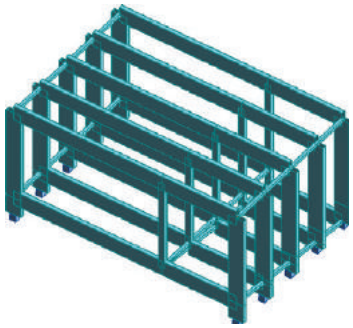


Figure 126: Preliminary analysis model

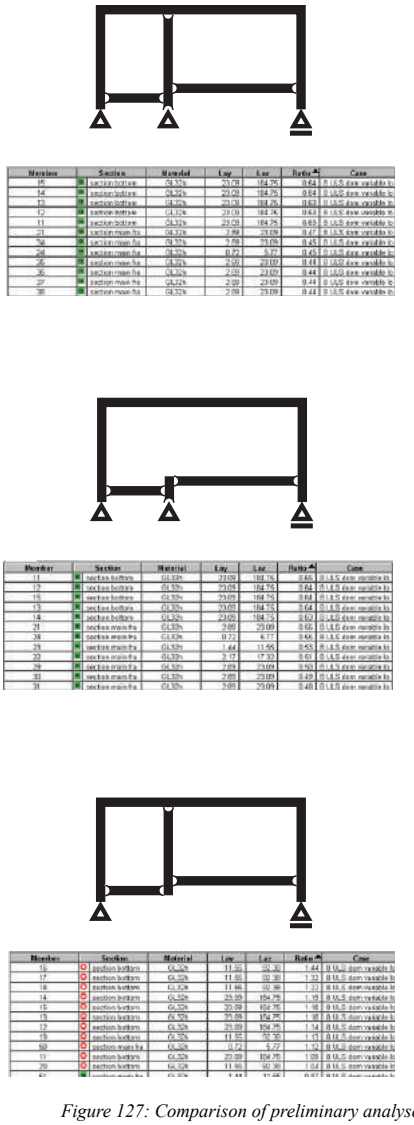


Figure 127: Comparison of preliminary analyses

The final structure of the building passes all the calculations of the ULS and SLS. All the ratios of the elements are below 100%, which means that the structure should withstand all the considered loads. The vertical part of the frame do not carry a lot of loads, but the dimensions were also important for the conceptual considerations and light conditions.

The live load from people is the most influential load in the design. In the most iterations the majority of problems happened either in the floor beams or the ramps. The highest ratios were calculated on the vertical column elements under the beginnings of the ramps. The forces from both sides of the column are creating strong shear load that leads to high section ratio. The next most used elements are the floor beams. The beams have 12,5 m span, and in the first iterations they often had very high deformations. Adding more longitudinal beams that transferred the loads between the frames stabilized the floor beams.

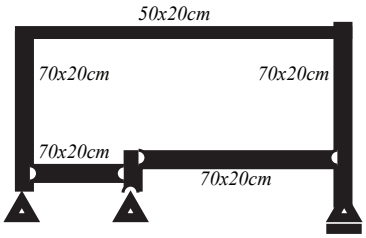


Figure 128: Final dimensions

	Section	Material	Ratio	Case
285	additional sectio	GL32h	0.97	8 ULS dom variable lo
303	additional sectio	GL32h	0.97	8 ULS dom variable lo
525	additional sectio	GL32h	0.97	8 ULS dom variable lo
499	additional sectio	GL32h	0.95	8 ULS dom variable lo
294	additional sectio	GL32h	0.91	8 ULS dom variable lo
512	additional sectio	GL32h	0.91	8 ULS dom variable lo
355	additional sectio	GL32h	0.83	8 ULS dom variable lo
578	additional sectio	GL32h	0.83	8 ULS dom variable lo
338	additional sectio	GL32h	0.82	8 ULS dom variable lo
552	additional sectio	GL32h	0.81	8 ULS dom variable lo
347	additional sectio	GL32h	0.77	8 ULS dom variable lo
665	additional sectio	GL32h	0.77	8 ULS dom variable lo
98	section bottom	GL32h	0.74	8 ULS dom variable lo
99	section bottom	GL32h	0.74	8 ULS dom variable lo
102	section bottom	GL32h	0.74	8 ULS dom variable lo
97	section bottom	GL32h	0.74	8 ULS dom variable lo
103	section bottom	GL32h	0.74	8 ULS dom variable lo
100	section bottom	GL32h	0.73	8 ULS dom variable lo
101	section bottom	GL32h	0.73	8 ULS dom variable lo
83	section bottom	GL32h	0.72	8 ULS dom variable lo
84	section bottom	GL32h	0.72	8 ULS dom variable lo
82	section bottom	GL32h	0.72	8 ULS dom variable lo
85	section bottom	GL32h	0.72	8 ULS dom variable lo
81	section bottom	GL32h	0.72	8 ULS dom variable lo
96	section bottom	GL32h	0.70	8 ULS dom variable lo
104	section bottom	GL32h	0.70	8 ULS dom variable lo
86	section bottom	GL32h	0.70	8 ULS dom variable lo
80	section bottom	GL32h	0.68	8 ULS dom variable lo
156	section bottom	GL32h	0.68	8 ULS dom variable lo
157	section bottom	GL32h	0.68	8 ULS dom variable lo
160	section bottom	GL32h	0.68	8 ULS dom variable lo
155	section bottom	GL32h	0.68	8 ULS dom variable lo
161	section bottom	GL32h	0.68	8 ULS dom variable lo
154	section bottom	GL32h	0.68	8 ULS dom variable lo
162	section bottom	GL32h	0.68	8 ULS dom variable lo
117	section bottom	GL32h	0.68	8 ULS dom variable lo
136	section bottom	GL32h	0.67	8 ULS dom variable lo
158	section bottom	GL32h	0.66	8 ULS dom variable lo

Figure 129: Final ratio results

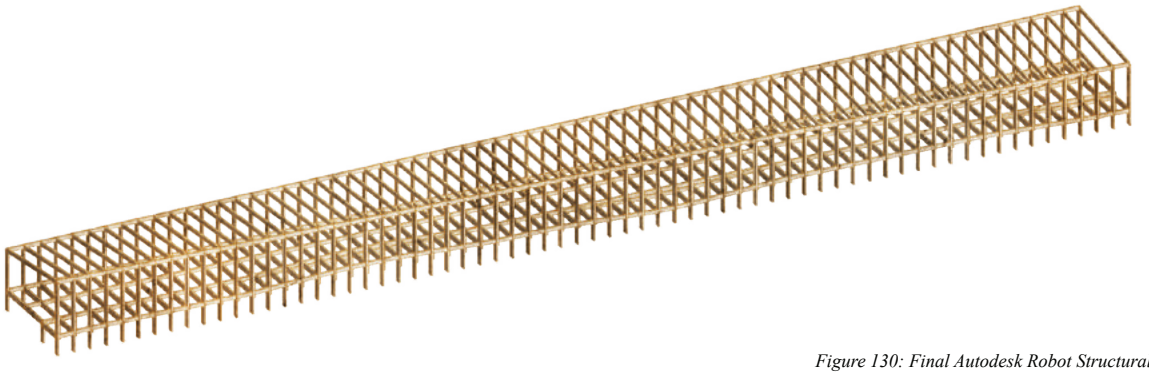


Figure 130: Final Autodesk Robot Structural Analysis 3d model

Displacement

The SLS calculations have checked the possible deformations. The maximum allowed displacement according to Eurocode 5 1.1 is l/300. According to Autodesk Robot calculations, the whole structures passes the SLS test.

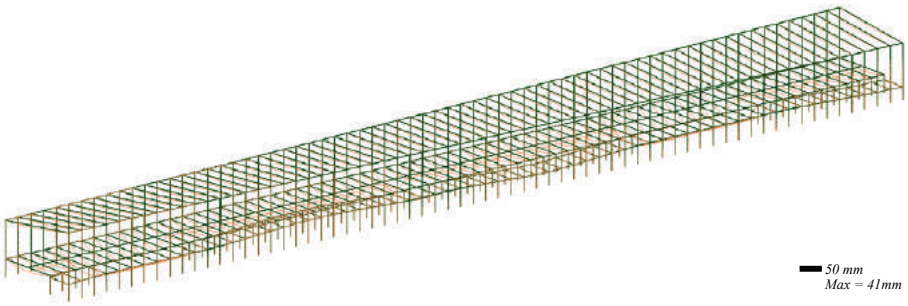


Figure 131: Displacement

Axial forces - compression/tension

Autodesk Robot calculations revealed the areas subjected to tension and compression forces. The floor and ramps support beams are all subject to tension. This happens due to the highest loads from people, furniture and interior applied to the beam, while the beam is supported only at the ends. The most other parts are compressed. The highest axial loads can be seen in the bottom parts of the columns.

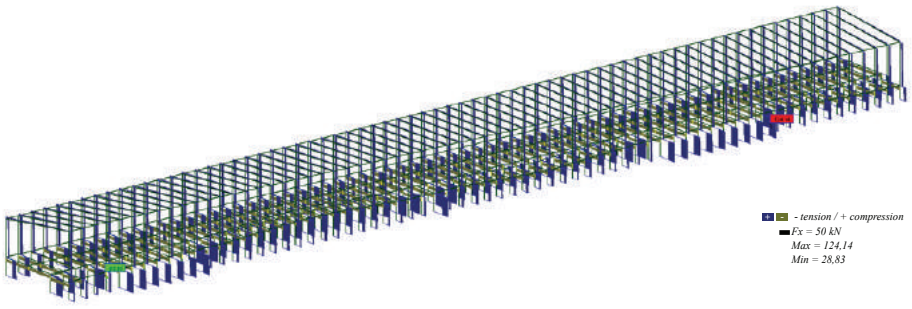


Figure 132: Compression/tension

Moment

The highest values of moment forces happen in the z direction. They are most prevalent in the floor beam elements.

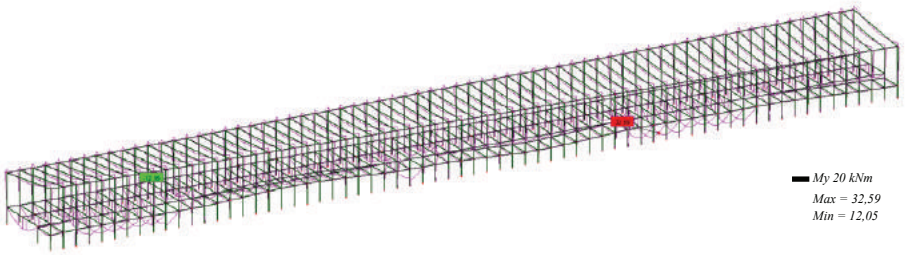


Figure 133: Moment

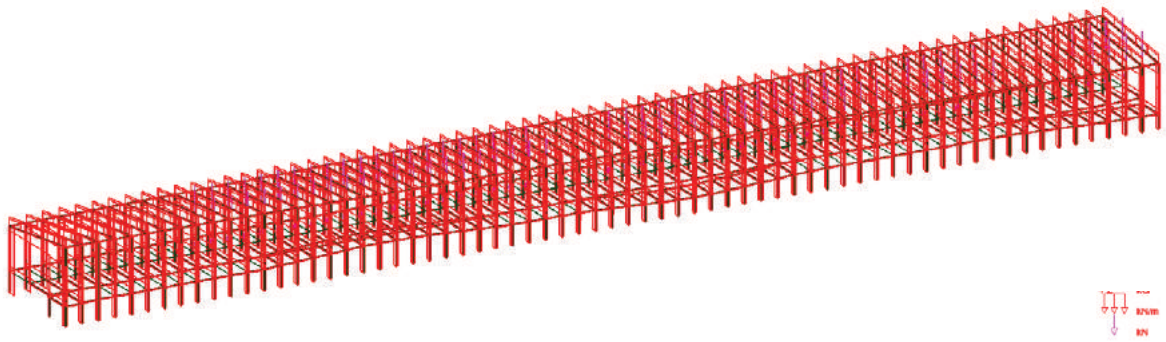


Figure 134: Loads in the model

Loads

In the process of creating the analysis model different loads have been considered. It was assumed that the structure will be exposed to:

- dead load
- wind load
- snow load
- live load

Dead load

The weight of the structure itself and the weight of the cladding and other elements. The weight load of the structure is calculated by the Autodesk Robot by adding the gravity load. Other elements have been hand-calculated: the floor, the roof and the partition walls (2 types).

Figure 135: Dead load calculations

Floor	Roof	Partition wall transparent
2cm wooden floor: *4,2 kN/m3* *0,02 * 4,2 = 0,084 kN/m2* *2cm OSB board:* *6,3 kN/m3* *0,02 * 6,3 = 0,126 kN/m2* *10x20cm Wooden beams for floor:* *(covering 20% of the section)* *4,2 kN/m3* *0,2*0,2*4,2 = 0,168 kN/m2* *45cm Insulation in 2 layers* *(top 80% of the section, bottom 100%)* *0,3 kN/m3* *0,2*0,3*0,8 + 0,25*0,3 = 0,048 + 0,075 = 0,123 kN/m2*	*2cm OSB board:* *6,3 kN/m3* *0,02 * 6,3 = 0,126 kN/m2* *5cm Insulation:* *0,3 kN/m3* *0,05*0,3 = 0,015 kN/m2* *8x20cm Wooden beams for floor:* *(covering 13,3% of the section)* *4,2 kN/m3* *0,133*0,2*4,2 = 0,112 kN/m2* *35cm Insulation in 2 layers* *(top 87,7% of the section, bottom 100%)* *0,3 kN/m3* *0,2*0,3*0,877+ 0,15*0,3 = 0,05262 + 0,045 = 0,09762 kN/m2* *3cm wooden ceiling:* *4,2 kN/m3* *0,03 * 4,2 = 0,126 kN/m2*	*2x2,5 m wall* *2x2 m ceiling* *5mm glass* *25 kN/m3* *9m2 * 0,005 * 25 = 1,125 kN* *9m of aluminium beam 5x4cm* *0,0093 kN / m* *4,5 * 0,0093 = 0,042 kN* *Dimensions:* *2,5 m wall* *2 m ceiling* *9mm Gypsum Board x2* *0,05884 kN / m2* *0,05884 * 7,3 = 0,265 kN* *8cm underconstruction (20%)* *0,2*8 *4,2*2=13,44 kN*
SUM: 0,501 kN/m2	*SUM: 0,477 kN/m2*	*SUM: 13,7 kN*

Wind load

Fundamental basic wind velocity:
$v_{b,0}$ *= 27 m/s*
Basic wind velocity:
$v_b = c_{dir} * c_{season} * v_{b\,o}$
[EN 1991-1-4:2005 (E)]

Assumptions:
$c_{dir} = 1$
$c_{season} = 1$
$v_b = 27$ *m/s*

Terrain category:
0 - Sea or coastal areas exposed to the sea
$c_{e\,(z)}$ *- exposure factor*

Peak velocity pressure
z = 7m (height at which we measure)
$q_{p\,(z)} = c_{e\,(z)} * 0.613 * v_b^2$
$c_{e\,(7)} = 2,6$
$q_{p\,(7)} = 2,6 * 0,613 * 27^2 = 1161,88\ [m^2/s^2]$
$q_{p\,(7)} = 1,16\ N/m^2$

The most apparent wind direction is west, that means that the wind strikes mostly the longer facade of the building.
e = b or 2h (whichever is smaller)
e = 2h = 15m
h = 7,5m

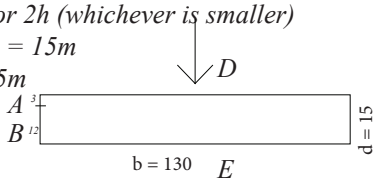


Figure 136: Wind load areas walls

Walls:
$C_{pe,10}$ *:*
A = -1,2
B = -0,8
D = 0,8
E = -0,5

$q_{pA} = -1,2 * 1,16 = 1,39\ kN/m^2$
$q_{pB} = -0,8 * 1,16 = -0,93\ kN/m^2$
$q_{pD} = 0,8 * 1,16 = 0,93\ kN/m^2$
$q_{pE} = -0,5 * 1,16 = 0,58\ kN/m^2$

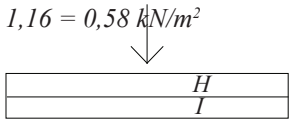


Figure 137: Wind load areas - roof

Roof:
H = -0,7
I = 0,2
$q_{pH} = -0,7 * 1,16 = -0,81\ kN/m^2$
$q_{pI} = 0,2 * 1,16 = 0,23\ kN/m^2$

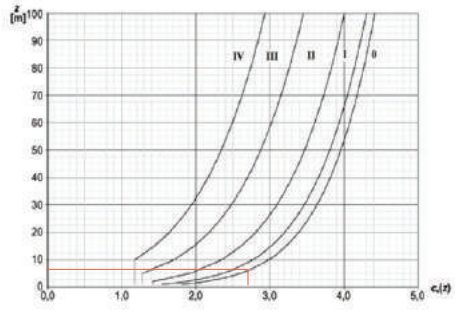


Figure 138: $c_{e\,(z)}$ *chart*

Snow load

$s = \mu_i * C_e * C_t * s_k$

Exposure coefficient C_e
$C_e = 0,8$ *- windswept areas*
Temperature coefficient C_t
Ct = 1,0
Roof shape coefficient
$\mu_i = 0,8$

Charecteristic snow load for Skagen
$S_k = 1,2\ kN/m^2$
$s = 0,8 * 0,8 * 1,0 * 1,2 = 0,77\ kN/m^2$

Live load - Variable imposed load

From [EN 1991-1-1:2005 (E)], use category C3 - 3 to 5 kN/m^2.

Load Combinations ULS and SLS

In the design process there were 3 ULS and 3 SLS load combinations considered.

ULS Dominant Wind Load
$\gamma_G*G + \gamma_{var}*\psi_{0,var}*Q_{var} + \gamma_{snow}*\psi_{0,snow}*Q_{snow} + \gamma_{wind}*Q_{vind}$
$1,35*G + 1,5*0,6*5 + 1,5*0*0,77 + 1,5*1,16$
ULS Dominant Snow Load
$\gamma_G*G + \gamma_{var}*\psi_{0,var}*Q_{var} + \gamma_{snow}*Q_{snow} + \gamma_{wind}*\psi_{0,wind}*Q_{vind}$
$1,35*G + 1,5*0,6*5 + 1,5*0,77 + 1,5*0,3*1,16$
ULS Dominant Variable Load
$\gamma_G*G + \gamma_{var}*Q_{var} + \gamma_{snow}*\psi_{0,snow}*Q_{snow} + \gamma_{wind}*\psi_{0,wind}*Q_{vind}$
$1,35*G + 1,5*5 + 1,5*0,3*0,77 + 1,5*0,3*1,16$
SLS Dominant Wind Load
$G + \psi_{0,var}*Q_{var} + \psi_{0,snow}*Q_{snow} + Q_{vind}$
$G + 0,6*5 + 0*0,77 + 1,16$
SLS Dominant Snow Load
$G + \psi_{0,var}*Q_{var} + Q_{snow} + \psi_{0,wind}*Q_{vind}$
$G + 0,6*5 + 0,77 + 0,3*1,16$
SLS Dominant Variable Load
$G + Q_{var} + \psi_{0,snow}*Q_{snow} + \psi_{0,wind}*Q_{vind}$
$G + 5 + 0,3*0,77 + 0,3*1,16$

Figure 139: Load combinations

Appendix

Acoustics

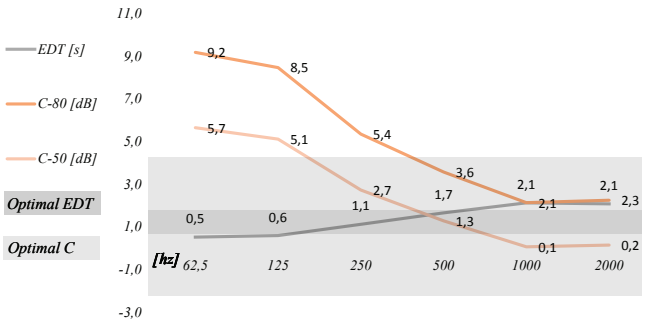
The proposed visitor centre encompasses big exhibition space. The area should be equipped with appropriate acoustic interior furnishing to create optimal atmosphere. The exhibition area interior should be designed in such way, that the possible noise could be minimized while also the sound clarity should be optimal. Special measures have been taken to include this problem into the design process. These pages presents results from different iterations of acoustic design of the auditorium area.

Main interest have been placed at testing how different absorption coefficients influence the acoustic qualities of the auditorium. It was fast observed that the area does not benefit from enlarging the absorption of the ceiling. The auditorium actually needed more properly reflected sound.

Different producers of panels have been tested to see how they can improve the qualities for human speech and music concerts. Finally, an own design has been proposed, that used knowledge from the previous iterations.

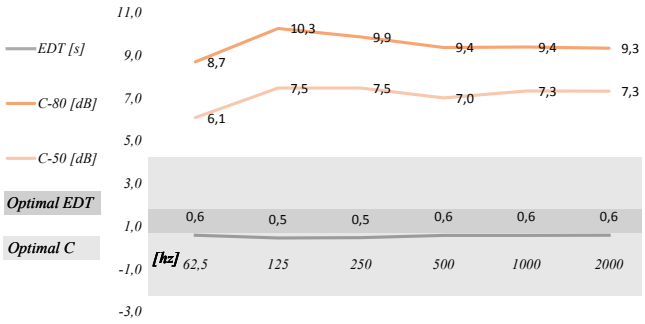
The proposed solutions, with parametrically organized ceiling panels (both absorbing and reflecting), gave values close to optimal.

Starting case, applied basic materials, glass windows, no walls on facade



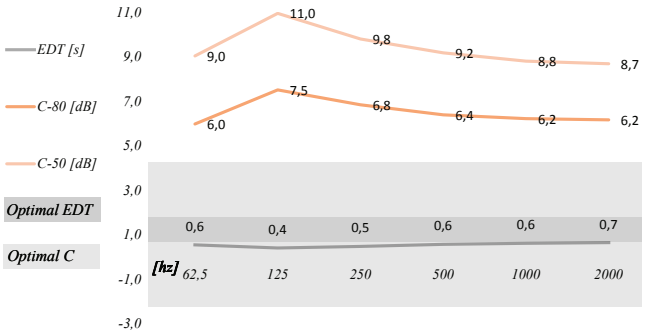
The initial results were a good starting point. The analysis shows very good reverberation at the human speech frequencies, but could have longer times in the lower band. Clarity is sufficient for the music (C-80) on higher pitches, while for the low band

High absorption acoustic panel



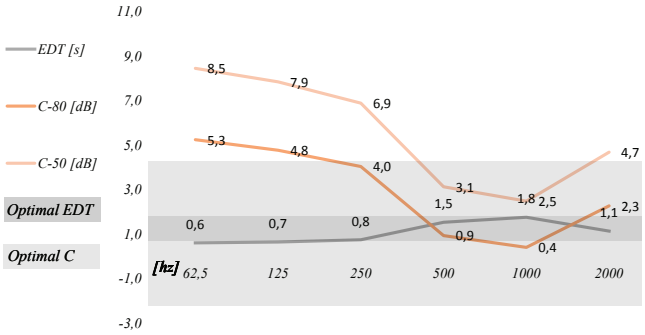
The tests with BCL timber acoustic panels placed on the ceiling area, which are characterized with high absorption rates, showed that too much absorption can make the acoustic atmosphere of the room too sharp. The Reverberation times are very low, and clarity is very high. This results could work in small classrooms or conference areas, but in auditorium there should more feeling of "space" - which is associated with longer reverberation times and slightly lower clarity.

Medium absorption acoustic panel



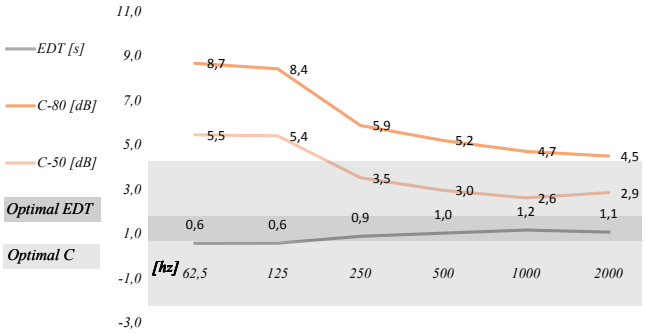
The tests with BCL timber acoustic panels placed on the ceiling area, which are characterized with high absorption rates, showed that too much absorption can make the acoustic atmosphere of the room too sharp. The Reverberation times are very low, and clarity is very high. This results could work in small classrooms or conference areas, but in auditorium there should more feeling of "space" - which is associated with longer reverberation times and slightly lower clarity.

Timber absorbtion and reflection panels with walls



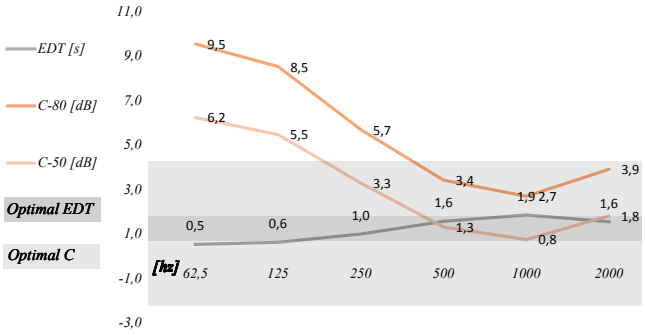
Next step was testing timber reflective and absorption panels - MDF panels supplied by Decoustics. The panels created better acoustics by bringing the reverberation time closer to the desired 0.8-1.8 range. The clarity is also much better in the higher bands. Resulting in clear, but not too clear sound.

Kinetics reflective panels with high absorption walls



In this step we have analyzed high reflectance timber panels, designed by kineticnoise.com. Kinetics panels have very low absorption properties, while the walls are being treated with BLC high absorption panels. The results show more even distribution of the values, close to the desired ones.

Ceiling with different panels - reflective in the auditorium area, and absorption in the exhibition, without wall panels



This step analyzed possibilities that gives us parametric design program - Grasshopper. The panels have been parametrically organized with changing the absorption coefficients depending on the distance from auditorium. This should create better qualities in the auditorium, while also enhance the acoustics in the exhibition area. The results show that the reverberation time is almost optimal for the frequencies of human speech. Also the clarity for human speech is very good, not too low, not too high. The clarity for musical performance is good, but could be a little bit lower to achieve a more "rough" sound.

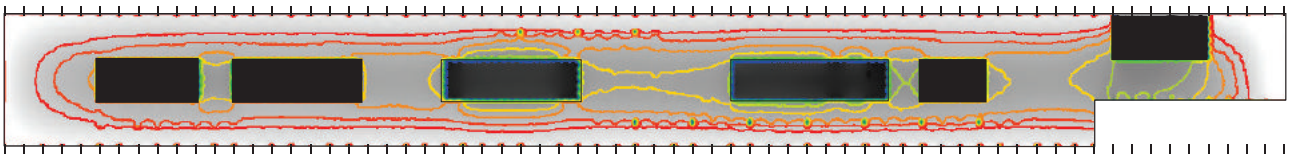
Figure 140: Acoustic analysis charts - 6 iterations

Appendix

Light analysis

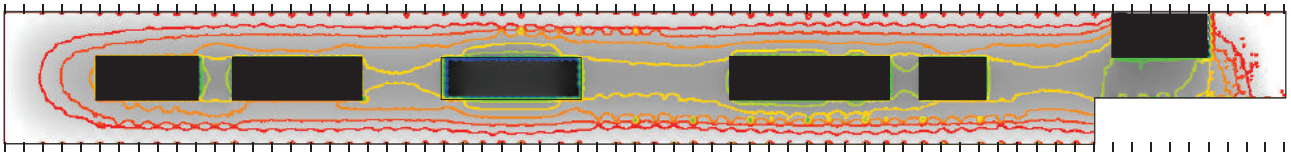
Daylight factor is an important measure that can be analysed, to see how good will be the interior quality in the designed building. The daylight factor analyses have been conducted using VELUX Daylight Visualizer. The presented iterations have been done over the course of the project, so the plan and different factors evolved together also according to other analyses.

The main target of daylight factor analysis is achieving enough daylight - this means Daylight Factor above 2%. This, in case of this building, have been achieved very easily, because of it's position, dimensions and layout. The only problematic area were the workshops, which positioned in the middle of the building, were getting smaller amount of daylight. Many exhibition areas were getting too much daylight, so the consecutive analyses tried to enhance daylight factor in the problematic workshop area, while decreasing it in the exhibition areas. Factor that have been changed during the analyses are: type of glass material, facade systems or material of the boxes inside the building.



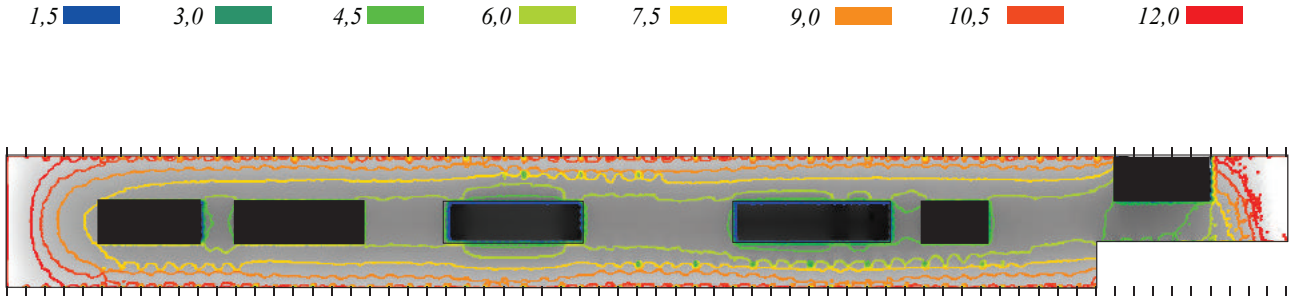
Case A

Structure dimensions 600 x 150 mm. Low light transmittance glass everywhere. Boxes for workshop and offices have solid wall and glass openings.



Case B

Structure dimensions changed to 800 x 200 mm due to DF and structural requirements. Low light transmittance glass everywhere. Without shutters. Boxes for workshop and offices have solid wall and glass openings.



Case C

Structure dimensions 800 x200 mm. Low light transmittance glass everywhere. With vertical shutters between the main frames. Boxes for workshop and offices have solid wall and glass openings.

Case D

Low light transmittance glass on the facade. With vertical shutters between the main frames. With vertical shutters between the main frames. Boxes for workshop and offices are now fully glazed with aluminium construction.

Case E

Structure changed to 700 x 200 mm due to optimization. Low light transmittance glass on the facade. With vertical shutters between the main frames. Boxes for workshop and offices are fully glazed boxes wth hight light transmittance glass.

Case F

Low light transmittance glass on the facade. Shutters have been replaced with different solution. Some of the places on the facade are replaced with solid wall instead of window to lower the DF in the exhibition area, and improve the thermal conditions.

Case G

Low light transmittance glass on the facade. The plan has been changed, the glass boxes shifted. The average value of DF is 5,8 % . The width of the building has been changed by 1,5m to improve daylight in the workshops.

Case H

The walls have been shifted to better help the DF, but also to create a gradient of openess towards the center. The results show good light qualities both in workshops and exhibition area. The average value of DF is 5,3 %

Figure 141: Daylight analyses - 8 iterations

Appendix

Fire strategy

The fire strategy has been developed according to the Danish Building Regulations. The designed escape routes follow the guidelines of a minimum width of 1.3m. The visitors should be lead from the fire sections to the exits without any obstructions.

The public part of the complex (exhibition area, workshops, cafe etc.) can accommodate more than 50 persons, and thus it is classified as application category 3. This means that the visitors do not know escape routes, thus a proper visual information is needed. Additionally an automatic fire alarm system will be installed.

The envelope of the building and the partition walls are considered to be EI 60 indicating that they should keep out the flames, gasses and heat for 60 minutes. The structural system is classified as REI 60, which means that it should additionally carry the loads for 60 minutes.

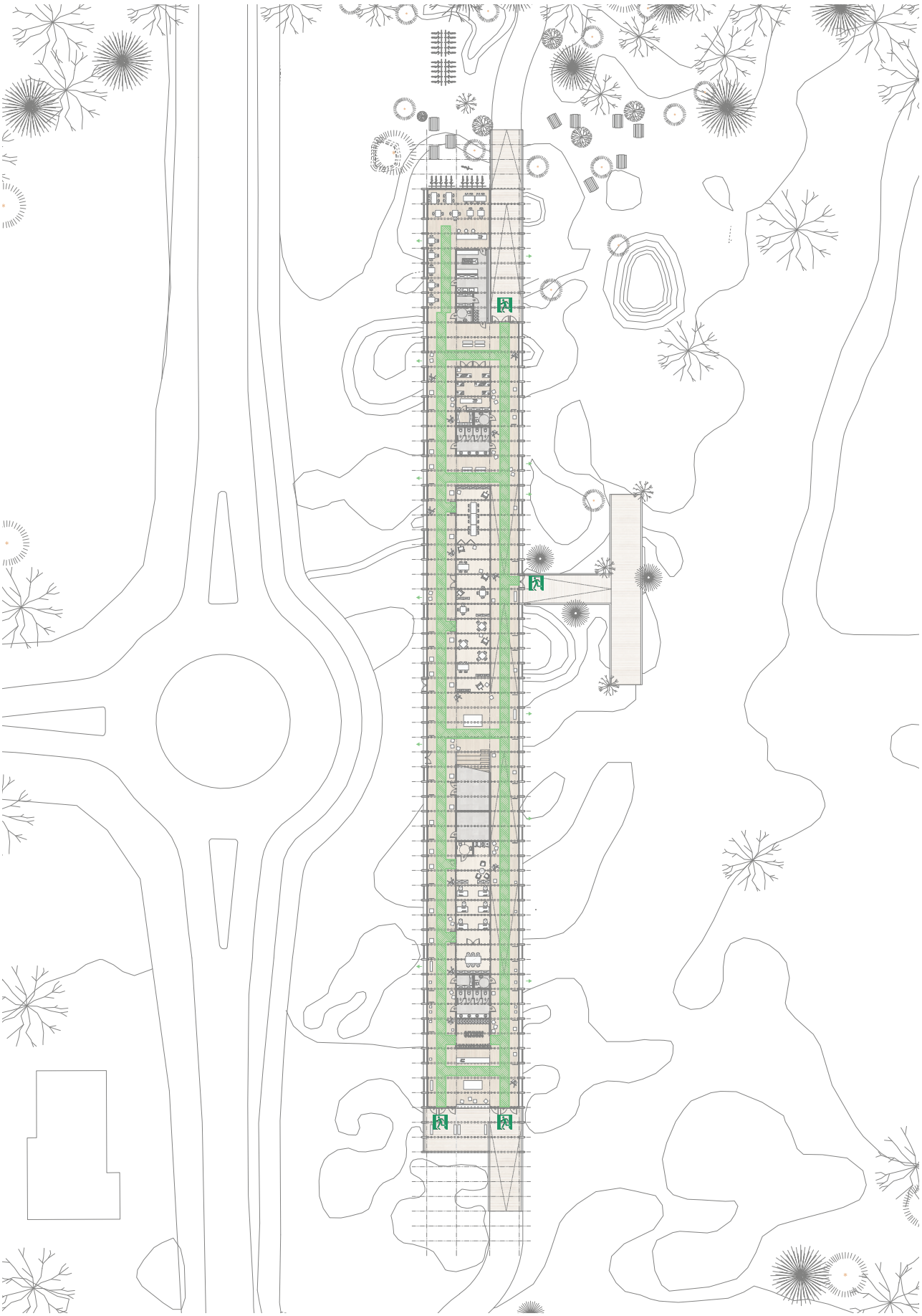
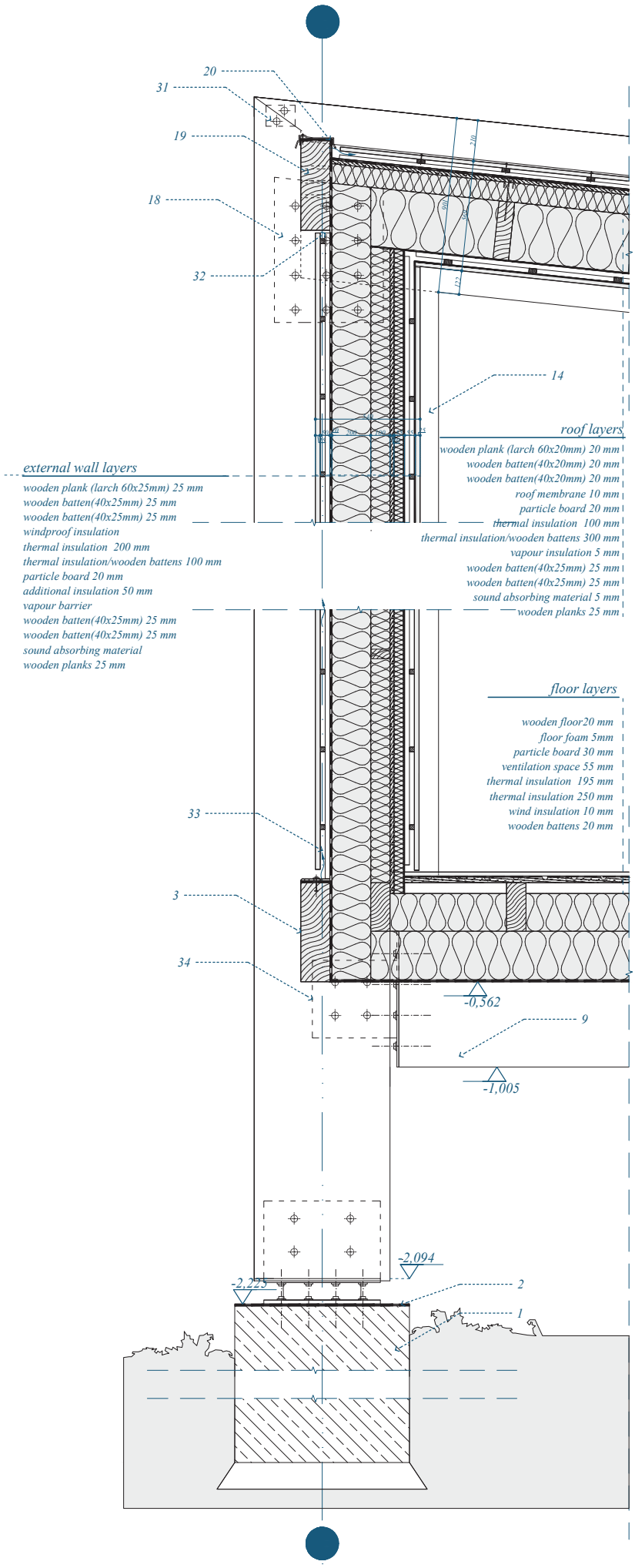


Figure 142: Fire plan

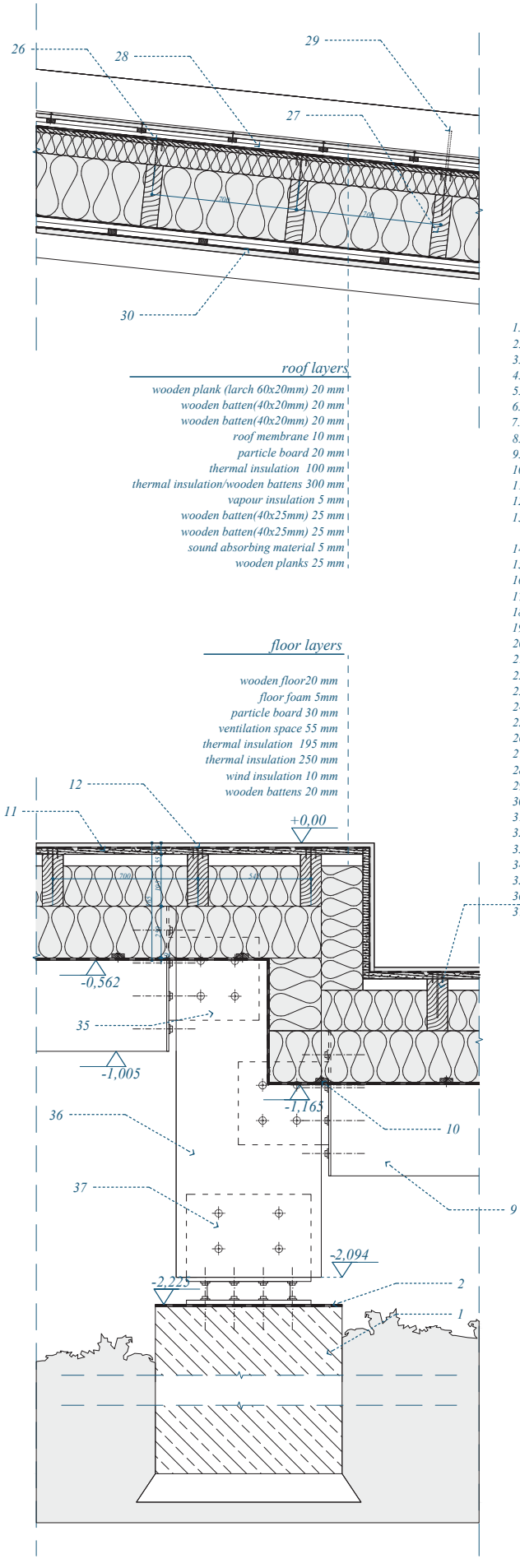
Appendix

Detailed Drawings



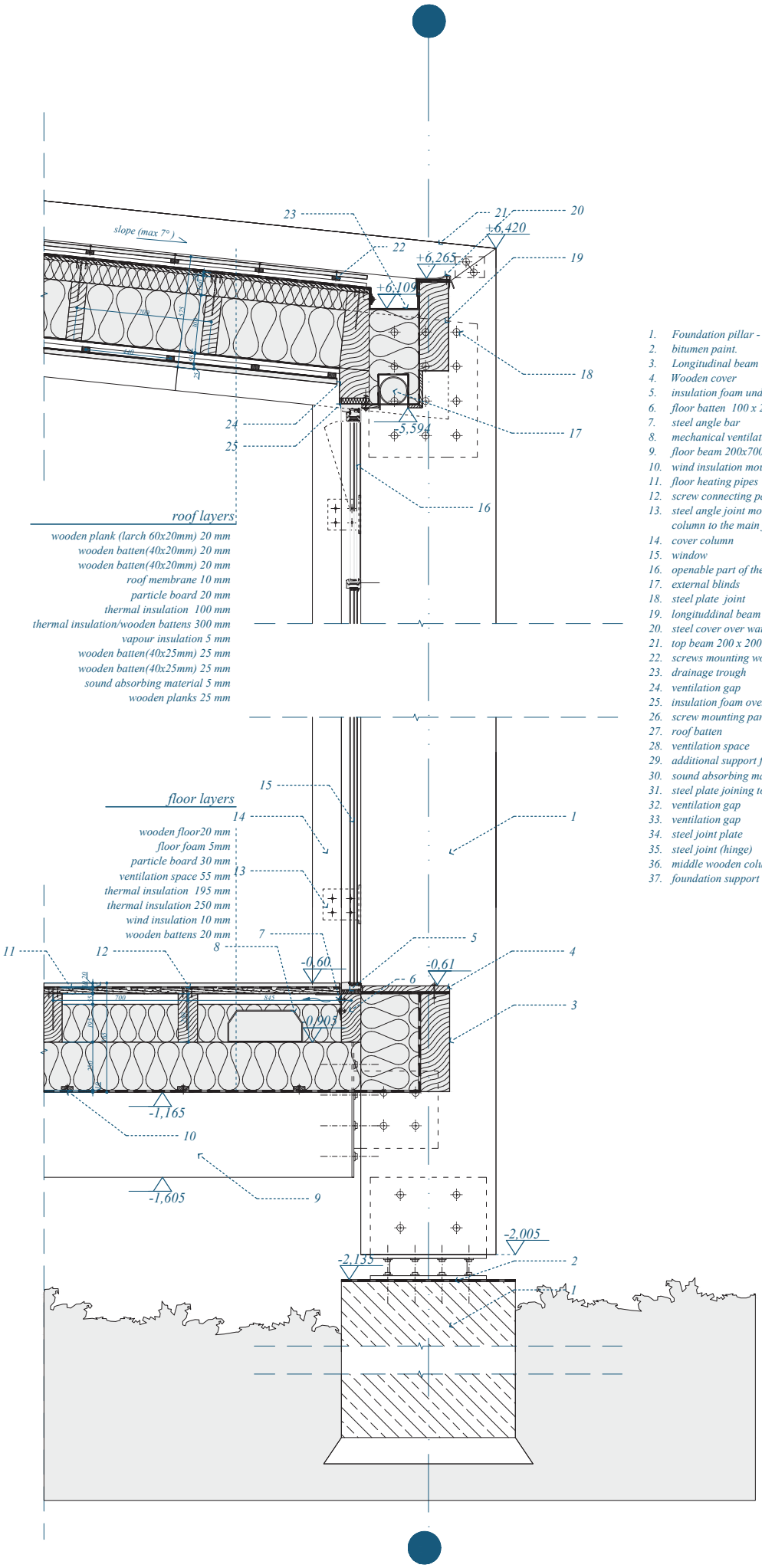
1. Foundation pillar - 800x300 mm
2. bitumen paint.
3. Longitudinal beam 150 x 510 mm
4. Wooden cover
5. insulation foam under the window
6. floor batten 100 x 250 mm
7. steel angle bar
8. mechanical ventilation duct
9. floor beam 200x700 mm
10. wind insulation mounting system
11. floor heating pipes
12. screw connecting particle board to the battens
13. steel angle joint mounting the window and cover column to the main frame
14. cover column
15. window
16. openable part of the window
17. external blinds
18. steel plate joint
19. longituddinal beam 460 x 150 mm
20. steel cover over waterproof insulation
21. top beam 200 x 200 mm
22. screws mounting wooden planks on the roof
23. drainage trough
24. ventilation gap
25. insulation foam over the window
26. screw mounting particle board to roof batten
27. roof batten
28. ventilation space
29. additional support for the top beam
30. sound absorbing material
31. steel plate joining top beam with main frame column
32. ventilation gap
33. ventilation gap
34. steel joint plate
35. steel joint (hinge)
36. middle wooden column 200 x 700 mm
37. foundation support

Figure 143: Detail 1 scale 1:30



1. Foundation pillar - 800x300 mm
2. bitumen paint.
3. Longitudinal beam 150 x 510 mm
4. Wooden cover
5. insulation foam under the window
6. floor batten 100 x 250 mm
7. steel angle bar
8. mechanical ventilation duct
9. floor beam 200x700 mm
10. wind insulation mounting system
11. floor heating pipes
12. screw connecting particle board to the battens
13. steel angle joint mounting the window and cover column to the main frame
14. cover column
15. window
16. openable part of the window
17. external blinds
18. steel plate joint
19. longituddinal beam 460 x 150 mm
20. steel cover over waterproof insulation
21. top beam 200 x 200 mm
22. screws mounting wooden planks on the roof
23. drainage trough
24. ventilation gap
25. insulation foam over the window
26. screw mounting particle board to roof batten
27. roof batten
28. ventilation space
29. additional support for the top beam
30. sound absorbing material
31. steel plate joining top beam with main frame column
32. ventilation gap
33. ventilation gap
34. steel joint plate
35. steel joint (hinge)
36. middle wooden column 200 x 700 mm
37. foundation support

Figure 144: Detail 2 scale 1:30



1. Foundation pillar - 800x300 mm
2. bitumen paint.
3. Longitudinal beam 150 x 510 mm
4. Wooden cover
5. insulation foam under the window
6. floor batten 100 x 250 mm
7. steel angle bar
8. mechanical ventilation duct
9. floor beam 200x700 mm
10. wind insulation mounting system
11. floor heating pipes
12. screw connecting particle board to the battens
13. steel angle joint mounting the window and cover column to the main frame
14. cover column
15. window
16. openable part of the window
17. external blinds
18. steel plate joint
19. longituddinal beam 460 x 150 mm
20. steel cover over waterproof insulation
21. top beam 200 x 200 mm
22. screws mounting wooden planks on the roof
23. drainage trough
24. ventilation gap
25. insulation foam over the window
26. screw mounting particle board to roof batten
27. roof batten
28. ventilation space
29. additional support for the top beam
30. sound absorbing material
31. steel plate joining top beam with main frame column
32. ventilation gap
33. ventilation gap
34. steel joint plate
35. steel joint (hinge)
36. middle wooden column 200 x 700 mm
37. foundation support

Figure 145: Detail 3 scale 1:30