ABSTRACT

The present report is the Master Thesis of Civil-engineer in Architecture & Design. The thesis is designed and written by Emilie Adamsen, Jacob Dahl Callesen and Lærke Hedely Jansen. The aim for the thesis is to design a Kunstrefugium where cultural heritage is a fulcrum for creating sustainable architecture. Kunstrefugiet will be located on Denmark's northern point, more specifically in Skagen's nature area Grenen. The thesis takes its set of in the former Skagens Badehotel which were earlier located on the project site on Grenen. The hotel burned to the ground in the late 30's which leaves us with a great freedom to imagine and interpret the qualities of the former hotel. In order to archive our aim, we have developed our own methodology that looks at sustainability on the three levels of Skin (the facade) - Meat (the spatialities) - Bone (the structure) in the three perspectives off Landscape - Still life - Portrait. With the methodology we are able to evaluate and design a sustainable building, not only looking at the numbers but also considering the more human and phenomenology aspect of sustainability. In the end we wanted to design a Kunstrefugium where architectural and social history of Skagen and the heritage of the site creates the roots for a future life to spouts and where art and nature sets the agenda for the success of the place.

PREFACE

This project represent our Master Thesis as the last sentence for our five years of education in Architecture & Design. The thesis is a statement of the skills and knowledge we have gained throughout our time at Aalborg University, and on what basis we start our journey as architects. The subject of the Master Thesis started as a redesign of the former Skagens Badehotel that evolved during the project period and became much more than just a redesign. In the project period from 1st of February 2019 to the 23rd of May 2019, we have been exploring the architectural history of Skagen and the dynamic in nature surrounding the project site on Grenen. The history and heritage located in Skagen helped shaping our project into an artistic and creative process where we now have designed a Kunstrefugium (Art refugium), where we through architecture and landscape have designed a place where the solid foundation of art history in Skagen once again can flourish.

Even though the official period for the Master Thesis have been from February to May, it has almost been a year since a close relative from Skagen mentioned a desire towards getting a new peaceful hotel on the old site of the former Skagens Badehotel. With our natural interest in transformation this architectural project seemed intriguing and let us with a freedom to interpret and put our own vision into the project. A long process of research on the former hotel started with visits to the Danish historical archives.

The creation of our Master Thesis Kunstrefugiet have been long, interesting and enriching. A process supported by many people. We would therefore like to express our gratitude to Hans Nielsen from The Local History Archives of Skagen for providing us with not only information but also beautiful photos of the former Skagens Badehotel. Ceramist Josephine Alberthe and painter Gitte Toft for helping us understand the life of an Artist and the special needs for their work environment. Frederik Hedely Jansen, for allowing us to use his artworks for the visualisation. Marie Frier Hvejsel and Agathe Revil-Signorat for guiding us in the best possible way, towards creating a Master Thesis reflecting our architectural and engineering knowledge.

Best Regards
Emilie Adamsen, Jacob Dahl Callesen & Lærke Hedely Jansen.

READING GUIDE

The project is divided into the following sections:
The **introduction** containing all formal information, abstract, this reading guide, motivation, sustainable approach and methodology. After this comes the **program**, which present the research and analysis done before and in the very beginning of the design phase. This is followed by a **presentation** of the final project. Knowing the end result before seeing the **process** will make it easier to understand the process, as it is not presented chronologically. The process is iterative and bouncing between subjects that are all intertwined. We have chosen to divide the process in the sections of Skin -Meat - Bone and Landscape - Still Life - Portrait, as this reflects our working method and overall approach to the project.
The process is followed by a section of **conclusion**, and in the end the **appendix** containing all comprehensive analysis and process material.
Furthermore in the back of the binder an **Extended Room Program** and additional **architectural drawings** are found. The Extended Room Program explains more in depth the variation of technical and phenomenological parameters we expect to achieve for the important spaces in the project.

The process is, as mentioned divided into the categories Skin - Meat - Bone,. The Skin is facades, cladding, roofs etc. In short - everything that has to do with materials. Meat is the studies of spacial experience and gesture and Bone is the construction and structure of the building. These sections are divided into subcategories of scale, following the Landscape - Still Life - Portrait method. The methods will be presented in the Methodology section in the Introduction. The process is iterative and intertwined and many of the studies have taken place simultaneously across categories. Therefore many of the studies and processes presented could have been placed in some of the other categories as well.
Working with the project in different scales, being able to switch between them, has given us a more thorough process and thereby a better result.

Inside the report there are two types of smaller grey pages. The dark grey pages show details which are worth highlighting, or makes sense to be able to move around the report (Album illustration). The light grey elongated pages are smaller conclusions summing up the sections in the report. The blue pages, are important pages presenting respectively,the abstract, the design parameters, concept and vision, presentation text and conclusion.

We now wish you a pleasant read.

01 INTRODUCTION

Abstract • 1
Preface • 2
Reading guide • 3
Motivation • 6
Sustainable approach • 8
Methodology • 12

02 PROGRAM

Architecture of Skagen • 18
Location • 28
Badehotellet • 36
User groups • 42
Typology & Room program • 50
Design criteria • 54
Concept & Vision • 56
Case studies • 58

03 PRESENTATION

Welcome to Kunstrefugiet • 62
Fyrvej • 68
Arrival • 70
Lobby • 72
Creative Space • 76
The heart of Kunstrefugiet • 80
Atelier • 84
Artistic stair • 88
Thatched building • 90
Guest room • 92
Spa • 96
Nature path • 98

04 PROCESS

Skin • 102

Meat • 116

Bone • 136

05 CONCLUSION

Conclusion • 144

Reflection • 145

Literature • 146

Illustrations • 148

06 APPENDIX

1: Shading • 150

2: Interview Artists • 152

3: Interview Skagen • 153

4: LCA • 154

5: Natural ventilation • 155

6: Air change rate • 156

7: Mechanical ventilation • 158

8: Daylight • 162

9: Guest room process • 164

10: Micro climate • 166

11: Be18 Key numbers • 167

"The architecture is rooted in the culture, in life and in the continued story of its own creation."

- (Pallasmaa in Harlang and Algreen-Petersen, 2015).

MOTIVATION

Today we strive to create better sustainable architecture. The sustainable approach is focusing on reducing energy demands and protecting the climate, which has resulted in a high level of regulation in the building industry, which again has influenced the decreasing level of creativity in today's architecture. The buildings become well insulated containers of function with little gesture and bodily experience. In short – the history, atmosphere and human scale are in many cases absent.

The motivation for choosing to build a new Skagens Badehotel in Skagen, Denmark, has been to explore a different perspective on sustainable architecture. Using DGNB certification as a representation of the common view on sustainable values, one might wonder if the certification is leaving out important aspects of architectural qualities?

The aspects of cultural history, atmosphere and traditions play a major role in how we perceive and relates to architecture, and as a result of that, what we later will try to preserve and renovate to maintain in a building. The aim for this project is therefore to challenge the common way of understanding sustainability, and instead use cultural history as the focal point for creating sustainable architecture.

There are many different approaches when redesigning or reconstructing a building. The approach of reconstruction is out of the question in this project, due to the large timespan, as the former Skagens Badehotel burned to the ground approximately 80 years ago. A historical reconstruction is false and disrespectful towards the present generation and its trends (Bendsen and Morgen, 2018) The architectural theorist, Fred Scott agrees;

"This begs the question, in the planned restoration, to what previous condition is the restoration intended? Restored to the scheme as it was when it was handed over by the contractors or when it was first occupied, or to an assumed purity of completion that may or may not have ever been achieved?" (Scott, 2008, p. 33)

He continues arguing that the time from construction to reconstruction is just as important or history will be lost. We believe this to be true. The long timespan between now and then leaves us with a greater latitude to interpret and be selective in the aspects which we chose to revive, sort out and reinterpret, when designing the new building. There is always a cultural history, which should be taken into consideration, and this project will be our stepping stone to create an approach that connects cultural history with present times sustainable approach.

The project of creating a reinterpretation of a traditional Badehotel is highly relevant, since we today are experiencing a second boom in the popularity of Badehoteller, as a reaction to the growing urbanisation and escape to the tranquillity of nature. This project is a response to the ongoing discussion of the possibilities of a new hotel located at Grenen. Our proposal will be a multifunctional building containing not only a hotel, that will attract more tourists, but also an environment the local community will benefit from. By implementing different user groups, the intent is to create a building, which will be in use all year, and not just during the high season.
Also, the history of Skagen as a town of art goes back to the time where the Skagen painters put the city on the map, in their chase for the perfect lighting. The hope is for this hotel to create an attractive environment for today's artists and tourists and accommodate them with a unique nature and the characteristic light above Skagen.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

- Brundtland Report (Iisd.org, n.d.)

SUSTAINABLE APPROACH

The following chapter is going to analyse different approaches towards sustainability, and how it has changed through history. The aim is to clarify the sustainable design approach that will be utilised in this thesis.

Being an architect is one of the oldest professions through history of time. A profession that has been aiming to develop architecture that can represent the needs and the tendencies in the society, and thereby create the setting for an idealistic life for people to live. The perception of the idealistic life is constantly changing and the architecture along with it (Scott, 2008). In 1962 a book named "Silent Spring" were published, which describes the effectual and often destructive impact we as humans have on the natural world. This book started the environmental movement as we know it today. Initially the focus was mainly on toxics and pesticides and later it shifted to air pollution, acid rain and the general global warming (Bernardi et al., 2017).

In 1987 the "Brundtland Report" was published and it laid out a global agenda towards a more sustainable future. The way sustainability was defined in this report became the most frequently used definition (Iisd.org, n.d.).

Usually, sustainability can be divided into the three pillars of sustainability: Environmental-, economic- and social sustainability. These three pillars along with the Brundtland Report is the very base for how the building industry through different measuring and certification tools evaluate their building designs, and thereby determines whether it is a sustainable solution or not. In Denmark the most used tools are DGNB certification along with the LCA assessments. In a DGNB certification the evaluation is divided into five qualities: environmental, economic, social, technical and process quality, plus an additional site quality. (DGNB, 2019)

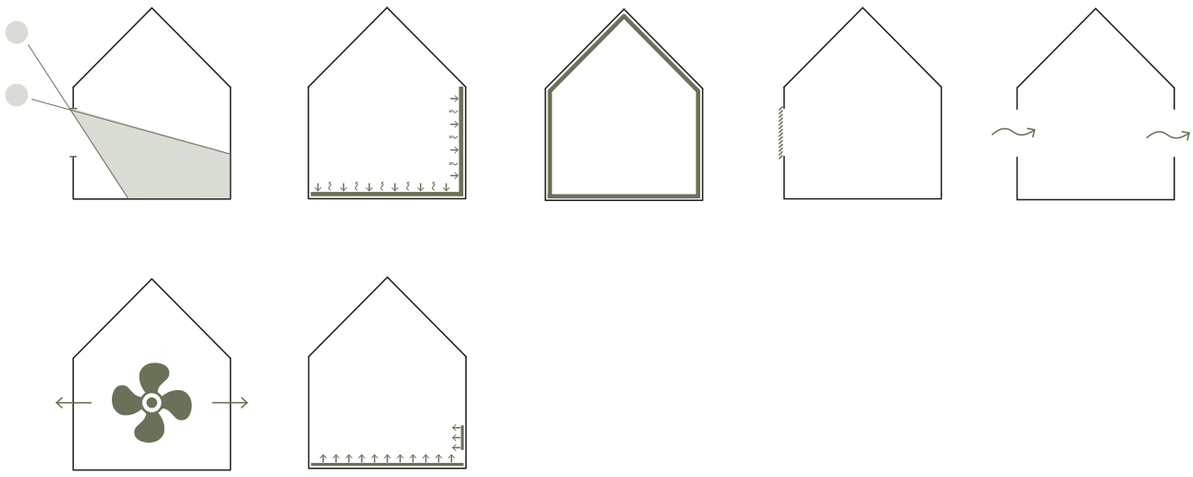
Focal points as cultural history, heritage and atmosphere, are essential qualities in this thesis but the above-mentioned tools do not address them enough. One subcategory under social sustainability in the DGNB certification considers architectural quality, including design, interaction with the context, materiality, usability and cultural value but this subcategory of architectural quality only accounts for 1,8 % in the final score (DGNB System Denmark, 2019). Nothing is wrong with the criteria already in the DGNB certification. Those are criteria turned into numbers, and the conclusion is, that if a building gets a high score, it is considered as high sustainable quality. Our critique of the DGNB system are absent measurement of the more subjective aspects as atmosphere, gestures and historical qualities, which we believe creates

good architectural quality. Good architectural quality is also sustainable, as these buildings tend to stand longer, have better maintenance, be more flexible and well-integrated, both in the building and the context. (DGNB System Denmark, 2019).

The sustainable approach for this thesis will challenge the common way of evaluating a sustainable building. The aim will be to explore a more nuanced picture of sustainability by looking not only at the numbers and create a building, that is not just an energy sufficient container of function, but also an architecturally sustainable building. A building that will stand longer, as it has qualities considered worthy of preservation and that it will be worthy of later restoration. A building that will contribute positively to the surroundings and heighten the overall quality of the area. A building where people feel like staying and which will create positive feelings for its inhabitants and a building with gesture and where these has been put into the details.

However important these phenomenological aspects are, the more number orientated tools to determine the sustainability cannot be left out. This thesis will therefore also pay attention to Life Cycle Assessment by using the software LCAbyg. LCA is a holistic method to evaluate the environmental impact of the building, not only looking at the final building but the entire life cycle of the building. To ensure a cohesive material choice the materials will be detailed in an assessment form, evaluating other parameters as tactility, scale, reference to site and Skagen. This will be part of ensuring that the measurable numbers do not stand alone but will be combined with the more soft and aesthetic values of the building as well.

On illustration Ill. 1.2 our interpretation of the lifecycle of a building is presented. The top circle presents the life cycle assessment of a building as evaluated in LCA. The lower circle is added on as a representation of the buildings with high architectural quality, where there is an extra loop of renovation, alteration or redesign as in our case. The circles illustrate that buildings with architectural qualities has a value worthy of preservation or renovation. They will also during their lifespan become part of the historical heritage of the place, by contributing positively to their surroundings and users. For those buildings the lifespan will be longer, as they should not just be torn down and recycled when they become obsolete. They should, potentially endlessly, be looping in the lower circle.



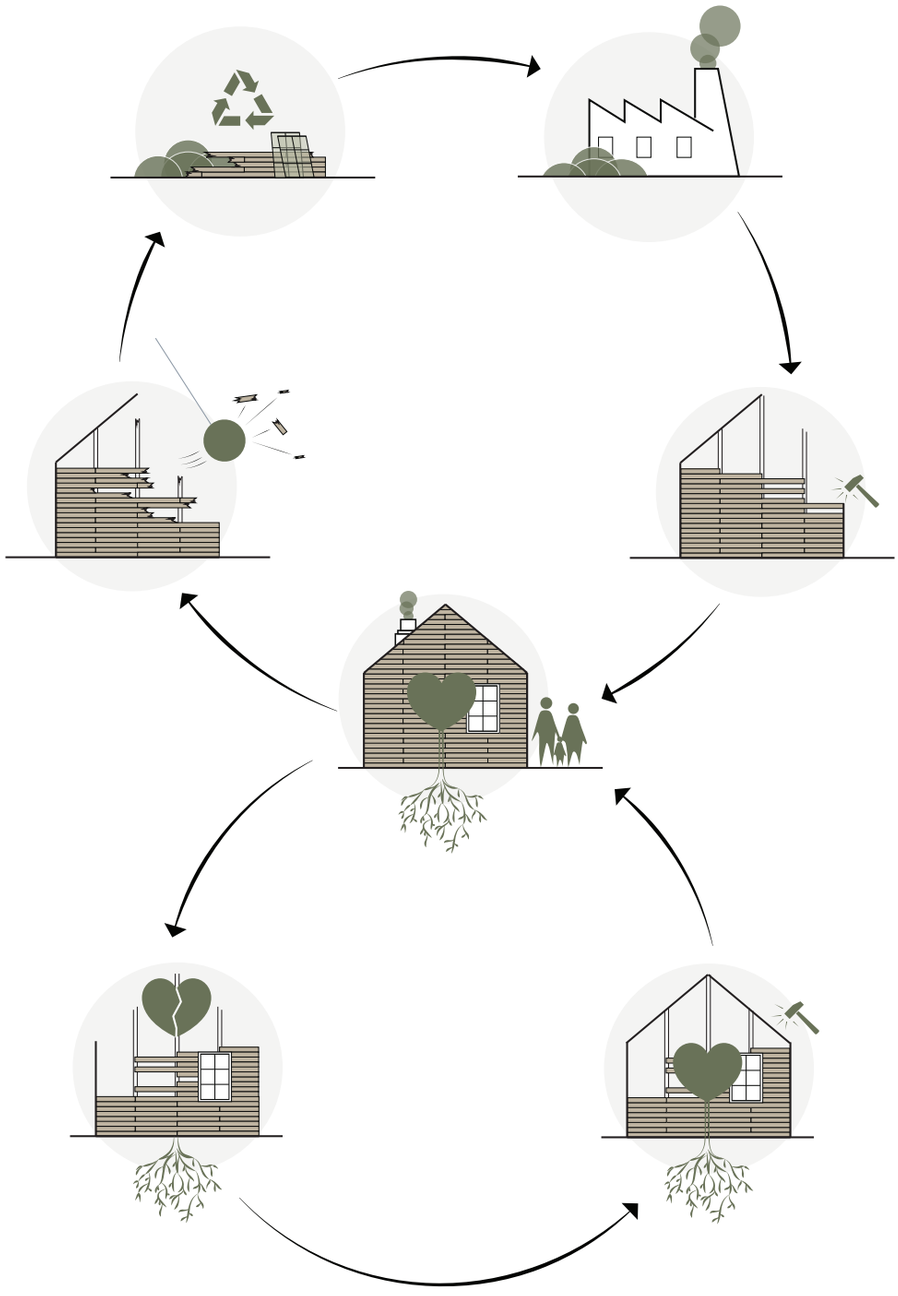
Ill. 1.1 Passive and active strategies

Indoor Environment/comfort

To feel comfortable in a hotel, a good indoor environment should be obtained. The parameters for a good indoor environment tend to have a mainly technical approach aiming to achieve a certain quality in each category. This thesis focusses on the reasoning behind choosing the level of comfort in categories of visual-, thermal-, acoustic- and atmospheric comfort. We, as humans, evaluate these parameters phenomenologically with our senses. Therefore, the approach will be an integrated strategy using both phenomenological and technical tools to evaluate and achieve the wanted qualities for each room in the building.

As Denmark has a temperate climate, we will aim to design a building that is well functioning and comfortable throughout the seasons. This means integrating both passive and active strategies in the design. The passive strategies are very beneficial for the energy consumption as they do not require any applied energy. These strategies will be integrated in the building envelope, natural ventilation, solar heating, shading and thermal mass. Mechanical ventilation will be a necessity to obtain a high atmospheric comfort along all year, with hydraulic heating for thermal comfort.

Along with a high architectural quality and indoor environment, the aim is to fulfill the 2020 energy requirement for a hotel which is 27.0 kWh/m^2/ year (Bygningsreglementet, 2019).



Ill. 1.2 Extended life cycle diagram

METHODOLOGY

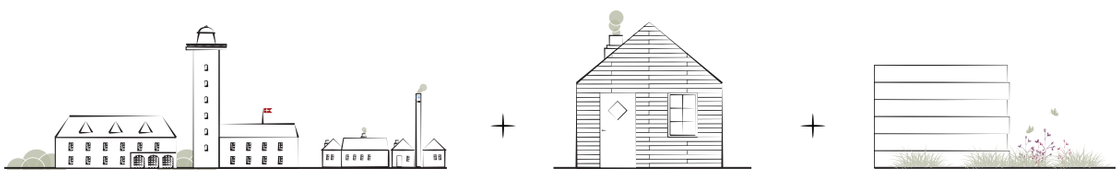
There are countless architectural methods and theories regarding reconstruction, alteration and preservation. Methods and theories will always have changing variations for each project. This chapter clarifies the variety of inspirational-, working- and analysis methods, why they are used and how they are the drivers to achieve the motivation of this thesis.

The base for the overall approach in the project is the trinity of Technical – Historical – Phenomenological, a method used when working with alteration and restoration of listed buildings (Harlang and Algreen-Petersen, 2015). According to the theory the categories are intertwined and cannot work alone, but due to historical events, we believe that for this project, the trinity need some customisation. Referring to the fact of not having an actual building today which complicate most altering and preserving theories, including this one, making the historical aspect stick out of the trinity toolbox. In the program, the historical aspects will be the core and timeline of the project, explained and analysed through a technical and phenomenological approach.

When presenting and analysing the technical aspects of this project we look at the project intellectually. Every physical registration and parameter are included along with the engineering-, functions- and construction parameters.

Phenomenology is an emotional approach, looking at the elements that cannot be measured and put into numbers. The background for this is using the senses and the human body as a measuring tool, to extract conclusions and design parameters. The phenomenological research and analysis are based on Peter Zumthor's theories on atmosphere (Zumthor, 2015) and Juhani Pallasmaa's studies of the senses (Pallasmaa, 2012).

The two perspectives will ensure more nuanced results from the analysis, and will aid us in setting up the right design parameters for us to design a building according to our sustainable approach.



Ill. 1.3 Landscape - still life - portrait

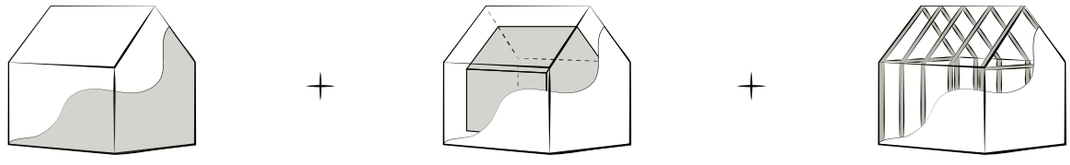
Another point of view

It is difficult to imagine a building without a concrete place, but the question is how much importance there is within the place. Do places create buildings? Or does buildings create places? According to the architectural theorist, Christian Norberg-Schulz, it is not necessarily supposed to be perceived as opposites but rather as extremes on a common axis with several stages in between. Instead of seeing a building as an isolated object, it must always be seen in the context of the surroundings. The architecture must adapt to the characteristics of the place and be based on the existing atmosphere. In the theory, he uses the ancient roman expression genius loci - spirit of a place. Places are intertwined in sociocultural contexts, which makes it difficult to separate an assessment of a social environment from an assessment of a place. The genius loci contain therefore a mixture of determinations as physical objects (technical), historical elements (historical) and the narrator's observations (phenomenological) (Norberg-Schulz, 1996).

Two independent theories, twenty years apart, states the same methodical trinity with only a few nuanced differences. This rises the confidence in the methods and allows us to expand them by collecting relevant aspects from both theories and adding additional viewpoints, as genius loci's sociocultural approach called the patina of a place.

The patina of a place takes into account the qualities throughout the life of the building- including both today's activities and the traces of past use and activities. This is shown in the dimensioning and materials of a place and how the building provides its users with an opportunity for aesthetic enjoyment, conversation and security. The genius loci are therefore relying on what other people do, think and express about a place (Norberg-Schulz, 1996).

The two theories above seem to omit a common parametric verification method on successful architecture. This does not mean that the Vitruvius' trinity of function, techniques and aesthetics are not considered. We see it more as interpretations, meaning the function aspect is implemented in the technical category and the aesthetics is part of the phenomenological analysis. It is the overall approach that is different.



Ill. 1.4 Skin - Meat - Bone

Landscape – Still life – Portrait
Skin – Meat – Bone

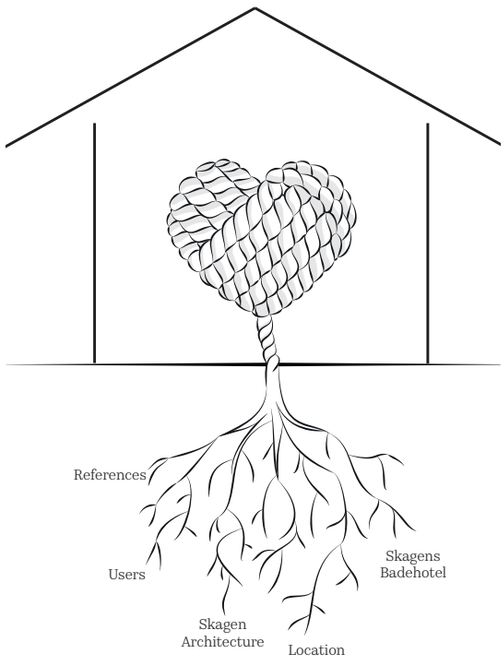
The methods have the intention for the design phase to ensure that all scales inform each other, and that they can develop simultaneously and inseparable. In the analysis of the former Skagens Badehotel the intent of using the scales as a more in-depth technical and phenomenological understanding of the building (Harlang and Algreen-Petersen, 2015). Bringing the same toolbox for every analysis but from different methodologies generates a great possibility for comparison, with completely different outcoming design parameters.

Landscape – Still life – Portrait is a tool that reflects analysis and designs from three different perspectives;

- **Landscape:** The building's relation to the surrounding environment.
- **Still life:** The building alone – building volume, construction and special qualities.
- **Portrait:** The details in the building – textuality, tectonic joints and meeting of materials.

Skin – Meat – Bone is tool that reflects analysis and designs from three different levels;

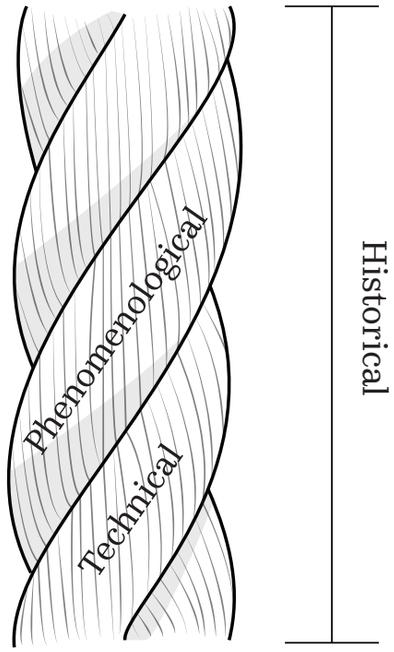
- **Skin:** The building's facade
- **Meat:** The room
- **Bone:** The structure



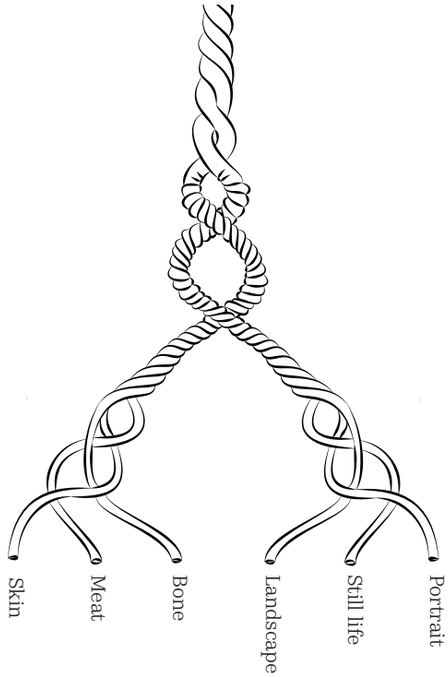
Ill. 1.5 Method tree

Wrapping the rope

Our defined method is the connection between the motivation and the design parameters, illustrated as a rope (see motivation illustration). The ropes are rooted in the cultural history and existing parameters of the project, and connects them all in an intertwined heart, symbolising the heart of the building and the integrated design process (Knudstrup, 2004).



Ill. 1.6 Method strands



Ill. 1.7 Method fibers

The relevant analysis is selected based on the historical method of the trinity, being the length of the rope. Meaning that an increased rope length, increases analysis, design parameters and ultimately the integrated design process. Technical and phenomenology, the remaining methods of the trinity, is illustrated as the rope's two twisting strands (see strands illustration). Ambiguously processing every historical pinpointed aspect, both technical and phenomenology. The technical strand is the hard physically engineering facts, and the phenomenology strand is the soft architectural atmospheres experiences. Each strand consists of twisting yarns, that finally unfolds as fibers of registration- and analysis tools (see fiber illustration), llustrating that every analysis is considered through the approaches Landscape – Still life – Portrait and Skin – Meat – Bone.

PROGRAM

The program contains all the initial research and analysis that creates the vary base for the Master Thesis and the designing process. The program is divided into five chapters all dealing with a new topic. Each chapters divides its analysis into the strands of Technical and phenomenology aspects and waves them together with the history of the given place. In the final chapter we describe our typology and present the room program and design criteria from which the project will be designed. As a conclusion on it all the concept and vision will be presented as the finale statement of the program.

ARCHITECTURE OF SKAGEN

This chapter will present the architectural styles and building techniques that have defined Skagen through history. The history of architecture in Skagen can be divided into the three periods Black, Yellow and Red which will be introduced though sketches and technical drawings. Lastly an evaluation of the traditional building materials will be made, to clarify which materials could be introduced in the design process of the project.

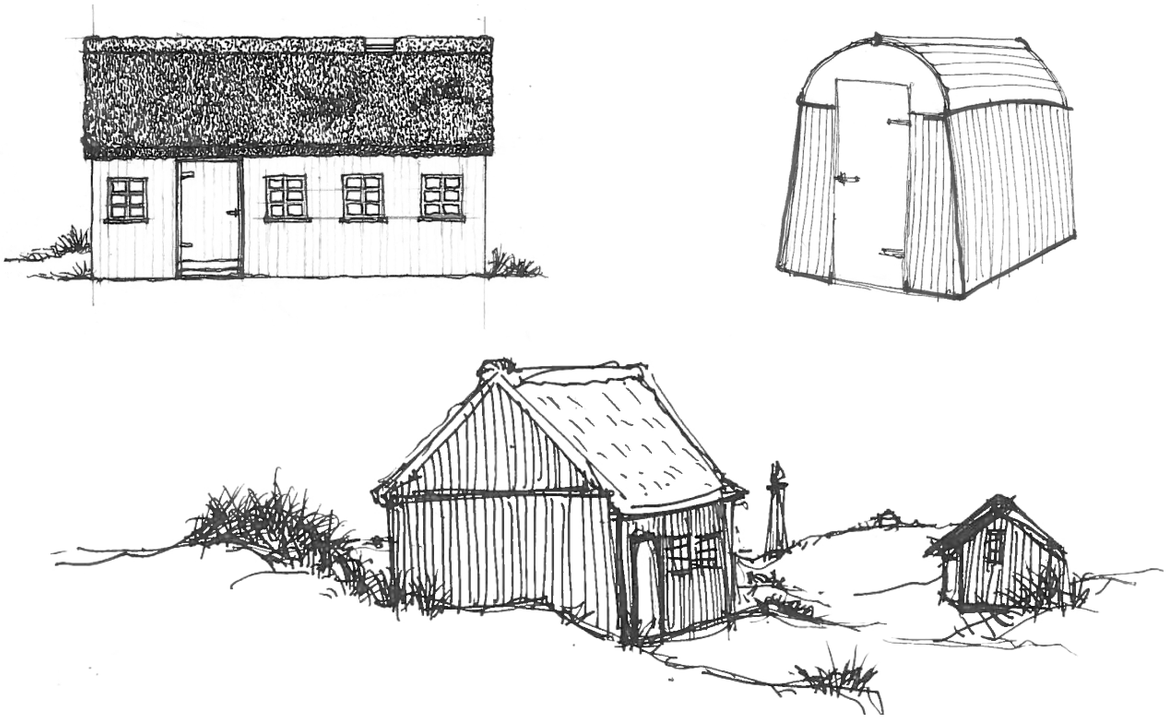
Ill. 2.1 Illustration of the variety of building typologies in Skagen.

ARCHITECTURAL HISTORY OF SKAGEN

Looking at Skagen's architectural history it can be divided into three main periods: the black, the yellow and the red. Each period is important to understand why Skagen looks as it does today, and will be presented in the following pages.

The black and yellow period is an expression of a poor fishing community that adapted to nature, and therefore created a long narrow town spread between the dunes. On the other hand the red period was an expression of a community in progress where the Skagen painters of that time brought the architects to the town, who through the years put their mark on the town. During the years Skagen has become famous for its specific yellow coloured houses, but the truth is that there were never more yellow houses than in any other town or city in Denmark. To give a more true insight into Skagens´s diverse architectural history it is therefore important to protect all the different types of buildings in Skagen (Lehmann and Nielsen, 2016).

The registration and analysis of the characteristics of the three periods, will be used as inspiration for the design process, by drawing parallels between the new building design and the architectural history of the city.



Ill. 2.2 Illustrations of houses from the black period

The Black period - 1875

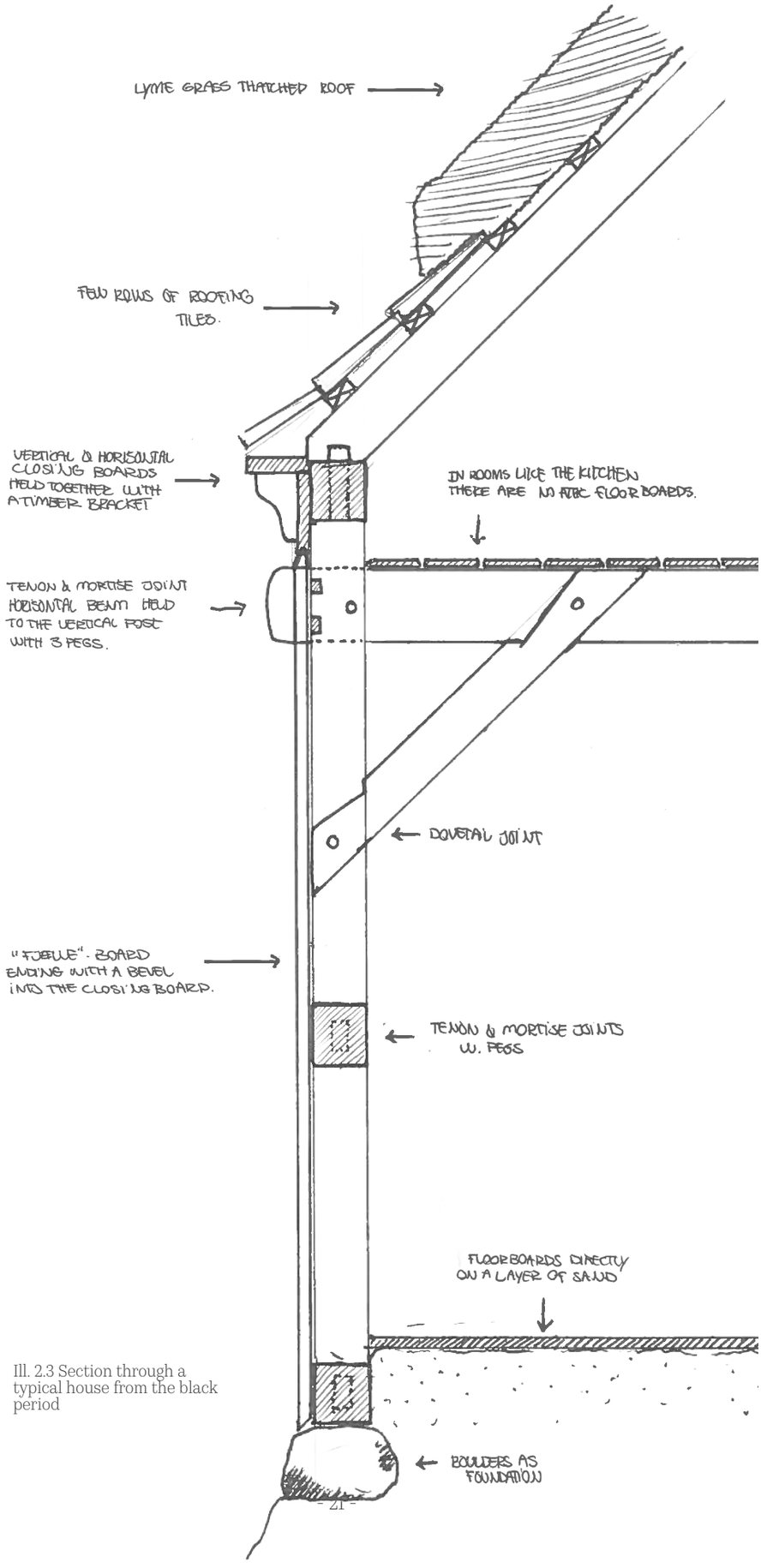
The black period is the time until 1875 where Skagen was a small fishing community. In this period the houses were narrow low houses covered with vertical black-tarred wood cladding, made of driftwood, the so-called "fjælle-beklædning". With barely any access to wood and stones, most houses were build with lyme grass thatched roofs with a small opening to let out smoke. Only small windows were seen in the facades and most of them were fixed with lead frames. To create extra storage the local people build small black-tarred wood sheds with a dinghy turned upside down to create a roof. A building design that the people in Skagen still uses as garden sheds.

The houses were due to the weather conditions orientated east - west and spread out in the sand dunes to seek shelter from the fierce climate (Lehmann and Nielsen, 2016).

The houses of the black period is very practically build and situated. Function, durability and available materials were the driving factors for the building design (Heegaard et al., 1982). Yet, the traditional building typology is still considered aesthetically beautiful, as we can relate to their scale and the structural details. Every detail has a purpose and the materials are found in nature and has a high level of tactility.

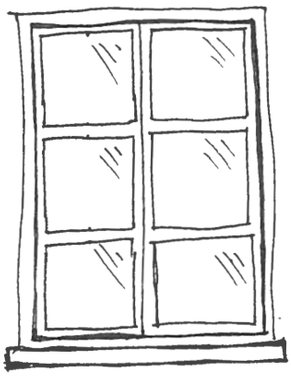
The buildings were raw and had a faint odor of tar. Only some of the houses has floorboards, whereas others had no flooring but just sand. In general the houses mirrored their surroundings.

These are qualities we should try to implement in the design to incorporate the history of the site in combination with fulfilling present building regulations.



Ill. 2.3 Section through a typical house from the black period

Ill. 2.4 The yellow period - houses in a line gable to gable.



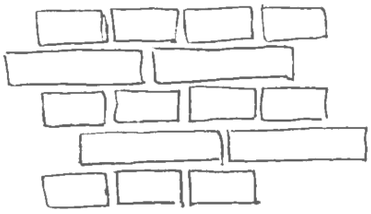
Ill. 2.5 Most used window type in Skagen

The Yellow Period - 1875-1907

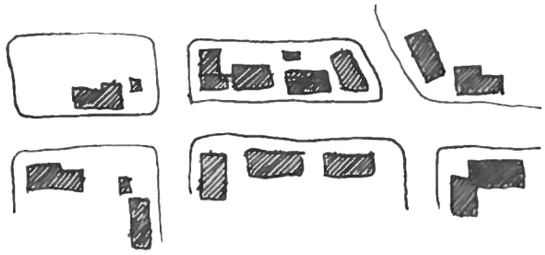
In the last part of the 1800th hundred, Skagen had an economic progress in the fishing industry. Furthermore the Building Act and health regulations were established, which had higher requirements for the way local people built their homes. As the new railway between Skagen and Frederikshavn took its form the architecture in Skagen changed. The old wooden houses were improved, rebuilt or entirely new brick houses were build. Some houses were only improved with bricks on the most vulnerable facades facing south, and keeping the wood cladding on the others. The new brick houses were like casted in the same form, and were usually build close together in a row, sometimes even sharing the gable to save materials. They were all yellow, white or red limed with red brick roofs and white cornice. This became Skagen's golden age and is called the yellow period. Along with the economic progress, new people like craftsmen and traders came and settled down in Skagen. These people build some of Skagen's first Badehoteller (Lehmann and Nielsen, 2016).

The Red Period - 1907

In 1907 Skagen harbour was inaugurated which created even bigger economic progress for the small fishing town. The red hard burned brick was now available to the locals, and it did not need any protection against the harsh weather. This is the start of the red period and many red brick villas and new neighbourhoods were build. The houses were no longer orientated east - west but was now orientated towards new streets. The houses started to get their own gardens with white or red painted fences. The fisher town had now evolved into a trading town, with boutiques, banks and villas. Many summer guest, artists and investors was travlling to Skagen and with them came some of that times most recognised architects. Among those were Thorvald Jørgensen who made Skagens Badehotel and Ulrik Plesner who has had the biggest impact on Skagens architecture through time. Plesner designed more than thirty buildings in Skagen, among them the King Christian X and queen Alexandrines summer retreat Klitgaarden (Lehmann and Nielsen, 2016).



Ill. 2.6 The red period - brick pattern

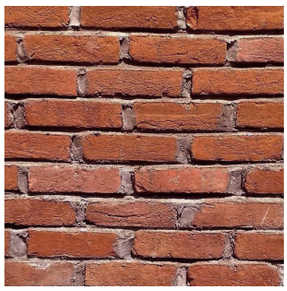


Ill. 2.7 The red period: Houses facing the streets

Reflection

By finding inspiration in the architectural history of Skagen, the cultural heritage of the site will be included in the new building in a physical form. As our method of analysis and design is working with the new building through the perspectives of landscape, still life and portrait, the cultural heritage should be implemented and recognisable in all scales.

Today Skagen is mainly known for its characteristic yellow limed houses, but many of these have been limed through resent years, and were originally red bricked houses.
Reflecting upon building traditions throughout the history of Skagen architecture, the black period is the one that stands out the most. The houses of the period were build out of materials available in Skagen and found in nature, whereas the yellow and red period reflects the societal progress and the materials available in the rest of the country as well.
As the plot for this project is in a nature conservation area on Grenen, we intent to find inspiration in the materials and structural details used in the black period, as the houses in this period were a result of the nature surrounding them. The houses were spread between the dunes and also due to sanddrift and the roof being thatched with the lyme grass surrounding the houses, they became one with nature, looking at them from a distance. This is an architectural expression we strive to create in the new Hotel on Grenen, looking at the design from a landscape perspective.
The still life perspective should be represented by choosing materials with a relation to the architecture of Skagen. On a portrait level, there are many structural details and building traditions in which to find inspiration during the black period in Skagen, and in general in the tradition of working with timber constructed buildings.



Ill. 2.8 Red bricks

Ill. 2.9 Chalk

Ill. 2.10 Tarred timber

MATERIAL EVALUATION

The schedule is presenting and evaluating the materials traditionally used as roofing and cladding in Skagen through history. The aspects, which the materials are assessed according to, are divided into three levels of importance, as some of the aspects are more important than others. The level 1 category are aspects, which are very important for the building to fulfil the vision and sustainable approach. Level 2 categories are aspects, in which it would be great to make a high score to improve the building, but they will not have a huge effect on fulfilling the vision and sustainable approach. Level 3 categories has a relevance to the material choice, but will not affect the vision and approach.

The materials are given 1-3 points. 3 points to the materials that performs best, and 1 point to the materials that performs worst. What each category weighs as a good performance will be described in the schedule.
By weighting the categories respectively 50 %, 75 % and 100 %, we will achieve a more accurate result for this case. An example; 'Reference to Skagen' is a level 3 category. Therefore a score of 3 will be counting only for 3*0,5=1,5 points.
The schedule is divided into two, one for roofing, and one for cladding assessing the materials on both technical and phenomenological aspects, to ensure a more nuanced result.

Ill. 2.11 Roof tiles

Ill. 2.12 Thatched roof

Ill. 2.13 Roofing felt

The evaluation of the materials will be used as an initial material analysis leading the way towards choosing the cladding and roofing materials for the project.

Conclusion

The conclusion of the material evaluation is that tarred timber and lyme grass thatched roof are performing best, according to the parameters set for the evaluation. These are the materials with a high level of tactility and variation - they are also the most natural materials and thereby with their colourations and reference to history, the most suitable material choice for this project. There are though a few parameters we need to be aware of when designing the hotel and using the materials. These parameters are specially related to the lifespan of the building and the maintenance.

The period of time between maintenance for tarred timber is significantly higher if used of facades not directly exposed to the sun. With this in mind, we might consider options of using different materials on the south facades. Also an important parameter is the lifespan of the lyme grass thatched roof. We need to be aware that decreasing the sloping of the roof surfaces, will significantly decrease the lifespan of roof. To achieve a minimum of a 20-year lifespan, the slope must not reach below 30 °.

Level 1 Level 2 Level 3

Phenomenological aspects	Red brick	Lime paint/ chalk	Tarred timber	Comments
Tactility (tactility is very important looking at the building up close, as it activates the sense of touch and gives the building a sense of legibility)	2	1	3	Wood is an anisotropic and natural material, where you can feel the wood grains. Red bricks have a high level of repetition and chalk has a relatively smooth surface.
Scale/variety (A material with larger or smaller variety in appearance, will give people a sense of scale and naturalness)	2	1	3	As wood is a natural material it has a high level of variation and a scale relatable to humans. Red brick is a constant repetition, which makes in less god for experiencing scale. Chalk has no variation.
Odor (if a material has a bad odor, it will affect the users negatively, and the other way around)	3	3	1	Tarred timber has an odor of tar, which will fade away eventually. Whether this is good or bad for the experience is a matter of opinion. Chalk and brick has no odor.
Reference to site (Will the material fit well with the surrounding landscape at Grenen)	2	1	3	Red brick and chalk is usually used in town. Tarred timber was originally used on vacation houses on Grenen and on the former Badehotel.
Reference to Skagen (Does the material have a special reference to the architectural history of Skagen)	1	2	3	The tarred timber were used back in the black period of Skagen. Chalk were used in many cities, and is a later emerged trend in Skagen. Red bricks are found everywhere.
Technical aspects				
Resilience* (Lifespan of the materials and resilience to climate)	1	2	3	If the facades are maintained properly they will stand for respectively: Brick; min 150 years Chalk; min 150 year (for brick construction) Tarred timber: potentially unlimited
Maintenance (How much effort is needed to maintain the material)	3	1	2	Brick has to be maintained every 50 years. Chalk has to be refreshed every 5-12 years. Tarred timber: every 5 years on south facade and every 20 year on north facade.
Total score	**11**	**8,5**	**14,25**	

*The resillience of the materials are based on the underlying construction. The salty air on Grenen will though affect the brickwork negatively. Examples of 700 year old lasting tarred timber constructions are still standing. Tarred timber are especially recilient to saltwater (Christensen and Vadstrup, 2014).

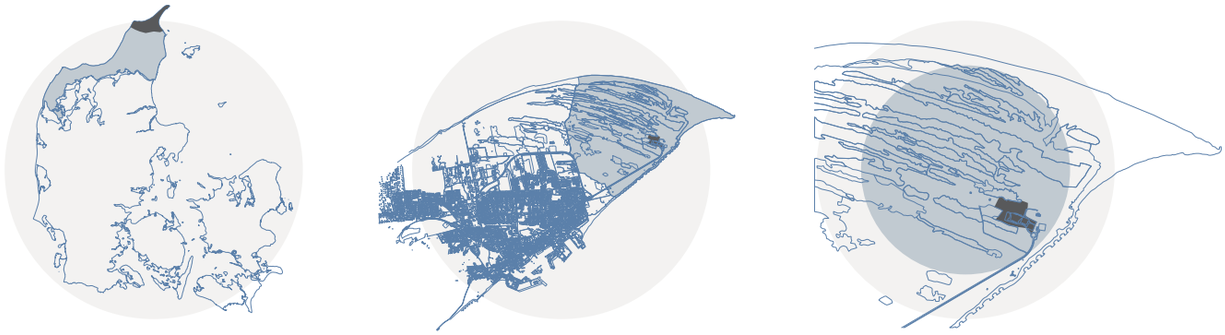
Level 1 Level 2 Level 3

Phenomenological aspects	Roof tiles	Lyme grass thatched roof	Roofing felt	Comments
Tactility (tactility is very important looking at the building up close, as it activates the sense of touch and gives the building a sense of legibility)	2	3	1	Roofing tiles have a smooth and fabricated surface. Same goes for roofing felt, that are also flat. Thatched roof is a natural material with a high level of tactility.
Scale/variety (A material with larger or smaller variety in appearance, will give people a sense of scale and naturalness)	2	3	1	Variation in roofing felt is little to non-existing. Tiles have a repeating rhythm, but little variation. Thatched roof is natural and relatable material in scale. Also the patina will create a variation in colour.
Odor (if a material has a bad odor, it will affect the users negatively, and the other way around)	2	3	1	Thatched roof has a natural odor, roofing felt has an odor of asphalt, and roof tiles has no odor.
Reference to site (Will the material fit well with the surrounding landscape at Grenen)	1	3	2	Roof tiles are mainly used in town. Roofing felt were used on the former Badehotel, and on the Vangby vacation home close by. Thatched roof was traditionally used in Skagen and blends in with the surroundings.
Reference to Skagen (Does the material have a special reference to the architectural history of Skagen)	2	3	1	Roofing felt is rarely seen in the architecture of Skagen. Roof tiles are the mainly used material in Skagen, but also in the rest on Denmark. Lyme grass thatched roof was special for the black period in Skagen.
Technical aspects				
Resilience* (Lifespan of the materials and resilience to climate)	3	1	2	If the roofs are maintained properly they will stand for respectively: Tiles; min 100 years Thatched: 50 years* Roofing felt: 50 years
Maintenance (How much effort is needed to maintain the material)	2	2	2	All materials need regular repairs. These depends on many variables.
Total score	**11**	**13,75**	**8,25**	

* The slope of the roof is crucial. 50 years is expected for a slope on 45 ° or more. The lifespan will decrease 10 years for every 5 ° less than 45 °. (Veludført stråtag, 2019).

LOCATION

The following chapter will be dealing with the location in two sections: Technical and Phenomenological, along with a smaller description of the history of the place. The technical section is divided into the division of Landscape - Still life - Portrait, where each section describe the location and micro climate from the three different perspective. The phenomenological section takes its fulcrum on how we as individual human beings experience and senses the location and how our interpretation of the place changes with time.



Ill. 2.14 Location

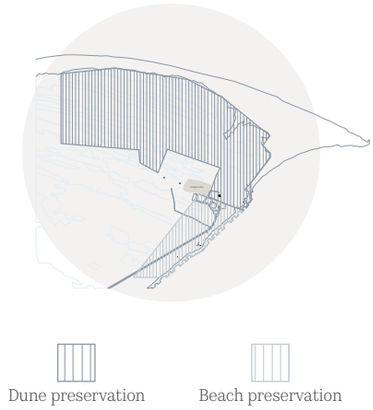
TECHNICAL REGISTRATION

This part is going to describe what type of area the project site is located within, and what challenges this specific location can create for a future building.

LANDSCAPE

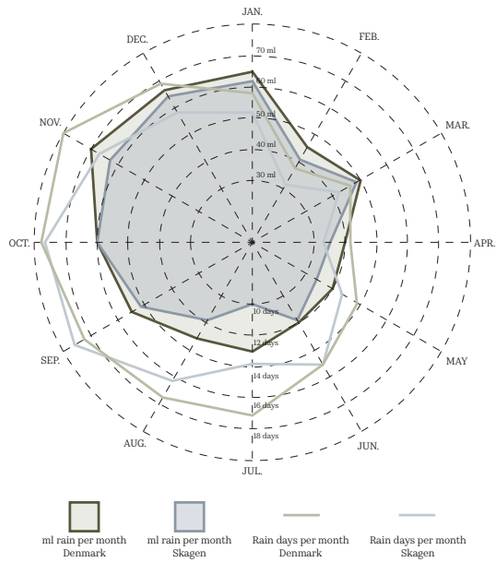
The Project site is located in one of the most valuable preserved nature areas in Denmark named Skagens Odde and more specifically at the northerly point of Denmark, Grenen. It is a unique nature area compared to other places in Denmark as it is affected by both the sea, the waves and the currents as well as the sun, the wind and the sand. All these elements are creating a harsh and dynamic nature which is rarely seen anywhere else. This harsh nature is however home for a unique wild life of birds and provides a variety of plants, that has adapted to the micro climate (Naturstyrelsen, 2017).

An aspect that needs to be kept in mind when building in the area of Grenen is the preservations of the nature. In general, the whole area is part of Denmark's coastal preservation areas which purpose is to protect different species and unique plants in the area which is in danger of disappearing. Furthermore, the project site is also surrounded by both beach and dune preservations. The beach preservation is ensuring that the beach areas is kept untouched and remain within the same condition. Where the dune preservation is also keeping the area untouched, it additionally protects the surrounding areas from possible sand drift. In general, the many protected areas that applies to the surrounding of the project site and the project site itself must be considered when designing a new building in the area. Designing a building that have a strong relation to the landscape and its qualities must be highly prioritised as well as creating a building that respects its ambient environment.



Ill. 2.15 Preservation areas

Ill. 2.16 Sunshine hours

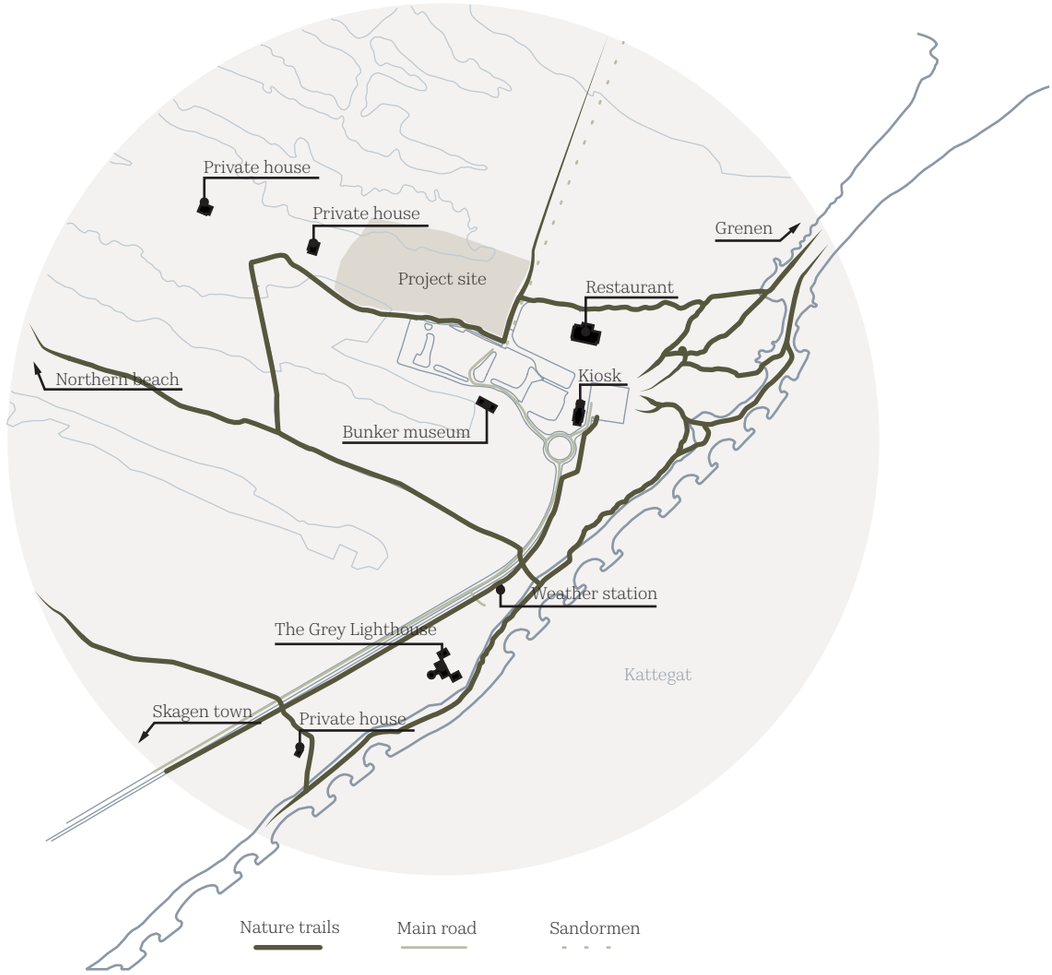


Ill. 2.17 Rainfall

Still life

The micro climate in the area is also very special for Denmark as Skagens Odde is located in what is called the desert of Denmark. This area that is going diagonal across Denmark from Sjælland to Skagen and the area has half the amount of rain a year as in the rest of the country. This naturally results in more sun hours in Skagen and creates a warmer micro climate (Naturstyrelsen, 2017). The sun light in Skagen has for more than a hundred years been claimed to be unique and has driven many artists to Skagen over the years. The claim might be true due to the fact that Skagen is surrounded by sea and white beaches that reflects the light together with the wind that blows salt crystals over land, which breaks and reflects the light differently (Christensen, 2002).

Looking at the more tangible elements surrounding the project site, a few other buildings are seen. A couple of private houses, a restaurant on the neighbour dune, a tourist kiosk, and a light house. Grenen is located at the end of the main road Fyrvej and limits the access to the area by car to one single road. All through the landscape, many nature trails gives a good opportunity to wander off from the project site and into the nature of Skagens Odde. South of the project site on a larger trail, "Sandormen" (The sand worm - a tractor in front of a wagon with seats) runs by, driving tourists to the top of Grenen to see the two oceans Skagerrak and Kattegat meet. Grenen's attractions are mostly seasonal, as the rest of Skagen, which create a major load of people on Grenen during the summer. The big flow of people and cars are also why the big gravel parking lot is found outside the project site and the tiled parking lot south from the site. This is a fairly big element that is necessary for the area to function, but can be disturbing element for a future hotel. Therefore it is important to consider this when design a building on the project site.



Ill. 2.18 Infrastructure

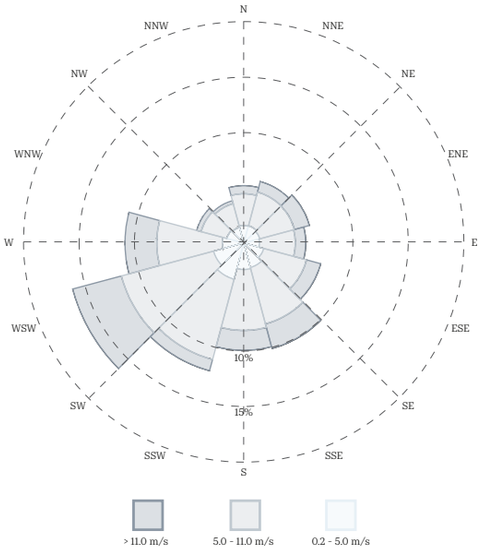
Medium high vegetation | Moor landscape with low vegetation | Sand dunes and beach | Edge between moor landscape and the sea | Sea

Ill. 2.19 Landscape and vegetation illustration

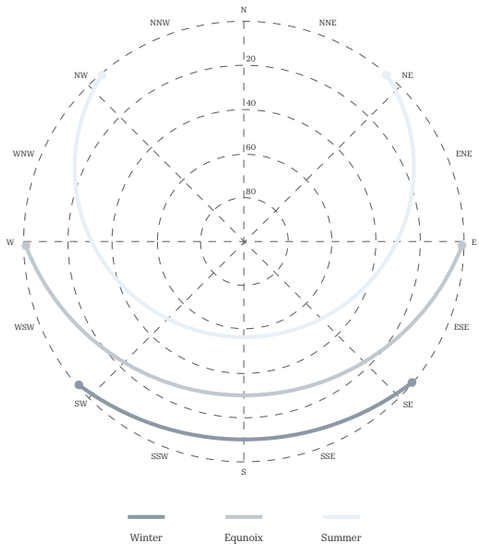
Portrait

Looking further into the micro climate surrounding the project site, you see the wild and slightly hilly moor landscape and preserved rows of dunes. The harsh nature is reflected in the low vegetation which mostly consist of low grasses, medium high bushes and trees. It is mostly small deciduous trees, rosehip bushes, heather, lyme grass and the famous Skagen rose that is dominating the landscape. The low vegetation in the area do not offer much shelter from the wind, hence there should be put an extra focus on designing comfortable outdoor spaces that can provide shelter from the strong wind that most frequently comes from a west-southwestern direction (Ill. 2.20 and Appendix 10) (Cappelen and Vråe Jørgensen, 2005). Furthermore the low vegetation limits the shading challenges for a future building, and the main factors in adapting a building in these surrounding becomes the forces of wind, sun and sea.

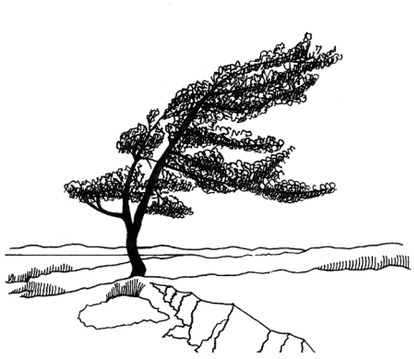
The low vegetation and the hilly moor is the only landscape that separates the project site from the sea. Here the moor landscape meets the sea with either sand dunes and beach or artificially placed boulders, which are there



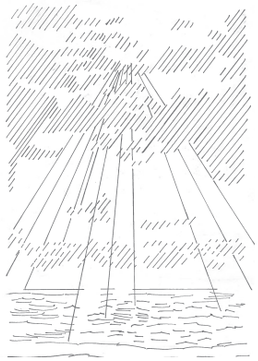
Ill. 2.20 Wind - technical



Ill. 2.21 Sunpath - technical



Ill. 2.22 Wind - phenomenological



Ill. 2.23 Sun - phenomenological

to prevent the sea from eating it's way further into the landscape on the eastern coast. Also the landscape north of the site has larger areas of swales. The close connection to the sea with high salinity waters results in a highly salty air that will affect durability and aesthetics of the building overtime. This environmental impact therefore needs to be considered when making material choices to ensure a long-lasting building with the least possible maintenance (Riemann et al., 2015).

Another important consideration, when building close to the sea, is flooding. There is though, a minimal risk of flooding on this site, as a result of the good hydraulic conductivity in the landscape and that only 10 pct. of the surrounding is paved. If the building is raised three meters above sea level the risk is even smaller. On the other hand, the groundwater in the area could potentially become an issue as the depth is normally found between 0,6 -0,3 meters and would possibly raise above the ground level at extreme rainfall. This again supports the idea of raising the building at least 3 meter above sea level and take the quality of the foundation into consideration when designing the building (Dingeo.dk, 2019).

The scale and wilderness took the eyes hostage. The body told a more detailed and translatable story of the landscape.

PHENOMENOLOGICAL REGISTRATION

During an initial site visit in early February, a phenomenological analysis was conducted as an additional approach to registering the site technically. The approach was to register the site using the body and all of our senses.

The phenomenon-related aspect helps to ensure a more poetic quality, in conjunction with technical and historical aspects, which ensure a more rational, nostalgic and contemporary context (Harlang and Algreen-Petersen, 2015).

The moment you step out of the car, at the site, you meet a wall of sensory experiences. The sensation of why the landscape you just slowly and gaping drove through, looked as wind-swept and robust as it did. You can almost taste the desiccate, salty and chilly breeze. The harshness of the nature around here and creeping feeling, that you are not going to be treated any different.

When the accumulated stress of the environmental contrast has left the body and you physically and mentally have adapted to the surroundings, you experience the tranquil silence. The silent and loneliness suppresses all external noise, unless you actively focus your attention on the blowing wind or the distant waves washing on to shore. Factors supporting and articulating the endless experience and understanding of how tiny and fragile you are in this context.

The scale and wilderness took the eyes hostage. The body told a more detailed and translatable story of the landscape. The expression of the dunes became overwhelming and confusing for the eyes (Pallasmaa, 2012). Trekking along hidden fragments by foot, the remains of the former Skagen Badehotel's foundation seemed endless. Not by the distance but by the physical journey, mapping and measuring the dunes. The eyes could only predict the ground covers outcome, whether the dune had an upward or downward slope and the firmness of it. The certainty was not provided ahead of every step but occurred with the direct contact through legs and feet.

Creating and preserving an environment for visitors to become earthly, synchronise with nature and get away from daily life and routine will be in focus, when designing a new Hotel. The visitors should still be able to enjoy and experience nature. The building will take away some of the natural environment and an exchange needs to take place. A give-and-take between the building and its surroundings (Zumthor, 2006). The building should be contributing and improve the overall quality- and potential of the site, by enhancing nature, fitting in and bringing new life to the site.

Ill. 2.24 Atmosphere collage

BADEHOTELLET

The following chapter will present the Former Skagen Badehotel in three sections: Historical, Phenomenological and Technical. The historical part will describe the journey of the hotel from its first idea until its disappearing and the society surrounding it. The phenomenological part is an interpretation of how we based on photos and stories imagine how the sensual experience of the hotel might have been. This part is structured by the Album method where it horizontal tells the story of how the building relates to Landscape - Still life - Portrait and vertically Skin - Meat - Bone. The technical part is structured by Landscape - Still life - Portrait and will describe the physical features of the former hotel and what the qualities of these were.

THE HISTORY OF SKAGENS BADEHOTEL

The original Skagens Badehotel was built in 1898 and had the most northern location in Skagen along the beach. The hotel was designed by the Danish architect Thorvald Jørgensen and was with more than a hundred rooms the biggest hotel in Denmark on that time (Nielsen,2018). It was a luxury hotel and often hosted guests from the elite of society and royalties. The guests often came from the bigger cities and was seeking a peaceful vacation in nature away from the cities. Therefore, the hotel also had its own healing doctor that instructed the guests in how to spend their vacation best. Furthermore, the hotel offered its guests tennis courts, ballrooms, restaurants and a hangar for private jets (Skagens Badehotel på Grenen, 1914).

In the 1890's the topic of building a Badehotel on the northern location of Skagen became a public debate, and the local people were split in their opinions. The Danish poet and painter Holger Drachmann who had a strong connection to Skagen since the 1870's (Skagens Kunstmuseer, n.d.), was strongly against the project and in 1898 he wrote in the newspaper:

"Let's kill this project before it takes it's Danish or Norwegian victims. When the local people of Skagen hears, that they in this climate will build a big Danish-European first class Badehotel, on Grenen or the Northern beach, then the local people of Skagen will laugh" (Christensen, 2014).

Drachmann was not the only one with these opinions, but nevertheless in 1898 the stock company "Skagens Badehotel" was established and Thorvald Jørgensen was proclaimed to be the architect (Jyllandsposten, 1898). The hotel was built, and from 1900 to 1920 the hotel was a major success and attracted some of Europe's wealthiest people. Unfortunately, it all came to an end on October 10th 1938 when a lightning struck down and burned down the east wing. In the 1940's the war came, and the Nazis took over the hotel and eventually it was all gone in 1943 (Nielsen, 2018).

After the war many attempts have been made to rebuild the spectacular Badehotel, latest under the municipal elections in both 2013 and 2017. This time it was due to a new Potential plan that had been worked out, under the title "Skagen as an international coast holiday town", in 2014. In this plan it is proposed by the municipality that it could be ideal to place a new Badehotel on the same location as the old one (Frederikshavn kommune, 2014). But in the city council not all parties were thrilled about the idea, due to two main factors; They were afraid to destroy the nature, which they believed belongs to all of us. Also the new Potential plan used an unfortunate choice of words, by describing the new Badehotel as a hotel for the society elite. In a final vote in the city council the project was outvoted once again and taken out of the Potential plan (Frederikshavn kommune, 2014). Nevertheless, the talk about the hotel is still wandering among the local people and investors are still attempting to make it possible to build a new hotel in the most attractive location in Skagen.

Making it possible to disappear underneath the high- and coffered ceilings, just for a moment, far from the endless buzzing in the city.

PHENOMENOLOGICAL REGISTRATION

The phenomenological registration is an attempt to approach architecture's sensory attributes and operationalise them into a registration-, analysis- and valuation tool. By framing the various characteristics of the building phenomenology in an Album, it is possible to generate a starting point for the new architectural interventions, that interact directly with our body, senses and consciousness (Harlang and Algreen-Petersen, 2015).

The vertically far left row is telling the story of the former Skagens Badehotel's interaction with the surrounding landscape. It results in some local boys having an annual gig of digging out by hand large parts of the building, before the first guests arrive. A necessity since dunes slowly embrace the hotel during the offseason, on the northern side at least. The landscape view of the building's skin showcases a completely different architectural approach on the more strict and welcoming southern side. The approach is still raw and natural but require much lesser maintenance, since the building stands monumentally on a raised plateau.

The closer you get to the facade the more it reveals in the upper horizontal row. From the landscape view you sense a dark surface due to the tar that protects the boards. The tar provides a natural transparent brown shade, so you sense the warmth of the structure in the wood. Standing right next to the wooden facade on a cold sunny day you experience the reflecting heat from the sun, as if you were sitting right next to an outdoor heater with a latte on a sidewalk café. Inside this invisible warm cloud near the cladding you immediately sense a whimsical wall of the tar odor. At first you have no idea what produce such a smell and search curiously after the source until you realise, with the entire face against the cladding, that it is the tar. Knowing the source, the smell grows on you and becomes more of a fascinating aroma, as it only appears in the direct sunlight.

The middle horizontal row frames the meat of the building, starting from the landscape view of the embracing nature. Almost staging the room as it was lying on top of a silky-smooth pillow-dune. Here, you can sit by one of the pavilion's many windows and enjoy the fish fillet with mushrooms from the á la carte. Greeting with the recognised non-verbal nod towards the nearest guests, as they, like you have a little crooked smile on their face. The nature seems so close despite sitting inside, due to the huge windows providing a panorama view in the almost column free room. Making it possible to disappear underneath the high- and coffered ceilings, just for a moment, far from the endless buzzing in the city.

The bottom horizontal row has a lot in common with the upper horizontal row with the exposed and highlighted structure framing the skin of the building. The sharp colouration contrast between the skin and bone, really makes the building's ornamentation pop out. From afar it seems like a gesture to the dune rows, with the dark skin as vegetation, the bright details as sand and the elongated slim building. Certainly, supported by the black and

Ill. 2.25 Badehotel Album

white format. The still-life and portrait view of the structure reveals small detailed cut-outs everywhere and by leaning your head all the way back, at the end of the roof's ridge-lines, you will see the guardians of the hotel. Wooden over watching dragon heads that takes you to another universe or fairy tale, like the Nordic mythology. Which is a bit laughable but simultaneously somehow fits the surrounding fairy tale-like context.

Aspects drawn from a phenomenological analysis can seem quite abstract and are only perceived as a translation-tool for possible further alteration or reconstruction. Some of the considerable aspects are the charm of the tar smell and the embracing nature, which relate to the different architectural approaches towards the connection between building and nature. The contrasting light and dark elements staging the ornamentation and emphasising the gesture towards the rows of dune, having an even stronger connection today as the seas have added several rows since then. Lastly, an overall observation and reflection for the design phase; do not let imagination limit the design as the site and surrounding itself could be a fantasy setting.

Technical registration

The technical registration will describe the physical features and layout of the former Skagens Badehotel.

Landscape

With architect Thorvald Jørgensen the former Skagens Badehotel was built in 1898. The former hotel was seen from the south located on top of a sand dune, were it on the western side where placed directly on the white beach. It consisted of one main building of three stories, and had two smaller pavilions of each one floor. One pavilion on the west side of the main building and one on the south side. Thorvald Jørgensen had designed the hotel in the Norwegian Dragon Style that, despite its characteristic appearance, had deep relations to that times architecture in Skagen. This could be seen in the black-tarred facade cladding and the window style which ensured that the building was not completely stranger in its environment.

The hotel was a long narrow building of approximately 12 meters width and was orientated north-south. This allowed a good visual comfort indoor, with rooms on both sides of the building. The orientation of the building might further have resulted in overheated rooms towards south, but by looking at the old photos it seams like the balconies might have been used as solar shading to ensure a better thermal indoor environment on the southern side. On the Northern side it seams like the balconies were mainly there for visual appearance and the comfort of the guests. Nevertheless the biggest reason for orientating the building like this have with big certainty been the direct access and view to the surrounding nature as beaches and the existing horizontal shaping of the landscape.

Still life

Moving on, the former Skagens Badehotel had a mix of flat and sloping roofs and consisted of three floors and a basement. Looking at the plan, the hotel was divided into two connected buildings. The building towards east

consisted in the parterre plan of a main entrance, a ballroom, dining-room, reading room and a porch in connection with a bigger outdoor terrace. The upper floors and the building towards west had private guest rooms, each room with its own bathroom and access to a balcony. Not much information on the hotel basement exists, but from photos and impaired stories it can be assumed that it had different staff services and a wine cellar. In general all the public facilities was located in the eastern wing of the hotel, which made great sense as this was the most exposed area due to cars, plains and in general noise from the people arriving and using the area. The hotel porch and dinning area was designed as to extension to the northern facade and create an outdoor space between them, where the large terrace was placed. This might have created more shading on the terrace but at the same time also provide shelter from the wind coming primarily from west.

Portrait

The former Skagens Badehotel was a black-tarred wooden building with white details seen as the balconies, windows and doors. Its Norwegian Dragon Style could easily be recognised by the white wooden dragon heads on the edge of the roof at each gable. The roof was made with asphalt roofing and had several dormer windows and chimneys

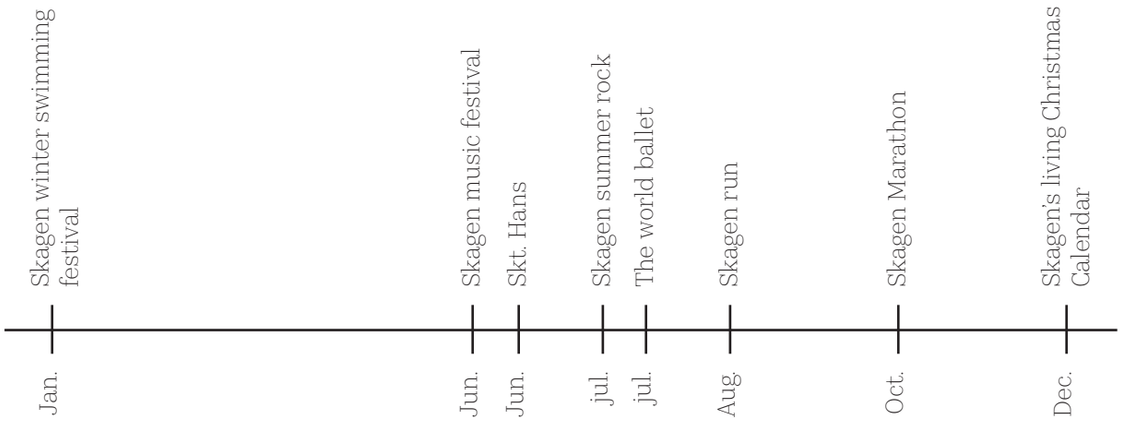
In comparison with the rest of the hotel the basement and the terrace were made of concrete, where the foundation was painted white and the terrace appeared in raw concrete. Both terrace and foundation both had rounded edges that created a softer appearance off an otherwise heavy element.

Looking at Skagens Badehotel both inside and outside you find various bone-details. Nicely rounded beams and columns that around the entrance was further decorated with a painted pattern. Also, doors appear with well-made panels and windows were traditionally divided with munitions into six smaller glazing areas. The interior of the building was the same. Here the dining room had nice big top rounded windows orientated towards north, east and west, that brought the beautiful daylight into the room. Furthermore, the dining room had a coffered ceiling where both ventilation and electrical light bulbs were visible. Looking at old photographs of the hotels roofing and comparing it with interior photographs we assume that the ventilation have been driven by thermal buoyancy and the ventilation shaft seen in the photos have been functioning as thermal chimneys.

Other than the Norwegian Dragon Style it is hard to tell how the former Badehotel was constructed as no sections and elevation drawings exist today.

USER GROUPS

This chapter will focus on the demands and needs of the four different user groups; hotel guests, locals, artists and housekeeping staff. The first part will discuss and explain why these four users have been chosen based on various analysis, interviews and statistics on all four user groups. To support these analysis the design tool Persona is being introduced which helps to give a more specific and detailed picture of the individual user. In the end a list of design criteria for each persona is made as a guidance to the design process.



Ill. 2.26 Yearly activity calender - Skagen

USERS

Though Skagen is an old fishing town it have throughout the last decade become known as one of the most attractive tourist towns in Denmark. The population in Skagen have been decreasing over the years and today the town have 8,047 permanent residents, all though many other people consider them self as part time residents of Skagen. During the summer weeks Skagen's population grows to over 50,000 thousand people due to tourism. Over the next years the truism in Skagen is expecting to grow even further, and in "The potentialplans for Skagen as an international coast holiday town" the municipality and local investors is putting focus on the importance of keeping the town attractive for the tourist. Here one of the proposals was to build a new hotel on Grenen with a unique location. In this thesis we have taken this proposal, and through various analysis looked at how this could be done in the most respectful way both for the given area Grenen, and for Skagen as a town. For us to design a new hotel that will be valuable for both tourism and the town, the opinions of the local residents of Skagen becomes important. We will therefore in the following look into the locals, to get a better understanding of who they are, what they already have, and what facilities they as locals could benefit from in a new hotel so that the hotel also brings extra value to the locals.

In Skagen the largest age group is today 40-64 years, strongly followed by the 65+ age group. This means that the local residents is mainly a mature audience. This is also seen in the many local activities and events the town is hosting, as the local cultural house is hosting many different lectures, concerts, intimate concerts etc. In general the local life in Skagen is very active all year, with larger yearly events like Skagen winter swimming festival, and Skagen music festival. All larger events where the local residents in large numbers participate along with the tourists. Even in the off season you find a strong cultural interested community in Skagen.

In Skagen the residents not only enjoy the many events, they also enjoy the unique nature that surrounds their every day life. The many nature trails have motivated the locals to use their nature more than before. This tendency can have a great influence on this thesis as the nature trails are leading to the project site. That creates a great opportunity for us to invite the local residents into the hotel and let them be part of generating life in the hotel. As we want the locals to use the hotel as an active part of their everyday life, we went directly to them through a qualitative survey and asked what facilities and opportunities they could imagine the hotel providing them with. Here most of the residents mention a places for drinking coffee, cocktails, and eating light food in close connection with the nature, and in general a peaceful place for them to relax and enjoy the nature.

Another user group that was interesting to look at is the artists. Skagen has for more than 100 years been famous for its art culture and the well-known Skagen painters. These painters not only brought Skagen into the sight of the rest of the country but also influenced the architecture in Skagen with the many ateliers and the large atelier windows facing north. The heydays of Skagens artist society was in the early 1900, but is today only seen as exhibitions at Skagen museum. This fact leaves us with a great opportunity to further emphasize the history and the cultural heritage of the former Skagens Badehotel and Skagen, by bringing the art culture back to Skagen as an active part of the hotel. The art environment, will not only provide stunning working spaces for art creation, but also let the tourists and locals have the most authentic experience of Skagen.

The idea is to create ateliers in connection with the new hotel, that allows artists to stay in Skagens unique nature and be working in the light of Skagen. The artist environment should not be seen as a separate part but as an integrated part of the new hotel, that also will offer the hotel guests and locals painting course in the spirit of the Skagen painters. Again this initiative will promote the generation of life at the hotel both in and off season, the ateliers could potentially also provide spaces for other events like intimate concerts, smaller gathering etc.

By implementing the locals and the artists as active users of the new hotel along with the staff and hotel guests, we are deviating from the traditional use of a hotel. We are thereby designing our own typology where a hotel stay is no longer only focused on providing a vacation space for the guests, but intents to bring them the most authentic cultural experience of Skagen and in general generate life for Skagen as a town all year.

Persona

In addition to the previous analysis of the hotel users, we are intending to look further into the user groups by creating a persona for both a local, an artist, a hotel guest and a staff member. A persona is a user archetype which can guide the design process, by understanding the archetypes behaviour patterns, goals, skills, attitudes and environment. To bring a persona to life, fictional details like job, family, gender and age are added. When creating a persona set, it is important to keep it small to ensure that only the key goals and behaviour patterns is illustrated. Too many personas will make many of them blur together which might result in making an irrelevant or wrong discussion. When using personas as a design tool it is important to understand that they cannot stand alone. They can only be used as an addition to other analysis to understand the user groups at a more specific level (Goodwin, 2008).

"Persona are fictitious users you create based on your user research. Persona summarise your user research findings and provides a practical approach to understanding your target audience and keeping user perspectives in mind when designing products."

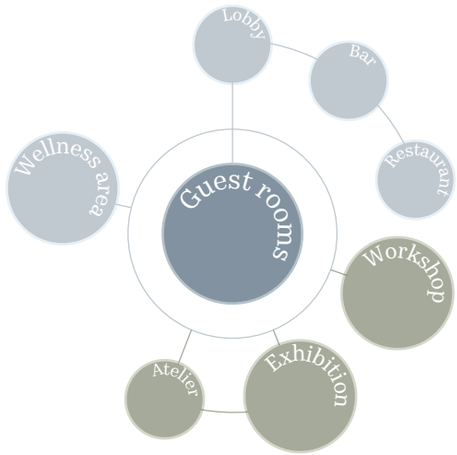
- Alan Cooper (1999)

In this thesis four personas have been chosen based on the previous analysis. These four personas have been studied and analysed in different ways to create the best possible understanding of their needs. The typical hotel guest have been chosen as a persona, as they are going to be the main users of the hotel. Therefore their needs and demands should be highly prioritised to ensure their comfort and well being.

A staff persona is also chosen as the behaviour and needs for staff members is a major part of creating a functional hotel, where the staff can provide the best service for the guest in the most undisturbed way. When choosing a specific staff member for the persona the choice landed on the housekeeping. This choice is based on various visits on both smaller and larger hotels, where it became clear that housekeeping is the staff group that has the largest connection to almost all departments in the hotel, and are also the workers that have to perform their work in the most discreet manner. This persona is mainly based on evidence based research papers that have been conducted in favour of optimizing the work environment for the housekeeping in hotels.

As mentioned earlier the locals have great influence on the success of the hotel and therefore their needs and demands for a future hotel becomes important. The local persona is based on the qualitative interviews (Appendix 3) of the local residents of Skagen along with more factual statistic of age and occupation from Statistics Denmark. Lastly we have the persona of an artist, which will help the process of providing the most authentic hotel stay, and emphasis the history of Skagen even further. This persona is again conducted on qualitative interviews with different artists (Appendix 2) and researched information on the topic.

In the end the personas will give us a list of key problems and design strategies for each persona along with a function diagram and a short description of them as everyday people. The result of the personas should in the end help guiding the design process towards a more holistic design for all users.



Ill. 2.27 Hotel guests function diagram

HOTEL GUESTS

Claus & Mette

Claus is a 40-year-old businesses manager that takes weekend trips with his girlfriend about 3 times a year. He has taken an interest in art over the last couple of years and is currently following the process of several young artists, whose art he finds interesting. His girlfriend, Mette, is a preschool teacher who in her spare time likes to do ceramics on an amateur level. She enjoys the quiet work and detailing but has little knowledge on techniques and the world of art in general. This weekend Claus and Mette is going to the new hotel on Grenen for an extended weekend. They need time to relax, away from their hectic everyday life, and have decided this time to combine the relaxation with their interests in art. Claus is interested in an artist currently working at the refugium, and Mette is intending to do a single half day course in ceramics.

Key problems

>> A hotel that offers an environment to include the guests in the working environment and process of the artists.

>> A quiet area or a spa where you can withdraw and de-stress in connection to nature.

>> A guest room with access to private outdoor space, and great views to nature.

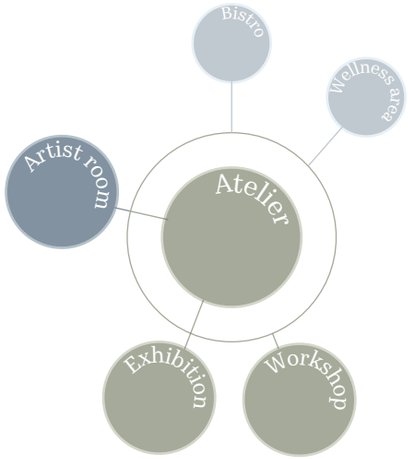
Design strategies

>> Design an open atelier where the guests can have a dialogue with the artists.

>> Create a workshop area where guests and visitors can take part in art classes and other art related events.

>> Design a wellness area that provides the guest with thermal baths in an intimate and relaxed space.

>> Design every guest room with a private balcony or outdoor terrace and ensure spacious rooms of high standard.



Ill. 2.28 Artist function diagram

ARTIST

Sam

Sam is an upcoming 27-year-old American artist. He works with a mixture of photography, painting and short films and is staying at the new hotel on Grenen for 6 weeks, to create a series of photographies and paintings of the characteristic nature on Grenen. The series will also contain a short film, that will premiere at the hotel at the end of his stay. Sam is staying at the hotel to create exposure for his art, and to create a network of friends and possible clients in the art community. As his work as an artist is mainly alone, he enjoys the company of other artists and art enthusiasts, and finds deep conversation inspiring for his mood and work.

Key problems

>> A working space with no direct sunlight to avoid any disruption from light and shadows (Appendix 2).

>> His painting work is a messy and smelly process and the photography work and short film premiere takes up a lot of space (Appendix 2).

>> A space for socialising with the other artists and possible clients.

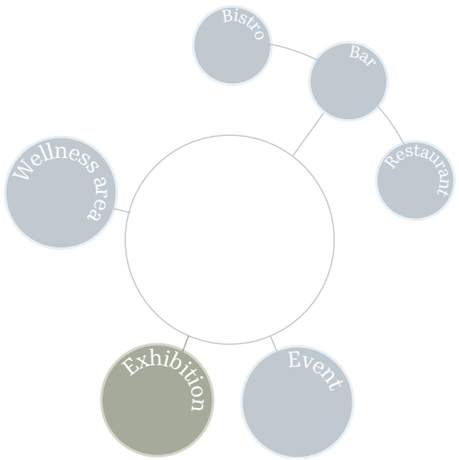
Design strategies

>> Ensure an efficient ventilation system in the atelier, based on a mixed ventilation system to vent out all the toxic materials.

>> Design an atelier with larger windows orientated towards north, for lots of diffuse daylight that ensure the best visual working environment, combined with durable surface materials both according to work and cleaning.

>> Incorporate plenty of storage in the space design and create a big enough space for a large working table.

>> Design a space with the possibility to present his short film at its premiere.



Ill. 2.29 Local function diagram

LOCAL

Jane

Jane is in the age of 45 and moved back to Skagen with her husband and their two kids 10 years ago. Jane have her own clothing store in the Skagen shopping street. When she is not in the store, she and her family takes long walks along the beach and enjoy the nature. Jane is an active and proud member of the community in Skagen and enjoy the volunteering at the social events. Her involvement in the community have also made her aware of the missing events when it comes to art. Skagen have a few places where art can be showcased but there is no places that offers people to be part of the creating process. She believes it is a shame considering the proud history Skagen has in term of the Skagen painters.

Key problems

>> Wants to protect the nature, to preserve the well-known atmosphere of Skagens untouched nature (Appendix 3).

>> Missing a place for local events.

>> Missing a place with space for wellness and mindfulness that seems welcoming for the locals (Appendix 3).

>> Missing a place in the nature on Grenen, where a cup of coffee can be enjoyed after a walk to the beach, or a place to sit for a late night drink to watch the sunset.

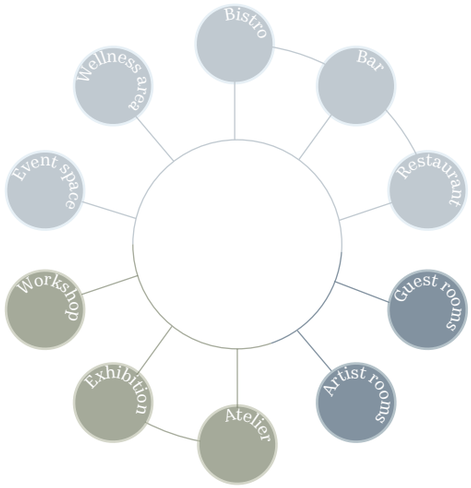
Design strategies

>> Pay attention to the buildings integration in the nature both in shape, placement and materials.

>> Design a space that can be used for local events.

>> Ensure a welcoming gesture, not only for the hotel guests, but also for any local and day visitor who wish to use the facilities of the hotel.

>> Ensure a clear connection between the bar/restaurant area and the nature, with direct access to an outdoor sitting space in the nature – potentially with a sunrise/sunset view.



Ill. 2.30Housekeeping function diagram

HOUSEKEEPING

Elena

Elena is a 34-year-old Romanian woman and has no education despite primary school. Elena works mainly at the new hotel as a housekeeper but is also working a few other cleaning jobs to earn enough money. As a housekeeper Elena has an eight-hour working day 5 days a week, and often with working overtime. During a work day she is very busy, cleaning a variety of spaces.

Key problems

>> Work overload due to many different work task in many different parts of the hotel (O'Neill and Davis, 2010).

>> Overexerted, due to pushing linen carts between rooms and floors, and over obstacles in the floor (Hsieh, Apostolopoulosc and Sönmez, 2013).

>> Affecting hotel guests negatively, by taken up hall way spaces with linen carts and other cleaning equipment (O'Neill and Davis, 2010).

Design strategies

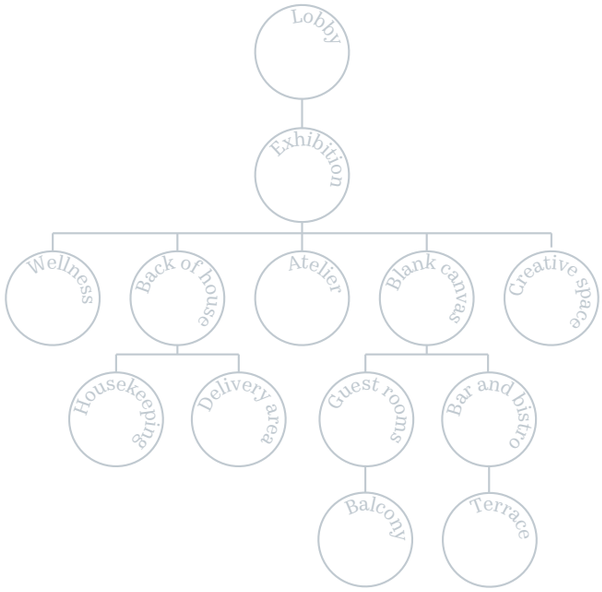
>> Ensure the shortest and best possible communication for housekeeping between most crucial working areas.

>> Ensure storages of cleaning equipment close to the area where it is needed.

>> Ensure that the width of the hall ways and corridors are large enough for housekeeping to perform their work without interfering the comfort of the hotel guest.

TYPOLOGY AND ROOM PROGRAM

This last part of the program will sum up all the different functions and qualities the new hotel should include. Throughout the program different approaches have been developed along with our own hotel typology, which will be described in the following. Lastly the finally concept and vision for the thesis will be explained along with a set of design criteria that have been conducted through the program.



Ill. 2.31 Function diagram

TYPOLOGY

The former Skagens Badehotel was a hotel that was focusing on luxury only available for the top of the society. But through the program analysis the history have taught us about the large variety of people that Skagen have been hosting over the last centuries. Skagen was put on the map because of the painters, that was drawn by the light and the life of the fishermen in Skagen. Today the art colony is gone and remains only as a history of paintings in Skagen's art museum. Skagen is still famous for its art history and still have its unique light and stunning nature that can be inspiring for many generations of artists to come. We therefore made it our aim to design a hotel out of the ordinary, that can provide the best possible condition for future artists to work in, located in the center of the beautiful nature on Grenen. We thereby create a new hotel typology which we call Kunstrefugiet, that puts art as a driving factor for generating life, relations and attractions throughout the building. Art therefore becomes an important factor of the hotels success and will create an even stronger relation to its historical context, by emphasizing and reinventing the artist colony of Skagen. Furthermore we strive to design the refugium so it focusses on tranquillity to create and to be creative. An environment that is created for everyone to be creative within.

This new approach towards the hotel typology changes the hierarchy of the hotels functions. In our thesis the relations and attractions start where the art is being created. Ateliers and exhibition areas therefore becomes of great importance for creating the most authentic Skagen experience for all the user groups. Next on the list will be the wellness area that will, along with the artistic environment and location, provide all users with the tranquillity and contemplation that is needed to allow the body to be conscious, focused and present in the moment.

The hierarchy and the layout of this typology is illustrated in the function diagram above.

ROOM PROGRAM

The following room program illustrates how the Artistic badehotel typology is expressed in the need of rooms and functions. The new typology have created a different demand of rooms compared to the traditional Badehotel. The room program is therefore based on a mix of hotel visits to Brøndums Hotel in Skagen, Ruths Hotel in Skagen and Comwell Hvide Hus in Aalborg, a hotel competition program and the analysis that have been performed during the program along with our aim of creating an Artistic hotel. The new typology is clearly seen in including an art area, artist rooms and a wellness area. The room program thereby provides a scheme of the rooms, which the hotel should consist off. The rooms are described with cross area, quantity, notable comments and the perception. The perceptions are department based and should be understood as the initiative though of atmosphere. In the bottom lines the total area of the building is given. The result - Cross area incl. circulation - is calculated with an 8 % area for circulation.

The indoor environment for the building is determined to be located in category 2. This is decided due to the condition of the building which is going to be completely new along with the user group which is not expected to be very sensitive and fragile people. The category 2 means that a set of general comfort parameters is set as followed:

Atmospheric comfort: Air quality 20 pct. dissatisfied, Air flow rate 7 l/s/pers.
Visual comfort: Minimum 2% daylight in occupied area
Thermal comfort: Summer temp. 23-26 °C, Winter temp. 20-24 °C

In some rooms theses parameters will variate and will be further described in the "Extended Room Program" folder.

1 Front house	**Room**		**Area[m²]**	**Quantity**	**Perception**
Totals	1.01	Lobby	100 m²	1	
Room: 491 m²	1.02	Reception office	20 m²	1	
Circulation: 40 m²	1.03	Staff sanitary	20 m²	1	*Welcoming*
Total area: 531 m²	1.04	Luggage storage	16 m²	1	*Homely*
	1.05	Restaurant	150 m²	1	*Embracing*
	1.06	Bar and bistro	100 m²	1	*Warm*
	1.07	Wine cellar	10 m²	1	*Calm*
	1.08	Private lounges	15 m²	3	*Daylight*
	1.09	Wardrobe	10 m²	1	
	1.10	Public toilets	15 m²	2	
2 Creative Space					
Totals	2.01	Atelier	80 m²	1	*Inspiriting*
Room: 400 m²	2.02	Workshop	60 m²	1	*Curiosity*
Circulation: 32 m²	2.03	Exhibition	200 m²	1	*Enclosing*
Total area: 432 m²	2.04	Small workshops	60 m²	1	*Transparent*

3 Wellness	Room		Area[m²]	Quantity	Perception
Totals	3.01	Spa reception	20 m²	1	*Intimate*
Room: 214 m²	3.02	Spa	100 m²	1	*Embracing*
Circulation: 17 m²	3.03	Changing rooms	20 m²	2	*Relaxing*
Total area: 231 m²	3.04	Treatment room	10 m²	2	*Calm*
	3.05	Steam room	10 m²	1	*Spiritual*
	3.06	Sauna	10 m²	1	*Warm*
	3.07	Public toilets	10 m²	1	*Silence*
	3.08	Mop room	4 m²	1	*Humid*

4 Guest areas	Room		Area[m²]	Quantity	Perception
Totals	4.01	Standard room	30 m²	30	
Room: 1,696 m²	4.02	StandardPlus room	35 m²	10	*Intimate*
Circulation: 136 m²	4.03	Suite	50 m²	3	*Relaxing*
Total area: 1,832 m²	4.04	Disability friendly room	30 m²	4	*Calm*
	4.05	Artist room	16 m²	6	*Embracing*
	4.06	Artist common room	50 m²	1	

5 Back house	Room		Area[m²]	Quantity	Perception
Totals	5.01	Staff office	30 m²	1	
Room: 415 m²	5.02	Staff canteen	20 m²	1	
Circulation: 34 m²	5.03	Kitchen	100 m²	1	
Total area: 449 m²	5.04	Staff changing room	30 m²	2	
	5.05	Dry storages	5 m²	1	
	5.06	Beverage storage	15 m²	1	Practical
	5.07	Mop room	5 m²	3	Functional
	5.08	Housekeeping	20 m²	1	Spacious
	5.09	Housekeeping storage	10 m²	1	
	5.10	Delivery area	20 m²	1	
	5.11	Plant room	100 m²	1	
	5.12	Waste storages	20 m²	1	

DESIGN CRITERIA

TECHNICAL & PHENOMENOLOGICAL

- The refugium should contain public spaces for creative work and exhibitions.
- The refugium should contain both the atmospheres of the vibrant and activity filled Skagen, but also the tranquillity of the closeness to nature.
- The refugium should be no more than three stories.
- The refugium volumes should be horizontally orientated to fit the shape of the dunes and the landscape.
- The areas of the refugium, which requires quietness, should be placed away from the disturbances of the parking area.
- The public areas of the refugium, including the entrance, should be placed close to the south east corner of the site.
- The refugium should be contributing and improve the overall quality- and potential of the site, by enhancing nature, fitting in and bringing new life to the site.

MATERIALS AND CONSTRUCTION

- The material choices should reflect the cultural and architectural history of Skagen and the former Skagens Badehotel.
- Choice of materials and construction should be based on LCA calculations, local historical references, resilience and phenomenological aspects.
- The building should be designed to withstand the harsh climate, using resilient materials and passive design strategies to keep the maintenance to a minimum.
- Traditional building techniques for timber constructions should be implemented.
- The refugium should be designed to let the harsh climate patinate its buildings gracefully.

LANDSCAPE AND MICRO CLIMATE

- Adapt outdoor spaces to sun and wind for most comfort.
- Orientate windows for best exploitation of daylight and wind for natural ventilation.
- The building should be adapted to the high groundwater in case of extreme rainfall.
- The building should take into account the possibility of sand drift.
- Outdoor spaces for watching sunrise and sunset.
- The refugium should present the users for the possibility of enjoying and experiencing the nature on Grenen, without ruining the uniqueness the site possesses today.

SUSTAINABILITY

- Cultural heritage should be a focal point in the sustainable approach.
- The hotel should set a new typology, namely an art refugium containing multiple functions for tourists, the local community and artists.
- Quality of indoor environment should be assessed for each room according to visual-, thermal-, acoustic- and atmospheric comfort.
- Passive and active strategies should be implemented to obtain a good indoor environment and fulfil the 2020-energy requirement for a hotel which is 27.0 kWh/m2/ year.

CONCEPT & VISION

In this Master Thesis we strive to challenge the ordinary view on how to evaluate sustainability. We believe that in the process of designing a sustainable building the cultural history of the given place have to be taken into account as an important aspect along with the atmospheres and building traditions. These factors have to take a major role but without compromising the needs for the next generation. We therefore aim to design a building that is not only an energy efficient box but also an architectural sustainable building, that in the future will be considered worthy of preservation and restoration.

By putting cultural heritages as fulcrum for creating sustainable architecture, we strive to design a building with strong relations to its context and which will contribute positively to its surroundings, by heighten and benefit from the environment it is built with in.

Furthermore, our new typology should together with the overall approach, guide the design process towards creating a built environment that focuses on providing the tranquillity needed to encourage the users to be creative in both the physical and mental space.

Our vision is thereby to design a refugium where cultural heritage becomes the fulcrum for creating sustainable architecture, and where art and the creative process becomes the centre for creating an attracting environment and relations among and for the users, while providing the tranquil environment that encourages the mind to be present in the moment.

CASE STUDIES

The following chapter will present the case studies which will be used as an inspiration for the project. In our believe, these projects have succeeded in their approach and execution of the design. Each project has unique qualities and design approaches from which we can draw parallels to in our design of the refugium.

WADDEN SEA CENTRE

Dorte Mandrup - 2017

There are several aspects of this project that we finds inspirational.

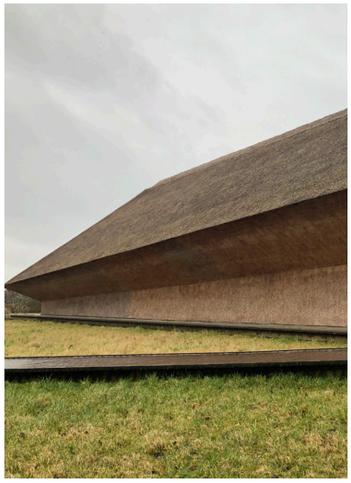
First of all the reinterpretation of the regional material and traditional craftmanship – the thatched roof. Dorte Mandrup has reinvented the traditional thatched roof by creating a building volume that both dissemble the traditional pitched roof buildings but differs as both the roof and parts of the walls are thatched. Referring to the left vertical column in the Album it is clear that this approach allows her to twist and stretch the building as a volume and in that way create a very distinctive and horizontal look that fit well into the flat landscape of the wadden sea. The landscape is, as on Grenen, flat and with only sparse vegetation, such as a variety of grasses. By thatching the roof and large parts of the walls, the building blends in with the landscape. Looking at the building from a landscape perspective, it is very geometrically strict and uniform. But looking at and feeling the materiality up close the former perception of the building changes (see top horizontal row in Album). The thatched roofs and facades are soft and raw at the same time. Each straw has rough ends but together they form this large soft surface, that bends when touched and with no sharp edges as perceived from a distance.

The harsh environment near the wadden sea are wearing on the materials. It is easy to read the climate on the building in the sense of understanding where the building is respectively exposed and protected. Because of this, the facades are mimicking the variety in the surrounding materiality, by the variation in colour. This makes the building more authentic and relatable.

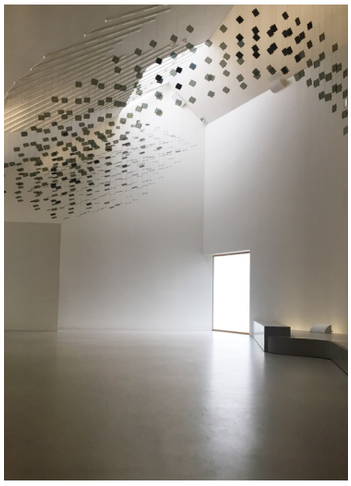
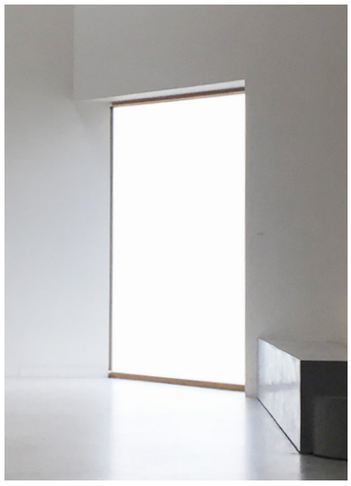
Acoustically the thatched facades and roof perform well, especially when walking from the interior exhibition spaces and into the courtyard (see middle horizontal row). As the building are to be used for exhibition, the interior are like a blank canvas of white hard surfaces, which causes the hard acoustic environment. The atmosphere and bodily experience of being inside the exhibition spaces and outside in the courtyard are very different. The interior are intriguing for the hearing and visual senses, due to the play with natural light, but in many cases the white surfaces create an unrelatable scale of the spaces. When stepping out into the courtyard, the soft acoustic experience is completely different. As the facades absorb the sound, the space is a quiet and natural environment, creating a secure and surrounded environment for the visitor.

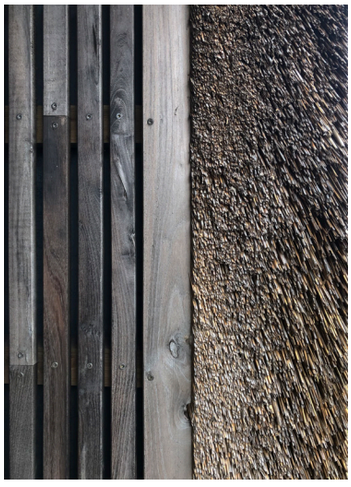
The bottom horisontal row in the Album show the constructional details in three scales and the meeting between timber and thatch. The timber and thatched cladding are very similar in appearance and go well together. The details in the meeting are thought out on all scales. In landscape perspective the transition is geometrical and liniar. In still life and portrait scale, the timber is in some way used to frame the change in surface, weather it is an opening in the facade or the transition from facade to ground surface.

When designing a new hotel, the aim will be to use and/or reinterpret the traditional craftmanship used in Skagen, and Denmark in general, and take inspiration in how the thatched and timber surfaces affects the atmosphere of the spaces, bot indoor and outdoor. Furthermore the building's relation to the surroundings are well thought out in Wadden Sea Centre.








Ill. 4.1: Wadden Sea Centre. Photographer: Adam Mørk (Dorte Mandrup, 2017)

Ill. 2.32 Wadden Sea Centre Album

TIRPITZ MUSEUM

Bjarke Ingels Group - 2017

The Tirpitz Museum is a historical museum displaying the history of the west coast in Denmark - particularly the Tirpitz bunker. Tirpitz is a case study for this project, mainly due to its relation to the surrounding nature and history.

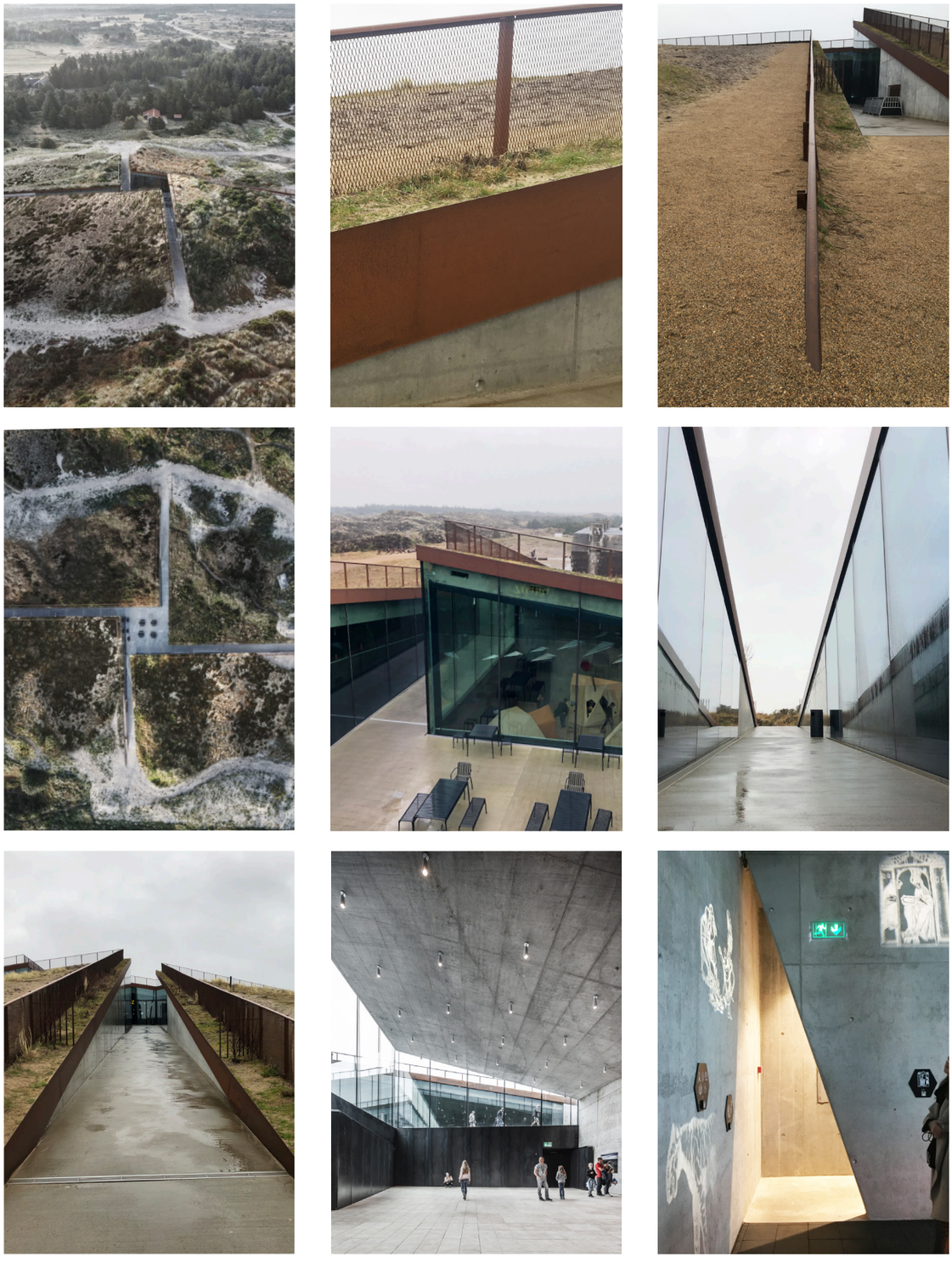
Looking at the left vertical row in the album, the building is seen in landscape perspective. Seen from here the building is buried below or covered by the dunes of the landscape, with only four openings in the dunes leading to the space inside, from where the entrance to the museum are located. The openings in the landscape are perceived as carved out of the dune making the crossing from the outside to the inside the dune a gradual transition.

The top and bottom horizontal row shows respectively the skin (facades) and the bone (construction) of the building. These are very intertwined as the building consists of two facades, the horizontal sloping skin of the dunes and the vertical glass and concrete skin inside the dune. The two facades are very much in contrast with each other. The transition between them are emphasised with a corten steel rim and fence growing out of the landscape. The interesting part of the construction is the horizontal sloping skin which below the dune and vegetation is a concrete slab suspended into the air, not supported by the vertical facade. This allows the vertical facades to all glass, emphasising the gap between the ground and the suspended slab.

The first image in the middle horizontal row in the Album shows the layout of the building seen from a great distance above. When walking into the dune, no clue is given about the room inside or the overall shape of the building. Only a small section of the building is visible from each path in, and there is no view through the dune, as each of the paths enters from a different direction.
The two outdoor spaces of the building are very distinctive and in contrast with each other. The exterior space surrounding the building is a natural environment with a soft ground with quietness despite the people walking around the site. The outdoor space hidden inside the dune, has a very different environment. The surrounding is very strict and the materials is hard, raw and dark which creates an acoustically hard environment.
These contrasts between the inside and the outside is mimicking the atmosphere of the bunker, by using the hard materials and the underground environment in the rest of the museum. The atmosphere inside the museum is also contrasting. The coolness of the materials and colours create a raw and dark environment, yet the high placed windows facing the outdoor room creates a sense of hideout at security below the surface.

Walking out of the dune and into the landscape, gives a sensation of the sky being dragged towards you. The contrast between the gradually flattening walls on each side of you and the rising of the surrounding landscape is emphasised.

For the design of the new refugium the aim is to integrate the building in the landscape. This will not be done as extremely as in this case, but more gently by using the building shape, materials and the curvature of the landscape. A special focus will therefore be given to how the building meets the landscape and the gestures of respectively the north- and south side of the site.
The historical references should appear be reference in materials and building technique, but also by recreating parts of the atmosphere present in the former Skagens Badehotel.



Ill. 2.33 Tirpitz Album

PRESENTATION

Welcome to Kunstrefugiet

Kunstrefugiet is focusing on providing you as a guest or artist with the most authentic art experience of Skagen, in a setting where history is reflected and interpreted in the architecture. It is a place with room for everyone with an art interest and curiosity in what is happening in the contemporary art society of upcoming artists. It is for you who wants to enjoy a moment in unique architecture on a unique location on Denmark's northern tip, where art and sensual experiences is paramount. Kunstrefugiet is a place with space for creativity and where you can unfold your creative skills. In the following, we will present to you a journey throughout Kunstrefugiet and how different aspects in the architecture is forming your stay and your state of mind.

Ill. 1.1 Site seen from above

Ill. 1.2 Masterplan 1:500

Fyrvej

Driving along Fyrvej on your way to Grenen, you will to the left in the horizon see three thatched building blending into the landscape of dunes and lyme grass. As you proceed further through the moor landscape towards the most northern point of Denmark, the thatched building will become more a clear image on the top of the sand dune.

• • •

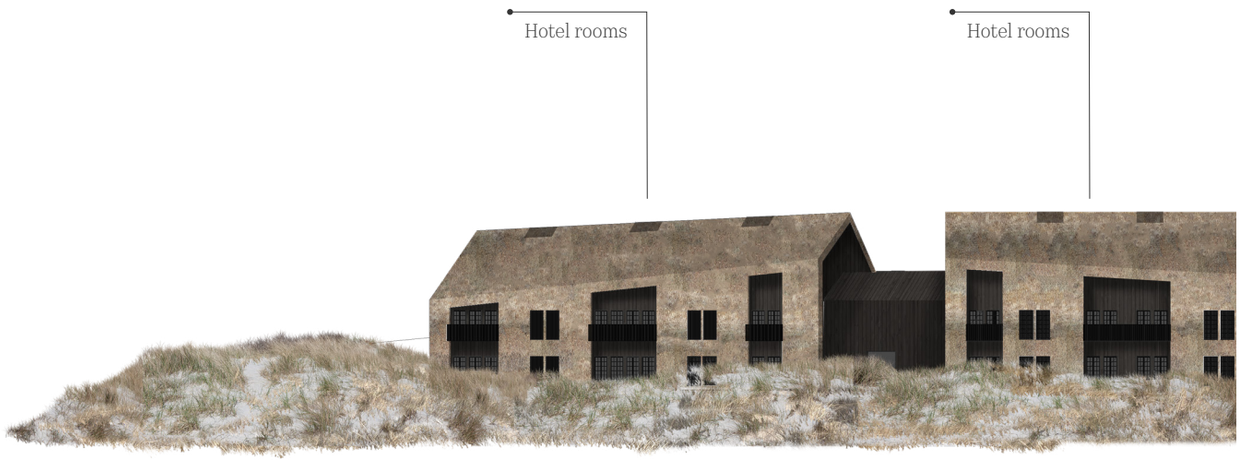
Ill. 1.3 Arrival

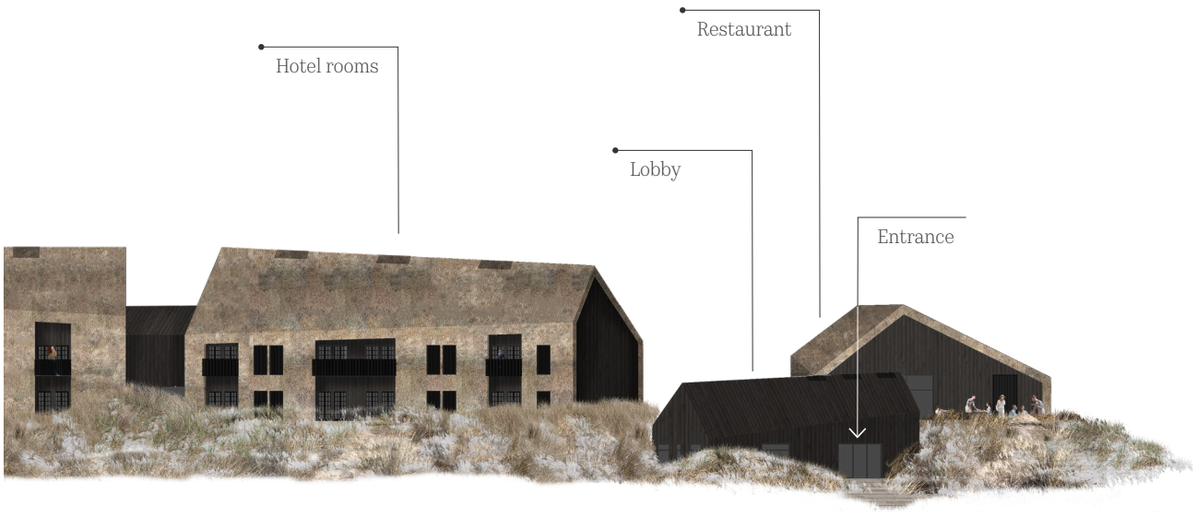
Arrival

As you arrive on Grenen you can now see how smaller black tarred buildings are connecting the three thatched buildings. A fourth but lower thatched house have now also appeared on the right of the dune where a few people seems to enjoy them self with a glass of wine. Parking your car and walking towards the dune you start to feel a different scent in the air of heat and smoke blending together with the salty ocean air. In this moment you know that you have reached Kunstrefugiet on Denmark's northern tip.

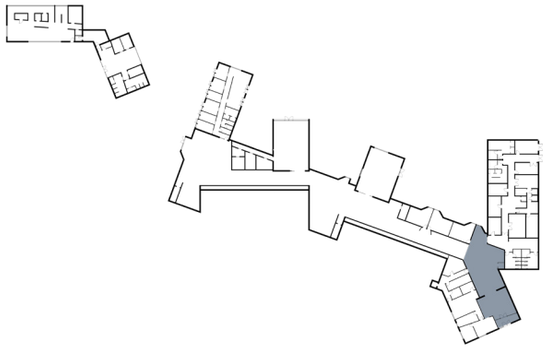
By beholding Kunstrefugiet from the outside, you for a moment wonder how to access the thatched buildings. It is as if the facade itself is saying that it offers you more than what the eye can perceive. Getting closer, a small Dune House of tarred wood appears more clearly and the landscape creates a path leading you in between the dunes and closer to the entrance of Kunstrefugiet. When you reach the entrance, where you get up close to the tarred timber and passes through the skin of the building that gives you a glimpse of a wooden construction and a feeling of a warm space on the other side.

• • •





Ill. 1.4 South facade 1:500

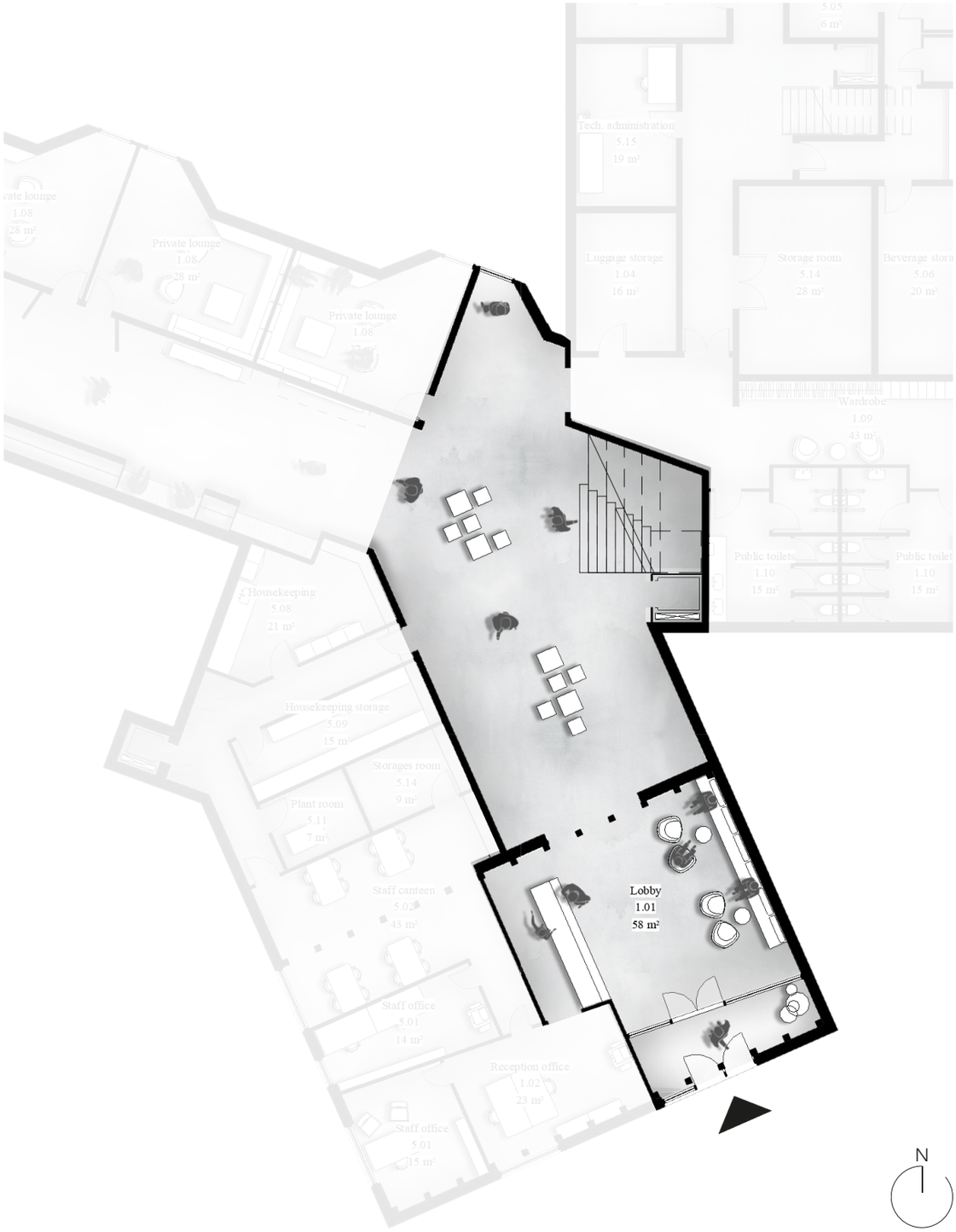


Lobby

The moment you enter Kunstrefugiet you arrive in an intimate warm space where the body of the Dune House is embracing you, with its characteristic timber construction. The lobby gives you a feeling of tranquillity and allows you for the first time to see what the facade were hiding from the eye. Between the timber columns a dark room appears and in the close distance your eyes is getting drawn towards a window that lights up in the dark and spikes your curiosity towards what else is hidden as proceeding further into the space.

Through the opening in the timber columns you start to move away from the brightness of the Dune House, leaving the lobby behind. When you reach the window, the rooms extends into the landscape leaving you in a small niche with a view to an enclosing dune landscape, awakening a feeling of being underground.

• • •



Ill. 1.5 Plan - Lobby & Creative Space 1:200

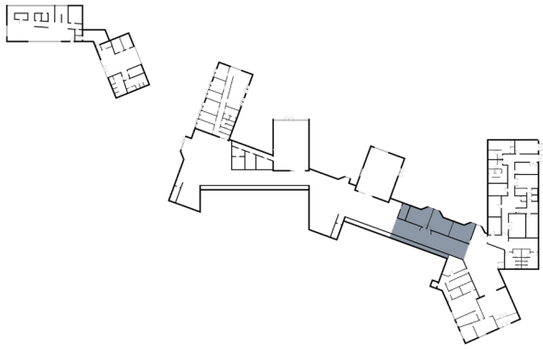
Materials: Behind the lamellas in the ceiling will be a felt layer, reducing the reverberation time in the room, together with the soft furniture and lamellas on the reception desk.

Reception: The reception is placed on the left side of the lobby along the natural flow through the building. It is in semi open connection to a reception office.

Window: The window is the eye-catching element when entering the refugium. The window is created by extending the walls, ceiling and floors out into the landscape, framing the view.

Lounge: The lobby is furnished with lounge chairs and a build in bench creating a space to relax. In the Creative Space, just behind the reception, is an integrated coffee stand, offering the hotel guests and visitors the opportunity to make their own coffee to take with them or enjoy in the lounge area.

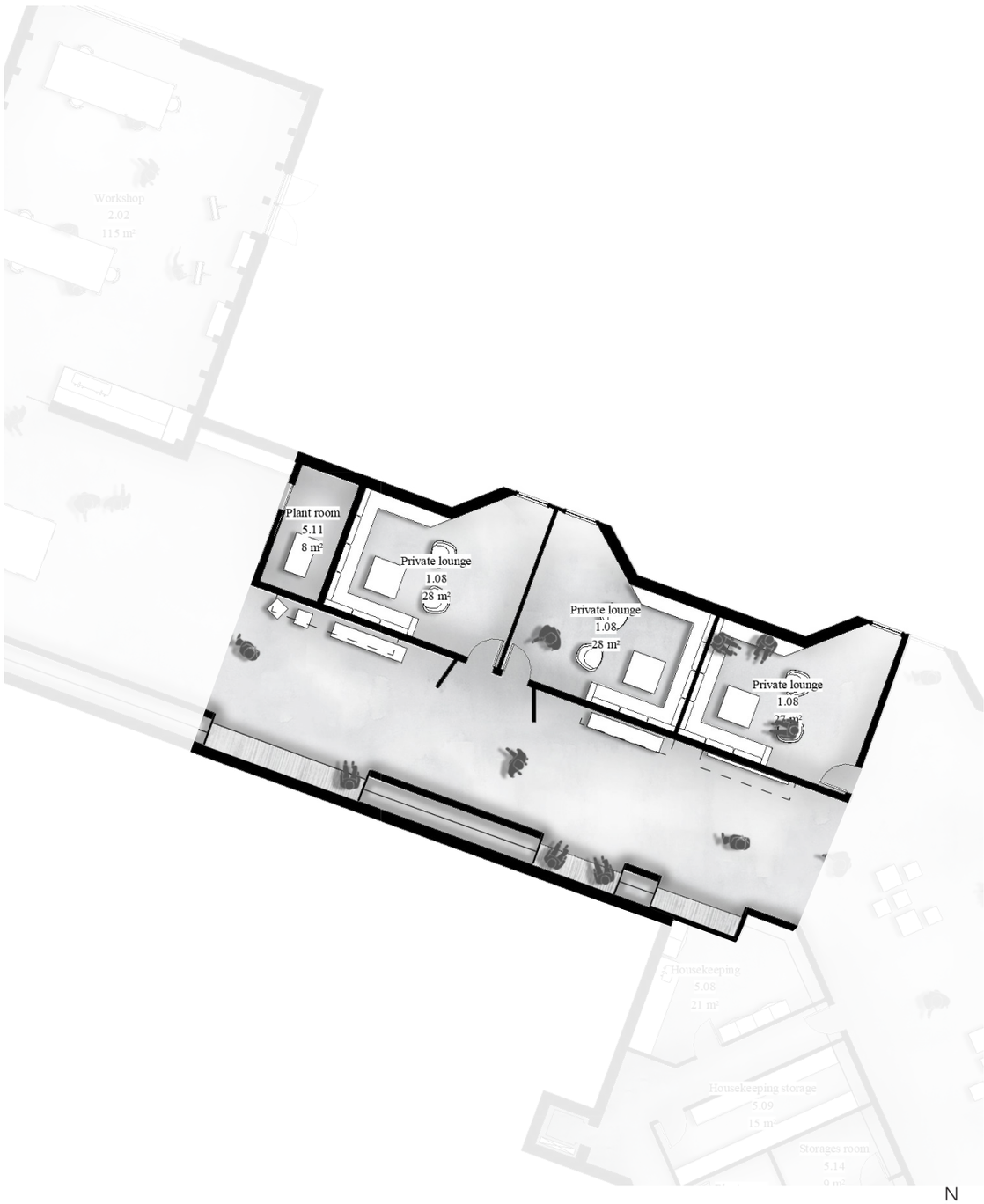
Ill. 1.6 Visualisation - Lobby and Creative Space



Creative Space

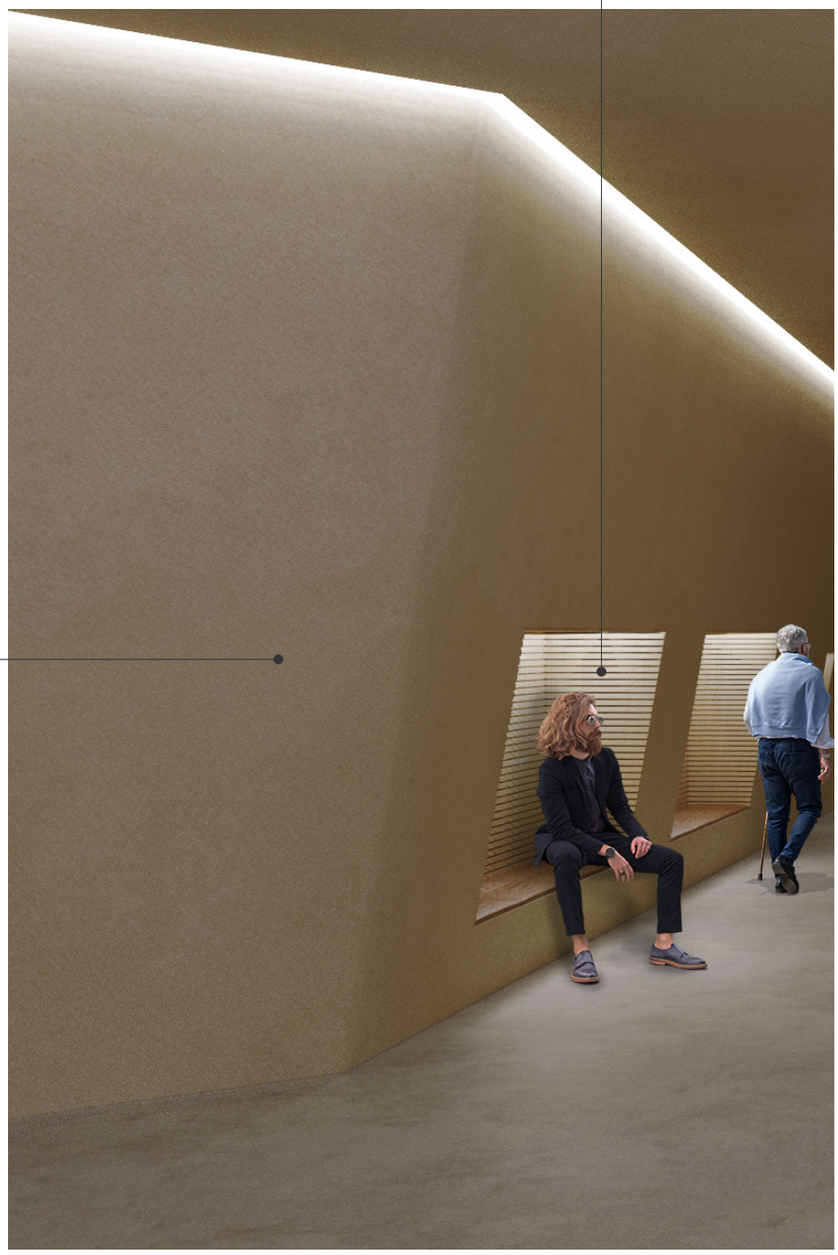
In the darkness of the Creative Space your eyes are being captivated by the soft subtile light coming from above and moving the focus of your sight to the creation of art coming to life. A slightly tilted wall on your left offers you a safe space from where the art can be behold. You no longer have a visual connection to external spaces on the other side of the wall and the darkness have been dimming the sharpness of your vision and are inviting your imagination to run freely. While sitting comfortably in safety of the tilted wall other spectators are passing by, when you get your eyes on a specific man passing through the room with a painting under his arm. Your curiosity in the art has been intrigued and your eyes are watching the painting fade into the darkness. The darkness is embracing you and again in the distance a new bight light appears and draws you further into the building.

• • •



Ill. 1.7 Plan - Creative Space 1:200

Niches: In the tilted wall small niches are made, to create a inmate space where you form a distance can behold the art.

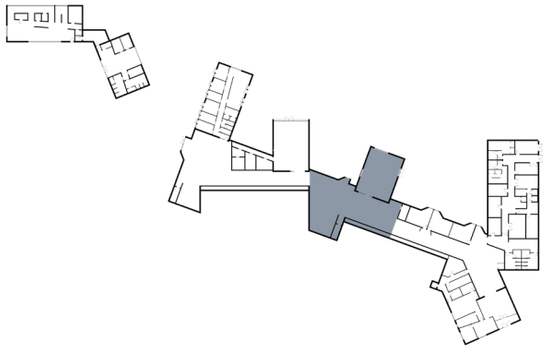


Tilted wall: As a continuous element through the creative space a tilted wall is shaping an embracing feeling that follows you on you way through the exhibition.

Skylight: The skylight is bringing in diffuse light and puts a natural focus in the art. The opening in the ceiling is made as a Continuation of the wall extending upwards and into the light.

Private lounges: Through the door are the private lounges, placed central in the refugium, creating a space for smaller private gatherings, courses or smaller exhibitions etc.

Ill. 1.8 Visualisation - Creative Space and Exhibition

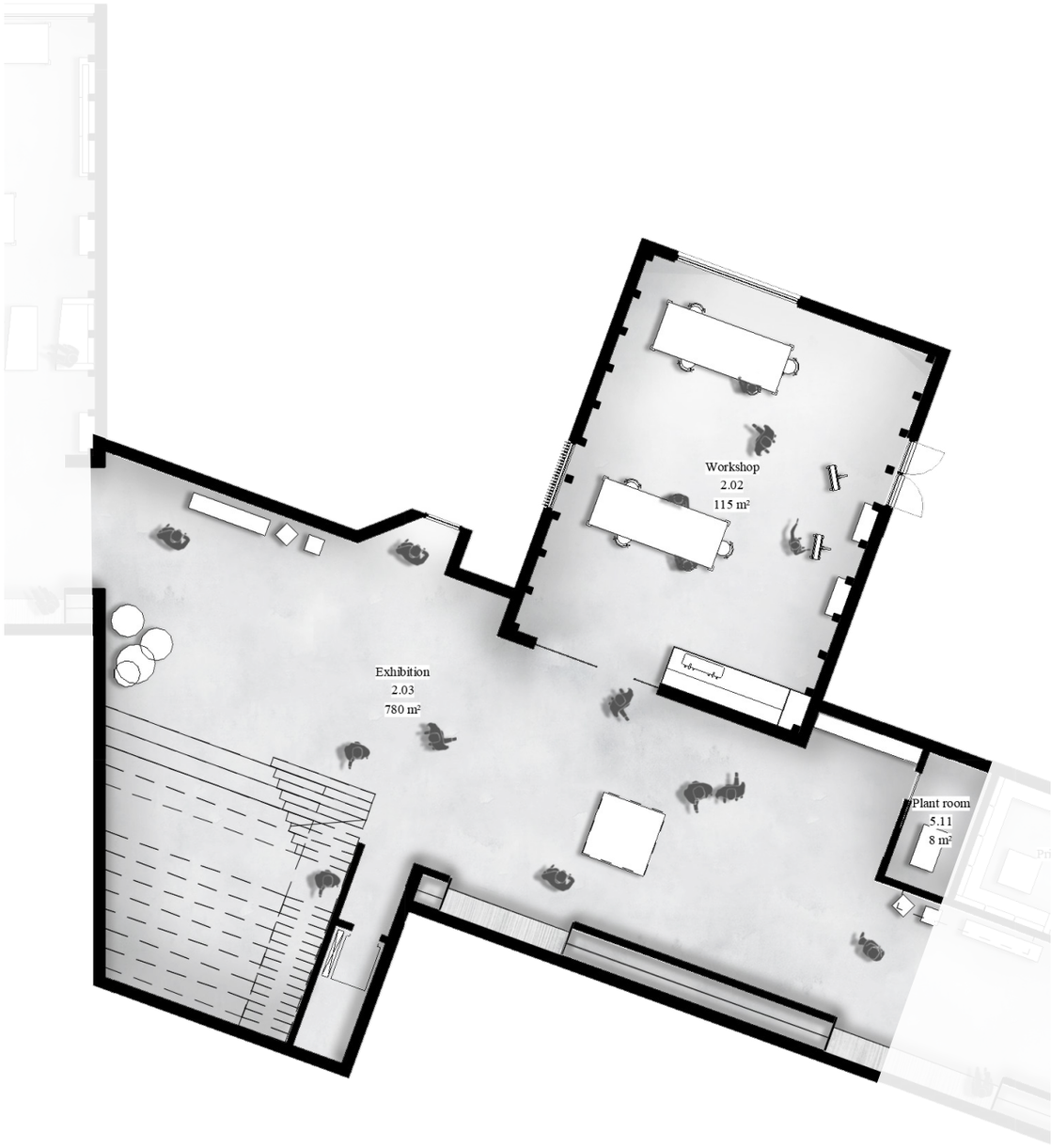


The heart of Kunstrefugiet

As you move closer towards the light, the Creative Space opens up and reveals a couple of wooden walls on your right, similar to the tarred facades you met when arriving outside. You are now in the heart of Kunstrefugiet. The wooden walls have large openings that are encouraging you to come inside and see the creativity and creation unfolding in both the Atelier and Workshop. Again a characteristic wooden construction appears in the brightness of the Dune Houses. Inside the Workshop, you see the movement of a couple of artists hanging pictures from the celling like they are preparing for a new exhibition to come.

On your left a wide stair unfolds into the Creative Space and carries the life of art out of the darkness.

• • •



Ill. 1.9 Plan - Exhibition and Workshop 1:200

Stair: The stair is unfolding into the creative space and leads the hotel guests to their rooms. The stair is made with repose that allow to continue the art into the thatched building.

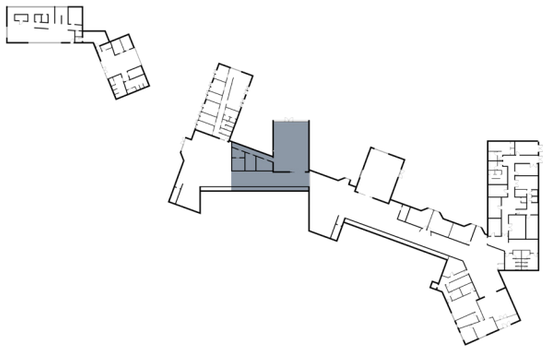
Atelier: The atelier is covered with a similar black cladding as the external facades, and shows the connection between the outside and inside.

Niches: The niches in the tilted wall have surfaces covered with slat. The timber slat is designed with a spacing and an absorbing felt behind to ensure a better acoustic experience.

Skylight: A larger skylight is made in the heat of Kunstrefugiet. This serves as a light source in the darkness that help bring life to the art.

Workshop: The workshop can be accessed from the exhibition through a big opening that invites people to go inside or behold the space from the outside.

Ill. 1.10 Visualisation - The heart of Kunstrefugiet



Atelier

In the brightness from the Dune Houses the painting from before comes into sight. You wander towards it and through the dark timber wall to walk into the artistic space of the Atelier. You approach the painting and fall into a conversation with the artist. The atelier have a large northern window that makes the space almost in seamless continuation with the nature. As you gaze through the window, you experience the raw and yet calming forces of the surrounding nature. Reeds and grasses cover the golden dunes and are as innate to the landscape as the water is to the beach. The view is inspiring and so is the art created by the different artists at Kunstrefugiet.

• • •

Ill. 1.11 Plan - Atelier 1:200

Construction: The dynamic construction is in the Atelier a multi functional element that host both ventilation and storage.

Inlet: The openings in the timber slats is hiding the ventilation, and through some of the spacings between the slat the air inlet and exhaust is found.

Window: The large window is orientated directly north and gives the best working light for the artist, which do not cast any distracting shadows or direct light.

Floor: The floor is made in the same concrete in all of the Creative Space. This is a durable material, which is good for the harsh work environment in the atelier.

Work space: The spacious room is allowing the artist to work at well dimensioned working tables.

Shelf: By using the construction we have created a flexible storage system that gives the artist the opportunity to move the shelves and their demand occurs.

Ill. 1.12 Visualisation - Atelier

Artistic stair

When following the wide stair of art, you move back into the brightness and with a window on the first stop along the stair, you now realise that you are located in the black tarred wooden houses you saw connecting the three thatched buildings when arriving on Grenen. While moving up the stair, your vision have been viewing the artworks showcased in the stair by the artists working and living at Kunstrefugiet. Moving further up the stair a spacious light coming from a window across the ridge is filling up the room. You have now reached the second floor and a wide opening is leading you into the thatched buildings.

• • •

Art/Skylight: The art is made with an atrium in the middle, where art can be exhibited in the skylight from above. The shape of the skylight is inspired by the old chimneys from the earlier fishermen houses in Skagen.

Connection: The section illustrates how the Creative Space and the privacy of the Guest rooms is connected through the tarred timber houses. A light in each end of the stair give the users a view to the outside nature.

Ill. 1.13 Section - Staircase & Exhibition 1:200

Entering the thatched building

When moving down the hall in the search for your room a lustre light in relationship with the shadows are broadcasting the distinctive construction on the surfaces. As you find your room you put the key in the keyhole and unlock the door. A transition from one internal space to another occurs and you are being meet with muted colours and the Skagen light that steals into the room. This is the charm of your room.

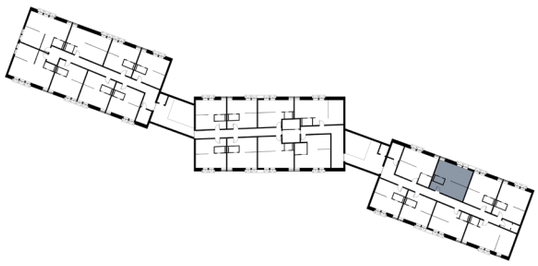
• • •

Skylight: The shape of the skylight is inspired by the old chimneys from the earlier fishermen houses in Skagen. The window cast a play of shadows on the surface in the hallway.

Acoustic: Curtains between the timber columns is an option for adjusting the acoustic in the room depending on the event.

Landscape: The building is towards north raised to the top of the dune and is towards south being lowered into the landscape.

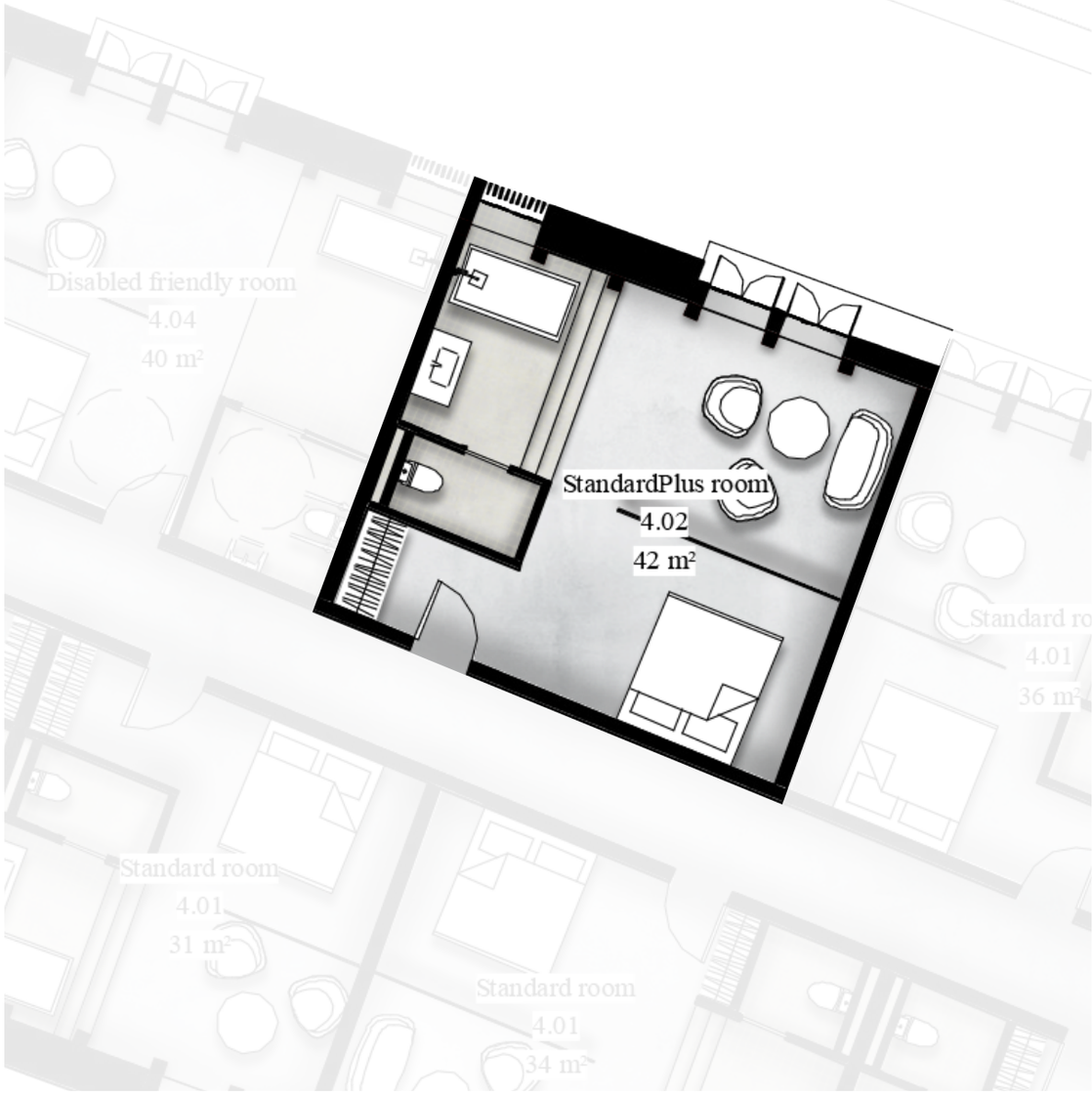
Ill. 1.14 Section - Guest rooms, Exhibition and Workshop 1:200



Guest room

While walking further into the room you perceive the three dimensional composition of the spacious timber construction surrounding you. The emergence of almost seamless materials are being fractured by a transparent coloured wall that breaks off the light between the living and the sleeping space. Walking towards the tall narrow windows a view to the surrounding nature become clearer and captivates the vision. Your room is full of sensual wellness where you can clean yourself both mentally and physically. A wellness area is raised a few steps above the rest of the room, and in a open connection to the living area, you will enjoy a warm and contemplative bath with a view to the outside dynamic nature, the windows will be slightly open and the sounds of the wild ocean, wind and birds, will infiltrate your surroundings.

• • •



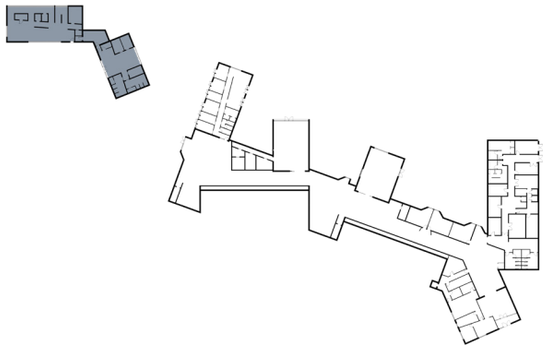
Ill. 1.15 Plan - Guest Room 1:100

Bath: . The bath is made in open connection to the rest of the room, and shape you as a sculpture in the light of the window. From the bathtub you can enjoy the dynamic nature.

Balcony: Each guest room have access to their own private balcony from where they can let in the fresh ocean air.

Red: The red glass wall creates a contrast to the other muted colours and breaks of a bit of light to sleeping area. A delicate red glow form the characteristic of the room.

Ill. 1.16 Visualisation - Guest Room



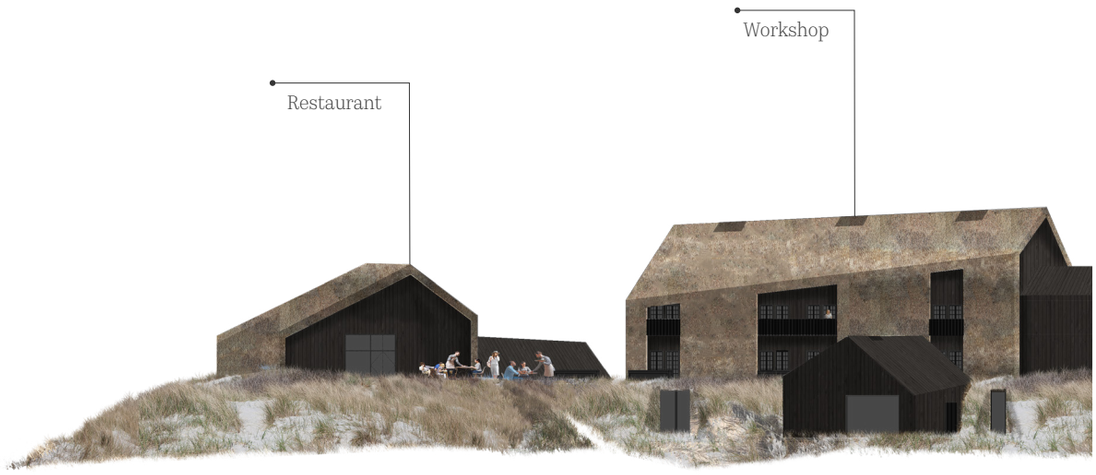
Spa

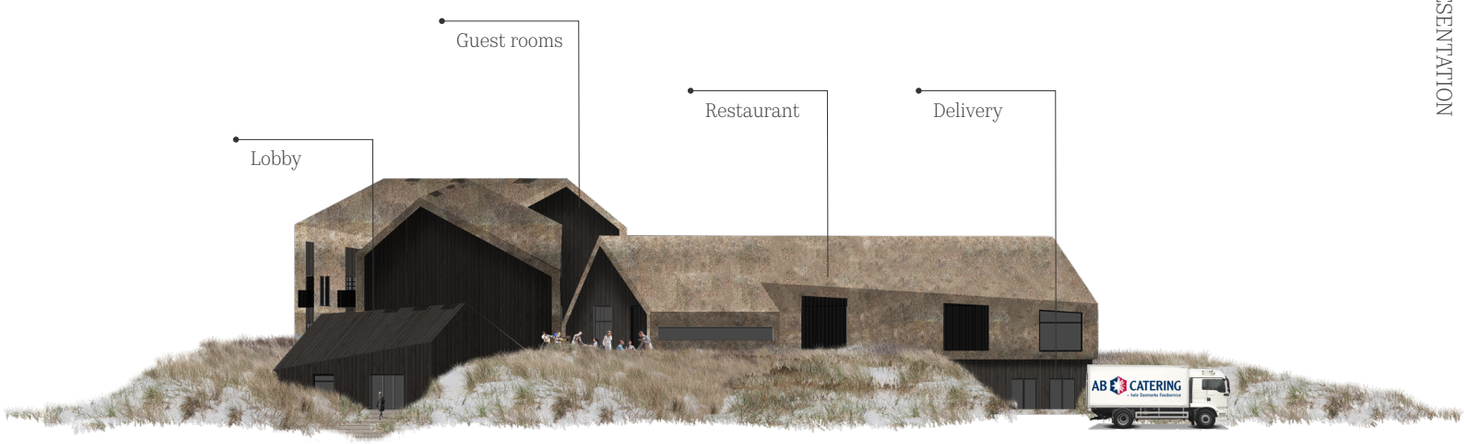
Kunstrefugiet offers you more than you experience on the way to your room and you now find yourself back in the darkness. As you stride along the tilted wall you observe the art that is guiding you further into the Creative Space. In the end of the pass an alcove full of light is meeting you with open arms. It is giving you a way out of the darkness and are tempting you with the golden dunes on the other side. Again a passages through the skin of the building occurs and as you follow the path along the dunes you see a set of black tarred Dune Houses hidden in sand. As you approach them the sound of the wind is surrounding you, and you feel the light breeze on your skin. Its a statement of the nature letting you know that this is a space where nature decides. The strong feeling of pure nature embracing you and guiding you closer to a space of tranquillity. You see the warm tarred timber facade where reflections of water shows its life in the windows glass. The windows are also exhibit the idiosyncratic shadows that are shaping the space within on the other side. As you enter the spa a rippling sound of water touching the hard surfaces of the foundation is filling your ears. There is a sense of echo in the room and the chilling feeling on your skin have vanished into the moist air enveloping your body. You have now found yourself in a self reflecting space where mind and body only can focus on the present.

Ill. 1.17 Plan - Spa 1:200

Nature path

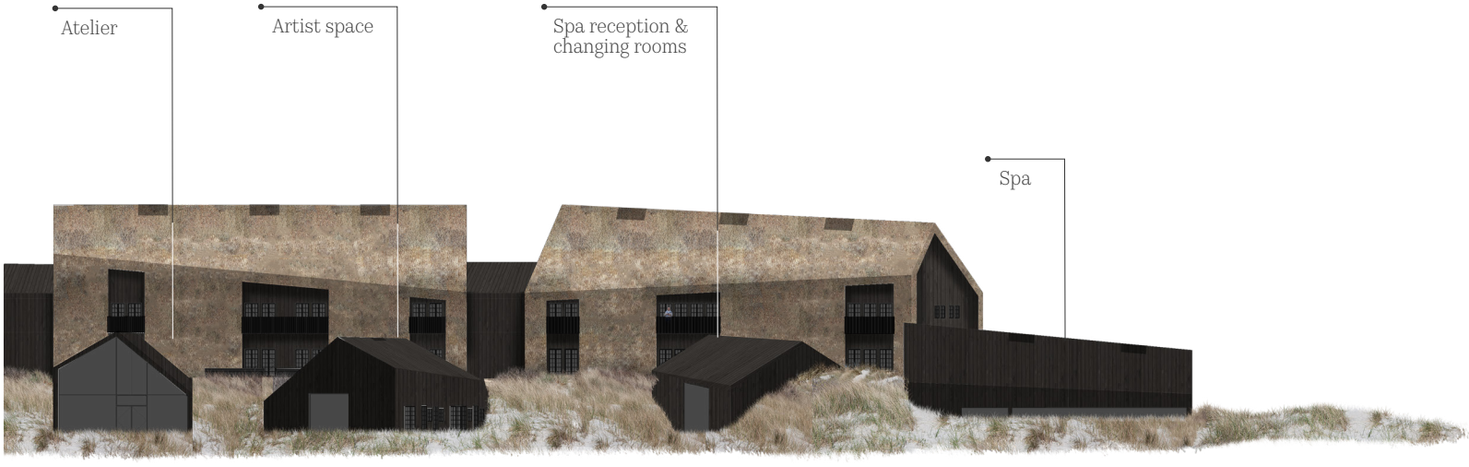
As you are leaving the mindfulness of the spa behind, a new path in the landscape falls into your sight. As you follow the path into the moor of lyme and heather, it tells you the story of the Dune Houses scattered between the dunes on the northern side of Kunstrefugiet. A pattern of sandy trails are inviting you further into the nature, and review the small Dune House that gives away a hidden history to the past. While walking along the northern facade glazing in the walls are letting the life on the inside into the landscape and tells you the story of the artistic life. The silence of the nature is for a moment surpassed by the laughter of people. On the top of the dune you see a group of people enjoying themselves in the last rays from the sun. You join them on the terrace while watching the sun vanish into the sea off Skagerrak.





Ill. 1.18 South East facade 1:500

Ill. 1.19 North west facade 1:500



Ill. 1.20 North facade 1:500

PROCESS

Based on our methodology we have divided the presentation of the Process into the three chapters of Skin - Meat - Bone where each element is looking into the three scales of Landscape - Still life - Portrait. The process has been irritative which means that the process is not presented in a chronological telling, and the different elements of the presentation will be referring to each other across the process chapter.

SKIN

The chapter of Skin will illustrate how the process and decisions regarding the skin of the building, both on the exterior and interior have been designed and analysed during the project. The different materials will be evaluated based on a variety of parameters, which are based on our approach and methodology. The chapter will be covering the following topics;

LANDSCAPE
- Cladding, phenomenology
- Cladding LCA
- Tarred timber

STILL LIFE
- Thatched roof and facades
- Facade studies
- Exhibition

PORTRAIT
- Building envelope
- LCA

Ill. 4.5 Landscape Grenen

Ill. 4.2 Thatched roof

Ill. 4.4 Natural timber cladding

Ill. 4.3 Tarred timber cladding

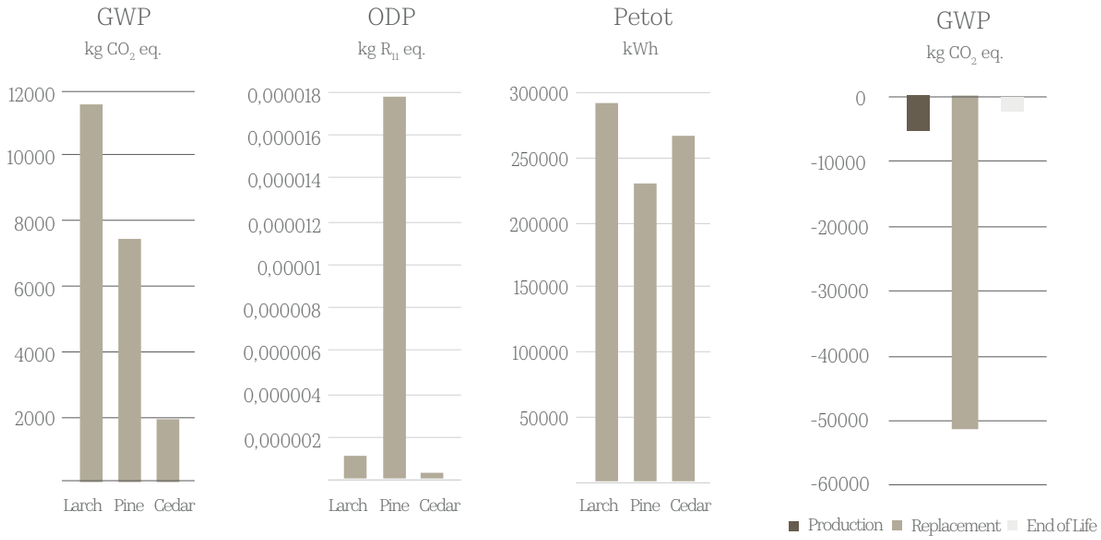
LANDSCAPE

This section evaluates the cladding materials based on a landscape perspective. The initial idea was to have a reference to the black timber houses with thatched roofs from the black period, as these fits well with the landscape and takes the micro climate into account. The idea is for Kunstrefugiet to blend in with the nature, more than the former Skagens Badehotel did, as it will be a fairly large building in a semi flat landscape. Potentially a mix of materials will contribute to create a building referring to the cultural history standing out of the landscape just the right amount for it to be seen and noticed, but without becoming a foreign object in the landscape.

As a continuation of the material schedule in the program, we have chosen to investigate the use of timber cladding and thatched roofs and facades.

Phenomenology

Phenomenologically the materials performs well in tactility and colouration. Thatched roofs and facades are blending in with the surrounding nature. Furthermore its surface appears almost soft, and is a natural material and therefore has a scale relatable to human. The timber also has a good tactile surface that is readable and relatable to human. The colour of the black tarred timber cladding stands out in the landscape, but is an important reference to the cultural history.



Ill. 4.6 Wood type cladding - 200 years

Ill. 4.7 Cedars GWP in phases. 200 year lifespan and combusted in End of Life Phase.

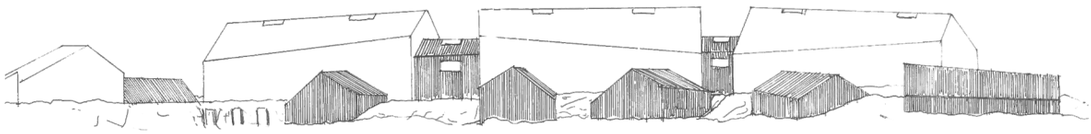
LCA

As an initial research on timber cladding a LCA analysis has been made, based on only the top layer cladding. The same amount of timber, just comparing three different types, namely larch, cedar and pine. The lifespan of those types of timber are based on a schedule from DS/EN 335, namely <25years for larch and cedar and 15-20 years for pine. Ill. 4.6 shows the LCA results for three chosen parameters; GWP (Global Warming Potential), ODP (Ozone Depletion Potential) and Petot (Primary Energy total). These show the impact on the CO_2 emission, ozone depletion and energy consumption using the respective materials as cladding on a principle building, as shown on Ill. 4.7 over a lifespan of 200 years.

The LCA evaluation shows that cedar performs best. It has the lowest impact on GWP and ODP. The Petot consumption is though almost the same for larch. Pine also performs well on these parameters, but has a limited lifespan compared to larch and cedar and is therefore no longer considered an option as durability is considered an important factor in our approach.

Lifespan and quality of cedar and larch are similar. They both grow in Denmark - cedar under the name thuja, which are similar to the Red Western Cedar from Canada, and they patinate to a grey silver. For that reason, the chosen material for cladding is cedar, as this performs best in the LCA evaluation.

The reason timber has a positive CO_2 score, is because the End of Life emission is calculated on the assumption that the timber will be combusted. In the EPD, there is a general number for GWP for this phase, if the timber is



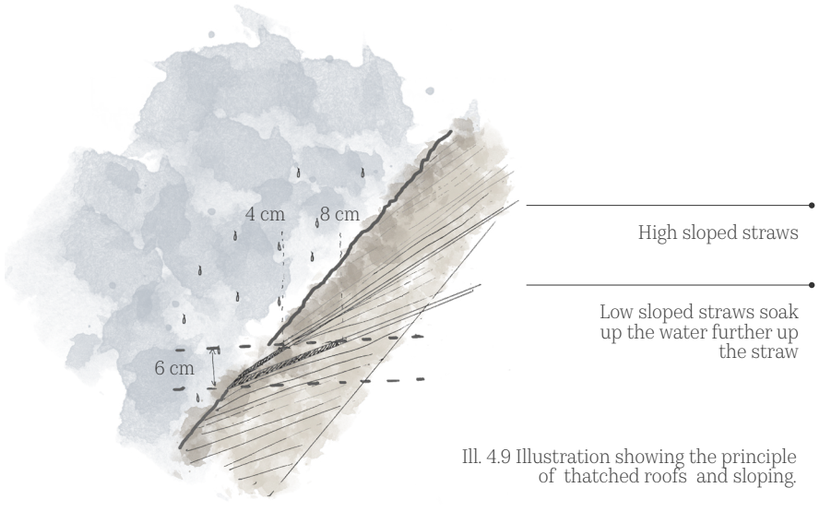
Ill. 4.8 Process sketch of northern facade showing the part of the refugium intended to be cladded in black tarred timber.

assumed recycled, leaving the total CO_2 emission negative. As we are calculating on a lifespan of 200 years for the building, this means a lot of replacements of cladding only lasting 25 years. The negative result will become even bigger the more replacements that are needed. This is somewhat misleading, and is only the case in theory. Therefore we use the result for timber combusted in the End of life phase.

Tarred Timber

Through research of wood tar, unfortunately no EPD has been found. There are though many factors to consider. Aesthetically the tar gives the timber a dark and almost black look, mimicking the old fishermen houses. Also it has a distinctive scent, that can add a character to the building, and in this case work as a reminder of the architectural history of the place as both the houses from the black period and the former Skagens Badehotel was tarred. Tar is an old type of wood protection and is a natural material. It is water repellent and thereby reduces the risk of decomposition of the wood and also works as a surface protection against UV radiation and sunlight. This leaves the timber with a potential unlimited lifespan, if treated right and maintained regularly (Christensen and Vadstrup, 2014).

As mentioned in the program, the maintenance of tarred timber is significantly lower on the northern facades, than on the south, as these are more exposed. Therefore in is project, the tar is used on the small Dune Houses facing north, as they have much less facade exposure towards south.



Ill. 4.9 Illustration showing the principle of thatched roofs and sloping.

STILL LIFE

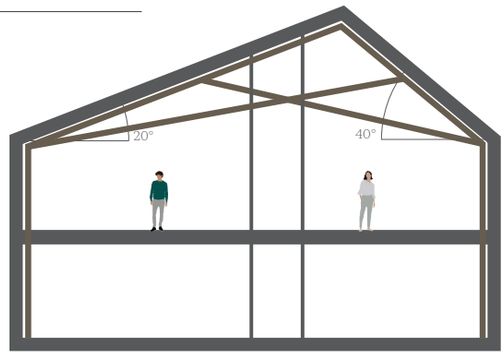
Thatched Roofs and Facades

Referring to the initial material evaluation in the program (page 24), the conclusion was to be aware of the sloping of the thatched roofs, to maintain an acceptable lifespan of the building.

The slopes on the roof in the chosen timber construction, has a big influence on the height of the building's corners, as an increasing slope will create a larger span between highest and lowest corner, leaving it more difficult to make a full use of the building (see Ill. 4.48 on page 137). Not having corners of the building with a low ceiling height, the roof needs to be raised accordingly. In the hotel rooms, this creates small rooms with very high ceiling heights, provoking a negative atmosphere, were the scales are off balance. By using the ventilation principle presented on Ill. 4.42 on page 133, we create a more intimate atmosphere, by lowering the ceiling in the room. This still leaves main parts of the construction visible in the rooms and at the same time create an efficient path for the ventilation system. The hall will still have a high ceiling height, but the atmosphere is different, as it is a circulation space. By implementing the skylights, as a reference to the black period in Skagen (see page 20), the space will be filled with diffuse light coming from above.

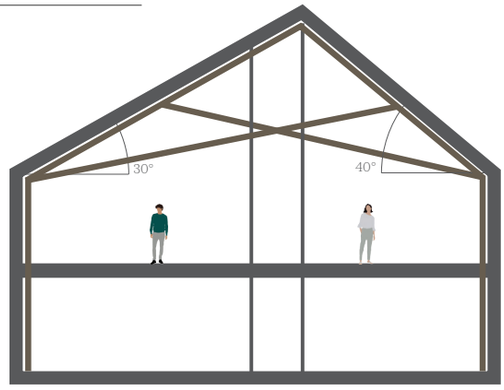
Again the outcome from LCA shows a misleading result regarding the lifespan of thatched roof. As the CO_2 emission for the End of life phase is negative, the result shows that the shorter the lifespan, to more replacements of materials, the better for the CO_2 emission as the straws absorbs the CO_2. Therefore we chose to conclude, that we still aim for the longest lifespan possible, hence a minimum of 30 ° slope on all the thatched roofs, implementing the ventilation principle to create great spacial quality in both the hotel rooms and the hallway.

First initial sloping of the thatched roof. A 20° sloped roof will be an inefficient roof, as the straws will absorb the water deep into the thatched layer, leaving the thatched roof with a very low lifespan.



Ill. 4.10 Sloped roof - 20°

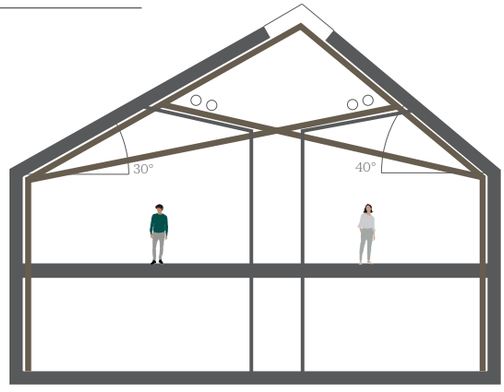
By raising the 20° sloped side of the roof to 30°, the lifespan of the roof increased to respectively 20 and 40 years. This though, leaves the interior spacial perception off balance, as the room height is very high compared to the size of the hotel rooms.



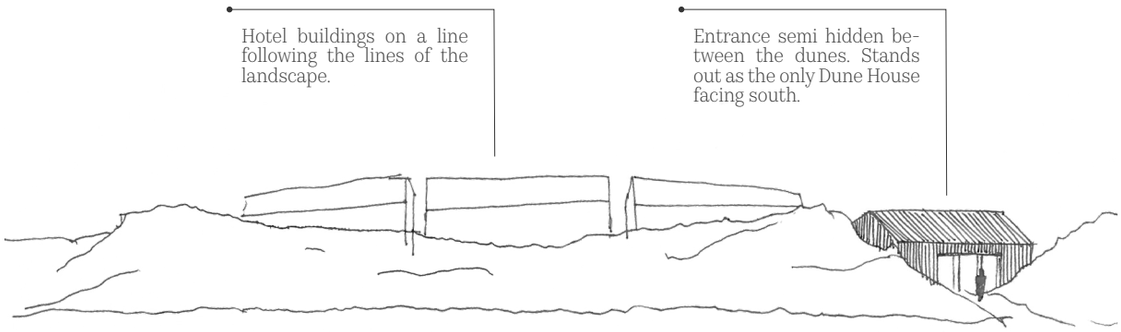
Ill. 4.11 Sloped roof - 30°

By closing of parts of the construction, it creates a space for the ventilation to run efficiently and at the same time reduces the height in the hotel rooms.

Having the hallway follow the cross in the construction, will reduce the experienced room height, and the light coming from above will be diffuse light spreading downwards.



Ill. 4.12 Sloped roof - 30° + implementation of ventilation principle and skylight



Ill. 4.14 Initial sketch of the meeting between the landscape and Kunstrefugiet

Ill. 4.13 Principle sketch of hotel buildings towards south

Facade Studies

The illustrations above show the first principle sketch of how we intended the refugium and landscape to meet. The gesture is for the largest buildings to hide in the dunes, by sloping the roofs downwards in the ends and raising the landscape, creating an illusion of the buildings growing from the landscape. This is also one of the reasons for choosing to thatch the facades, as seen on Ill. 4.13. When using the same material on the facade as on the roof, we create an interpretation of the classical pitched roof house, with a clear separation between the facades and roof. The building is perceived more as a volume adapting to its surroundings. The principle of using the same material on the facades and roofs, is also used on the Dune Houses, making them simplified and minimalistic interpretations of the traditional black tarred houses from the black period in Skagen. They become small edgy volumes spread into the landscape.

Simple facade with only the windows visible. No balcony yet.

Exploring the use of both thatched facades and tarred timber cladding.

By adding the thatched facade, we are able to use a subtract areas and create niches for the balconies, creating a small amount of shading and outdoor privacy for the hotel guests.

Ill. 4.15 Facade studies

Ill. 4.16 "Sweet Vanilla" Wall texture

Ill. 4.18 Concrete flooring

Ill. 4.17 Black timber cladding

Exhibition

The atmosphere in the exhibition space is different than the rest of the refugium. The lighting will be dim and the art will only be lit up by skylights, northern lights and artificial lighting, to create a controlled environment for the art. The architectural gestures and principles should enhance the art, and the surrounding nature, and leave "blank spaces" for the art to fill out and fit into.

Looking at the exhibition space through a Skin - Still Life perspective, the material choice will be very important to create the atmosphere needed. As the art should be in focus, there must be no disturbing elements, so the materials should be simple, leaving a blank canvas for the artist to fill.

To include the art throughout the building, the idea was to also use the staircase as an exhibition place, and not just for circulation, and in that way continue the Creative Space and connect it to the hotel buildings.

Ill. 4.19 shows a part of the process of deciding which materials to use in the exhibition space, and the reasoning behind it, in combination with choosing a direction for the final staircase design. It should be noticed, that the illustration is a part of the process, and the layout of the final staircases have changed, as the rotation of the buildings connected to them have changed.

The conclusion was, to create a warmer space, using a raw putty paint, with slight variation and depth in the colour. The continuous floor throughout the Creative Space will be in concrete, and the staircase will be a light toned wood emphasising the transition to a more private space.

For the staircase, a smaller space than the initial idea, will make the hanging art piece the centre of the room, lighting it up using diffuse light from the large skylight above it.

Initial the idea was to create a spacious staircase with room for both hanging and standing art. We started of with an all white space, leaving all surfaces the same, to not drawing any attention to itself other than the shape and the choice of windows.

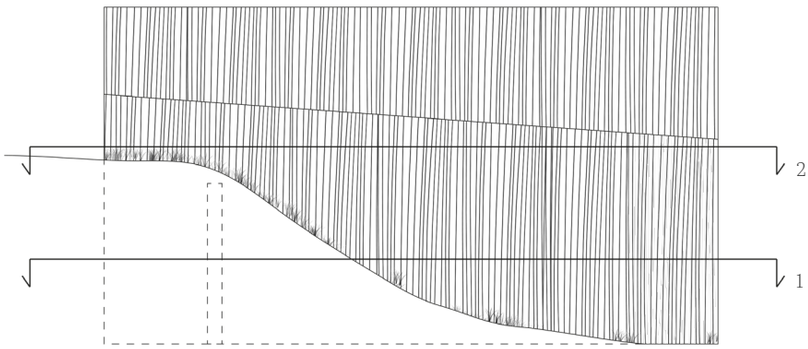
After researching on other art galleries and talking to other artists, we decided to work with more warm muted colours instead of all white, as this is actually a more preferred background to exhibit art on.

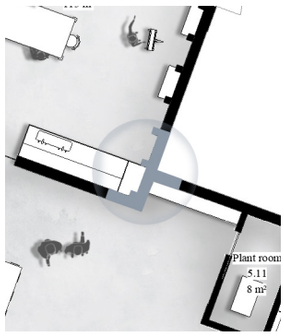
The choice fell on a sand coloured raw putty paint (Ill. 4.16), mimicking the outside colours of the nature. There is a more raw finish to the putty paint, leaving it with an overall even surface, but with slight variation in the colouration. These variations will create more in depth in the material making it appear more natural, than a completely uniform painted wall.

This muted colour will contribute to a warmer atmosphere, and enhance the experience of being under ground. The floor will be a concrete floor in the exhibition space continuing into the Dune Houses, and together with the warm colours of the material, create a coherence in the Creative Space and the rest of the refugium.

The stairs will be a light toned wood, to highlight the transition form public space to the privacy of the hotel guests.

Ill. 4.19 Staircase design and materials





Ill. 4.20 Illustration showing the sections for the construction details

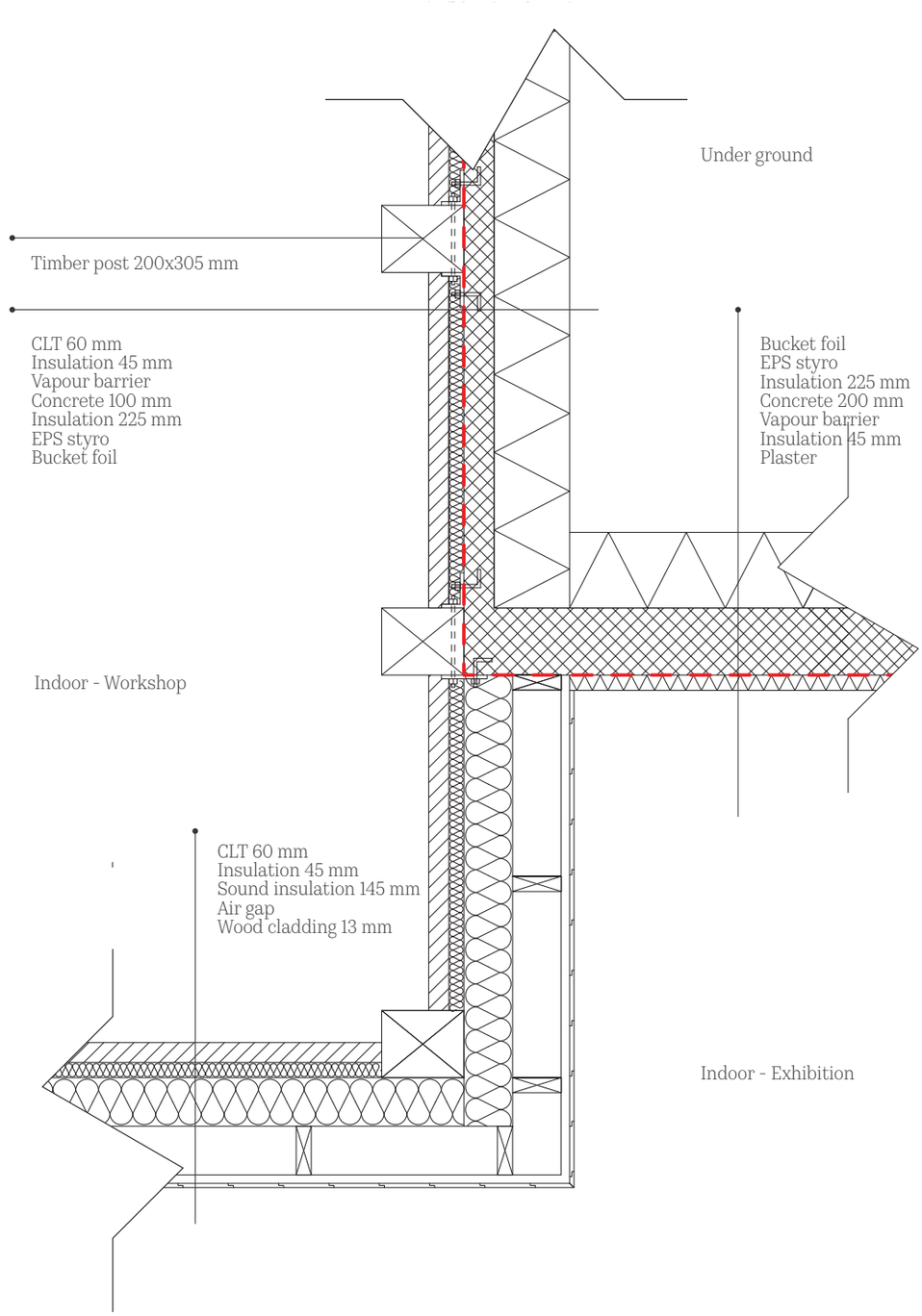
PORTRAIT

Building envelope

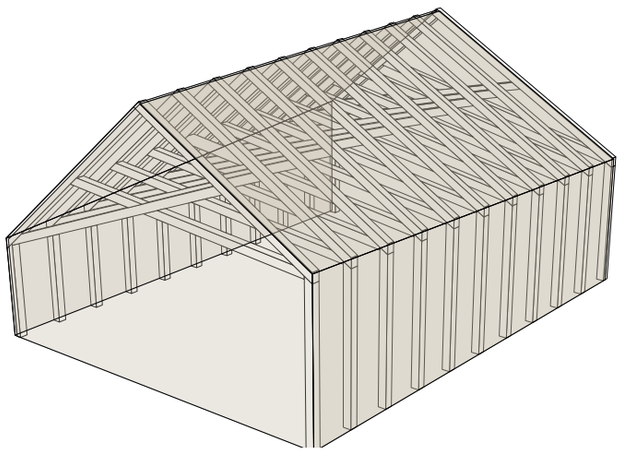
On Ill. 4.21 the final wall construction of the Dune Houses are shown, in connection to the outer walls of the Exhibition space. We have chosen to make a principle construction detail on the meeting between these two walls, as this is a meeting occurring several places throughout the building design, where the Dune Houses meet the Exhibition space.

The choice of displacing the Dune House wall and the Exhibition wall, is to avoid having the two walls meet in a corner - a meeting almost impossible to make in practice. By pushing the Dune House an extra c/c distance into the Exhibition space, it clarifies the transition from the Exhibition to the Dune House. When marking the Dune Houses by continuing the timber cladding on the inside, it gives the guests a clearer overview of where they are in the building, which can otherwise be difficult in a building with few windows facing the surroundings.

The Dune Houses are partly build into the ground. For the construction, this means there has to be a transition from underground to above ground. This is shown on the construction details, as the top layer is the wall construction above ground and the layer below, is the construction under ground. The construction is reinforced with an extra layer of concrete on the outside of the load bearing timber structure, to be able to carry the load of the ground resting against it.



Ill. 4.21 Construction detail 1:20



Ill. 4.22 Elements included in the LCA evaluation

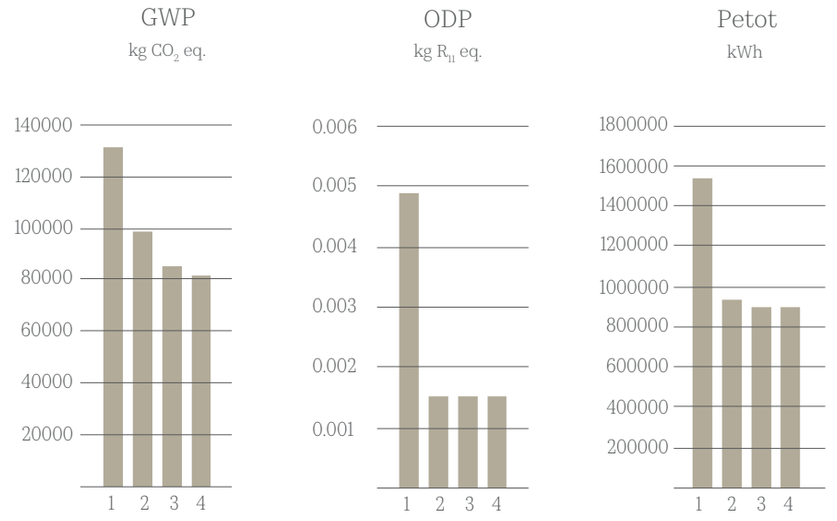
LCA

An LCA evaluation has been part of the process of designing the construction of the building. The model has been based on the outer walls, roofs and load bearing timber structure, of a simplified version of one of the thatched buildings (Ill. 4.22). Initially the choice was to detail the thatched building, to look into the influence of using thatched facades and roofs. Unfortunately the LCA shows a misleading result using the EPD for thatched roofs, and the choices concerning this material has been made based on expectations and research (See previous section on Thatched roofs and facades).

On Ill. 4.23 the results of the process of the LCA is shown. Four changes as been made to the model, in the attempt to improve the results.

The first change is adjusting the c/c distance between the timber posts from 600 to 1200 mm. This improves the spacial quality too, leaving more freedom to place windows and doors in the wall construction without interfering with the construction. Also the robot analysis showed that the construction was over dimensioned with a c/c distance of 600 mm. Looking at the LCA results this is the changes that has the largest influence on the result.

The next step is choosing a better insulation type, and in that way reduce the amount of insulation in the building with 50 mm. The U-values for these constructions were calculated in Rockwool's energy calculator, and both con



1:
c/c 600 mm
Flexibatts 37

2:
c/c 1200 mm
Flexibatts 37

3:
c/c 1200 mm
Flexibatts 32

4:
c/c 1200 mm
Flexibatts 32
- 100 mm insulation in roof construction

Ill. 4.23 LCA results

structions meets the 2020 criteria. The adjustments to the insulation made a positive difference for the GWP result, but had very little influence on the ODP and Petot results.

The last change made, was reducing the amount of insulation by 100 mm in the roof construction, as this is a role of thumb for thatched roofs, as they have good insulation properties. This again has a small influence on the GWP result, but no influence on ODP and Petot.

MEAT

The chapter, which comprehend the Meat of the building, will be going into describing the volume and spaces in relation to both the Landscape, Still life and Portrait. Our early volume studies will be shown and explained according to which challenges we have experienced and later the focus will move towards the indoor environment and the shaping of the internal spaces. The present chapter will be dealing with the topic as followed;

Landscape

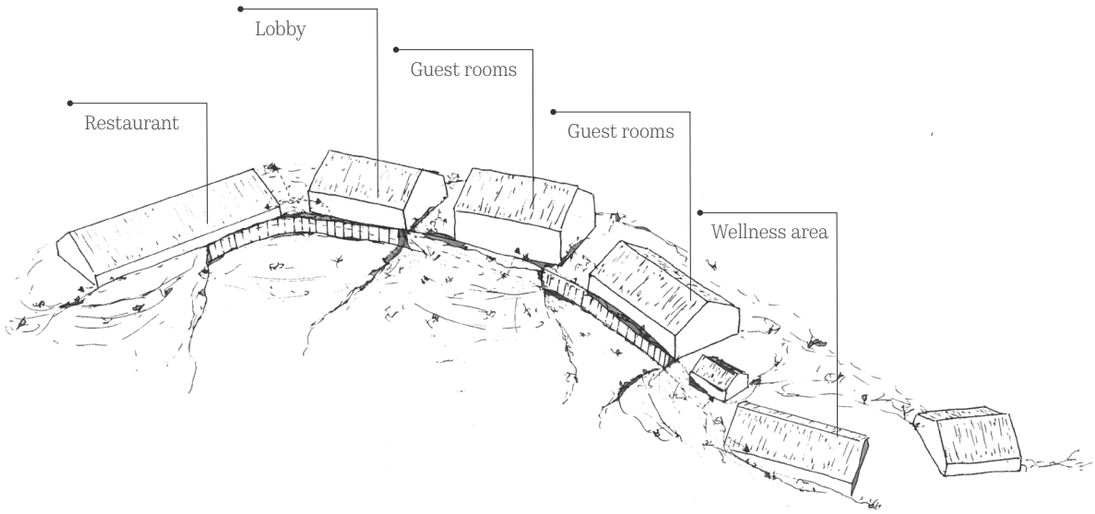
- Volume studies
- The atmosphere of the context

Still life

-Model workshop
- Natural ventilation
- The gesture of light
- Indoor environment
- Mechanical ventilation
-Energy frame

Portrait

- In darkness and in light



Ill. 4.24 Volume studies - first proposal

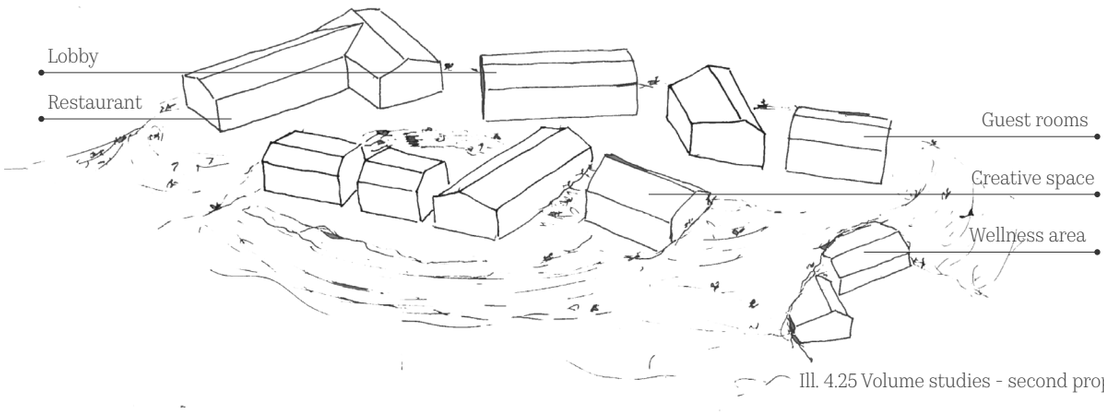
LANDSCAPE

The initial idea for the volume study of Kunstrefugiet, is found in the history of Skagen's architecture. Where the small fishermen houses were scattered between the dunes. The reason for this is found in protecting the buildings from the harshness of the nature in Skagen - a parameter that is still present and relevant today.

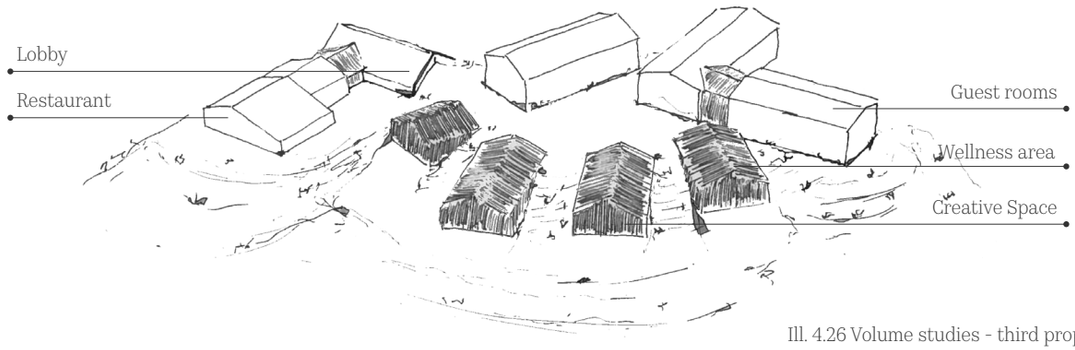
The nature on Grenen is in these years are undergoing a re-establishment in an attempt to return the nature to its original state of lyme grass, low vegetation and sand dunes. The present trees at the site, was originally planted as a few trees that should prevent sand drift, but they have over the decades spread to major parts of Grenen. The Nature Agency of Denmark are removing some of them to recreate the natural flat landscape on Grenen and in general in the entire area of Skagens Odde. Grenen is otherwise a protected area, but as it is already undergoing major changes we have decided to create a terrain that is adapted to the buildings of Kunstrefugiet, by creating attractive outdoor spaces that complement and accommodate the need of the building and its functions. The vegetation on the project site will be designed in coherence with the Nature Agency's work in returning the vegetation to its natural state.

Volume studies

A general aspect in the volume studies have been to divide the hotel into different sizes of buildings based on the room program and locating the different buildings along the existing dunes. The many proposals have been evaluated according to the parameters of shading between the buildings, location of balconies and terraces,



Ill. 4.25 Volume studies - second proposal



Ill. 4.26 Volume studies - third proposal

views from the different internal and external spaces, daylight factors and the coherence in angels between the buildings and the landscape.

First proposal

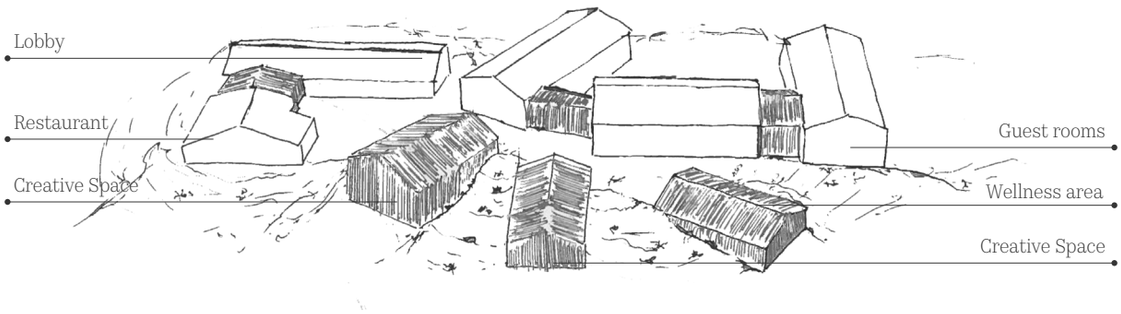
· Partly hidden corridor in the dunes connecting the buildings through a nature path across the complex.
· Many individual small buildings imitated as a long horizontal building on the dune top, creates a gesture to the former Skagens Badehotel.
· Too small building footprints would create a tall building out of propositions in the otherwise low dune landscape.

Second proposal

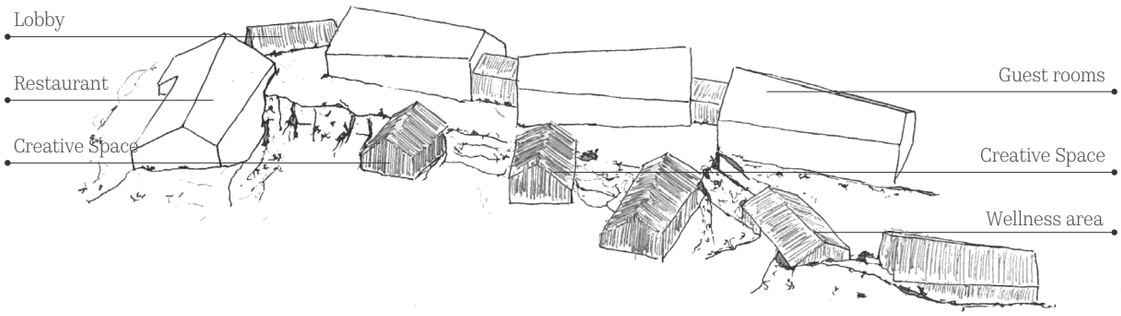
· Larger building volumes that more cohesively can be integrated into the landscape without compromising the images of the long horizontal building on top of the dune.
· Smaller buildings are located lower than the main building, where the initiating idea was to create a centre in the refugium that were orientated around the creation of art.
· The proposal were only providing the users to wander between the buildings outside.

Third proposal

Between second and third proposal many different volume studies where made, but the current one had the biggest relevance.
· The hidden connection under the dune became a central design parameter for connecting all buildings with the creation of art.
· A division in materiality was made among the buildings to emphasize the relation to the old fishermen houses.



Ill. 4.27 Volume studies - fourth proposal



Ill. 4.28 Volume studies - fifth proposal

· The central art connection had problems with its size and connection to all the buildings, It became too deep and lost its inmate an embracing feeling when wandering through it.

Fourth proposal

· Here we introduced the idea of connecting the different functions through blank spaces(canvas) in from of timber stair building.

· The division in materiality was here adjusted to create not only a physical connection between the blank spaces and the artistic area, but also visually from the outside.

· The main building was created with a courtyard between the buildings, but it gave to many issues according to sun and views within the guest rooms. The same applied for the Wellness area.

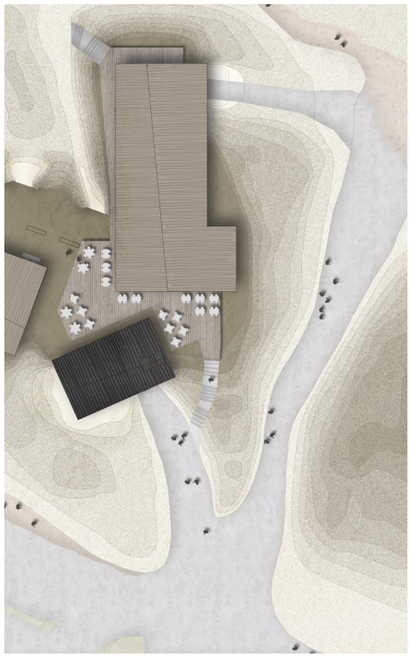
Kunstrefugiet

· More Dune Houses were added to create a stronger feeling of a small art colony and it created a stronger balance between now and then.

· The main building became more horisontally orientated and got its relation to the former Skagens Badehotel back.

· A dune hidden connection were preserved from the earlier proposals, and became smaller and more intimate, as creating a natural flow for all guests an visitors through the Creative Space. This was also a result of moving the entrance to parterre level.

· The spa was moved to be its own mindful space in deep relation to the nature, and the tranquillity surrounding it.



Ill. 4.29 Entrance from the parking lot

The atmosphere of the context

The project site for the Master Thesis has two contradictory atmospheres surrounding it. The building is on the south side located on the edge of the very crowed arrival area on Grenen. Where a large flow of cars and people is part of the everyday lift. On the northern side the site is becoming part of the wild nature of Grenen where a silence is slowly joins the space. This split between the atmospheres is a general condition in Skagen, as the town is in close connection to the nature and tranquillity that follows. On the other hand the liveness of the active town centre and harbour is found.

The challenge for Kunstrefugiet is to embrace both atmospheres in one cohesive setting. For this we uses the art and the Creative Space to shape a room that is designed in strong coherence with the lifestyle of the Skagen painters. Buy studying their painting as lifestyle through books we see a pattern of a group of individual artist sharing a common passion for, that united them in a social art society, where they where socialising among there fellow artist and the clients.
Based on that knowledge the focus on creating an artistic environment that is orientated around community and socialisation a parameter for designing a successful hotel.

The organisation of the hotel hold several different functions, where the Creative Space holding the Exhibition, Atelier and workshop became an answer to a space connection not only the artist with the guest and visitor but also being the heart of the building connecting all the hotel function.

Arrival

The lobby that will be the main arrival to Kunstrefugiet should be facing the active flow of car an people towards

Ill. 4.30 The spa withdrawer to the dunes

Ill. 4.31 The dune creating distance to the parking

south. This is where we can create the most natural and straightforward entrance for the hotel guest and artist and at the same time invite in the people already visiting Grenen. The Dune House with the lobby should be obvious and at the same time reflect a transition between the two contradictory atmospheres. This transition is designed by the landscape which unfolds and encircle the path to the entrance.

Spa

The location of the spa was important to be embraced by the silence to the north but still receive the sun from the south on its external space. The spa is therefore placed in the western end of the refugium as this has its place furthest away from the sounds of the life happing on the southern side and is instead catching the tranquillity of the nature. Likewise is the Spa detached from the rest of the complex, the emphasize the transition from the community of art in the Creative Space to the peaceful and contemplative space of the Spa.

Terrain

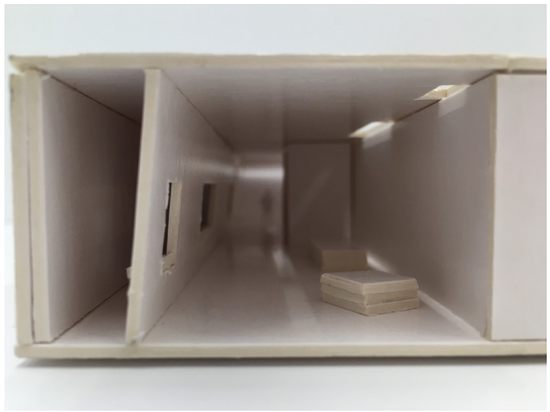
The terrain has for this project been utilised as strong aspect of creating a distance to the parking area on the south by moving the thatched building onto the dune top, and at the same time shaping the dunes towards to entrance and allowing people in. The landscape is also hiding on parts of the creative space, which visually create a bigger landscape of wild nature enclosing the building all around. The terrain is kept in the wild natural state of Grenen and are allowing small terraces to join and offering the guest a place to enjoy the nature and sunset from the cosiness of the restaurant and bistro.

Ill. 4.32 Process model studies - Lobby viewt to window

STILL LIFE

Model workshop

As part of our design process we chose the physical model as a design tool for the Creative Space. The Creative Space offers many different meetings and connections between the buildings different functions. To get a better understanding of these curial meeting the physical model was a huge factor. Building the model up step by step we slowly started to understand the spacious volumes we had created and how they in a three dimensional world were connected. The first model study were made on the Dune House hosting the lobby and the official entrance to Kunstrefugiet. Here the construction plays an important role in shaping architectural space and the visual light. It was important for us to let in a great amount of daylight, to create a bright and welcoming space. Here skylight where tested in the model to see how the light could be moving on the surfaces and changing the atmosphere depending on the day. At the same time we wanted a natural element that could draw people further into the building underneath the dune top. At first the space outside the lobby was fairly dark and didn't seem quite welcoming. Again the play of light was utilised and a narrow window in the distance of the darkness was designed to create a bright light source that also would reveal a glimpse of the dune landscape on the other side. The light became the natural curiosity to continue further and the wooden construction was kept as a light transparent transition between the Dune House and the Creative Space.

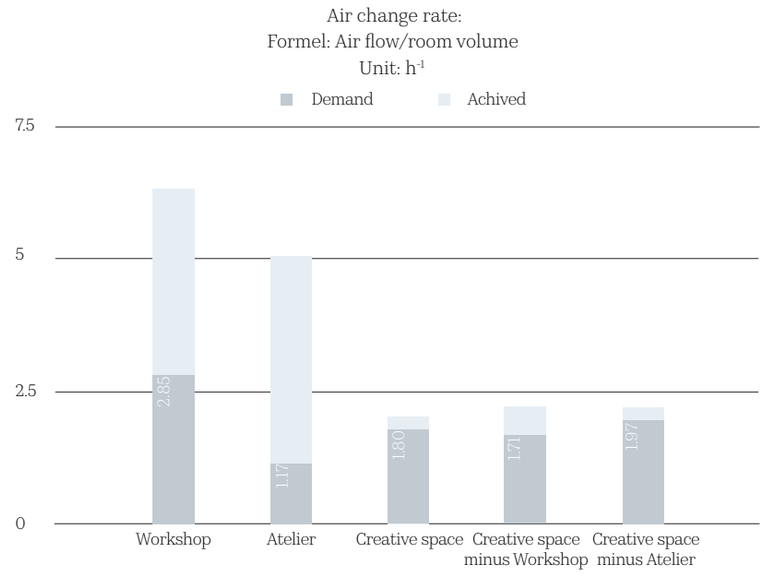


Ill. 4.33 Process model studies - Exhibition

Ill. 4.34 Process model studies - Opening Workshop

Extending the model we started to investigate how an otherwise large space could feel embracing without compromising with the distance that is needed to behold the art. A slightly tilted wall was designed to create a more enclosing space for people to stay or to slowly move further into the building. We wanted the wall to be more than an enclosing element for the long narrow space, we wished for it to be an active element in the Creative Space guiding and letting people in. The tilted wall became a continuous element running through the entire Creative Space and offering the beholder a place to safely sit and view the life of the art and the people. To break off the darkness and create a larger focus on the art different skylights were discussed where the model showed that narrow windows along the wall, would bring in a diffuse light, which would be enough to showcase in a natural lighting.

The connection between the Dune Houses and the Exhibition space were for a long time challenging us. The physical model were therefore also extended to this part of the building. At first we imagined the transition to happen through a large opening covering the entire width of the Dune House. But through the model we realised that through this specific connection it was as if the different spaces blended together as one and was not at first really seen as a switch between the buildings. Therefore the opening were minimised and was put into a more framed and visible connection, that also gave us a clear switch between the dark Exhibition and the bright Dune Houses.

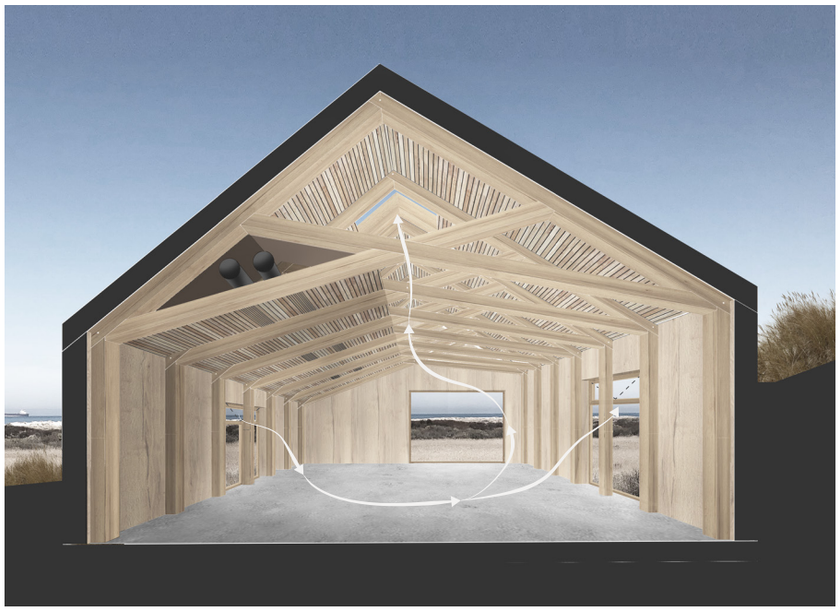


Ill. 4.35 Air change rate

Natural ventilation

To promote a more sustainable building the passive strategy of natural ventilation has been a designing factor in this thesis. Natural ventilation is a passive strategy as it can be used without increasing the building's total energy demand. Natural ventilation is thereby solely driven by wind pressure and thermal buoyancy. When using natural ventilation different factors needs to be taken in to consideration to ensure the best possible indoor environment. The process of dimensioning the natural ventilation has therefore been affected by the daylight conditions, atmospheric and thermal comfort along with the overall aim of designing a building with strong relations to the past.

For Kunstrefugiet, the natural ventilation has been dimensioned for the Creative Space and the guest rooms. This part will focus on the Creative Space and the guest rooms is seen in Appendix 5. The Creative Space is the most dynamic room according to functions and people load. It is a large open space with connection to upper floors and is the main communication flow within the building. To dimension the natural ventilation correctly, the air change rate for each space has been calculated (Ill. 4.35). Here most rooms is determined by the olfaction in the room due to the low people load per square meter. During some occasions the Workshop area will have a high people load which makes the CO_2 pollution the dominating parameter. As we want the natural ventilation to be sufficient in any

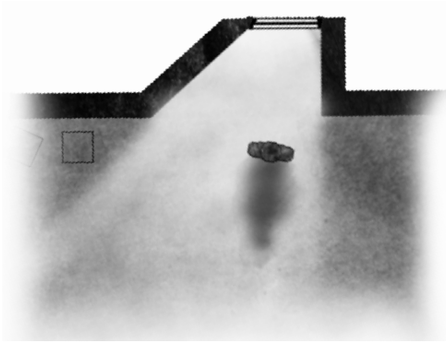


Ill. 4.36 Natural ventilation

case, this room will be calculated for the CO_2 pollution. When the Creative Space is one open area the natural ventilation will be driven by thermal buoyancy due to the long span between each opening which exceed five times the building hight. When rooms, like the Workshop area, is closed off, it has opportunity to be driven by both thermal buoyancy and cross ventilation.

In an iteratively process with both daylight and indoor environment the natural ventilation has been designed with the air change rate as a base. The condition for when the natural ventilation is sufficient it is calculated with a wind speed of 1 m/s and a temperature difference of 1 degree between inside and outside. This has been chosen, as we assume that if the natural ventilation is sufficient enough under these circumstances, it will be in any case. The general principle that has been utilised for Kunstrefugiet are lower fixed windows with an operable top as seen in Ill. 4.36. Because of our asymmetric timber construction there is a natural low and tall facade which creates a large enough height difference between the windows to allow for thermal buoyancy. In many rooms skylight are implemented as well which again is well functioning for thermal buoyancy. In the Creative Space the skylights are crucial to ventilate the space and especially the skylights in the stair cases are a determining factor as they are located 13 meters above ground level.

Ill. 4.37 Light gesture study - skylight



Ill. 4.38 Light gesture study

The gesture of light

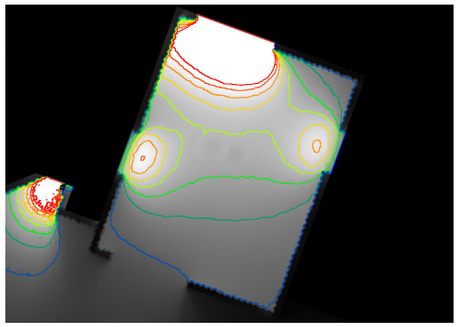
The use of daylight variates in its gesture throughout the Creative Space. In the Exhibition the darkness and the shadows becomes an essential part of dimming the sharpness of the vision and creates an ambiguous depth and distance which invite unconscious tactile imagination of daydreaming. This state of the vision, guides the visitors in the Exhibition space to think clearly and embrace the space itself and the artworks within it. The Exhibition space is thereby deliberately designed as a darker space where diffuse light and shadows induce the visitor to take part in the art environment. The darkness of the Exhibition creates an importance of qualitative placed windows that do not challenge the darkness, but uses the darkness and the shadows to give shape and life to the object in the light. The Exhibition spaces is therefore designed with mostly skylights which brings life to the artworks with defuse light without interfering with the darkness. Furthermore the room has been extended out into smaller niches with floor to ceiling windows that branch out into the dune landscape. These windows brings a northern light into the Exhibition and gives the visitors a glimpse of the space on the outside of the facade, by framing the nature. The window niches become their own intimate and embracing space that allows for fantasies and dreams to arise.

In contrast to the darkness in the Exhibition, the Dune Houses are focusing on bringing in daylight as part of creating a more transparent space where the distance between the internal and external nature becomes smaller. By creating larger windows that frames the external space we are inviting in the nature to take an active part in the internal space and using the nature as an inspiring, immersive and captivating focus in the space. The use of daylight in the Dune Houses gives the users a visual space for being creative, create and behold the creativity, in a room with natural lighting.

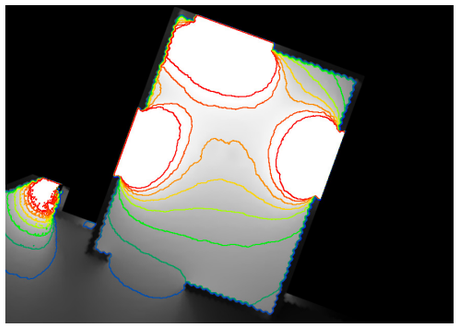
Through the Extended Room Program we have set some goals for the visual comfort in the different spaces. For the Exhibition, which do not hold much daylight, the argument and final visual terms are shown through the visualisation. In the Workshop area the aim for the daylight has been an iterative process along with BSim, natural ventilation and mechanical ventilation. The process will be seen in the following.

In this analysis the windows are based on the previous calculation of the natural ventilation. The results shows a daylight factor where more than half of the floor is covered with a 2% daylight factor. This result is obtaining the regulations for a work environment where 2% only needs to cover the occupied working zone.

Even though the regulations are achieved, the connection to the nature is smaller as the window towards east and west are placed in a still hight of 1,700 mm.

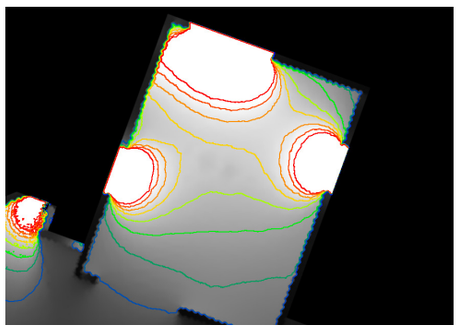


In an attempt to solve overheating hours and create a larger connection to the nature both the operable part of the windows were extended. This resulted in a well exposed space concerning daylight, where a minimum of 2% covers the entire space. A daylight factor well over what is needed for this space.



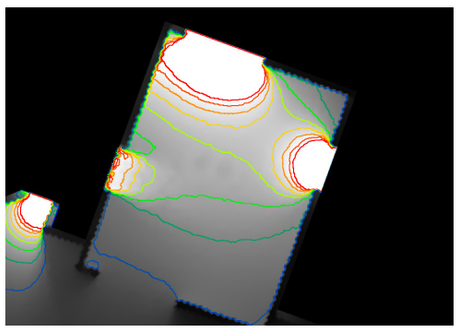
In this third analysis one meter in the width is taken of the windows towards east and west. The daylight factor for this case is still sufficient according to the regulation and to our aim to create a room able to be lit up with natural daylight . At the same time the nature is still visually invited inside the internal space.

With this high daylight factor curtain might still be needed to control the visual of the room depending on the occasion.

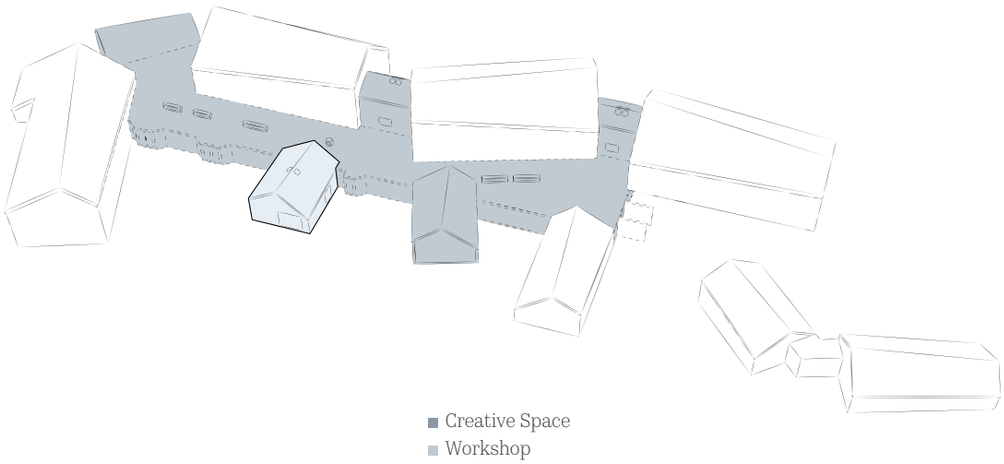


In the fourth analysis the shading is applied to the western window due to over heating in the BSim analysis. Applying the shading only reduces the daylight factor in the close area surrounding the western window. The regulations are still obtained with 2% or more in most of the space.

The shading is designed with vertical slat that still allows view to the nature.



Ill. 4.39 Process daylight - Workshop



Ill. 4.40 Creative Space and Workshop

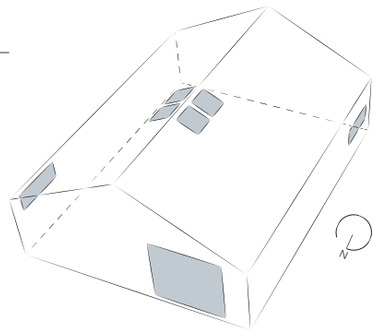
Indoor environment

The Creative Space within Kunstrefugiet have because of its dynamic shape been interesting to analyse further when it comes to the indoor environment. The Exhibition space is part of the heart in Kunstrefugiet and is hidden in the dunes. It is a large open space with a low people load compared to the square meters, but is openly connected to both the Lobby, Workshop, Atelier and upper floors which we assumed would create a larger variation in the room temperatures and CO_2 pollution. The building simulation program - BSim - was therefore utilised to analyse the indoor environment of the entire Creative Space to see how the different rooms would affect each other(Ill. 4.40). When running an analysis we assumed that the temperatures would be below 21°C as most of the windows is orientated towards north and great parts of the Creative Space is located in the dune. The result on the other hand proved us wrong as the temperatures showed to be steadily around 21°C. By being built into the dunes the exhibition space have limited windows that allows for little external influences which creates a fairly steady space when it comes to indoor environment.

The dynamics of the Creative Space is not only found within the people load, but also in the way we can open and close the Dune Houses that contains the Workshop and the Atelier. The atelier will only be closed during times where no artist are occupying it, which make the indoor environment in that space less interesting to look further into. On the other hand the Workshop is meant as a multifunctional space where up to 50 people can participate in different events. It means that if this space is closed off, as its own thermal zone, the conditions would change significantly. Therefore the BSim analysis for the Workshop was utilised as an integrated design tool ,that guided the design flow and simultaneously ensured an indoor environment that meets the Danish regulations and our own visions. In the following, four steps shows the process that were made in BSim and how the results turned out. In the end, number four meets the regulations of maximum 100 houses above 25 °C, maximum 25 hours above 28 °C and a CO_2 concentration below 1000ppm at all time(category 2).

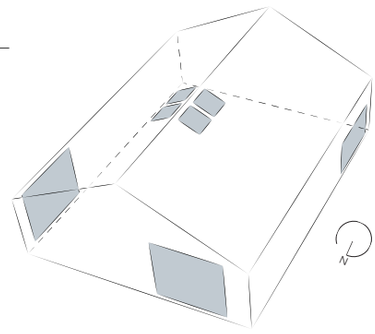
Temp. above 25 °C: 568 hours
Temp. above 28 °C: 138 hours
Co_2 concentration: 505 ppm

In the first analysis the windows where created on the bases of previous calculations on natural ventilation. At the same time all systems where based on a general load over one year. This resulted in much over heating but a generally good air quality. We therefore assumed that the air changed rate needed to raise to lower the overheating.



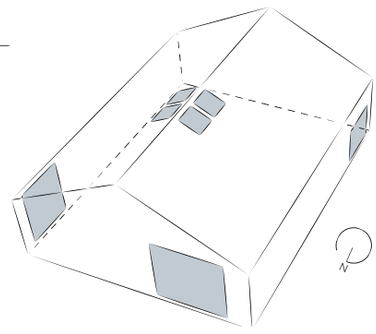
Temp. above 25 °C: 753 timer
Temp. above 28 °C: 199 timer
Co_2 concentration: 496 ppm

In the second analysis we created bigger openings for natural ventilation, and added more glazing towards east and west, to improve the daylight and the atmosphere visually. This resulted in more hours above 25 and 28 degrees. Adding a higher air change rate didn't improve the result when adding too much glazing at the same time.



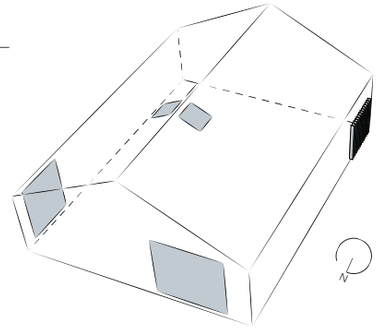
Temp. above 25 °C: 357 timer
Temp. above 28 °C: 47 timer
Co_2 concentration: 477 ppm

In the third analysis we minimised the glazing area towards east and west, but without compromising the atmosphere of the space and the daylight factors. Until now only natural ventilation had been utilised during week 18 to 40. By locating the hours with over heating and adding mechanical ventilation and cooling in those weeks we managed to lower the amount of hours above 25 and 28 degrees.



Temp. above 25 °C: 82 timer
Temp. above 28 °C: 0 timer
Co_2 concentration: 412 ppm

In the fourth analysis we took a closer look at the people load and created a more specific schedule for both weekdays, weekends and off-, pre- and in season. Furthermore the activity level was adjusted depending on the amount of people in the space. Lastly shading in the form of timber slats was applied to the western window to minimize any heating from the sun.



Ill. 4.41 BSim model process

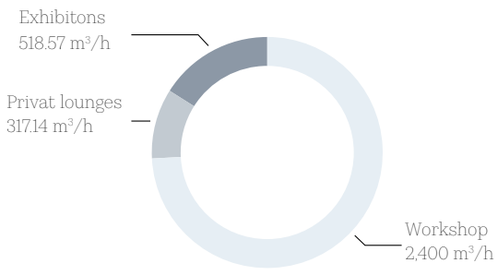
Mechanical ventilation

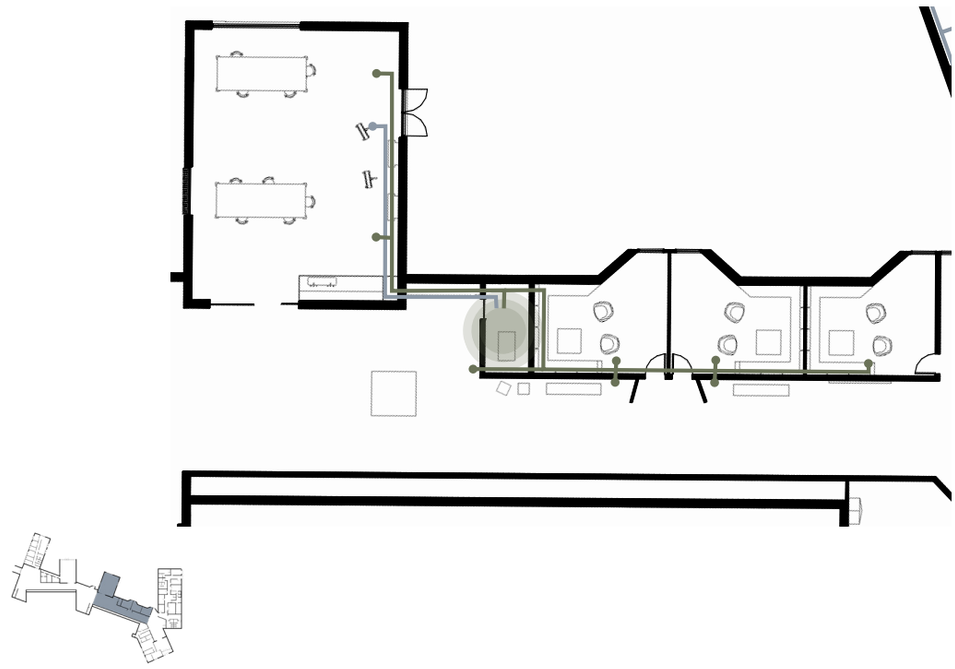
Denmark is a country with a tempered climate which means cold winters and warmer summers. The tempered climate makes natural ventilation expensive in energy during the winter months. Mechanical ventilation is therefore utilised during the heating season to minimize any extra heating demand on cost of the natural ventilation.

Running time
Natural ventilation: May - September
Mechanical ventilation: October - April

When dimensioning the mechanical ventilation, the air flow is important to determine in the matter of finding the right aggregate that can provide the needed air change for the building. As with the natural ventilation most rooms is determined by the olfaction but the workshop area is determined by the CO_2 pollution due to the high people load.

To ventilate Kunstrefugiet properly it is divided into nine different ventilation zones. This is done to both minimize the dimensions of the air handling unit and optimize the efficiency of it by shorten the length of the ducts. The decision of the division was made based on the air flow demand for each room. In parterre plan six out of the nine units are found where one is supplying the Workshop and the private lounges. The air flow for this area is as seen below.





To choose which ventilation system is most beneficial for the space the variation in pollution is the main parameter. For the Creative Space the load of people is going to variate depending on time of day and season. These big variation calls for a VAV-system (variable air volume) as the most beneficial. A sensor will be placed in each zone and activate the ventilation depending on the need. This way it is possible to save energy and keep the air changes at the current demand. The air handling unit will be equipped with a heat recovery to minimize the heat loss within the system during winter.

When choosing between displacement- and mixed ventilation its necessary to look at the pollution, the room volume and the occupied zone in the ventilated space. In the exhibition area, atelier and lobby the main pollution is going to be the olfaction of the space. As the people load is fairly low compared to the room volume, the polluted air will never be warm enough to raise up and out of the occupied zone. Because of that, mixed ventilation is chosen in these rooms to obtain both a good thermal and atmospheric comfort. The workshop is a bit different as it is a multi functional space. In event of concerts, art courses and lectures the people load will be great enough to heat up the polluted air which would make displacement a good choice. As the space is also intended to be used to create art it brings different polluting materials, that will never raise upwards with the heated air. As we want the space to have a good indoor environment in any case, mixed ventilation should also be utilised in this space.

Principle & Gesture

As part of integrate ventilation in the design process, the ventilation principle's influence on the gesture has been explored. For this, two principles for ventilation integrated in the timber construction the buildings has been explored using a 3D section of the workshop (Ill. 4.42 and Ill. 4.43).

Principle 1: The principle is to use the timber construction to create a space for the ventilation ducts to run efficiently. By closing off part of the construction from one space end to the other, the mechanical ventilation can efficiently supply the room with fresh air, placing the supply and exhaust in the slightly sloped lowered ceiling below.
The ventilation principle is to create a gesture in the workshop space by creating a spacial division in the room, due to the variation in ceiling height and the light in the space. One side will appear as more intimate and darker as the ceiling is lowered and the light from the skylight will be reflected into the room on the opposite side. It also emphasizes the movement of the construction through the room.

Principle 2: The principle is to hide the ventilation in the roof construction in between the structure and timber lining boards and the insulation and outer construction. This will leave a large space for the ventilation ducts to run. It will though separate the load-bearing timber structure from the rest of the roof construction, leaving a space in between for the ducts. That space will have to be supported with extra timber beams, which will limit the path of the ducts and other installations to one direction. The gesture is, the openness of the room with full ceiling height throughout the space, leaving the construction to create the diversity in height and movement through the space.

Principle 1 is chosen as the most efficient solution with a gesture that contributes positively to the atmosphere in the spaces. When lowering a part of the ceiling it will also affect the acoustics in the space in a positive way.
The principle will be applied in all areas of Kunstrefugiet where the timber construction is the structural element, namely the workshop, atelier, artist rooms, restaurant and 1. floor with the hotel rooms.

Principle: This principle is using the structural system to create a ventilation niche inside the room.

Gesture: The ventilation niche creates a spacial division and emphasises the movement of the construction.

Ill. 4.42 Ventilation principle 1 in the workshop area 1:100

Principle: Hiding the ventilation in the roof construction between the timber frames and the timber lining boards.

Gesture: The open space with full ceiling height.

Ill. 4.43 Ventilation principle 2 in the workshop area 1:100

BE18 KEY NUMBERS

Ill. 4.44 Be18 Key numbers

ENERGY FACTOR 2020

Ill. 4.45 Energy Factor 2020

Room heating

Domestic hot water

Lighting

Electricity for building operation

ENERGY FRAME

Throughout the project our sustainable approach has been one of the determined factors towards designing a Kunstrefugium that have strong roots to its past and relates to its surroundings in a contemporary and innovative way. By evaluating external materials, structures, gestures and atmospheres of the building and holding it against the traditional verification tool, we have designed a building that values endurance and historical qualities in both Landscape - Still life - Portrait.

As the simulations of the indoor environment presented in the previously section, we have formed a space underneath the dunes where the thermal comfort is influenced minimally by external factors. When looking into the energy frame of Kunstrefugiet, the combination of a hidden thermal mass under the dunes and wooden houses above, confirms the assumption of a fairly low heating demand. Using a calculated average of the heat capacity for the entire complex.

To verify the energy frame the verification tool Be18 is utilised. Be18 calculates by monthly key numbers the total energy requirement of a building. Based on the building design in combination with averages and bulletins from Danish Standards (Dansk Standard, 2019) and are thereby able to verify whether if the building obtains the regulations of 27 kWh/m^2 per year for a new establish hotel in building class 2020.

Kunstrefugiet can be classified according to the building class 2020, without any implementation of renewable energy, with a total energy requirement of 25,7 kWh/m^2 per year (see Appendix 11). Ill. 4.44 shows the total energy consumption in kWh/m^2 per year where Ill. 4.45 is the converted result with the associating energy factors, given by the building regulation.

The verification of the energy frame in Be18 are supporting our sustainable approach. Meaning that even when considering cultural heritage and the coherence between the building and the surroundings as strong values towards sustainability it is still possible to comply some of the numeric based verifications.

Ill. 4.46 Window gesture

Ill. 4.47 Skylight gesture

PORTRAIT

In darkness and in light

This part will be a continuation of the statement in "The gesture of light" and will show the end result for how the light shapes and gives life to the rooms. The play of light has been focused on in the Creative Spaces and more defined in the darkness of the Exhibition. The Exhibition is a space where the main flow of people is found within the building. We wanted that specific space to give its visitors a unique experience, that makes Kunstrefugiet a captivating place to enjoy the beauty in art. A place that in the beginning is hidden for the eye and then unfolds as you pass through the lobby, and draws you in. The contrast between the darkness in the dune and the small openings to the outside, is the element within the exhibition, that is going to draw you in and create a natural guidance through the room. The shape of the windows was important to design, so they not only became a source of light, but a fundamental element in creating a contemplative space that allow the mental body to drift away into the harmony of light and darkness. The windows were therefore designed as a niche where one wall is angled to form a gesture of safety together with the embracing of the light. Ill. 4.46 show the visualisation of how a delicate glow of light is floating into the room. A Wanted directed diffuse light coming from above and running down the wall, showcasing the art. Illustration Ill. 4.47 tells how the wall extends into an opening in the ceiling and creates a spotlight to the surfaces below. The light puts a focus on the art in the darkness and give them a life that would otherwise have been dissolved in the darkness. A small distance between the skylights is deliberately made to form an interaction between shadows and light. Creating a clear orientation towards the art underneath. When arriving in the lobby the two types of light will be the elements in the dark, revealing what before was hidden under the surface of the golden dunes.

BONE

The present chapter will be dealing with the topics of the core for the building body. The main topic will be on the construction and how this have affect the overall design of Kunstrefugiet from the very early start.

LANDSCAPE
- Building volumes

STILL LIFE
- The gesture of the structure

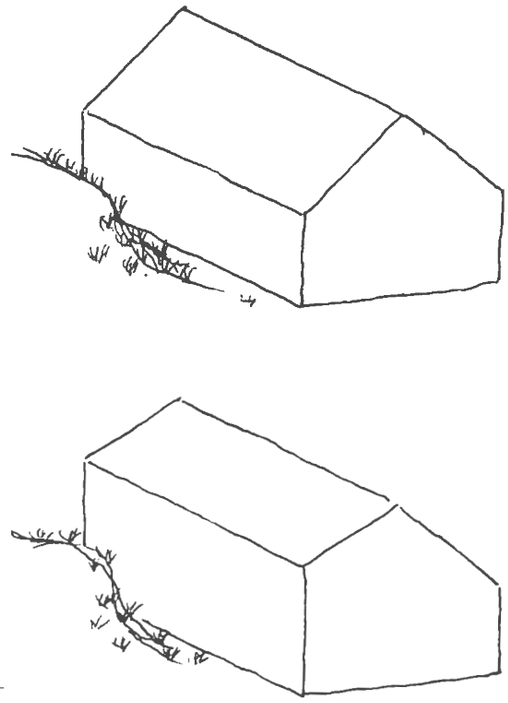
PORTRAIT
- Sustainability
- LCA
- Joints

LANDSCAPE

Building volumes

As a continuation of the volume studies formerly presented, the overall idea is for the building volumes to relate to the site, not only by scattering them in between the dunes, but also to use the shape to fade the building into the landscape. As an inspiration from the study trip and case study of the Wadden Sea Centre by Dorte Mandrup, we decided to use the shape of the roofs to do this.

As a reference to the building tradition in Skagen and the former Skagens Badehotel, the roofs are pitched. This gives us the possibility of adjusting the roof surfaces in a variety of ways.

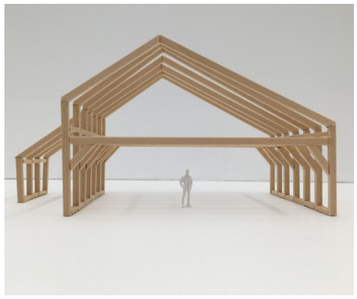


Changing one or both of the angles will move the ridge line to one side, creating a lower and a higher facade.

If making the ridge line more diagonal, each roof surface will reach respectively higher and lower on each side. This creates an orientation of the facade and roof, facing either closer to the ground or away from it.

Finally lowering the roof in one end will make it easier to fade into the landscape.

Ill. 4.48 Shapes of the building volume using the roof.



Ill. 4.49 Construction solution 1

Ill. 4.50 Construction solution 2

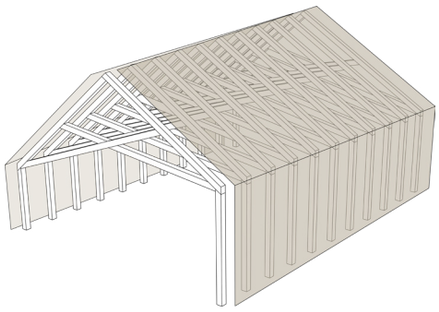
Ill. 4.51 Construction solution 3

Still life

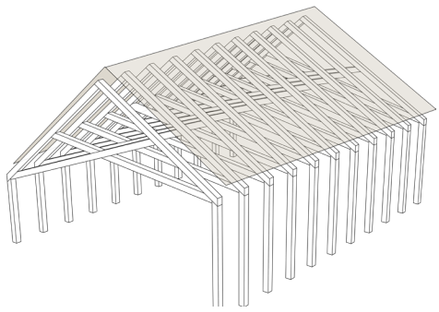
The gesture of the structure

In all the dune- and thatched houses, a distinctive timber construction is defining the space within it. From the moment you enter the space the construction plays its role in embracing you in the space. With its asymmetrical shape and dynamic timber cross moving with the length of the room it guides your vision towards exploring the room you just entered. The light will be playing with the structure of the space and casting spacious shadows on all the surfaces with a lustred diffuse light. The construction is the bone in the body of the building and testifies the early beginning a life that will shape the scenery and life for many generations to come.

A thorough design parameter all through the Master Thesis have been the characteristics of the displayed timber construction. It has from an early start been analysed in different variation where the first step took inspiration from the original black tarred fishermen houses in Skagen. Again, the physical model was taken in to use, to both visually and structurally get a broader understanding of the timber construction. The three models above show the three different solutions we have tested out. The two first ones is not that different from one another. Both have long collar beams spanning between the vertical rafters and creating a horizontal limit on the height of the celling. The third solution was made with a bigger variation on the heights of the ridge and the collar beam was re-constructed to consist of two diagonal collar beams crossing each other in volume of the room underneath. This type of timber construction allowed us a more flexible construction where the wooden buildings could blend into the hilly landscape. Furthermore, the asymmetric structure creates a dynamic with in the spaces it is surrounding.



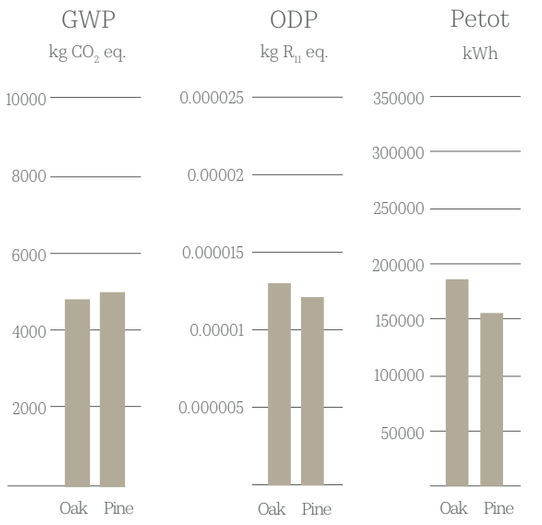
Ill. 4.52 Wind load



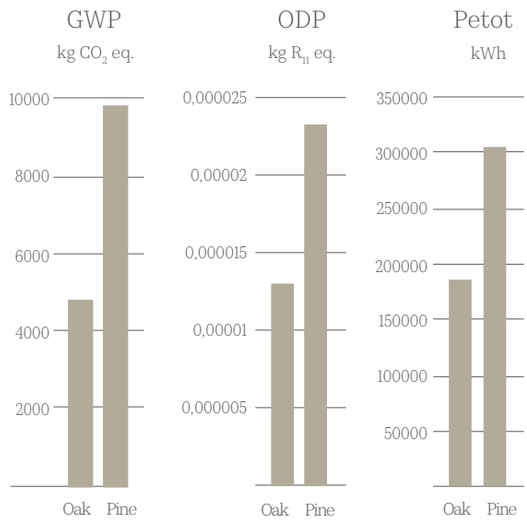
Ill. 4.53 Snow load

To ensure our new designed construction was a durable as well the structural verification tool Autodesk Robot Structural Analysis was utilised for the constructional principle. With the Timber Design it is possible to define a three-dimensional structural system, stressed by self-weight and planar loads that generates calculations for every beam or column in the structure and thereby the design of them. By adding load combination factors, the calculation accounts for the most critical limit states on every member according to the design codes for timber structures EN 1995-1:2004/A2:2014.

This way we are able to define the wanted joints, supports, centre-to-centre distances, strength properties and structural sections of the timber structure. Initially the structure had a common centre-to-centre distance of 600 mm that changed numerous times accommodating spacious studies of visible structures, window measurements and the fact that it structurally was unnecessarily oversized. The spacious study indicated construction timber and therefore a square section of 200x200 mm with a centre-to-centre distance of 1200 mm to fit standard windows. The restaurant calculation is based on the load combinations of snow, wind and self-weight. The hotel calculation is based on the same load combination but with added dead load, as the hotel is the only multi-story building. Both calculations are confirmed stable with the construction timer C30 which has a high strength property and therefore often used for rafters.



Ill. 4.54 LCA timber construction materials **100 years**



Ill. 4.55 LCA timber construction materials **200 years**

PORTRAIT

The portrait scale in this section will be based on the sustainability approach, as it focuses on architectural quality and thereby lifespan of the building.

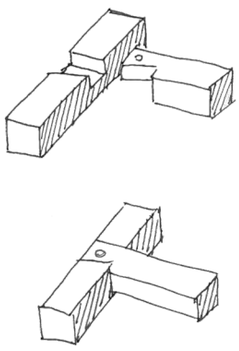
Sustainability

According to our sustainable approach, we wish to design a building of high architectural quality, namely a building that has qualities worth preserving for many years. Looking at a long lifespan of 200 years, most materials will need to be replaced or repaired through the years. The elements that should be remaining and ever presented is the structure of the building and the site. These elements are the core for future adaptation or rebuild to meet the needs of users in the future, which will with high probability have changed.

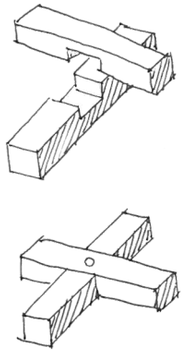
Lca

In our case the structural element is the unique timber constructions. An LCA evaluation has been made, to decide whether to use oak or pine for the construction system. Pine is a commonly used material for constructional purpose, but looking at old traditional timber constructions, oak was commonly used for timbered buildings and joints in a building needing extra strength (Larsen and Vadstrup, 2012). Therefore we have chosen to hold the two types against each other using LCA. Looking at the parameters GPW, ODP and Petot in the new Beta version of LCA the construction parts are divided into layers, leaving it possible to compare two different options for the same layer. In this case two layers containing only the construction in respectively oak and pine, has been made and compared.

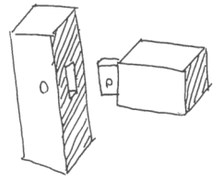
As seen on Ill. 4.54 oak performs better in all three parameters. This is also due to the fact that pine has a life expectancy of 120 years, and the numbers in the graph are calculated on a 200 year lifespan. Therefore pine will have to be replaced about halfway through the expected lifespan of the building, and this doubles the numbers.
Ill. 4.54 shows the same evaluation for a 100 year lifespan,



Ill. 4.56 Dovetail joint



Ill. 4.57 Cross-halving joint



Ill. 4.58 Dowel joint

leaving a different result. As we aim to build a structure that stands for many years, oak will be a good solution, as it has a lifespan of 300-800 years. Since the two wood types has a very similar appearance and will be protected from the weather, there are no aesthetically reasons for which one to choose.

Joints

The joints in the timber construction is of great importance to the overall load capacity of the structure. Joints are always the critical areas of a construction and will have to be designed carefully. Horizontal, vertical and inclined dowel joints have great strength against compressive stress, and too some extend against torsional stress, but almost nothing against tension. Here, is it only the flimsy dowel that holds the joint together. In this case we accommodate that by using dowel joints (see Ill. 4.58) in the frame with x-bracing. The x-bracing are two beams with intersecting cross-halving joints (see Ill. 4.57), fixed in the frame structure with dovetail joints (see Ill. 4.56). The cross-halving joints are the aesthetic element dividing the room in half and stabilises the construction against torsion. The dovetail joints are placed in joints that needs to absorb both compression and tension. When the wind blows heavily directly onto a roof surface, that side bends inwards and the opposite side outwards. The dovetail joint cannot move and are therefore very strong against tension.

As the timber construction is visible inside the building, the joints bring quality to the experience of the room, as they clearly reflect how the building is constructed in a scale relatable to human. Also, the joints present a traditional hand-craft worth preserving and learning from.
These joints have been proved to work efficiently and even better than many new joint details. Another advantage of using no metal parts is the exclusion of rot in the joints due to condense gathering on the cold metal, leaving the timber moist.

CONCLUSION

CONCLUSION

In the harshness of wind, sand and sea we find Skagen's silence of nature on Grenen, from where a new cultural experience lies between the dunes: Kunstrefugiet. A sustainable building which shape blends into the landscape and from a cohesive and respectful volume in the protected nature.

We have designed a new and innovative typology from which both the building and its surroundings benefits from. Kunstrefugiet is designed to fit its surroundings both in shape and in materiality. This is important as we are building in a place where all laws and legislations are against it. By closely evaluating every angle of the building along the materiality we have designed a building, that do not take over the nature, but a building where nature embraces its new found friend and encloses the heart of the building like a protecting duvet of sand and lyme grass. Even seen from the outside the material choice of thatched roof and facades create an image of the nature extending up the facade and shaping the asymmetrical building on the top of the dune.

Not only do the nature embraces the building from the outside. The Dune Houses on the northern side of the nature fills up the room with the unique light of Skagen and big northern windows invites the nature in as an inspiring source for creativity and as a contemplative aspect of creating an environment that encourages the mind to be present in the moment.

By approaching the building design with a genuine interest and knowledge on the heritage of the site and surroundings, we have designed not only an environmentally sustainable building, but a building with a durable core that are designed to outlive us, with the intention of preserving the characteristics of the architecture even through transformations or complete restoration in the future.
The fulcrum for our new typology focus on shaping an architectural environment that supports the intention to revitalise the heydays of the art community of Skagen. We have created a platform where artists and visitors can meet at eye level and explore their common interest for art, regardless of the position of creating-, enjoying- or beholding art. From here, in the Atelier and Workshop, creativity can spread out in the Creative Space and transform the entire refugium. Bringing art back to Skagen.

REFLECTION

Starting the Master Thesis, it went under the working title “Skagens Badehotel”. The title reflected a very specific typology which most people have an opinion and expectation towards. During the process of developing the Program containing various analysis and research our overall idea of creating a Badehotel changed towards being more than just a Badehotel. We wanted to create a place that offers Skagen not only a hotel on a unique location but also a unique experience in architecture and function. The title of the thesis changed to “Kunstrefugiet” and became a new typology that did not already exists nor had an established room program. The new typology created some challenges regarding the understanding and needs of the different users and combining them in one typology, from where they should benefit from each other. We developed a room program where art took a major role as the link between all functions. Along with the new typology we quickly learned more on the topic along the way, among other things, the sizing of recreational spaces and exhibition areas. The final building is not a one to one representation of the room program but a further development of it.

The fulcrum for the Master Thesis has been to challenge the ordinary way of assessing sustainability in architecture. As we wanted historical values and durable solutions to be the important aspects in the evaluation of sustainability along with the general certification tools like LCA. We therefore laid out our own strategy for the sustainable approach where cultural heritage became an important aspect in achieving sustainability. By investigating and understanding the different elements in cases like what angle to choose for the thatched roof or what type of construction timber should be utilised, the combination of the different sustainable approaches only improved both the historical, aesthetics and sustainable quality of the project.

Not only our sustainable approach ensured the sustainable quality of the building. Also, our methodology of History - Phenomenology - Technical played a huge role in understanding the sustainability of the building in the different perspective of Skin - Meat - Bone and Landscape - Still life - Portrait. This methodology improved our design process as it made a natural flow of dealing with the character of the building in all scales and levels. Creating a better understanding of the hierarchy of certain design choices and why this certain choice is the right one.

LITERATURE

Books

Dahlkild, N. (1991). Fra sommervilla til feriehytte. København: Dansk Byplanlaboratorium.

Dahlkild, N. (2018). Sommerlandets arkitektur. København: Museum Tusculanums Folag, pp.7-32.

Harlang, C. and Algreen-Petersen, A. (2015). Om Bygningskulturens Transformation. 1st ed. Denmark: GEKKO.

Heegaard, B., Lange, B., Nielsen, M. and Nielsen, T. (1982). Huse i Skagen II. Skagen: Skagen Kommune og Fredningsstyrelsen.

Just, G., Termansen, j. and Jepsen, A. (2007). Nordeuropæiske Badehoteller. 1st ed. København: Nærhaven Book A/S, Danmark, pp.13-18.

Knudstrup, M. (2004): Integrated Design Process in Problem-Based Learning. The Aalborg PBL Model: Progress, Diversity and Challenges, Aalborg Universitet, Aalborg, Denmark

Lehmann, M. and Nielsen, H. (2016). Sort Gul Rød. Frederikshavn: Kystmuseets Forlag.

Pallasmaa, J, (2012) The Eyes of the Skin - Architecture of The Senses. John Wiley & Sons

Skagens Badehotel på Grenen. (1914). pp.9-31.

Wong, L. (2017). Adaptative Reuse. 1st ed. Basel: Birkhäuser

Zumthor, P, (2006) Atmospheres, Birkhäuser, Basel, Switzerland

Pdf-files

Christensen, J. and Vadstrup, S. (2014). Trætjære. [ebook] København: Kulturstyrelsen. Available at: https://slks.dk/fileadmin/user_upload/kulturarv/publikationer/emneopdelt/bygninger/Bygningsbevaring/9.11_Traetjaere.pdf [Accessed 6 May 2019].

Den lille lune. (2018). 32nd ed. 2640 Hedehusene: Rockwool, p.12.

DGNB System Denmark. (2019). [ebook] Denmark: Green Building Council. Available at: http://www.dk-gbc.dk/publikationer/dgnb-manual-for-nye-kontorbygninger-2016/ [Accessed 13 Feb. 2019].

Frederikshavn kommune (2014). Referat Frederikshavn Byråd. Frederikshavn: Frederikshavn kommune, pp.11-13.

Frederikshavn kommune (2014). Potentialeplan for Skagen som international kystferieby. København.

Grudin, J. & Pruitt, J. (2002). Personas, Participatory Design and Product Development: an infrastructure for engagement. Proceedings of the Participatory Design Conference, Sweden

Larsen, N. and Vadstrup, S. (2012). Træ til husbygning. [ebook] København: Kulturstyrelsen. Available at: https://

slks.dk/fileadmin/user_upload/SLKS/Omraader/Kulturarv/Bygningsfredning/Gode_raad_om_vedligeholdelse/8.2_Trae_til_husbygning.pdf [Accessed 10 May 2019].

Stenak, M. (2018). SAVE – Kortlægning og registrering af bymiljøers og bygningers bevaringsværdi. København V: Kulturministeriet, Kulturarvsstyrelsen 2011.

Veludført stråtag. (2019). 6th ed. [ebook] København: Tækkelauget. Available at: http://www.taekkelaug.dk [Accessed 6 May 2019].

Papers

deRoos, J. (2011). Planning and Programming a Hotel. Cornell University, School of Hospitality administration. [online] Available at: https://scholarship.sha.cornell.edu/cgi/viewcontent.cgi?article=1293&context=articles [Accessed 22 Feb. 2019].

Hsieh, Y., Apostolopoulosc, Y. and Sönmez, S. (2013). The world at work: hotel cleaners. [online] Available at: https://oem.bmj.com/content/70/5/360 [Accessed 28 Feb. 2019].

Mısırlısoy, D. and Günçe, K. (2016). Adaptive reuse strategies for heritage buildings: A holistic approach. Sustainable Cities and Society, 26, pp.91-98.

O'Neill, J. and Davis, K. (2010). Work stress and well-being in the hotel industry. International Journal of Hospitality Management. [online] Available at: https://www.sciencedirect.com/science/article/pii/S0278431910000897 [Accessed 28 Feb. 2019].

Email

Nielsen, H. (2018). Skagens Badehotel. Skagens lokalhistorisk arkiv [email].

Web

Bygningsreglementet.dk. (2019). BR18. [online] Available at: http://bygningsreglementet.dk/ [Accessed 20 May 2019].

Christensen, T. (2002). Skagenslyset bliver svagere. Ingeniøren. [online] Available at: https://ing.dk/artikel/skagenslyset-bliver-svagere-46926 [Accessed 18 Feb. 2019].

Dansk Standard. (2019). Danish Standards Foundation - Dansk Standard. [online] Available at: https://www.ds.dk/en [Accessed 20 May 2019].

Dingeo.dk. (2019). Fyrvej 42, Skagen | DinGeo.dk – Servicebygning – DinGeo.dk. [online] Available at: https://www.dingeo.dk/adresse/9990-skagen/fyrvej-42/ [Accessed 20 Feb. 2019].

d.o.o., Y. (2019). Skagen, Denmark - Detailed climate information and monthly weather forecast | Weather Atlas. [online] Weather Atlas. Available at: https://www.weather-atlas.com/en/denmark/skagen-climate [Accessed 20 Feb. 2019].

Goodwin, K. (2008). Perfecting Your Personas | Cooper. [online] Cooper.com. Available at: https://www.cooper.com/journal/2001/08/perfecting_your_personas [Accessed 23 Feb. 2019].

Kysterne.kyst.dk. (2019). Klitfredningslinjen. [online] Available at: http://kysterne.kyst.dk/klitfredningslinjen.html [Accessed 24 Feb. 2019].

Skagens Kunstmuseer. (n.d.). Holger Drachmann | Skagens Kunstmuseer. [online] Available at: https://skagenskunstmuseer.dk/kunstnere/holger-drachmann/ [Accessed 11 Feb. 2019].

ARTICLES:

Christensen, H. (2014). Da der var halløj på Skagen Badehotel. Nordjyske.

Jyllandsposten (1898). Skagen Bad.

Keiding, M. (2019). Uforfærdet Faglighed - Interview med Natalie Mossin. Arkitekten, (06 Biennale 2018 Vol. 120), p.37.

VIDEO:

Copans, R. (2001). Les Thermes De Pierre. [video] Available at: https://www.youtube.com/watch?v=DpkpiK4o-cw [Accessed 11 Feb. 2019].

Naturstyrelsen (2017). Skagens Odde - En vildmark i Danmark. [image] Available at: https://www.youtube.com/watch?v=3tc_moMZABU [Accessed 18 Feb. 2019].

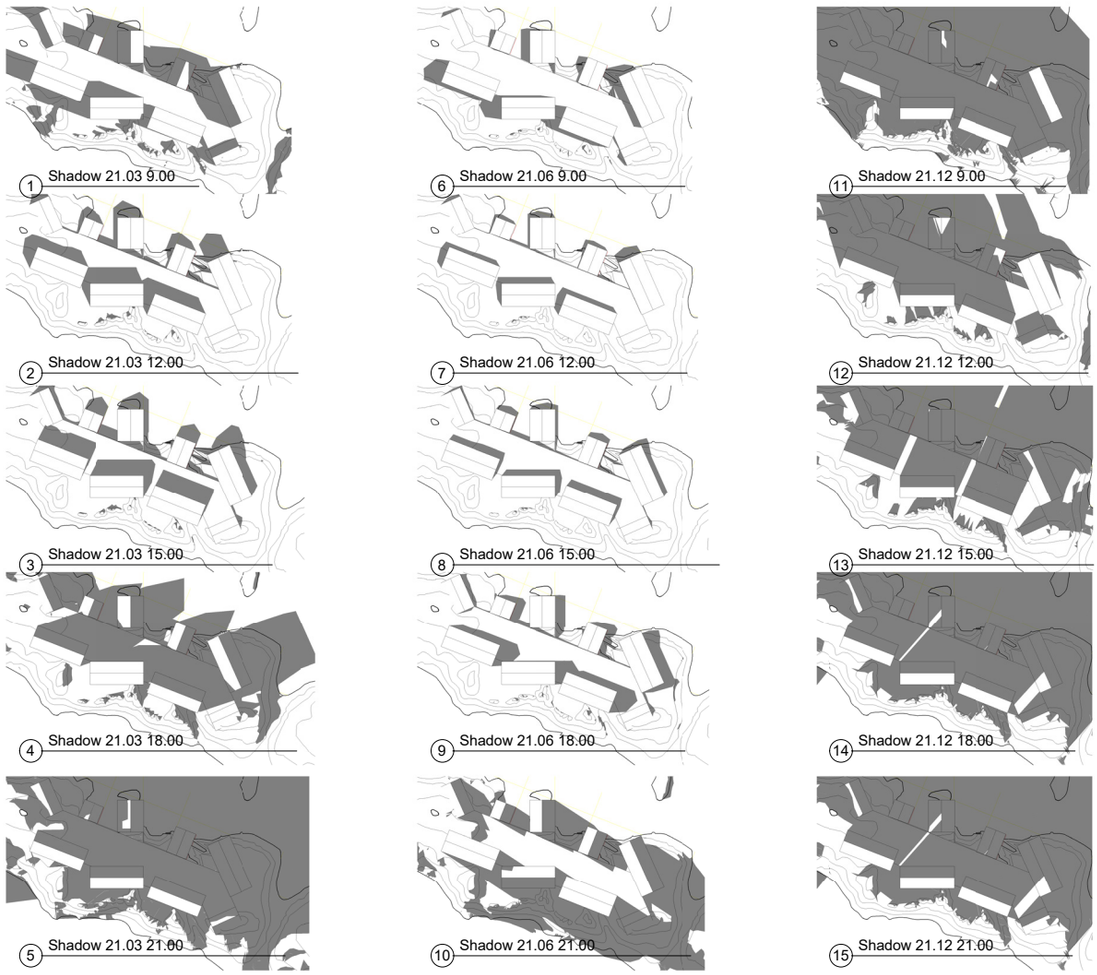
ILLUSTRATIONS

All illustrations are own illustrations unless otherwise is stated.

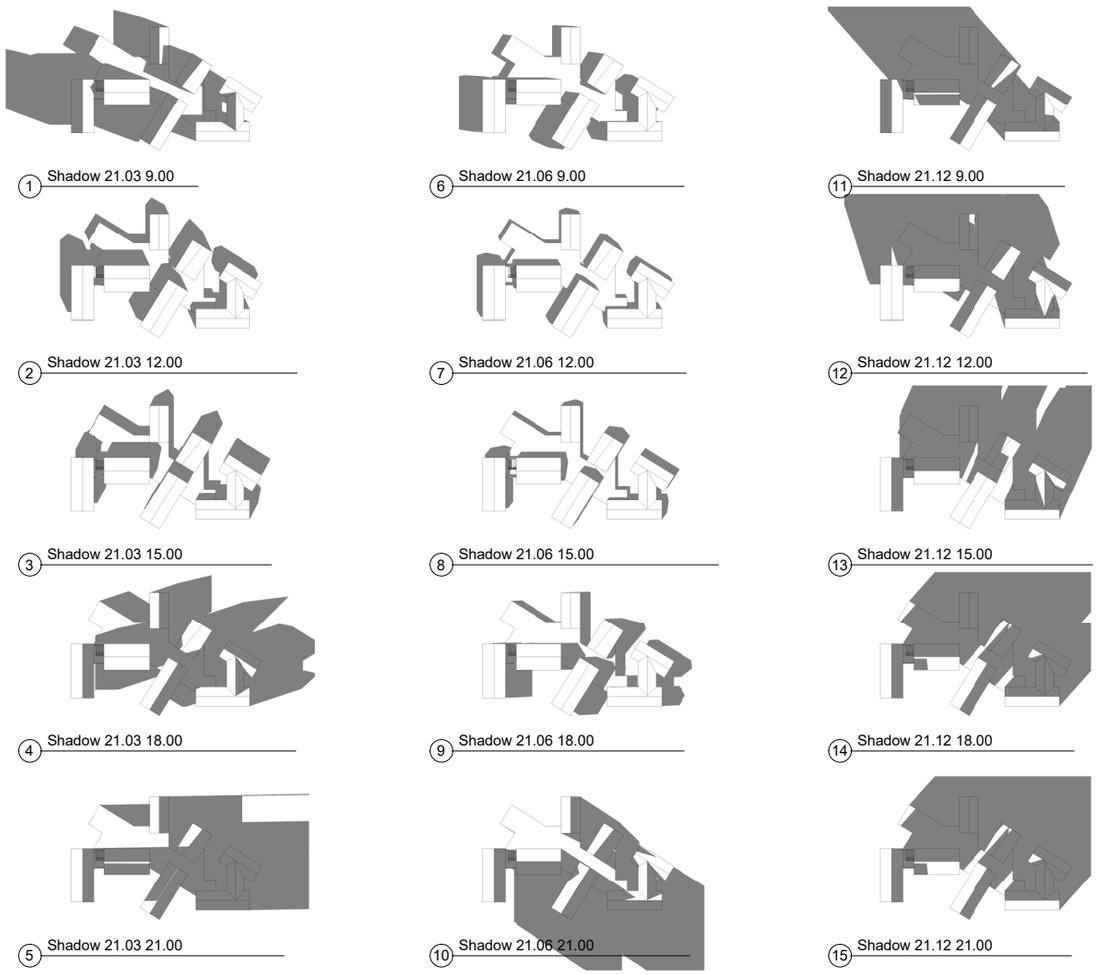
APPENDIX

APPENDIX 1

Shading



Ill. 6.1 Shading study final



Ill. 6.2 Shading study fourth proposal

APPENDIX 2

INTERVIEW

CERAMIST JOSEPHINE ALBERTHE

How would your dream atelier look like? What would your preference as an artist be?

It is always very nice if the floors can withstand various types of materials, but also that they can withstand to be washed often. Personally I would prefer one big space instead of a room that is divided. Then I would also definitely make the room really practical according to storages etc. but at the same time try and make it an aesthetic solution. The working table has to be big so that you have plenty of space and do not have to clean all the time. And lastly I would probably want a cosy corner where I can drink coffee.

But one thing that I know that most artist do is being messy and you are really messy unless you are only using paper and pen. Therefore surfaces are properly really important. And after that you can always add the aesthetically elements. But today the focus is on the health related harmful products in the artist community as so many things is semi toxic. At least I have never cleaned as much as I have since I came to this school on Bornholm.

PAINTER GITTE TOFT

How would your dream atelier look like? What would your preference as an artist be?

A perfect atelier is a large room with simple white walls and high ceilings. 16-20m2.

The room should be orientated towards north due to light. Towards north the celling should be high and windows of at least three meters. If the windows are orientated otherwise they can be big and without any mullions and have to option of solar shading without blocking all light out.

Aircondition/heat - two daylight lamps - Big stable easel on wheels so it can be moved - A large working table with height adjustable functions preferably 2 x 1 meter - A ergonomic chair and a standard office chair.

A zink - refrigerator - cooktop - essential kitchen ware - Wifi and a bluetooth speaker - Storage for materials.

APPENDIX 3

Interview Skagen

QUESTION 1

What is your opinion about a possible new Skagens Badehotel could be build on Grenen? And why?

>>Good idea, if it is kept in the old building traditions.

>>Fine if it is made with ideas from the earlier hotel.

>>Quite ok, if it is made with respect to nature.

>>It is fine if it is made exactly like the earlier hotel.

>>Good idea, with the right architecture that is united with the nature.

>>Fantastic idea as part of promoting the tourism in Skagen.

QUESTION 2

What would you like,a Badehotel like this to offer you, for you to visit the hotel as a local resident?

>>Space for calm walks.

>>The opportunity for good food and drinks.

>>Space for calm walks.

>>A cosy(hyggelig) and relaxed atmosphere, and the feeling of being connected to the nature.

>>Lots of atmosphere in the old style.

>>Small intimate concerts and lectures

>>A cocktail bar.

>>A view to the sunset and sunrise.

>>Exhibitions

>>Wellness, sauna, yoga and mind fullness.

>>Painting courses.

>>Cooking with local commodities.

QUESTION 3

In general Skagen offers many lectures and intimate concerts both off and in season. In your opinion do you think Skagen needs more cultural offers for you as a local resident?

>>A sauna with space for the elderly generation.

>>A place from where you can enjoy the sunset and sunrise.

>>A cocktail bar.

>>Activities for kids.

>>Believe that Skagen have enough offers for the locals.

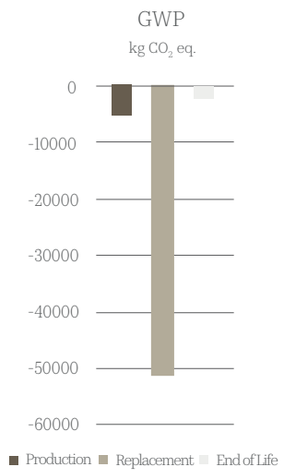
APPENDIX 4

LCA

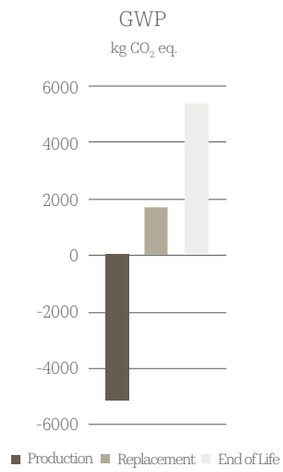
The graphs shows the GWP result for cedar cladding for a 200 year lifespan.

Ill. 6.3 is the result if we assume the timber is recycled and has a lifespan of 25 years.

Ill. 6.4 is the result of we assume the timber is combusted and has a lifespan of 25 years.



Ill. 6.3 Cedar GWP for - recycled



Ill. 6.4 Cedar GWP for - combusted

APPENDIX 5

Natural Ventilation

The two tables below shows how natural ventilation is calculated for the Creative Space when it is in an open connection with both Atelier and Workshop. The other table shows the situation when the Workshop is closed and work as its own thermal zone. Similar calculation have been bade for other situations a rooms and the result can be seen in Appendix 6.

Creative space

Pressure Coefficient			Windfactor	0,54		Pwind	0,2 pa		
Windward			Vmeteo	1 m/s		Pmin	0,0 pa		
Leeward			Vref	0,54 m/s		Pmax	0,0 pa		
roof									
Location of neutral plan, Ho	6,38 m			Buildingvol.	m3				
Outdoor temperature	21 C			Volume	m3/section/floor				
Zone temperature	22 C								
Discharge coefficient	0,6			Internal pressure, Pi	pa	-0,06			-0,06
Air density	1,25 kg/m3								

	Area m2	Eff. Area m2	Height m	Thermal Buoyancy pa	AFR (thermal) m3/s	Pres Coefficient	Wind pressure pa	AFR Wind) m3/s	Wind pressure pa	AFR total m3/s
West(Exhibition)	2	1,200	2,6	0,157	0,60	0,06	0,071	0,404	0,071	0,725
South(lobby)	1	0,600	2,25	0,172	0,31	-0,5	-0,031	-0,134	-0,031	0,285
North(Atelier)	1,00	0,600	1,7	0,195	0,33	0,2	0,096	0,236	0,096	0,410
West(Atelier)	1,60	0,960	1,5	0,203	0,55	0,06	0,071	0,323	0,071	0,636
East(Workshop)	1,00	0,600	2,25	0,172	0,31	0,2	0,096	0,236	0,096	0,393
West(Workshop)	1,00	0,600	1,4	0,207	0,35	0,06	0,071	0,202	0,071	0,400
Roof(Workshop)	2	1,200	6	0,016	0,19	-0,4	-0,013	-0,172	-0,013	0,082
Roof(Stair)	4,00	2,400	13	-0,275	-1,59	-0,4	-0,013	-0,345	-0,013	-1,630
Roof(Stair)	4,00	2,400	13	-0,275	-1,59	-0,4	-0,013	-0,345	-0,013	-1,630
Roof(lobby)	6,00	3,600	6	0,016	0,57	-0,4	-0,013	-0,517	-0,013	0,246
				Massebalance	0,00		Massebalance	0,00		0,00
Rumvolumen	5653 m³			AIR CHANGE RATE	2,03		AIR CHANGE RATE	51,69		2,07

Ill. 6.5 Natural ventilation - Creative Space

Workshop

Pressure Coefficient			Windfactor	0,54		Pwind	0,2 pa		
Windward			Vmeteo	1 m/s		Pmin	0,0 pa		
Leeward			Vref	0,54 m/s		Pmax	0,0 pa		
roof									
Location of neutral plan, Ho	3,92 m			Buildingvol.	m3				
Outdoor temperature	21 C			Volume	m3/section/floor				
Zone temperature	22 C								
Discharge coefficient	0,5			Internal pressure, Pi	pa	-0,06			-0,05
Air density	1,25 kg/m3								

	Area m2	Eff. Area m2	Height m	Thermal Buoyancy pa	AFR (thermal) m3/s	Pres Coefficient	Wind pressure pa	AFR Wind) m3/s	Wind pressure pa	AFR total m3/s
West	1,00	0,500	1,4	0,105	0,20	0,06	0,071	0,168	0,061	0,258
East	1,00	0,500	2,25	0,069	0,17	-0,35	-0,004	-0,039	-0,014	0,149
Roof	2	1,000	6	-0,087	-0,37	-0,4	-0,013	-0,144	-0,023	-0,418
				Massebalance	0,00		Massebalance	0,00		0,00
Rumvolumen	661 m³			AIR CHANGE RATE	2,02		AIR CHANGE RATE	6,27		2,24

Ill. 6.6 Natural ventilation - Workshop

APPENDIX 6

Air change rate and Air flow rate

The following tables shows have both the air change rate and air flow rate is calculated, taken the Creative Space as an example. A calculation for with both olfaction and Co_2 pollution is shown, as the workshop have a higher demand for air changes calculated based on a Co_2 pollution, due to the high load of people. The last table shows all demands for air changes and air flow in the specific rooms.

Determined by OLF		**Atelier**	**Exhibition**	**Workshop**	**Lobby**	**Staircases**	**Private lounge**
C_i	Pollution in inlet air Unit: ppm	350.00	350.00	350.00	350.00	350.00	350.00
	Amount of people	6	40	50	15	2	10
	Area Unit: m^2	100.00	900.00	116.00	100.00	48.00	24.00
	Room hight Unit: m	5.70	3.00	5.70	5.70	10.00	3.00
q	Total pollution load Unit: olf	26.00	220.00	73.20	35.00	11.60	14.80
c	Sensed air quality Unit: dp	1.40	1.40	1.40	1.40	1.40	1.40
V_L	Air flow rate Formel: $V_L=C_i+10*(q/c)$ Unit: l/s	185.71	1571.43	522.86	250.00	82.86	105.71
	Air flow Unit: m^3/h	**668.57**	**5657.14**	1882.29	**900.00**	**298.29**	**380.57**
	Air flow Unit: m^3/s	0.19	1.57	0.52	0.25	0.08	0.11
	Room volume Unit: m^3	570.00	2700.00	661.20	570.00	480.00	72.00
	Air change rate pr. m^2 Formel: V_L/m^2 Unit: l/s pr. m^2	1.86	1.75	4.51	2.50	1.73	4.40
	Air change rate: Formel: Air flow/roomvolumen Unit: h^{-1}	**1.17**	**2.10**	2.85	**1.58**	**0.62**	**5.29**

Ill. 6.7 Air flow and air change rate - Olf

Determined by Co_2		Workshop
C_i	Pollution in inlet air Unit: ppm	350.00
	Amount of people	50.00
q	Total pollution load Unit: m3/h	1.20
c	Sensed air quality Unit: ppm	850.00
	Area Unit: m²	116.00
	Room hight Unit: m	5.70
V	Room volume Unit: m3	661.20
n	Air change rate: Formel: (q*10^6)/((c-Ci)*V) Unit: h-1	**3.63**
	Air supply m3/s	0.67
	Air flow rate Formel: ACR*Room volume Unit: m3/h	**2400.00**

Ill. 6.8 Air flow and air change rate - CO_2

Main results for ventilation principals	Air flow Unit: m³/h	Air change rate: Formel: Air flow/ roomvolumen Unit: h^{-1}
Standard room 1. Floor	210.86	2.27
Standard room 2. Floor	210.86	1.36
StandardPlus 1. Floor	257.14	2.14
StandardPlus 2. Floor	257.14	1.29
Suite 1. Floor	313.71	2.05
Suite 2. Floor	313.71	1.23
Disable friendly room 1. floor	257.14	2.14
Disable friendly room 2. floor	257.14	1.29
Artist room	82.29	1.50
Artist common	617.14	1.37
Ceramic	123.43	2.52
Spry room	123.43	2.52
Restaurant	5142.86	1.71
Office	87.43	1.46
Staff canteen	493.71	2.74
Spa area	1542.86	1.80
Spa reception	581.14	1.62
Changing rooms	339.43	3.72
Treatment rooms	102.86	1.80

Ill. 6.9 Air flow and air change rate - results

APPENDIX 7

Mechanical ventilation

Aggregate 1	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Standard room 1. Floor	5	210.86	1054.29
Standard room 2. Floor	5	210.86	1054.29
StandardPlus 1. Floor	3	257.14	771.43
StandardPlus 2. Floor	3	257.14	771.43
Total Air flow for aggregate Unit: m³/h	-	-	**3,651.43**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	400-3,900	2,400 x 1,825 x 1,149	https://www.exhausto.dk/produkter/Counterflow/VEX300T/VEX350T

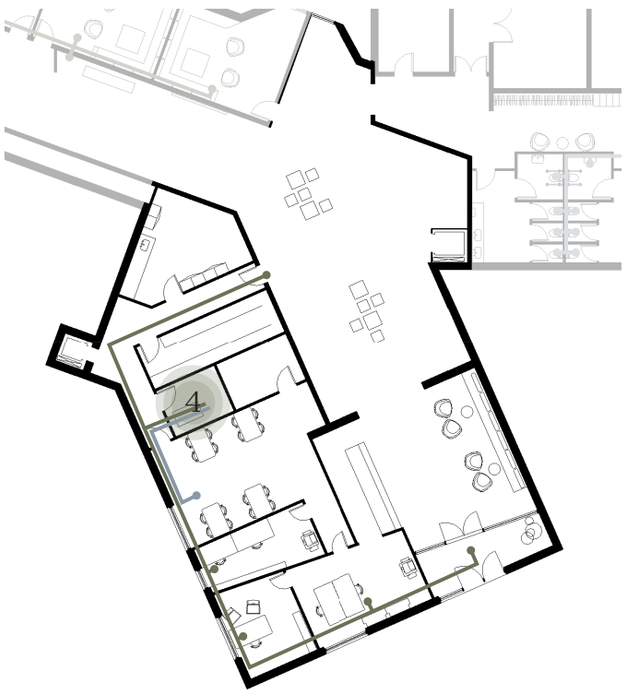
Aggregate 2	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Standard room 1. Floor	6	210.86	1265.14
Standard room 2. Floor	6	210.86	1265.14
StandardPlus 1. Floor	2	257.14	514.29
StandardPlus 2. Floor	2	257.14	514.29
Total Air flow for aggregate Unit: m³/h	-	-	**3,558.86**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	400-3,900	2,400 x 1,825 x 1,149	https://www.exhausto.dk/produkter/Counterflow/VEX300T/VEX350T

Aggregate 3	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Standard room 1. Floor	5	210.86	1054.29
Standard room 2. Floor	5	210.86	1054.29
StandardPlus 1. Floor	1	257.14	257.14
StandardPlus 2. Floor	1	257.14	257.14
Suite 1. Floor	2	313.71	627.43
Suite 2. Floor	2	313.71	627.43
Total Air flow for aggregate Unit: m³/h	-	-	**3,877.71**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	400-3,900	2,400 x 1,825 x 1,149	https://www.exhausto.dk/produkter/Counterflow/VEX300T/VEX350T

Ill. 6.10 Air flow rate for aggregate 1-3

Aggregate 4	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Lobby	1	833.14	833.14
Office	2	87.43	174.86
Staff canteen	1	493.71	493.71
Exhibition	0.3	1571.43	518.57
Total Air flow for aggregate Unit: m³/h	-	-	**2,020.29**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	330-2,450	1,908 x 1,765 x 830	https://www.exhausto.dk/produkter/Counterflow/VEX340H%20series/VEX340H

Ill. 6.11 Air flow rate for aggregate 4



Ill. 6.12 ventilation principle - aggregate 4 (lobby)

Aggregate 5	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Workshop area	1	2400.00	2400.00
Private lounge	3	105.71	317.14
Exhibition	0.3	1571.43	518.57
Total Air flow for aggregate Unit: m³/h	-	-	**3,235.71**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	400-3,900	2,400 x 1,825 x 1,149	https://www.exhausto.dk/produkter/counterflow/VEX300T/VEX350T

Ill. 6.13 Air flow rate for aggregate 5

Ill. 6.14 ventilation principle - aggregate 5+6 (atelier and artist rooms)

Aggregate 6	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Atelier	1	668.57	668.57
Ceramic	1	123.43	123.43
Spry room	1	123.43	123.43
Exhibition	0.3	5657.14	1866.86
Total Air flow for aggregate Unit: m³/h	-	-	**2,782.29**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	400-3,900	2,400 x 1,825 x 1,149	https://www.ezhausto.dk/produkter/Counterflow/VEX300T/VEX350T

Aggregate 7	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Artist room	6	82.29	493.71
Artist common	1	617.14	617.14
Total Air flow for aggregate Unit: m³/h	-	-	**1,110.86**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	1980.00	1.401 x 1.365 x 750	https://www.ezhausto.dk/produkter/Counterflow/VEX100CF/VEX140CF-H-V

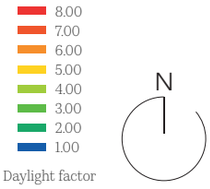
Aggregate 8(Spa)	**Quantity of room type**	**Air flow pr. Room** Unit: m³/h	**Air flow pr. Room type** Unit: m³/h
Spa area	1	1542.86	1542.86
Spa reception	1	581.14	581.14
Changing rooms	2	339.43	678.86
Treatment rooms	2	102.86	205.71
Total Air flow for aggregate Unit: m³/h	-	-	**2,124.00**
Aggregate data	**Air flow m3/h**	**h x l x w**	**Web**
	330-2,450	1,908 x 1,765 x 830	https://www.ezhausto.dk/produkter/Counterflow/VEX340H%20series/VEX340H

Ill. 6.15 Air flow rate for aggregate 6-8

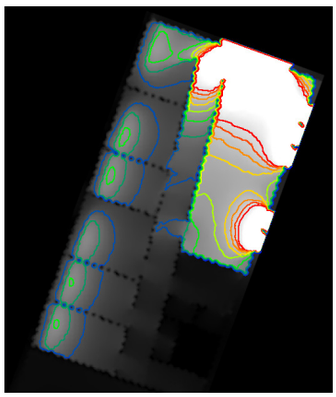
APPENDIX 8

Daylight

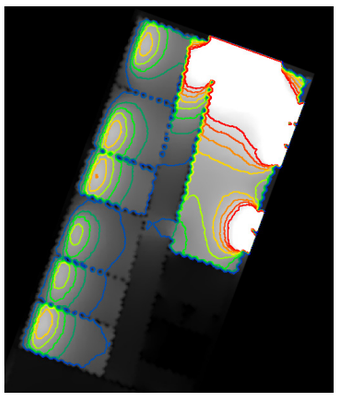
We have here collected a few of the daylight process, we have had in throughout the designing process. Daylight have taken great part in ensure a good indoor environment for the users.



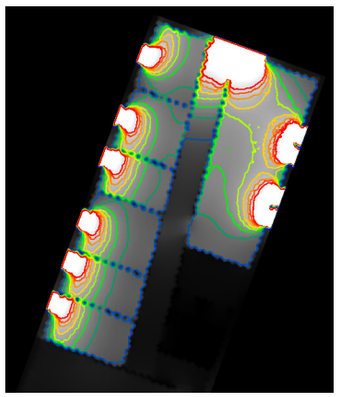
Artist rooms and artist common



Ill. 6.16 Windows for natural ventilation in private rooms. And windows for view in common space.

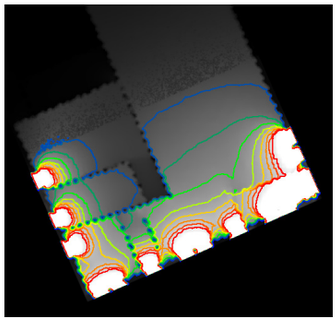


Ill. 6.17 Added an extra window in all private rooms for better daylight

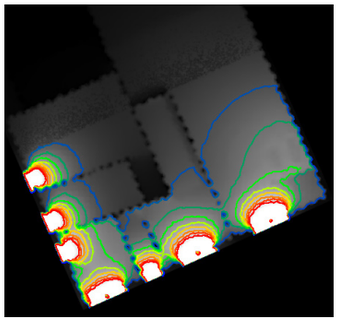


Ill. 6.18 One window is changed for a door in the private rooms and the amount of windows in the common space is reduced for more privacy.

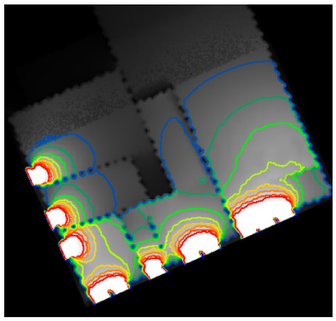
Lobby



Ill. 6.19 Windows for natural ventilation and views-

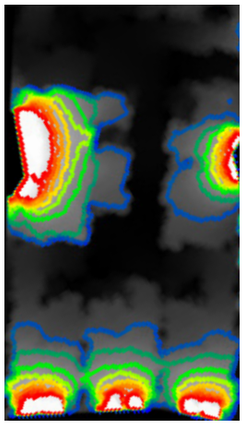


Ill. 6.20 Windows in east removed as the landscape where changed to cover the eastern facade.

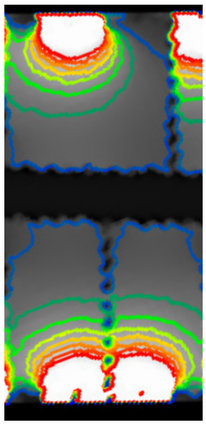


Ill. 6.21 An extra window were added in the facade facing the parking lot and a three skylight to improve the daylight and the views.

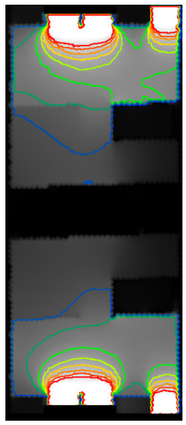
Guest rooms



Ill. 6.22 Long narrow guest rooms. Early proposal.

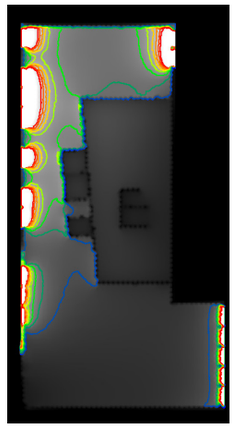


Ill. 6.23 Both squared and rectangular proposal.

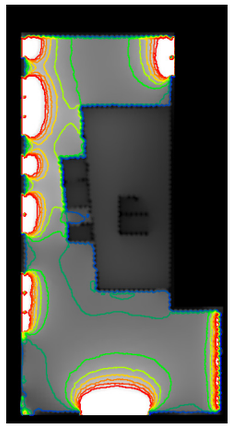


Ill. 6.24 Final proposal.

Restaurant, Bar and bistro



Ill. 6.25 Restaurant, bar and bistro.

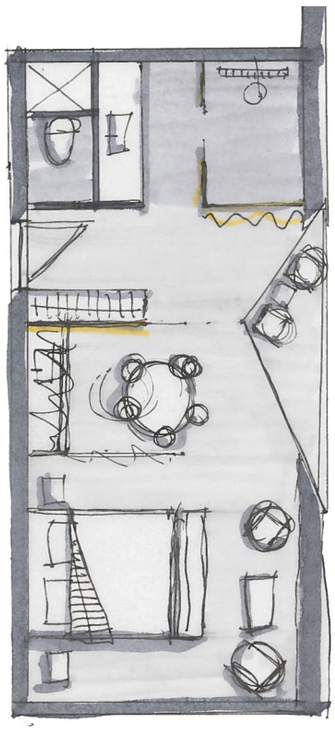


Ill. 6.26 Restaurant, bar and bistro.

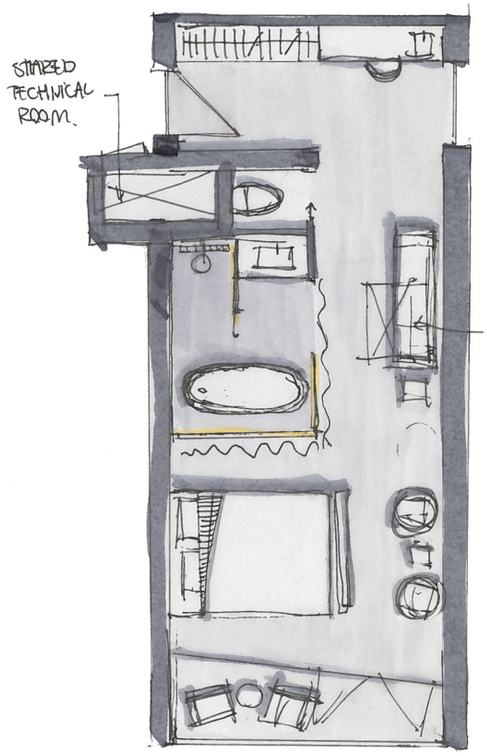
APPENDIX 9

Guest rooms - Process

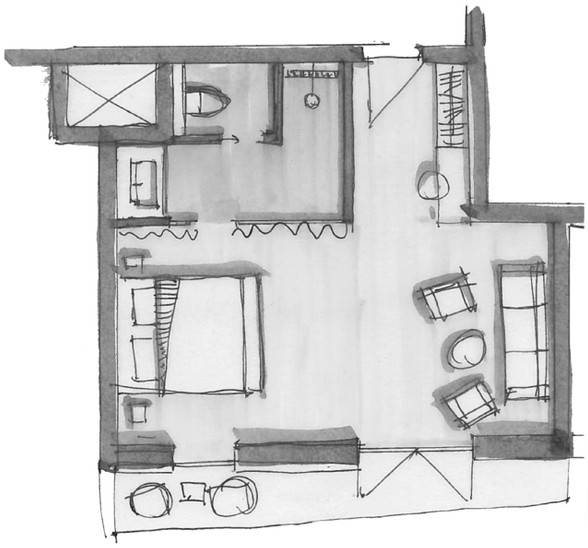
The plans below showcases a part of the process in creating the final plan for the guest rooms. In early stages we had an idea of long narrow guest rooms which are seen on the two first illustration. But because of bad light condition and an overall poor exploitation of the plan more squared guest rooms were looked further into. A couple of examples are seen in the two next illustrations.



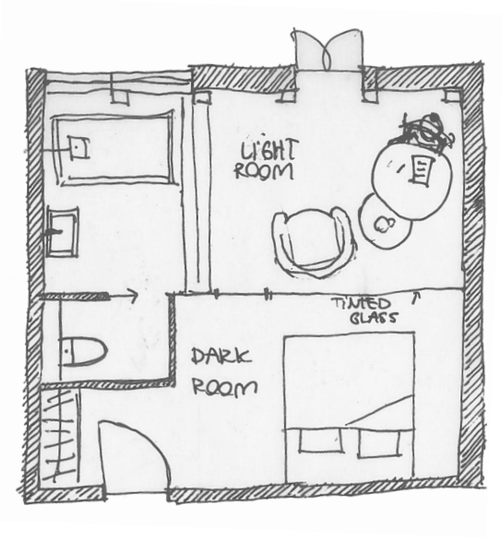
Ill. 6.27 Early room plan 1:100



Ill. 6.28 Early room plan 1:100



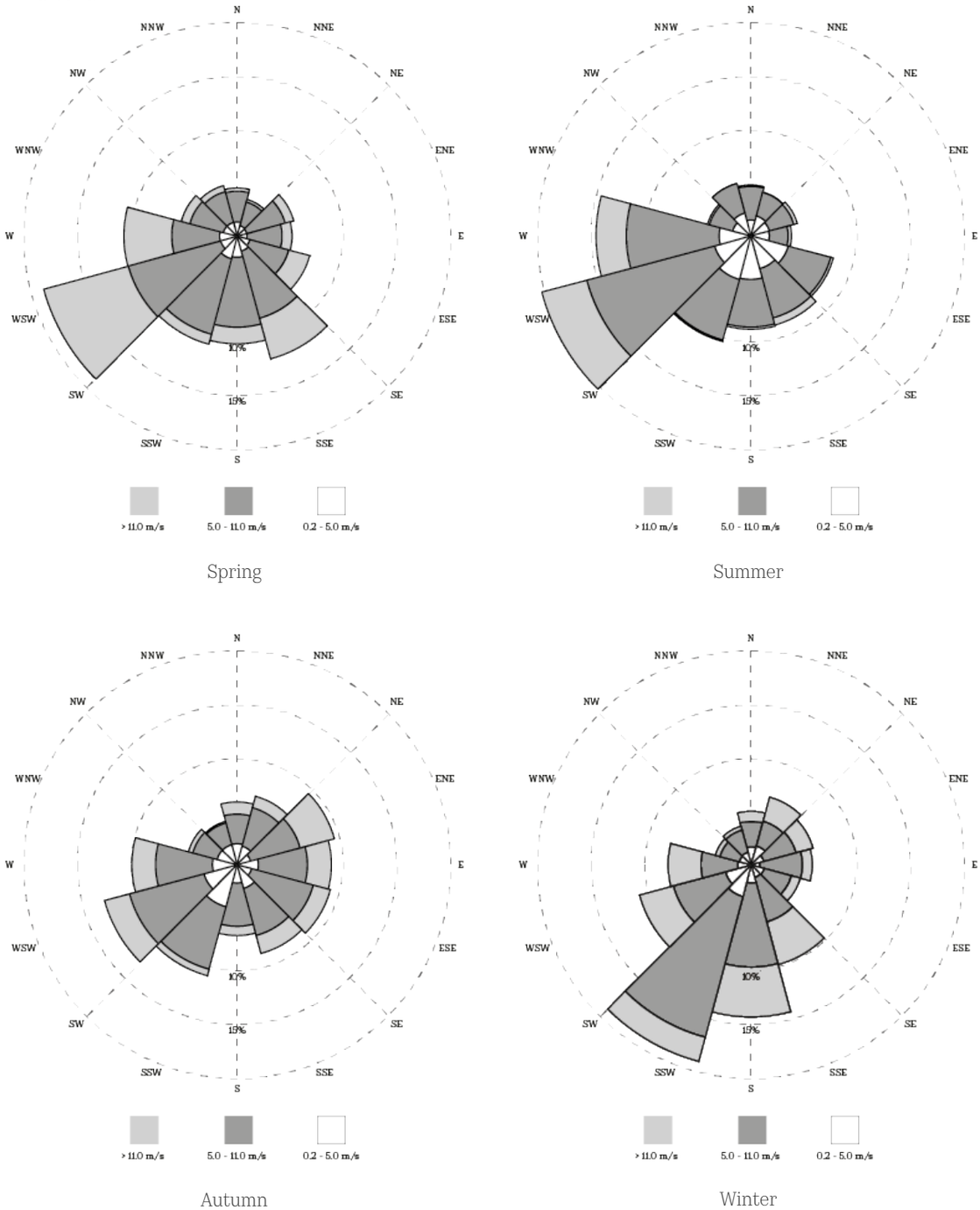
Ill. 6.29 Early room plan 1:100



Ill. 6.30 Pre sketch of final room plan 1:100

APPENDIX 10

Micro climate



Ill. 6.31 Wind diagram - seasons

APPENDIX 11

BE18 KEY NUMBERS

Key numbers, kWh/m² year

Renovation class 2

Without supplement	Supplement for special conditions	Total energy frame
70.4	0.0	70.4
Total energy requirement		25.7

Renovation class 1

Without supplement	Supplement for special conditions	Total energy frame
52.8	0.0	52.8
Total energy requirement		25.7

Energy frame BR 2018

Without supplement	Supplement for special conditions	Total energy frame
30.2	0.0	30.2
Total energy requirement		25.7

Energy frame low energy

Without supplement	Supplement for special conditions	Total energy frame
27.0	0.0	27.0
Total energy requirement		25.7

Contribution to energy requirement

Heat	7.0
El. for operation of bulding	10.4
Excessive in rooms	0.0

Net requirement

Room heating	4.5
Domestic hot water	10.5
Cooling	0.0

Selected electricity requirements

Lighting	3.0
Heating of rooms	0.0
Heating of DHW	0.0
Heat pump	0.0
Ventilators	10.4
Pumps	0.0
Cooling	0.0
Total el. consumption	62.9

Heat loss from installations

Room heating	2.4
Domestic hot water	0.0

Output from special sources

Solar heat	0.0
Heat pump	0.0
Solar cells	0.0
Wind mills	0.0

Ill. 6.32 Be18 Keynumbers