VEJERS COMMUNITY HOUSE

A NEW TAKE ON TOURISM AND LIVEABILITY AND SMALL TOWNS

by Jonas Philippon

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ABSTRACT

Today, tourism has become a crucial factor in urban economies and is necesarry for certain towns to survive. While tourism is a positive result of the growing economy and the social standing of the world's population, it also has a great impact on the specific towns. Tourism is often defined as the means to an end by the locals, but why should tourism and local life be two seperate thing - one essential for the other to exist? This paper aims to represent the entire process of redesigning Strandhotellet at Vejers Strand, Denmark to improve both the tourism and the local life of the residents. The paper displays a design favoring the locals and the local life to create a place where tourists becomes a temporapart of the town, contrary to merely observe the residents. The final design features a mixed programme with a communal kitchen, workshop area, community hall, visitor centre, exhibition area, accomodation and flexible outdoor area. The new community centre focuses on improving the natural environment and allows for a new experience of the West Coast for the visitors.

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INTRODUCTION

PROLOGUE

This master thesis in Architecture is developed by Jonas Philippon at the M.Sc. program at Architecture and Design, Aalborg University. The paper presents the entire process of redesigning Strandhotellet at Vejers Strand, Denmark, including analysis, design process and a presentation of the final project. The theme of the project is Tourism and Local Communities, focusing on improving both the tourism and the local life of the residents of Vejers.

GUIDE OF READING

The paper is divided into seven chapters; Introduction, Theoretical Framework, Framework, Presentation, Design Process, Epilogue and Appendix. The Introduction states the motivation and methodology of the project. The framework chapters are analysis-based and are summed up in sub conclusions and end with the design parameters. The final project is presented under Presentation while being elaborated under Design Process. The paper concludes with an Epilogue of a conclusion and reflections. The Appendix contains extra material from the design process; technical considerations and investigations, with further studies, calculations, simulations, etc.. All illustrations are numbered and named, such as “Ill. 35 - Infrastructure”. References and illustrations are listed in the Epilogue. A dotted line marks the favoured design choices.

MOTIVATION

The Danish West Coast is unique. The 550 km long, almost untouched and accessible, coastline offers culture, history, marsh (Marsken) and the Wadden Sea (Vadehavet) - and displays some of Denmark's most beautiful nature, in the form of long white beaches and spectacular dunes.

Today, the West Coast of Denmark is accountable for approximately half of all overnight stays in coastal and nature tourism in Denmark, but in the future, it must be an even more significant driver of growth in Danish tourism. Denmark's West Coast must be among Northern Europe's most attractive coastal destinations and a driving force for growth in tourism in Denmark. With an ambition of significant growth in revenue, overnight stays, daily consumption and satisfaction. (Partnerskab for Vestkyst turisme, 2018)

The growth in tourism has not followed the increase in the rest of Europe and have problems with short peak seasons, low-quality accommodation, lack of unique experiences and a uniform selection of accommodation. (Partnerskab for Vestkyst turisme, 2018) Due to this, the primary objective is to create a new hybrid space that can strengthen tourism all year around in Vejers Strand and be a driver for danish tourism, sustainability and nature conservation while supporting and strengthening the local environment.

While tourists sustain the small town (mainly during the summer), many problems can follow with a rise in tourism. Tourism transforms towns, landscapes and cultures for better and for worse. The main focus is to develop a project for both locals and tourists, creating a synergy, through the interaction between residents, visitors and tourists. A project that extends the tourist season to all seasons, while prioritising the local community and their everyday life.

The project must assist in creating a more comprehensive selection of accommodation and attract new target groups with higher consumption. It must match the trends of shorter holidays, higher quality, flexibility and couple travelling. Furthermore, it must be a gathering place for the local community and reinforce their focus on nature and the natural environment.

In short; this project will investigate how to strengthen the local community and tourism by creating a new hybrid between tourist accommodation and activities, and the local community and their activities - forcing interaction between the two, making it easier to share knowledge and experiences, so that everyone gets the most out the area.

This will require a careful approach to environmental sustainability, protecting the natural qualities of the area, studying sustainable materials and structural techniques, and understanding the local identity. Social sustainability will be in focus, where social gathering and community are keywords, creating the foundation for the interaction between residents and tourists. The spaces must be flexible, so that the locals can use them all year round, strengthening local initiatives. The accommodation must focus on nature, as it is the main focus of the town. This asks for careful consideration of tectonics and atmosphere, including all senses in the design.

METHODOLOGY

The process of development and design is based upon Mary-Ann Knudstrup's Integrated Design Process in Problem-based Learning. This process is used to achieve a holistic and sustainable result, using an iterative process. The iterative process allows for fluidly navigating between five different phases, including a problem, analysis, sketching, synthesis and presentation phase. (Knudstrup, 2004) A holistic approach will be added to the Integrated Design Process, implementing and combining knowledge from both architecture and engineering in each phase.

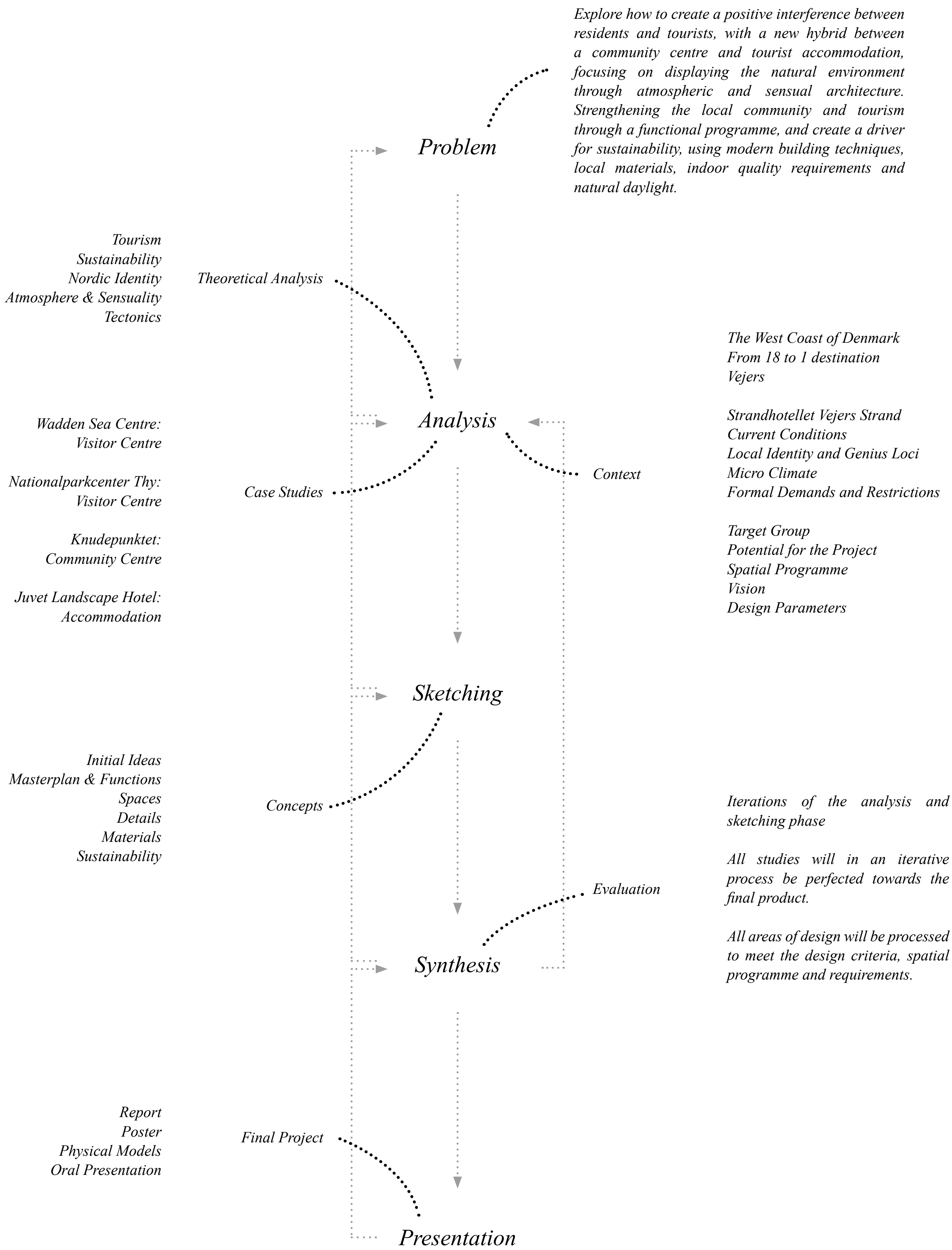
The problem is determined through a thorough investigation of the current conditions of the West Coast of Denmark, including the vision and ambitions from the municipalities and solutions for improving tourism in the region. The development plan for the West Coast has laid the foundation for the project topic and choice of site. The focus of the project is to explore how to create a positive interference between residents and tourists, with a new hybrid between a community centre and tourist accommodation, focusing on displaying the natural environment through atmospheric and sensual architecture. Strengthening the local community and tourism through a functional programme, and create a driver for sustainability, using modern building techniques, local materials, indoor quality requirements and natural daylight.

A programme is developed to set the basis for the sketching phase. This programme includes theoretical analysis of theorists on sustainability, atmosphere & sensuality and tectonics, as well as theoretical analysis of Nordic architecture and Nordic identity. The conditions of the site will be based on analysis of the history of the site and the area, the local identity and genius loci, formal demands, restrictions and points of interest from the community. Theory on positive and negative interference will be used to understand how to develop places for interaction and knowledge sharing between residents and tourists. Case studies will supply knowledge about new technological advances, current trends in the area and inspire the project, while a target groups analysis, an analysis of the potential for a such a project and investigations of what community centres and tourist accommodation can be today, will display why the project is relevant.

The knowledge from the analysis phase will be used to develop a general concept and concepts for the various spaces, details and materials, using light and acoustics studies, combined with the previously mentioned theories. Ideas will be developed through stochastic sketching by hand and 3D-modelling, both digital and physical. Varies studies will be conducted according to the theme – such as plan studies, light studies, atmosphere studies, tectonics studies and so forth. All studies will combine architecture and engineering in a holistic approach, with sustainable solutions implemented where necessary.

In the synthesis phase, iterations of the before mentioned studies and modelling will be made to ensure optimal results. The concept will be evaluated and further developed until the final design is found. Investigations such as form studies, material studies and light studies, will in an iterative process be perfected towards the final product. All areas of design will be processed to meet the design criteria, spatial programme and so on. Since most factors of design will impact each other, the analysis, sketching and synthesis phase becomes fluid, where small corrections require several iterations of each area.

The final phase is for visualisation. This phase will focus on highlighting the qualities of the project, through a paper that present the project well, with simple and explanatory diagrams, elaborating text, plans and sections and 3D renders. A physical model and presentational posters will be developed to understand the project correctly and effectively.



PROBLEM	ANALYSIS	SKETCHING	SYNTHESIS	PRESENTATION
Motivation	Theoretical Data	Stochastic sketching	Stochastic sketching	Physcal modelling
Theoretical Data	Empiric Data	Physical modelling	Physical modelling	Academic report setup
Empiric Data	Phenomenological Data	2D drawing	2D drawing	Presentational poster setup
	Semistructured interviews	Digital 3D modelling	Digital 3D modelling	Script of oral presentation
		Simulation of climate	Simulation of climate	

Ill. 01 - Methodology

THEORETICAL FRAMEWORK

TOURISM

Tourism transforms towns, landscapes and cultures for better and for worse. The municipalities of the West Coast are focused on attracting more tourists, but should this be the main focus? This project will investigate how to create a positive interference between residents and tourists, allowing a sharing of knowledge and experiences among each other - creating a scenario where tourism engages with the place graciously.

SUSTAINABILITY

Sustainability can be divided into three aspects; sociological, environmental and economical. The social aspect will focus on how daylight, acoustics and other atmospheric qualities must improve the living quality of the visitors, but also how materials impact the users of the spaces. The environmental aspect will focus upon material properties, sense of place and how to implement circular thinking, with reuse and Cradle to Cradle, to create a sustainable driver for the West Coast. The economic aspect will mostly be based on assumptions to keep the project realistic.

NORDIC IDENTITY

To ensure a viable and fitting concept, it is crucial to understand the local identity; the Nordic Identity. The Nordic Identity in architecture can be defined as unique a way to understand and relate to nature, the environment and light. Nordic architecture is a culture of sensitivity and simplicity, that seeks legitimacy in place and nature, where the parameters such as place, location and identity are important factors. (Kjeldsen, 2012) This project will focus on connection to place, materials and use of daylight.

LIGHT

Light is one of the most important design criteria in most projects, as many elements behave according to light conditions. How light interacts with a building, can change the expression and shape. It is therefore essential to understand how light and shadows create the expression of a building, space or shape and how materiality and atmospheric parameters vary.

ATMOSPHERE

The contemporary world is dominated by sight. A tactile approach will create a building that influences all senses. A building not just for the eyes, but a building that utilises sight, touch, smell, hearing and maybe even tastes. (Pallasmaa, 2005) The project will investigate how dimensions, shape, choice of materials, light, temperature and humidity impact spaces.

TECTONICS

Looking back at the previous theoretical aspects - sustainability, Nordic identity, light and atmosphere - and compare them to tectonic theory, we find a lot of similarities and overlaps. These similarities underline that tectonics is not a separate discipline. The tectonic approach of this project will balance the aspects of the previously mentioned theoretical frameworks and focus on more relevant areas of design for a community centre to display the local qualities and history of the area - such as traditional construction methods, local materials and the natural environment.

THEORETICAL FRAMEWORK

TOURISM

Local businesses, hotel owners, tourist guides and many others eagerly try to live up the expectations of modern tourists - but it is not viable to develop a place according to the needs of tourists. The focus should be upon the place itself and the people who will maintain and develop the identity of the place.

Tourists often come for an authentic experience - but by their very own presence, they change the authenticity of the place.

> *"We travel to experience the authentic, but thus the authentic disappears." Bodil Stilling Blichfeldt, Former Associate Professor and Tourism Researcher at Aalborg University. (Husted, 2013)*

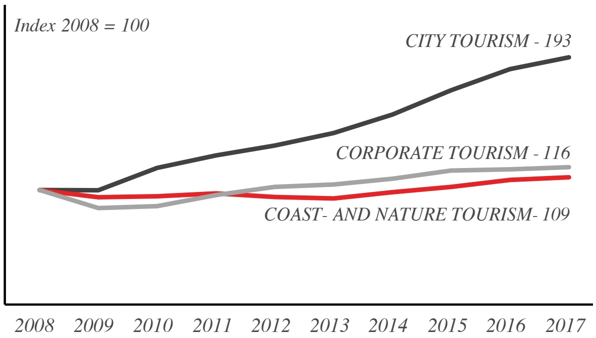
One can imagine that the place slowly looses its authenticity - which occurs - but Carina (Ren, 2007) explains that tourism can help preserve traditions and cultural characteristics, and does not necessarily undermine culture, but can promote it. The revenue from tourists will give the locals the economic backing to protect the culture and natural environment.

Tourists want to become part of the culture they visit - they want to be locals. This creates a possibility to combine the needs of visitors and residents. Hence, when designing new projects, we should focus on how to appeal to both tourists and locals. The locals will be able to use the facilities during tourist season and low season, while visitors and tourists will interact with local residents - creating an authentic experience.

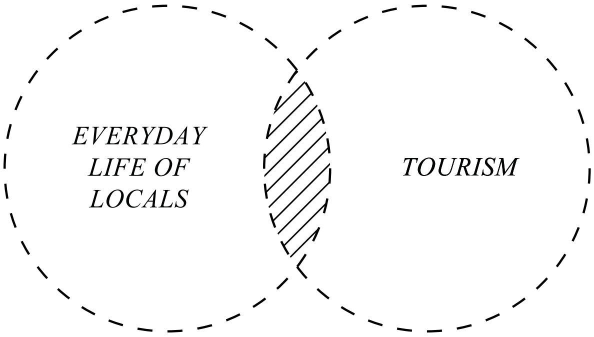
So how do we appeal to both segments? Anne (Skovbro, 2017), Philanthropy Director at Realdania states; "First and foremost, it requires that you have a sharp eye for the unique. This is what tourists are seeking, and at the same time it is the very best starting point for local development." Thus, we can conclude that mapping out the significance of the area and including the locals are critical elements for sustainable development. Residents are experts of the area. They should play a significant role in informing visitors about the qualities of the area and hopefully can engage new local participants in the area.

The Danish coastal towns are one of the main tourist attraction of Denmark, as they have all the elements tourists are looking for; culture, history, contact with the sea, close to nature and the possibility to interact with the everyday life of the locals. Many of these destinations are for nature-loving tourist and should be programmed with a balance between accessibility and protection - tourism must engage with places in a more meaningful way and leave a positive impact of the destination.

A few examples of how to display the local culture and protect the area is to create pathways, defining how and where visitors move through the area. Restoring the historic buildings or building a restaurant with local foods are other ways of strengthening both local life and tourism, making the area interesting for everyone.



Ill. 02 - Growth in Overnight Stays



Ill. 03 - Positive Interference

Tourism-Dominated Spaces

Tourism is greater than ever before - and growing. We live in a globalised world, where knowledge and experiences are shared instantly on the internet with the whole world. More and more people can effort to travel due to the global economy and the advances in transportation have enabled global mobility. This has made tourism an unavoidable parameter in architecture and planning. The tourist dominated spaces, therefore, have to be a positive impact on the town.

Jens Christian Leth Pasgaard finds the term tourism-dominated space (as opposed to the everyday-dominated space) more accurate than the term tourist space - which often has been used as a negatively loaded adjective. Tourist space is dependent on tourism activity and is thereby a temporary condition. A condition where the character of the space is determined by the behaviour of tourists as well as the physical frame, which stimulates this behaviour. (Pasgaard, 2014) This renders tourism behaviour and tourist spaces as fluid and relative concepts.

Positive Interference

Tourism-related flows, and thus tourism-related challenges impact more and more spaces. This asks for tourism to become a positive driver for local development and leave a positive impact on the locals. Pasgaard refers to the concept of positive interference as significant when working with tourism-related challenges within the urban fabric. Pasgaard characterises positive interference as a spacial quality, where spaces can accommodate and benefit from both tourism-related and non-tourism-related activities. (Pasgaard, 2012)

> *"Positive interference is understood as the friction between tourism-related and everyday-related activities and is launched as a 'potential desirable quality' of the tourism-dominated space." (Pasgaard, 2014)*

In his PhD-dissertation, Jens Christian Leth Pasgaard exemplifies positive interference through early-developed northern seaside resorts, the development of Miami Beach and the development of the French region of Languedoc-Roussillon. The Northern seaside resorts were 'amusement-dominated', and Miami Beach was 'hotel-dominated', while Languedoc-Roussillon demonstrated a new holistic approach, establishing a more socially aware and commonly accessible destination. (Pasgaard, 2012) All three cases have that in common that they are large scale projects, ranging from city-scale to resort scale. We can, however, extract some of the spatial qualities of positive interference and use them in a small-scale project.

Pasgaard concludes that the significant spatial lesson of the northern seaside resorts is the 'linking surfaces' - the British seafront promenades and the American boardwalks. The scales of these are often much larger than the small town context of the project and much larger than the scale of a community centre. However, what we can extract from this, is the mix of tourism and non-tourism programmes and the possibility to accommodate different activities and population groups simultaneously in unprogrammed areas.

Miami Beach is built upon a flexible grid-structure in very different scales and proportions. The system allowed for different spatial rhythms and dynamics, where narrow lots stimulate a local pedestrian-dominated flow and wide lots stimulates a car-dominated flow. However, more importantly for this project, is the lobbies and ground floors of the resort hotels. The hotels face both the sea and the urban street. The lobby came to function as an interface between the street and the beach - an in-between space serving both guests and non-guests. The hotel lobbies were inscribed in the urban fabric and functioned as meeting grounds - the lobby became an important place to socialise.

> *"They were seductive td-spaces [tourism-dominated spaces] that managed to unite and benefit from several types of flows - both tourism-dominated, everyday-dominated and business-dominated." (Pasgaard, 2012)*

The last example Jens Christian Leth Pasgaard gives is the development of the French region of Languedoc-Roussillon. The plan focused on individual resort homes as 'personal hubs' interconnected by different forms of mobility networks and on transitions between spaces. (Pasgaard, 2012) The latter is more relevant for this project. The layout of the city stimulated a positive co-existence between tourists and permanent residents, through programmatic complexity and interconnected semi-private backyards which usually were publicly accessible.

Subsequently, Pasgaard discusses the importance of 'architectural form' within 'tourism architecture' and refers to the architects as dream interpreters and dream makers. Which was the purpose of the resorts - being dream-resorts. The tourism architecture was for a long period not regarded as architecture and received massive critique. The critique has shifted with time, to fascination and appreciation, however. Pasgaard argues that tourism architecture represents a cultural value and that it generally speaking has particular potential concerning 'identity creation' and 'spatial extraordinariness'. (Pasgaard, 2012)

Pasgaard argues that original tourism architecture played a significant role in the formation of the local identity of the first tourist destinations. The structures did not just function as physical landmarks; they also functioned as 'culture bearers'. This is referring to great destinations developed for tourism. While the scale is different from these destinations and that the project site already has an identity, the idea of 'identity creation' is still valid. The project must reinforce the identity of the place and can help to create new identities for the area.

Spatial extraordinariness refers to the uniqueness of the space or structure and the ever ongoing competition to stand out. Pasgaard describes it as a 'Darwinesque selection process':

> *"Tourism Architecture was and is defined through difference - and only survives if it manages to stand out from the ordinary". (Pasgaard, 2012, p.234)*

These tourism-dominated structures can pull a person out of everyday life - both physically and mentally. It is dreamlike spaces for special occasions and moments. They often include spaces that frame certain perspectives of the context and evoke feelings of mental escapism. The extraordinary experience emerges by combining this aspect with the concept of positive interference and is expressed when it interacts with the ordinary everyday environment. It is essential that the extraordinary does not exclude the ordinary. Pasgaard claims that the most successful tourism structures "are those able to establish an interesting dialogue between the 'extraordinary' and the 'ordinary/everyday'. (Pasgaard, 2012, p.236)

Part Conclusion

Tourists are seeking the authentic experience. They want to become part of the culture they visit - they want to be locals. This asks for a project that appeals to both tourists and locals, where they can interact - creating an authentic experience. The project must map out the significance of the area and help preserve traditions and cultural characteristics. Utilising the knowledge from the locals and engaging them in informing visitors about the qualities of the area. The project must be unique and be programmed with a balance between accessibility and protection - tourism must engage with places in a more meaningful way and leave a positive impact of the destination.

Jens Christian Leth Pasgaard generally investigates tourism on a large scale compared to this project - from city-scale to holiday resorts. Even though the scale of his focus is greater than the scope of this project, it is still possible to extract relevant focal areas of design.

By implementing the concept of positive interference, the spaces will accommodate and benefit from both tourism-related and non-tourism-related activities, by mixing tourism and non-tourism programmes. This positive interference can be enforced by creating linking surfaces, where the structure(s) must be publicly accessible from all directions. The structure will then be part of the local infrastructure, inviting both locals and visitors to use the area. Unprogrammed square-meters will give the project a character similar to public spaces and creates the possibility to accommodate different activities and population groups simultaneously - places where the locals can create new activities for everyone.

These linking surfaces can also be thought of as an 'urban lobby'. Like in the example of Miami Beach, can the lobby function as an interface between the street and the beach - an in-between space serving both guests and non-guests. The lobby will then become a place to socialise and a place to meet. A mixed set of programmes will generate a variety of activities. This will unite several types of flows - both tourism-dominated, everyday-dominated and business-dominated. The goal is to create a space where it is questionable whether it is primarily serving as a tourist attraction/destination or is the centre of the local community. The structure must provide extraordinary spaces for ordinary activities, establishing a fluid interaction between the extraordinary and the ordinary.

THEORETICAL FRAMEWORK

SUSTAINABILITY

"Sustainability" has become one of the most critical terms of today - also within the building industry. The term is used in various aspects of construction and design - but in very different degrees. While one aspect of a building or one aspect a building component can be very sustainable, others can be the opposite. This makes it essential to define the sustainable approach of each project.

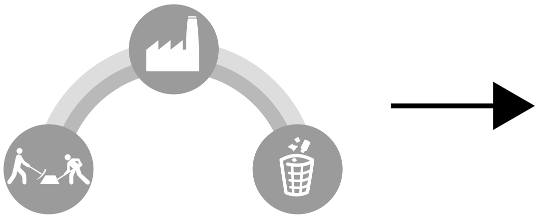
Sustainability can, as mentioned, be divided into three aspects; sociological, environmental and economical. The following will mostly focus on environmental and economic sustainability. The three aspects of sustainability will in most cases overlap and impact each other. The building will consume energy for heating, electricity and ventilation. The building(s) need to perform well, with low energy consumption, through passive strategies. (Mason, 2018) The heating requirements can be lowered by following the BR2020 standard (for Denmark) of insulation for construction elements. The consumption of electricity can be reduced by using LED-lighting, low-consuming applications and by minimising the need for electric lighting through the use of windows and skylights. The electrical demand could be further minimised by using natural or hybrid ventilation, to reduce the need for electronic ventilation systems - when possible. Ventilation systems can save energy by using heat recovery, taking advantage of heat transmission from people and passive heating from the sun, to heat up the new and cold air.

Cradle to Cradle

Cradle to Cradle is an environmental certification tool developed by chemist Michael Braungart and architect William McDonough in the 1990s. With a focus on holistic design quality, Cradle to Cradle is set to improve the 'positive footprint' in contrast to reducing the 'negative footprint'. As Professor Dr. Michael Braungart states;

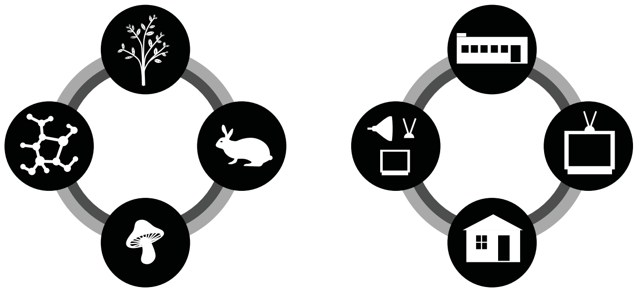
"The end goal of conventional sustainable strategies is to be carbon neutral. But you can only have zero carbon emissions when you do not exist. So is this our biggest goal? Instead of not existing, let us create a big positive footprint." (Jørgensen et al., 2013, p. 1)

The concept of Cradle to Cradle is to eliminate waste. Everything should be reused or recycled. Both production and consumption should have a positive influence on the environment and people while being economically sustainable - without the need for lowering our current welfare or consumption. (Vugge til Vugge, n.d.) Cradle to Cradle is a response to the Cradle to Grave concept of the industrial age. We have become wiser, in relation to resource consumption, but we a still working to minimise the adverse effects we create, instead of changing our way of creating and using. (Braungart and McDonough, 2007) A clear vision is needed to succeed in changing from 'Cradle to Grave' to 'Cradle to Cradle'. William McDonough & Michael Braungart describes their goal as;



Ill. 04 - Cradle to Grave

materials are burned or landfilled



Ill. 05 - Biological and technical circuits

materials can either be biodegraded or recycled into new products

"A delightfully diverse, safe, healthy and just world - with clean air, water, soil, and power - economically, equitably, ecologically and elegantly enjoyed" (Jørgensen et al., 2013, p. 11)

Circular Economy

In a time where we are focused on how the climate is reacting, we are still bound to the economy of it all. Cradle to Grave is still the dominant production type of today. Statistics show that more than 90% of the resources used for producing and manufacturing products, only are used for a short time. (Jørgensen et al., 2013) Some manufacturers even design their products to last for a shorter time, to keep costumers buying new products. (Braungart and McDonough, 2007)

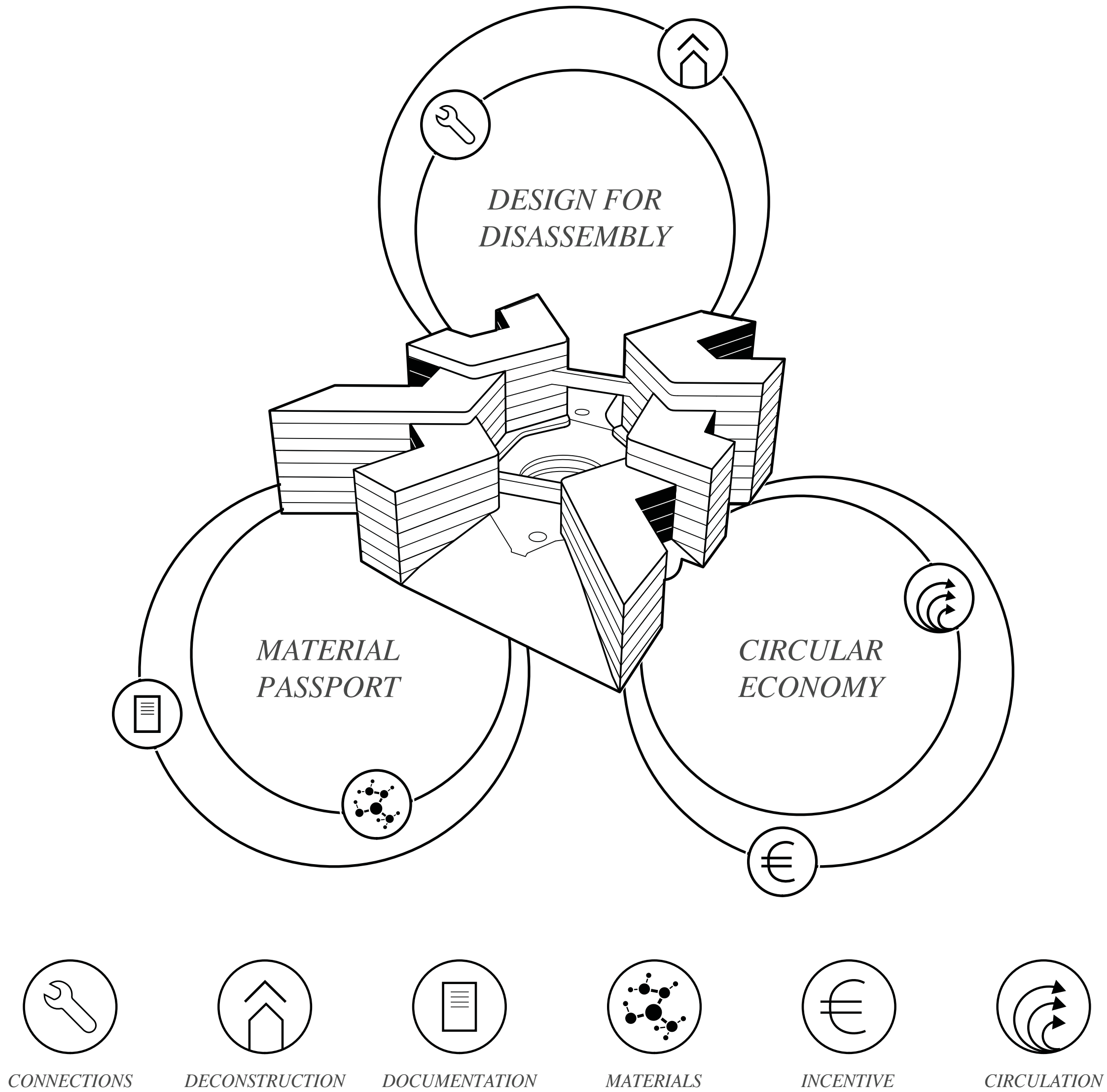
Cradle to Grave is considered as a bad business model within the Cradle to Cradle approach because all values from the extraction and production phase are lost when the product is discarded. In addition, are many harmful effects of the production, consumption and destruction often not included in the price of the product - such as the death of animals due to plastic in the seas. (Jørgensen et al., 2013, p. 161) The economy has to be a primary part of the vision to change this. This is why the goal for Cradle to Cradle is to support a complete circular use of resources - thus raw materials never lose their value. (Jørgensen et al., 2013, p. 161)

Circular economy is an important selling point for developers - and especially for the environment. With the vast production of materials and the costs for production and demolition, circular economy can help reduce the cost of development - perhaps even profitable, not to mention beneficial for the environment. Circular economy focuses on reuse and recycling. The developer or owner shall be able to recycle, reuse or resell the majority of materials. This will make the demolition (disassembly) of buildings profitable in contrast to being a cost. The building industry will go from a linear production model to circular reuse of materials.

Upcycling & Downcycling

Reuse is the keyword - and as many materials and products as possible are needed to be reused in favour of being recycled. Today we have 'great' statistics for recycling. According to VHGB (Videncenter for Håndtering og Genanvendelse af Byggeaffald), 7% of construction waste in Denmark goes to landfill, while 87% are recycled. This would be something we could be proud of if a considerable part was reused, and not used for road filling or to incineration. (Bæredygtigt Byggeri, n.d.) That is a measurement of weight, not of quality nor economic value. (Guldager Jensen and Sommer, 2016)

The recycling of materials, while degrading the quality and value of the materials, for example when a concrete wall is recycled for road-fill, is 'downcycling' the material.



Ill. 06 - Circular Economy

This is merely a prolonging of the material's path towards landfill or incineration - from cradle to grave. In contrast, we have 'upcycling' where the material is reprocessed to a higher value. The ultimate goal is for the materials to keep their original value. (Jørgensen et al., 2013, p.12) For this to succeed, we have to rethink how we design and construct building today. We have to prepare our buildings for reuse. One approach to this is Design for Disassembly.

Design for Disassembly.

> *"Concrete crunched into road fill, in fact, has an average value of five euro per ton, a value 50 times lower than that of a new concrete element. Almost all building waste today is being downcycled into the lowest value possible." (Guldager Jensen and Sommer, 2016, p. 3)*

These elements could have been reused if they were designed for disassembly. 'Design for 'Disassembly' is a holistic design approach where any given product is easy to disassemble into all its components. In the book 'Building a Circular Future', they estimate that preparing the superstructure of a building for the use of a circular economy model would be an additional cost of just 0,35% of the total value of the building. (Guldager Jensen and Sommer, 2016, p. 189) And it will most likely become cheaper as the methods become common practice. The environmental impact will be significantly reduced when materials are reused as building components again. Mechanical joints designed for disassembly will allow for faster construction time while lowering the cost of operation and maintenance.

Part Conclusion

Following the relatively new BR2020 standard for Denmark, everyone has to take advantage of passive strategies when designing new buildings. The focus of this project is to minimise the environmental impact by minimising energy consumption from electrical- and heating-installations. This will be done by utilising passive energy from sunlight, through strategically placing windows to heat the building(s), while ensuring it does not overheat. Efficient use of daylight through windows and skylights can minimise the need for electric lighting and thereby the energy consumption. LED-lighting will reduce energy consumption for the necessary electric lighting. Natural and hybrid ventilation will minimise electrical energy consumption for cooling in the summer and transmission loss will be minimised by following the insulation requirements of the BR2020 standard.

The concept of Design for Disassembly and Reuse are closely related. Elevating structures in sensitive areas will leave a minimal impact on the natural environment when the structures have fulfilled their purpose. Mechanical joints will make the building component easy to disassembly and enable reuse of the materials. By using simple, but effective, construction methods while following the concept of Design for Disassembly we limit the possibility of mistakes during construction and deconstruction. This will result in a low-tech construction, that is flexible and reusable where many elements as possible are thought in components - of course allowing for personalisation, detailing and variation. Prefabrication of either building components or larger segments of the building(s) can limit construction-work and construction-time on site and thereby limit the impact from construction-workers, lorries and so on - this is especially important when working in a conservation area. Prefabrication will also minimise challenges with moisture when using timber.

By using natural materials as raw as possible and limit the use of paint, glue and non-removable fasteners, we can allow for reuse of the materials. Elements of the consisting structure can be reused to minimise environmental impact on extracting, manufacturing, and transporting of new materials.

Life Cycle Assessments (LCA) will be made to ensure using sustainable materials, by calculating the potential environmental impacts and resource consumption from a building's total consumption of materials and energy throughout the life of the building. Due to the difference in the life of separate building components and building-life in general, it is important to recognise the importance of life expectancies. The lifetime of materials determines the number of replacements in the total life cycle. The same material can have different lifetimes depending on the use and placement - for example, will exposed wood have a shorter lifespan than structural timber protected by facades. By using local materials, we can minimise the impact on the environment (minimal pollution from transportation, possibly from extraction and manufacturing).

THEORETICAL FRAMEWORK

NORDIC IDENTITY

The Nordic countries form only a small fraction of the world, but Nordic architecture has still reached a certain status within the architectural world and community. The Nordic architecture was traditionally characterised by programming through the opportunities and constraints of the context and has only further evolved this approach, into being characterised by opportunism and contextualism.

Scandinavians have always been deeply connected to the natural environment, and so has the architecture. Nordic architecture has long been associated with architecture that relates to and understands the physical context surrounding it.

MicroClimate

The harsh environment of the Nordic countries, with extreme temperatures, strong and cold winds and large amounts of rainfall, have been a significant factor in the development of Nordic architecture. However, as Peter MacKeith, a professor studying contemporary Finnish and Nordic architecture, states, light - and its absence - also has a significant impact on the architecture of the north and the everyday life in these countries. (Kjeldsen, 2012) Natural light is one of the essential place-specific factors within Nordic architecture. It enhances certain atmospheres, and it creates the characters of spaces. As Louis Kahn puts it;

> *"Light gives all things their presence." (Frampton, 1995)*

In the northern hemisphere, the sun will shine its light more diagonally on the surface and will display a combination of light, darkness and shadows. It is a place where winter days are short, and darkness dominates. (Norberg-Schulz, 1997) The short summers and the long and dark winters have made light a celebrated element of the environment and have a particular focus in Nordic architecture. The different angle of the sun, the limitation of daylight in colder months and the vegetation all play a role in the dramatic natural light of the north. This is why Nordic architecture often is defined as connected with light and nature, with a sense of place and a certain simplicity and sensitivity. (Kjeldsen, 2012) Light gives the environment its primary character and "infuses all things with mood". (Norberg-Schulz, 1997, p. 2) Hense, light defines places and objects, and their appearance and how we see them are shifting with light and shadows.

Critical Regionalism

Architectural theorist and historian Kenneth Frampton expressed these nordic tendencies with a place-specific

Ill. 07 - Nordic Pavilion by Sverre Fehn

Ill. 08 - Healthcare Center

Ill. 09 - Naturum Tåkern by Wingårdh

approach. Kenneth Frampton is a Critical Regionalist. Frampton looks critically towards modern architecture and often refers to Martin Heidegger's theories on the phenomenon of universal placelessness when describing formal traditions of modern avant-garde architecture. Critical Regionalism involves a more direct relationship with nature than the more abstract tendencies of modernisation, such as clearing a site for a new structure. (Frampton, 1983) He argues for architecture that assimilates local culture and foreign features through a critical approach. (Kjeldsen, 2012, p.42)

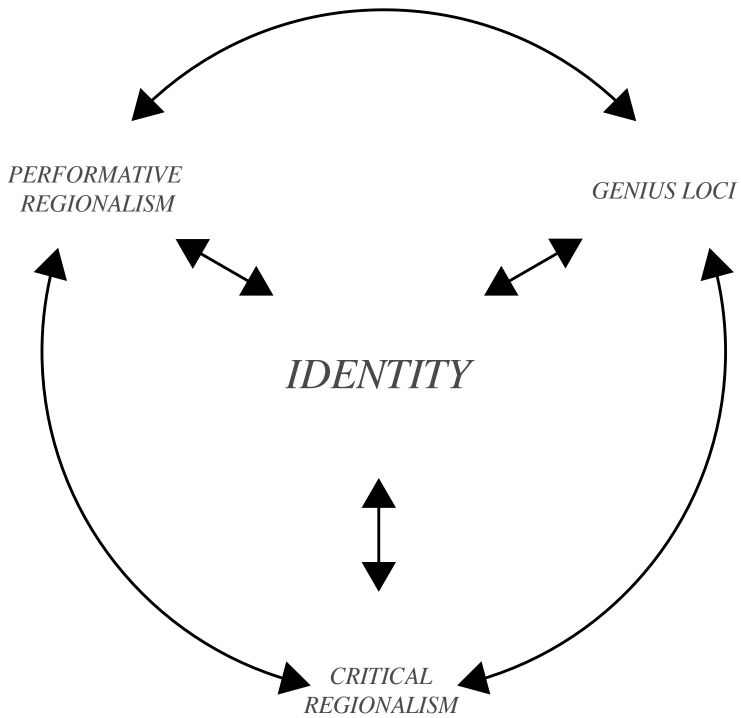
> *"The fundamental strategy of Critical Regionalism is to mediate the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place. [...] Critical Regionalism depends upon maintaining a high level of critical self-consciousness. It may find its governing inspiration in such things as the range and quality of the local light, or a tectonic derived from a peculiar structural mode, or in the topography of a given site." (Frampton, 1983)*

However, as Frampton states himself, it is just as important to distinguish between critical regionalism and superficial attempts at reviving ancient architecture expressed in the tendencies of nostalgic historicism. (Tostrup, 2006) When describing the term 'place-form', he refers to the building's relation to the place. The topography of the place and the climate are expressed through the architecture - through materials and construction. (Kjeldsen, 2012, p.42)

Genius Loci

Genius Loci is a regionalistic answer to the international style. It is the sense people have of a place - the sum of both psychical and symbolic values in nature and the environment, engaging a holistic approach to all senses, contrary to only the visual. Norberg-Schulz writes that Genius Loci can be recognised by four thematic levels in the environment; the topography of the earth's surface; the cosmological light conditions and the sky as natural conditions; buildings; and symbolic and existential meanings in the cultural landscape. (Norberg-Schulz, 1979) Christian Norberg-Schulz finds nature to be the basis for people's interpretation, and places and objects take on meaning in relation to nature. There has to be a relationship between building, the native place and the natural environment.

With the increasing urbanisation, ever more people are deprived of any contact with the natural environment.



Ill. 10 - Nordic Identity

Our places and buildings tend to be more alike, and our understanding of 'place' and how to create them are changing. Michael Asgaard Andersen, a Danish Associate Professor in Architecture at Aarhus School of Architecture, believes that the new generation has a new definition of 'place'. It has moved from being a connection with nature, topography and native soil as Norberg-Norbert-Schulz describes, to a more social approach. An aspect where society, community and democracy have greater influence than ever before. (Kjeldsen, 2012)

Performative Regionalism

New tendencies are emerging in response to the place-specific approaches, where we only focus on the local qualities. Barbara Allens Performative Regionalism puts humans in the centre. People are no longer just passively receiving, but instead playing an active role in the experience of the place. (Kjeldsen, 2012, p.42)

With this approach, she criticises the former views for focusing on the materialistic and static qualities. Her regionalism is a relationship between people and the place.

Her perception of regionalism follows newer cultural research. The place is no longer viewed as a geographical place, but as a social construction that is set up as a community of identities. Identities that are based on how we "interact with each other and form a lively culture". (Kjeldsen, 2012, p.42)

"I argue that regionalism in architecture should be, in large part, based on the spatial dimensions of people's practices and normative behaviours. So any investigation of regionalism must begin with an investigation into what people actually do in that region that marks them as part of that place." - Barbara Allen (Canizaro, 2007, p.422)

Part Conclusion

So what is Nordic Identity in architecture? One can interpret that a 'Nordic' building is deeply rooted in the local environment, physically in terms of sense of place, connection to nature and materials and sociologically reflecting Nordic values such as community, society and democracy. Architecture is ever changing to meet the global and local, as well as the social, cultural and political, changes. Nordic architecture cannot be defined as something specific or stylistically. Nordic architecture adapts and evolves according to the context - both physically and socially

The architecture of the North is bound together, but not by material or form. It is bound by understanding the local environment, cultures and societies. Nordic architecture is for the people and their needs. Architecture in Scandinavia respects the urban sphere and invites the public to participate. It is an architecture for people.

Norberg-Schulz considers the human identity anchored to the place. Every place has an objective quality that characterises it. It is then the architect's job to understand the character of the place and shape according to the identity of the area. This should result in authentic and original architecture, that expresses the identity of the place - and thereby expresses the human identity. Where Norberg-Schulz allows the architect to be the only interpreter of the place, is the architect in Frampton's Critical Regionalism instead staging the qualities of the place for human perception. Our identity is no longer just about being present at the place, but also about how we perceive the place - the atmosphere and sensory experience of the place. Performative Regionalism priorities the individual experience and interaction, contrary to Norberg-Schulz' and Frampton's staging of the place, it is no longer about decoding and expressing the qualities of the place, but instead putting people in the centre of architecture.

In my opinion, it is not necessary to choose a single direction. For a small coastal town with history and a large conservation area, it becomes relevant to understand the surroundings and the climate. This project will focus on the natural environment and sense of place, following Norberg-Schulz. The understanding of the history of the town, the natural qualities and conservation areas will aid in creating an identity of the place. By following Frampton's Critical Regionalism, we focus on the human perception of the place. This requires an understanding of the sensual and atmospheric qualities of the natural and environment, the local materials and the spaces relevant to the area. While enforcing the identity of the region through natural qualities is essential, I still find people to be the centre of architecture. The building(s) have to create a positive impact on society and the local community. This is the central aspect of the project. Creating spaces that drive tourism while strengthening the community - creating a synergy between locals and visitors by following Barbara Allen's Performative Regionalism by creating spaces for interaction and knowledge sharing between the two. I believe that this approach can establish a local connection, both physically and psychologically, integrating social and cultural values, history, innovation and nature in a sensitive manner.

THEORETICAL FRAMEWORK

ATMOSPHERE & SENSUALITY

Atmosphere and sensuality are vital factors when creating architecture for people and nature. In the following, I strive to investigate how we perceive and experience spaces through the atmosphere and how this impacts architecture. Examining German philosopher, Gernot Böhme's definition of atmosphere, Finnish architect, Juhani Pallasmaa's phenomenological aspects of the human sensory experience and Swiss architect, Peter Zumthor's nine quality criteria to reach a multi-sensory experience.

Gernot Böhme

Beauty has long been associated with proportionality, harmony and regularity, often found through geometry and mathematical forms. Gernot Böhme states that beauty, in an architectural sense, lies within a holistic understanding and experience of a space. (Böhme, 2010)

> *"One cannot speak of beauty, one has to experience it." (Böhme, 2010)*

Böhme speaks towards the possibility of beauty as an atmosphere. (Böhme, 2010) In his 'Atmospheric Architectures - The Aesthetics of Felt Spaces' he clarifies his definition of atmosphere in architecture as; "the sphere of felt bodily presence" (Böhme, 2017, p. 69) Böhme further argues that atmosphere is a crucial part of our perception, which shapes our relationship to our surrounding environment, people and objects - and therefore a vital part of architecture. Gernot Böhme emphasises the importance of multi-sensory architecture, in contrast to merely focusing on sight and the visual sense, as atmosphere and perception are complex and not simply perceived visually. He stresses that architecture should be accessed through bodily presence. (Böhme, 2017, p. 70)

Sound and silence are understood through the contrast of spaces - or atmospheres. Sound and acoustics are an important architectural tool since they have a great impact on the experience of spaces and the desired atmosphere hereof. Silence can be overwhelming, but also provide the opportunity for contemplation. (Böhme, 2017) Light, like sound, is a powerful element when creating atmospheres in a space. Light is experienced in the contrast between light and darkness. Without darkness, the power of light will weaken. (Böhme, 2017)

In Böhme's further discussion of atmosphere, he argues how atmosphere is unique and how different atmospheres are created through material properties and constellations. (Böhme, 2017, pp. 118-119) Gernot Böhme argues how the geometry of a space is less important, in comparison to the placement of objects and the choice of materials - and how the materials interact with each other. He exemplifies this with how the source of light or sound can feel distant or near in our spatial experience and thereby enhance a certain spatial atmosphere. (Böhme, 2017, p. 75) When Böhme states that geometry has a minor effect in relation to appealing to our emotions, he refers to atmosphere existing in both in and around architecture, through what can be viewed as 'non-objective means'. He argues how light can create spaces. He exemplifies this with how the cone of light from a street lamp creates spatial boundaries, without creating physical ones. (Böhme, 2017, p. 76)

“To treat light and sound as objects would be to underestimate their spatial significance. They actually create spaces of their own kind, or endow spaces with a character of their own. The light that fills a space can make it serene, buoyant or gloomy, festive or homely. The music that pervades a space can make it oppressive, energizing, compact or fragmented.” (Böhme, 2017, p. 76)

An atmosphere can be created through a vast array of architectural means, such as the tactility or colour of the material, light, acoustics etc.. The function of the space can also have a significant impact of the atmospheric experience. Through our associations to the functionality of the space, we consciously or unconsciously create an atmosphere for the space. (Böhme, 2017, p. 119)

Juhani Pallasmaa

In the book ‘The Eyes of the Skin: Architecture and the Senses’, Juhani Pallasmaa tries to discuss the phenomenological aspects of the human sensory experience within architecture. (Pallasmaa, 1996) Juhani Pallasma is a former professor and dean of Aalto University and is highly respected for both his buildings and his books on architectural theory and history. In his arguments for sensory experience, he criticises how the visual sense has gained a dominant role within architecture. This prioritising of the visual sense are suppressing our other senses and limits our perception of the space and creates an incomplete image thereof. (Pallasmaa, 1996, p. 39) We must consider and implement all human senses in architecture.

“Every touching experience of architecture is multi-sensory; qualities of space, matter and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton and muscle” (Pallasmaa, 1996, p. 41)

These all together are creating the sensory experience, by interacting and infusing with each other. All senses extend into the tactile sense, relating to the fact that all senses are based upon touch - a haptic architecture of our skin (Pallasmaa, 1996) The experience of the space and the architecture will decrease in quality, when ignoring the other senses and not stimulating them. We as architects should, therefore, use our own sensory experiences when creating spaces for all senses.

The visual sense becomes essential when experiencing distance and separation, as the eyes seek to investigate and control the visual experience of a space. On the contrary, will nearness and intimacy be experienced through the sense of touch, inviting for human interaction. (Pallasmaa, 1996, p. 46) When addressing emotions, Pallasmaa argues that the senses need to be approached in a more analogue and primitive way, which he exemplifies with the contrast of vision to hearing, light to shadow, and touch to smell. (Pallasmaa, 1996, p. 48)

Further explaining how we and our senses interact with architecture, Pallasmaa describes how vision and touch jointly creates a complexity of space and together enhance the diversity of the sensory experience. When comparing the visual and auditory senses and the importance of sound and hearing, he argues how the visual sense seems to separate, while the auditory sense includes;

> *"Sight isolates, whereas sound incorporates; vision is directional, sound is omnidirectional. The sense of sight implies exteriority, whereas sound creates an experience of interiority. I regard an object, but sound approaches me; the eye reaches, but the ear receives. Buildings do not react to our gaze, but they do return our sound back to our ears." (Pallasmaa, 1996, p. 49)*

All spaces create a unique auditory experience; intimate, monumental, rejecting, inviting, etc.. This experience can have just a great of an impact on the perception of the room as the visual impact. Pallasmaa also stresses how the auditory sense is a crucial part of achieving tranquillity. He emphasises how peace and calmness serve as an essential experience when creating spaces for general focus and fundamental solitude. (Pallasmaa, 1996, p. 49) As we are in constant interaction with our surroundings and the surrounding environment, our body becomes the centre of how we experience the world through our senses. (Pallasmaa, 1996, p. 65)

Peter Zumthor

Swiss architect, Peter Zumthor, is well experienced and well known within atmospheric experiences. In his book 'Atmospheres' he utilises his own experiences to define nine quality criteria to reach a multi-sensory experience; (Zumthor, 2010)

Body of Architecture

A body of materials. The body is how materials and spaces create the sensory experience of a bodily mass - an anatomy of a building is formed with a membrane, a fabric, a skin.

Material Compatibility

Materials have endless possibilities: How is it created? How is the visual appearance? How does it feel to the skin? How is it used? This can create many variations, but when you combine materials into new compositions, it behaves differently. A composition of certain materials could be perfect for creating the appropriate atmosphere for a space, while a single material of the composition would work against the very purpose of the space.

The Sound of Space

"Listen! Interiors are like large instruments, collecting sound, amplifying it, transmitting it elsewhere," (Zumthor, 2010, p. 28) What sound is created when you enter the space? Which sounds are produced by the space itself? What kind of atmosphere would complete silence create? This is about how all materials, objects, shapes and surface affect the perception of the space.

The Temperature of a Space

When we touch wood, it radiates warmth. When touching steel, it feels cold. Temperature is not only based on touch, but it is also about what we see and feel more psychologically.

Surrounding Objects

Buildings - or spaces - could be considered as receptacles for objects. It is imperative not to forget the future use of the space. How will the future personalisation impact the space? Does the space allow for customisation or for creating a sense of home?

Between Composure and Seduction

Architecture involves movement. Architecture guides, prepare, stimulates, surprises. But how do architecture guide peoples movement or lead them to certain areas of the space? Can light direct you in a particular direction or would a specific surface invite you to touch it?

Tension between Interior and Exterior

There is a certain tension between the inside and the outside; public vs private spheres, unlimited space vs enclosure, cold vs warm etc.. Often contrasts will enhance the experience here of and create very different experiences - not to forget the experiences of the boundaries and the transition between the two.

Levels of Intimacy

How do parameters such as dimension, scale, proximity and distance create intimacy? How does the level of intimacy impact the user? One space can make you feel small and insignificant, while another will make you feel safe and proud.

The Light on Things

Peter Zumthor explains his process as "hollowing out the darkness, as if the light were a new mass seeping in." (Zumthor, 2010, p. 58) Which areas should be filled with light? Which should be in darkness? How does the ever-changing daylight impact the space throughout the day or the year?

Part Conclusion

All three authors express the importance of multi-sensory experiences and atmosphere of spaces. It becomes essential to map out the intended use of the room at how people should perceive it. To create the correct atmosphere of the spaces, I intend to look at the individual elements of the building(s) and find the visual, acoustic, tactile, taste and olfaction qualities. By focusing on the distinctive qualities of the materials and the composition hereof we choose how the space should be perceived, and by working with contrasts of these spaces by combining spaces with different atmospheric qualities, we can strengthen the atmosphere perceived in the individual spaces. The composition of materials and spaces thereby becomes essential aspects of this project.

Juhani Pallasmaa argues how the senses should be approached in an analogue and primitive way. This method will be implemented when investigating the contrast and interaction of senses by using my own experiences to create spaces for all senses. The sensual experience must create a synergy, where the sensual impacts work together to form the overall experience. For example when creating an intimate space, will echo create the acoustical experience of a large monumental space, contrary to an intimate one. As Pallasmaa states, will nearness and intimacy be experienced through the sense of touch, inviting for human interaction, while the visual sense becomes essential when experiencing distance and separation.

But the senses are not merely stimulated from the response to materials and spaces of buildings. We are constantly interacting with our surroundings, and the natural surroundings have a significant impact on how we perceive indoor and outdoor spaces. Of course, daylight comes apparent when discussing the effects of the natural environment on architectural spaces. But when working in an open area such as the west coast of Denmark, the natural qualities becomes an essential part of the architecture and should be incorporated - in contrary to larger city centres where the surroundings can be affected by noise or smog. The qualities of a conservation area on the coast include open areas of untouched nature, uncontrolled local vegetation and proximity to the sea. The sea is often regarded as a visual quality within architecture - which it still is, but it offers much more. With the close proximity, it becomes interesting to investigate how to implement the sound, taste and smell of the sea into the spaces - if relevant. By bringing the natural environment into the building(s), we minimise the boundaries between inside and outside - which becomes even more relevant in the Nordic countries where it can be too cold, wet or windy to be outside. The proximity of the sea can also create issues with wind. The natural environment usually adapts to these elements and can help limit the difficulties by taking advantage of the environment - for example by placing the building strategically according to the topography or the vegetation.

The nine criteria of Peter Zumthor will be the base for further evaluation of spaces and assist in creating a direction for each element of the building(s). This should help succeed in creating the appropriate atmosphere and function of each space. Juhani Pallasmaa's theories will be used for a more phenomenological approach to sensory design - carefully considering how the spaces impact all senses. As I strive to address this atmospheric aspect of architecture, I ask myself how I through form, material, sound and light can create spaces with the human body - and all the senses - at the centre of the architecture?

THEORETICAL FRAMEWORK

TECTONICS

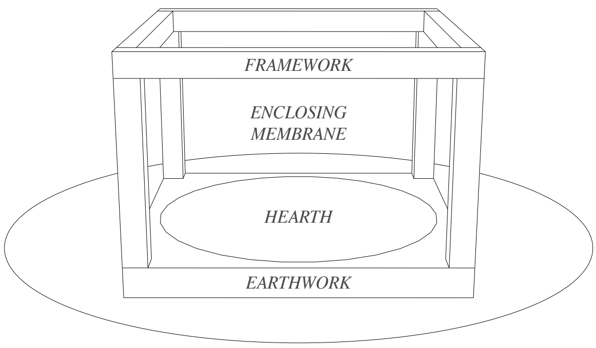
Tectonics has been theorised and discussed for centuries - and still debated today. To understand the term and to understand tectonic architecture, we have to look closer at the high points of the development of tectonic theory.

The tectonic theory dates back to the ancient Greek and derives from the word 'tekton' - the Greek word for craftsman or carpenter. The definition of the term has evolved from being the 'art of construction' in Homer's writings in ancient Greece, to hold a more poetic character, referring the craftsman assuming the role of a poet in the writings of Sappho later the same period. (Frampton and Cava, 1995) The meaning shifted from referring to something physical and specific, such as carpentry, to being 'the art of creating', investigating the boundaries and possibilities between architecture and construction. The role and meaning of the 'tekton' became more of a 'masterbuilder' capable of bringing together aesthetics and technique.

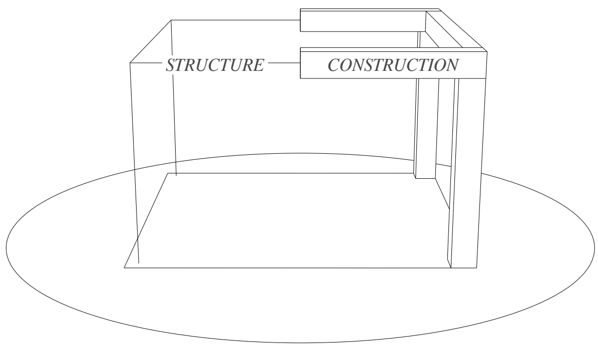
Karl Bötticher, a German archaeologist, specialising in architecture, divided architecture into kernform (core-form) and kunstform (art-form). The core-form is understood as the structure of the building, whereas the art-form can be seen as the ornamentation or 'dressing'. The art-form must not obscure the core-form but should emphasise the structure. (Frampton and Cava, 1995)

Inspired by Karl Bötticher's core-form and art-form, Gottfried Semper, in his 'Die Vier Elemente der Baukunst' from 1851, analysed vernacular dwellings and construction principles and proposed the theory that architecture had developed out of the experience of four basic elements: the earthwork, the framework/roof, the hearth, and the lightweight enclosing membrane. (Foged and Hvejsel, 2018, p.22) Semper divided the four elements into two fundamental procedures of constructing a building; the tectonics of the frame, in which light-weight components are assembled to encompass a spatial matrix, and stereotomics of the earthwork, in which heavy-weight components are cut and stacked to form mass and volume. (Foged and Hvejsel, 2018, p.151) As illustrated in Ill. 11 - Semper, the first two represents the technical elements of architecture and the latter being more symbolic - at least when analysing Semper's Caribbean Hut. However, the combinations in which the four elements of architecture were arranged had to change according to "how different human societies developed under the varied influences of climate, natural surroundings, social relations, and different racial dispositions." (Foged and Hvejsel, 2018, p.22) Semper used the four elements to argue for a generalised theory about architecture, for creating a pleasant and habitable place, rather than attempting to specify a particular typology of architecture.

In the essay 'Structure, Construction, Tectonics' from 1965, Eduard Sekler argues for coherency between architectural expression and structure - expressivity



Ill. 11 - Semper



Ill. 12 - Sekler

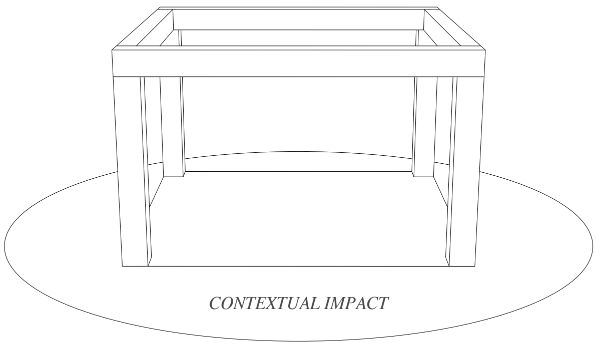
arising from the statical resistance and the structural logic. The functional and structural aspect of the structure should be clearly expressed, allowing it to be understood as one, rather than competing elements. (Sekler, 1965) Sekler, as Bötticher, emphasise the importance of clarity in architecture. As illustrated in Ill. 12 - Sekler, he separates the concepts of 'structure' and 'construction'; "Structure, as the more general and abstract concept, refers to a system or principle of arrangement destined to cope with a force at work in a building […]. Construction, on the other hand, refers to the concrete realisation of a principle or system - a realisation which may be carried out in a number of materials and ways." (Foged and Hvejsel, 2018, p.203)

Vittorio Gregotti followed Karl Bötticher's and Gottfried Semper's reintroduction of tectonic theory as a means to develop architecture meaningfully within the context. He critically looked upon how earlier works solely considered the economic and technical aspects of the space, indifferent to the site. Gregotti emphasised the importance of the context and the natural qualities when designing architecture. The Italian architect wrote in 1983;

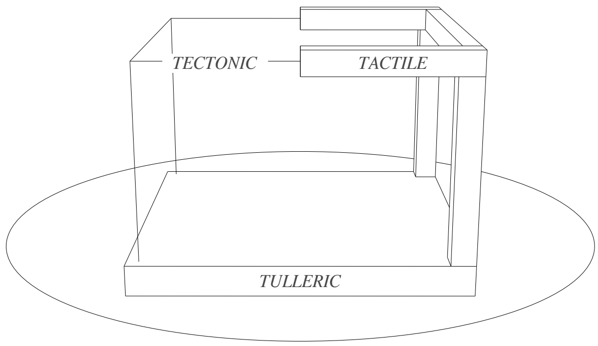
> *"Through the concept of the site and the principle of settlement, the environment becomes the essence of architectural production. From this vantage point, new principles and methods can be seen for design. Principles and methods that give precedence to the siting in a specific area. This is an act of knowledge of the context that comes out of its architectural modification." (Foged and Hvejsel, 2018, p.154)*

As Gregotti argued about the cosmogonic implications of the earthwork, we can look back at Christian Nordberg-Schulz' 'Genius Loci: Towards a Phenomenology of Architecture' mentioned earlier. Norberg-Schulz discusses four thematic levels in the environment; the topography, the cosmological light conditions, the buildings and the symbolic and existential meanings in the cultural landscape. (Norberg-Schulz, 1979) He emphasises the importance of the context and the use of local resources - there has to be a relationship between building, the native place and the natural environment. Ill. 13 - Norberg-Schulz

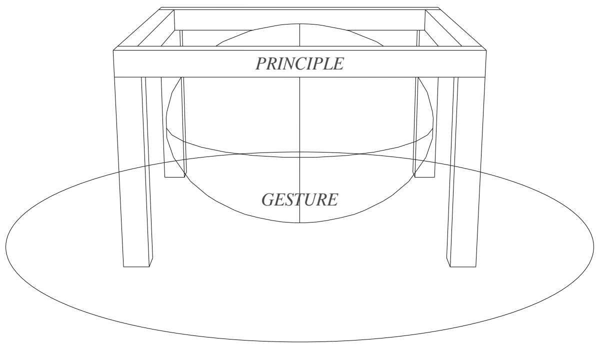
In the 1990s another high point within tectonic theory arose. This build on the work of Eduard Sekler and Marco Frascari, but gained popularity due to Kenneth Frampton's 'Studies in Tectonic Culture' from 1995. Following Sappho's concept of poetry within architecture and tectonics, Frampton repositioned tectonic theory and applied it as a tool of architectural analysis and criticism - giving the term meaning and potential as an approach to architecture rather than a formal strategy. (Foged and Hvejsel, 2018, p.398) The tectonic theory is often interpreted as a rational approach to architecture. But as Marie Frier Hvejsel



Ill. 13 - Norberg-schulz



Ill. 14 - Frampton



Ill. 15 - Hvejsel

states in her essay 'Gesture and Principle: Tectonics as a critical method in architecture';

> *"While this may be an attractive thought (as it allows us to imagine an objective lawfulness in architecture), it is misleading and inadequate. In particular, the notion of 'honesty of construction', which was derived from the Vitruvian triad, is exemplary of this pitfall - as argued by Ove Arup. Aspiring to the understanding that the quality of architecture lies solely in the logic and readability of its structure seems almost like a pretext for inaction." (Foged and Hvejsel, 2018, p.399)*

Frampton focuses on the humanist notion of 'experience' over the more visual and scenographic conception of architecture. His alternative to these aesthetic modes is framed by the values of 'the tactile', 'the tectonic' and 'the tulleric' and argues that architecture should contain all three elements for achieving poetic unity. The three should merge, with 'the tactile' referring to the sense and feel of the materials, 'the tectonic' referring to the structural or static system and 'the tulleric' relating to the earthwork. Ill. 14 - Frampton As Semper argues how tectonics should be considered through climate, culture and local materials, Frampton states that form is influenced by "building-type, technique, topography and temporal circumstance." (Frampton and Cava, 1995)

Frampton's reintroduction of tectonic theory was motivated by addressing the subject of architectural quality. In the essay by Marie Frier Hvejsel mentioned earlier, she argues that we often recognise architectural quality due to its empathy, curiosity, and even poetry, rather than its structural honesty. She marks Frampton's account of tectonics as 'poetry of construction' as significant as "it aspires, simultaneously, to the imagination of the architect and the perception of the inhabitant." (Foged and Hvejsel, 2018, p.399) Hvejsel repositions tectonics and applies it as a critical method within architecture and refers to tectonics as the unity of gesture and principle. 'Gesture' as the phenomenological awareness of a spatial quality by the envisioned and experienced spatial quality of the architectural form (explaining what the space does) and 'Principle' as the structural system creating this architectural form (explaining how it does it) – displaying tectonic as an interplay between phenomenological gesture and a technical principle. Ill. 15 - Hvejsel

Part Conclusion

When assessing the theories and texts above, it becomes apparent that tectonic theory has changed and evolved through time. We can, however, conclude that they all touch upon the areas of aesthetics, structure, materials and socio-cultural values. Throughout architectural history, tectonic theory has revolved around the development of architecture in relation to its physical, technological and societal context.

All the theoretical framework above emphasise the importance of the joint and the detailing within architecture. The ongoing theories and discussions about tectonics and architecture illustrate that architecture, art, structure and construction are inseparable - from Semper's spatial conception of the tectonics to Sekler's linking of this conception the human scale and perception. Frampton further developed tectonic theory into an academic tool, using it as a critical tool for architectural analysis, whereas Hvejsel repositioned it as a critical methodological tool. By working with 'gesture' and 'principle' as a critical methodical tool throughout the design process, it can enhance the architectural quality and improve the development of built environments capable of enriching everyday life. As Marie Frier Hvejsel states in her essay;

> *"Hereby, tectonics reads simply as a general critical and methodological means for improving the quality of the built environment, not as a separate discipline, aspect, or area of architecture." (Foged and Hvejsel, 2018, p.405)*

Precisely this understanding of tectonics not being a separate discipline, aspect, or area of architecture becomes apparent through the tectonic theory. If we look back at the previous theoretical framework in this report - sustainability, Nordic identity and atmosphere & sensuality - and compare them to tectonic theory, we find a lot of similarities and overlaps. The architectural and structural choices have a significant impact on how spaces are perceived and what atmospheric qualities are created for the specific space. Semper's and Sekler's focus on the spacial concept can be understood through the reading of Juhani Pallasmaa and Peter Zumthor in Atmosphere & Sensuality, while Kenneth Frampton's Critical Regionalism and Christian Norberg-Schulz' Genious Loci and their focus on the local context, can be seen as one of the key elements of Nordic architecture. The sustainable aspect of tectonics is always present. From the sociological sustainability aspect dependent on how space is perceived and how pleasant the architectural space is for the users. While the environmental and economical sustainbility aspects can be dependent on the efficiency of the structure, choice of materials and contextual understanding.

The theoretical points have led to a few guidelines for further development of a community centre. White surfaces are often used in housing today. White surfaces provide a blank canvas and gives future residents the possibility to personalise the spaces according to their liking, but when we are working to create a unique experience for visitors, white surfaces must only be used where necessary - to reflect daylight in the space or creating a blank canvas for human interaction. It is more relevant, as a community centre and visitor centre, to display the local qualities and history - such as traditional construction methods, local materials and the natural environment.

Materials should be chosen by balancing local availability, atmospheric value, historical value and sustainability - and not by simply copying architecture from the past. If the existing architecture is reused, it must be critically reintegrated into the present.

THEORETICAL FRAMEWORK

SUBCONCLUSION

AUTHENTIC & UNIQUE EXPERIENCES

Appeal to both tourists and locals

Restore historic structures

Authentic restaurant to display local foods

Creating pathways in nature to make the unique environment accessible to everyone.

A balance between accessibility and protection

POSITIVE INTERFERENCE

Mixing tourism and non-tourism programmes.

Programmatic hybrid - simultaneously recreational and product space. (Pensioners can use the space for their hobbies and local activities, while visitors can join the activities or learn about the area and the cultural background provided by the locals)

LINKING SURFACES

Linking surfaces, where the structure(s) must be publicly accessible from all directions

Unprogrammed square-meters will give the project a character similar to public spaces

A lobby as an in-between space serving both guests and non-guests.

Extraordinary spaces for ordinary activities

DESIGN FOR DISASSEMBLY

Elevate structures in sensitive areas to leave a minimal impact on the natural environment

Mechanical joints for easy disassembly and reuse of materials

Simple, yet effective construction methods

Prefabrication for limiting construction-work and construction-time on site and thereby limiting the impact from construction-workers, lorries and so on.

SUSTAINABLE MATERIALS

Life Cycle Assessments (LCA) of the relevant materials to calculate the potential environmental impacts and resource consumption.

Compare life expectancies of the materials to the LCA. The lifetime of materials determines the number of replacements in the whole life cycle - depends on use and placement.

Use local materials for minimal environmental impact (extraction, transportation and manufacturing)

REUSE

Use natural materials as raw as possible and limit the use of paint, glue and non-removable fasteners to allow for reuse of the materials

Reuse elements of the consisting structure to minimise environmental impact on extracting, manufacturing, and transporting new materials.

PLACE-SPECIFIC APPROACH

Programming through the opportunities and constraints of the context

Shaped by the microclimate, with extreme temperatures, strong and cold winds, large amounts of rainfall, and light and its absence.

Following a place-specific approach with a more direct relationship between building, nature and the surroundings.

HUMANS IN THE CENTRE

Taking the focal areas further than being a connection with nature, topography and native soil, to a more social approach where society, community and democracy have greater influence

Placing humans in the centre of the architecture - having people play an active role in the experience of the place, contrary to passively receiving. Creating a relationship between people and the place.

MULTI-SENSORY EXPERIENCES

Investigating the distinctive qualities of materials and composition thereof, to define how spaces should be perceived.

Defining the visual, acoustic, tactile, taste and olfaction qualities for the individual spaces.

The sensual experience must create a synergy, where the sensual impacts work together to form the overall experience.

CONTRASTS & NATURE

Strengthening the atmosphere perceived in the individual spaces, by working with contrasts of these spaces and combining spaces with different atmospheric qualities.

Integrating the natural surroundings and minimising the boundaries between the inside and the outside, by activating all senses with natural elements when defining the atmospheric qualities - taking advantage of untouched nature, uncontrolled local vegetation and proximity to the sea.

FRAMEWORK

FRAMEWORK

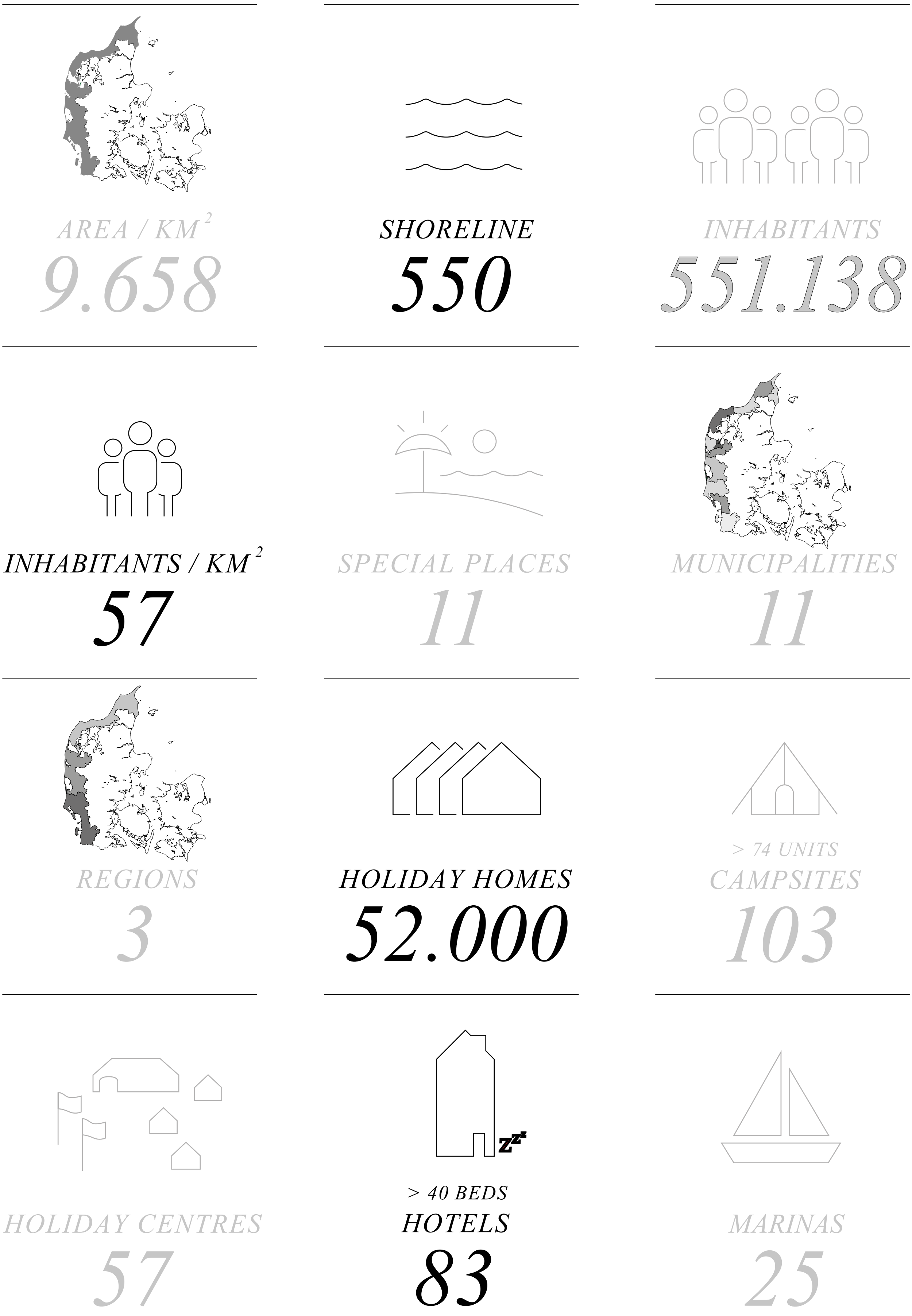
OPPORTUNITIES OF THE WEST COAST

The 11 municipalities on the West Coast of Denmark has a clear ambition to develop west coast tourism. The municipalities have come together to create a development plan that identifies 5 focus areas and 19 specific measures. The 5 focus areas are; Create a single destination, strong holiday areas, nature as the main attraction, differentiated accommodation capacity and strategic investment promotion. Some of the specific measures relevant for this project are; prioritising and developing 18 strong holiday areas, developing unique experiences in nature and good accessibility, strong communication centres and attractions, new accommodation capacity in build areas, more varied accommodation and create new knowledge. (Partnerskab for Vestkyst turisme, 2018) To achieve this, the following development principles will be en focus;

Ill. 16 - Development Principles

The numbers on the following page provide an overview of the West Coast of Denmark. The 550-kilometre long shoreline, that stretches from Germany to Skagen, is a popular tourist attraction with an unspoilt coastline where heathland, marshland and kilometre-wide beaches meet the force of the North Sea. The total area of 9658 square-kilometre with only 57 inhabitants per square square-kilometre, shows a very natural embossed area. The density in the coastal area is even lower, as the concentration of people is higher in the larger towns. The population density of Denmark is 135 inhabitants per square square-kilometre. (Danmarks Statistik, 2019) Many families own a holiday home on the West Coast and the local inhabitants tend to rent out their home in the tourist season. With 52 thousand holiday homes and only 83 hotels, accommodation possibilities and off-season activities in hotels are limited and the tourist season is primarily limited to the summer.

THE WEST COAST IN NUMBERS



Ill. 17 - West Coast in Numbers

FRAMEWORK

VISION FOR THE WEST COAST

The Danish West Coast is the epitome of Danish coastal holiday. It was here the first Danish holiday towns originated in the 19th century. The West Coast is one of the biggest tourist attractions in Denmark today, with approximately half of all overnight stays in coastal- and nature tourism in Denmark. The coast offers 550 kilometres of mostly untouched and accessible coastline with nature being the biggest attraction. (Partnerskab for Vestkyst turisme, 2018, p.7)

The grand and untouched nature is the most prominent tourist attraction, but also the strong individual attractions and the holiday home offers unique experiences. The holiday home is the dominant holiday form on the West Coast, with 65% of all overnight stays. The holiday home appeals to families and larger groups which have led to a relatively low average daily consumption of DKK 490, while the average for Denmark is DKK 850. (Partnerskab for Vestkyst turisme, 2018, p.16) The holiday home also attracts tourist for an extended stay, but limits other target groups need for shorter holidays, flexibility and easy access to experiences. This creates the need for new and different accommodation offers.

By diversifying the accommodation offers with hotels, cabins, cluster houses or others, the destinations get a better chance of matching new tendencies - such as more couple holidays and an ageing population, more and shorter holidays, higher quality and demand for special and unique experiences.

THE SITUATION TODAY:

Annual revenue growth of 4.6% from 2013-2016

Germans and Danes are the primary guests
89% of all nights

40% traveling with children
60% traveling without children

Long stay - 71% over a week

The holiday home is the dominant accommodation offer

Two tourism hubs: Søndervig-Blåvand and Skagen-Løkken-Blokhus

The major destinations have driven growth. Small destinations have experienced large percentage growth

CHALLENGES:

Mass tourism and lack of capacity in the major destinations during the high season

Unilateral accommodation

Short season (many areas)

Relatively low average daily consumption

High price level in Denmark

Lack of investments

Many minor stakeholders - lack of labor

Lack of skilled labor

Lack of quality in accommodation, experiences, urban environments and service

Lack of access to nature experiences

Limited experience opportunities

Massive competition from German destinations

WEST COAST 2025

STRENGTHS / POTENTIAL:

Brand value as a single destination

National and municipal focus

Well-established and well-functioning destinations with a long history and loyal guests

550 km of sea, coast and high quality beach open to everyone

Very varied experiences in nature and strong attractions

Basically a well-developed product and the holiday home offers a unique experience

Local stakeholders with an interest in local development

Varied offers in experiences and diversity in the product

3 airports

TRENDS:

Global growth in tourism at an international level

Aging population and more couples as a target group

Stagnant population in the primary markets - but demographic changes

Globalization: Greater market and increased competition

Travel accustomed guests make demands on quality and flexibility

More and shorter holidays are common today

The special and unique experiences

Multi-generation trips and your-mine-our holidays

Digitization of travel choices, marketing and communication

Ill. 18 - West Coast 2025

Ill. 19 - Vision 2025

The following vision is developed for the entire West Coast of Denmark, but has for this project been translated and reduced to the most relevant points in this report (Partnerskab for Vestkyst turisme, 2018, p.19):

The holiday destinations offer vibrant and authentic towns, with hospitable locals, inviting urban spaces and a variety of experiences, activities and accommodation. The wild and untouched nature is the West coast's prominent tourist attraction, and the accessibility to nature for residents and tourists is strengthened.

Access to the Grand Nature

Nature and the coast are the most prominent tourist attraction of the West Coast and the potential of nature focus on both various target groups and more seasons. The natural environment forms the framework for tranquillity and recreational purposes.

Modern Danish Coastal Holiday

The atmosphere of the Danish coastal holiday is transferred to the other seasons than summer, to new accommodation types and shorter visits. The Danish costal holiday equals for many the holiday home; the cosy, the informal and the proximity to experiences and activities. The holiday home will still be a unique offer, while new accommodation possibilities of higher quality will create many different options to stay at the West coast for both shorter and longer periods.

Vibrant Town Life and Experiences

The West Coast offers vibrant coastal towns with authentic, high-quality urban environments, some of which are active tourist destinations throughout the year. Experience centres and tourist centres will help raise awareness of the West Coast, create reasons-to-go and attract new target groups.

Strategy

The development plan for the entire West Coast recommends a differentiation, expansion and enhancement of the quality of the accommodation in the coastal towns. These new accommodation types must match the latest tendencies of shorter holidays, flexibility, couple-holidays and quality. Examples of new accommodation types include hotels, unique accommodation types and new accommodation types. Hotel guests generally have a high daily consumption, and the accommodation type matches the trend with more and shorter holidays. Unique accommodation types can focus on unique natural attractions or authentic local experiences and will create reasons-to-go. New accommodation types can be hybrids of existing types, such as combining traditional hotel functions with local activities.

At the same time, it is crucial to not only focus on the economic aspect of tourism - but also how to create a synergy between tourism and residents to enhance and develop the towns. This can be achieved by creating the foundation for tourist and residents to interact and creating experiences and activities for both segments. This can at the same time expand the season from summer to all four seasons.

FRAMEWORK

FROM 18 TO 1 DESTINATION

The 18 areas are all characterised by having a developed city centre - more or less. Most are coastal towns. All towns are in different stages of development towards a more tourism friendly west coast. Skagen, Lønstrup, Løkken, Blokhus, Klitmøller-Vorupør, Hvide Sande, Søndervig, Henne, Blåvand, Fanø and Rømø are all relatively well-developed holiday destinations. They are great drivers for tourism today and will be central areas for future development in west coast tourism.

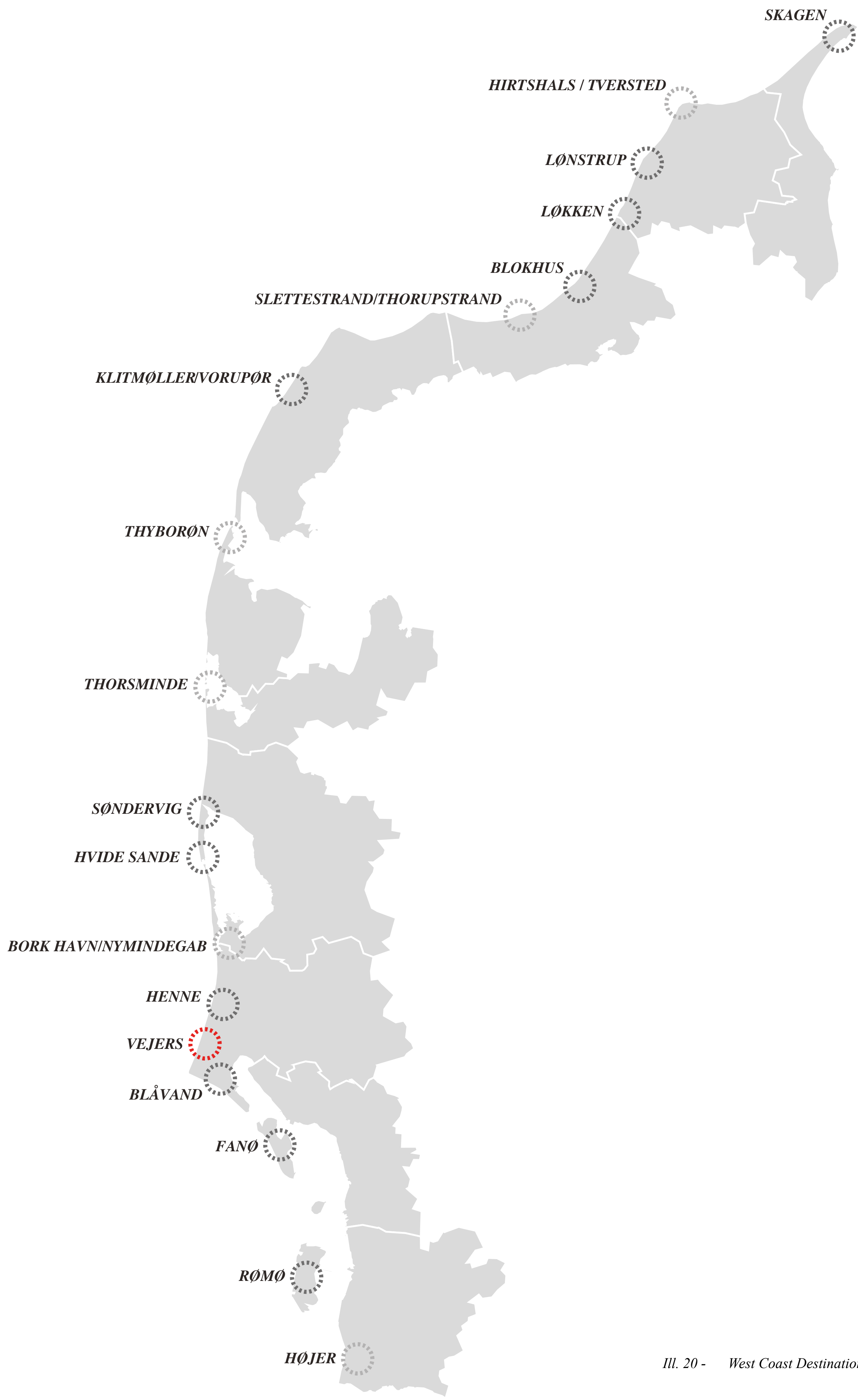
New future holiday destinations include Hirtshals/Tversted, Slettestrand/Thorup Strand, Thyborøn, Thorsminde, Nymindegab/Bork Havn, Vejers and Højer. They all have the potential to become a great tourist attraction, with a unique culture, local identity and experiences in nature. Developing these destinations could help create a more balanced development in tourism throughout the west coast, taking some of the pressure from the major attractions and destinations. (Partnerskab for Vestkyst turisme, 2018)

These destinations will have to be improved with new experiences, services and accommodation. The activities and accommodation should be concentrated around the town centre, so the natural qualities of the holiday destinations can be strengthened and developed for recreational and commercial purposes. "The focus must be on differentiating the product - both in relation to accommodation offers, experiences and services." (Partnerskab for Vestkyst turisme, 2018)

As the existing well-developed destinations experience capacity challenges during peak season, there is great potential to complement with new and more niche-oriented destinations that appeal to new segments. The new holiday destinations must be developed based on the specificity and strengths of each location and not necessarily resemble the existing well-established destinations.

> *"The new holiday areas are developed with accommodation capacity, experiences and services with a focus on the cultivation of special target groups and with a more experimental approach to tourism development." (Partnerskab for Vestkyst turisme, 2018)*

It is crucial to include private investors as well as local stakeholders to drive the development of the areas. The towns and destinations will be strengthened by involvement and cooperation with local citizens, volunteers and associations, through interaction with local life - so that they can contribute to creating a positive change.



Ill. 20 - West Coast Destinations

FRAMEWORK

VEJERS

> *"Vejers is the coastal town in the dunes - and a more natural alternative to Blåvand and Henne Strand and has the potential to complement and differentiate the offer in the area even more." (Partnerskab for Vestkyst turisme, 2018)*

Vejers is closely linked to the beach and has a small, but strong, local community. Many local initiatives are based on voluntary effort and teamwork of the locals. Some of the local initiatives are 'Marehalm Ind I Byen', a new playground for everyone, an amber festival, a red deer festival and organises the Danish championship in turbot fishing. (INTERVIEW, 2019)

Vejers is a small community, with only 90 year-round residents. The local commitment shows in the development plan for Vejers, where the locals have created the plan in collaboration with the municipality of Varde. The motto of the plan is; "A true nature experience - all year round." (Varde Kommune, n.d.)

Ill. 21 - Turbot

Ill. 22 - Amber

Ill. 23 - Red Deer

Ill. 24 - Areas of Vejers

FRAMEWORK

TOURISM IN VEJERS

Tourism is a large part of Vejers. The number of residents changes from ninety to several thousand during the peak of the season. The driver of tourism in the small town is the local community.

Potential
Tourism is vital for Vejers and is the main focus of the development plans for both the west coast and Vejers. The association, Partnership for West Coast Tourism, and the municipality of Varde try to strengthen the position of Vejers as a popular tourist destination in both Denmark and Northern Europe. Vejers has a combination of beach, sea, landscape, light and cultural values. This makes Vejers an attractive area for visitors - but many other west coast destinations have the same qualities and selling points.

Why Vejers?
So why choose Vejers? Great tourist destinations such as Skagen or Klitmøller offers many different activities. Skagen offers historical, cultural and artistic experiences, while Klitmøller has branded itself as 'Cold Hawaii' focusing on water sport. Vejers provides a more natural experience. While all west coast destinations offer various experiences in the wild, Vejers has focused more on the local, intimate and natural environment of a small coastal town.

Vejers offers a natural environment with silence, rural nature, beaches, dune landscape and a vast forest. This creates a varied interaction with nature. Many tourists come for nature, but often, to keep them coming back, you need to provide something more. The locals in Vejers have worked to include tourists in the small community. The tourists are invited to join the local communities, where they can participate in cleaning the beach, collective morning bathing, sports-week on the beach, beach-week for children, joint bicycle rides and weekly trips in the surrounding natural environment - to list a few. This shows an active community where they work to create a personal experience for the tourists. The tourists relate not only to the place but to the social relations that the visit has created. The active local community is displayed through the investment from The Landowner Association and The Business Association, who invest a lot of volunteer hours and a cash amount of DKK 200,000 in 'Vejers Strand Experiences', every year. (INTERVIEW, 2019)

FRAMEWORK

HISTORY OF VEJERS

Before the 20th century, Vejers Strand was a place for extensive seasonal fishing, where the fishermen lived by the beach during the summer in small huts (Esehytter) - small A-shaped cabins, which are located low in the landscape with a close relation to nature. This fishing subsided in the late 19th century, and the first tourists came to the area because of the wide sandy beach and the excellent bathing water, which is child-friendly compared to other west coast destinations.

The first summer homes were built in 1910 in the dunes facing the sea. These were later supplemented with a holiday home area further inland, which has led to approximately 1,200 holiday homes today. Two seaside hotels (badehoteller) were constructed around 1925 and still exists today - 'Strandhotellet' and 'Klithjem Badehotel'. (Varde Kommune, n.d.)

Ill. 25 - Strandhotellet in 1930

Ill. 26 - Esehytte

Ill. 27 - Strandhotellet in 1945

FRAMEWORK

VEJERS STRAND

Vejers Strand, together with Blåvand, Henne and Nymindegab, is one of Varde Municipality's most significant tourism catalysts. The town is located in the dunes, close to the sea, forest and beach. The town is small, with around 1200 holiday homes and a small town centre, with two seaside hotels, restaurants, an art gallery, speciality stores, a bakery and a grocery store. The town centre is formed around Vejers Havvej, which leads one down past Strandhotellet, down to the sea. The centre is small, with a few stores and buildings in different colours.

Vejers Strand is frequented by holidaymakers, not least by German tourists. It is a bustling holiday town with a small local community, that offers a wide selection of experiences and activities, focusing on the natural environment. The locals wish to expand the season to succeed in creating "A true nature experience - all year round." (Varde Kommune, n.d.)

Ill. 28 - Café

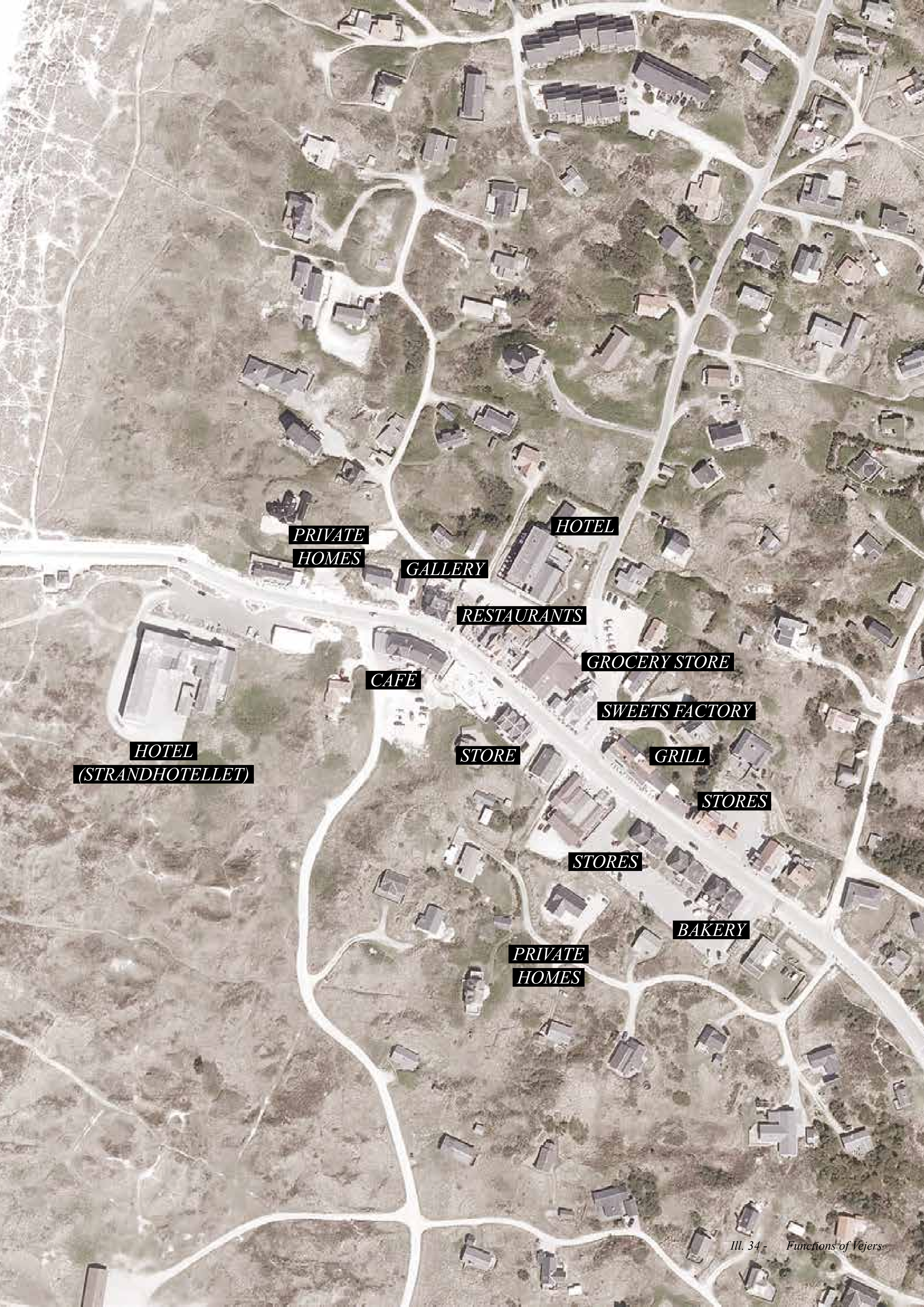
Ill. 29 - Stores

Ill. 30 - Restaurants

Ill. 31 - Stores

Ill. 32 - Grill

Ill. 33 - Bakery



Ill. 34 - Functions of Vejers

FRAMEWORK

INFRASTRUCTURE

The main road runs through the small town and is the only way to the town and the sea and the beach. The road has two lanes and can be very busy during the warm months with cars, cyclists and pedestrians. Many Danes from the surrounding area and tourists arrive by car, as cars are legal to drive on several beaches on the West Coast - including this one.

The small roads are gravel roads leading to the many holiday homes. The roads and holiday homes are fluidly placed in the dune landscape and create a quiet and intimate environment.

Pedestrians use both the main and small roads to travel around the town and to the beach, but many smaller pedestrian paths are created through the dune landscape as many want to experience the landscape up close. It is legal to walk around in the dunes, while it is illegal to damage them by jumping, slide or making fires in them. The dunes are protected by the Danish government and are checked every year for damages and are repaired if necessary.

No bus routes are connecting the town to the rest of Denmark, which makes it challenging to get to without a car. Most guests arrive by car, while others bike to the town and the beach.

The holiday homes have private parking by the houses, and four public parking areas are spread out around the town. The western parking area - by the hotel - is used for public parking today as the hotel has shut down, but the area is privately owned by the hotel owners and was used by the hotel guests before it closed. The other four parking areas are hidden behind the storefronts of the town, creating an uninterrupted path through the town. The flat, dull parking area in front of the hotel is the last thing tourists see before arriving at the beach. The residents have built new dunes around the parking area to make it more presentable, but it still appears out of place. The many tourists and guest can also park their cars on the beach during the day - all year around.

The local initiative of constructing new dunes to create 'the town in the dunes' works well throughout the town to eliminate dead and dull areas and creating an identity for the town. The parking area by the hotel has been used for local and tourist activities, such as festivals and markets, but should be integrated into the town and create a more inviting entrance to the beach.

IIIIIIIII *MAIN ROAD*

▬ ▬ ▬ *SMALL ROADS*

• • • • • *PEDESTIRAN PATHS*

P *PARKING*

Ill. 35 - Infrastructure

FRAMEWORK

VISION FOR VEJERS STRAND

Vejers Strand is all about nature. When explaining their vision, they describe nature as one big playground for both big and small, young and old. A place where you can learn about nature and the local culture: you can experience how nature, culture, town life, quiet and active holiday melts together in the middle of the Natural Park 'Vesterhavet'.

The town is investing in differentiating themselves from the other coastal towns by focusing on more genuine and authentic nature experiences. "It is exactly the authentic seaside town, which is part of Vejers' DNA and which is attempted to be further developed." (Vardekommune.dk, n.d.)

The beach is one of the most important attractions of Vejers. The sea and the beaches are the main reason why tourists have come to Vejers for generations. The community of Vejers has a vision of extending the beach season so that it can be used not only during the summer - but be experienced all year round. They have further developed this vision into a proposal of a project in the dunes - a sauna where you can experience nature in all types of weather.

They further wish to create a lookout - a "Nature Cinema". They propose a terrace close to the sauna and the hotel, 'Strandhotellet'. In relation to these two projects, they are proposing to reestablish the small fisher-huts (Esehytter) that characterised the area more than a hundred years ago. They describe the huts as an authentic way to experience the west coast, where nature, beach and landscape are in focus.

All these visions are closely related to the hotel 'Strandhotellet'. A hotel placed in the dunes located on a site larger than 8,000 m2. They wish for the hotel to house up to 100 guests on special occasions. They further want for a hotel that can expand the holiday season.

The town centre must continue to appear as a beautiful and inviting entrance to the coast and with a unique and aesthetic connection between the public areas and places and the privately owned businesses.

The Danish Nature Agency owns a large part of the areas around Vejers Strand. The locals hope to change how the ownership is set up today, as the ties associated therewith have a limiting effect on the further development of Vejers as a tourist destination. This would allow for new developments while keeping great respect for the natural areas.

Part Conclusion

Vejers is focused on the natural environment and experiences in nature. They further wish to extend the season, creating a more lively town during autumn, winter and spring. They have a small, but active community, which can be further reinforced.

The recently closed hotel, Strandhotellet, allows for new development, close to the authentic natural environment of the West Coast. It is a rare possibility to construct a new building so close to the west coast and in the dunes - which is a protected natural area. A hotel, in its traditional form, can attract customers with higher daily consumption than holiday homes and a hotel close to both the beach and the town centre can with more rooms generate more live to the town. However, a hotel alone does not necessarily extend the season. The hotel rooms or the activities the hotel offers will need to attract the customers in the off-season. The hotel rooms can create unique experiences around nature, focusing on displaying how the Danish seasons change during a year. Varied room sizes can also attract different customers and favour both long and short holidays. Activities such as saunas, wellness, biking, hikes can also extend the season. Creating a sauna or wellness would attract couples and can be used all year round - still focusing on the natural environment and the natural qualities of the West Coast. Extending the season through a project, that would attract costumers with a high daily consumption would benefit the local inhabitants and can attract other businesses to Vejers.

The current hotel was a big part of the local community. The hotel was used for many activities, using both the hotel itself and the area around it. The local festivals were held on the large square in front and around the hotel, while the hotel was used as a community centre - which they now are missing. (INTERVIEW, 2019) This asks for more than a hotel - a new type of accommodation - a place to gather the community but also to join tourists and locals. A place for the residents, where tourists can join the local life.

FRAMEWORK

SUBCONCLUSION

SYNERGY BETWEEN LOCAL RESIDENTS & TOURISTS

Community centre + Accommodation - knowledge sharing between locals and visitors

Gathering place - a foundation for tourist and residents to interact

Inviting urban spaces

Activities for and by locals - The tourists relate not only to the place but to the social relations that the visit has created.

A new type of accommodation - a place to gather the community and to join tourists and locals. A place for the residents, where tourists can join the local life.

A SPECIAL AND UNIQUE EXPERIENCE

Authenticity - local foods, local materials, local history

Include tourists in local life - combining traditional hotel functions with local activities

Unique natural attractions or authentic local experiences

Cultivate new target groups with a more experimental approach to tourism development

Differentiate from the other coastal towns by focusing on more genuine and authentic nature experiences.

ACCESS TO EXPERIENCES IN NATURE

Accessibility - open and accessible for everyone

Functions placed in nature

Pathways through nature

Focus on the local, intimate and natural environment - displaying local nature and culture

Use the beach and the sea - not only during the summer but so that it can be experienced all year round.

MODERN ACCOMMODATION

Unique & flexible - shorter holidays, couple-holidays and quality.

Hotel functions, in its traditional form, can attract customers with higher daily consumption than holiday homes

Use history to create a relation to the place - reestablish fishing huts as an attraction, function or accommodation, using dunes as a design element, following the vision of being 'the town in the dunes' and extend the town as a beautiful and inviting entrance to the coast and beach

Extend the tourist season - hotel rooms in and around nature, focusing on displaying how the Danish seasons change during a year and activities such as saunas or wellness

FRAMEWORK

STRANDHOTELLET VEJERS STRAND

The seaside hotel 'Strandhotellet' in Vejers Strand is beautifully set in the dunes 100 meters from the beach. 'Strandhotellet' has for decades been a synonym for Vejers Strand. The hotel first opened in 1927, but have been rebuilt several times, so that today it appears without visible features from the original hotel and is in poor condition. This allows for a unique possibility to either wholly or partly demolish the hotel to construct a new, more up-to-date hotel, with higher capacity than what is today. (Freja Ejendomme, 2018) It is a rare possibility to construct a new building so close to the West Coast and in the dunes, which allows for a thorough investigation of how to create a place that not only attracts tourists but also adapt to the surroundings of a protected natural environment. The hotel has had a significant impact on community life throughout the years, and the community will have to be a large part of the new project. The locals hope for a modernisation of the hotel, having it play a significant role in the tourist development of Vejers. In the development plan, they propose new modern rooms, a wellness area and a larger capacity. (Vardekommune.dk, n.d.)

Ill. 36 - Strandhotellet Vejers Strand

Visual Appearance

"Exterior walls must be made with wood cladding and / or as a brick building that can appear in glossy masonry or polished and painted. Construction must be carried out with a symmetrical roof, with a roof pitch of between 15 and 45 degrees. No glossy and reflective roofing materials. Colour choices on exterior walls, windows, doors and other building parts must be subdued in natural colours and earth colours or their mixture with white or black." (Freja Ejendomme, 2018)

Parking

The P-norm in the local plan is 1 per. 50 m2 building. Parking spaces must be fitted into the dune landscape and must not be fenced.

Possibilities

"If the existing building on the site is demolished, there will be the possibility of a new hotel with a restaurant. The buildings can be a maximum of 3.346 m2 in 1-2 floors. At maximum utilisation of the building percentage, this will trigger 67 parking spaces." (Freja Ejendomme, 2018)

Natural Conservation

A small part of the site is protected by section 3 of the Nature Protection Act, while the area surrounding the site is protected by Preservation of Dunes Act. This project will challenge this restriction and request a dispensation for building in a protected area. The project will also seek an exemption for expanding the site into the dunes south and south-west from the site.

ADDRESS:	VEJERS HAVVEJ 105, 6853 VEJERS	SITE AREA:	8.366 M2
ZONE:	CITY ZONE	FLOOR AREA, BBR:	1.114 M2
LOCAL PLAN:	NR . 04 .004 .98		(2 .250 M2 MEASURED ON DRAWINGS)
	”VEJERS STRAND SOMMERHUS - BYOMRÅDE”	LIMITATIONS:	
APPLICATION:	HOTEL, GUEST HOUSE AND RESTAURANT.	MAXIMUM PLOT RATION:	40 %
		MAXIMUM HEIGHT:	2 FLOORS AND
CURRENT ROOMS:	31		8.5 M. OVER TERRAIN

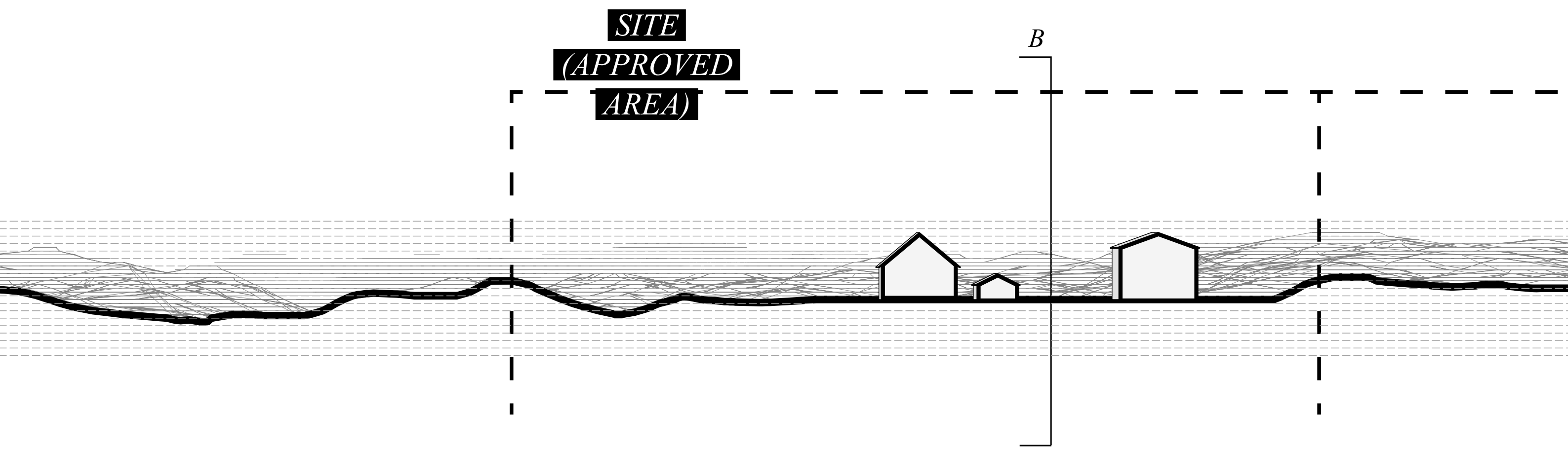
Ill. 37 - Site - Vejers Havvej 105

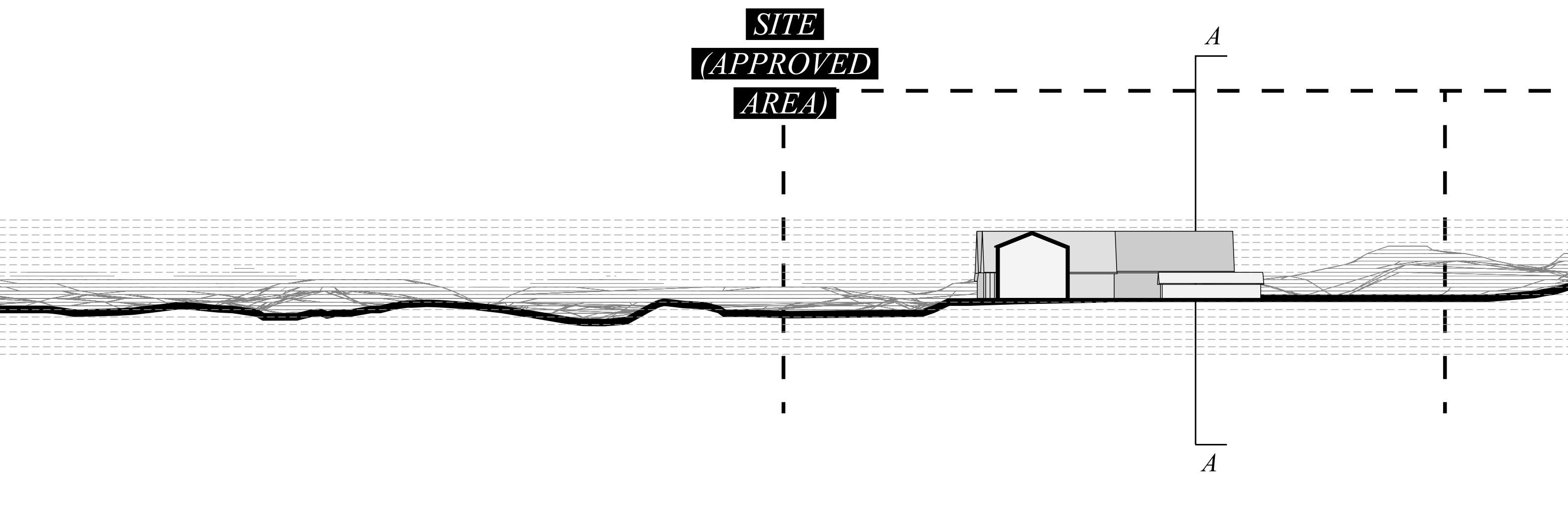
FRAMEWORK

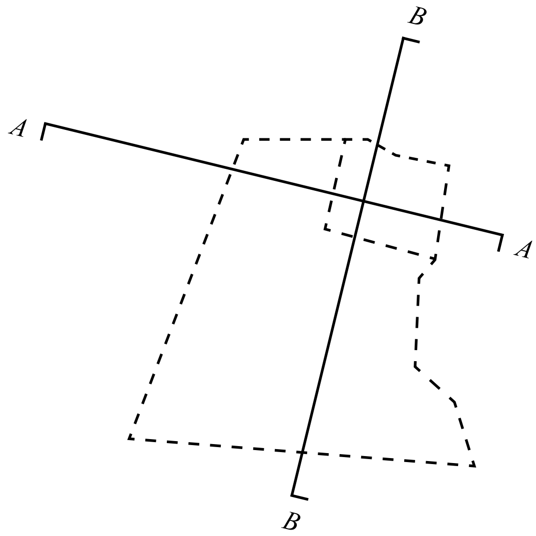
TOPOGRAPHY

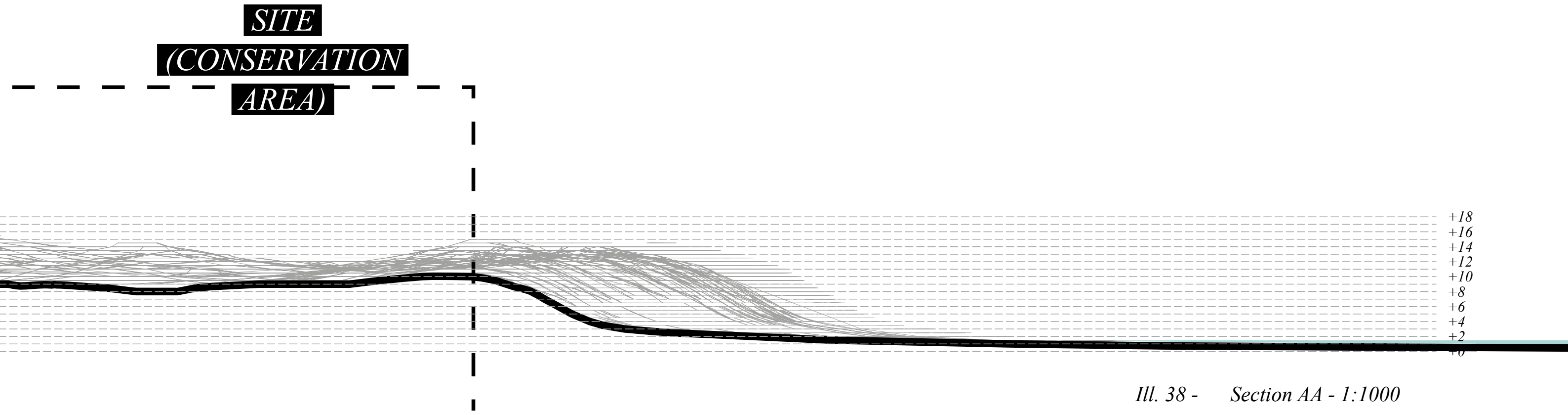
The area surrounding the plot has been flattened to build the hotel. The harsh windy weather is displayed in the hilly landscape surrounding the hotel. The terrain varies from sea level to seventeen meters above sea level - where the hotel is placed at eight meters above sea level. The dunes limit the view to the sea, which can only be seen in the distance from the second floor of the hotel. As the closest dunes are smaller and the biggest is nine meters higher than the current hotel, they will not shade the sun.

The topography is created by the wind and will shield the site from some of the intense western winds. The hotel has dunes an all for sides, but the northern dunes a distanced by a large parking area and the main road. The dunes can strategically be used to shelter the building(s) and the parking area. Drifting from the dunes will be limited as the landscape is covered by grass and heaths.

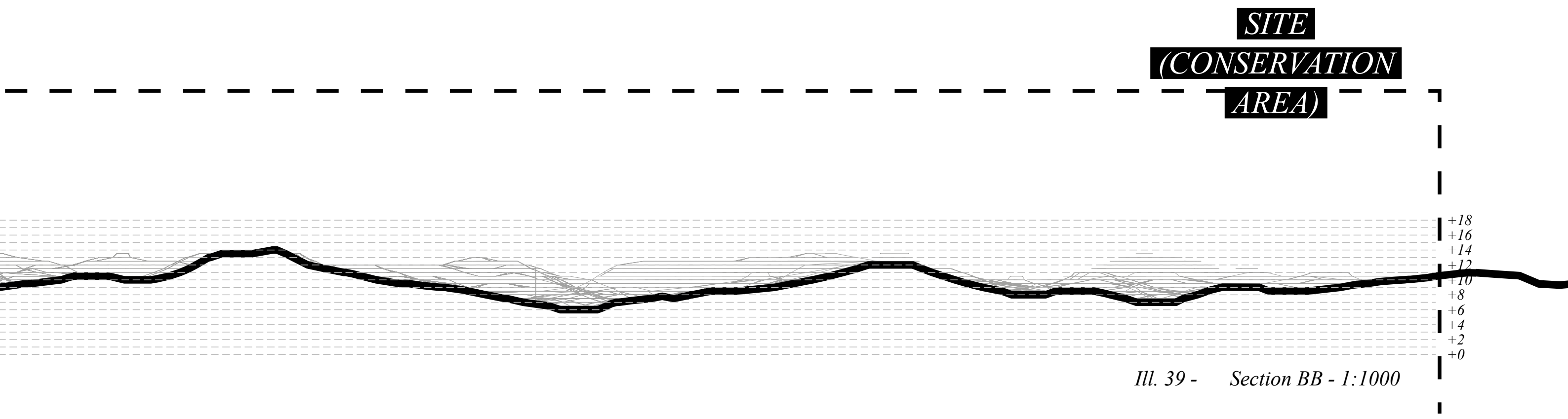








Ill. 38 - Section AA - 1:1000



Ill. 39 - Section BB - 1:1000

FRAMEWORK

CURRENT CONDITION

The hotel has been expanded several times - but not modernised in several years. The hotel has changed appearance throughout the years. At the time of the opening of the in1927, it had a deep-red wood cladding, with white windows and a thatched roof. The hotel later had a renovation, where the whole building was cladded with grey asbestos plates and an asbestos roof. However, the old wooden cladding remains under the new 'skin'. The hotel today is 2.400 square meters and has 31 rooms, with two in original condition from 1926.

The hotel today seems dilapidated with a neglected facade and an old roof. The building has been expanded to including three wings today. The building lacks coherency, and the three wings stand as three separate structures. The facade facing the road and the facade facing the beach are cladded with the grey asbestos. The courtyard is cladded with grey wood, while the wing facing the town is constructed in light-grey bricks.

The landscape around the hotel has been flattened and covered with concrete. The hotel no longer has any relation to nature or the natural environment surrounding it - other than being placed right in the middle of it.

Ill. 40 - Current Front Entrance

Ill. 41 - Current West Facade

Ill. 42 - Current North+East Facade

Ill. 43 - Current Hotel from the dunes

Ill. 44 - Current West Facade

Ill. 45 - Current South Facade

FRAMEWORK

SURROUNDINGS

All the houses surrounding the hotel along the main road are black. The house across for the hotel is a single story black and white house, with a black timber cladding and roof combined with white windows and fascia boards. The two-story house east of the hotel is also black and white but with a red tiled roof - the only non-dark roof in the area. The house again is cladded with black timber board with white windows and fascia boards. The house is built into the dunes, with a fabricated dune in front - a project by the locals to bring the dunes into the town, creating 'the town between the dunes'. Further east is a café located. In contrast to the houses and holiday homes in black, has this commercial building a plastered masonry structure in beige and white, again with a black roof. Across from this is the most modern building in the area. The house is timber cladded in black with a black roof. This home introduces a warm brown timber for doors and windows. The other surrounding structures in the dunes also have dark or black roofs, mostly thatched roofs, roof tiles or roofing felt. These houses are in various materials and colours, mainly timber cladding, masonry and plastered masonry, spanning from red to blue to black.

The town centre has the same diversity in materials and colours, focusing on bright and colourful materials, leaving the black and dark colours to houses and holiday homes.

The surrounding structures favour timber cladding and dark roofs in the form of thatched roofs, roof tiles or roofing felt. The buildings are often built into the dunes with only the roof visible. The colours of the houses vary, with many of the adjacent structures being cladded with black timber. The theme is natural materials and a close relationship with the surrounding nature. The building that achieves this the least is the hotel as it is today.

Ill. 46 - Surroundings

Ill. 47 - Thatched Roof

FRAMEWORK

NATURAL QUALITIES

In Constant Movement

Most of the West Coast is under constant change. In most places, the natural dynamics do not cause us, humans, any problems, but building close to the West Coast and in the dunes near the coast can create many problems. The Danish coast is eroding due to wind and waves - and due to occasional storm floods with extreme sea levels. The erosion is a completely natural processes and is not forced by climate changes, but with rising sea levels and more extreme winds and rainfall, the erosion will increase. (Sørensen, 2012) Along the West Coast, there are certain areas of erosion, while other areas of deposition (advancement of the coast). The profile-change of the coast can vary from deposition to very little erosion of 0,1 to 0 meters and up to more than 1 meter per year. The West Coast has the most extensive erosion pressure in Denmark with many places of more than 1 meter erosion per year.

The Erosion Atlas (Sørensen, 2017) shows deposition of the coast around Vejers. This makes it more viable to build into the dunes and closer to the coast in this area of the West Coast compared to the rest, where the coastline can move inland by several meters per year.

The natural landscape of Vejers primarily consists of sand. The dunes that make up most of the coastal area is a natural result of drifting sand. The dunes protect the area behind them from flooding. The shape and sizes of the dune landscape are defined by wind direction and strength, and the amount of available mobile sand. (Kystdirektoratet, 2017) The dune landscapes create a unique experience and improves the beaches' aesthetic value while lowering the risk of erosion.

Fauna and Flora

The soil consists predominantly of lean fly sand, sometimes mixed peat. Along the coast, there are gravel and rocky beach ridges, and there has previously been digging for gravel in Vejers. (Naturstyrelsen, n.d.) The coastal areas both north and south of Vejers Strand are part of a unique landscape, as a partially wooden dune belt. The characteristic of this area is the long rows of north-facing dunes, which form a hilly terrain, and thus differ from the more even landscape behind with extensive heath and plantation areas. The site has few trees, but very hilly terrain. The immediate proximity to the North Sea with the wind and water

Ill. 48 - White Dunes

Ill. 49 - Green Dunes

Ill. 50 - Heaths

impacts that prevail in the outer front zone towards the sea also characterises the landscape. Heath, wetlands and plantations characterise the underlying areas on the inland dunes.

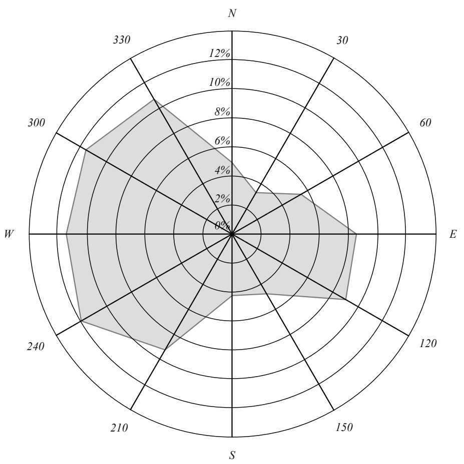
Dunes can be divided into moving dunes and stabilised ones. The front dunes are most prone to moving because they are closest to the sea and exposed to erosion. Dune-plants, however, will start growing and stop the sand from moving - stabilising the dunes. The vegetation of the dunes can vary a lot and can be divided into; The white dune, the green dune and the grey dune. (Damgaard, Nygaard and Nielsen, 2008) The dunes on the site are mostly stabilised, only leaving parts of the front dunes with no vegetation. These outermost dunes are the white dunes. These are white from loose sand and only have spots of vegetation, mostly lyme grass and European marram. When the white dunes become overgrown and stabilised, the dune will become greener and lusher, allowing various grasses and flowering plants to grow. The majority of the landscape behind the first row on the site are green or brown dunes with healthy vegetation of grasses, plants, flowers and moss. The moss is evergreen, leaving the moss both green and brown all year round. The grey dunes are the next step from the green and brown dunes. The grey dunes are washed out for most nutrients and are very vulnerable to wear - e.g. beach guests' movement. (Damgaard, Nygaard and Nielsen, 2008) The dunes on the site are lush and healthy and have not reached the grey state, making the area usable and available to the public.

Light

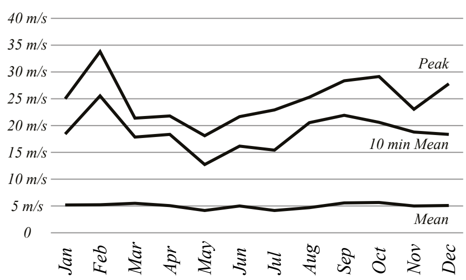
Light is a great part of the West Coast experience. Like many places on the West Coast, Vejers has an open landscape with few trees along the coast. The daylight can reach most areas of the coast, creating a peculiar quality of light. The proximity to the sea and the hilly topography creates a unique experience of daylight, with the sea reflecting the sun and the topography displaying a play between light and shadow. The great natural environment with sandy and green surfaces influence the lighting condition, leaving an ever-changing experience for the people who visit.

FRAMEWORK

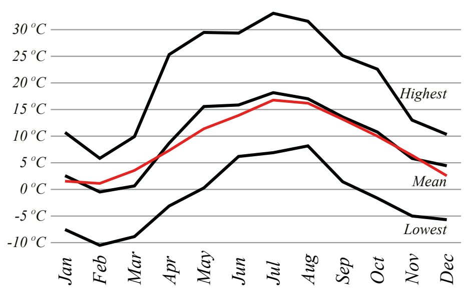
MICRO CLIMATE



Ill. 51 - Wind Direction at Blåvandshuk



Ill. 52 - Wind speed in Varde (2018)



Ill. 53 - Temperature of Varde (2018)
(2006-2015)

Wind Direction

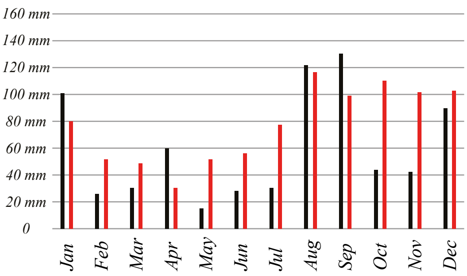
Wind has a significant impact on the West Coast in general. The strong winds alter the landscape at any time, leaving an ever-changing landscape in constant movement. The continuous change is visible in the moving dunes. This unpredictability and wild scenery is a great attraction. The measurements are taken at Blåvandshuk Fyr, 10 kilometres from Vejers. The main wind directions are west, north-west and south-west. (Cappelen and Jørgensen, 1999) The front dune line will direct a large part of the wind upwards, and the dunes, in general, can help to shade from the wind by carefully placing the structures between them.

Wind Speed

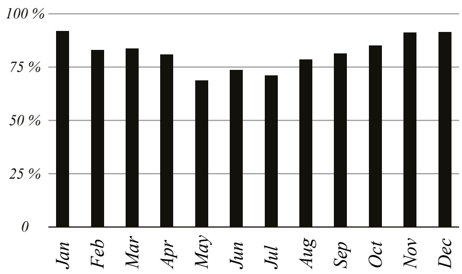
The strongest winds in Denmark are present during the winter, where the winds also are colder. The west coast is one of the windiest places in Denmark. The measurements from Blåvandshuk are taken 20 meters above sea level with no obstacles. They show a mean wind velocity of 7,2 m/s and a peak velocity of 27,3 m/s. The high wind speeds have a significant impact on the environment and the way locals and tourists will interact with nature. The wind speeds will be affected by the dunes and the vegetation on them. (Cappelen and Jørgensen, 1999) The measurements are from 1999 and can have changed since then. Climate change will increase the number of strong winds and wind strength. The diagram above displays the wind speed in 2018 for the entire municipality of Varde.

Temperature

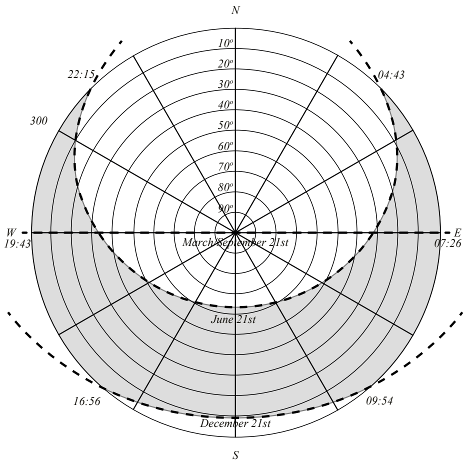
Denmark is warmer than many other places on the same latitude. This is due to the warm North Atlantic current, making the Danish coasts warmer than inland. (DMI, 2019) The air temperature is also more stable near the sea, as the coast will have close to the same temperature as the sea, whereas the temperature will vary more inland. The temperature is a mean temperature for the whole Municipality of Varde. The proximity to the sea means that wind speed, wind direction and water temperature will have a significant impact on the temperature of Vejers Strand. The mean temperature for the last eight years has been around 9 Co, with peak temperatures around 30 Co and lowest temperatures between -8 Co and -20 Co. The average temperature between 2006 and 2015 was 1,4 Co in February and 17 Co in July. (DMI Vejrarkiv, 2019)



Ill. 54 - Precipitation of Varde (2018)
(2006-2015)



Ill. 55 - Humidity of Varde (2018)



Ill. 56 - Daylight in Vejers

Precipitation

The precipitation levels between 2006 and 2015 were highest in August with 117 mm. July had 'just' 78 mm, making the two busiest months very different. The autumn generally has precipitation, with the more dry months being between February and June. June, July and August only had around 80 mm rainfall in 2015 and 2017, while in July 2016 had 100 mm and August in 2018 had 122 mm. (DMI Vejrarkiv, 2019) This displays a volatile weather situation, making it hard to presume future conditions.

Humidity

The humidity levels vary between 75-90%. The highest levels of moisture occur during the winter and lowest around spring. The levels can get close to 100% in the winter and close to 30% during spring. (DMI Vejrarkiv, 2019) Humidity levels are indicating the probability of precipitation, dew and fog. The humidity levels will change the human perception of temperature, with high temperatures being perceived warmer with a high humidity level.

Daylight

Situated in the Northern hemisphere mean that winter and summer are very different in Denmark. The days are very short during the winter and very long in the summer. The shortest day is around 6 hours while the longest is longer than 17 hours. This is due to the angle of the incoming sun and therefore the distance to the sun. The angle differs between around 9 degrees on the 22nd of December at noon to approximately 55 degrees on the 21st of June at the same time of day. The coastal areal of Denmark generally have more sun hours than inland. Vejers had around 1750 hours in 2016, 1550 hours in 2017 and 1950 hours 2018. (DMI Vejrarkiv, 2019) The times displayed above are the actual times for sunrise and sunset in Vejers.

FRAMEWORK

FORMAL DEMANDS

Importance of Vejers

Vejers has long been a popular tourist destination and an attractive area to own a holiday home. Unique nature surrounds the area, and the locals and the municipality has a strong focus on the natural environment - using nature as the driver of tourism in the small town. The natural aspects must be considered and should be protected to avoid detriments in the original landscape and wildlife. The community has the vision to become 'the town between the dunes' and appreciate the hilly and natural landscape of the area. While the town is the epitome of nature, it also survives on the tourists visiting the town every year. It requires a sustainable and holistic approach to develop the area with both the ecological aspect and tourism in focus.

Preservation / Conservation area

"About 5% of Denmark's land area has been protected over the last approximately 100 years. The creation of conservation areas is carried out to secure valuable landscapes and natural and cultural history areas, and to ensure the population's access to the areas." (Miljøstyrelsen, n.d.)

When an area becomes a conservation area, you usually cannot construct new buildings in the area. In cases where a building is already erected, you can on occasion get permission to either renovate or build a new house within the outer boundary of the current building.

The plot is located in a conservation area, protected by the Nature Protection Act that included both coastal protection and preservation of dunes. According to the Nature Conservation Act, the shoreline and dunes along the North Sea are protected at a distance of 300 m from the base of the first line of dunes. The state of Denmark has approved rebuilding the current hotel within the plot, with the limitations stated earlier. The flattening of the topography of the plot has allowed for a larger building area. The conservation area south of the plot has not yet been approved for constructing buildings. It is generally forbidden to intervene in and on areas that are covered by the dune-conservation line. Exceptions are only granted in very special cases. (Kystdirektoratet, 2019)

The conservation area is part of the Natura 2000-areas. In Denmark, there are 252 different sites. The Natura 2000 sites consist of habitat areas and bird protection areas - including ramsar areas. Each area is designated to protect certain species and habitats that are rare, endangered or characteristic of EU countries. (Miljøstyrelsen Natura 2000, n.d.)

The Natura 2000 site that the conservation area is part of is a large plantation and forest area of 11.636 HA. (MiljøGIS, 2016) Other areas of the West Coast are protected by Natura 2000 law due to dunes with specific vegetation and wildlife, while this site is protected due to the animals and vegetation in the plantation and forest areas - and not the dunes in the proposed project area. (Miljøstyrelsen, 2012)

As mentioned earlier, has the area been home for small huts (Esehytter) between the dunes. These huts were primitive and were designed to blend in with nature, having either a thatched roof or a roof with vegetation. A special focus on how to create an exceptional experience in the unique landscape, while protecting the natural environment could make a dispensation possible. Traditional building techniques and natural materials combined with modern environmental and sustainable knowledge could inspire how to build in a conservation area, allowing for close interaction with nature, while protecting it - leaving the least possible impact on the area or even reinforcing the state of it.

FRAMEWORK

CASE STUDIES

Wadden Sea Centre

Architect:	Dorte Mandrup
Location:	Ribe, Denmark
Type:	Visitor Centre
Area:	2.800 m^2
Constructed:	2017

The Wadden Sea Centre is placed on the West Coast of Denmark and is the visitor centre for the marshlands. The centre is structured as a courtyard with both detached and interconnected buildings in different sizes.

The modernised visitor centre refers back to the longhouses of the region with thatched roofs and following the flat landscape. The building takes the traditional thatched roof further than before and lets the roof become one with the facade — the thatched roofs and facades interplay with facades of wood. The wood is treated to look aged, and the brown and grey wooden lamellas are reminiscent of rural wooden buildings like farmhouses or barns.

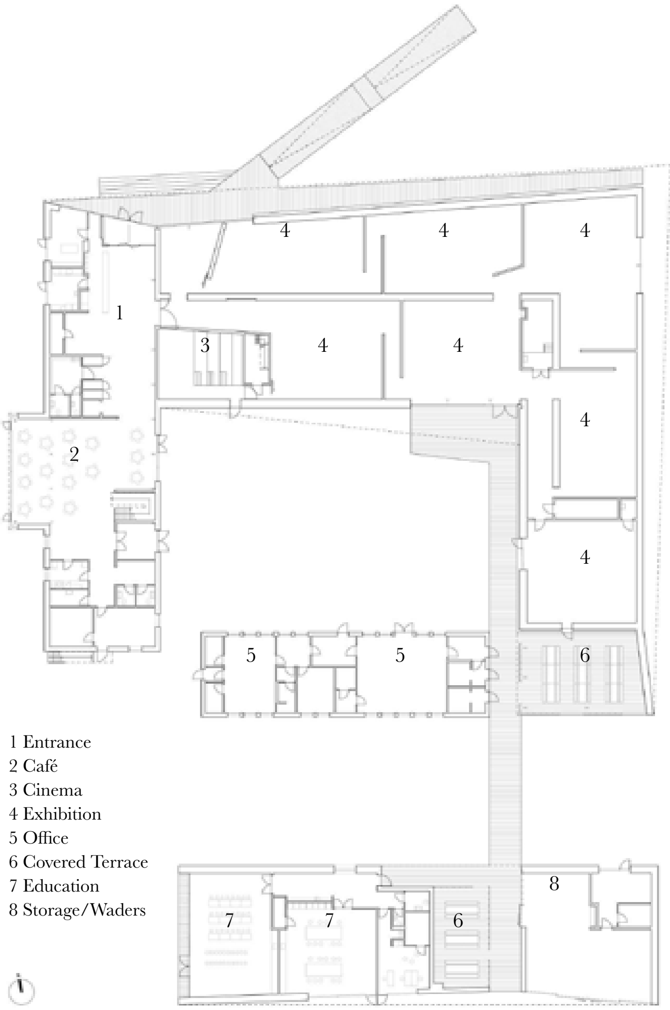
The material choice refers to the natural scenery, regional materials and traditional craftsmanship of the Wadden Sea. The building displays the tactile and visual qualities of traditional crafts and materials of the region, where visitors can touch and feel the materials up close. The centre will, through time, be a display of robustness and environmentally friendly materials.

The visitor centre is almost one with nature. The inclining thatched facade moving from the landscape ending in the peak of the structure creates a strong connection to the surrounding landscape, while the long flat structures mirror the flatness of the landscape. The inclining facade, combined with the rural material choice, creates a visual concept of a structure growing from the landscape. The colours of the reeds mirror the green, yellow and brown landscape almost becoming one with the surroundings.

Inspired by the marsh farms of the region, the rectangular courtyard is shielded from all sides, but most importantly from the westerly winds. The interior stands in contrast to the more rough exterior, with a subtle feel. With large white surfaces and subtle use of natural light, the interior keeps a strong connection with the natural environment and creates a calm space shield from the harsh environment. The structure consists of exhibition facilities as well as teaching and activity rooms, workshops and laboratories. The new building encloses the preserved school building and appears as originally with water-washed white walls and red tile roof.

The visitor centre is inspired by the surroundings and local building tradition, demonstrating an understanding of landscape, materials and light. The modern interpretation of the farmhouse is here a more abstract where the natural and local materials balance the abstract with the traditional and regional. The strict choices of natural materials give a clear and simple visual appearance. The project displays a great understanding of abstraction, materials and history with a balance between abstraction and tactility.

Ill. 57 - Wadden Sea Centre - Courtyard



Ill. 58 - Wadden Sea Centre - Floorplan - 1:2000

Ill. 59 - Wadden Sea Centre - Detail

Ill. 60 - Daylight in Vejers

Nationalparkcenter Thy

Architect:	Loop Architects
Location:	Nørre Vorupør, Denmark
Type:	Visitor Centre
Area:	700 m^2
Constructed:	2019-

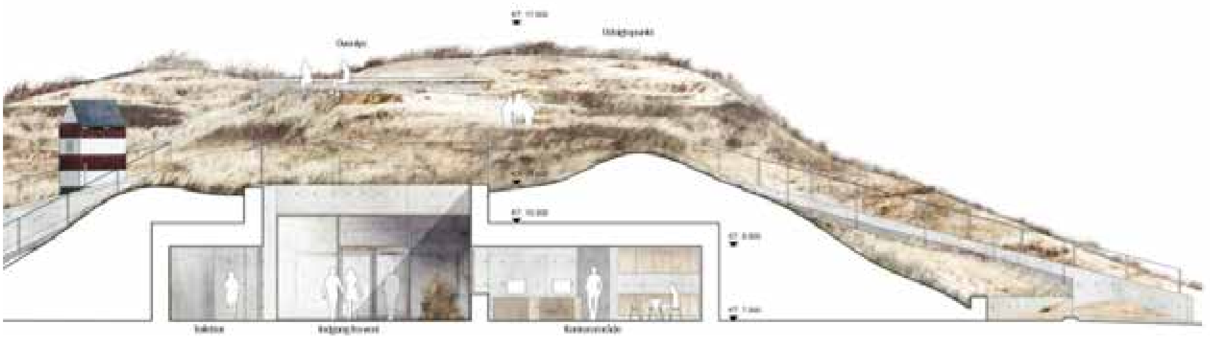
Nationalparkcenter Thy is going to be a visitor centre in Nr. Vorupør on the West Coast of Denmark. The centre is closely connected to the national park as it is built into the dunes, offering a sheltered space under the sandy landscape. Hidden away in the dunes, the visitor centre blends into the national park. The subtle expression leaves the landscape in focus, which becomes a building material.

The visitor centre is drawn with only a few different materials - all natural. When building on the West Coast of Denmark, the structure has to be robust, and the materials must be able to withstand the harsh wind and weather conditions. The building is constructed by concrete elements of integrally casted walls and floors to ensure the longest possible life in the very harsh environment. The light grey concrete blends well with the sandy dunes on the exterior, where the grass in various colours softens the 'cold' expression of concrete. On the interior, the concrete is combined with natural bright wood for exhibition elements and window frames, bringing 'warmth' to the spaces. The natural light plays an important role to keep the indoor spaces well lit, so the many concrete walls, floor and ceiling surfaces appears bright - contrary to dark and cold.

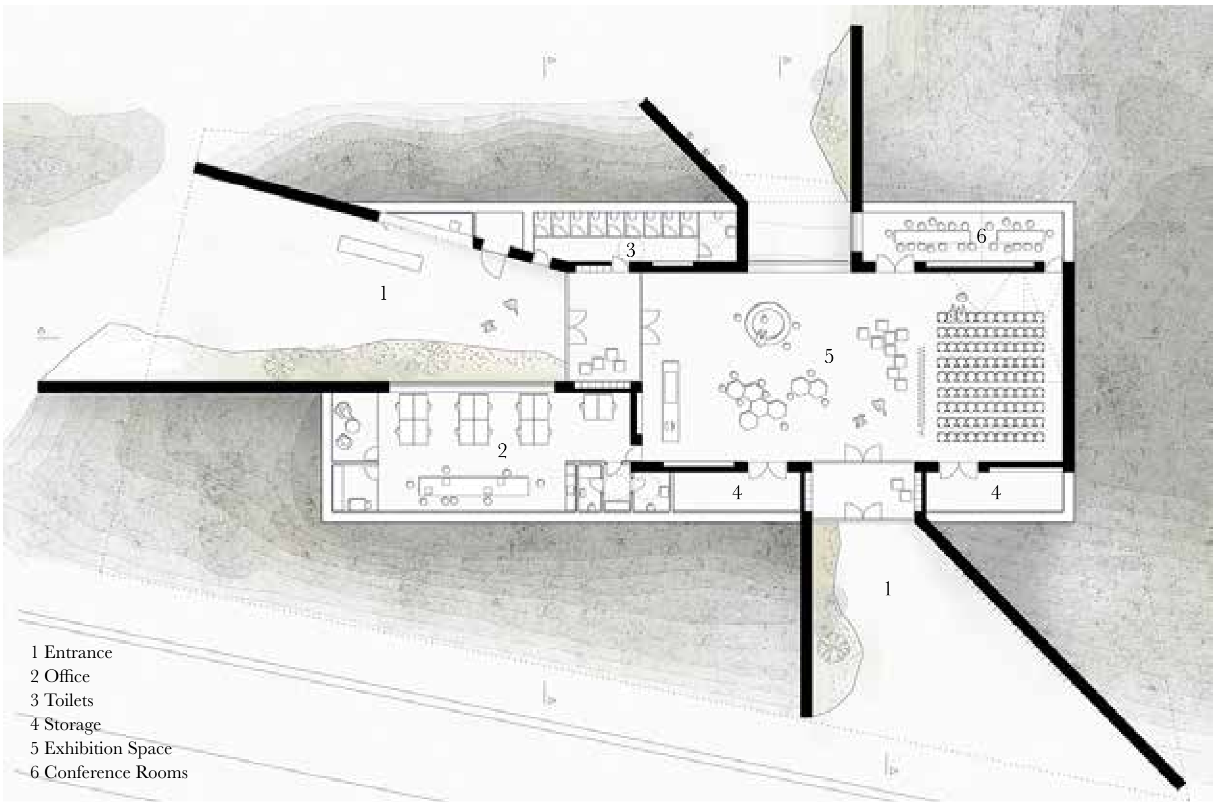
The structure has four openings, with two entrances, a window and a skylight. The skylight provides a large amount of natural light and creates a connection to the sky. The entrances are deep and are narrowing in, inviting visitors to enter the centre. The window connects the main space to the surroundings, framing the national park. The building has a simple rectangular plan with the three entrances leading to the main exhibition space. An ample office space, toilets, conference rooms and storages are surrounding the main space, creating a simple, yet functional plan.

All four openings are inviting visitors into sheltered space while bringing them into nature. The structure is relatively small and with large openings. The building then displays the surrounding landscape, while passerby is drawn to look through the building, finding the sea, the town or the park. The roof becomes an active surface, where visitors walk in the dunes and admire the national park. The structure is simple and robust - both in materials and appearance. The integration into the dune landscape seems successful, and the concrete walls in the openings create a connection between town and landscaping - scaling from urban to the natural environment.

Ill. 61 - Nationalparkcenter Thy - View From the Sea



Ill. 62 - Nationalparkcenter Thy - Section



Ill. 63 - Nationalparkcenter Thy - Plan

Knudepunktet

Architect:	Transform
Location:	Knebel, Denmark
Type:	Community Centre
Area:	2.000 m^2
Constructed:	2018-

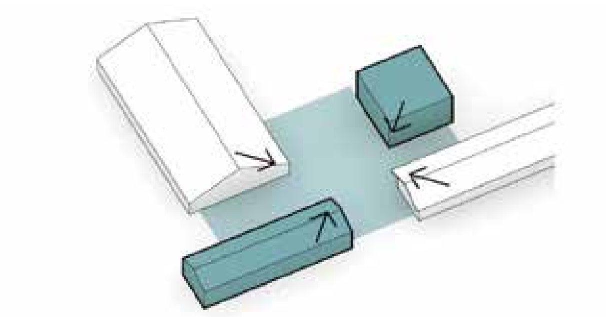
Knudepunktet, 'the junction' or 'the hub', is a community centre on the east coast of Jutland, Denmark. The hub houses various functions for young as well as elderly residents - everyone is welcome across age, interests and social divisions. The idea is to create a space where people meet and interact through a wide selection of functions.

The centre is a hub between the existing local school 'Molsskolen' and the local sports hall 'Molshallen'. The two are placed on the edge of town and landscape, and the transition between the flat land and the hilly national park 'Molsbjerge'. The concept of the hub is to connect the two existing structures with new functions attracting the whole community.

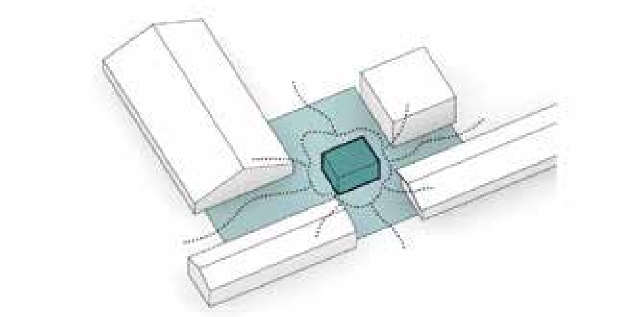
Three new buildings accompany the existing structures. Two are placed so that they together with the existing forms a square. Space between all four buildings leaves the hub open to the north, south, east and west. With various functions towards all sides - forecourt to the north, playground to the east, sports fields to the south and the school and the main street to the west - the hub becomes the central heart of all functions and flowlines throughout the area. The two new structures contain a 'children's house' and a multipurpose hall that together with the existing school and sports hall creates a strong composition that arises from new and existing - all with their qualities and moods. The 'food house', a café, is placed at the centre of the hub. The restaurant attracts people who not necessarily have any relation to the surrounding functions, while also being a central space for meeting people from the other buildings. The café or central kitchen can serve larger conferences, the school, and passersby looking for a meal - but it can also act as a communal kitchen for the town.

Food is a great way to connect people, and by placing the kitchen at the centre of the hub, the dining area becomes the meeting space of the town - which makes it essential for the kitchen to be flexible and open. The kitchen is primarily constructed in wood with exposed joints, combined with durable materials where needed - such as flooring and countertops. The space seems open and bright and has entrances from all directions, while the kitchen space itself has entrances facing both north and south. The dining hall extends to outdoor dining areas, expanding the food hall on occasion. The large food hall that surrounds the kitchen is part café, part dining hall and part activity space - a flexible space for everyone. The many unprogrammed square meters allows for various activities when it is not used for dining.

Ill. 64 - Knudepunktet - Kitchen



Ill. 65 - Knudepunktet - A Collective House



Ill. 66 - Knudepunktet - A Vibrant House

Ill. 67 - Knudepunktet - Ground Floor

Juvet Landscape Hotel

Architect:	Jensen & Skodvin
Location:	Valldal, Norway
Type:	Accommodation
Area:	210 m^2 + 80 m^2
Constructed:	2008

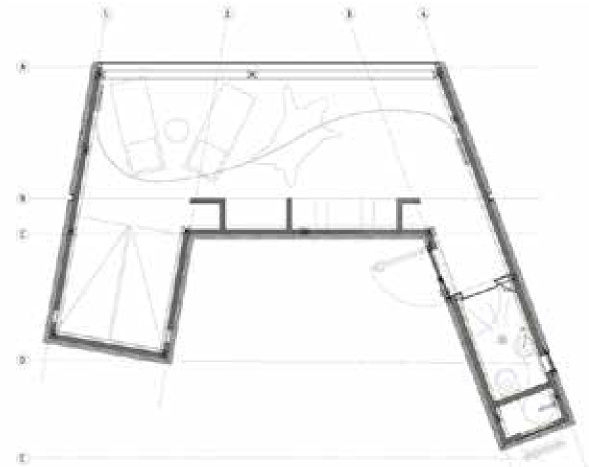
Juvet Landscape Hotel is located at Valldal in north-western Norway and is known as the first 'landscape hotel' in Europe. The idea is to create the opportunity to exploit breathtaking scenery with minimal intervention with the natural environment - allowing locations which would otherwise be prohibited due to conservation.

In contrary to conventional hotels, with guest rooms stacked together in a single building, the landscape hotel distributes each room as a detached small independent house with one, or sometimes two of the walls constructed of glass, thus minimising the boundary between the indoor and the outdoor - bringing the natural surroundings into the bedroom. No rooms face each other, leaving a view of unspoilt nature and ensuring a private experience for the guests - without the need for curtains. This is possible in this area with no other visitors or tourists but can be difficult in more busy areas. The large window facade and the careful orientation of the rooms to an exclusive view of a unique piece of the landscape, allows the guests to experience the surroundings, always changing with the season, the weather, and the time of day. The rooms have slightly different designs, as a result of topography and vegetation, and to meet a requirement of privacy while framing the best possible views.

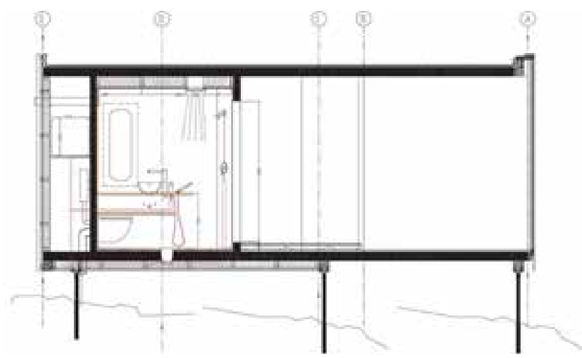
The rooms, or cabins, are built in massive wood construction with no exterior insulation and are intended for summer use. The individual structures are lifted off the ground on steel rods drilled into the rocks, leaving existing topography and vegetation left almost untouched. The exterior is cladded with vertical pine panels, treated with iron vitriol, which creates a chemical process on the surface of the wood that resembles ageing; the wood turns grey faster — the vertical cladding blends with the surroundings, mirroring the verticality of the trees. The spacing of the lamellas creates a varied expression of different nuances, resembling nature. The interiors are treated with transparent oil with black pigments, to minimise reflections from the inner surface of the glass wall. (Jensen & Skodvin, n.d.) The visual presence of the interior is simple, with only a few materials. The massive wooden elements of the construction are reused for shelves, benches and small tables - maybe from the cutouts for the windows?

The simple and homogeneous interior plays well with the complex exterior, allowing the guests to focus on nature. The unique plans for every room results in slightly odd shapes, which gives a charming impression - almost like the floorplan happened naturally. In Norway, where the ground is rock, these unique floorplans ensure that there is no need for altering the topography. Elevating the structures on poles is another way of thinking sustainably. Most focus exclusively on reduced energy consumption in production and operation - conservation of the topography is another aspect of sustainability. A good example of Design for Disassembly, where the whole structure can be taken down after its service life, leaving no mark that it was ever there. Conserving the site is a way to respect the fact that nature precedes and succeeds man.

Ill. 68 - Juvet Landscape Hotel -



Ill. 69 - Juvet Landscape Hotel -



Ill. 70 - Juvet Landscape Hotel -

Ill. 71 - Juvet Landscape Hotel -

FRAMEWORK

TARGET GROUP

Ill. 72 - Locals

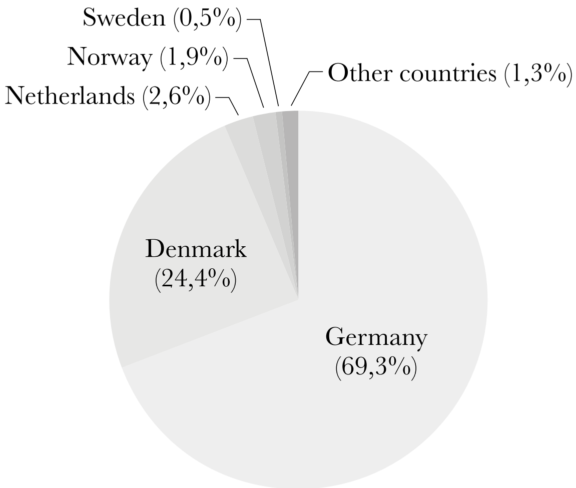
Ill. 73 - Tourists

The natural environment is the essential aspect of Vejers - for the locals and the tourists. The landscape is in constant movement and ever-changing. The play between light and shadow, the sound of the sea, the unique vegetation and the hilly topography all adds up to a unique experience. The area is close to the beach and is surrounded by nature, where one can go on hikes or bike rides, look for red deer or join in some of the activities held by the community. The local community and the full-time residents care a lot for the environment and the nature in their town. They focus their vision around nature, and the activities and festivals they arrange are based on interacting with nature.

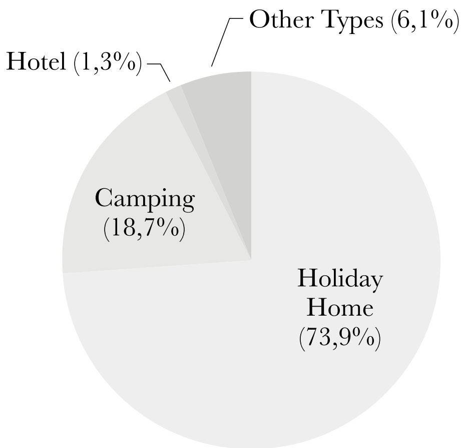
Potential for Tourists

Many tourists from Denmark, Germany and the Nordic countries already holiday along the West Coast of Denmark - most due to the proximity to the beach and the focus on the natural environment. Many holiday homes are already situated between the dunes, allowing the visitors or residents to experience the local nature up close. The buildings are often built several decades ago, with more focus on being close to the beach, than the surrounding elements. Many buildings blend in well with nature - while others do the opposite. The homes often lack a sense of place when building in wild nature. Many have chosen to flatten the plot, leaving a permanent mark in nature, while others have chosen inorganic materials. The current hotel is a great example of this - having done both. When driving through the town, you end by the western sea and the beach, but the last structure you see is the hotel. A building cladded with dilapidated asbestos plates on as flattened site surfaced with concrete.

The joint development plan for the West Coast and the local community both have a wish to extend the tourist season and to increase daily consumption from tourists. The development plan points out the importance of creating differentiated accommodation options, with more focus on couples, short versus long holidays and niche products attracting costumers with higher consumption. Many holiday homes often have a low daily consumption compared to other accommodation types. A hotel or functions similar to a hotel, such as serviced rooms, the possibility of half board or full board, wellness/sauna, high quality of service and high quality of accommodation will attract these target



Ill. 74 - Commercial Tourists in Varde



Ill. 75 - Accommodation in Varde

groups. A hotel attracts customers with higher daily consumption. They often require a higher standard of quality than the current hotel and many holiday homes. A regular hotel would most likely only attract tourists in the summertime, like today. Combining accommodation with the possibility of having conferences will attract businesses all year round, and including wellness would extend the season for families and couples, allowing visitors to experience the Danish nature all year round. The concept of individual serviced rooms allows for shorter holidays and attracts more couples. However, merely rebuilding the seaside hotel will only attract more of the same and add very little value to the community.

Potential for a Community Centre

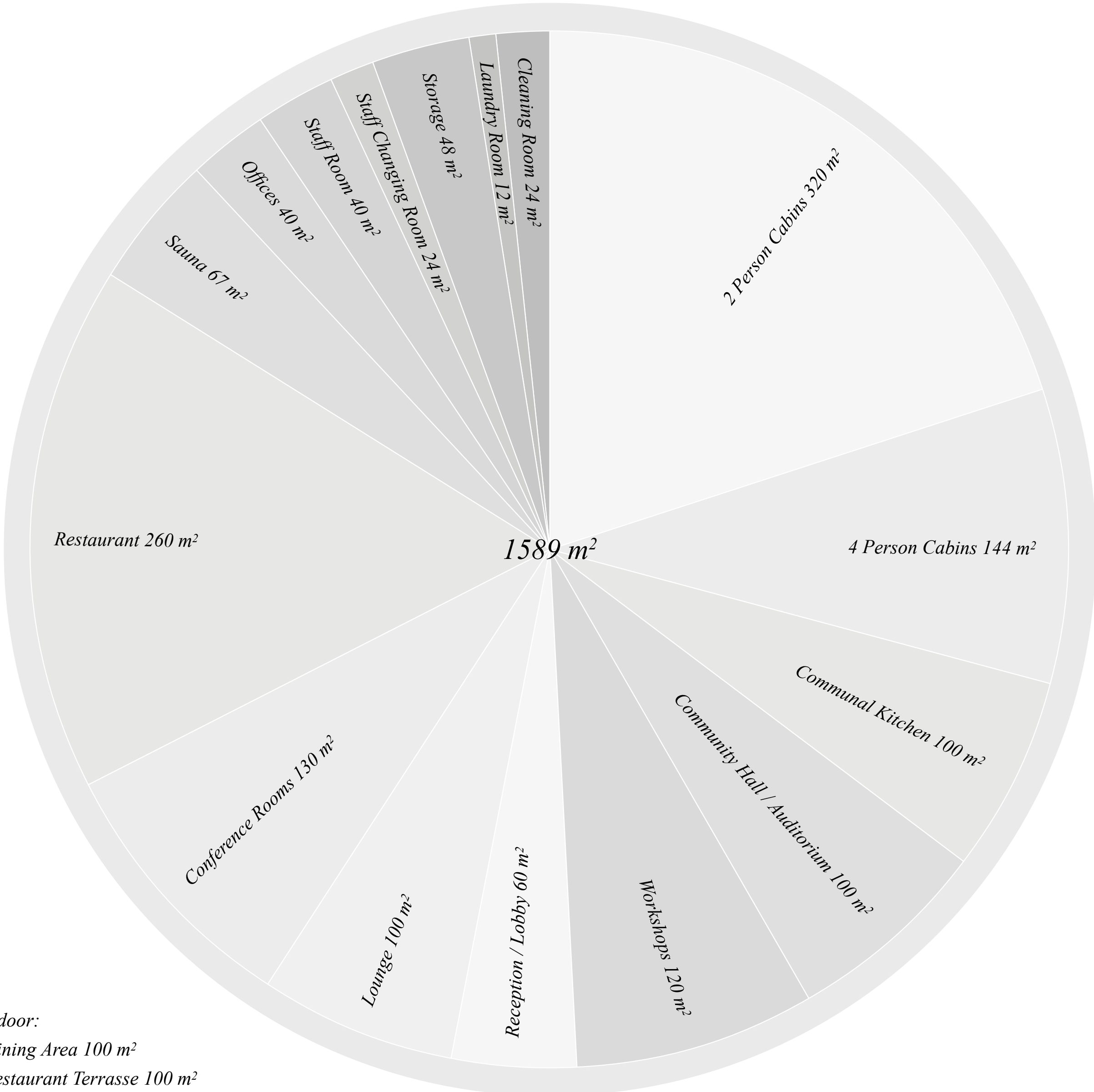
The community is the most important driver for the activities and local development of the town - and therefore has a significant impact on how the tourists will experience Vejers. A new building in this protected area, close to the beach, must, therefore, give something back to the community. When the hotel closed, the local community lost its community house and its place for social gatherings. The hotel has been gathering place for decades, where associations, regulars and locals have held parties such as christenings, weddings and birthdays. The paved areas around the hotel have been used for the many festivals and activities arranged by the local community. By combining community functions with accommodation, the new structure will attract both locals and tourists. By focusing mostly on the local community and building a community centre with accommodation, the tourist will get a unique experience of being part of the community and join the everyday life of the locals. The close relation to nature must be in focus. The community centre must respect the surroundings and the natural environment. It is an investigation of how to create a unique experience in nature. The materials should be natural and relate to nature. The structure(s) should leave the least impact on the environment as possible. The centre could then be a driver for a sustainable approach to tourism, driving people and profit to the area. Still protecting and strengthen the natural environment. It would be a part of the community and be the gathering place of the town, where a synergy between tourists and residents creates a knowledge sharing of activities, local qualities and history.

FRAMEWORK

SPATIAL PROGRAMME

To create a place for tourism, we first and foremost have to create a place for locals. The spatial programme favours the local community with a new gathering place in town. By focusing on the residents and the local life, we lay the foundation for tourism - a place where tourists can become a part of the local life. The common functions include a communal kitchen, community hall/auditorium, workshop areas, lobby/ exhibition areas, lounge and conference rooms. Tourists can overnight in cabins, contrary to traditional hotel rooms. A cleaning room, a laundry room and storage rooms are necessary to operate the cabins. As today, a commercial restaurant will offer the taste Vejers with local, regional food. The operation of the restaurant and the cabins can be combined with the communal areas to take advantage of spaces such as the conference rooms and the auditorium when possible.

The sauna is not included in the design, but can possibly extend the tourist season through the winter months. The outdoor areas must be flexible to allow for local initiatives of different sizes and purpose.



Outdoor:
Dining Area 100 m²
Restaurant Terrasse 100 m²
Flexible Area 1000 m²
Parking 953 m²
2153 m²

Ill. 76 - Spatial Programme

	Quantity	Unit Area	Total Area	Room Height	Capacity
TWO PERSON CABINS	**16**				
Bedroom/Livingroom	1	16 m²	16 m²	2,8 m	2
Bathroom	1	4 m²	4 m²	2,8 m	1
			320 m²		
FOUR PERSON CABINS	**4**				
Livingroom	1	12 m²	12 m²	2,8 m	4
Bedroom	2	10 m²	20 m²	2,8 m	2
Bathroom	1	4 m²	4 m²	2,8 m	1
			144 m²		
COMMUNAL FUNCTIONS					
Communal Kitchen	1	100 m²	100 m²	3,5 m	20
Community Hall / Auditorium	1	100 m²	100 m²	3,5 m	75
Workshops	2	60 m²	120 m²	3,5 m	20
Reception/Lobby	1	60 m²	60 m²	3,5 m	6
Lounge	1	100 m²	100 m²	3,5 m	25
Conference Room	1	80 m²	80 m²	2,8 m	50
Conference Room	2	25 m²	50 m²	2,8 m	10
Restaurant	1	200 m²	200 m²	3,5 m	100
Kitchen	1	60 m²	60 m²	3,5 m	10
			870 m²		
SAUNA					
Sauna	1	30 m²	30 m²	2,8 m	10
Changing Room	2	15 m²	30 m²	2,8 m	5
Toilet	2	4 m²	7 m²	2,8 m	1
			67 m²		
STAFF FACILITIES					
Offices	4	10 m²	40 m²	2,8 m	2
Staff room	1	40 m²	40 m²	2,8 m	15
Staff Changing Room	2	12 m²	24 m²	2,8 m	5
Storage	4	12 m²	48 m²	2,8 m	1
Laundry Room	1	12 m²	12 m²	2,8 m	1
Cleaning Room	4	6 m²	24 m²	2,8 m	1
			188 m²		
			1589 m²		
OUTDOOR FACILITIES					
Dining Area	1	100 m²	100 m²		
Restaurant Terrasse	1	100 m²	100 m²		
Unprogrammed Area	1	1000 m²	1000 m²		
Parking	32	30 m²	953 m²		
			2153 m²		

Natural Light	***Dayligt Factor***	***Visitor Access***	***Outdoor Access***	***Architectural Quality***	***Ventilation Type***
✓	*3%*	✓	✓	*Raw materials, natural, bringing nature in*	***Natural (N)***
		✓		*Compact, light, easy-to-clean, wet-room*	***Mechanical (M)***
✓	*3%*	✓	✓	*Raw materials, natural, bringing nature in*	***Natural (N)***
✓	*3%*	✓		*Raw materials, natural, bringing nature in*	***Natural (N)***
		✓		*Compact, light, easy-to-clean, wet-room*	***Mechanical (M)***
✓	*3%*	✓	✓	*Open, easy-to-clean, accessible*	***Mechanical (M)***
✓	*3%*	✓	✓	*Open, flexible, accessible*	***N + M***
✓	*3%*	✓		*Flexible, accessible, tear-resistant materials*	***N + M***
✓	*3%*	✓	✓	*Raw materials, light, open*	***N + M***
✓	*3%*	✓		*Intimate, 'warm materials'*	***N + M***
✓	*3%*	✓		*Light, view to sea*	***N + M***
✓	*3%*	✓		*Light, view to sea*	***N + M***
✓	*3%*	✓	✓	*Light, flexible, functionable*	***N + M***
	3%			*Functionable, easy-to-clean*	***Mechanical (M)***
✓		✓	✓	*Intimate, 'warm materials',*	***N + M***
		✓		*Compact, light, easy-to-clean, wet-room*	***Mechanical (M)***
		✓		*Compact, light, easy-to-clean, wet-room*	***Mechanical (M)***
✓	*3%*			*Light, flexible*	***N + M***
✓	*3%*			*Light, flexible*	***N + M***
	3%			*Compact, light, easy-to-clean, wet-room*	***Mechanical (M)***
				Compact, easy-to-clean	***Mechanical (M)***
				Compact, light, easy-to-clean	***Mechanical (M)***
				Compact, easy-to-clean	***Mechanical (M)***

FRAMEWORK

VISION

Create a community centre, where travellers can stay and experience the local culture, community and natural environment - a central meeting point for locals where they can display the local qualities for tourists. Community and nature are fundamental aspects of the design, with the protection of the environment and local life in focus. The community centre must reinforce the local initiatives and create the foundation for growth through extending the holiday season.

Ill. 77 - Dunes of Vejers

FRAMEWORK

DESIGN PARAMETERS

LINKING SURFACES

Linking surfaces, where the structure(s) must be publicly accessible from all directions.

Unprogrammed square-meters will give the project a character similar to public spaces.

A lobby as an in-between space serving both guests and non-guests.

Extraordinary spaces for ordinary activities.

MULTI-SENSORY EXPERIENCES

Investigating the distinctive qualities of materials and composition thereof to define how spaces should be perceived.

Defining the visual, acoustic, tactile, taste and olfaction qualities for the individual spaces.

The sensual experience must create a synergy, where the sensual impacts work together to form the overall experience.

SYNERGY BETWEEN LOCAL RESIDENTS & TOURISTS

Positive interference - mixing tourism and non-tourism programmes.

Appeal to both tourists and locals.

Community centre + Accommodation - knowledge sharing between locals and visitors.

Gathering place - a foundation for tourist and residents to interact.

Activities for and by locals - The tourists relate not only to the place but to the social relations that the visit has created.

AUTHENTIC & UNIQUE EXPERIENCES

Authenticity - local foods, local materials, local history.

Include tourists in local life - combining traditional hotel functions with local activities.

Unique natural attractions or authentic local experiences.

Restore historic structures.

Creating pathways in nature to make the unique environment accessible to everyone.

CONTRASTS & NATURE

Strengthening the atmosphere perceived in the individual spaces, by working with contrasts of these spaces and combining spaces with different atmospheric qualities.

Integrating the natural surroundings and minimising the boundaries between the inside and the outside, by activating all senses with natural elements when defining the atmospheric qualities - taking advantage of untouched nature, uncontrolled local vegetation and proximity to the sea.

DESIGN FOR DISASSEMBLY

Elevate structures in sensitive areas to leave a minimal impact on the natural environment.

Mechanical joints for easy disassembly and reuse of materials.

Simple yet effective construction methods.

Prefabrication for limiting construction-work and construction-time on site and thereby limiting the impact from construction-workers, lorries and so on.

HISTORY & ACCOMMODATION

Use history to create a relation to the place - reestablish fishing huts as an attraction, function or accommodation, using dunes as a design element, and reinventing the entrance to the coast and beach.

Unique & flexible accommodation - shorter holidays, couple-holidays and quality.

Hotel functions, to attract customers with higher daily consumption than holiday homes.

Extend the tourist season - hotel rooms in and around nature, focusing on displaying how the Danish seasons change during a year and activities such as a sauna.

SUSTAINABLE MATERIALS & REUSE

Life Cycle Assessments (LCA) of the relevant materials and compare life expectancies of the materials to the LCA.

Use local materials for minimal environmental impact (extraction, transportation and manufacturing).

Use natural materials as raw as possible and limit the use of paint, glue and non-removable fasteners to allow for reuse of the materials.

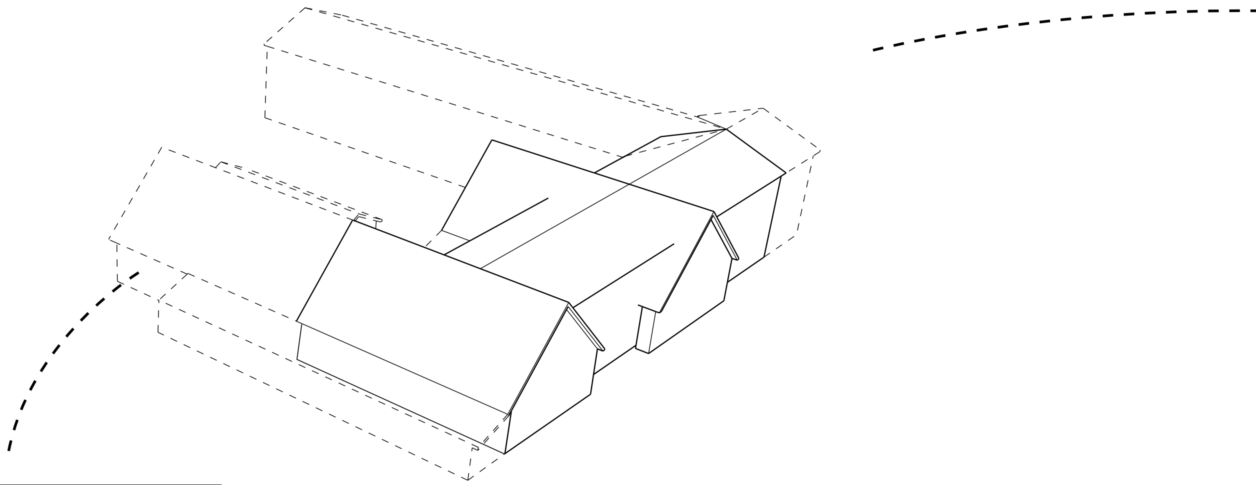
Reuse elements of the consisting structure to minimise environmental impact on extracting, manufacturing, and transporting new materials.

PRESENTATION

PRESENTATION

CONCEPT

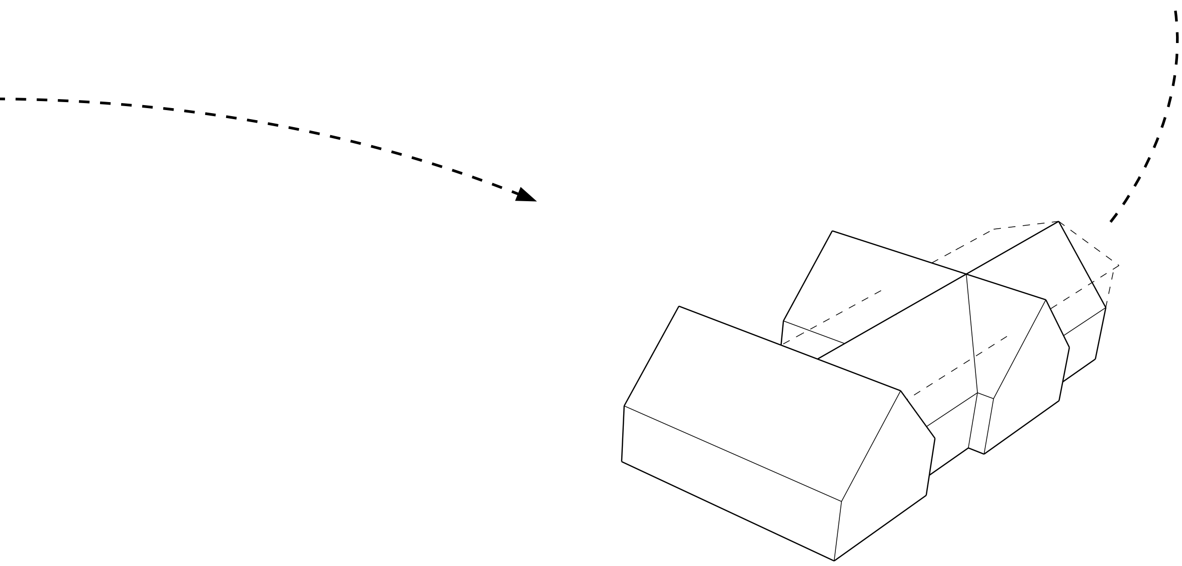
THE NORTHERN WING THAT
BEARS A POOR RESEMBLANCE
TO THE ORIGINAL HOTEL IS
RENOVATED



THE TWO SOUTHERN WINGS
ARE DEMOLISHED AS THE
WHOLE STRUCTURE LACKS
COHERENCY AND AS THEY
ARE IN A POOR STATE

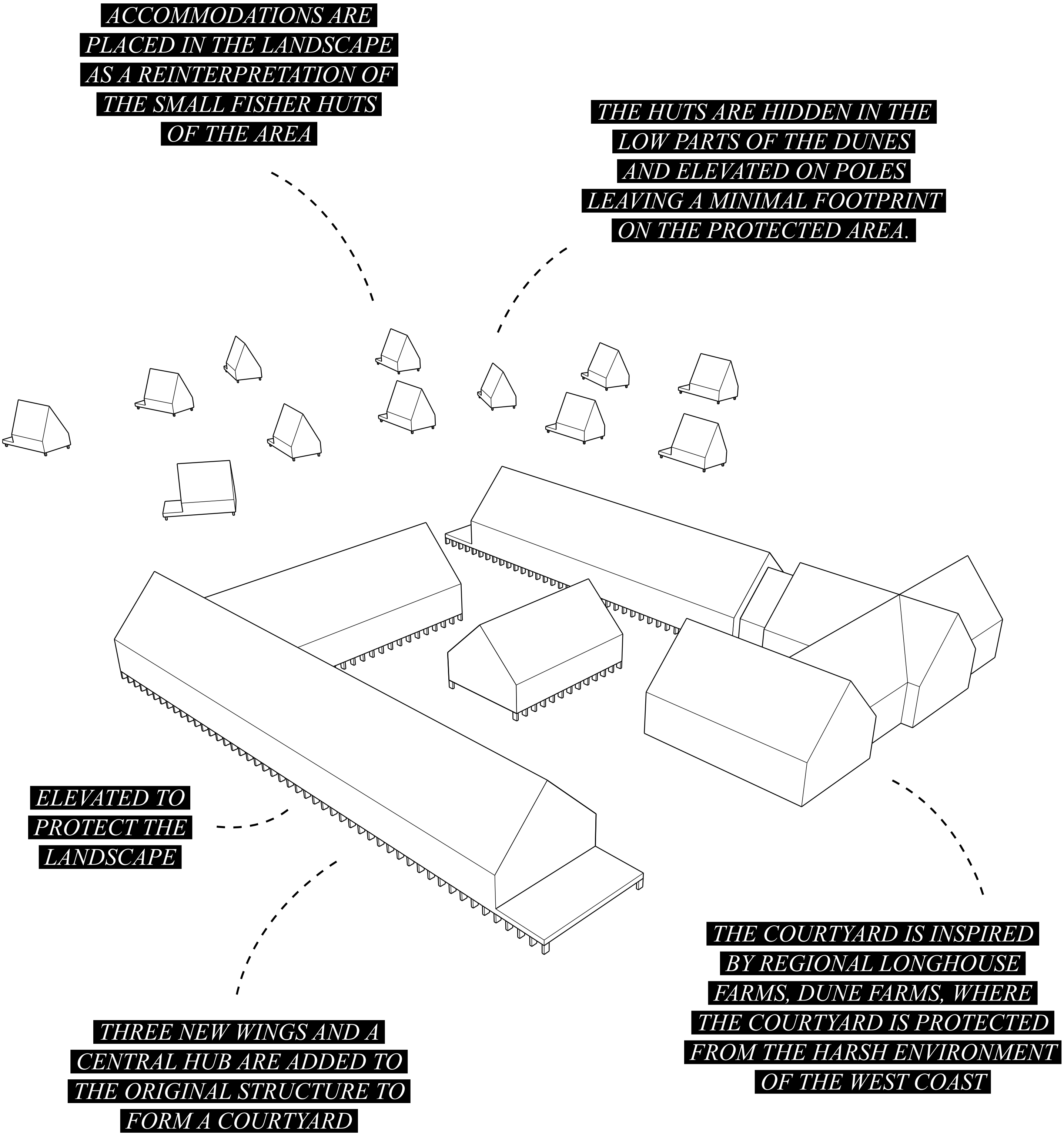
Ill. 78 - Concept 01 - Current Building

THE EXPANDED ROOF IS
CONVERTED INTO THE
ORIGINAL PITCHED ROOF

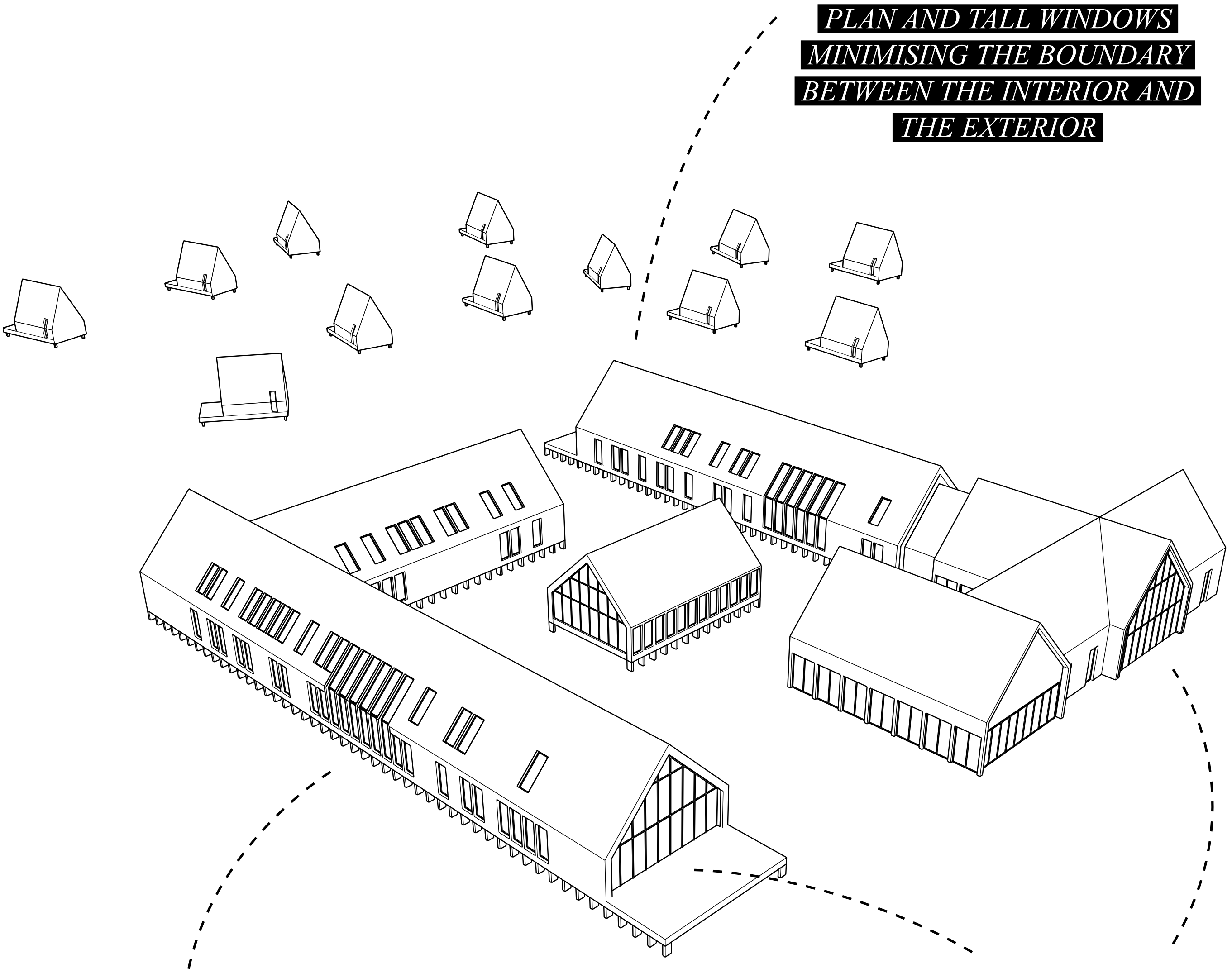


A REINTERPRETATION OF THE
ORIGINAL SEASIDE HOTEL WILL
HELP PRESERVE THE HISTORY
OF THE PLACE WHILE CREATING
A LINK BETWEEN THE NEW AND
THE OLD

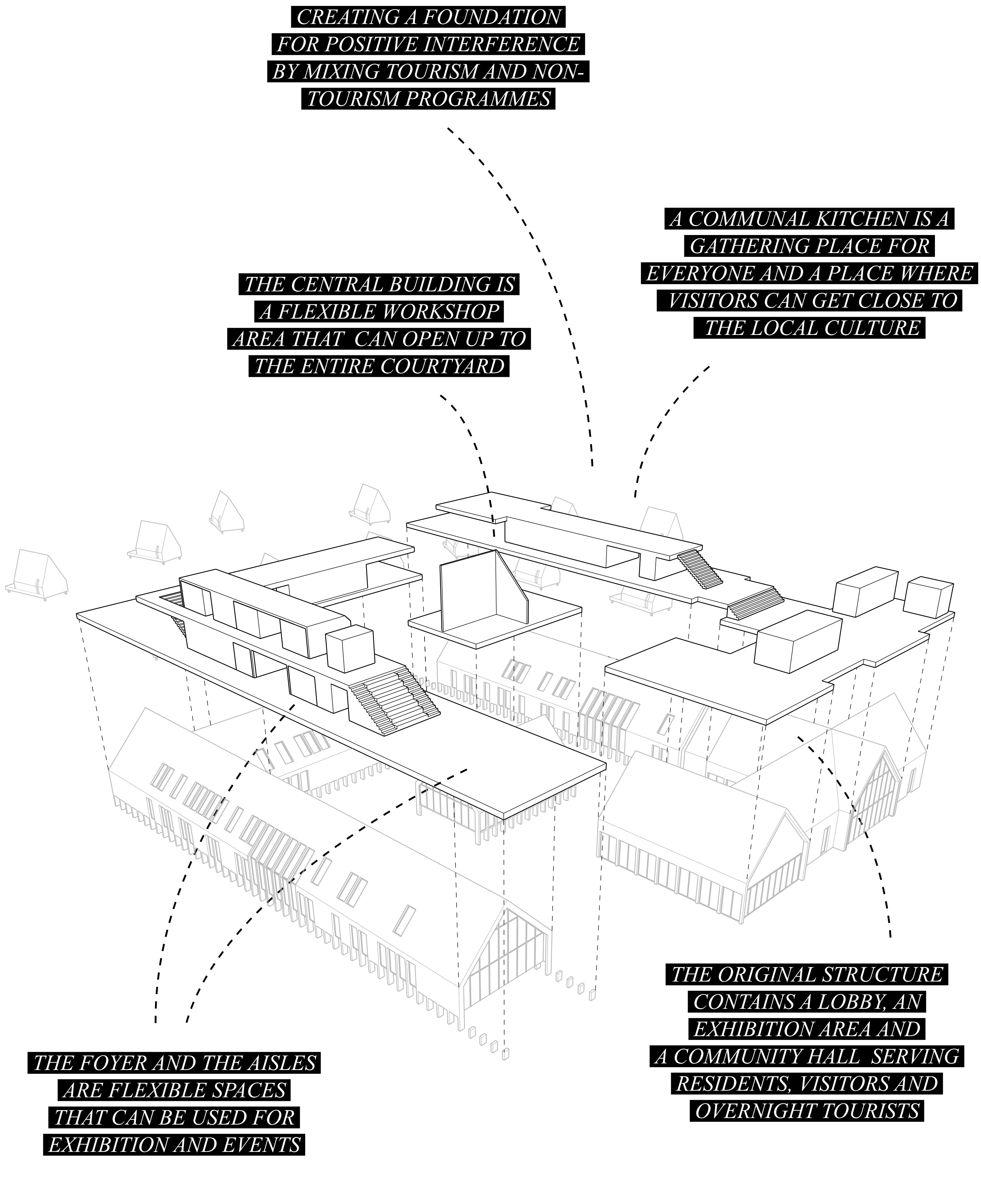
Ill. 79 - Concept 02 - Renovated Original Building



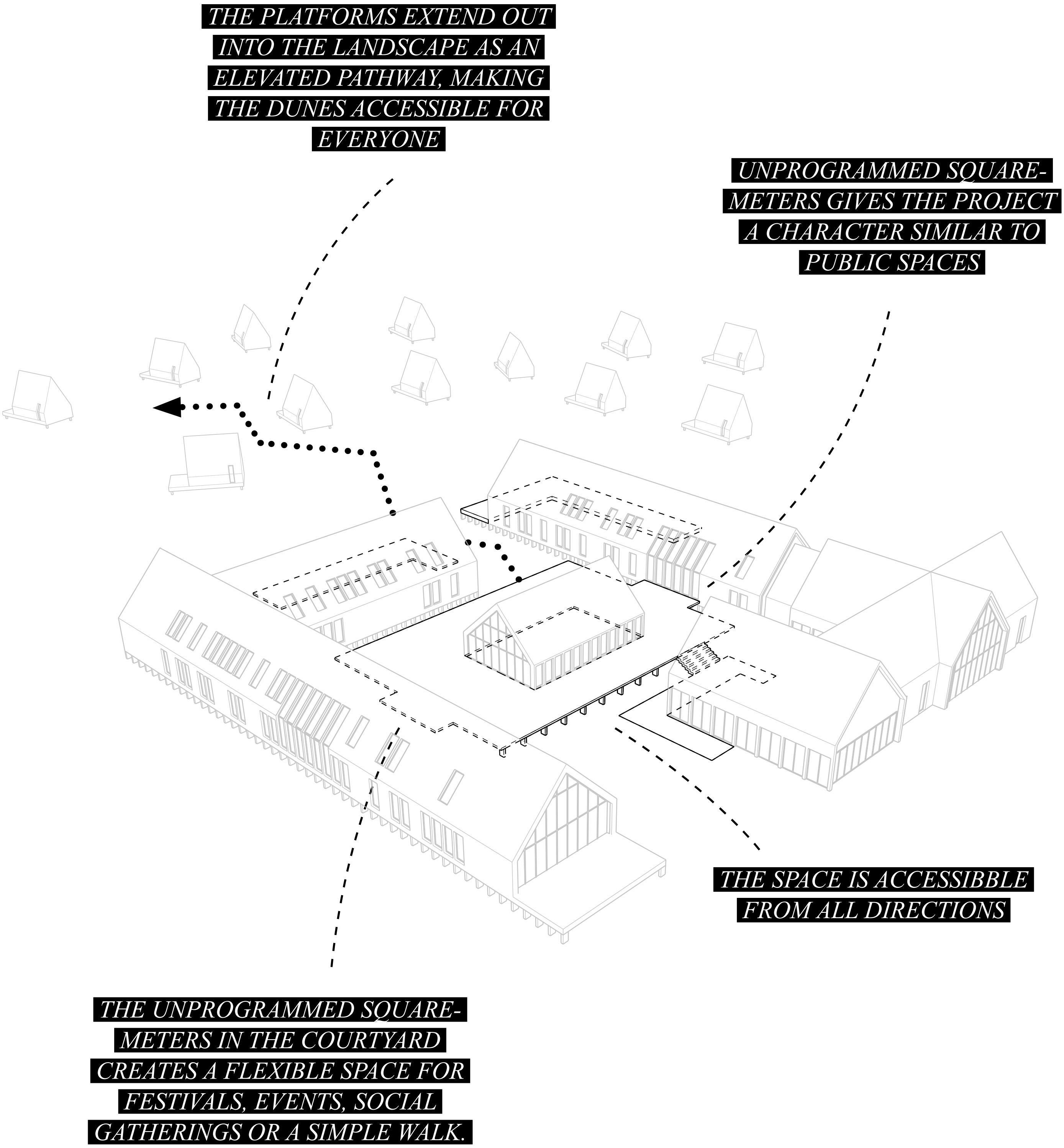
Ill. 80 - Concept 03 - New Elevated Structures



Ill. 81 - Concept 04 - Integrating the Natural Enviroment



Ill. 82 - Concept 05 - Indoor Linking Surfaces

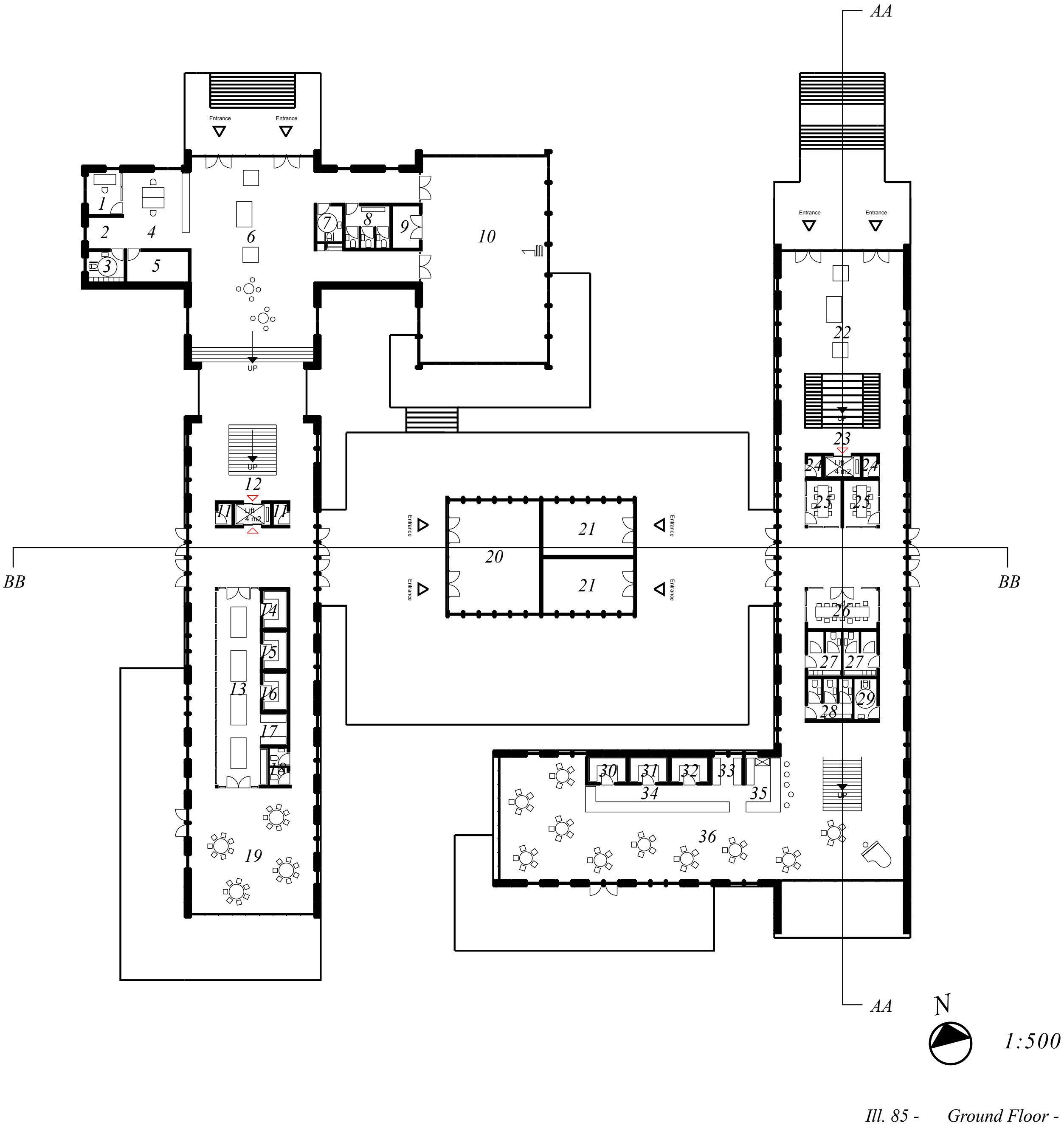


Ill. 83 - Concept 06 - Outdoor Linking Surfaces

Ill. 84 - Masterplan - 1:1000

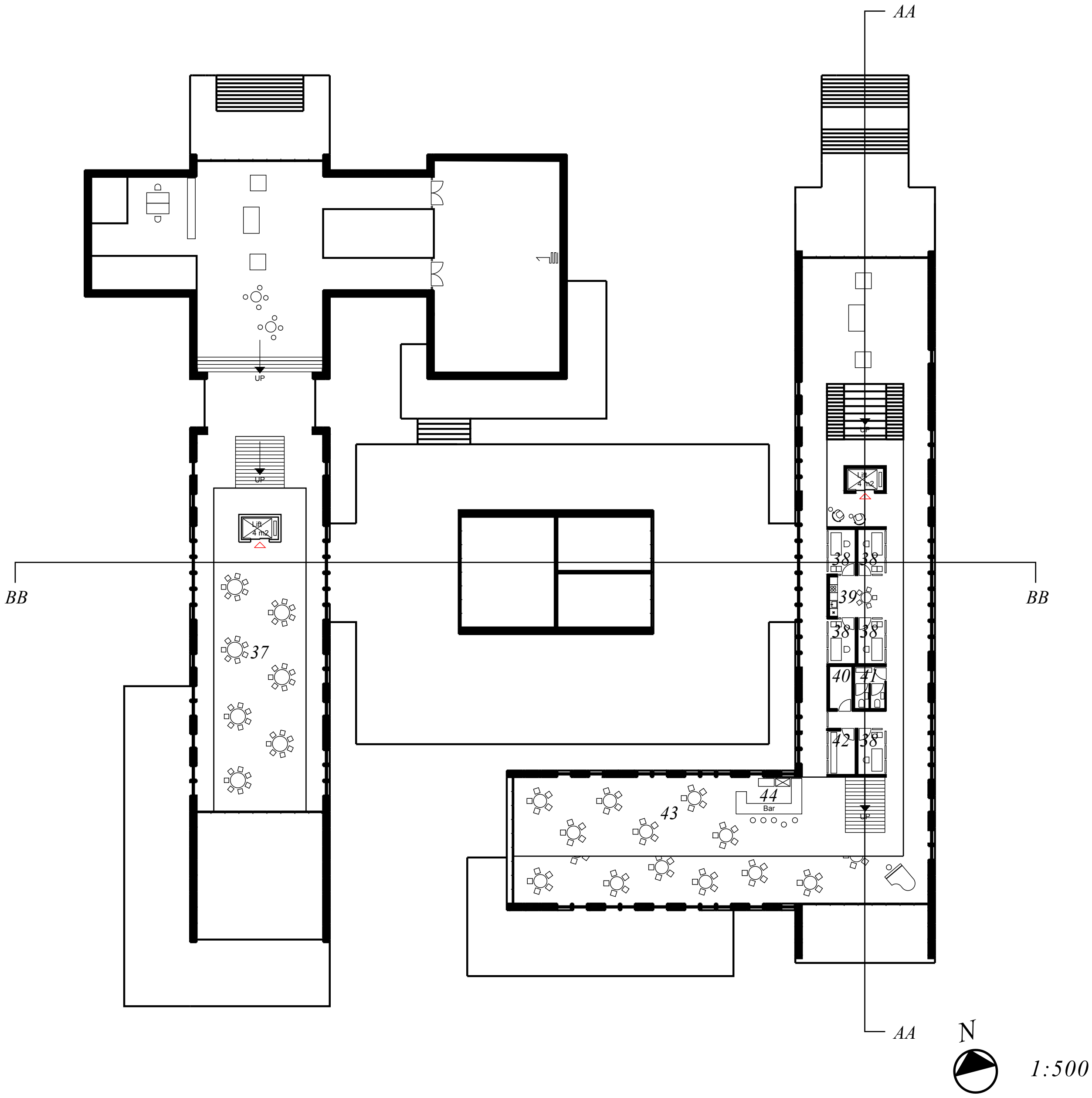
PRESENTATION

PLANS



Ill. 85 - Ground Floor - 1:500

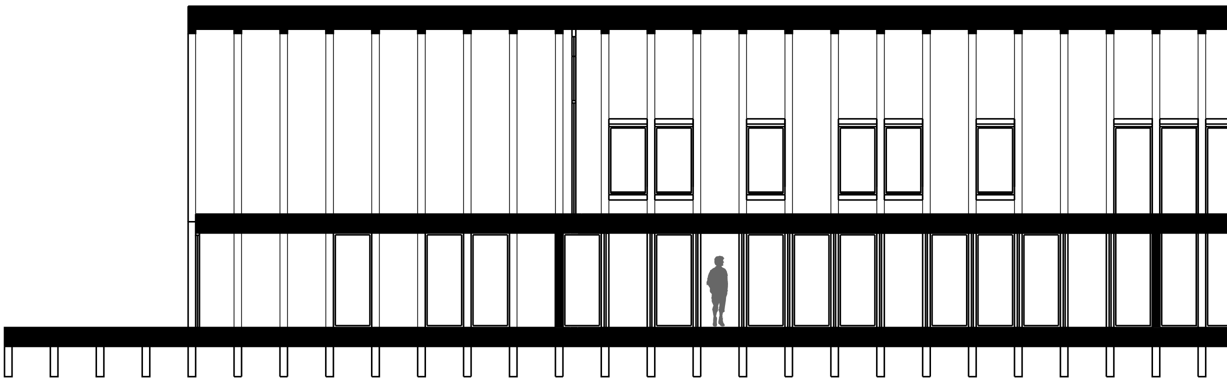
1: Office
2: Print
3: Employee Toilet
4: Reception
5: Storage
6: Lounge / Exhibition
7: Toilet for Dissabled
8: Toilets
9: Storage
10: Community Hall
11: Storage
12: Lift
13: Communal Kitchen
14: Freezer
15: Fridge
16: Dry Storage
17: Dishwasher
18: Toilets
19: Dining Area
20: Workshop / Activity Space
21: Workshop / Activity Space
22: Lobby / Exhibition
23: Lift
24: Storage
25: Conference Room
26: Conference Room
27: Staff Changing
28: Toilets
29: Toilets for Dissabled
30: Freezer
31: Fridge
32: Dry Storage
33: Dishwasher
34: Open Kitchen
35: Bar
36: Restaurant - Ground Floor
37: Dining Area
38: Office
39: Employee Dining Area
40: Storage
41: Employee Toilet
42: Laundry Room
43: Restaurant - First Floor
44: Bar

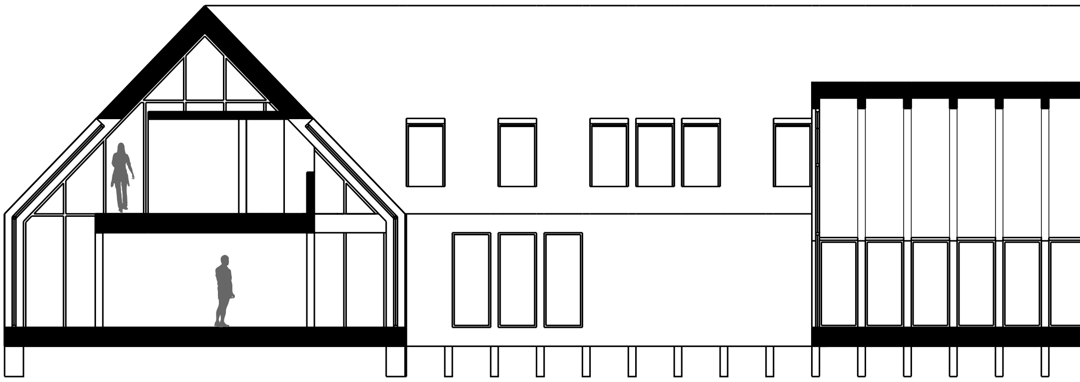


Ill. 86 - First Floor - 1:500

PRESENTATION

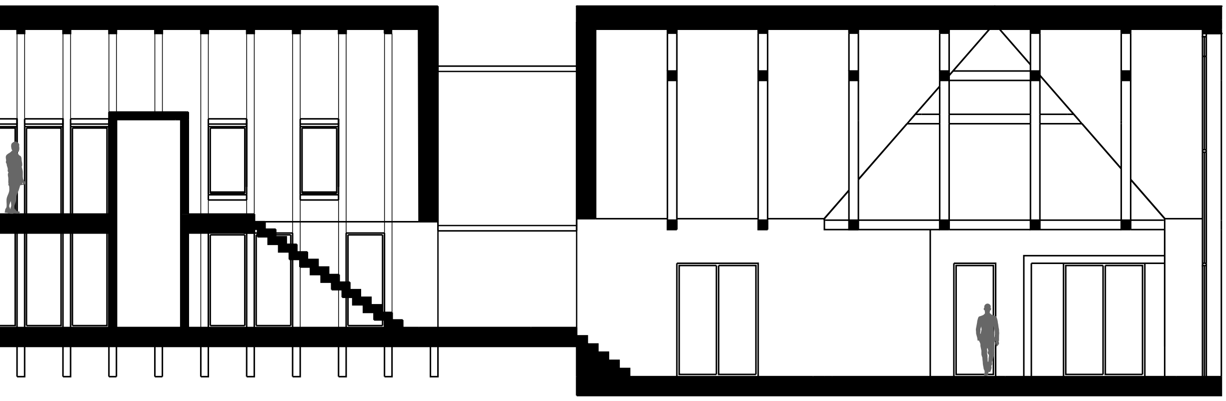
SECTIONS



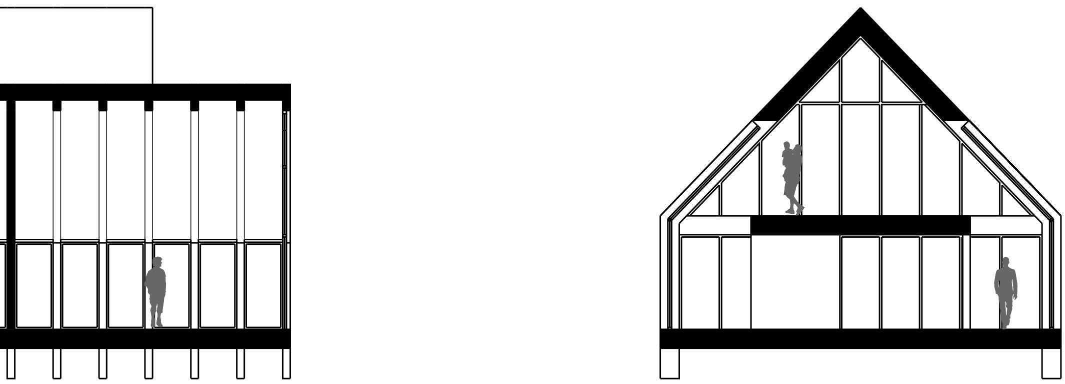


The sections show the building's relation to the landscape. The original building is set at contour 7,5 m the upper floor. The new buildings are elevated above the terrain to protect the landscape - the upper floor level for the new structures is at contour 8,8 m which is a height difference of 1300 mm as seen on section AA. The restored hotel is hollowed out and displays the original structure. The space is nine meters at its tallest point. The windows are three meters tall to complement the vast space. The taller windows and the full gable curtain wall gives the space a monumental impression.

Section BB displays the open spaces of the new buildings. The ground floor and the first floor are one space with the enclosed room at the centre for the structure. The western wing is open on both sides, making it easy to interact between the floors. The eastern corridore has the offices and requires more daylight. The offices are moved to the western side of the first floor, creating a lively east side with room for exhibitions and information about the area on both levels.



Ill. 87 - Section AA - 1:200



Ill. 88 - Section BB - 1:200

PRESENTATION

EXTERIOR MATERIALS

The renovated building and the new buildings are visually differentiated to emphasise the restored historic building. The former seaside hotel was at the opening cladded with a deep red timber and a thatched roof. Ignoring the current grey asbestos on facades and roof, we look back towards the original expression. The facades will once again be covered with wood - this time locally-grown Larch. The colour changes from deep red to black to complement the surrounding houses. The overhang and thatched roof are replaced with the same cladding as the facades, creating a clean and modern expression. The cladding is assembled with vertical boards in various sizes to create a lively character inspired the ever-changing natural environment surrounding the buildings. Paint or pressure impregnation is, in most cases, not a sustainable choice for facades. Alternatively, is charring used to colour the facades black. The outermost layer of the boards is charred. The result is a board that is both weather-resistant, stable and which has a UV-resistant front, which retains maintenance-free a beautiful black finish. Since no chemicals are used for impregnation, the wood can be reused and be part of a circular future. The dark facades are contrasted with window frames of oak, bringing warmth to the facades.

The new buildings are cladded with the same Larch wood and with the same patterns as the former hotel to create a coherency between the restored and the new. The cladding differs by colour and thereby treatment. The wood is kept untreated and will within a year, fade to a silver-grey hue. The grey will blend into the landscape and allow the scenery to stand out, contrary to the buildings. The windows are kept the same throughout the buildings.

The boardwalk and platforms mirror the buildings, with a black deck around the community hall and grey for the remaining.

Ill. 89 - Charred Larch

Ill. 90 - Untreated Larch

Ill. 91 - Oak

PRESENTATION

INTERIOR MATERIALS

With a harsh and cold environment and facades to reflect it, it was necessary to soften up the expression of the interior. The community house must be welcoming for locals as well as visitors. In the resurrected hotel building are the original trusses and rafters restored and given an oil treatment to achieve a warm brown tint. The exterior window frames of oak are mirrored inside. The oak is reused for the interior glass wall instead of the regular steel frames. The interior side of the exterior walls is cladded with acoustical panels of vertical wood lamellas with a black backdrop. The interior walls are cladded with flat cross-laminate boards to contrast the expressive acoustic panels and the darker oak. The floor is oak planks. Oak has been chosen as it is a robust, beautiful and local material.

The timber frames that make up the structural system of the new buildings contrasts the facades exposing are warmer interior enclosed by the silver-grey wood. The interior materials of the original building are reused in both the new buildings and the cabins to create a connection between them.

Ill. 92 - Acoustic Oak Panel

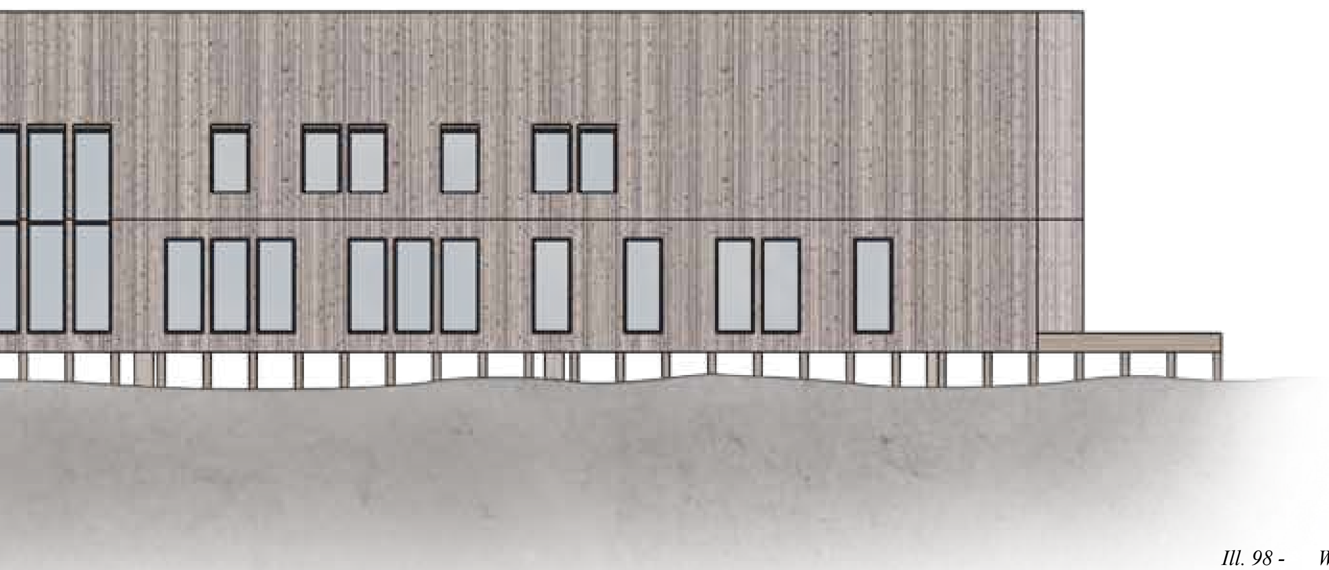
Ill. 93 - Glass Walls

Ill. 94 - Oak

Ill. 95 - North Elevation - 1:200

Ill. 96 - South Elevation - 1:200

Ill. 97 - East Elevation - 1:200



Ill. 98 - West Elevation - 1:200

PRESENTATION

STRUCTURAL DETAILS

The new buildings are constructed of timber frames made from hardwood. It is vital for the integrity of the construction that it is hardwood, as the foundation of the frames is exposed to the harsh climate. The span of the building is 10.600 mm, and the frames are distanced by 1200 mm. Optimisation of the structural system has been left out of the scope of this project.

The space between the frames is determined by daylight analysis and visual appearance - which is elaborated under the design process.

Following the concept of Design for Disassembly, the structural elements are connected with mechanical joints to ensure both a fast and efficient erection and dismantling, so that the materials can later be reused if necessary. The elements are joined by metal plates sliced into the frames and bolted together.
The frames are only visible on the exterior by the foundations. They are, however, visible on the interior, where the wood brings a subtle warmth and soft tactile qualities to the space. The drain is built into construction for a minimalistic and streamlined expression.

External Roof Layers

30x30 mm Vertical Timber Lamellas: 30 mm
Acoustical Absoruber + Fabric: 45 mm
Cross Laminate: 12 mm
45x45 mm Timber Battens + Insulation: 45 mm
Vapour Barrier: 0,2 mm
300x100 mm Timber Battens + Insulation: 300 mm
38x73 Timber Battens + Insulation: 73 mm
Wind Barrier - Cross Laminate: 12 mm
Ventilation Gab: 25 mm
Larch Cladding: 22 mm

= 564 mm

External Wall Layers

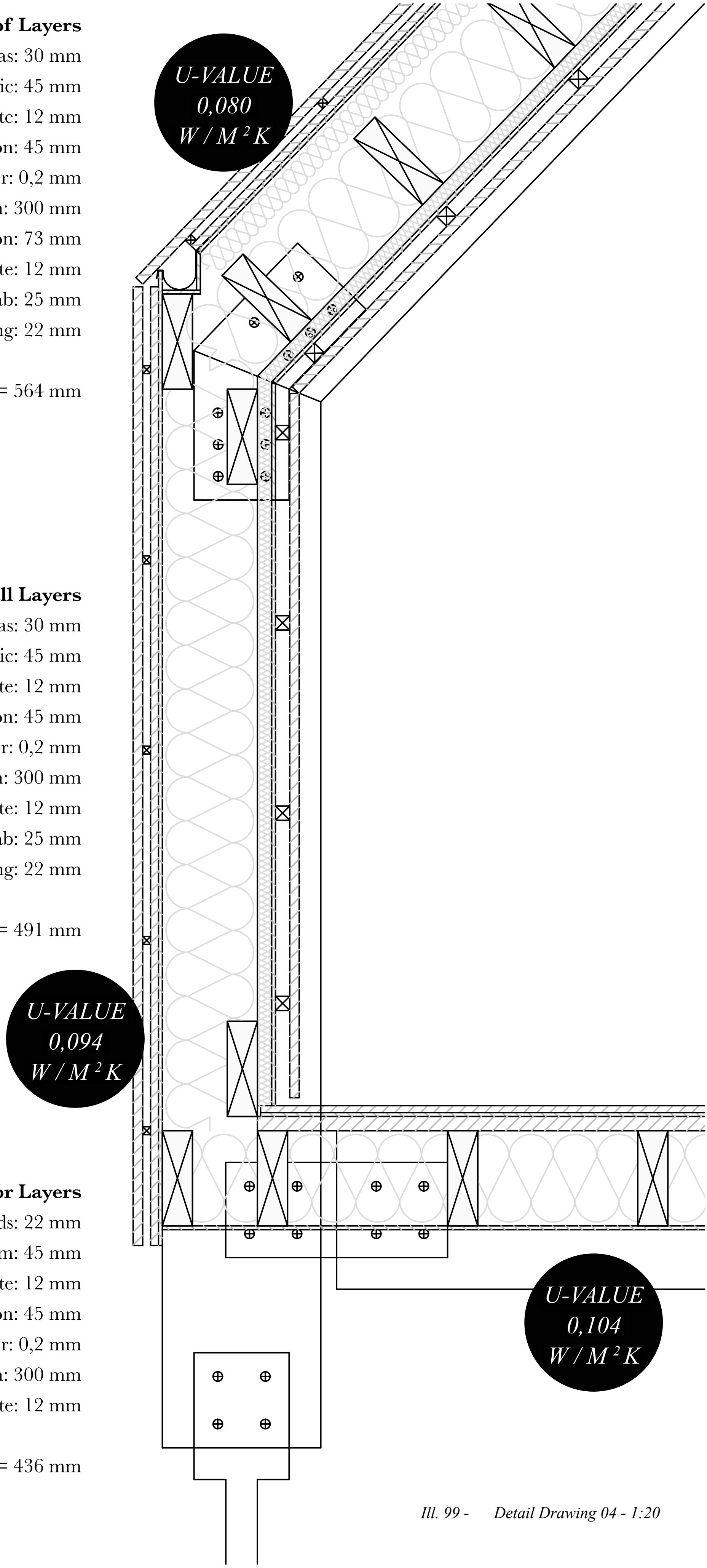
30x30 mm Vertical Timber Lamellas: 30 mm
Acoustical Absoruber + Fabric: 45 mm
Cross Laminate: 12 mm
45x45 mm Timber Battens + Insulation: 45 mm
Vapour Barrier: 0,2 mm
300x100 mm Timber Battens + Insulation: 300 mm
Wind Barrier - Cross Laminate: 12 mm
Ventilation Gab: 25 mm
Larch Cladding: 22 mm

= 491 mm

Floor Layers

Oak Floor Boards: 22 mm
Floor Foam: 45 mm
Cross Laminate: 12 mm
45x45 mm Timber Battens + Insulation: 45 mm
Vapour Barrier: 0,2 mm
300x100 mm Timber Battens + Insulation: 300 mm
Wind Barrier - Cross Laminate: 12 mm

= 436 mm



Ill. 99 - Detail Drawing 04 - 1:20

PRESENTATION

PATHWAYS

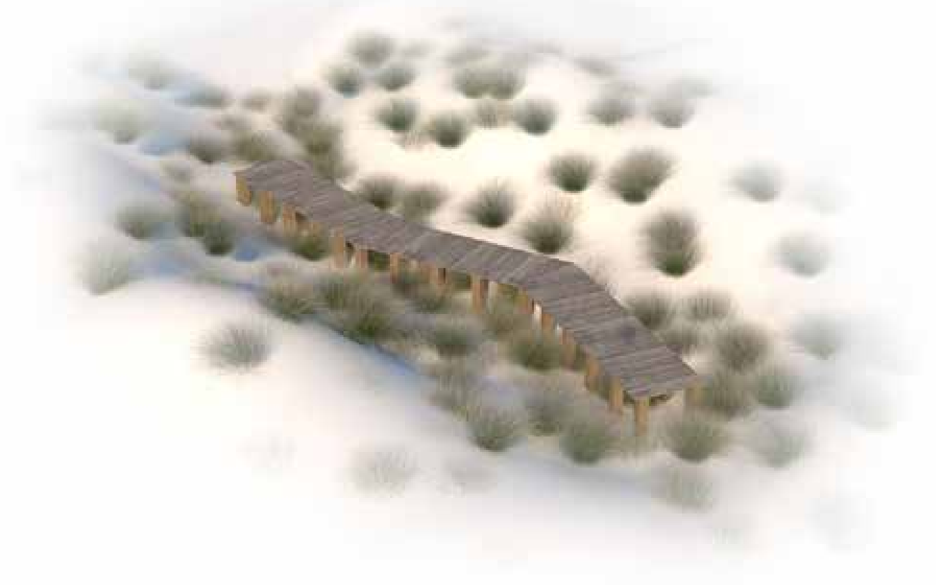
A pathway is necessary to access the cabins in the dunes. The primary purpose of the boardwalk is access to the cabins, but it will also make the landscape accessible to impaired visitors - which is why the slope of the pathway never exceeds 1:20.

The boardwalk is, similar to the buildings, elevated above the landscape to protect the natural environment. While it is allowed to walk in the dunes will a boardwalk encourage people to use the path instead of harming the dunes.

The boardwalk will frame the various natural aspects of the area while protecting and strengthening it. The experience will alternate between great views in the distance to intimate spaces at the bottom of the dunes, from strong winds to shelter and from sea to heaths.

The boardwalk connects the community centre with the North Sea and the hilly scenery. The pathway will, at strategically chosen points be level with the landscape to allow visitors to explore the area where the dunes are healthiest.

Like the buildings, is the boardwalk constructed in Larch - a long-lasting timber - that appears untreated and will patinate in a silver-grey colour so that it does not distract attention from the landscape.



Ill. 100 - Pathway 02 - Elevated

PRESENTATION

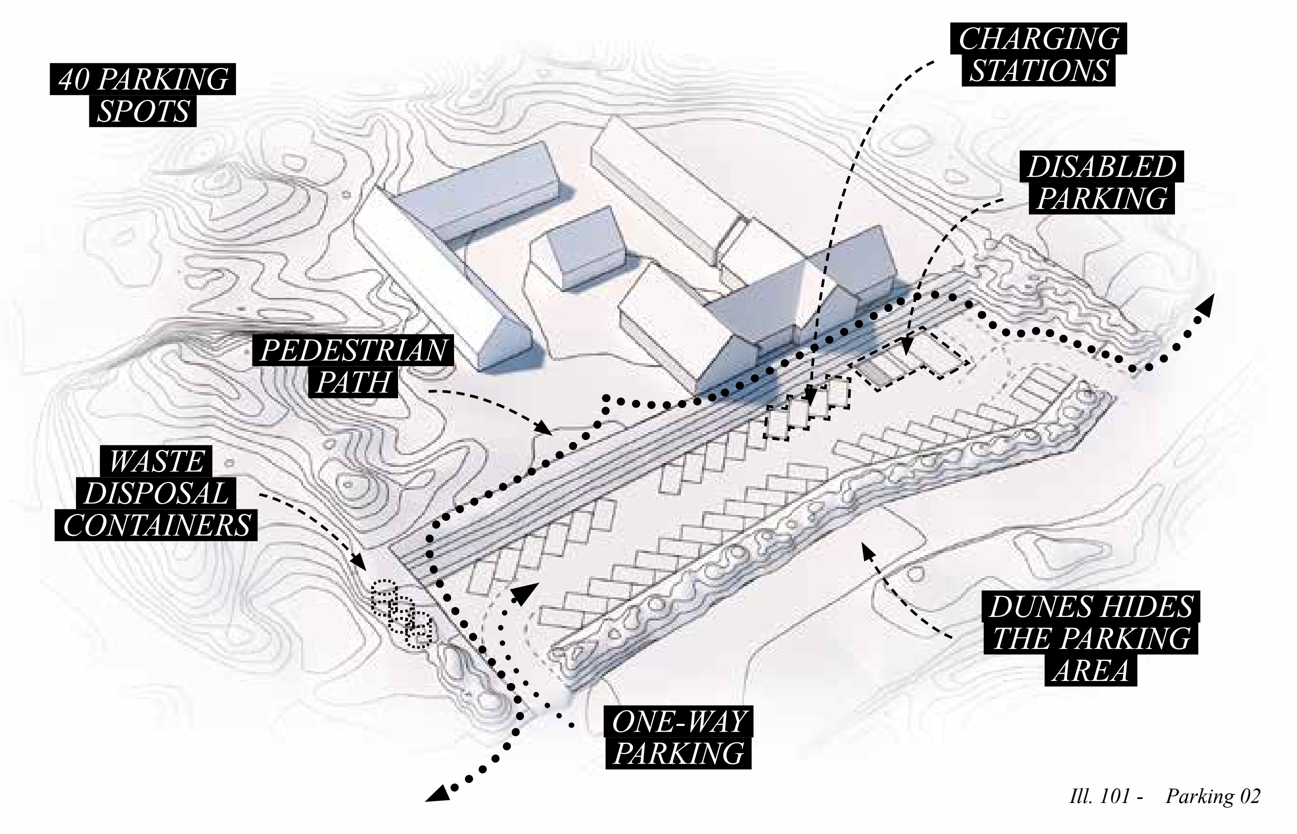
PARKING

The existing parking area consists of an undefined paved area in front of the dilapidated hotel. The area is kept for parking but is restructured to the new parking standards and requirements. The parking area is the last thing visitors will pass before they enter the beach. To improve the current rather tedious parking area will the new proposal encapsulate the vehicles in new dunes. The dunes will hide most cars from the main road and create a more pleasant edge of the town.

As the dunes take up a lot of space is one-way parking, the only option following the parking requirements. The area consists of 40 parking spots with one for large disabled vehicles, one for regular disables vehicles and one with a larger service area close to the entrance. The four parking spots nearest the entrance to the original building is reserved for electric cars.

A small area by the entrance to the lot is reserved for refuse collection, where the waste disposal containers are dug into the ground, minimising the visual appearance of the containers and allowing trucks to access them easily.

There are pedestrian paths at both the entrance and the exit eliminating the need for crossing the parking area.



Ill. 101 - Parking 02

DESIGN PROCESS

DESIGN PROCESS

FLOW STUDIES

The two most relevant flow patterns for the community centre are mixed and linear flows which are displayed diagrammatically on the following page. The patterns demonstrate how the functions are connected and how guests will pass through the area.

Mixed Flow

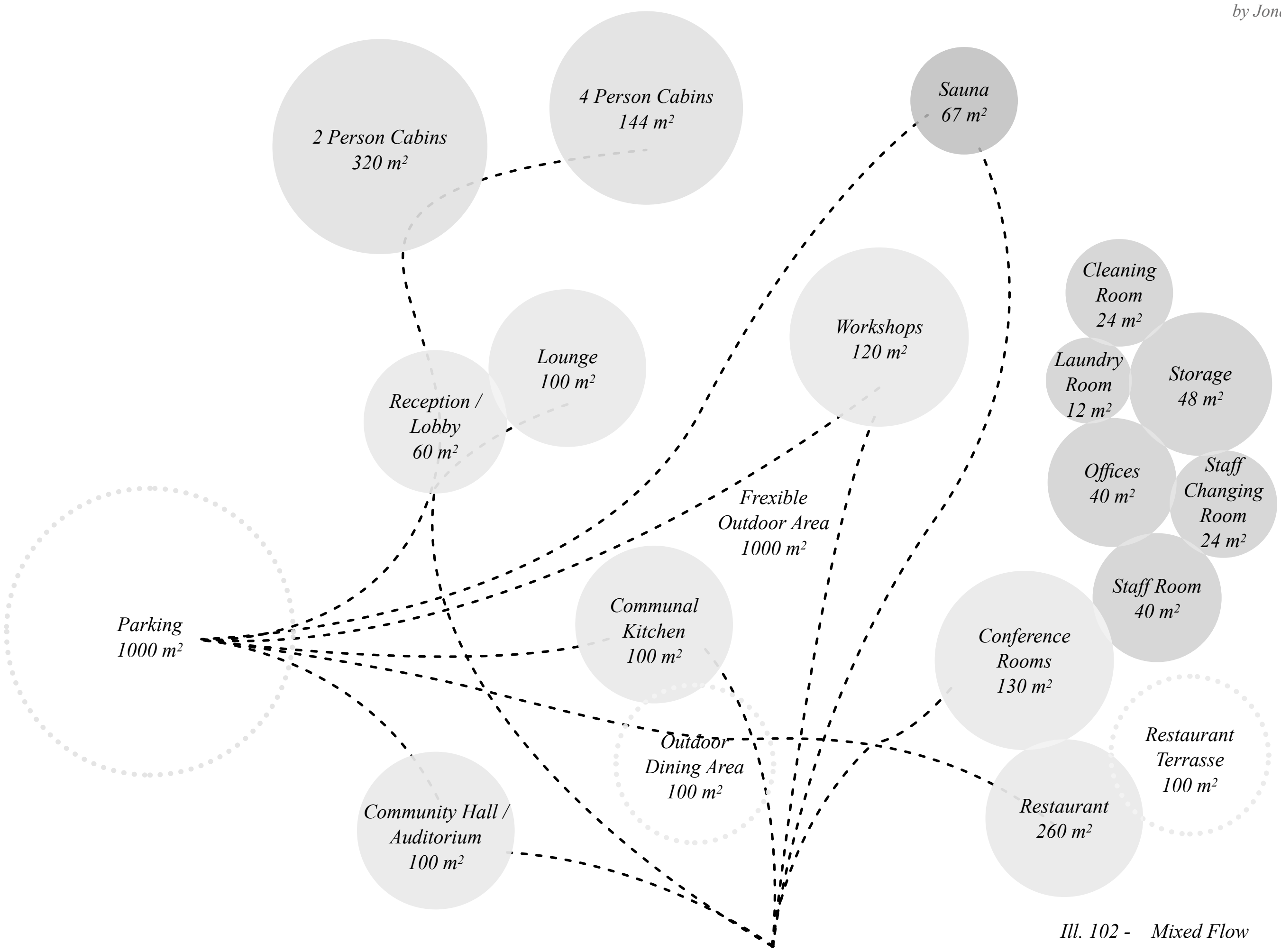
The mixed flow pattern mainly focuses on positive interference in the flexible outdoor area. The functions are spread out on the site in individual structures. The reception, lobby and lounge are placed in the same structure, guiding guests to their huts or cabins, which also are spread out on the site. The interaction between guests and locals rely on the communal kitchen, workshops, the sauna and the community hall. The common functions are open for everyone and are chosen to strengthen the local community, while tourists can join the local life. The restaurant has staff facilities and practical functions to service the restaurant, conference rooms and the cabins. The restaurant is placed towards the public, to invite passersby, one-day tourists and locals to use it, and not only be a restaurant for the guests staying in the cabins. By spreading the function out in individual structures, the space between the buildings becomes and urban space for everyone. The community will make it their own and not be closed off as another tourist attraction. The problem by focusing on an outdoor space as the primary area for locals and tourists to interact can be problematic as the urban space mostly will be attractive in the warmer months. However, the idea is that all the functions will seem inviting for everyone, encouraging tourist to join the activities in the individual spaces.

Linear Flow

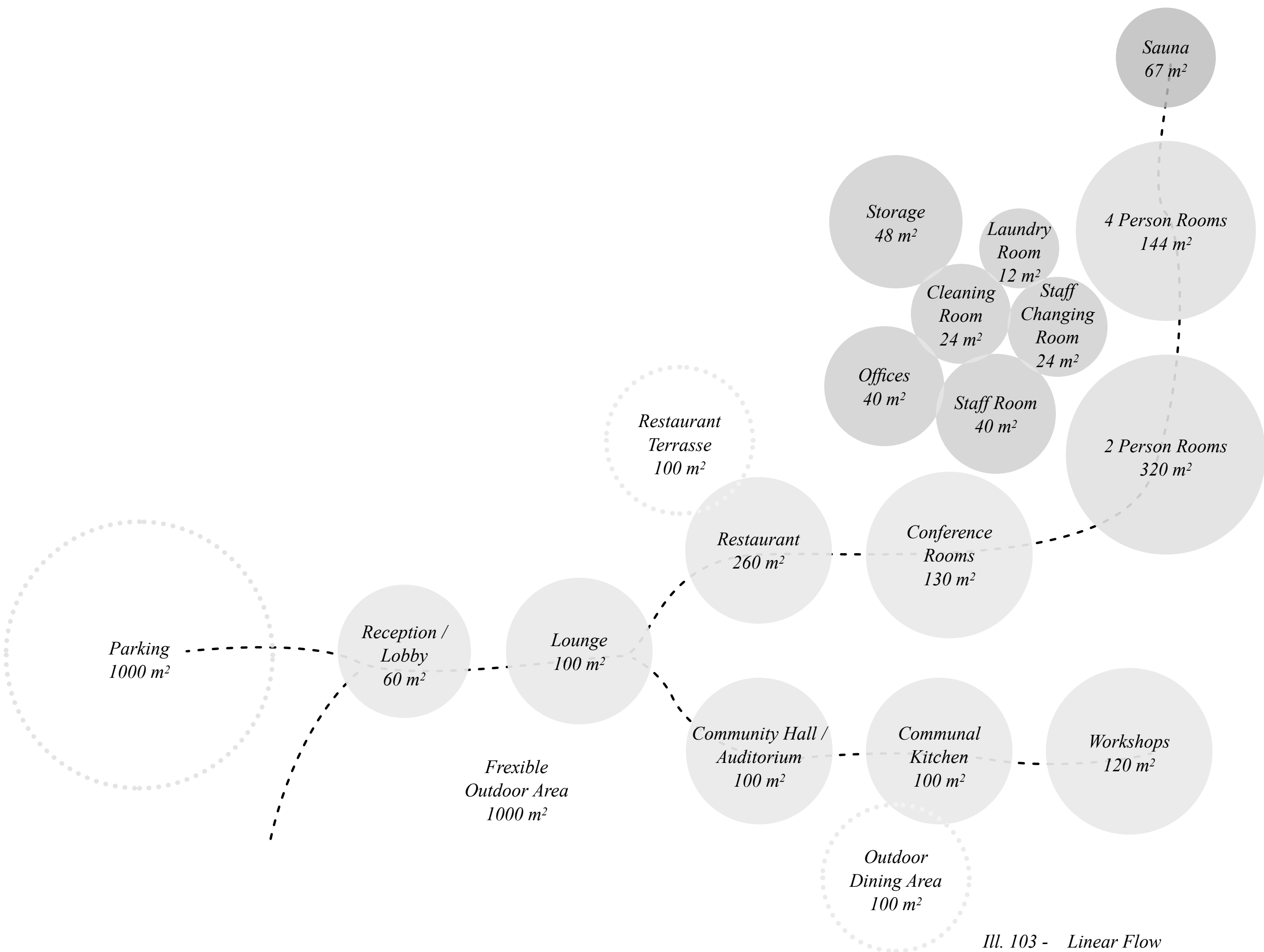
The linear flow pattern focuses on tourists and locals interacting in a single structure - merging accommodation and community centre functions. Contrary to the mixed flow pattern will both tourists and residents enter through the reception. The community functions and the accommodation functions are split up and can be used individually. As the functions are closely linked, the guests are allowed or 'forced' to notice the local activities and can choose to join the local everyday life. By having traditional 'hotel rooms', you attract another type of guests, compared to huts. However, the structure will relate more to the traditional seaside hotel and will be more economical. The problematic aspect of this flow pattern can be that it will seem more like a hotel. This will make it difficult for the locals to make it their community centre, and the positive interference between locals and tourists will be challenged.

Part Conclusion:

The mixed flow pattern is prefered for its diversity. The way of mixing activities, spaces and programmes in a 'web' will create more interactions between different people. The common areas that are created as transportation paths when the functions are spread out can become the most frequented areas that would not exist otherwise. The design must reflect the vision of a place for the community and tourists and not a regular hotel merely for tourists.



Ill. 102 - Mixed Flow



Ill. 103 - Linear Flow

DESIGN PROCESS

INITIAL FORM STUDIES

The initial form studies are based on the previous flow studies - both patterns are investigated. Most of the studies are based on reusing parts of the original structure to revive the original seaside hotel - both for the history of the town and by limiting materials use.

The Courtyard - 1st Row

The open courtyard is restoring the original seaside hotel, which then is surrounded by smaller structures inspired by the traditional 'long-house'. The original structure is then in focus, and the functions are spread out with an urban courtyard. The two other courtyard designs are also inspired by the long-house, where the half-circle design extends the eastern wing is extended, and the half-circle is separated by glass and is smaller, to show it is an extension. The circular design twists the long-house in almost a full circle, also attaching to the original structure with a glass separator - but restoring the original hotel.

The Crossyard - 2nd Row

The next three designs restore the original hotel and focus on the central 'crossyard'. The first allows for crossing the urban space from east to west. A smaller long-house structure is attached to the original structure with a glass separator, and two crossed long-houses encloses the crossyard, where the central communal kitchen is placed. The next design is flipped with a west to east crossing. The last of the three is more open, displaying the dunes, but also allowing the western winds to penetrate the site. The designs focus on inviting passersby through the site.

Huts - 3rd Row

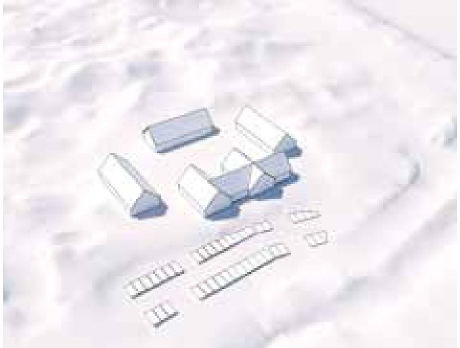
The following three designs focus on huts as both common functions and accommodation. The first has cabins for accommodation towards the west and the sea, with the original structure and a crossed long-house for common functions - having an urban space in-between. The next two designs have mixed accommodation and common functions in huts, where some of the individual cabins will be for activities and some for accommodation. The original structure is a central point for activities and local life - the last design of the three has the original structure centralised to strengthen this.

The New - 4th Row

The first of the three is a larger courtyard structure, where the original building has been extended with a third wing towards the sea - inspired by the symmetry in traditional danish seaside hotels. The second design restores the dunes on the, otherwise flattened, site and elevates the structure to give the site back to the locals and the visitors. The elevation leaves a minimal impact on nature. All common functions are placed in the elevated structure, while huts are elevated on poles and spread in the dunes. The third design is more modern, with boxes in various sizes surrounding a courtyard, where all functions face the centre of the site. See Ill. 94

Built-in - 5th Row

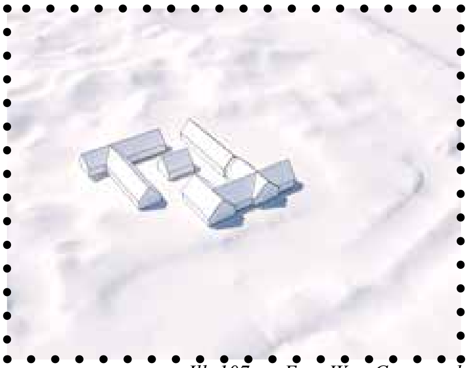
The three built-in designs all restore the dune landscape on the site. The first of the three integrates relevant functions in the southern dunes while building a new sculptural building towards the north. The new building leads into the courtyard with the communal kitchen and a surrounding urban space. The second design integrates four structures into the dunes, leaving the space above the structures to the public. The last design has cut-in entrances, inviting everyone into the structures and the central courtyard.



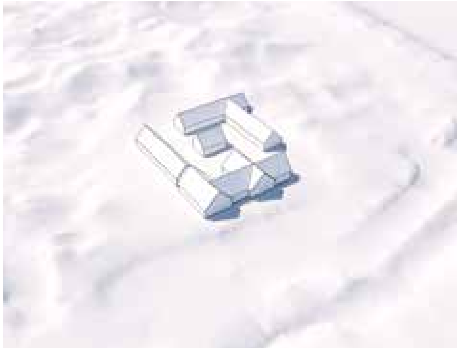
Ill. 104 - Open Courtyard

Ill. 105 - Half-circular Courtyard

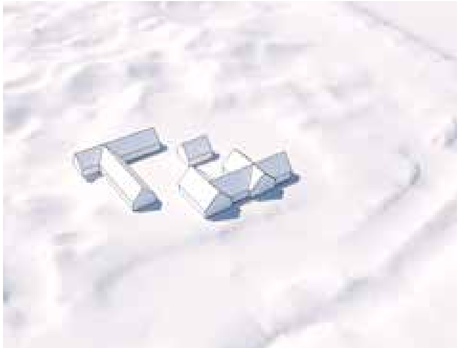
Ill. 106 - Circular Courtyard



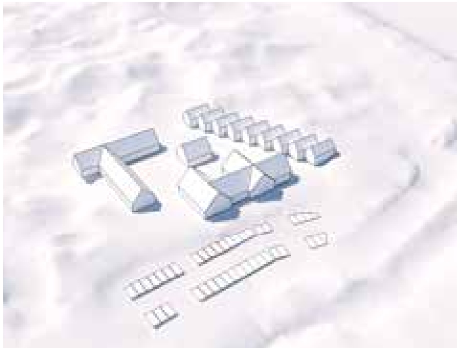
Ill. 107 - East-West Crossyard



Ill. 108 - West-East Crossyard



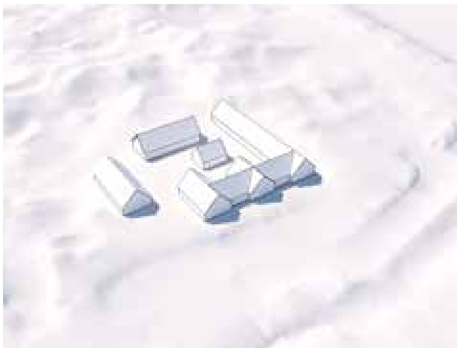
Ill. 109 - Open Crossyard



Ill. 110 - Crossed Long-house + Huts

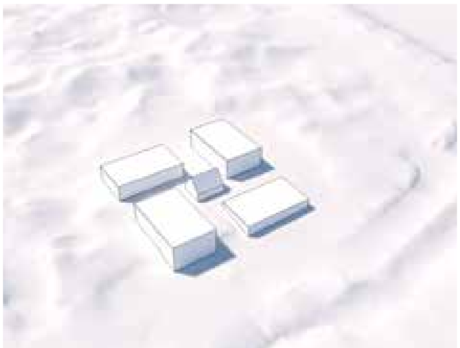
Ill. 111 - West-facing Huts

Ill. 112 - South-facing Huts



Ill. 113 - Symmetrical Extension

Ill. 114 - Elevated



Ill. 115 - Blox

Ill. 116 - Sculptural + Built-in + Huts

Ill. 117 - Built-in Blox + Huts

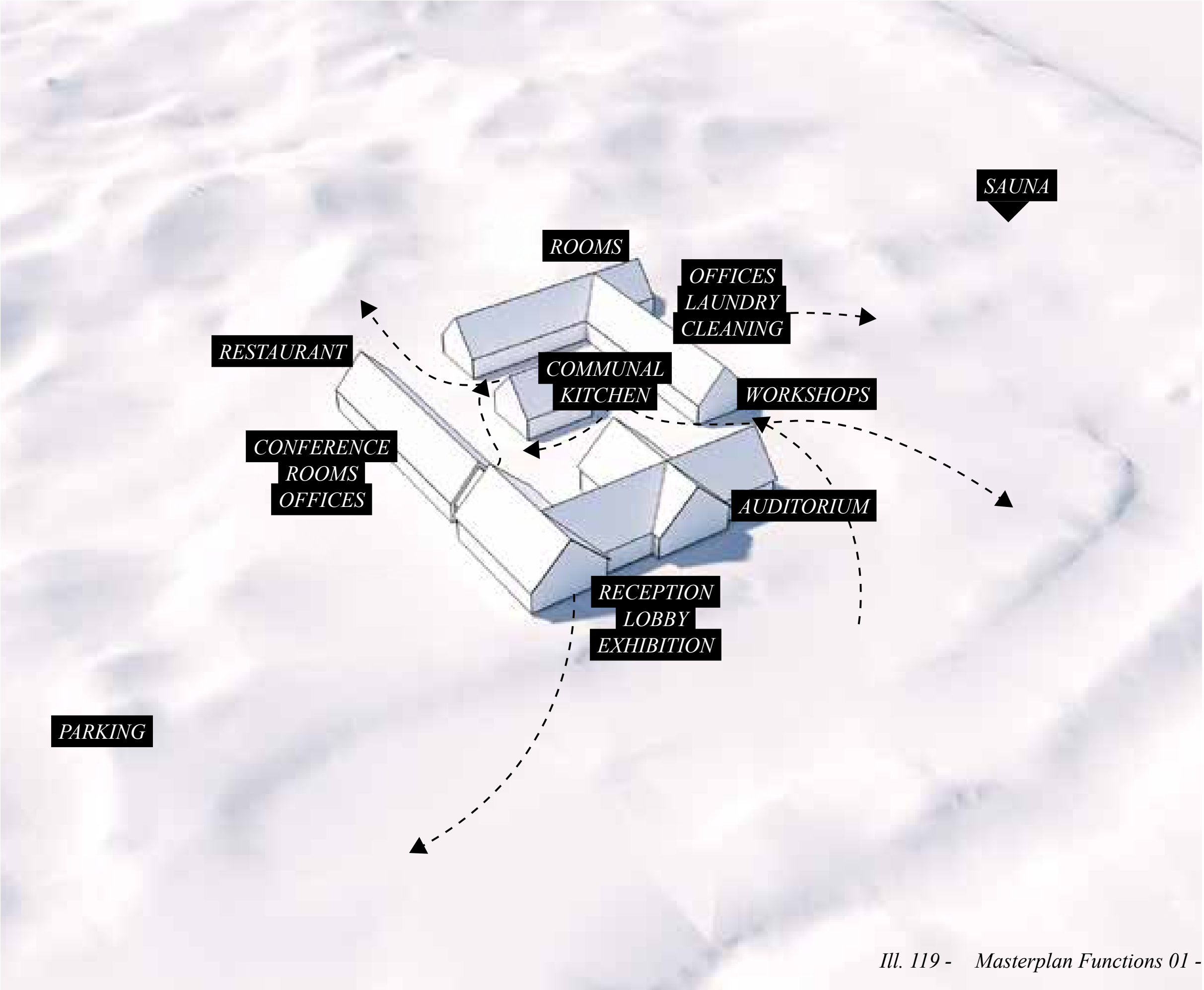
Ill. 118 - Built-in Blox w. Cutout Corners + Huts

DESIGN PROCESS

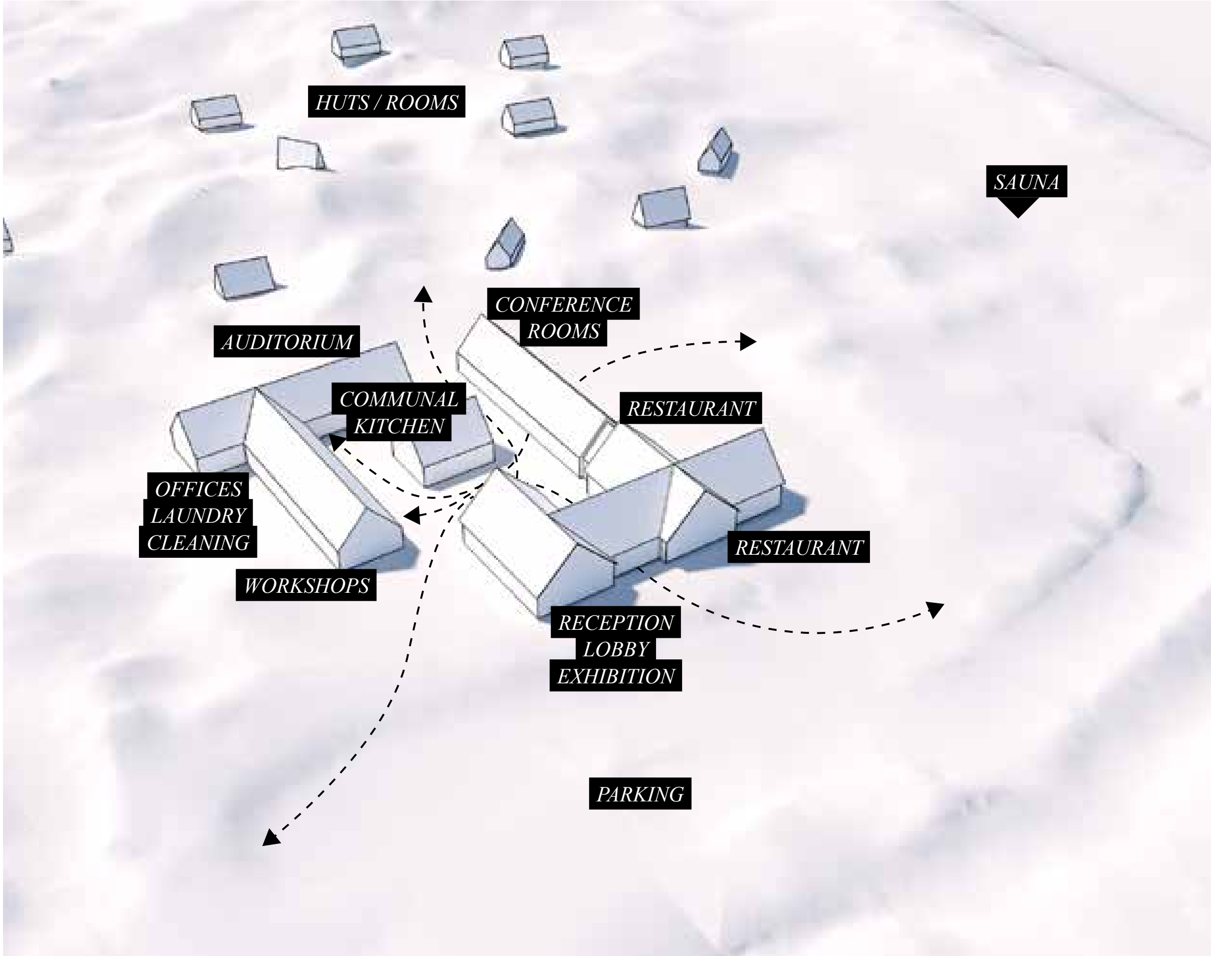
MASTERPLAN STUDIES

The 'roocrossyard' concept is chosen for its restoration of the original hotel, where new structures are subjected to the original to respect the history of the small town. The enclosed courtyard supports positive interference through a mixed flow across the yard. The traditional design of the seaside hotel and the new long-house inspired structures unites through the smaller connector between the new and the old buildings.

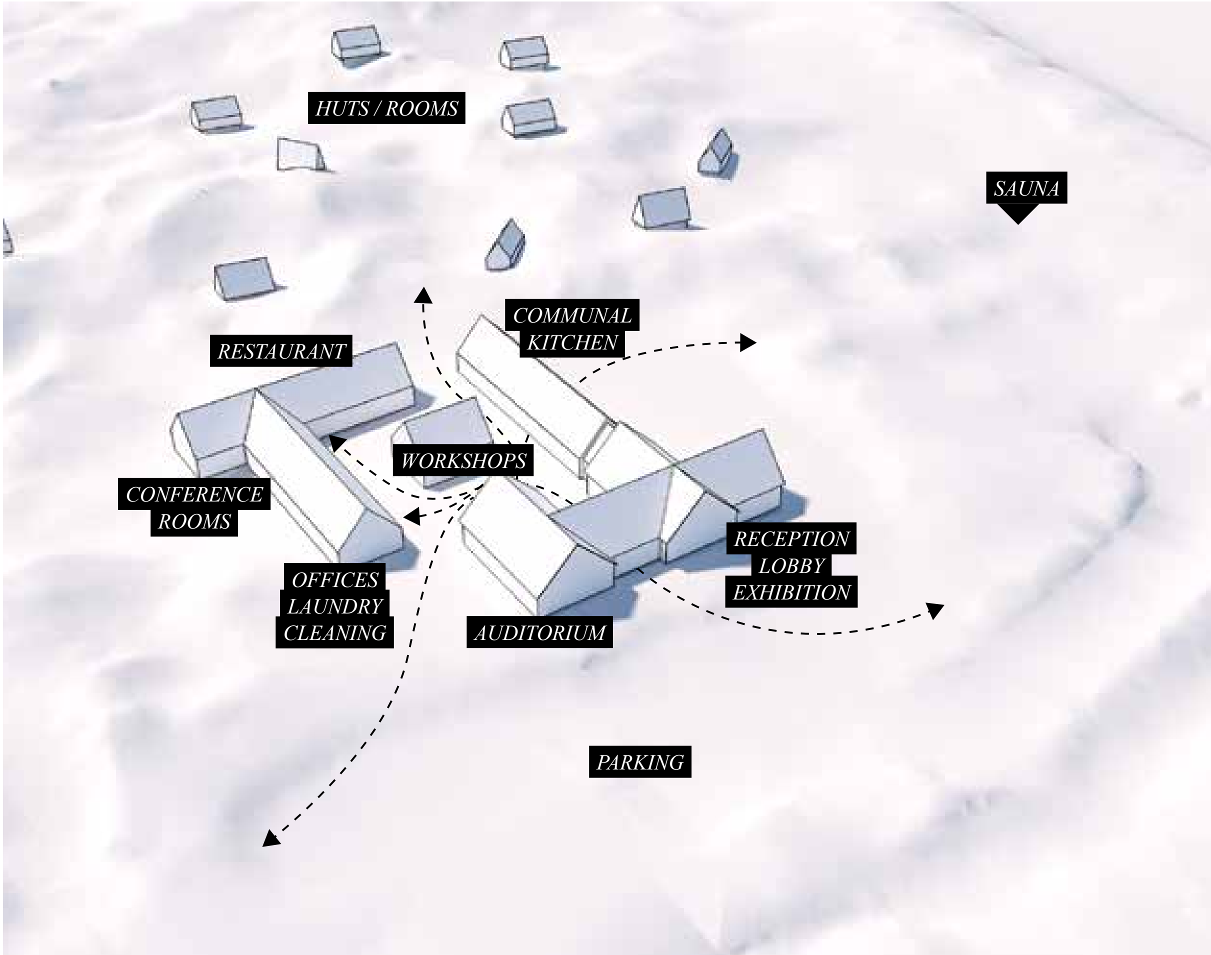
The three masterplan proposals are all based on mixed flows. The third composition is favoured for placing a flexible workshop or activity space in the centre of the courtyard that can open up for activities and events. The restaurant has its own separate entrance and has a great view across the landscape. The communal kitchen is placed towards the sea, shielding the courtyard from strong winds. The auditorium or community hall is appropriately placed in the original building with room for exhibitions or visitor information about the area. The communal kitchen and auditorium are connected for the possibility of shared events and gatherings.



Ill. 119 - Masterplan Functions 01 -



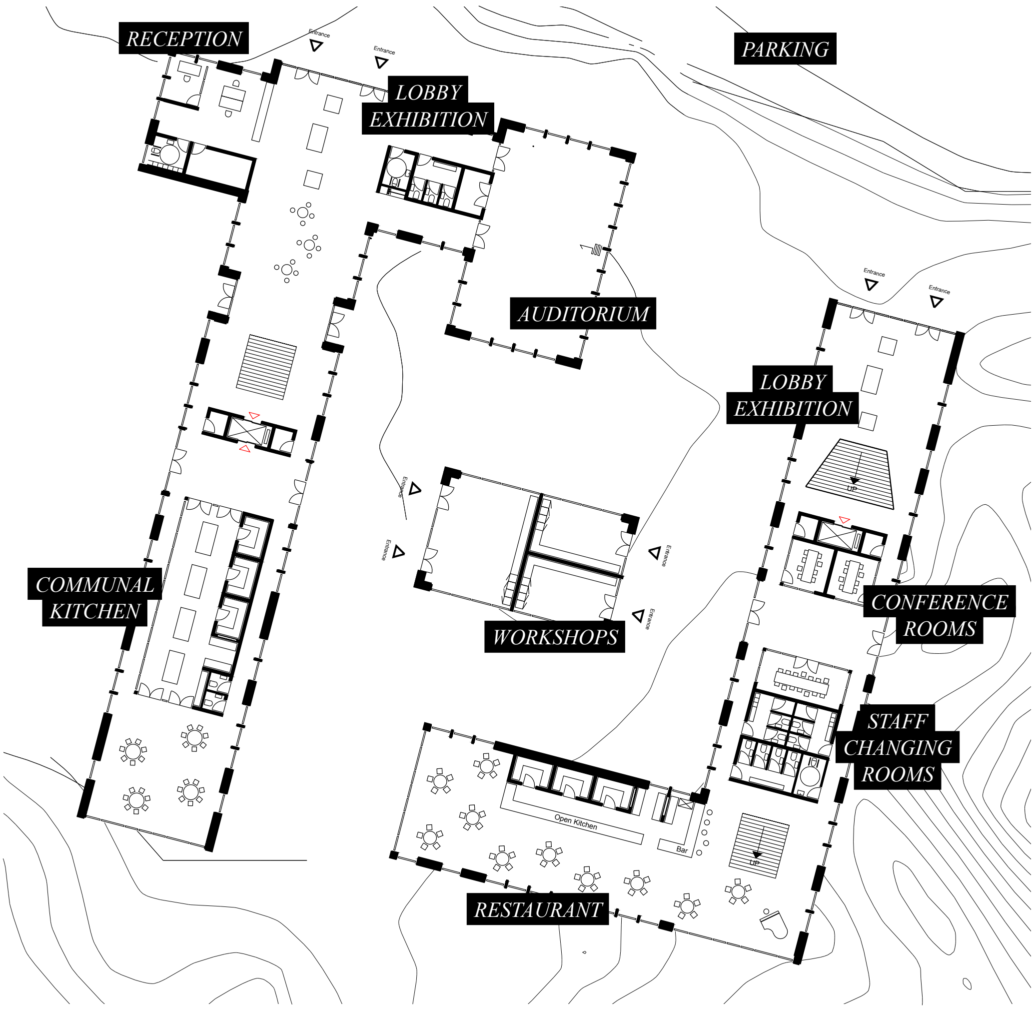
Ill. 120 - Masterplan Functions 02 -



Ill. 121 - Masterplan Functions 03 -

Masterplan 01 - Ground Floor:

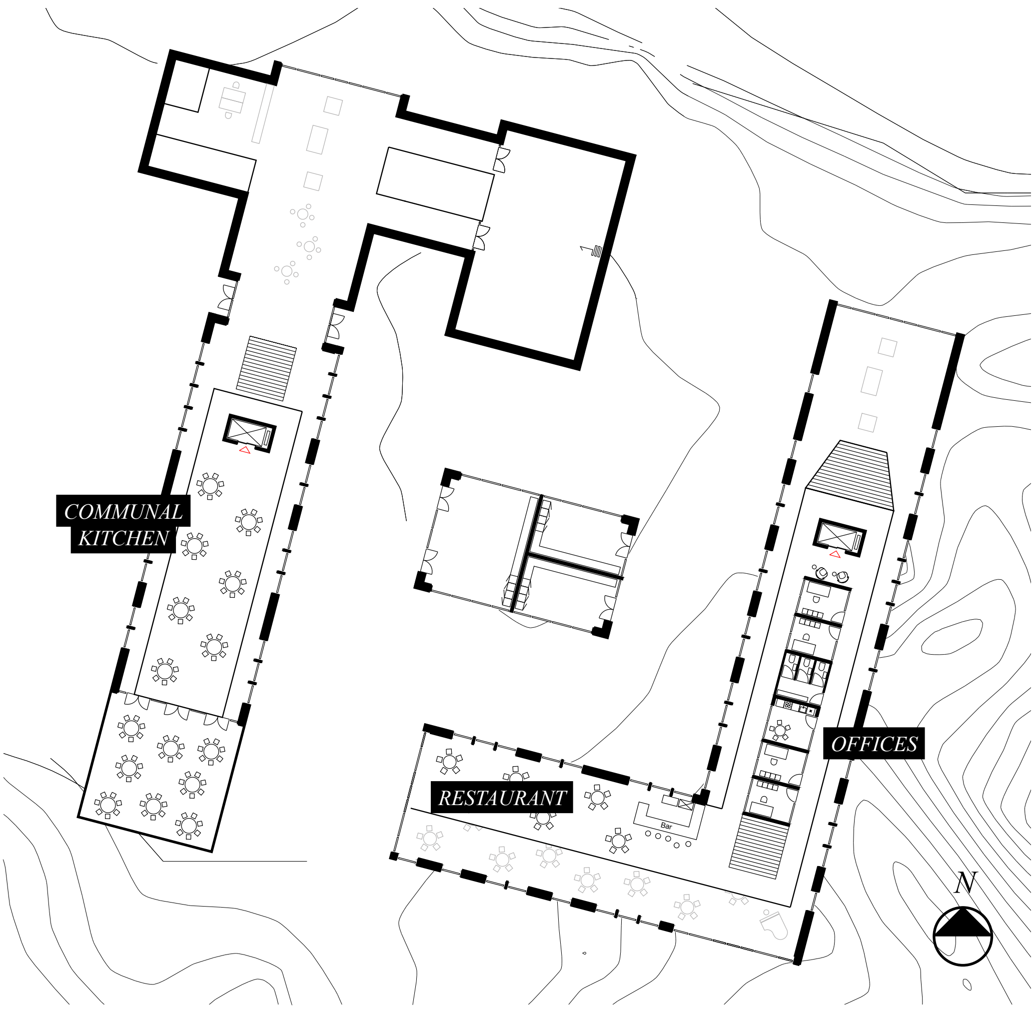
The lobby functions as an exhibition or visitor centre where locals can share knowledge, activities and experiences from the area. The auditorium or community hall is designed as an open space with a close connection to the courtyard - a place where passersby easily recognise activities and catch the possibility to join in. The communal kitchen is placed in the west wing that connects to the community hall, which creates the possibility of easily using them together. The workshop in the centre of the courtyard will be a flexible space that can open towards the entire courtyard and assist outdoor events. The east wing consists of a grand entrance that can be used for displays, conference rooms for both locals and visitors, staff functions, and the restaurant. The restaurant is placed furthest from the main road, which makes it vital to ensure an interesting experience through the building when arriving as a guest.



Ill. 122 - Masterplan 01 - Ground Floor - 1:500

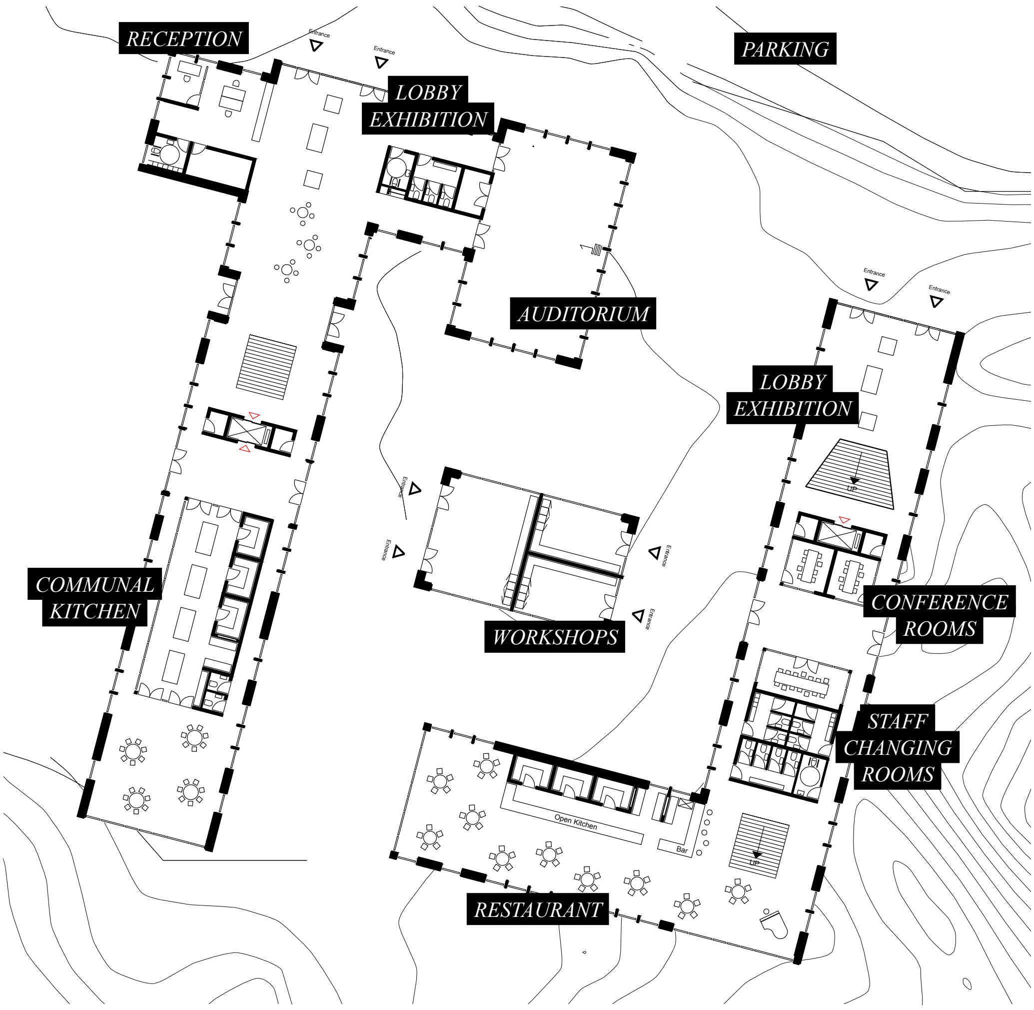
Masterplan 01 - 1st Floor:

The old seaside hotel is hollowed out and consists of only one floor, creating a grand entrance to the community centre. A larger dining area for the communal kitchen is placed above the kitchen. The large spaces, such as the dining area and the exhibition area, are flexible spaces that can adapt to the needs of the town. The first floor of the east wing is designed as an open office area where visitors and employees share the space. While the idea of placing the functions in the centre of the building is to create a path for information and experiences close to the surrounding natural environment, this design has several long and narrow corridors.



Ill. 123 - Masterplan 01 - 1st Floor - 1:500

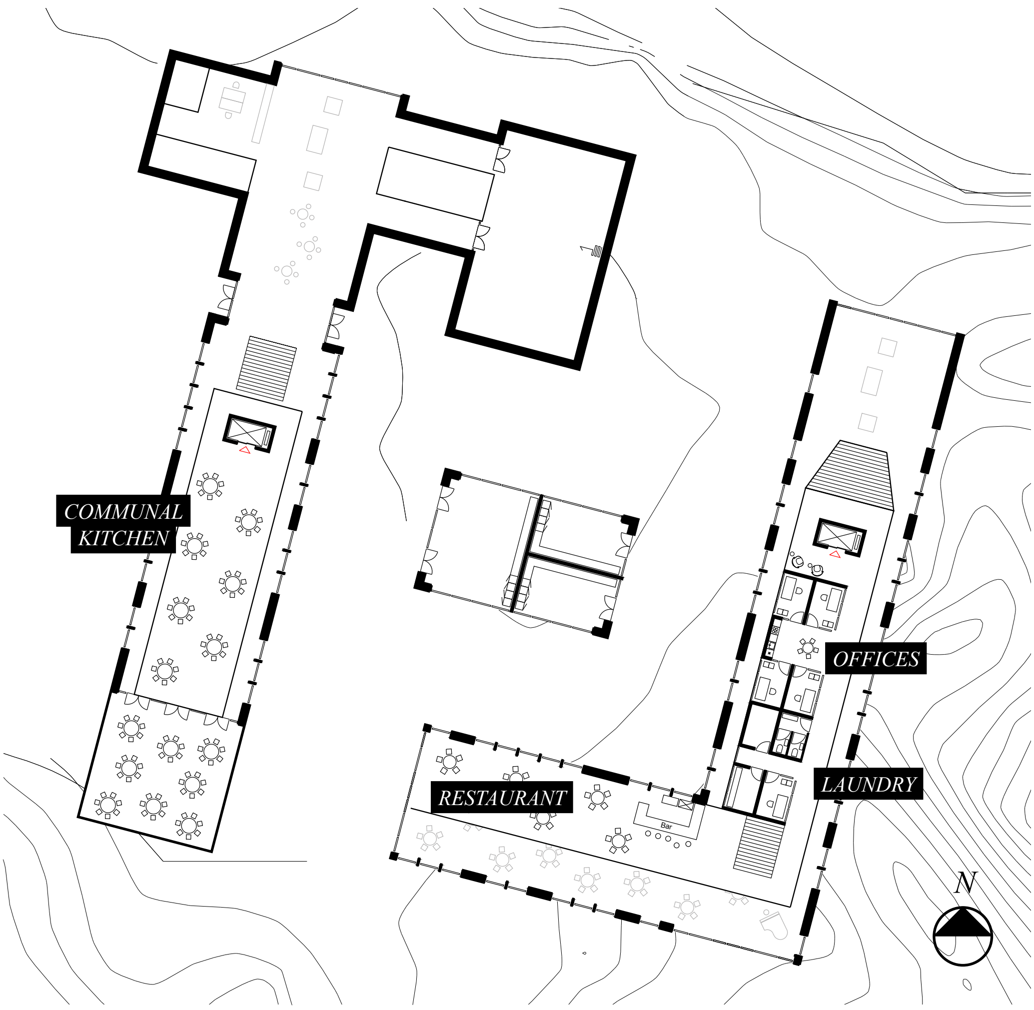
The ground floor plan is the same for both proposals. The proposals prioritise large flexible spaces connected by a circulating path around the functions. Only the first-floor plan was altered because the two pathways was a waste of space. The paths on the ground floor were assumed wide enough for exhibiting information about the area, creating a path of information through the buildings and towards the restaurant. This was later proven incorrect and has been improved in the final floorplan.



Ill. 124 - Masterplan 02 - Ground Floor - 1:500

Masterplan 02 - 1st Floor:

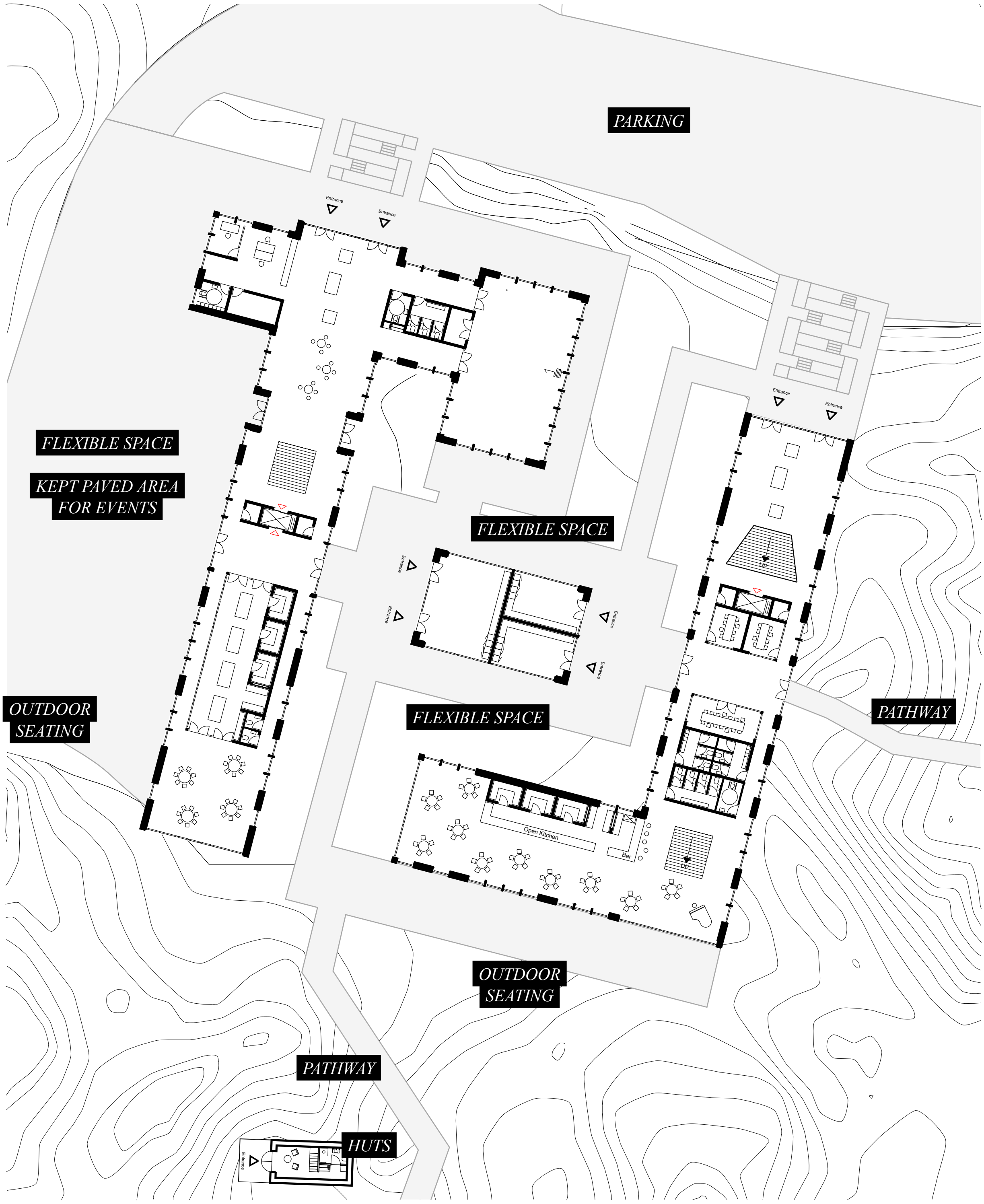
The second path on the first floor is discarded in favour of a single wider pathway and more space for the staff functions. By moving the offices closer to the windows, they will receive more natural daylight and thereby require fewer or smaller windows.



Ill. 125 - Masterplan 02 - 1st Floor - 1:500

DESIGN PROCESS

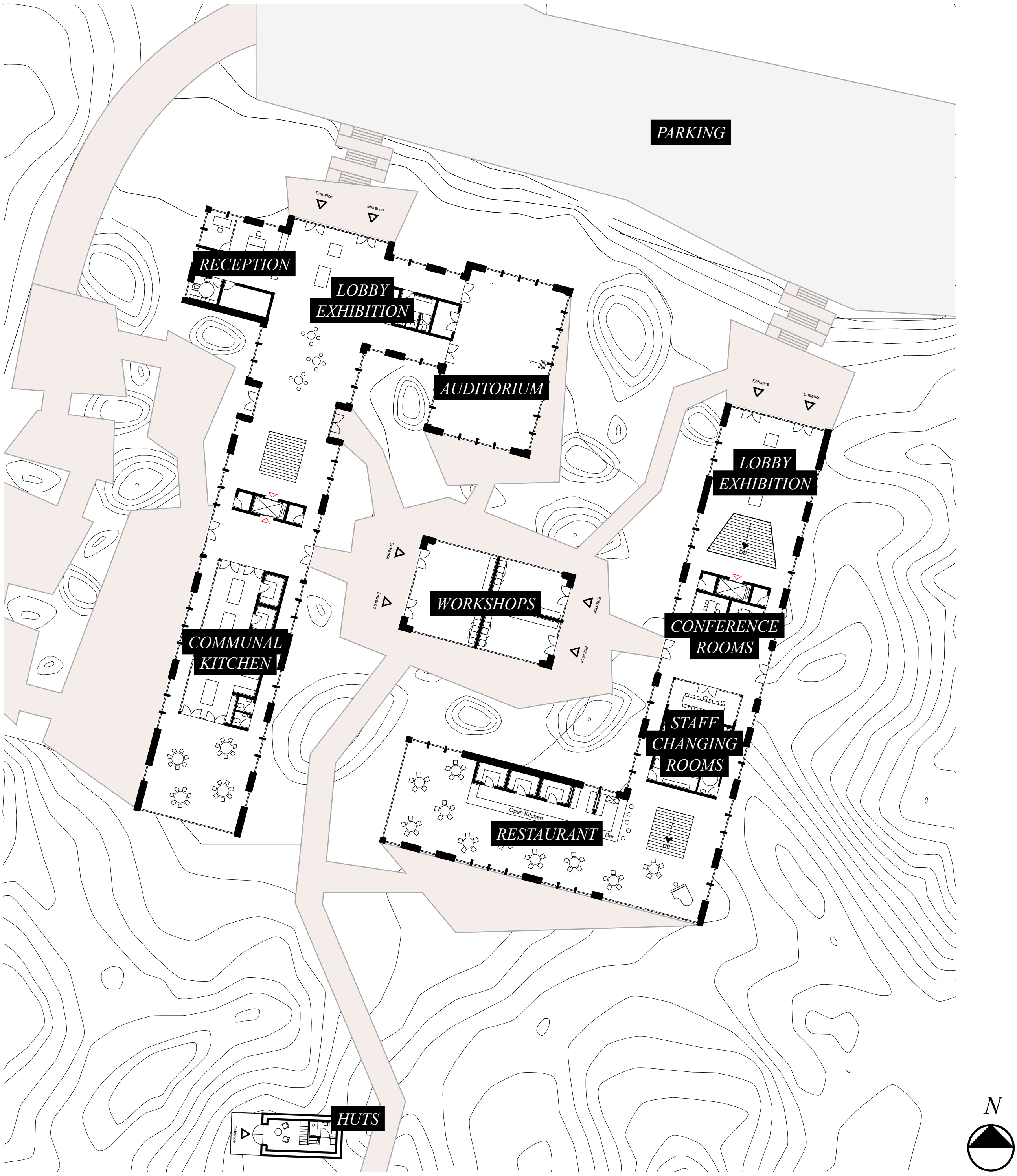
OUTDOOR AREA STUDIES



Ill. 126 - Outdoor Area 01 - Reusing the Pavement- 1:500

The first design focuses on utilising the vast amount of concrete and pavement existing on the site today. The parking area has been used for events such as festivals and social gatherings by the former hotel. The idea is to retain the paved area on the western side of the site for events, creating a large flexible space with minimal use of resources. The courtyard and outdoor pathways are constructed in concrete to create a coherency throughout the site. The orthogonal layout has a subtle expression. Still, while keeping the current paved area will save some resources compared to constructing new outdoor spaces, it does not justify covering a large area of the landscape with concrete.

In response to the use of concrete, focuses the second proposal on wood as the only material. The layout is inspired by nature, constructing the path according to the landscape. The layout looks chaotic in plan but can have an exciting expression when walking through it. Both proposals focus on the paved area west of the site. The final result prioritises the courtyard, with a larger platform emerging from the workshop, and smaller platforms from the auditorium, kitchen and restaurant. The paved area removed and the dunes are restored, creating a great view from the kitchen and dining area.



Ill. 127 - Outdoor Area 02 - Elevated Terraces - 1:500

DESIGN PROCESS

PLAN STUDIES: HUTS

The four featured design proposals are all inspired by the small A-shaped fisherman-huts (Esehytter) that were placed in the dunes before holiday homes and hotels. The first is spurred by traditional hotel rooms, including a bed, bedside tables, a desk and a large closet. The layout of the space is more oriented inward with the bed facing the desk. The windows could, of course, be moved to that facade, but that would deviate from the traditional huts.

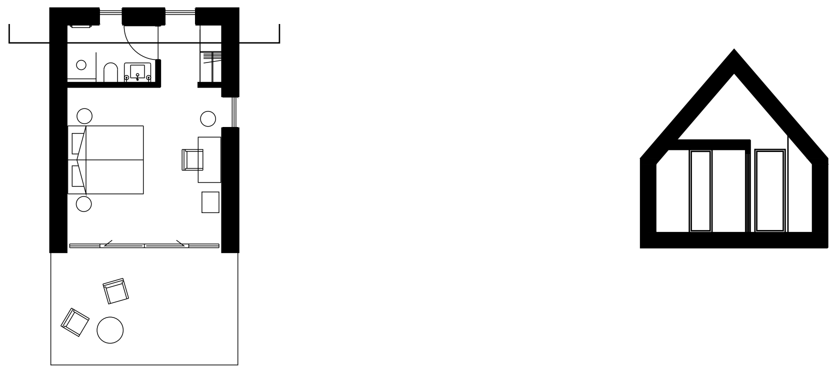
Both the first and the second design features full-height walls to utilise the entire floor area. The purpose of the community house is not to provide serviced apartments; the aim is to offer a unique type of accommodation where the visitors come to socialise and learn about the local life and environment. By discarding all unnecessary furnishings and creating shared everyday spaces, such as the communal kitchen, contrary to individual everyday spaces, such as the kitchen in a holiday home, we lay the foundation for the interaction between visitors and the positive interference between locals and tourists. The space above the toilet can be used as a secondary room where a skylight frames the sky contrary to the ground floor framing the landscape.

The third proposal has more similarities to the fisherman-huts with the walls closer to the ground. The roof is pointier than the others to utilise the space in front of the walls. The plan ensures that people of all heights effortlessly can circle the bed without feeling close to the ceiling. The bed is centrally placed in the room with closets behind it. One of the cabinets can be replaced with a desk to offer a place contemplation. The concept of the hut is to offer an experience as close to the otherwise protected natural environment as possible. The visual barrier between the interior and the exterior is minimised by facing the bed towards a large glass facade. The environmental qualities can be further implemented by activating other senses than sight. The cabins are placed in the bottom of the dunes to hide them in the landscape, which means that they do not have a view of the sea. By simply dividing a window into two can a small open window be used to allow the sound of the sea in without letting a large amount of the warm air out.

The fourth proposal favours a living area and places the bed on the first floor. The cabin was initially designed for two people but ended up being the smallest possible cabin for four people by replacing the living room furniture with a bed.

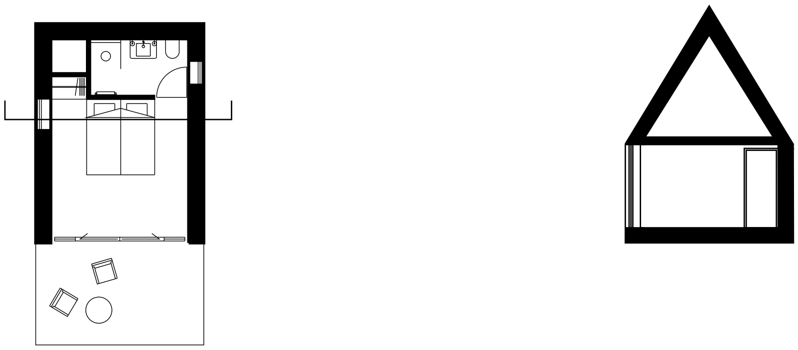
The third and fourth designs were chosen because of size and visual appearance. The third proposal resembles the fisherman-huts the most, while the fourth was difficult to compress to a fitting size for the landscape.

It is essential that the huts do not compromise the landscape, and by elevating the structures on poles, they will leave a minimal impact on the site. While this will protect the area from a permanent foundation, it will not protect the landscape from a sewer system. The biggest obstacle with the cabins being placed in the dunes is the need for a sewer system. Durable solutions have not been thoroughly investigated, but the current design features compostable toilets which have become very efficient in recent years.



Entrance

INTERNAL GROSS AREA:
25 M^2

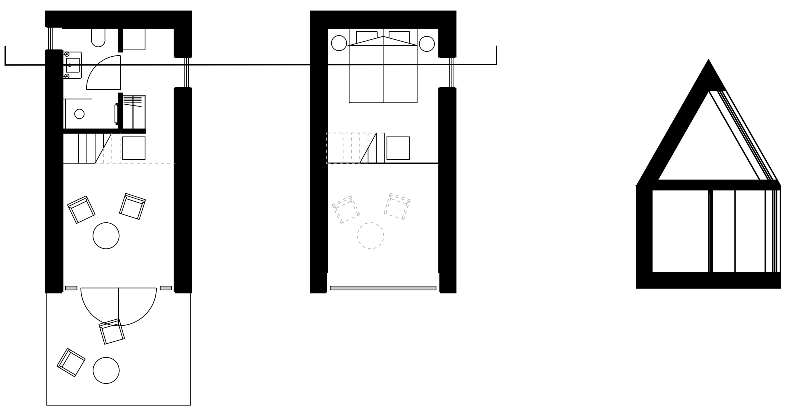


Entrance

INTERNAL GROSS AREA:
20 M^2

Entrance

INTERNAL GROSS AREA:
24 M^2



Entrance

INTERNAL GROSS AREA:
29 M^2

Ill. 128 - Plan and Sections Studies of the Huts - 1:200

DESIGN PROCESS

PATHWAY STUDIES

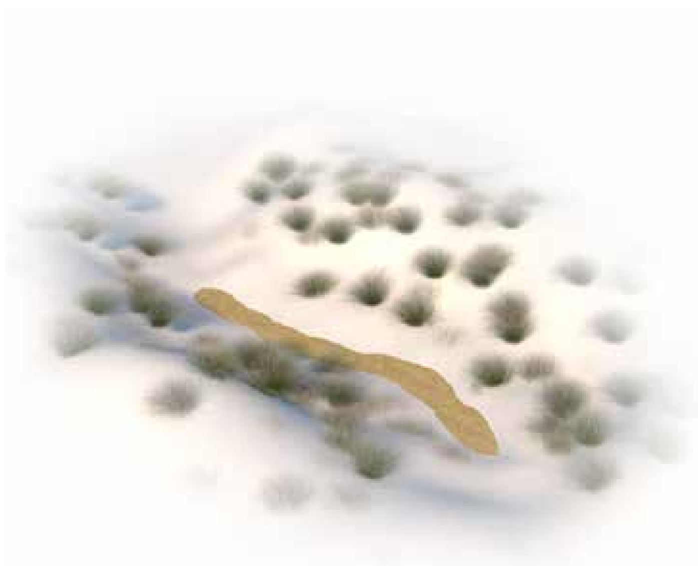
Pathways are necessary to ensure accessibility, with the cabins placed in the dunes. The sandy pathway is the most primitive option. They are created by visitors hiking the dunes and can be relevant for creating smaller routes in the landscape, but not possible as the only path to the huts.

The elevated pathway is simple and effective, making the dunes accessible for disabled or impaired visitors. The pathway blends well with the environment and is not pulling attention away from the landscape.

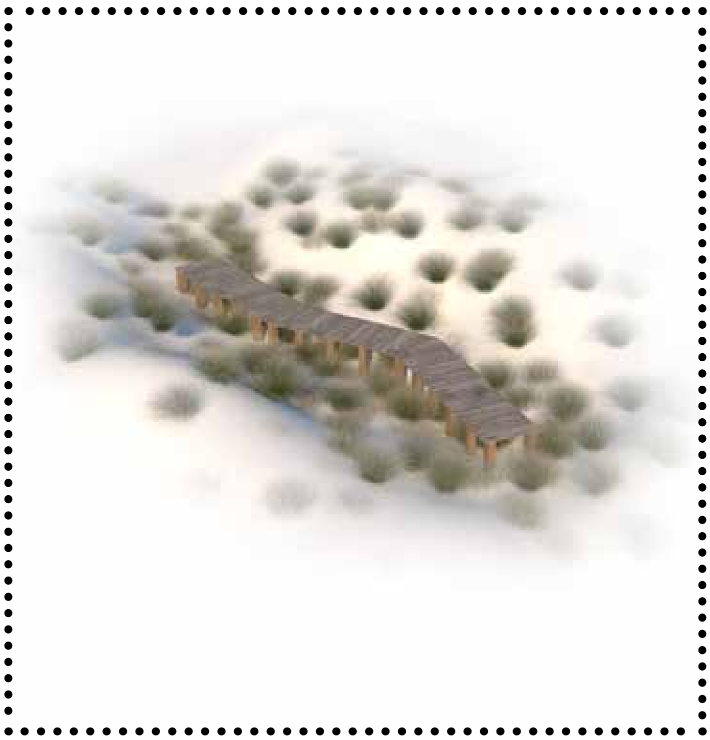
The covered pathway is a further development of the elevated path. The roof will shield the visitors from rain, but we have to look towards the next expansion to shield from the strong winds. It is undoubtedly necessary with protection against the strong winds and the heavy rain, but it cannot be justified to building such large constructions through a preservation area.

The elevated pathway has been chosen for its simplicity in appearance and construction. The path will blend in with the landscape. The pathway can be further developed with specific 'touch-down' places along the trail to display specific areas of interest.

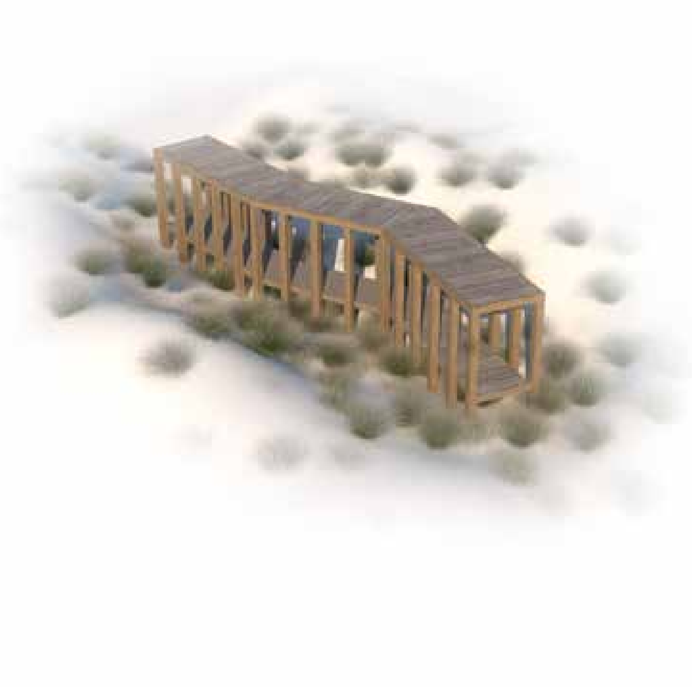
SANDY PATHWAY



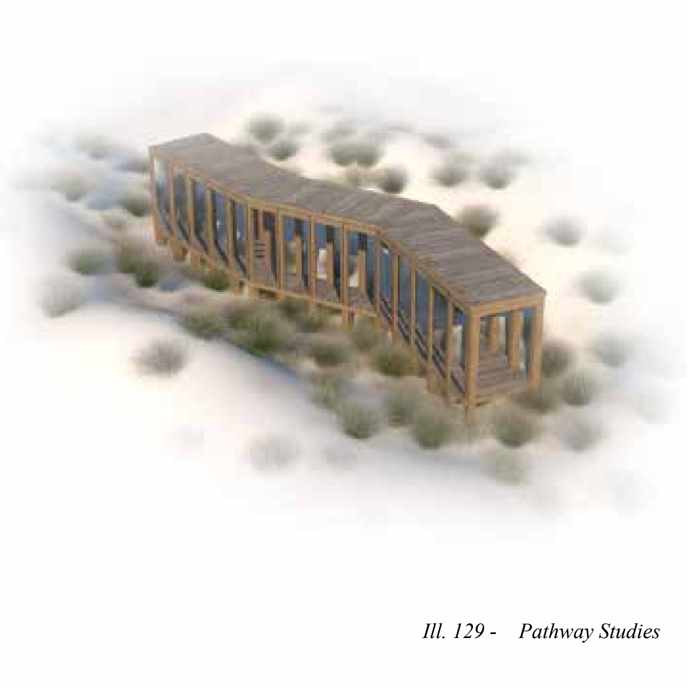
ELEVATED PATHWAY



COVERED PATHWAY



ENCLOSED PATHWAY



Ill. 129 - Pathway Studies

DESIGN PROCESS

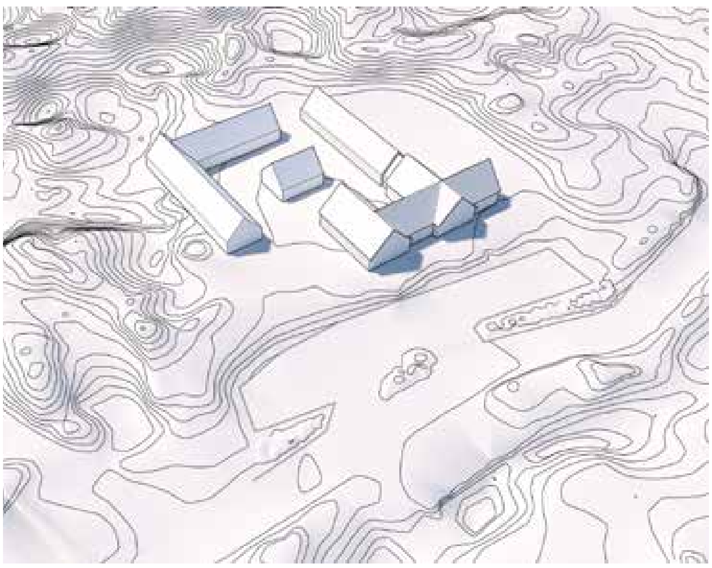
PARKING

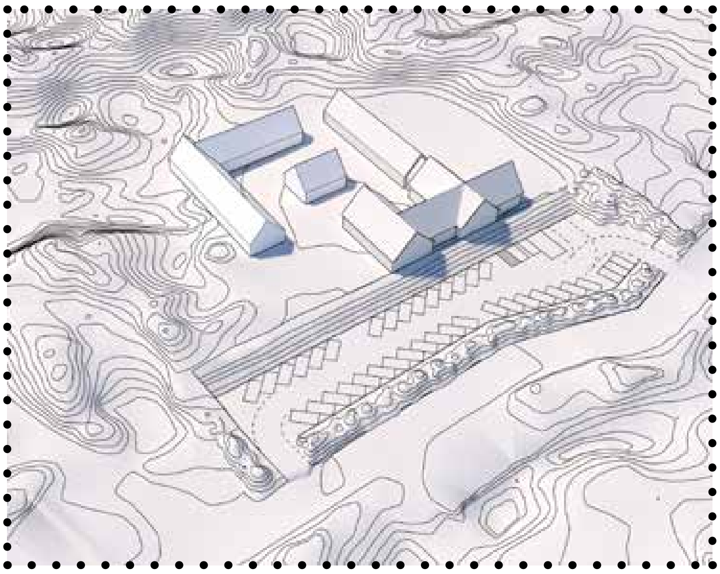
The current parking area consists of an undefined paved area in front of the dilapidated hotel. While the town has taken initiatives to embellish the area with small dunes, it is still not worthy of being the last thing visitors experience before they reach the beach. The place has, however, benefited the locals, as it has been used for carnivals, festivals, events, etc.. Keeping the current parking area, saves both resources and capital, but it will leave the renovated building with an unwelcoming entrance.

The second design aims to improve the visual appearance of both the community centre and the scenery when driving along the main road. The parking area is enclosed by tall dunes hiding the parked cars. The parking area is one-way to take account for the extensive dunes. The two openings have pedestrian paths to lead pedestrians around the parking area, instead of through it. The area contains 40 parking spots with 3 for disabled parking and four reserved for electric cars.

CURRENT PARKING AREA

CURRENT PARKING AREA, ADDED SURROUNDING DUNES



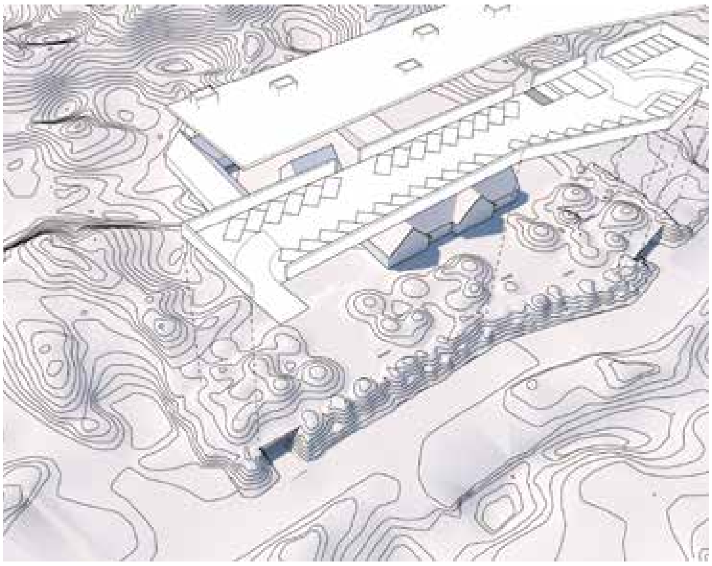


The third concept features underground parking, where the parking area is lowered one meter to be able to reestablish the dune landscape above. Dunes will enclose the community centre, and the landscape will be a beautiful last view of the town. The solution, however, is extensive, expensive and resource-demanding.

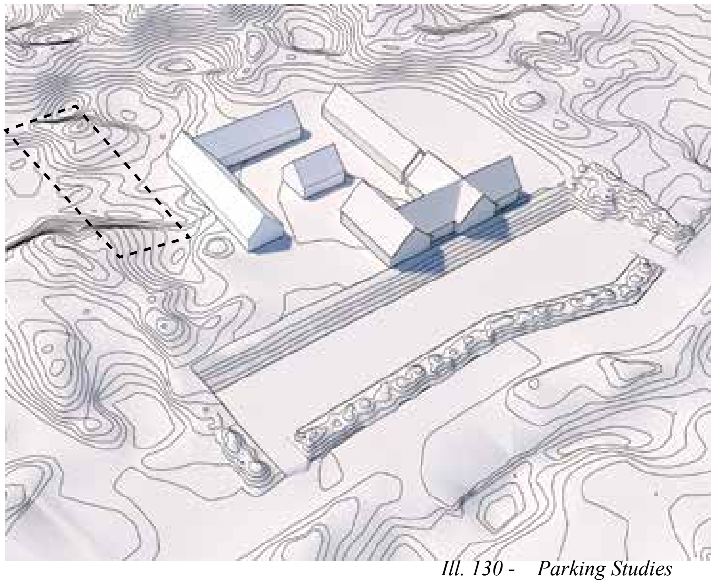
The last design establishes a row of dunes to shield the space and to enrich the visual appearance of the town. The space is kept as a flexible outdoor space for events and activities. The parking is moved further south accessible by a smaller road. While attractive with a big public square to accommodate the local initiatives, is the alternate placement of the parking unfortunate, as it will be necessary to clear more landscape to construct it.

The second design has been chosen for being the most straightforward solution to achieve both efficient parking and a beautiful entrance.

CURRENT PARKING AREA BUILT UNDER DUNES (SHARED PUBLIC AREA)



MOVED SOUTH-EAST AND BUILT UNDER DUNES



Ill. 130 - Parking Studies

DESIGN PROCESS

FOUNDATIONS

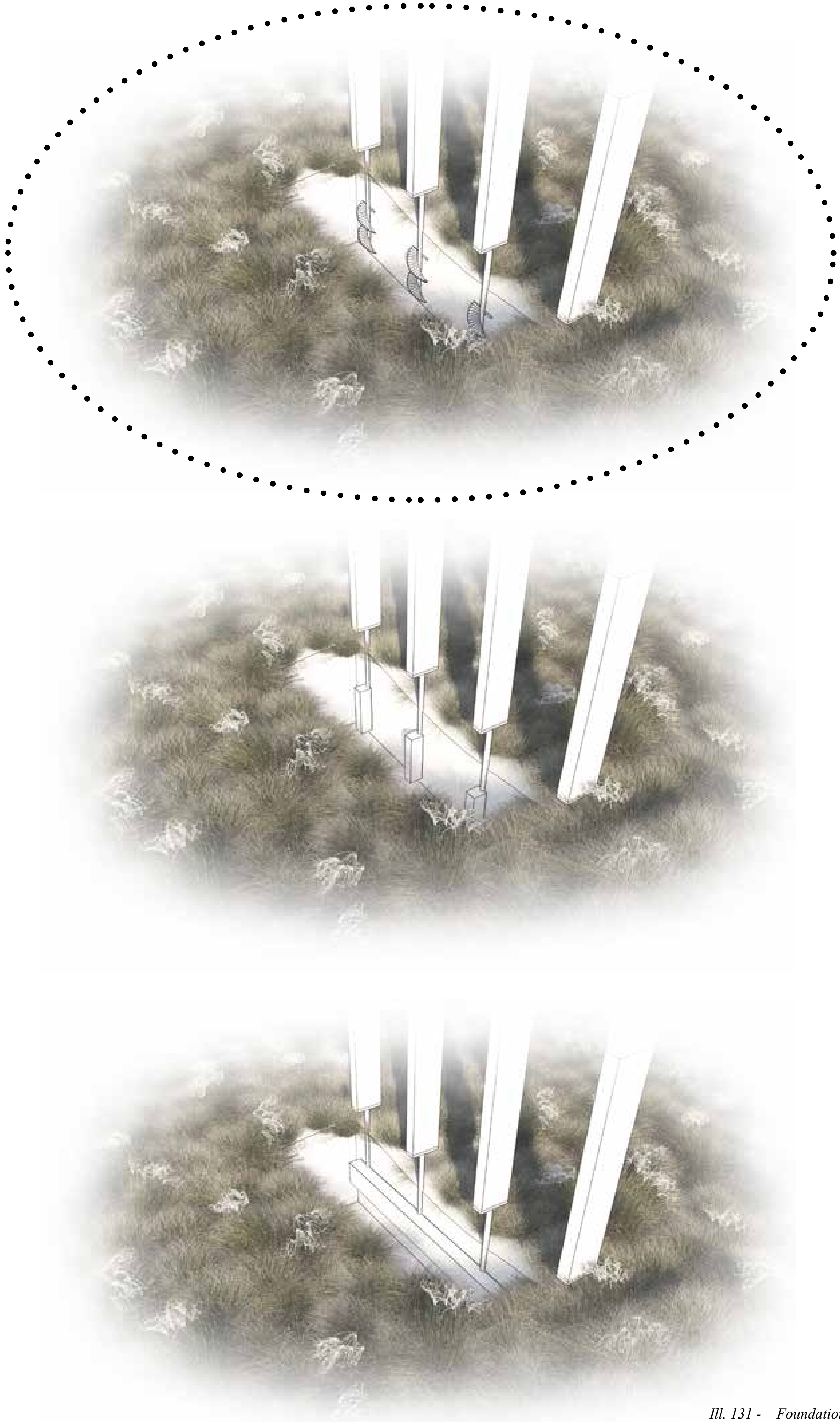
Constructing in a preservation area requires careful consideration in the design process to ensure that the local natural environment suffers the least possible impact. The concept of elevating the structures will allow natural vegetation under the building and leave a minimal effect on the landscape.

Three concepts of elevating the structure have been considered. The first was using Helipoles, which are big metal screws that a turned into the ground and later fastened to the construction - in this case, the frames. The Helipoles leaves a minimal impact on the landscape and can be dismantled when the building is decommissioned. This follows the concept of Design for Disassembly, which can be further implemented by mechanically assemble the construction.

The second solution is pile foundations of reinforced concrete. The procedure only impacts the ground where the pile is inserted - no unnecessary removal of vegetation around the foundations. Pile foundations are usually hammered deep into the ground, transferring loads to the stronger underground layer. The installation of the piles is possibly the biggest problem with this solution, as the installation process requires heavy equipment that can harm the preservation area.

The last solution is a line foundation dug into the ground. The process is simple, but this solution also has the most significant impact on the environment. By digging the line foundation deep down, can the vegetation layer above possibly re-grow.

The Helipoles has been chosen for easy installation, minimal impact on the environment and the easy disassembly. The strength of Helipoles is out of the scope of this project. A deeper investigation must define the precise dimension, number and placement of the Helipoles.

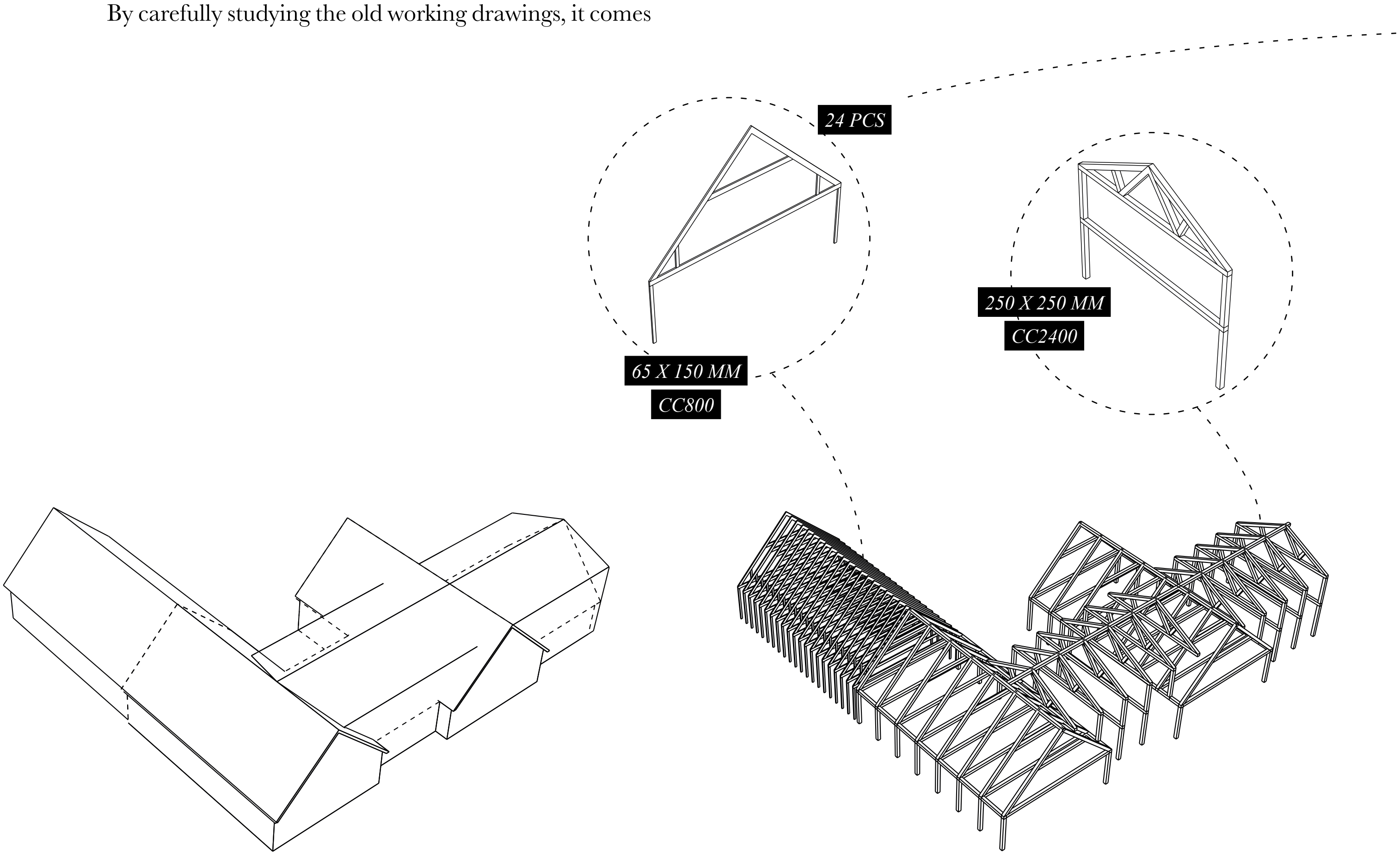


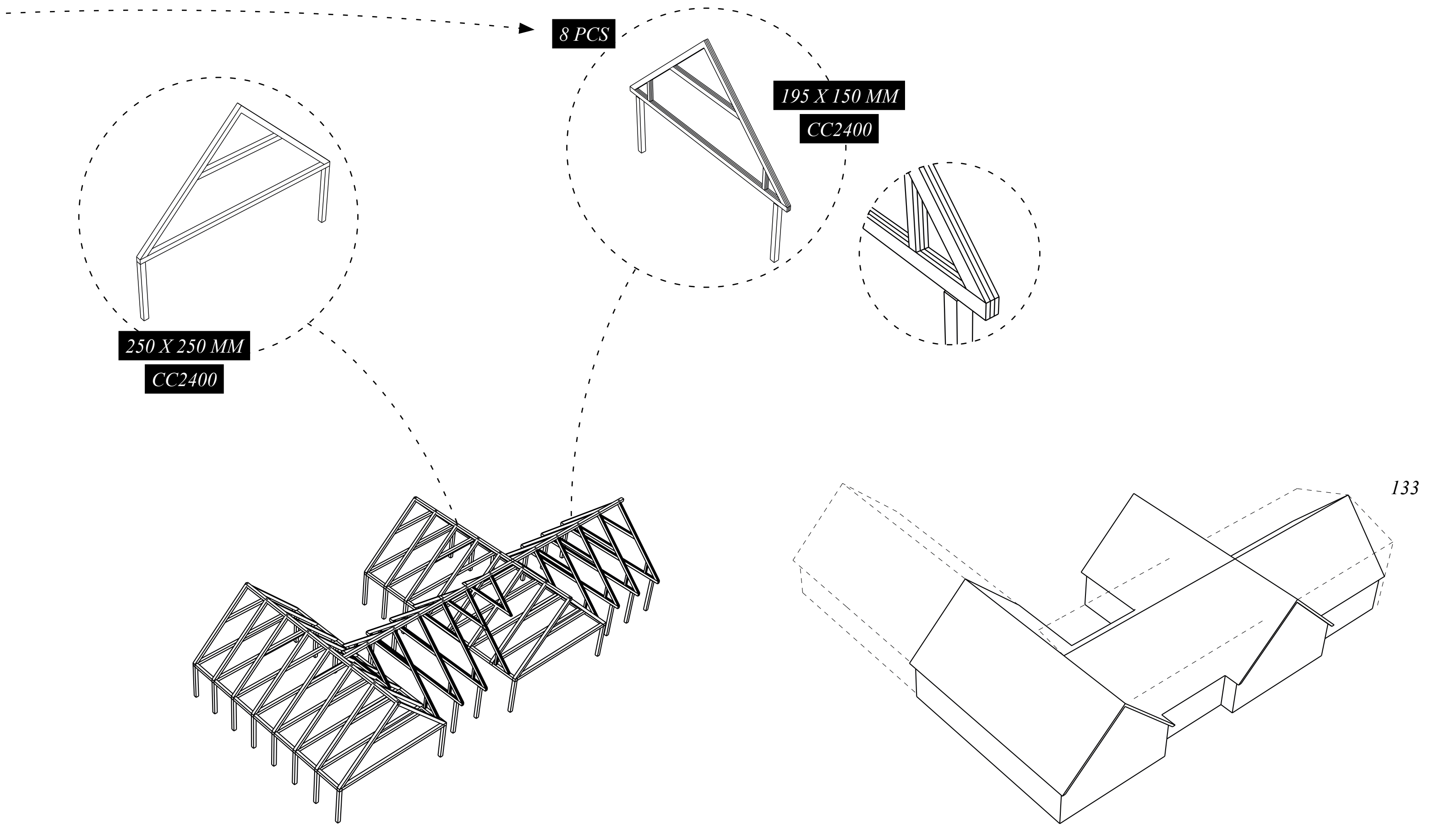
Ill. 131 - Foundation Studies

DESIGN PROCESS

STRUCTURAL CONCEPT STUDIES

The structural concept of the seaside hotel has been studied through the original working drawings obtained from the municipality. The drawings show that the part of the building with the lower roof is the original trusses from when it was first built. The part of the building with the taller roof has been replaced and raised under renovations in the 70s and are constructed with fan trusses. It is necessary to lower the renovated roof to restore the visual appearance of the original building. By carefully studying the old working drawings, it comes apparent that the private residence in the south-eastern wing of the hotel is constructed with collar beam trusses in the appropriate height and slope. As the residence is set to be demolished, it must be skillfully disassembled to reuse the trusses. The building contains 24 trusses of 65 x 150 mm. By merging three pieces to one, we get eight pieces of 195 x 150 mm distanced by 2400 mm, which luckily is the same as the original building and the exact number necessary.





133

Ill. 132 - Structural Concept Studies - Original Structure

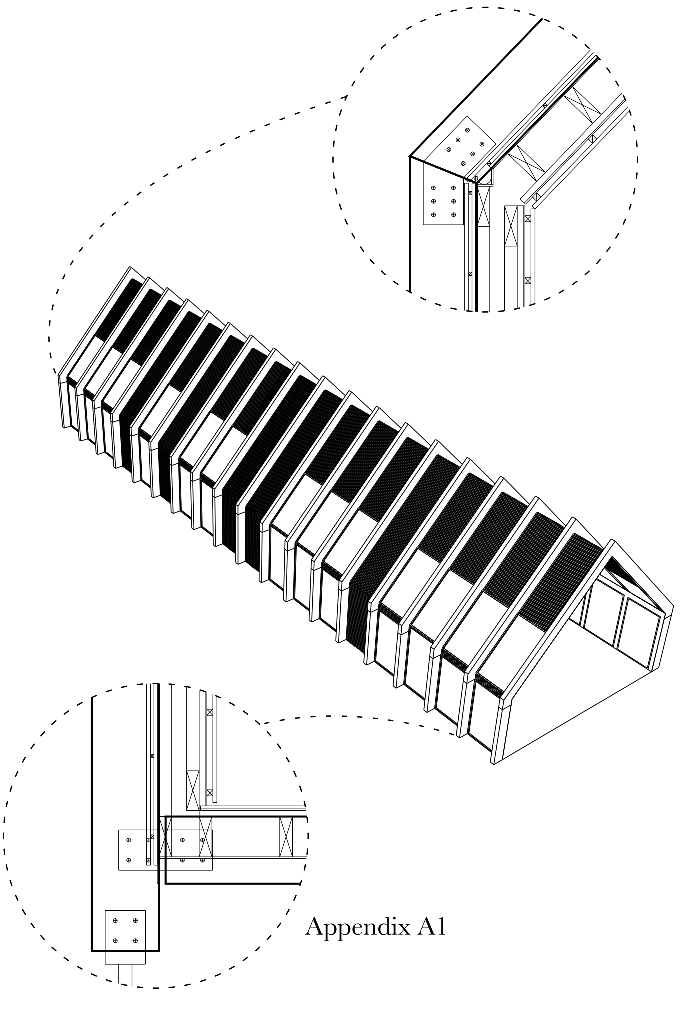
DESIGN PROCESS

STRUCTURAL CONCEPT STUDIES

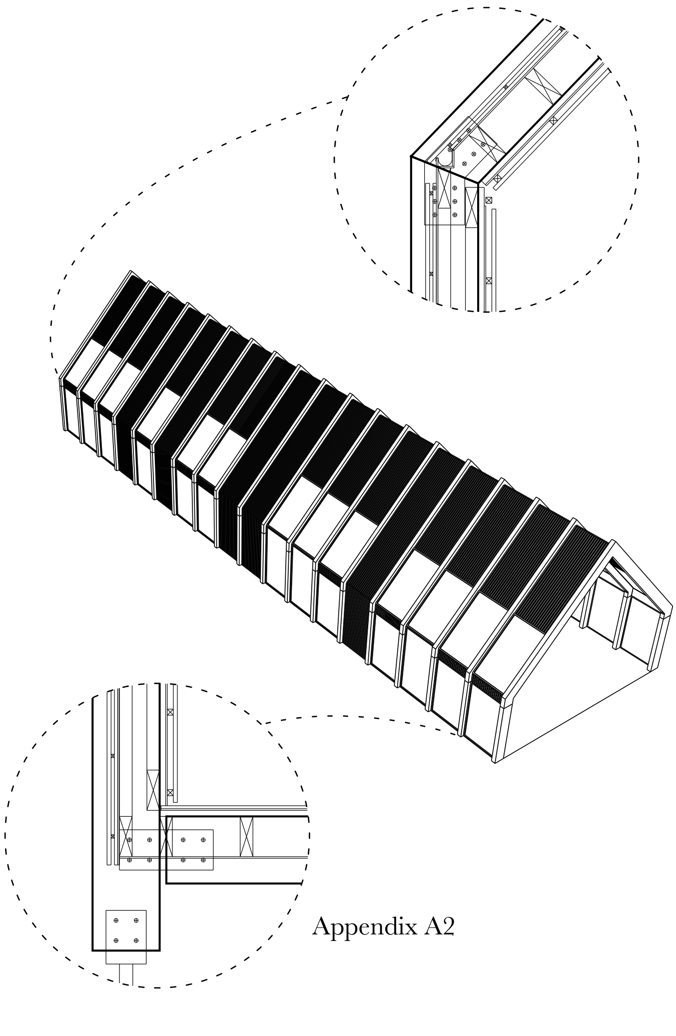
The new buildings are constructed of frames repeated through the structure similar to trusses. The visual appearance of the building will radically change depending on the placement of the frame in the building envelope. The four different designs are evaluated according to visual appearance, ease of construction and integrity of the building envelope.

The first design resembles a skeleton, where the whole frame is exposed while the building envelope is mounted on the inside of the frame. The solution is rather simple to construct and has eliminated most cold bridges as the entire envelope is placed inside the frame. The expression is interesting but requires detailing.

The second solution has a more subtle expression. The inside of the envelope flushes the inside of the frame, which causes a cold bridge. The frame is exposed on



Appendix A1

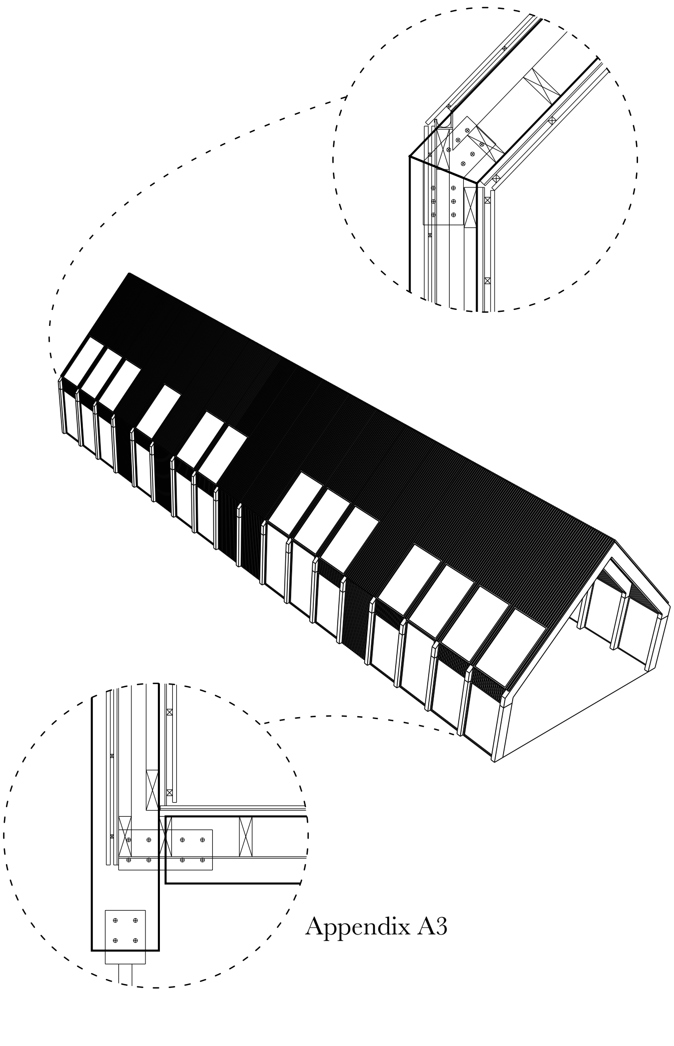


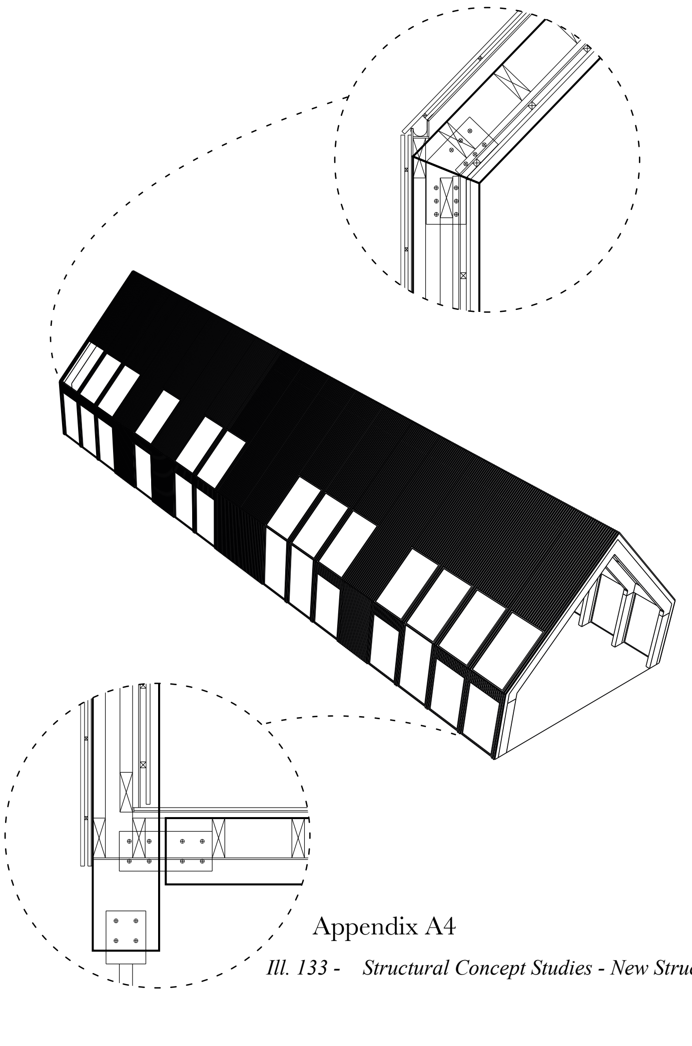
Appendix A2

the exterior while having no insulation on the interior. The third proposal covers the frame on the roof while exposed the wall part of the frame. The frame is insulated on both the wall and the roof part on the interior. The cold bridges are limited but not eliminated even though wood is a poor heat conductor.

The fourth design exposes the frame on the interior and encapsulates it on the exterior. The solution has no cold bridges and extra insulation in the roof makes it possible to hide the gutter. The fourth solution is chosen for its minimalistic exterior, great building envelope and the expressive interior.

The frame is exposed at the foundation in all designs. Wood is, as mentioned, a poor heat conductor, and is preferred over a steel plate through the envelope to connect the frame and frame foundations.





Ill. 133 - Structural Concept Studies - New Structure

DESIGN PROCESS

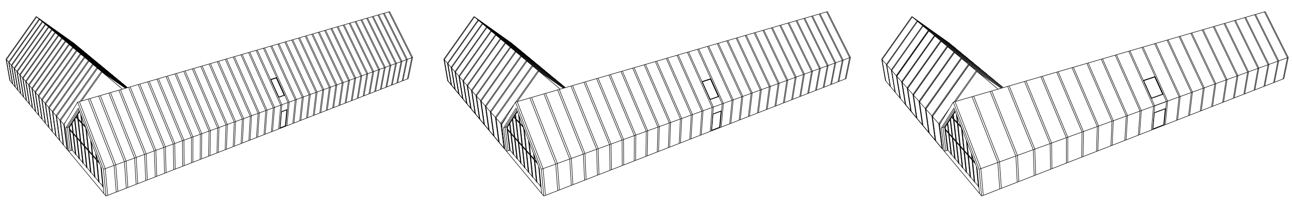
LIGHT STUDIES: WINDOW DIMENSIONING

WIDTH OF THE WINDOWS

The initial light studies focused on the width of the windows and thereby the width between the structural frames. The height of the windows are set to 2500 mm to eliminate a barrier between the inside and the outside. The ground floor windows are leveled with the floor creating a more spacious floor plan. The first floor windows are placed with the same distance from the wall/roof corner as the ground floor windows - this elevates the window 1250 mm above the floor. The daylight factor is measured at 850 mm above the floor on both floors. The trancemittance of the window glazing is set to 68% - the medium setting of Velux Daylight Visualizer, which is used for the following studies. The materials are set to a light wood as natural materials are prefered over paint and synthetic products. Light wood will present a more realistic result, as high reflective materials, such as painted white surfaces, will be limited - if possible. When placing spaces that require a high daylight factor in the middle of the building, bright or white surfaces will help reflecting the necessary daylight deeper into the structure. When comparing window dimensions and trancemittance this simplified study is sufficient, but a study closer to reality is necessary to evaluate the building as a whole, with the correct materials and trancemittance.

Part Conclusion:

The studies show that the largest window tested (1965x2500 mm) on two facades facing each other is not enough to reach a daylight factor of 2% in the center of the building. On the first floor, however, is two 1460x2500 mm enough to reach 2,3%. A higher dayligh factor can be reached by choosing a more reflective material of the interior or glazing with a higher trancemittance. The test does not eliminate any window dimensions, as the 2% can be reached by adding the appropriate number of windows, but with the structural frames limiting the spread of diffuse light when using wider windows, and thereby deeper structural profiles, a test is necessary to evaluete the difference.



Ill. 134 - Width of Windows 01

Windows (1015 mm):

4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood

Windows (1460 mm):

4x 1460x2500 mm (3,65 m2)
= 14,6 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood

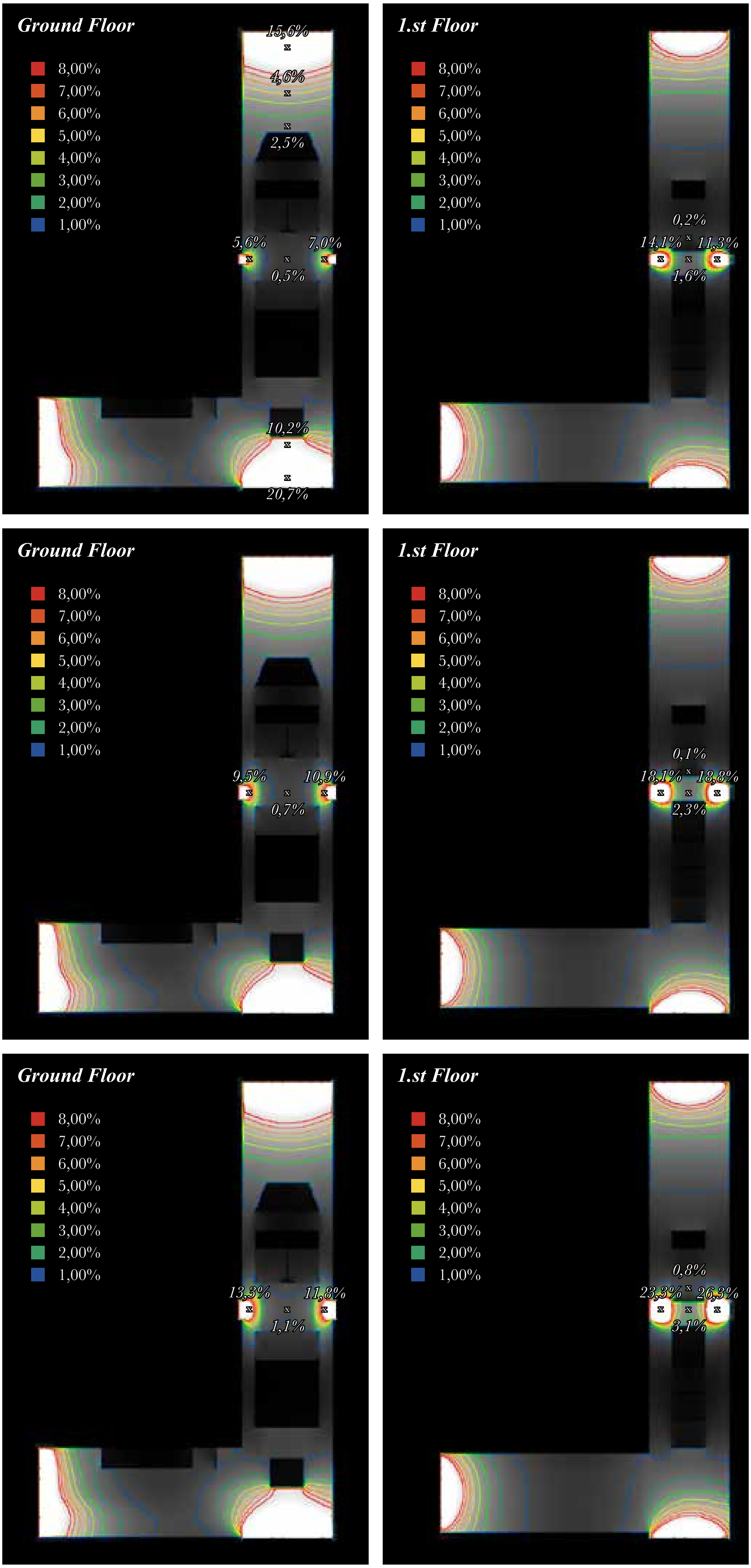
Windows (1965 mm):

4x 1965x2500 mm (4,91 m2)
= 19,65 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood



Ill. 135 - Daylight Studies - Width of Windows 01

DESIGN PROCESS

LIGHT STUDIES: WINDOW DIMENSIONING

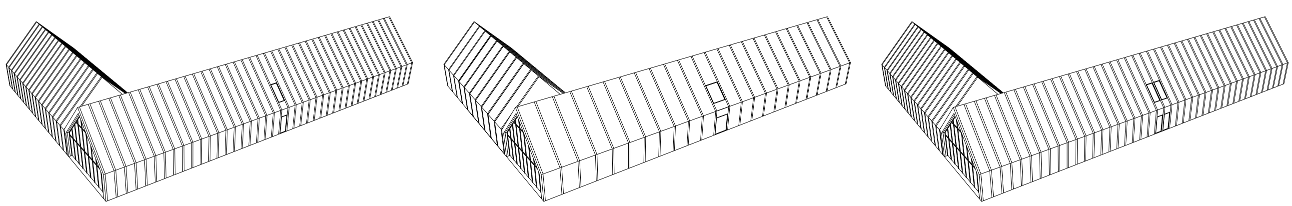
WIDTH OF THE WINDOWS

The first two rows of the following page is the results from the study on the previous page. The results are compared to two windows of 1015x2500 mm, which is displayed in the third row. The structural frame is 200x500 mm. The 2 x 1015 mm windows has a 3,25% larger glass area, while having 20% lower daylight factor in the center of the building.

Part Conclusion:

The 20% lower daylight factor is a result with great uncertanty, as 0,9% and 1,1% is low numbers with no decimals - adding a single decimal could possibly change the result by almost 10%. We can, however, conclude that the frame does limit the daylight factor between 0,1% and 0,3%. While the larger windows provide more daylight, they are also heavier, requiring special handling, possibly poluting more under production, transportation and handling. They provide a better view to the outside with less structural frames, while they are less flexible when placing windows and framing views.

The 1015x2500 windows are chosen for the flexibility, lower weight and easier handling, and visual appearance, creating a visually lighter bulding with horizontal lines contrasting the long structures.



Ill. 136 - Width of Windows 02

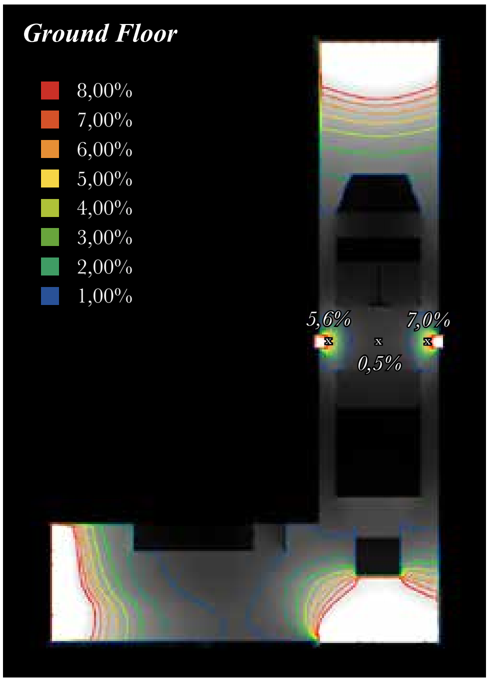
Windows (1015 mm):

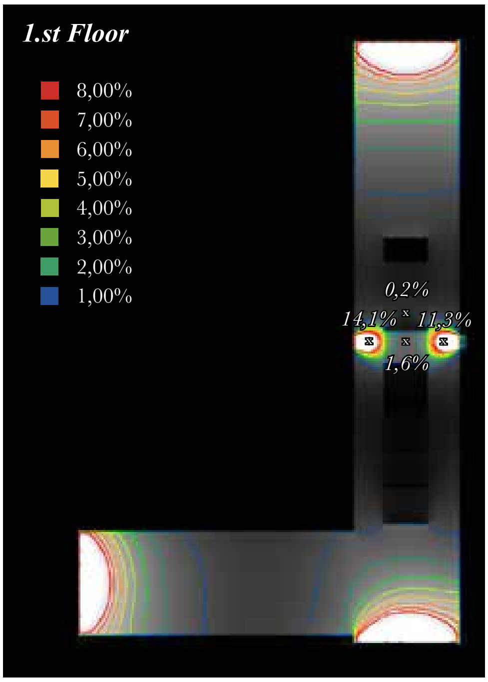
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





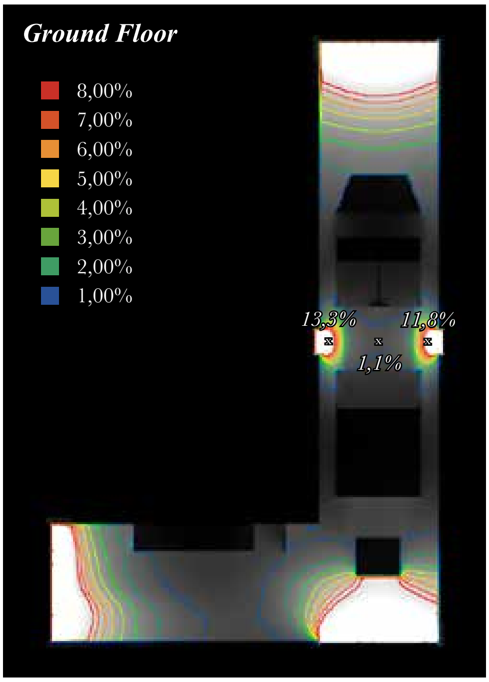
Windows (1965 mm):

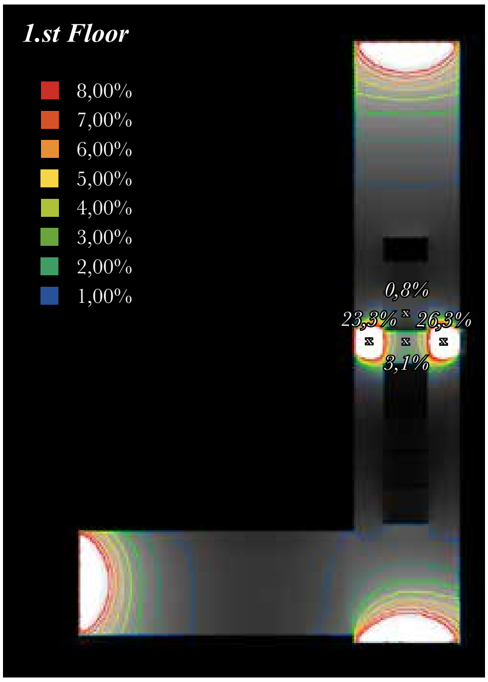
4x 1965x2500 mm (4,91 m2)
= 19,65 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





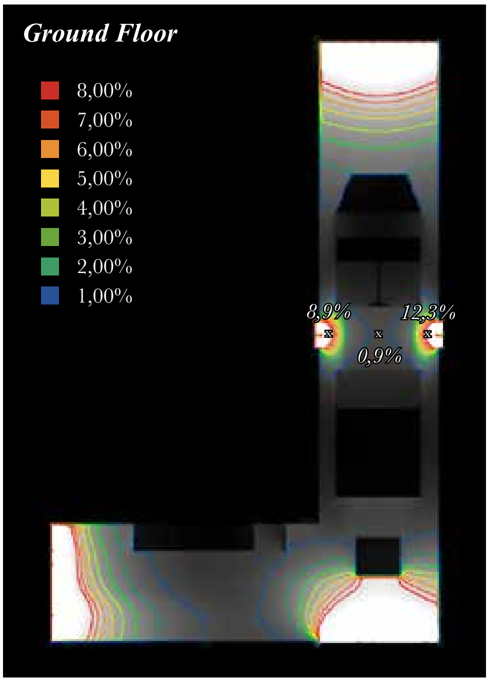
Windows (2 x 1015 mm):

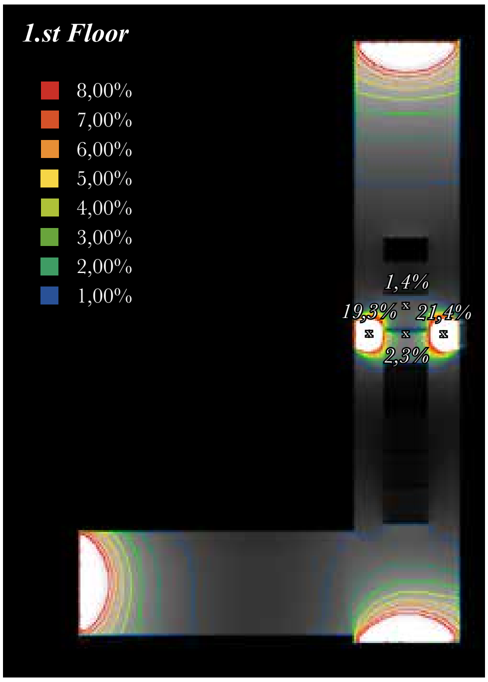
8x 1015x2500 mm (2,54 m2)
= 20,30 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





Ill. 137 - Daylight Studies - Width of Windows 02

DESIGN PROCESS

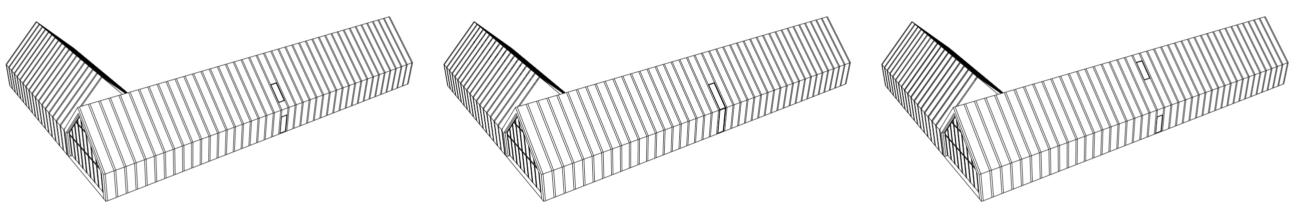
LIGHT STUDIES: WINDOW DIMENSIONING

HEIGHT & PLACEMENT OF THE WINDOWS

This analysis focuses on the difference between a 1015x2500 mm window, a 1015x3500 mm window and a 1015x2500 mm skylight placed on the upper part of the roof. The 3500 mm tall windows fills the wall from top to bottom with the windows on the roof placed from the corner between wall and roof, creating a seamless transition from wall to roof. The larger windows provides an uninterupted view of the scenery outside whether you are standing on the ground floor or first floor. The glass corner creates a very bright and transparent wall and roof. The larger windows will, while providing more daylight, also allow for more solar heating, which can cause overheating with more windows. The 1015x3500 mm windows are 33,33% larger than the 1015x2500 mm windows, while providing 53%-57% higher daylight factor at 850 mm above the ground floor. The daylight factor is nearly identical 850 mm above the first floor. The 1015x2500 mm skylight shows significantly lower results as the windows are placed high above where the daylight factor is calculated.

Part Conclusion:

Skylights is not suited for this project, as they will be placed high above the floor and provides not views to the landscape outside, compared to the two other window solutions. The 1015x3500 mm windows eliminates the barrier between the inside and the outside, but will also add many extra square metres of glass if this glass corner is used for the entire structure. The 1015x2500 limits the boundary between the interior and the exterior. The wall/roof corner and the structure will not feel as light and airy as with the 3500 mm windows, but placed strategically they will frame the exterior and allow adequite daylight and passive heat. The corners can then be formed for acoustical advantages. As glass will reflect sound, will acoustical absorbers in the corners allow for more windows in eye-height, creating a more open structure. Both 1015x2500 mm and 1015x3500 will be used for the design. Testing for daylight requierements and overheating will be tested further.



Ill. 138 - Height of Windows

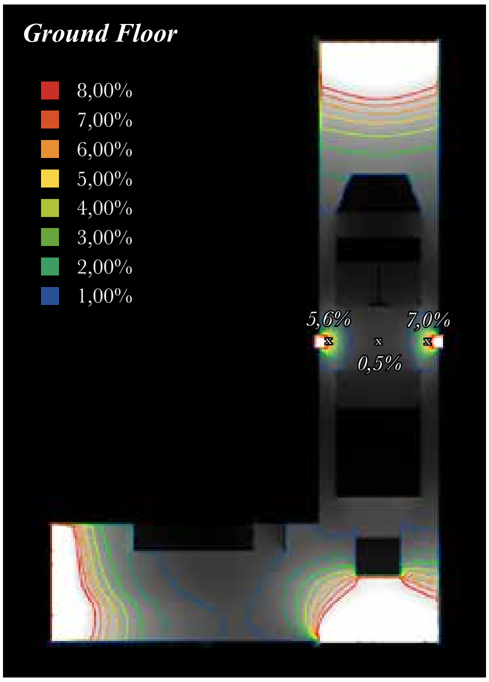
Windows (2500 mm):

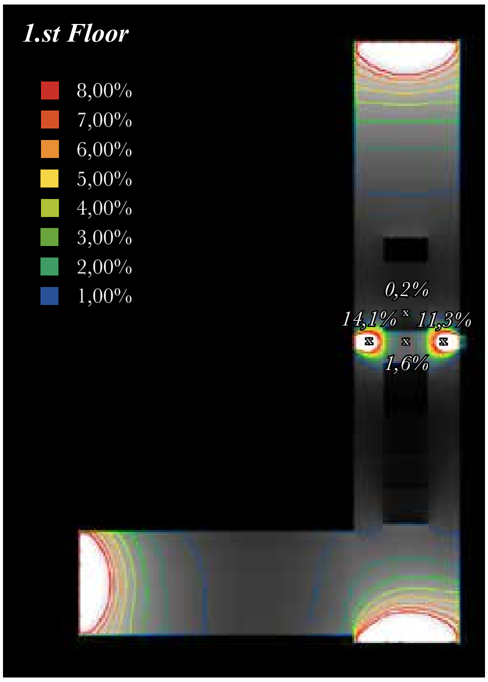
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





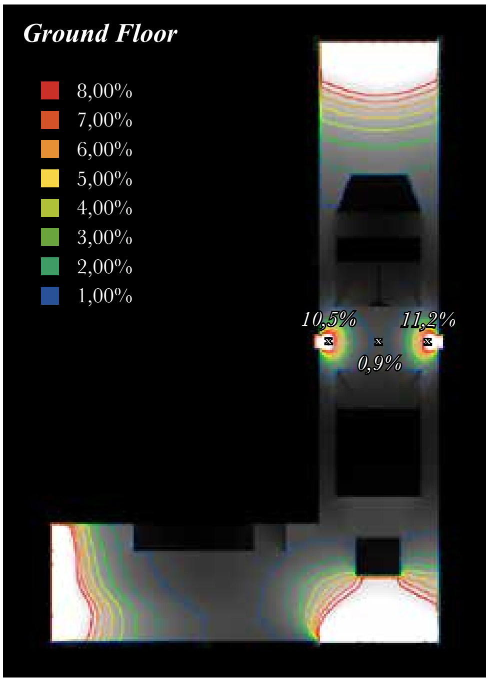
Windows (3500 mm):

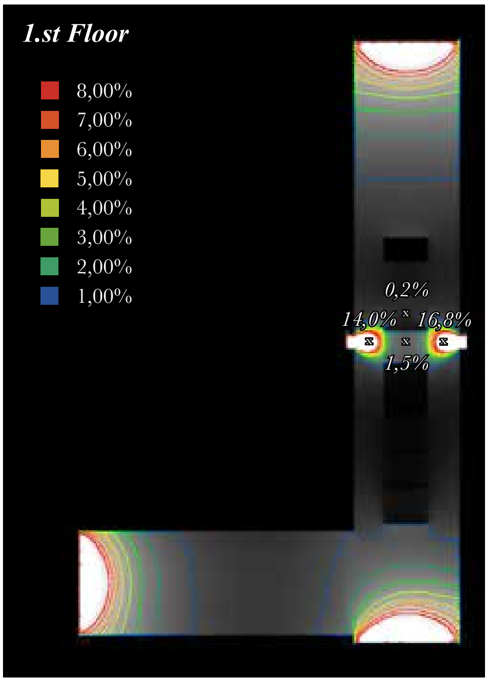
4x 1015x3500 mm (3,55 m2)
= 14,21 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





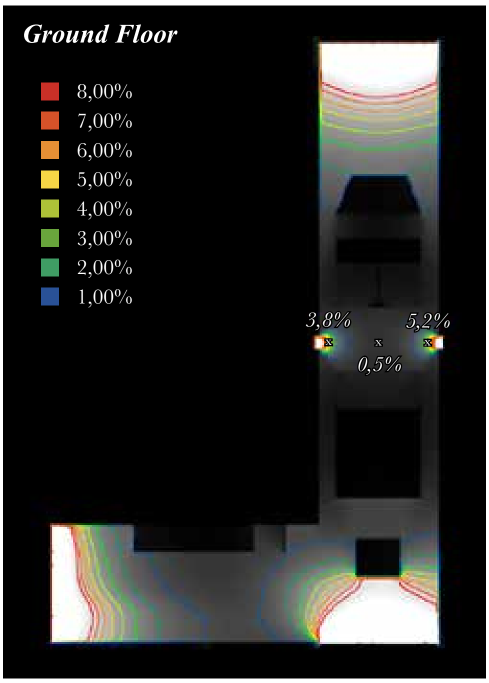
Windows (2500 mm Skylight):

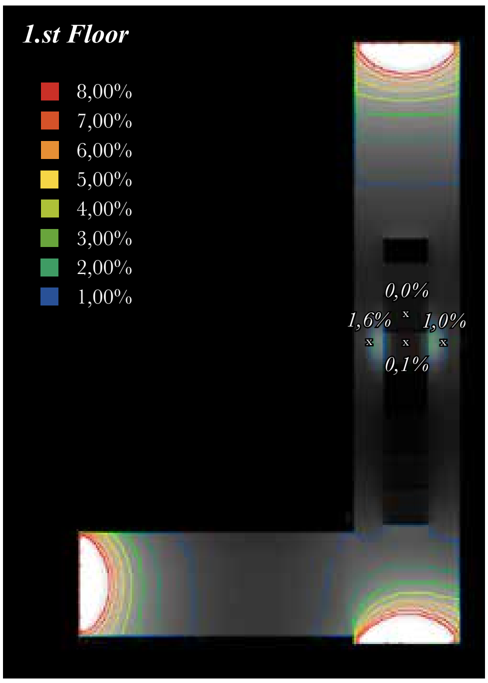
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





Ill. 139 - Daylight Studies - Height of Windows

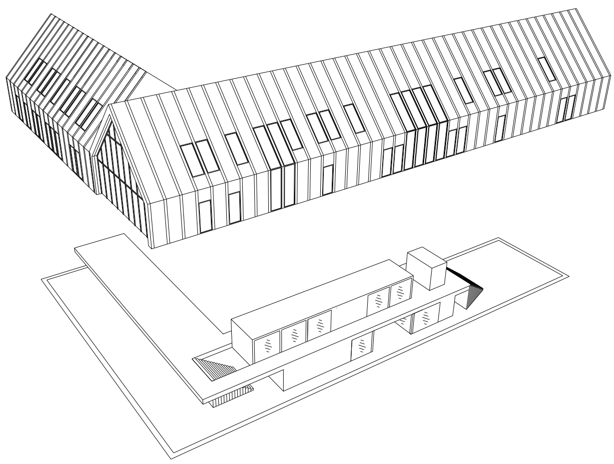
DESIGN PROCESS

LIGHT STUDIES: BUILDING C

The windows are placed according to views of the outside and sufficient daylight, limiting the need for electrial lighting. 1015x3500 mm windows are placed at the entrances at the center of the north wing to indicate that it is an entrance and welcome people into the building - as the gable does. 1015x2500 mm windows are placed according to views to the outside when walking along the two pathways on the eastern and western sides of the building. Windows are placed to eliminate dark corridors and to create an open and light structure. The design is then analysed for glazing with different transmittance specifications - 20%, 42% and 78%. The interior glass has been tested with 42%, 68% and 78%, which have shown that the highest possible trancemittance is necessary to achieve an acceptable daylight factor in the interior spaces (see Appendix A1.1). The dark glazed windows with 20% trancemittance show promising indoor temperatures, but also requires most of the building cladded in glass to achieve a daylight factor of 2% in the interior spaces. The window has a low trancemittance as the glass is dark and reflective on the exterior, which will seem uninvitable to guests and will work against a natural expression of the building. The 42% is soft coated glass, which shields a significant portion of the sun's heat while the treatment on the pane is almost invisible (Jydsk Vindueskompagni, 2019). The Velux Daylight Visualizer analysis shows almost 2% daylight factor in the offices in the center of the first floor, while 1,3% and 1,0% in the conference rooms on the ground floor. The windows with 68% trancemittance reaches the reqiered daylight factor in both the conference rooms and the offices on the first floor, but the 24 hour average temperature is 32,8 °C. Such high temperatures can be diffucult to minimise with external shading. However, external shading solutions will be necessary for all 3 window types, as the 24 hour average temperatures are 26,2 °C, 29,3 °C and 32,8 °C.

Part Conclusion:

It is necessary to consider 24 hour average temperatures, external shading and daylight factors when determining the correct window panes. The 68% windows panes are the only ones that reaches the requiered daylight factor of 2%. The windows panes with 42% trancemittance will on the other hand allow for more windows and provide are more open structure. 24 hour average calculations with various shading solutions is necessary to ensure that the windows with 68% trancemittance will not overheat the building.



Ill. 140 - Building C

Windows (20% Exterior, 78% Interior):

North: 62,25 m²

South: 62,25 m²

East: 46,69 m²

West: 44,66 m²

Roof: 88,81 m²

Trancemittance:

= 20%

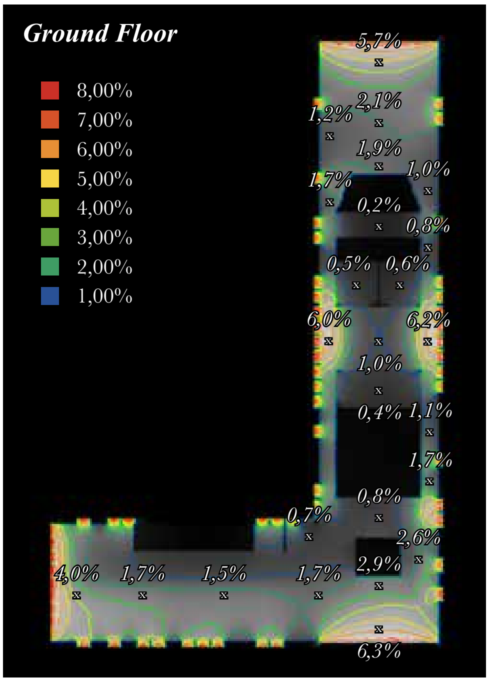
Materials:

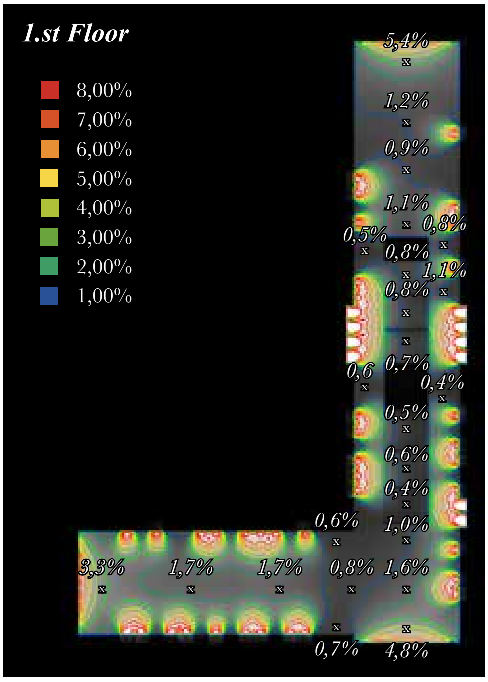
- All Surfaces: Light Wood

Temperature (Appendix B1.1):

24 Hour Average = 26,2 °C

Max. Temperature = 28,4 °C





Windows (42% Exterior, 78% Interior):

North: 62,25 m²

South: 62,25 m²

East: 46,69 m²

West: 44,66 m²

Roof: 88,81 m²

Trancemittance:

= 42%

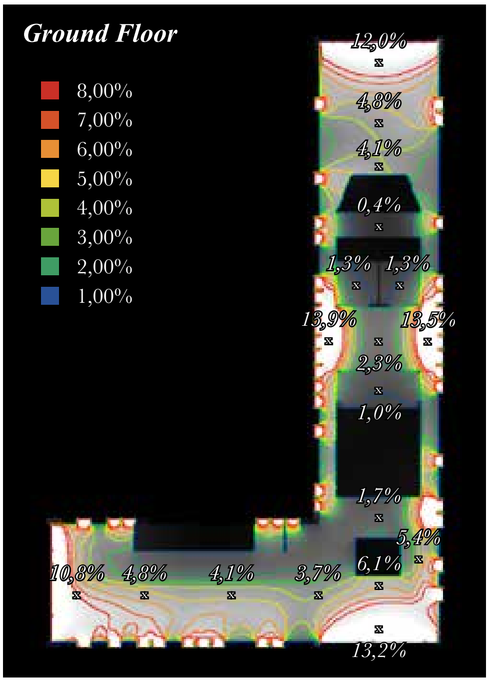
Materials:

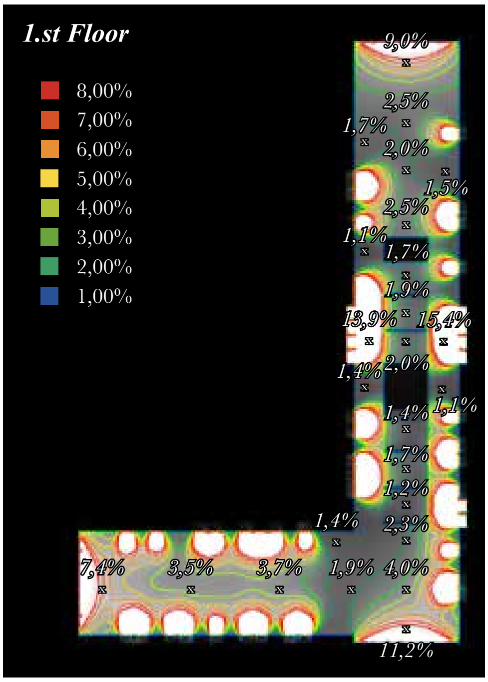
- All Surfaces: Light Wood

Temperature (Appendix B1.2):

24 Hour Average = 29,3 °C

Max. Temperature = 32,2 °C





Windows (68% Exterior, 78% Interior):

North: 62,25 m²

South: 62,25 m²

East: 46,69 m²

West: 44,66 m²

Roof: 88,81 m²

Trancemittance:

= 68%

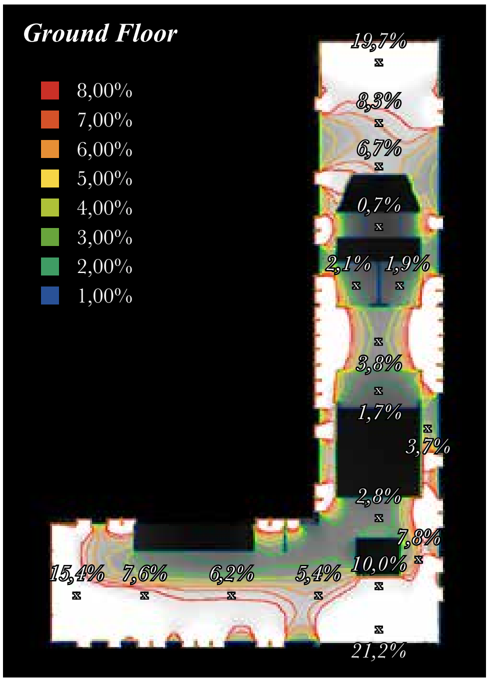
Materials:

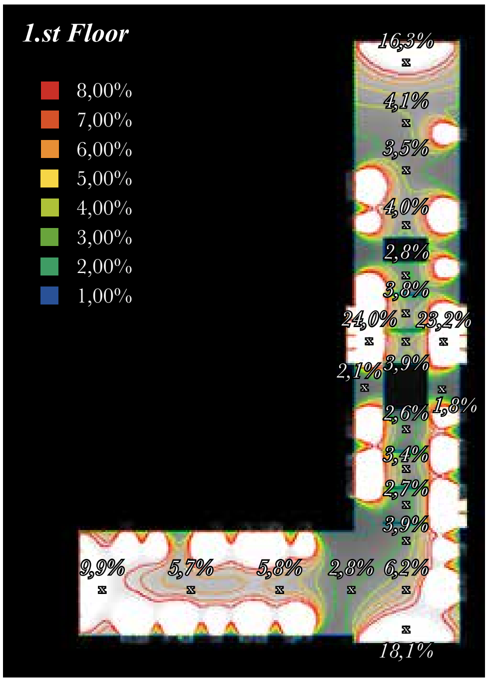
- All Surfaces: Light Wood

Temperature (Appendix B1.3):

24 Hour Average = 32,8 °C

Max. Temperature = 36,6 °C





Ill. 141 - Daylight Studies - Building C 01

DESIGN PROCESS

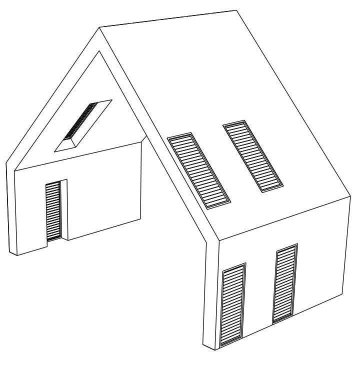
LIGHT STUDIES: BUILDING C

To ensure an optimal operative temperature between 21 ºC and 25 ºC it was necessary to use 42% trancemittance window panes, as the 24 hour average temperature of 32,8 ºC and a maximum temperature of 36,6 ºC on the 68% window panes required fewer windows and more external shading than desired.

Bright blinds between the window panes will with the bright surface reflect the solar rays. Being inside the panes, the blinds will not impact the external visual appearance of the building. The blinds will not need the same maintenance as external blinds, but they are also more difficult to repair. These blinds made nearly no difference on the indoor temperature.

The external blinds are most effecient when dark, as they will absorb the sunrays instead of reflecting them onto the window pane. The medium dark blinds lowered the temperature by 2,6 °C while the dark external blinds lowered it by a full degree more, resulting in a diffrence of 3,7 °C.

By moving the windows deeper into the facade the temperature is lowered by 0,3 °C. While this is not a



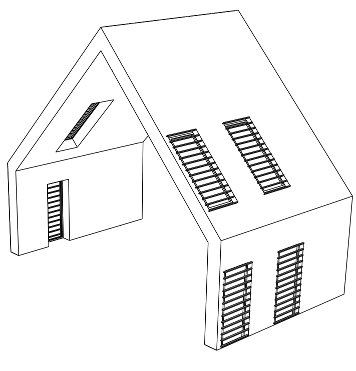
BLINDS BETWEEN WINDOW PANES

Bright Blinds

Temperature (Appendix B2.1):

24 Hour Average = 29,1 ºC

Max. Temperature = 31,9 ºC



EXTERNAL BLINDS

Medium Dark External Blinds

Temperature (Appendix B2.2):

24 Hour Average = 26,6 ºC

Max. Temperature = 28,8 ºC

Dark External Blinds

Temperature (Appendix B2.3):

24 Hour Average = 25,6 ºC

Max. Temperature = 27,6 ºC

Windows (42% Exterior, 78% Interior):

North: 62,25 m²

South: 62,25 m²

East: 46,69 m²

West: 44,66 m²

Roof: 88,81 m²

Trancemittance:

= 42%

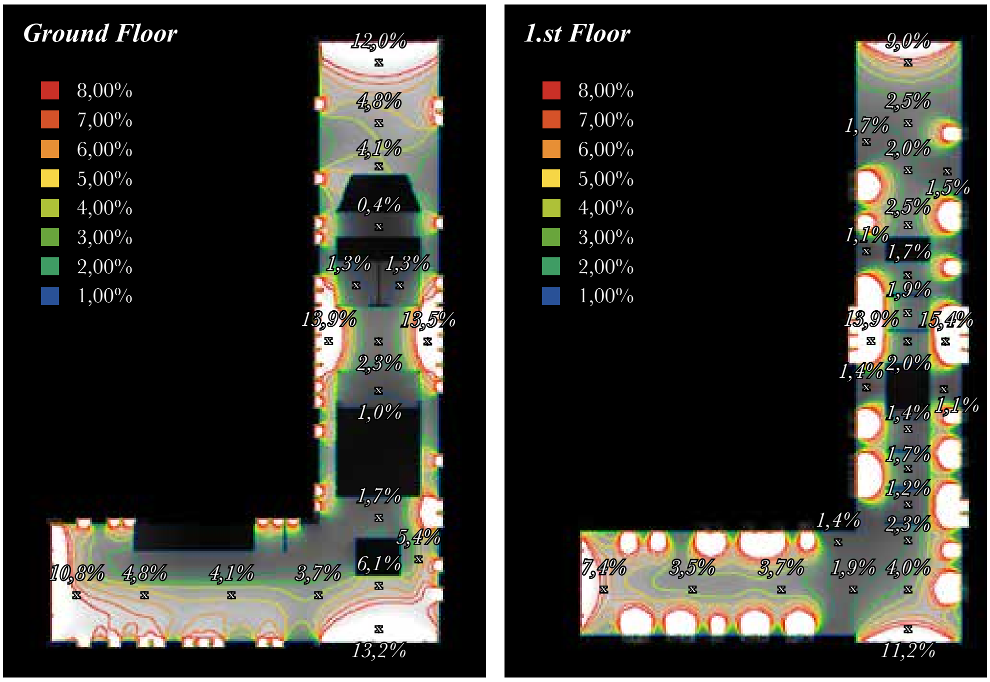
Materials:

- All Surfaces: Light Wood

Temperature (Appendix B1.2):

24 Hour Average = 29,3 °C

Max. Temperature = 32,2 °C



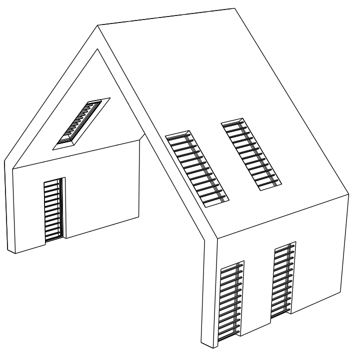
Ill. 142 - Daylight Studies - Building C 02

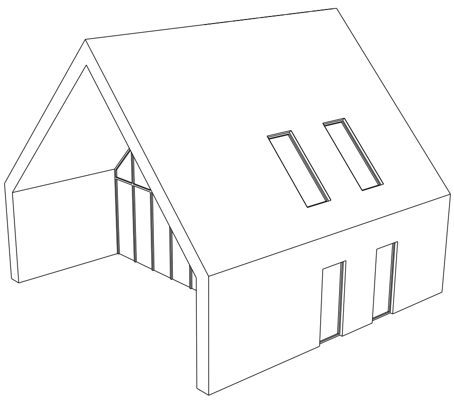
lot, it creates the possibility to hide the external shading in the constructing over the windows when not in use.

A 24 hour average of 25,3 °C is not satisfying. A large overhang over the south gable glass wall is added to allow for a great view of the dunes, while limiting the solar heat gain. The overhang lowers the indoor temperature by 1,2 °C, resulting an 24 hour average temperature of 24,1 °C without cooling from a ventilation system. By cooling with 2 °C lower than the outdoor temperature the 24 average temperature will be 22,6 °C with a maximum temperature of 23,4 °C.

Part Conclusion:

By using the 42% trancemittance window panes, thermal comfort can be reached. The daylight factor cannot though. The 1,3% and 1,0% on the ground floor is acceptable as they are conference rooms and not permanent work spaces - it will have to be improved with more or larger windows around the center entrance. The floorplan of the first floor will have to altered and the offices will have to be moved closer to the windows. External blinds and a large overhang on the south gable is necessary, but futher investigations has to focus on making the new floorplan brighter with more windows.





WINDOWS MOVED INTO THE FACADE

Medium Dark External Blinds

Temperature (Appendix B2.4):

24 Hour Average = 26,2 °C

Max. Temperature = 28,4 °C

Dark External Blinds

Temperature (Appendix B2.5):

24 Hour Average = 25,3 °C

Max. Temperature = 27,3 °C

SOUTH GABLE OVERHANG

Dark External Blinds

Temperature (Appendix B2.6):

24 Hour Average = 24,1 °C

Max. Temperature = 25,7 °C

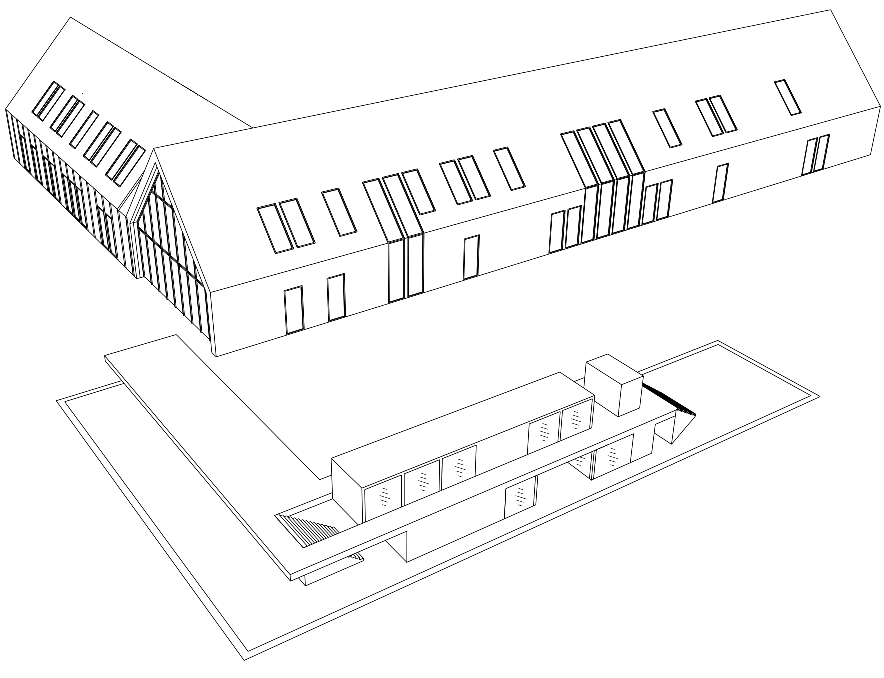
Ill. 143 - Shading Diagrams

DESIGN PROCESS

LIGHT STUDIES: BUILDING C

The first-floor staff functions in the east wing are moved toward the facade to ensure better daylight conditions and have a more efficient floor plan. The facade is updated with windows according to the new floorplan. The larger windows that connect in the corner of the structure are reserved for the entrances to the building to make it easy for visitors to orientate themselves.

With the south gable overhang, external blinds and the windows moved into facade is the 24-hour average temperature 22,7 °C and the maximum temperature 24,9 °C, which ensures that building does not overheat and has to spend energy on cooling in the summer months.



Windows (42% Exterior, 86% Interior):

North: 62,25 m^2

South: 62,25 m^2

East: 46,69 m^2

West: 44,66 m^2

Roof: 88,81 m^2

Trancemittance:

= 42%

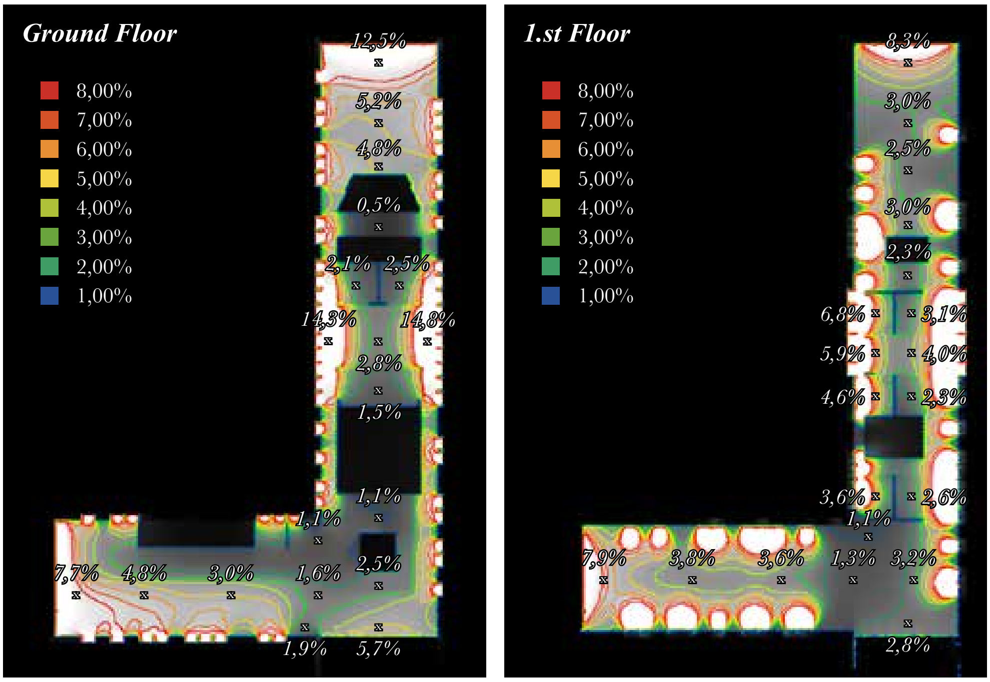
Materials:

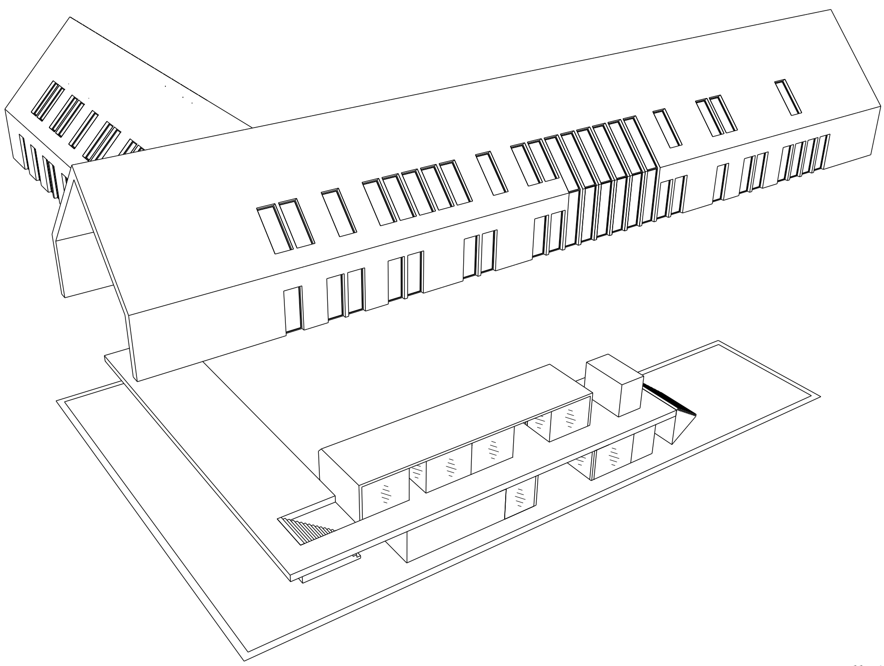
- All Surfaces: Light Wood

Temperature (Appendix B3.1.2):

24 Hour Average = 22,7 °C

Max. Temperature = 24,9 °C





Ill. 144 - Building C

DESIGN PROCESS

MATERIAL STUDIES

The term 'sustainability' is a very important, but also a very overused, term today. In the building industry, sustainability is about social, environmental and economical quality in buildings. Construction, usage and demolotion of buildings is accountable for 40% of the world's energy consumption and 40% of the world's resource consumption today. (InnoBYG, 2017)

Life Cycle Assessment

Life Cycle Assessment, or LCA, is a calculation of resource consumption and potential environmental impacts from a building's total consumption from materials and energy through the entire life cycle of the building. LCA can be used in different ways and for different purposes. For this projects LCA is used in the early design phase to compare construction methods and materials. Materials are compared to find the most environmentally friendly solution and then evaluated in relation to atmospheric, sensory and architectural quality.

Life Expectancies

Life expectancies determines the lifetime of materials through the number of replacement in the total life cycle of the building. The life expectancy is dependent on the use and placement of the materials - where for example exposed wood will have a shorter lifespan than structural timber protected by facades. The life expectancy for holiday homes is 60 years, for service buildings and offices it is 80 years and for cultural buildings it is 120 years. It is difficult to determine the exact life expectancy, when the projects is a cultural building, with holiday homes and office-space, but 80 years has been chosen as a mean value for the further calculations. The lifetime have been determined with a lifetime table for materials by SBi - which is the same one used for DGNB. (Aagaard, 2013)

LCA-Profiles

LCA-calculations is comprehensive and time-consuming. Simplified LCA-profiles calculated by Innobyg are analysed for this project to validate various LCA-profiles of materials and structural composition. Innobyg, together with Statens Byggeforskningsinstitut, Henning Larsen Architects and Rambøll have made around 800 LCA-calculations of construction elements and compositions. Since the processes of a life cycle area based on specific scenarios and are defined with some unvertianty, only 8 of the 15 processes area a part of the DGBN system. (Marsh and Nygaard Rasmussen, 2014) The energy consumption for the operation of the building is excluded from the calculations and the calculations are created from the generic LCA-databases; ESUCO og Ökobau - the same used for DGNB.

Life Cycle Phases	***Process***	***Part of DGNB***	***Part of this LCA***
PRODUCTION	*Extraction of Raw Materials*	✓	✓
	Transport to Manufactoring	✓	✓
	Material Manufactoring	✓	✓
CONSTRUCTION	*Transport to Construction Site*		
	Installation		
USE	*Maintenance / Repair*		
	Replacement	✓	✓
	Refurbishment		
	Energy Consumption for Building Operations	✓	
	Water Consumption		
END-OF-LIFE	*Demolition*		
	Transport to Waste Processing		
	Waste Processing	✓	✓
	Disposal	✓	✓
NEXT PRODUCT SYSTEM	*Potential for Reuse or Recycling*	✓	✓

The comparison of materials can be done with simplified LCA-profiles, consisting of three categories; primary energy consumption, greenhouse effect and ozone depletion, since the LCA calculations have shown a statically relationship between most of the categories for environmental impact and resource consumption. Due to this relationship can the primary energy consumption be used to represent the greenhouse effect, photochemical ozone formation, acidification and nutrient salt loading. The degradation of the ozone layer has its own category as it is the only one that varies from the others. The greenhouse effect has its own category as it often is a sought after category by consultants and contractors, and because it shows a reciprocal relationship with the consumption. This means a low greenhouse effect most likely will mean a bigger part of renewable energy sources for a given primary energy consumption. (Marsh and Nygaard Rasmussen, 2014) The calculations are based on one square meter of construction that has the same u-value to make them functionally comparable.

Concrete and Brick Cladding
180 mm Reinforced Concrete w. Paint
300 mm Mineral Wool
108 mm Brick

Concrete and Wood Cladding
180 mm Reinforced Concrete w. Paint
300 mm Mineral Wool w. Steel Frame
8 mm Fiber Cement Board
25 mm Larch Cladding w. Timber Frame

Timber and Wood Cladding
13 mm Plasterboard w. Paint
13 mm Plasterboard
45 mm Formwork w. Paper Wool
Vapor Barrier
300 mm Timber Frame w. Paper Wool
8 mm Fiber Cement Board
25 mm Larch Cladding w. Timber Frame

$U = 0{,}12\ W/m^2K$

Structural Walls

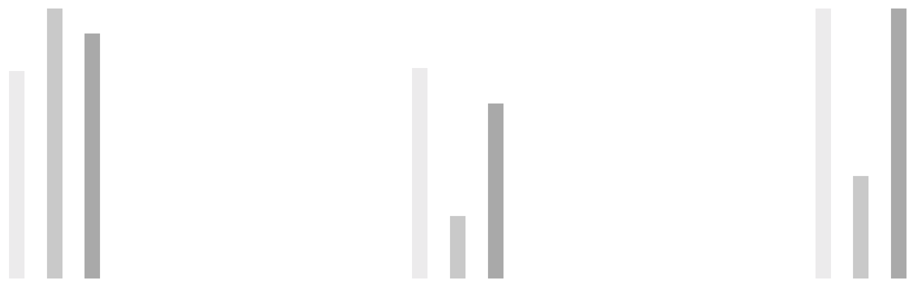
The results of three different exterior walls do not show an unambiguous relationship between concrete, brick and wood. Wood generally show lower potential environmental impacts in all three areas with only the primary energy consumption being higher than the concrete and brick cladding composition. Structural compositions with more timber elements will sometimes have a higher primary energy consumption than ones with less timber, but the majority of the primary energy is from renewable sources which can be seen by the reciprocal value of the greenhouse effect.

Wood is, compared to the two other materials, a more sustainable materias as it bind CO2 and requires less energy to produce than concrete and brick. Wood is also a renewable resource as it grows faster than houses are built today. (Konstruktøren, 2017) Norway and Sweden have a tradition of constructing buildings in wood, whereas Denmark has a great tradition of building with brick and concrete. This tradition in Denmark began due to a short supply of wood in the last 400 years. Only 2% of Denmark covered in forrest in the year 1700. Today that number is 15% and rising which means that wood is no longer in short supply. (InnoBYG, 2017) Seaside hotels and holiday homes near the sea have a tradition of timber buildings with wooden cladding and sometimes thatched roofs.

Conclusion for Structural Walls

From an environmental point of view, wood is the best choice for both cladding and structural elements. The timber construction with wooden cladding has the best LCA results compared to concrete and brick, but are also lighter and easier to mount compared to concrete. Wood has great fireproofing capabilities as it burns predictable and slow, contrary to steel that can collapse with no warning at higher temperatures. Wood also has a competitive price compared to other building materials All three materials are produced locally in Denmark. Wood cladding and timber constructions also have great acoustical advantages as it has good noise absorption properties. (Auken Beck, 2015) Constructing in wood produce less noise and air pollution, and due to the low structural weight can wooden elements be prefabricated and be delivered by lorries. This will take advantage of being easier and faster to install, reducing the number of lorries on the building site and reduce the construction period on site. When constructing Regal Homes in London the deliveries by lorries were reduced by 80% in the construction period. (InnoBYG, 2017) Every cubic meter of wood that replaces another building material leads to a reduction of CO2 in the atmosphere by 1,1 ton on average. If the 0,9 ton of CO2 that the trees binds when growing are taken into account will the reduction be around 2 tons of CO2. (Bach Vestergaard, 2015)

Wood is more appealing to the human senses than concrete - acoustically, tactilely and olfactory. Wood also creates a better indoor environment in terms of temperature and moisture-levels. (Konstruktøren, 2017)



Concrete and Roofing Felt
220 mm Concrete Slab w. Paint
Vapor Barrier
400 mm Pressure-resistant Mineral Wool
2-layer Bituminous Roofing Felt

Timber and Roofing Felt
13 mm Plasterboard w. Paint
13 mm Plasterboard
45 mm Formwork w. Mineral Wool
Vapor Barrier
350 mm Timber Frame w. Mineral Wool
22 mm Plywood
2-layer Bituminous Roofing Felt

Timber and Roof Tiles
13 mm Plasterboard w. Paint
13 mm Plasterboard
45 mm Formwork w. Mineral Wool
Vapor Barrier
350 mm Timber Frame w. Mineral Wool
22 mm Plywood
30 mm Roof Tiles w. Timber Frame

$U = 0{,}09\ W/m^2K$

Roofing

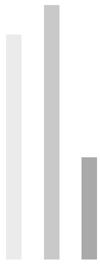
Similar to the analysis of the structural walls is the LCA for the roofing construction better for timber construction compared to concrete. The comparison shows that roofing felt has a lower environmental impact compared to roofing tiles. Green roofs also have a greater environmental impact as the roofing felt is applied under the green roof as well. The greenery, with a separation layer and the growth layers are just extra material layers. The LCA for green roofs as a cladding material shows similar results to roofing tiles and zinc cladding. A green roof will, however, be able to handle rainwater locally (LAR).

Thatched roofs have not been included in the analysis, but a separate study have shown that thatched roofs from local danish reeds have significantly lower greenhouse gas emissions compared to the production of the materials used for a traditional tile roof. The reeds also have a positive effect on the wetlands where they naturally grow and where they helps to alleviate problems with eutrophication which can cause increased algae growth and oxygen depletion. Reeds from China has a great energy consumption from the transportation to Denmark. The analysis shows that the greenhouse gas emissions from the transportation is compensated for through the absorption of carbon from the atmosphere during the growth of the plant. (Teknologisk Institut, 2014)

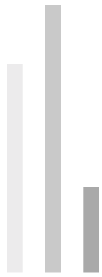
Conclusion for Roofing

Roofing felt is according to the LCA-profile the most sustainable choice. However, can the slightly higher environmental impact of green roofs be justified, as green roofs have a cooling effect in the warm months and a heating effect in the cold months, sit lows down rainwater and assists in a more stable indoor climate. A green roof or a dune roof will let the building visually blend into the environment and possibly give the natural environment back to the visitors by allowing guests and locals to use the roof as part of the dune landscape.

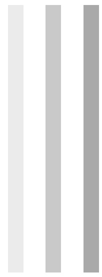
Thatched roofs has a lower environmental impact compared to roofing tiles and the analysis shows the energy consumption for the roofing tiles is more than 5 times higher than the the energy consumption for danish reeds. Since reeds has a 5 times lower energy consumption compared to roofing tiles and compensates through the absorption of carbon from the atmosphere during the growth of the plant - and therefore also compensates more than roofing felt - thatched roofs can be considered a sustainable choice for the building. Thatched roofs are often used on the West Coast of Denmark and blends well with the natural environment.



Wooden Frame
50x150 mm Wooden Frame
2- or 3-layer Energy Glass
Flourescent Coating



Wooden and Composite Frame
50x80 mm Wooden Frame
50x30 mm Composite Frame
2- or 3-layer Energy Glass
Flourescent Coating



Wooden and Composite Frame w. External Shading
50x80 mm Wooden Frame
50x30 mm Composite Frame
2- or 3-layer Energy Glass
Flourescent Coating
Permanent Larch Shading

2-layer Glass: U = 1 W/m^2K

3-layer Glass: U = 0,5 W/m^2K

Windows

Windows are an essential part of buildings today. When choosing windows it is a balance of daylight levels, indoor climate and energy consumption. To balance these it is important to investigate materials, possibility of overheating and the necessity of shading. Windows are very technical and difficult to produce, which shows in the LCA. Calculations show that windows with aluminum profiles has the highest resource consumption and potential for environmental impact than any other building part. This is mostly due to the production of the materials and the life expectancy of windows - as windows are changed more often than other building parts.

Today 3-layered windows are common in new buildings or renovations - but with more layers comes more material. So are 3-layered windows more sustainable? They do have lower u-values and reduces the energy consumption - but the savings are modest. While they use more material, are heavier, are less durable and consist of 50% more glass, they only save about 5-15% compared to 2-layered windows.With people spending most of their time indoor, windows becomes an essential provider of natural daylight, which is important for people's health. Several analysis show that 2-layered windows are better at transmitting the natural spectral of daylight.

When the heat gain from the sun through windows I bigger than the heat loss in the heating season, the windows has a positive Eref-value. This usually lead to 3-layered windows. However, by adding a low iron content to 2-layered windows it is possible to achieve a positive Eref-value. The window then has a U-value of 1,2 W/m2K - which is a lot higher than the 0,6 W/m2K of 3-layered windows. The natural light will also increase by 15% and the heat gain with 30-40% - which of course will create greater demands for external shading to prevent overheating.

Conclusion for Windows

Windows with aluminum frames has the highest environmental impact, while windows with wooden frames and windows with a composition of wood and composite has close to similar results - wood and composite being a bit better. The composite and wood windows are 40 mm thinner and will therefore be less visually disturbing - limiting the barrier between the inside and the outside. Composite is an expensive material. With the short life expectancy of windows (less than 80 years) this is an area where the project can save on the costs by changing to wooden frame - with close to similar results. The high environmental impact of the external solar shading means that the placement and direction of the windows is very important. By calculating the 24-hour average temperature of the rooms, we can determine where solar shading is necessary or if it possibly can be excluded while still taking advantage of passive heat gain with a sufficient daylight level and no overheating.

245 mm of Mineral Wool
U = 0,15 W/m²K

320 mm of Mineral Wool
U = 0,12 W/m²K

420 mm of Mineral Wool
U = 0,09 W/m²K

Insulation

Insulation is one of the most important building elements today, as regulations for the building envelope are getting harder and harder, to lower the u-value of the building composition and to reduce the transmission loss. Analysis of foundations, exterior walls and roofing with various u-values and different amount of insulation have showed that an increase in insulation only changes the LCA-profile very little. This is due to the insulation having a smaller impact compared to the other materials in the construction. (Marsh and Nygaard Rasmussen, 2014)

Conclusion for Insulation

Using less insulation will result in a higher u-value and a higher transmission loss. It is not reasonable to use less insulation as the LCA-profile only changes very little with the different amounts of insulation. This analysis only investigates the efficiency of mineral wool. Mineral wool is mostly a recycled product and therefore has a good LCA-profile. For further analysis it would be ideal to investigate several different insulation materials and test their efficiency in regard to thickness, u-values and LCA.

Limitations of Wood

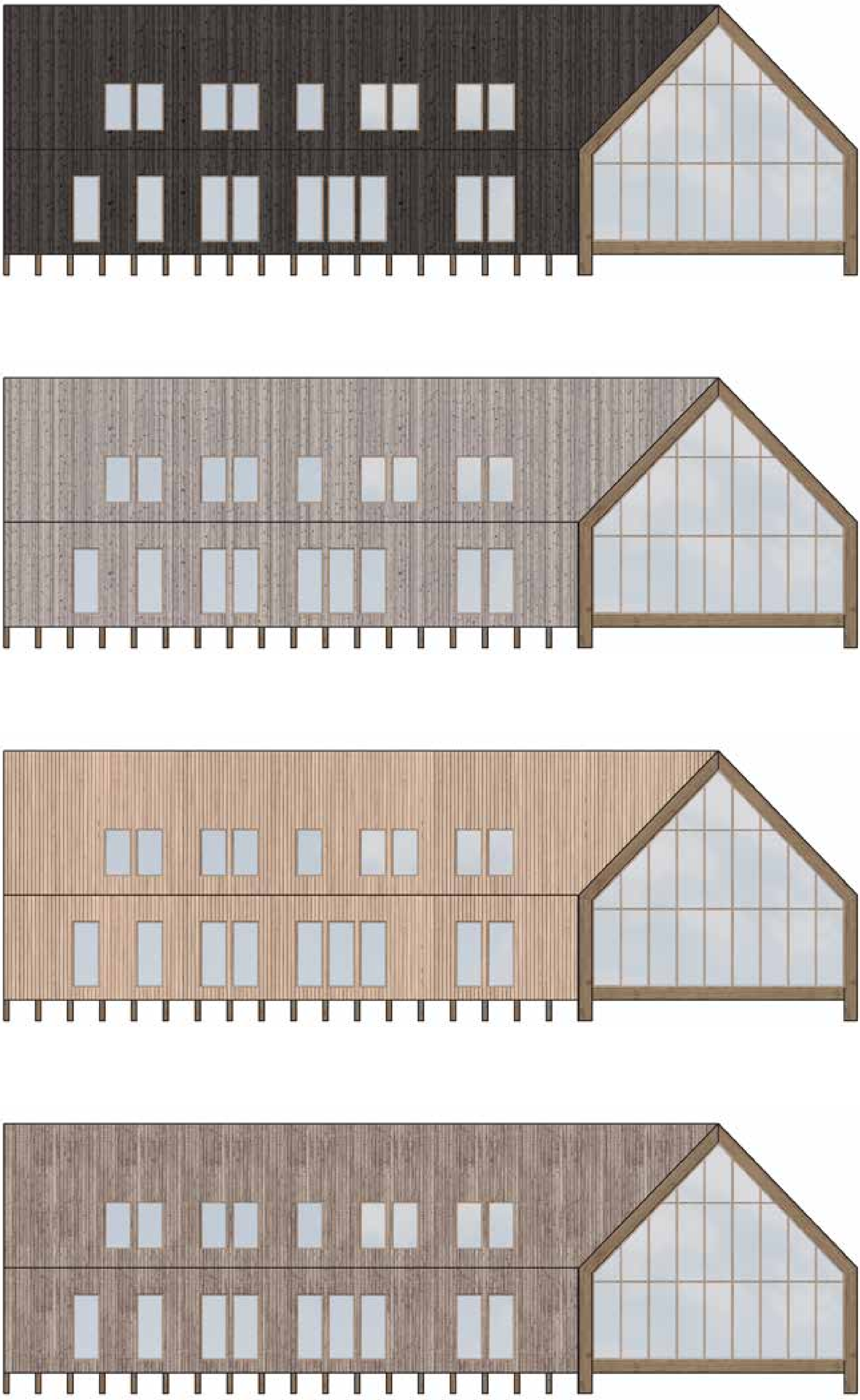
Fire and safety is considered one of the biggest limitations - even through several of examples of large timber structures are built without compromising the fire-safety of the building. (Schmeichel, 2017) Solid timber is hard to ignite, while it burns slowly and predictably. Steel performs unpredictably in case of fire. Systems for fire detection, alerting systems and sprinkler systems lower the risk in case of fire, while sealing techniques and comprehensive fire containment strategies lower the risk of fire.

Sound insulation in lightweight buildings is a contradictory issue, since heavy weight in itself provides sound insulation. It is technically possible - while difficult - to achieve equal sound insulation in lightweight buildings, often resulting in a thick and multi-layered construction. Noise pollution and sound insulation is less of a problem with the huts and various functions spread out on the remote site.

Moisture issues should be the primary concern in timber construction, where unique and specific design strategies, as well as careful execution is required to avoid eventual technical failure and mold in the construction - it is especially important to assess during the erection or construction period. (Wood Stock, 2017)

DESIGN PROCESS

FACADE STUDIES



Ill. 145 - Facade Studies

EPILOGUE

DESIGN PROCESS

CONCLUSION

DESIGN PROCESS

REFLECTION

The most prominent reflection is that the initial project grasped too much. The very ambitious take on the project requested a vast amount of time at the beginning of the project. The time would have been better spent by zooming out and strategically choose only a few focal points or areas to work with and investigate. The initial focus on the atmospheric and sensual qualities of spaces has been implemented when designing, but not to a fulfilling extend. The materialistic focus and detailing would benefit from acoustical analysis and more precise LCA studies.

It has been incredibly challenging to plan the project and create an effective timetable. Going from a group of five to a single person has been a more significant change than I expected. While expecting that the tasks would be more comprehensive, they have taken even longer than expected, resulting in a pushed timetable several times. One of the negative outcomes of this is the lack of renders due to time-pressure. The overall composition will be harder to understand without the visualisations. One of the primary purposes of the renders was to illustrate the composition of materials and the composition of the interior spaces, which will be much harder to grasp without them.

The initial idea was to design a sauna or wellness to complement the local activities. Since a sauna can be a full project in its own right, it has been excluded from the scope of this project.

The primary things to improve for future projects is better planning and a more concise strategy, to allow for deeper investigations of fewer focal areas.

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Jonas Philippon

APPENDIX

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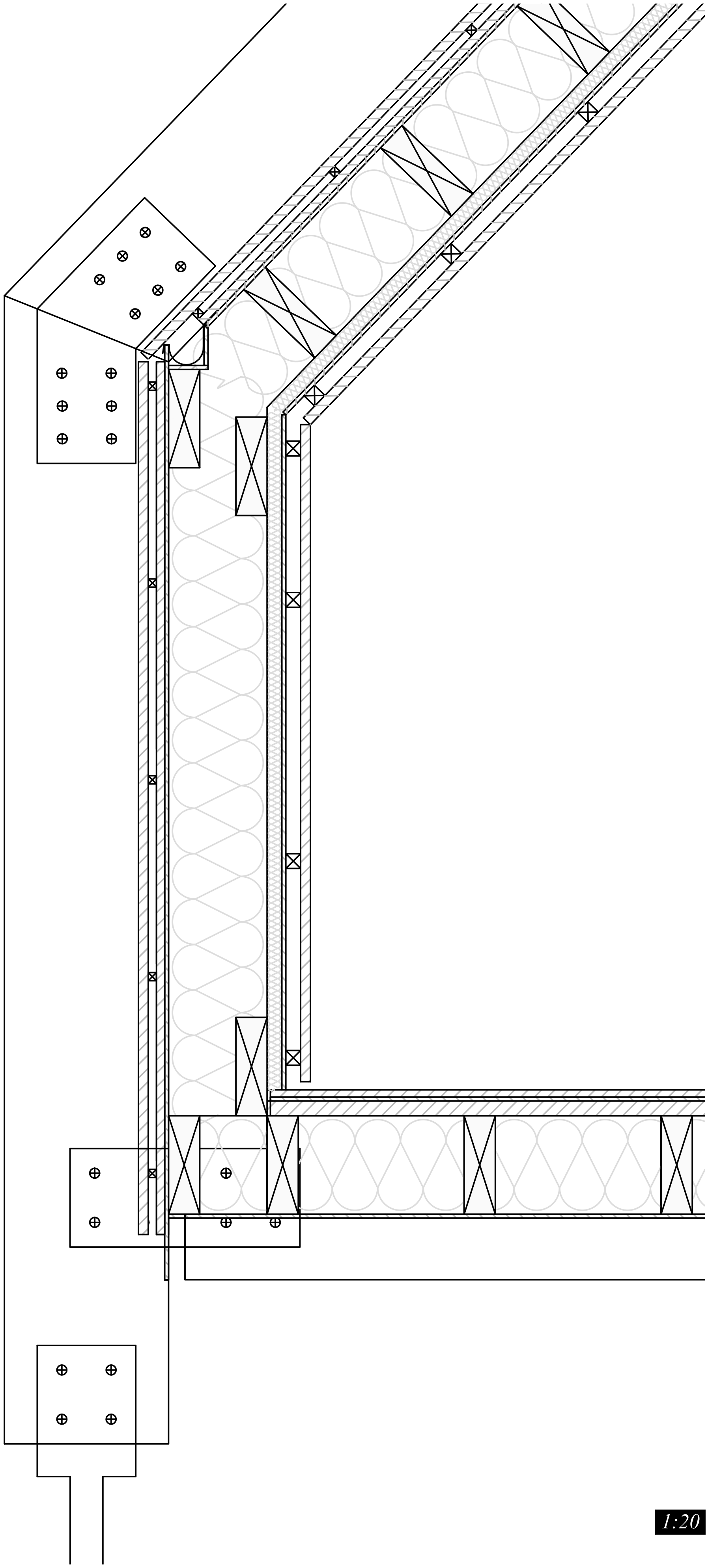

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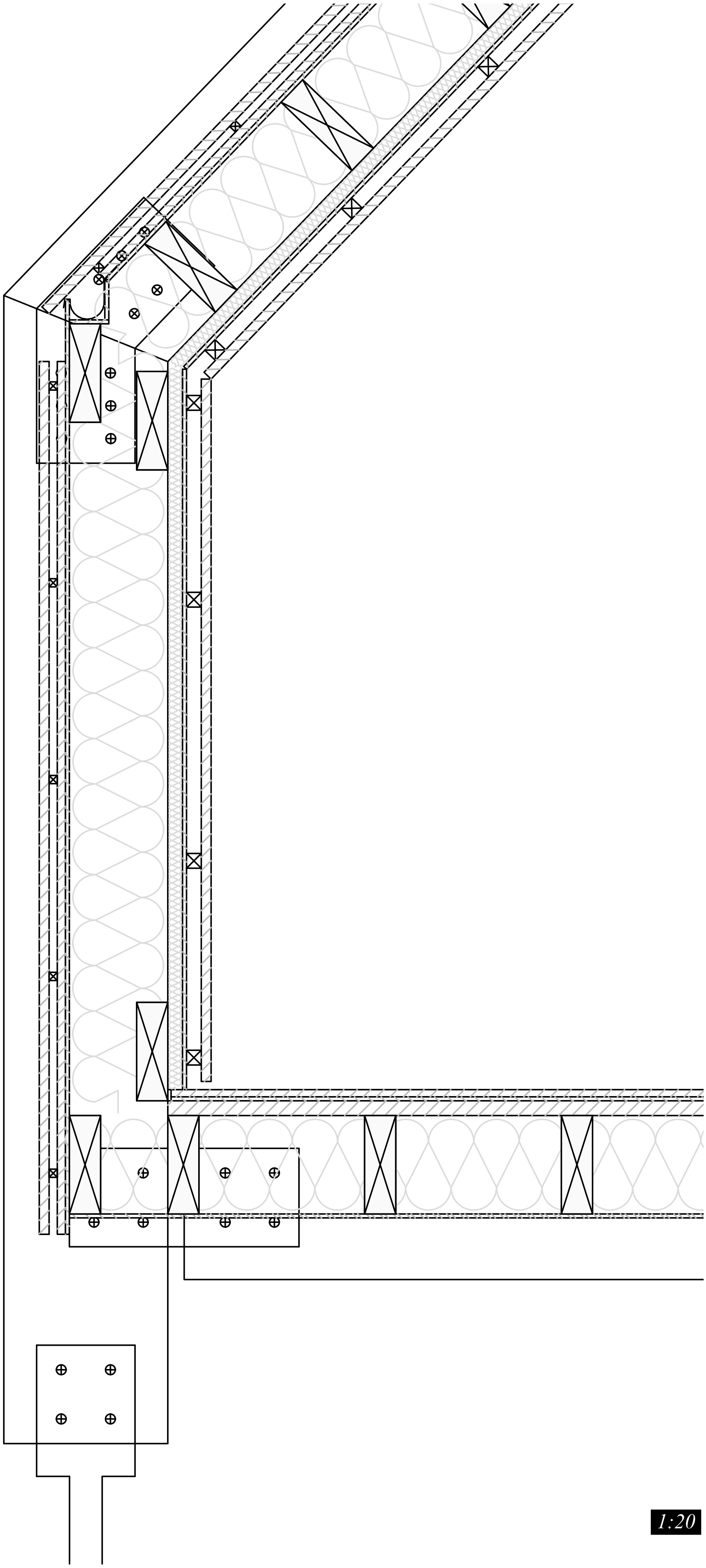
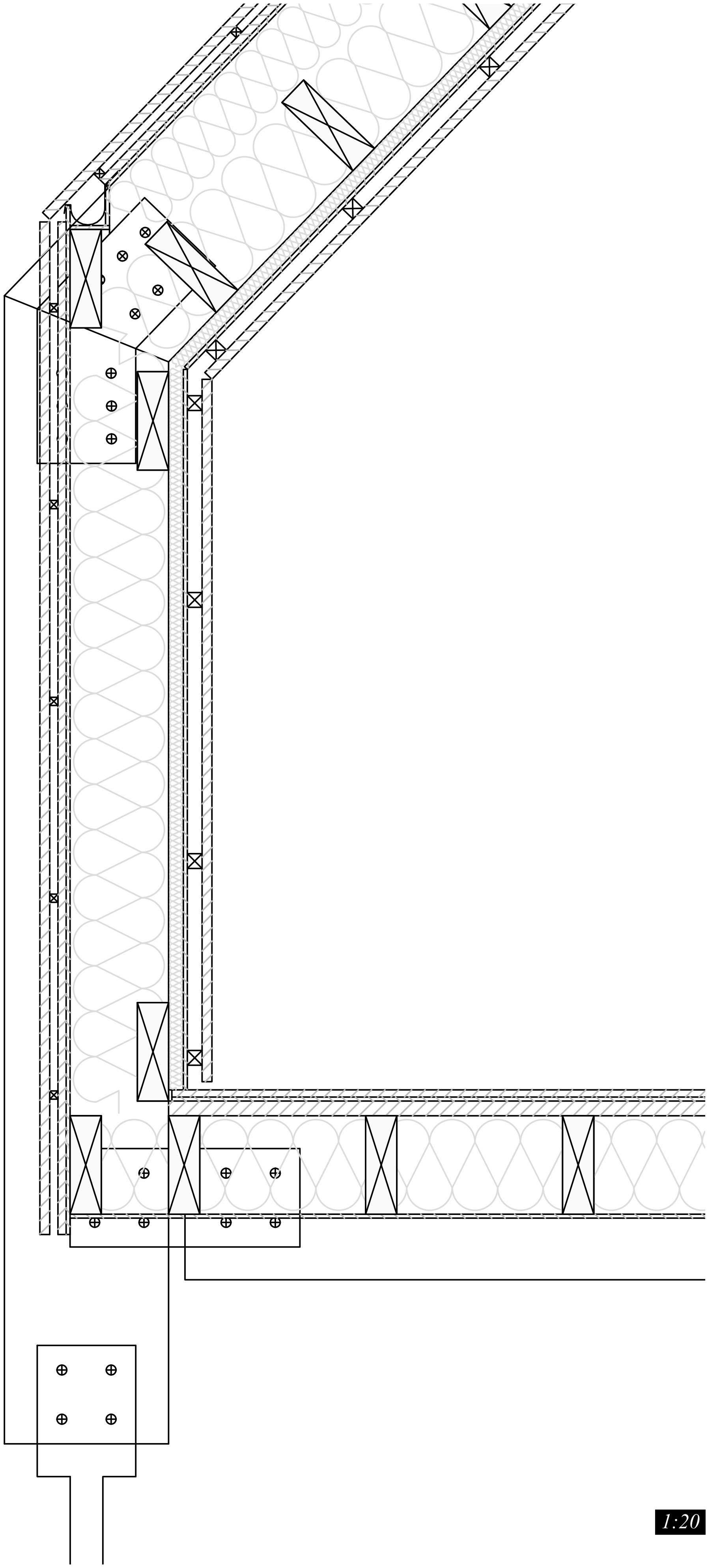


APPENDIX A3: CONSTRUCTION DETAIL 03



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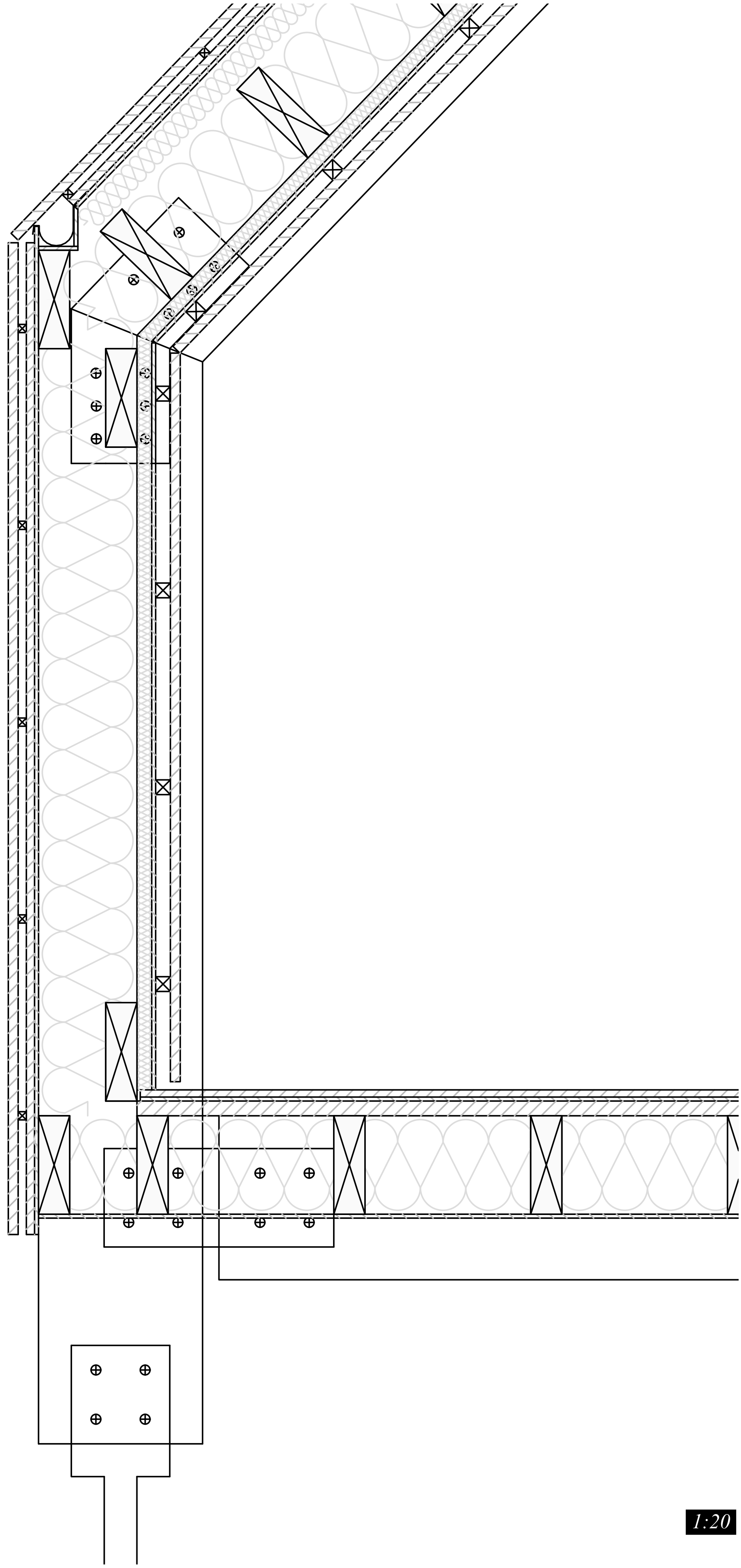

1:20

APPENDIX B1

24 HOUR CALCULATIONS: TRANSMITTANCE

APPENDIX B1.1: 20% EXTERIOR, 78% INTERIOR

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,20	0,90	0,40	1,00	0,80	0,06
2	Windows - South	1	62,25	0,82	51,05	180	90	0,20	0,90	0,40	1,00	0,80	0,06
3	Windows - East	1	46,69	0,82	38,29	90	90	0,20	0,90	0,40	1,00	0,90	0,06
4	Windows - West	1	44,66	0,82	36,62	270	90	0,20	0,90	0,40	1,00	0,90	0,06
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,20	0,90	0,40	1,00	0,90	0,06
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20	°C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	26,2	°C
Temperature variation	Δti =	4,4	°C
Max. Temperature	timax =	28,4	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	26,2	°C
Temperature variation	Δti =	2,8	°C
Max. Temperature	timax =	27,7	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	24,7	°C
Temperature variation	Δti =	2,8	°C
Max. Temperature	timax =	26,1	°C

APPENDIX B1.2: 42% EXTERIOR, 78% INTERIOR

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m²	U W/m²K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m²	U W/m²K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	1,00	0,80	0,12
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	1,00	0,80	0,12
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,40	1,00	0,90	0,14
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,40	1,00	0,90	0,14
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,40	1,00	0,90	0,14
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m²	U W/m²K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20 °C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	29,3	°C
Temperature variation	Δti =	5,8	°C
Max. Temperature	timax =	32,2	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	29,3	°C
Temperature variation	Δti =	4,2	°C
Max. Temperature	timax =	31,4	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	27,7	°C
Temperature variation	Δti =	4,2	°C
Max. Temperature	timax =	29,9	°C

APPENDIX B1.3: 68% EXTERIOR, 78% INTERIOR

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K
1	North	0,00	0,09	0,00
2	South	0,00	0,09	0,00
3	East	83,90	0,09	7,55
4	West	85,93	0,09	7,73
5	Elevated Floor	530,00	0,10	53,00
	Total	699,84		68,29 = Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow) [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,68	0,90	0,40	1,00	0,80	0,20
2	Windows - South	1	62,25	0,82	51,05	180	90	0,68	0,90	0,40	1,00	0,80	0,20
3	Windows - East	1	46,69	0,82	38,29	90	90	0,68	0,90	0,40	1,00	0,90	0,22
4	Windows - West	1	44,66	0,82	36,62	270	90	0,68	0,90	0,40	1,00	0,90	0,22
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,68	0,90	0,40	1,00	0,90	0,22
	Total	5	304,66		249,82 = Bu,win								
	Total specific heat loss towards outdoors, Bt				318,11 = Bt = Bu,con+Bu,win								

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W
1				0,00	7,60	0,00
2				0,00		0,00
3				0,00		0,00
4				0,00		0,00
5				0,00		0,00
	Total	0		0,00		0,00 =Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00 = Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20 °C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	32,8	°C
Temperature variation	Δti =	7,4	°C
Max. Temperature	timax =	36,5	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	32,8	°C
Temperature variation	Δti =	5,9	°C
Max. Temperature	timax =	35,8	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	31,3	°C
Temperature variation	Δti =	5,9	°C
Max. Temperature	timax =	34,2	°C

APPENDIX B2

24 HOUR CALCULATIONS: SHADING

Internal heat loads

Project:
Building C - North Wing
Internal heat loads

Time	Personbelast W	Belysning W	Andet W	Sum W
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	3808	2650	1500	7958
10	3808	2650	1500	7958
11	3808	2650	1500	7958
12	3808	2650	1500	7958
13	3808	2650	1500	7958
14	3808	2650	1500	7958
15	3808	2650	1500	7958
16	3808	2650	1500	7958
17	3808	5300	1500	10608
18	762	5300	400	6462
19	762	5300	400	6462
20	762	5300	400	6462
21	762	5300	400	6462
22	762	5300	400	6462
23	762	5300	400	6462
24	0	0	0	0
Sum	38844	58300	15900	113044
Middelværdi	1619	2429	663	4710 =Φi
Max. timeværdi	3808	5300	1500	10608 =Φimax
Min. timeværdi	0	0	0	0 =Φimin

Pr. m² gulvareal	Personbelast W/m²	Belysning W/m²	Andet W/m²	Sum W/m²
Middelværdi	3,05	4,58	1,25	8,89
Max. timeværdi	7,18	10,00	2,83	20,02
Min. timeværdi	0,00	0,00	0,00	0,00

External loads

Choose destination
Copenhagen

Choose month
June

Outdoor temp: 24-hour a	20	°C	= tu
variation	12	°C	= Δtu

Solar gain windows	Area m2	Orientation degree	Inclination degree	Fsun [-]	Φs W	Φsmax W
1	62,25	0	90	0,11	792	1884
2	62,25	180	90	0,01	136	457
3	69,02	90	90	0,02	230	921
4	61,92	270	90	0,02	211	793
5	115,71	90	45	0,02	385	1545
Total solar gain in room					1754	5600

Help for internal loads

Heat from persons:	Activity lev met	Total W/person	Sensible he W/person	Number of	Sensible, to W
	1,2	118	76	50	3808

Ligthing: general	Level: lux	Incandesce W/m² g.a.	fluorescent W/m² g.a.	Lowenergy W/m² g.a.	Choose pow W/m² g.a.	Ligthing i alt W
	300	78	24	12	10	5300

APPENDIX B2.1: BRIGHT BLINDS

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	0,90	0,80	0,11
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,40	1,00	0,90	0,14
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,40	1,00	0,90	0,14
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,40	1,00	0,90	0,14
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20	°C

If the ventlation air has same temperature as outdoor air

24-hour average	ti =	29,1	°C
Temperature variation	Δti =	5,7	°C
Max. Temperature	timax =	31,9	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	29,1	°C
Temperature variation	Δti =	4,2	°C
Max. Temperature	timax =	31,2	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	27,6	°C
Temperature variation	Δti =	4,2	°C
Max. Temperature	timax =	29,6	°C

APPENDIX B2.2: MEDIUM DARK EXTERNAL BLINDS

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m²	U W/m²K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m²	U W/m²K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	0,90	0,80	0,11
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,15	1,00	0,90	0,05
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,15	1,00	0,90	0,05
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,15	1,00	0,90	0,05
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m²	U W/m²K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under desi
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20 °C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	26,6	°C
Temperature variation	Δti =	4,5	°C
Max. Temperature	timax =	28,8	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	26,6	°C
Temperature variation	Δti =	2,9	°C
Max. Temperature	timax =	28,1	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	25,1	°C
Temperature variation	Δti =	2,9	°C
Max. Temperature	timax =	26,5	°C

APPENDIX B2.3: DARK EXTERNAL BLINDS

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	0,90	0,80	0,11
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,05	1,00	0,90	0,02
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,05	1,00	0,90	0,02
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,05	1,00	0,90	0,02
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20 °C

If the ventlation air has same temperature as outdoor air

24-hour average	ti =	25,6	°C
Temperature variation	Δti =	4,0	°C
Max. Temperature	timax =	27,6	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum \mathbf{B}_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\,\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u(B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	25,6	°C
Temperature variation	Δti =	2,4	°C
Max. Temperature	timax =	26,8	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	24,1	°C
Temperature variation	Δti =	2,4	°C
Max. Temperature	timax =	25,3	°C

APPENDIX B2.4: MEDIUM DARK EXTERNAL BLINDS

Windows moved into facade

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m²	U W/m²K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m²	U W/m²K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow) [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	0,70	0,80	0,08
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,15	0,90	0,90	0,05
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,15	0,90	0,90	0,05
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,15	0,90	0,90	0,05
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m²	U W/m²K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under desi
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20	°C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	26,2	°C
Temperature variation	Δti =	4,3	°C
Max. Temperature	timax =	28,4	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	26,2	°C
Temperature variation	Δti =	2,8	°C
Max. Temperature	timax =	27,6	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	24,7	°C
Temperature variation	Δti =	2,8	°C
Max. Temperature	timax =	26,1	°C

APPENDIX B2.5: DARK EXTERNAL BLINDS

Windows moved into facade

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,40	0,70	0,80	0,08
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,05	0,90	0,90	0,02
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,05	0,90	0,90	0,02
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,05	0,90	0,90	0,02
	Total	5	304,66		249,82	= Bu,win							
Total specific heat loss towards outdoors, Bt					318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
Total specific heat loss towards ground and surrounding rooms				0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20	°C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	25,3	°C
Temperature variation	Δti =	3,9	°C
Max. Temperature	timax =	27,3	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	25,3	°C
Temperature variation	Δti =	2,3	°C
Max. Temperature	timax =	26,5	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	23,8	°C
Temperature variation	Δti =	2,3	°C
Max. Temperature	timax =	25,0	°C

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APPENDIX B2.6: SOUTH GABLE OVERHANG

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m²	U W/m²K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	83,90	0,09	7,55	
4	West	85,93	0,09	7,73	
5	Elevated Floor	530,00	0,10	53,00	
	Total	699,84		68,29	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m²	U W/m²K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,05	0,70	0,80	0,01
3	Windows - East	1	46,69	0,82	38,29	90	90	0,42	0,90	0,05	0,90	0,90	0,02
4	Windows - West	1	44,66	0,82	36,62	270	90	0,42	0,90	0,05	0,90	0,90	0,02
5	Roof - East+West	1	88,81	0,82	72,83	90	45	0,42	0,90	0,05	0,90	0,90	0,02
	Total	5	304,66		249,82	= Bu,win							
	Total specific heat loss towards outdoors, Bt				318,11	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m²	U W/m²K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20 °C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	24,1	°C
Temperature variation	Δti =	3,2	°C
Max. Temperature	timax =	25,7	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	24,1	°C
Temperature variation	Δti =	1,6	°C
Max. Temperature	timax =	24,9	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	22,6	°C
Temperature variation	Δti =	1,6	°C
Max. Temperature	timax =	23,4	°C

APPENDIX B3.1.1: BUILDING C

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - North Wing

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m^2	U W/m^2K	Bu W/K	
1	North	0,00	0,09	0,00	
2	South	0,00	0,09	0,00	
3	East	48,13	0,09	4,33	
4	West	55,23	0,09	4,97	
5	Elevated Floor	530,00	0,10	53,00	
	Total	633,36		62,30	= Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m^2	U W/m^2K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	62,25	0,82	51,05	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	62,25	0,82	51,05	180	90	0,42	0,90	0,05	0,70	0,80	0,01
3	Windows - East	1	69,02	0,82	56,60	90	90	0,42	0,90	0,05	0,90	0,90	0,02
4	Windows - West	1	61,92	0,82	50,77	270	90	0,42	0,90	0,05	0,90	0,90	0,02
5	Roof - East+West	1	115,71	0,82	94,88	90	45	0,42	0,90	0,05	0,90	0,90	0,02
	Total	5	371,15		304,34	= Bu,win							
	Total specific heat loss towards outdoors, Bt				366,64	= Bt = Bu,con+Bu,win							

Constructions towards ground and surrounding rooms

Nr	Surface	A m^2	U W/m^2K	Br W/K	tr °C	Br*tr W	
1				0,00	7,60	0,00	
2				0,00		0,00	
3				0,00		0,00	
4				0,00		0,00	
5				0,00		0,00	
	Total	0		0,00		0,00	=Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00	= Br		

Ground temperature for area chosen under dest
7,6 °C

Results

Project:
Building C - North Win

Choosen month:	June	tu =	20	°C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	24,6	°C
Temperature variation	Δti =	3,7	°C
Max. Temperature	timax =	26,5	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	24,6	°C
Temperature variation	Δti =	2,2	°C
Max. Temperature	timax =	25,7	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	23,1	°C
Temperature variation	Δti =	2,2	°C
Max. Temperature	timax =	24,2	°C

APPENDIX B3.1.2: BUILDING C

Calculation of 24-hour average temperature

AALBORG UNIVERSITET
ARCHITECTURAL ENGINEERING

Project:
Building C - Whole Building

Description of the room

If comments not are shown
they can be activated under "view"

Constructions towards outdoors

Nr	Surface	A m²	U W/m²K	Bu W/K
1	North	208,68	0,09	18,78
2	South	198,53	0,09	17,87
3	East	428,13	0,09	38,53
4	West	435,23	0,09	39,17
5	Elevated Floor	530,00	0,10	53,00
	Total	1800,56		167,35 = Bu,con

Windows towards outdoors

Nr	Surface	Number stk	A m²	U W/m²K	Bu W/K	Orient degree	Inclination 90/45/0	g-value [-]	f(beta) [-]	f(shade) [-]	f(shadow [-]	f(glass) [-]	Fsun [-]
1	Windows - North	1	97,78	0,82	80,18	0	90	0,42	0,90	0,40	0,90	0,80	0,11
2	Windows - South	1	107,93	0,82	88,50	180	90	0,42	0,90	0,05	0,70	0,80	0,01
3	Windows - East	1	69,02	0,82	56,60	90	90	0,42	0,90	0,05	0,80	0,90	0,01
4	Windows - West	1	61,92	0,82	50,77	270	90	0,42	0,90	0,05	0,80	0,90	0,01
5	Roof - East+West	1	115,71	0,82	94,88	90	45	0,42	0,90	0,05	0,80	0,90	0,01
	Total	5	452,35		370,92 = Bu,win								
	Total specific heat loss towards outdoors, Bt				538,27 = Bt = Bu,con+Bu,win								

Constructions towards ground and surrounding rooms

Nr	Surface	A m²	U W/m²K	Br W/K	tr °C	Br*tr W
1				0,00	7,60	0,00
2				0,00		0,00
3				0,00		0,00
4				0,00		0,00
5				0,00		0,00
	Total	0		0,00		0,00 =Σ Br*tr
	Total specific heat loss towards ground and surrounding rooms			0,00 = Br		

Ground temperature for area chosen under desi
7,6 °C

Results

Project:
Building C - Whole Bu

Choosen month:	June	tu =	20 °C

If the ventilation air has same temperature as outdoor air

24-hour average	ti =	22,7	°C
Temperature variation	Δti =	4,4	°C
Max. Temperature	timax =	24,9	°C

$$t_i = \frac{B_t t_u + \sum B_r t_r + B_L t_L + \Phi_i + \Phi_s}{B_t + \sum B_r + B_L}$$

$$\Delta t_i = t_{imax} - t_{imin} = \frac{\Delta\Phi_K}{B_t + \sum B_r + B_L + B_{akk}}$$

$$\Delta\Phi_k = \Delta\Phi_{k1} + \Delta\Phi_{k2}$$

$$\Delta\Phi_{k1} = \frac{2}{3}[(\Phi_i + \Phi_s)_{max} - \Phi_{i,min}]$$

$$\Delta\Phi_{k2} = \Delta t_u (B_{u,vin} + B_L)$$

Additional calculations

If the ventilation air has the same temperature as the outdoor 24-hour average temperature

24-hour average	ti =	22,7	°C
Temperature variation	Δti =	1,8	°C
Max. Temperature	timax =	23,6	°C

Calculation where the ventilation air has a constant inlet temperature which is Δt = 2 °C lower than the outdoor 24-hour average temperature

If the ventilation air has a constant temperature of 18 °C

24-hour average	ti =	21,0	°C
Temperature variation	Δti =	1,8	°C
Max. Temperature	timax =	21,9	°C

Internal heat loads

Project:

Building C - Whole Building

Internal heat loads

Time	Personbelast W	Belysning W	Andet W	Sum W	
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	
8	0	0	0	0	
9	3808	1000	1500	6308	
10	3808	1000	1500	6308	
11	3808	1000	1500	6308	
12	3808	1000	1500	6308	
13	3808	1000	1500	6308	
14	3808	1000	1500	6308	
15	3808	1000	1500	6308	
16	3808	1000	1500	6308	
17	3808	1000	1500	6308	
18	7616	7620	400	15636	
19	7616	7620	400	15636	
20	7616	7620	400	15636	
21	7616	7620	400	15636	
22	7616	7620	400	15636	
23	7616	7620	400	15636	
24	0	0	0	0	
Sum	79968	54720	15900	150588	
Middelværdi	3332	2280	663	6275	=Φi
Max. timeværdi	7616	7620	1500	15636	**=Φimax**
Min. timeværdi	0	0	0	0	**=Φimin**

Pr. m² gulvareal	Personbelast W/m²	Belysning W/m²	Andet W/m²	Sum W/m²
Middelværdi	4,37	2,99	0,87	8,23
Max. timeværdi	9,99	10,00	1,97	20,52
Min. timeværdi	0,00	0,00	0,00	0,00

External loads

Choose destination

Copenhagen

Choose month

June

Outdoor temp: 24-hour a	20	°C	= tu
variation	12	°C	= Δtu

Solar gain windows	Area m2	Orientation degree	Inclination degree	Fsun [-]	Φs W	Φsmax W
1	97,78	0	90	0,11	1244	2959
2	107,93	180	90	0,01	236	792
3	69,02	90	90	0,01	204	819
4	61,92	270	90	0,01	188	705
5	115,71	90	45	0,01	342	1373
Total solar gain in room					**2214**	**6648**

Help for internal loads

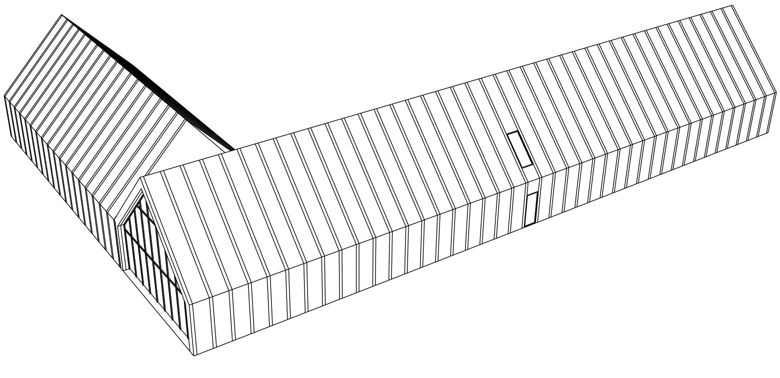
Heat from persons:	Activity lev met	Total W/person	Sensible he W/person	Number of	Sensible, total W
	1,2	118	76	100	7616

Ligthing: general	Level: lux	Incandesce W/m² g.a.	fluorescent W/m² g.a.	Lowenergy W/m² g.a.	Choose pow W/m² g.a.	Ligthing i alt W
	500	130	40	20	10	7620

APPENDIX C1

LIGHT STUDIES: WINDOW TRANCEMITTANCE

42% VS. 68% VS. 78%



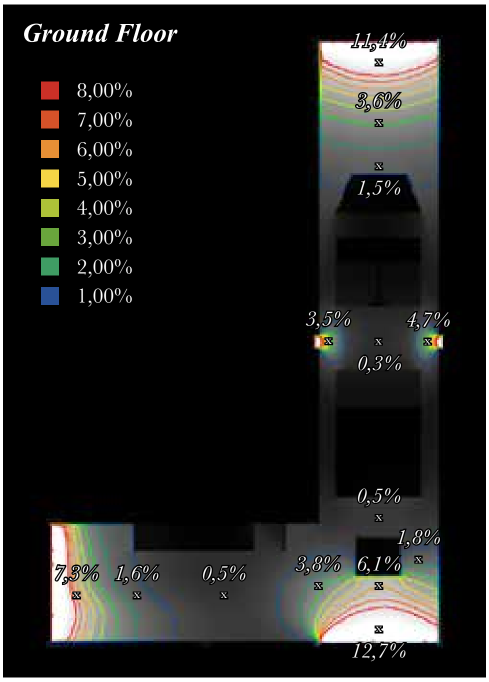
Windows (42%):

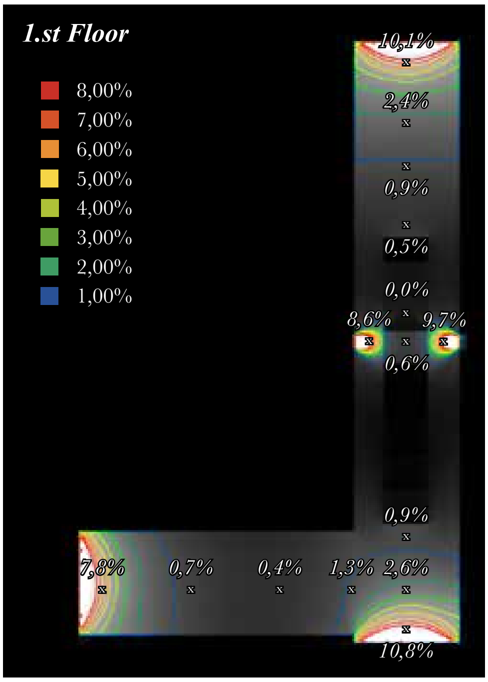
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 42%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





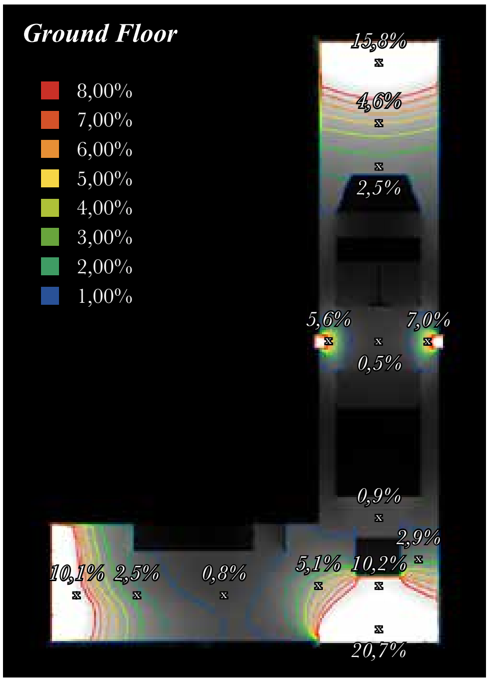
Windows (68%):

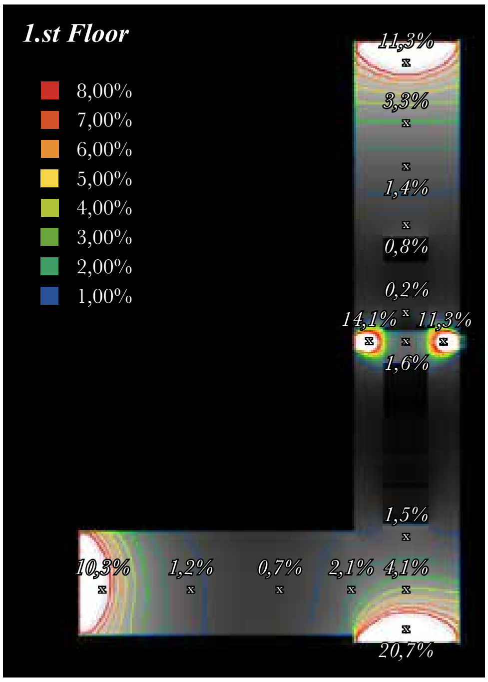
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 68%

Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





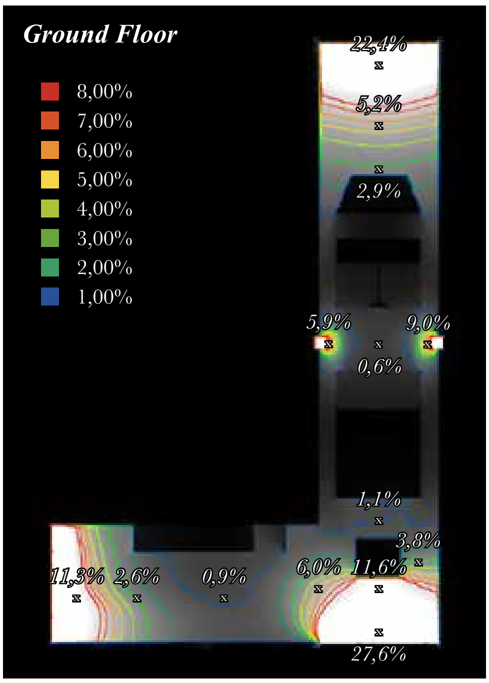
Windows (78%):

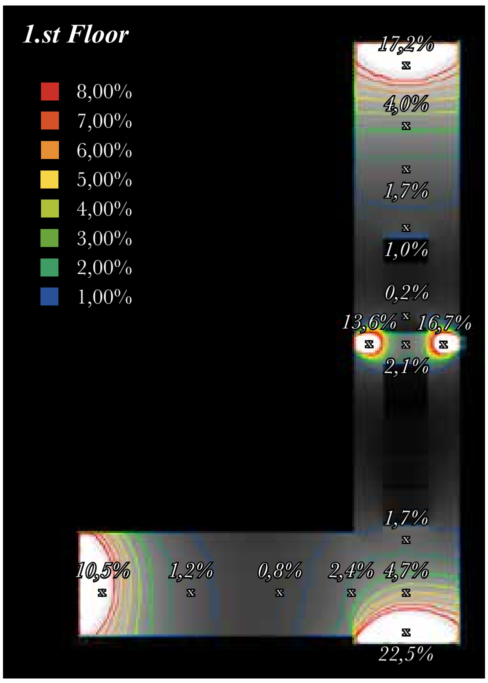
4x 1015x2500 mm (2,54 m2)
= 10,15 m2

3x Fully Glazed Gables (55,57 m2)
= 166,72 m2

Trancemittance:
= 78%

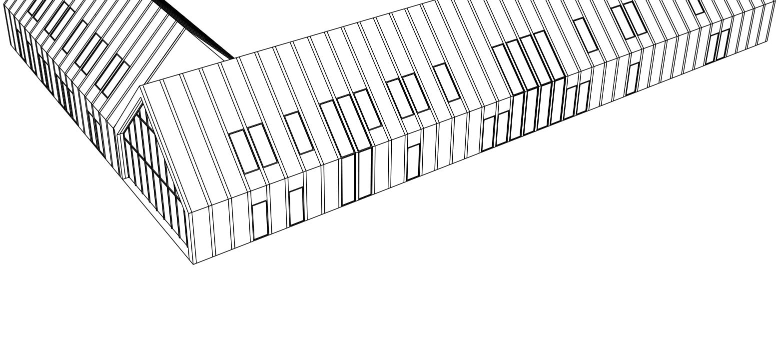
Materials:
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





APPENDIX C2

LIGHT STUDIES: BUILDING C



Windows (42% Exterior, 42% Interior):

4x 1015x2500 mm (2,54 m2)

= 10,15 m2

3x Fully Glazed Gables (55,57 m2)

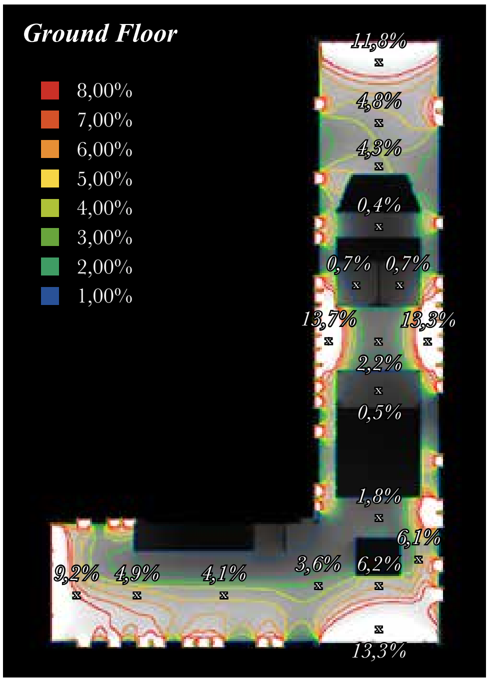
= 166,72 m2

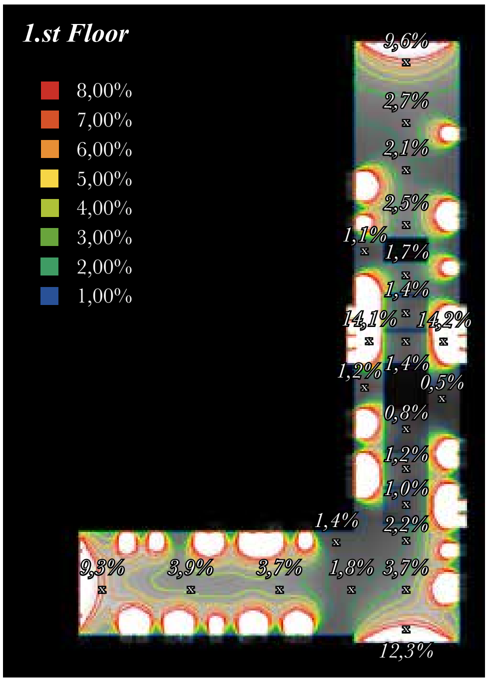
Trancemittance:

= 42%

Materials:

- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood





Windows (78% Exterior, 78% Interior):

4x 1015x2500 mm (2,54 m2)

= 10,15 m2

3x Fully Glazed Gables (55,57 m2)

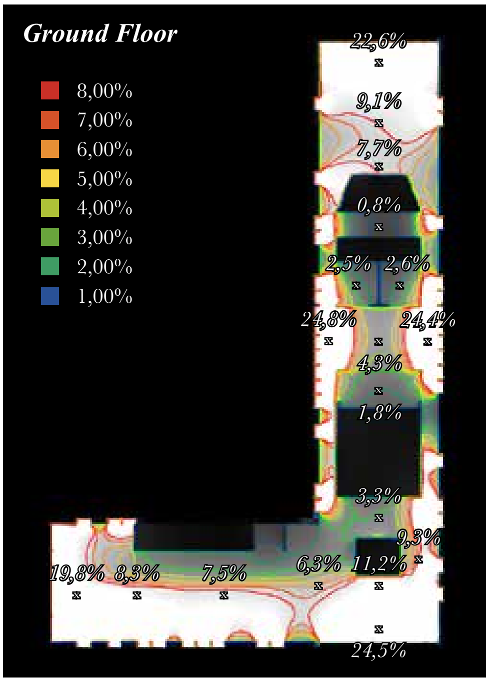
= 166,72 m2

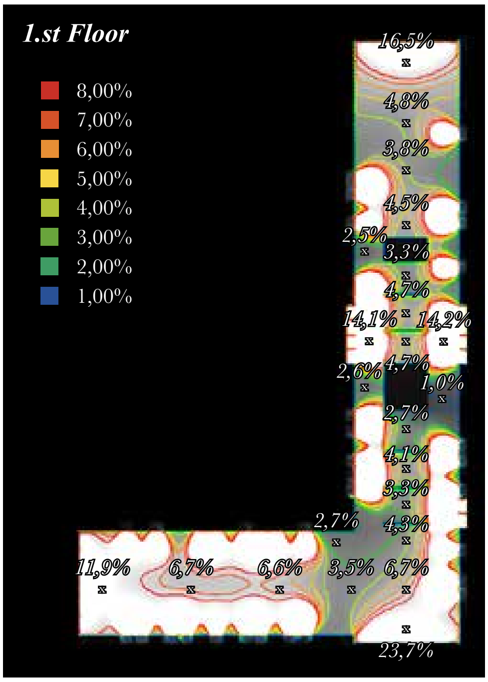
Trancemittance:

= 78%

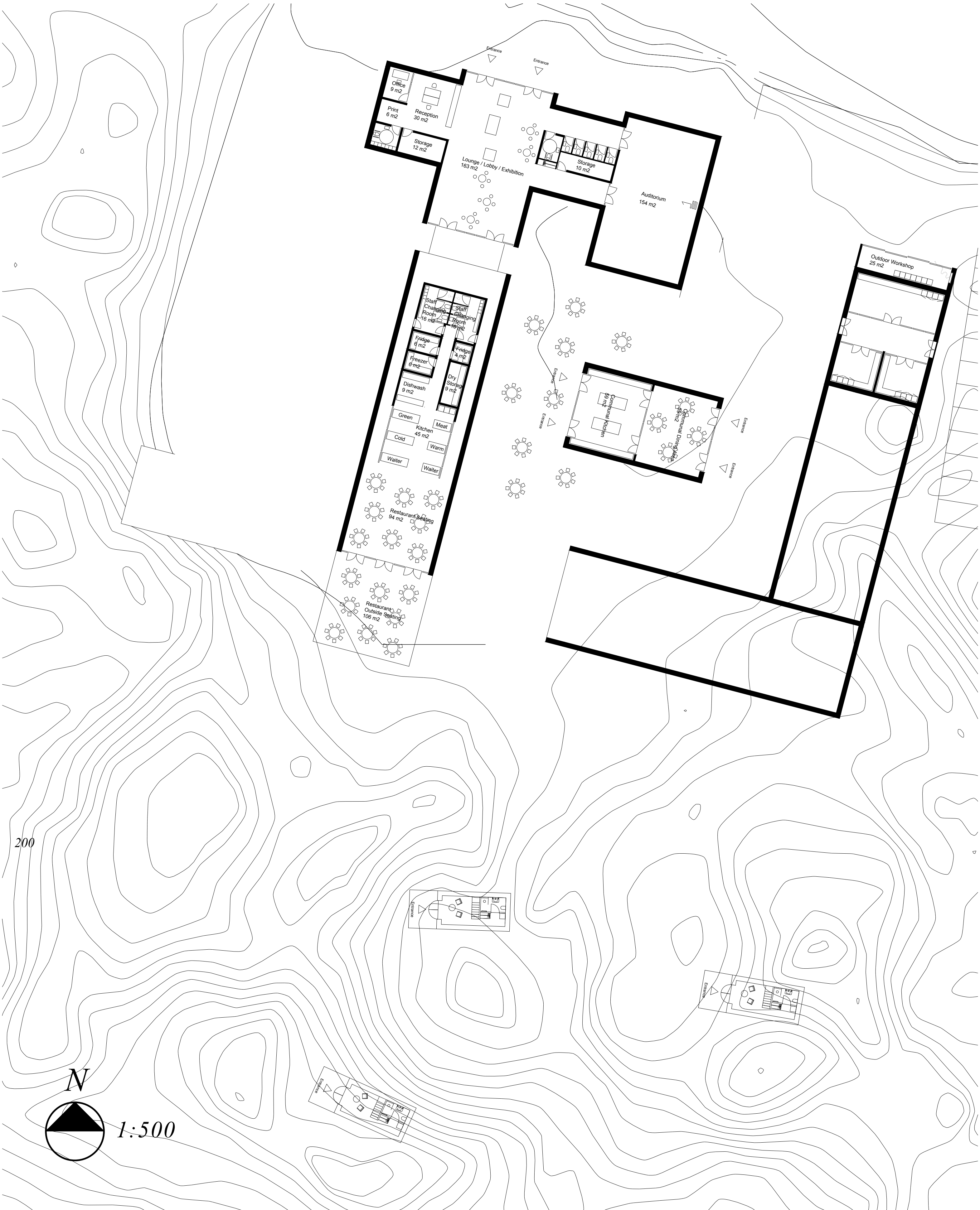
Materials:

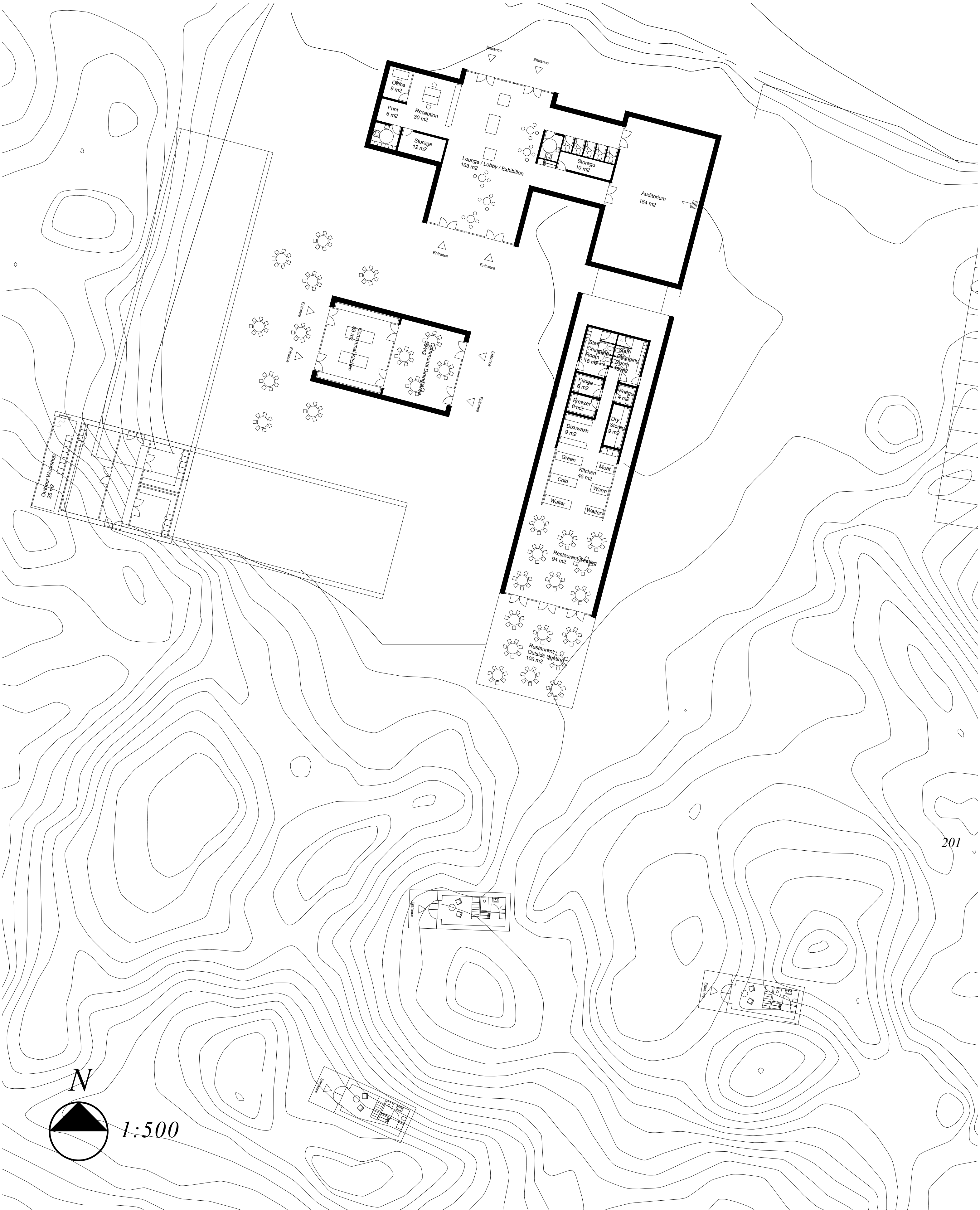
- Window Frames: Light Wood
- Floor: Light Wood
- Walls: Light Wood
- Ceiling: Light Wood

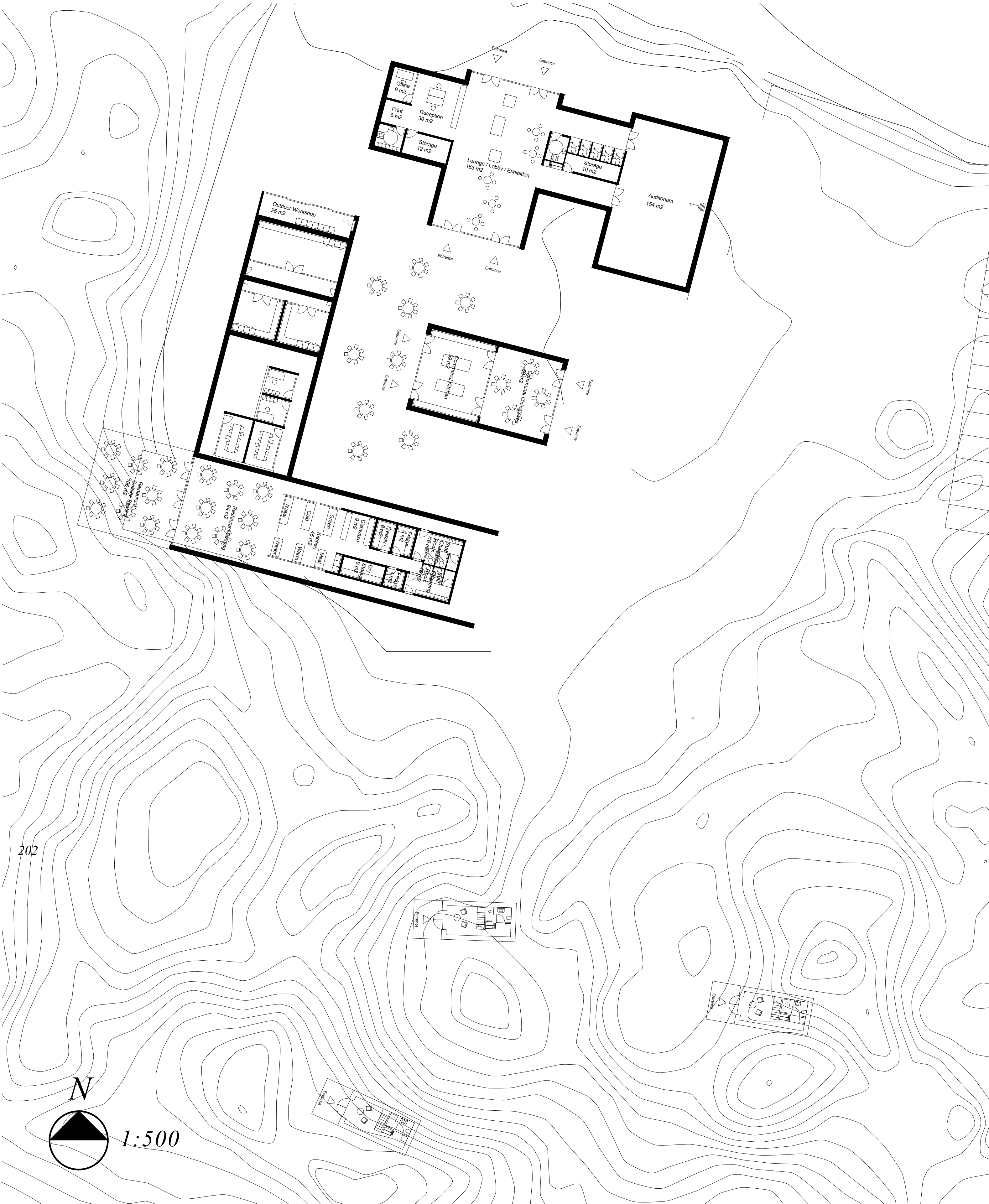


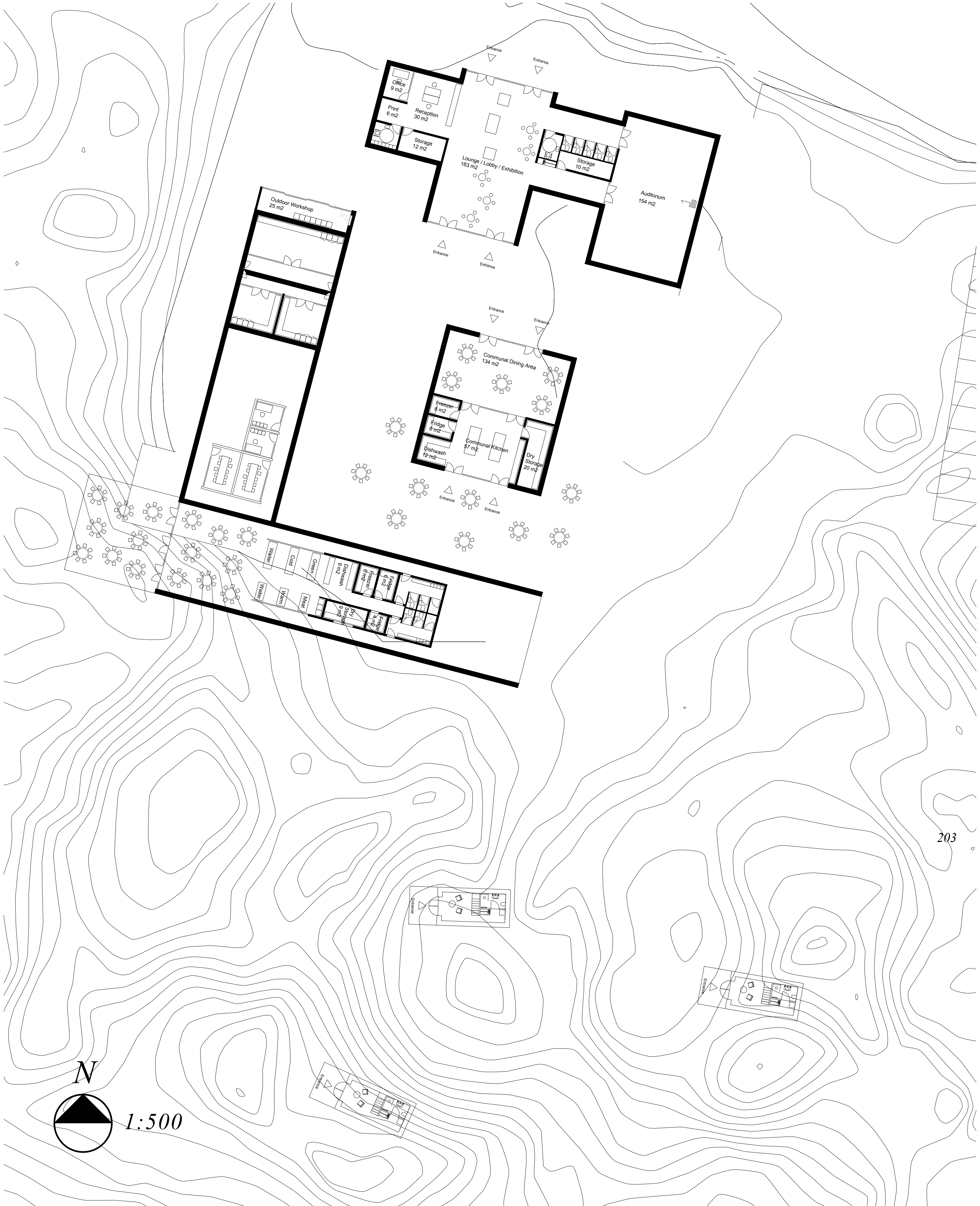


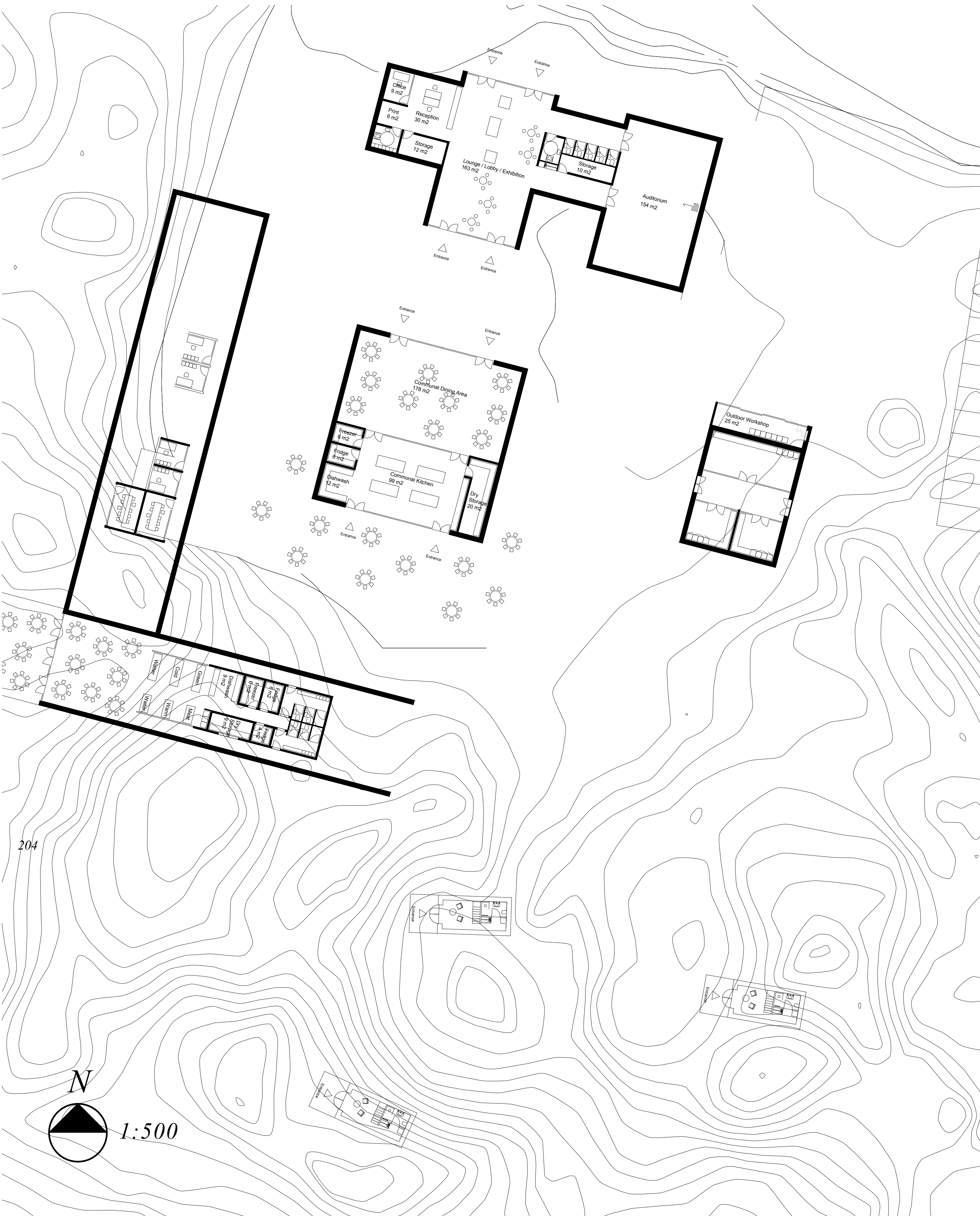
APPENDIX D1.1: PLAN STUDIES - MASTERPLAN

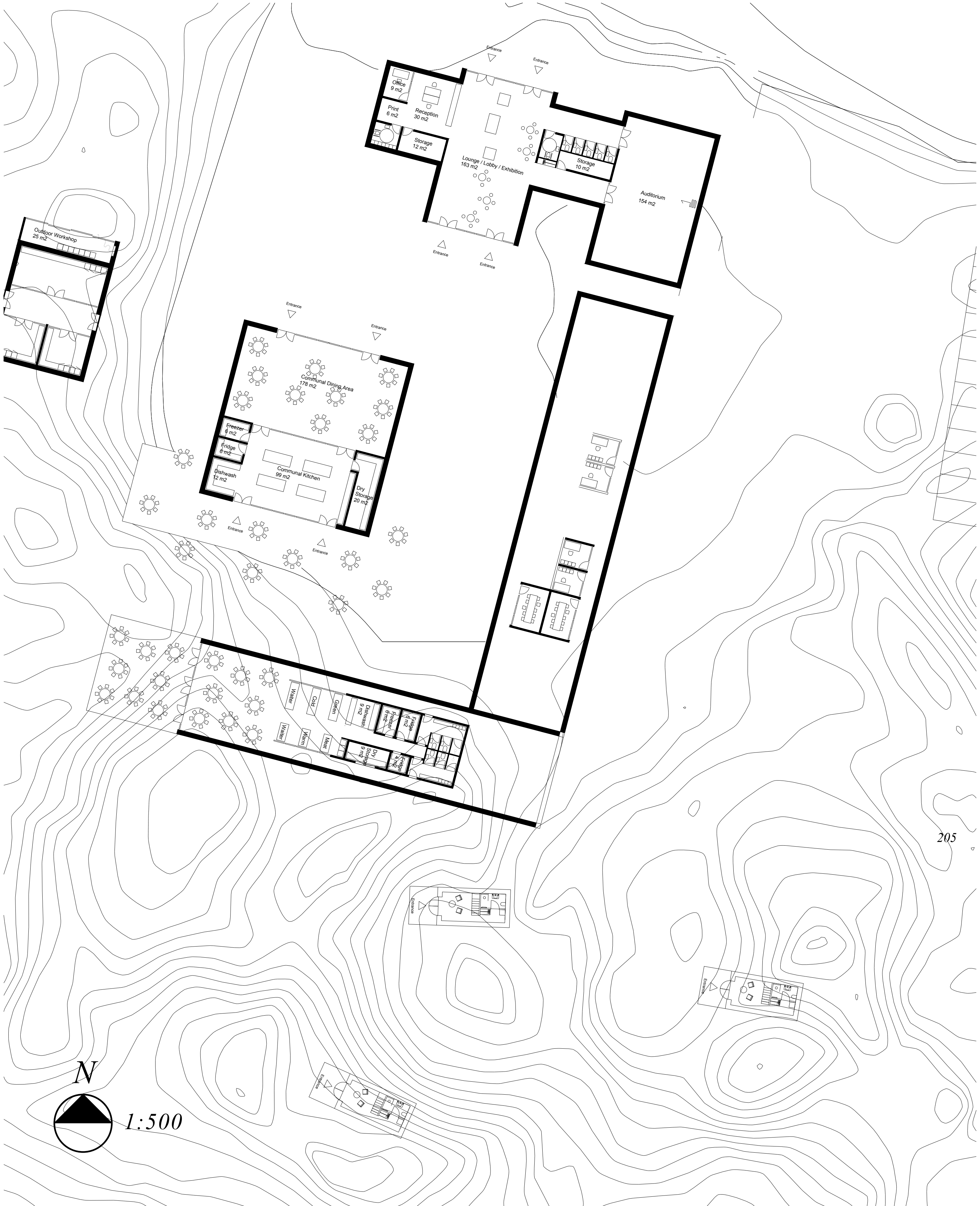



Entrance
Entrance
Office
9 m2
Reception
30 m2
Print
6 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
Entrance
Entrance
Communal Kitchen
59 m2
Communal Dining Area
Entrance
Entrance
Entrance
Entrance
Staff Changing Room
16 m2
Staff Changing Room
16 m2
Fridge
6 m2
Fridge
4 m2
Freezer
6 m2
Dry Storage
9 m2
Dishwash
9 m2
Green
Meat
Kitchen
45 m2
Cold
Warm
Waiter
Waiter
Restaurant Seating
94 m2
Restaurant Outside Seating
106 m2
Outdoor Workshop
25 m2
Entrance
Entrance
Entrance
N
1:500

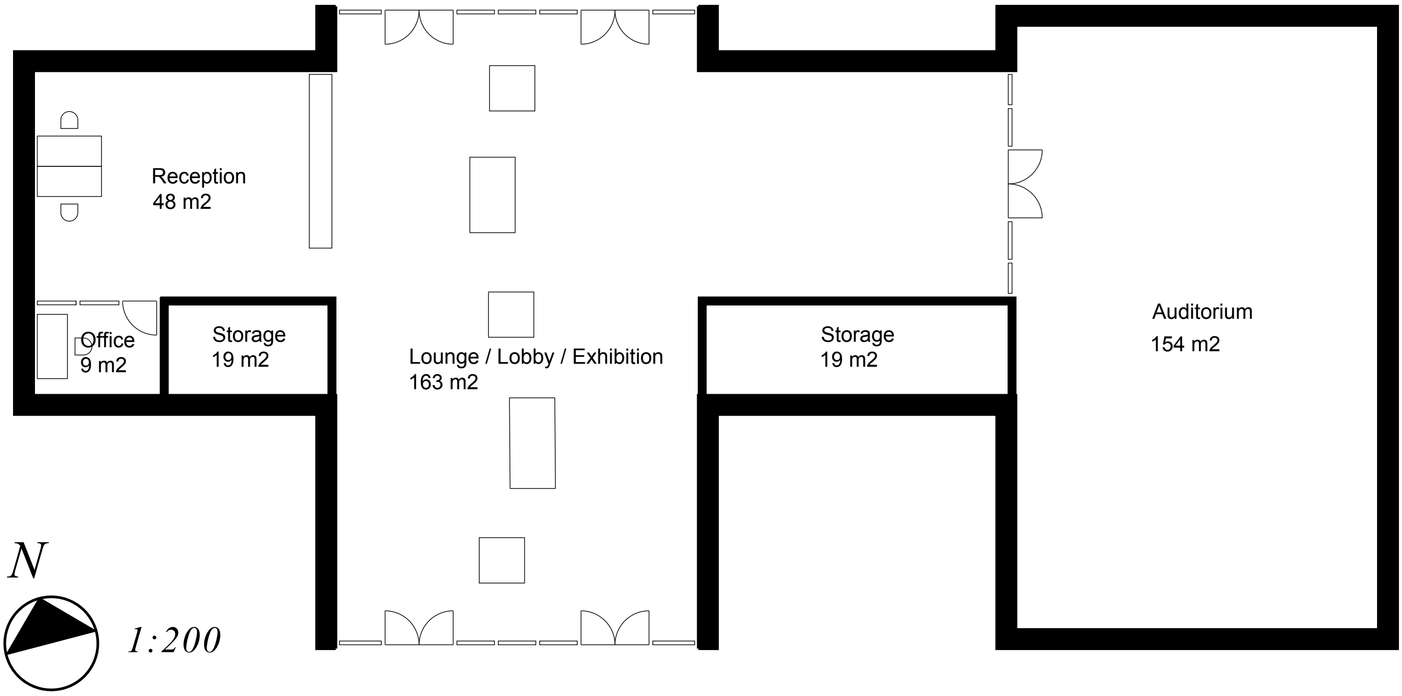

Entrance
Office
9 m2
Print
6 m2
Reception
30 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
Outdoor Workshop
25 m2
Communal Kitchen
Communal Dining Area
Restaurant Seating
94 m2
Kitchen
45 m2
Dishwash
9 m2
Freezer
6 m2
Fridge
6 m2
Dry Storage
9 m2
Staff Changing Room
N
1:500

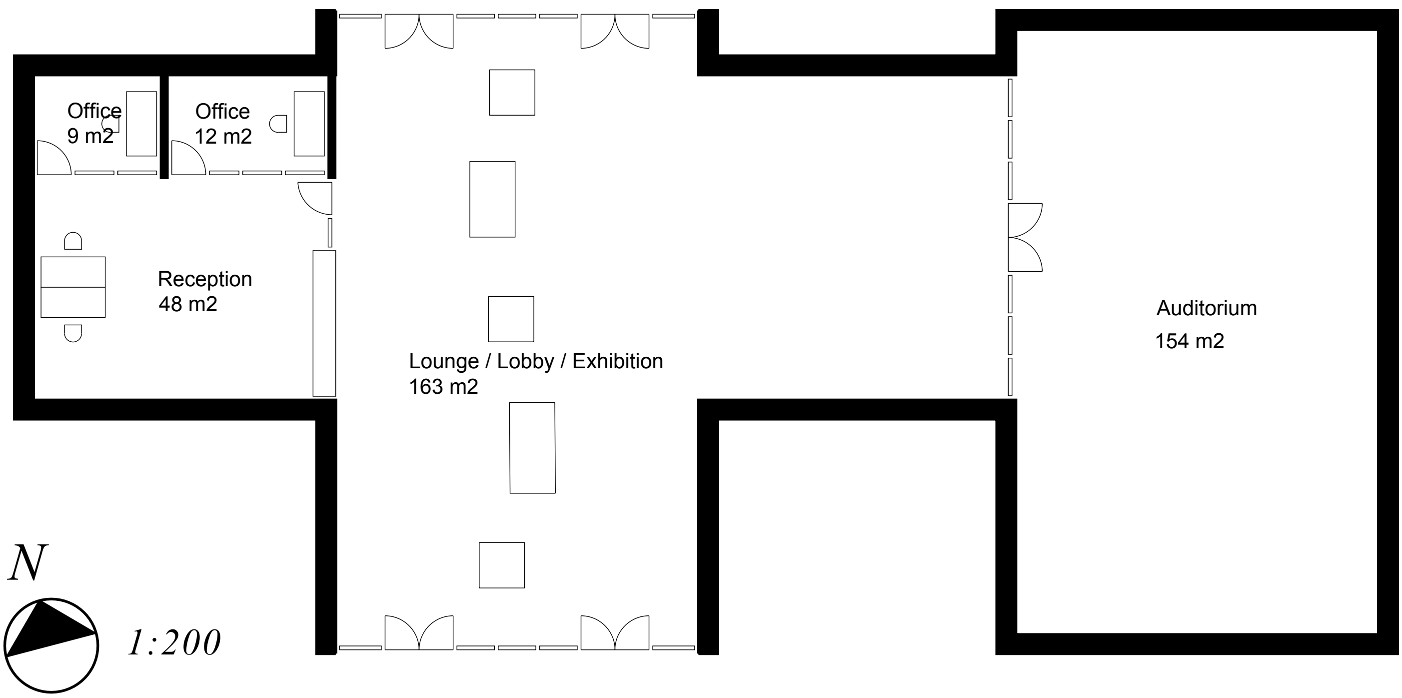

Entrance
Entrance
Office
9 m2
Print
6 m2
Reception
30 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
Outdoor Workshop
25 m2
Entrance
Entrance
Entrance
Entrance
Communal Dining Area
134 m2
Freezer
6 m2
Fridge
6 m2
Communal Kitchen
57 m2
Dishwash
12 m2
Dry
Storage
20 m2
Entrance
Entrance
Water
Cold
Green
Dishwash
9 m2
Freezer
6 m2
Fridge
6 m2
Water
Warm
Meat
Dry
Storage
9 m2
Fridge
4 m2
N
1:500

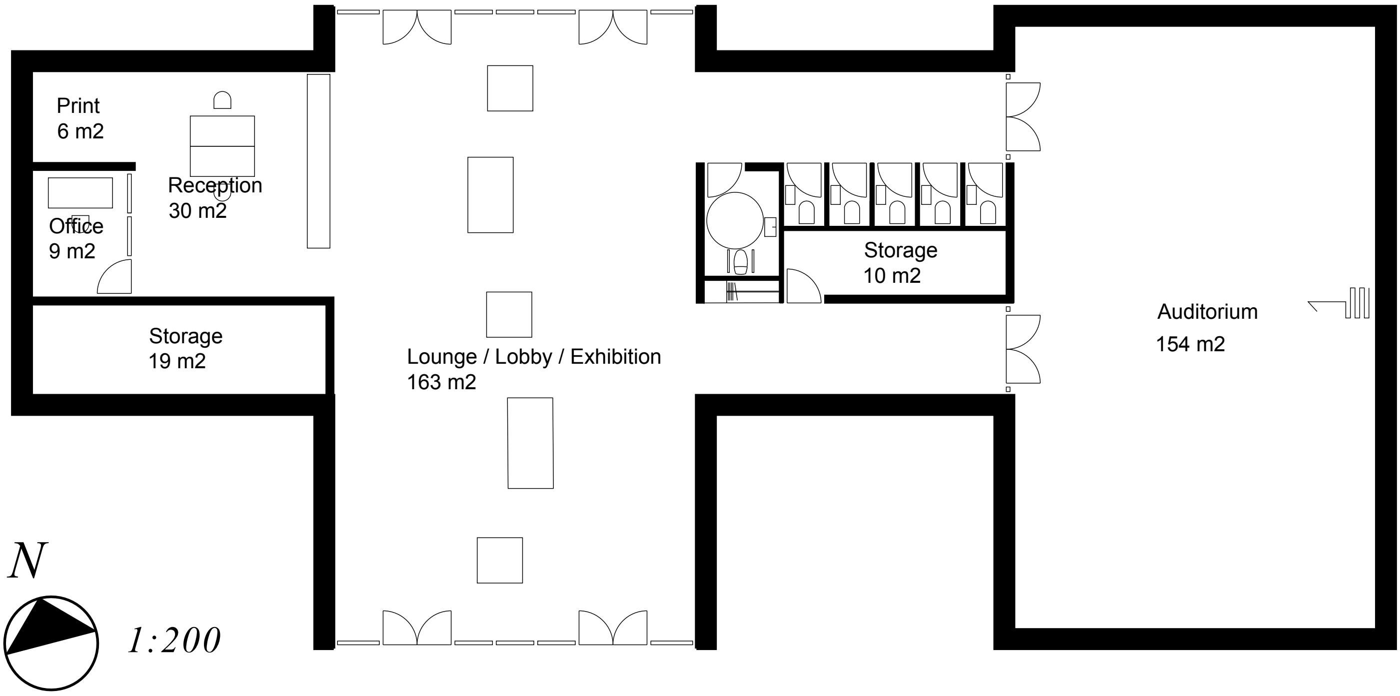

Entrance
Office
9 m2
Print
6 m2
Reception
30 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
Communal Dining Area
178 m2
Freezer
6 m2
Fridge
6 m2
Dishwash
12 m2
Communal Kitchen
99 m2
Dry
Storage
20 m2
Outdoor Workshop
25 m2
Water
Cold
Green
Dishwash
9 m2
Warm
Meat
N
1:500

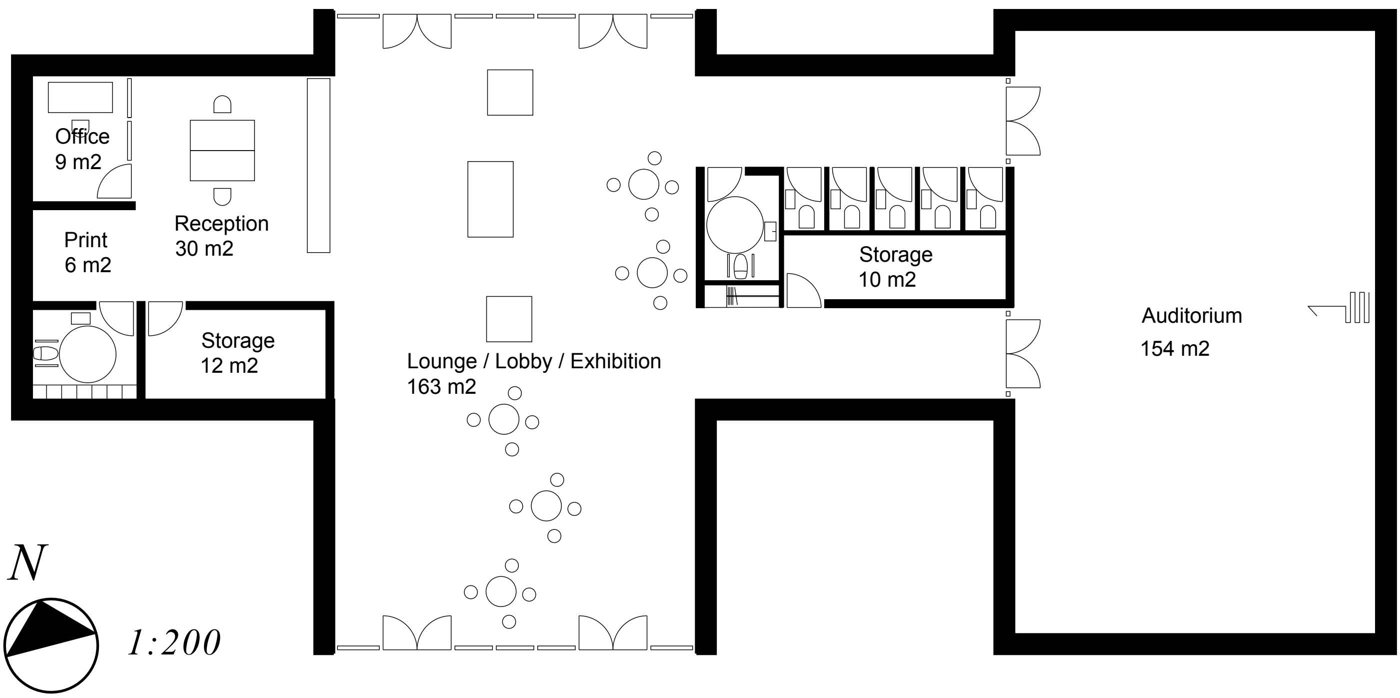

Entrance
Entrance
Office
9 m2
Print
6 m2
Reception
30 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
Entrance
Entrance
Outdoor Workshop
25 m2
Entrance
Entrance
Communal Dining Area
178 m2
Freezer
6 m2
Fridge
6 m2
Dishwash
12 m2
Communal Kitchen
99 m2
Dry
Storage
20 m2
Entrance
Entrance
Waiter
Cold
Green
Dishwash
9 m2
Freezer
6 m2
Fridge
6 m2
Waiter
Warm
Meat
Dry
Storage
9 m2
Fridge
4 m2
Entrance
Entrance
Entrance
N
1:500

APPENDIX D2.1: PLAN STUDIES - CURRENT BUILDING

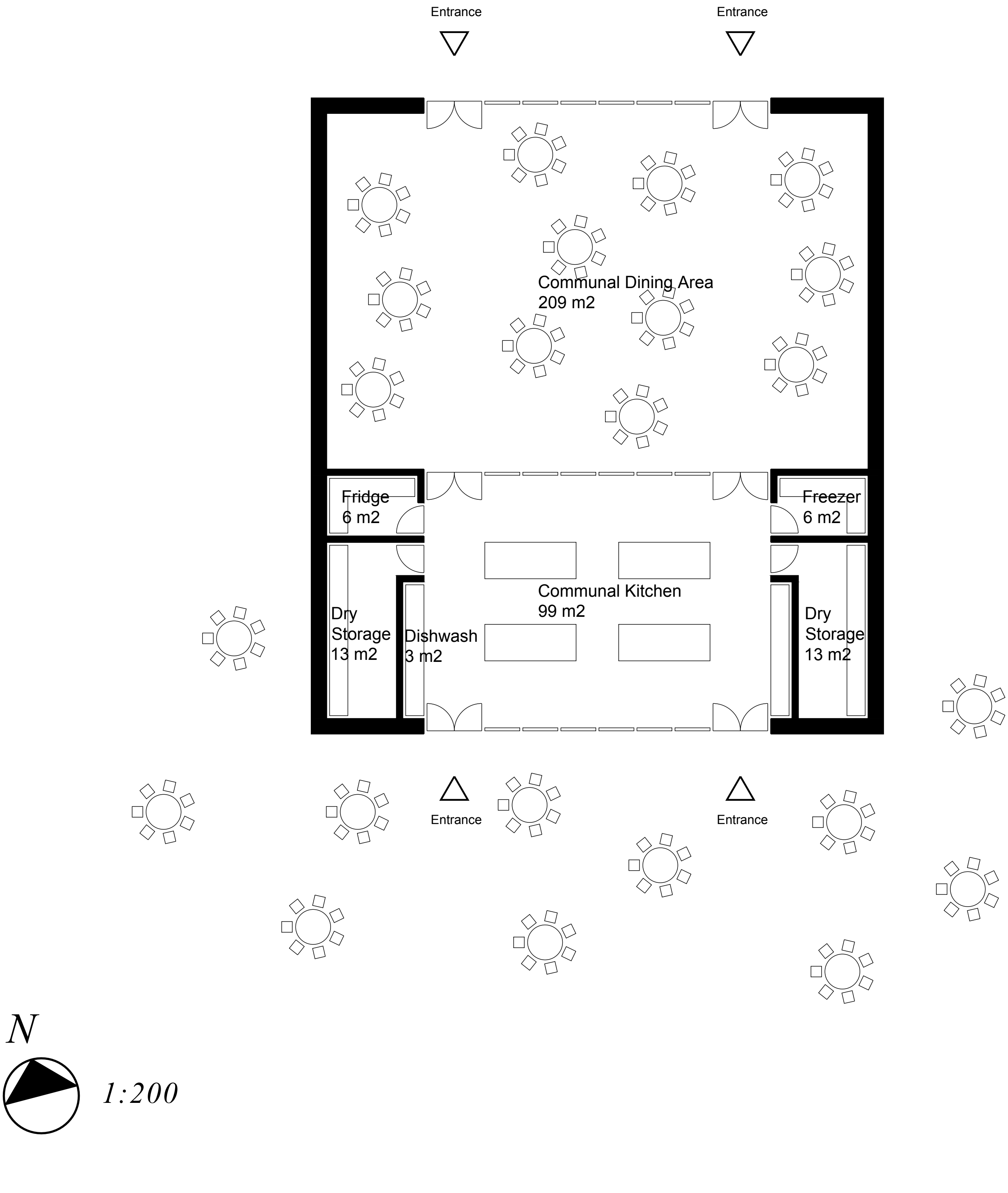


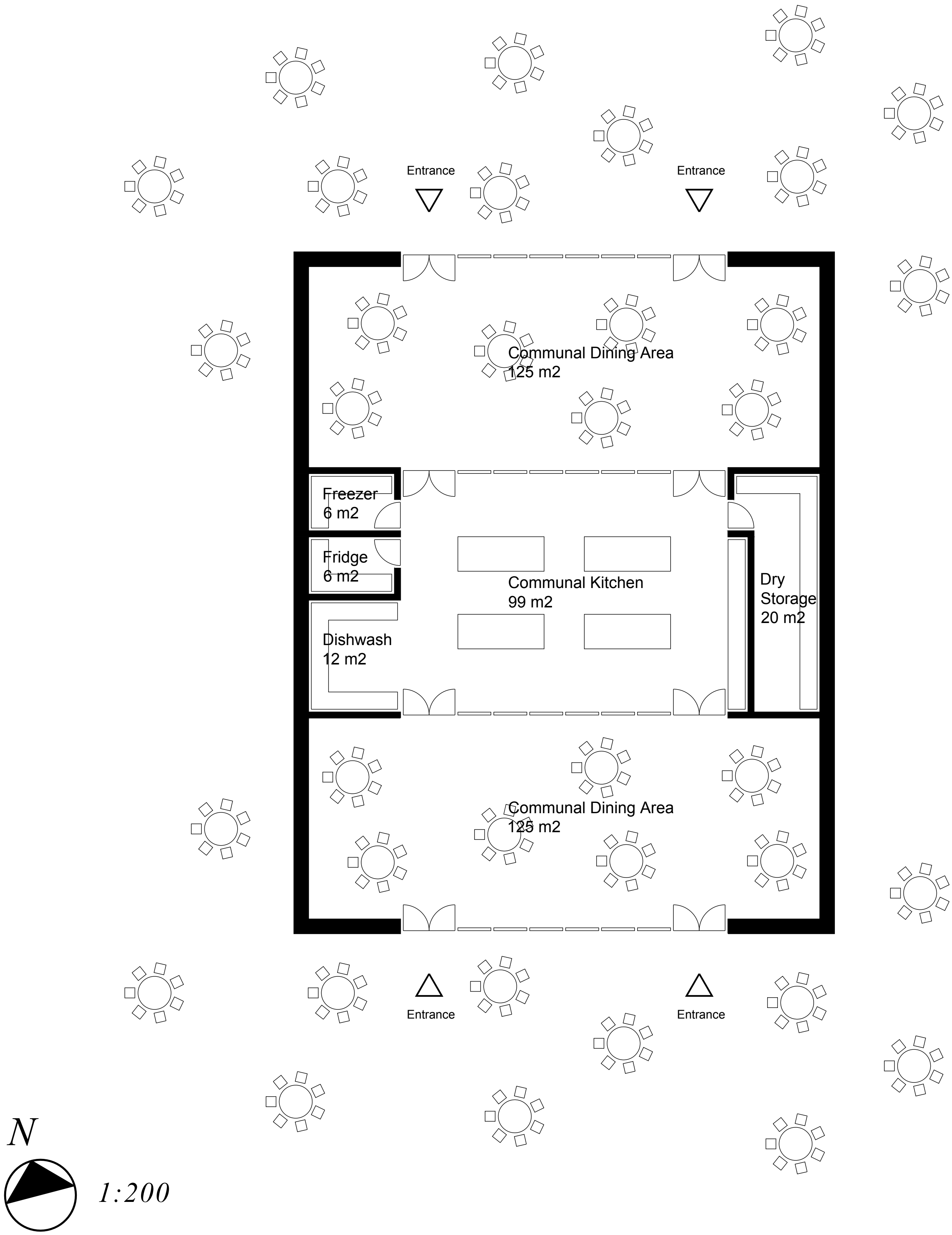



Print
6 m2
Reception
30 m2
Office
9 m2
Storage
19 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
N
1:200

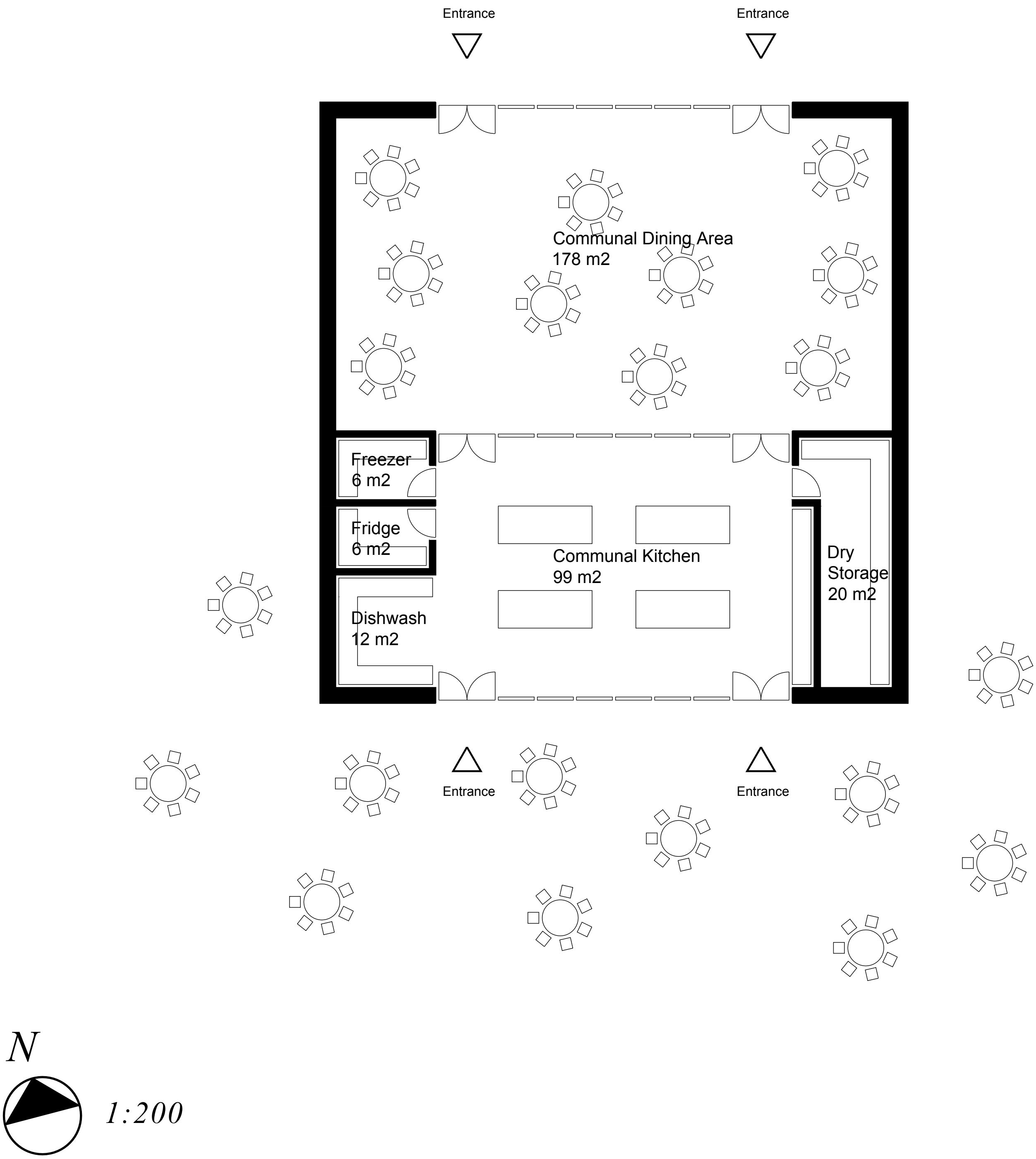

Office
9 m2
Reception
30 m2
Print
6 m2
Storage
12 m2
Lounge / Lobby / Exhibition
163 m2
Storage
10 m2
Auditorium
154 m2
N
1:200

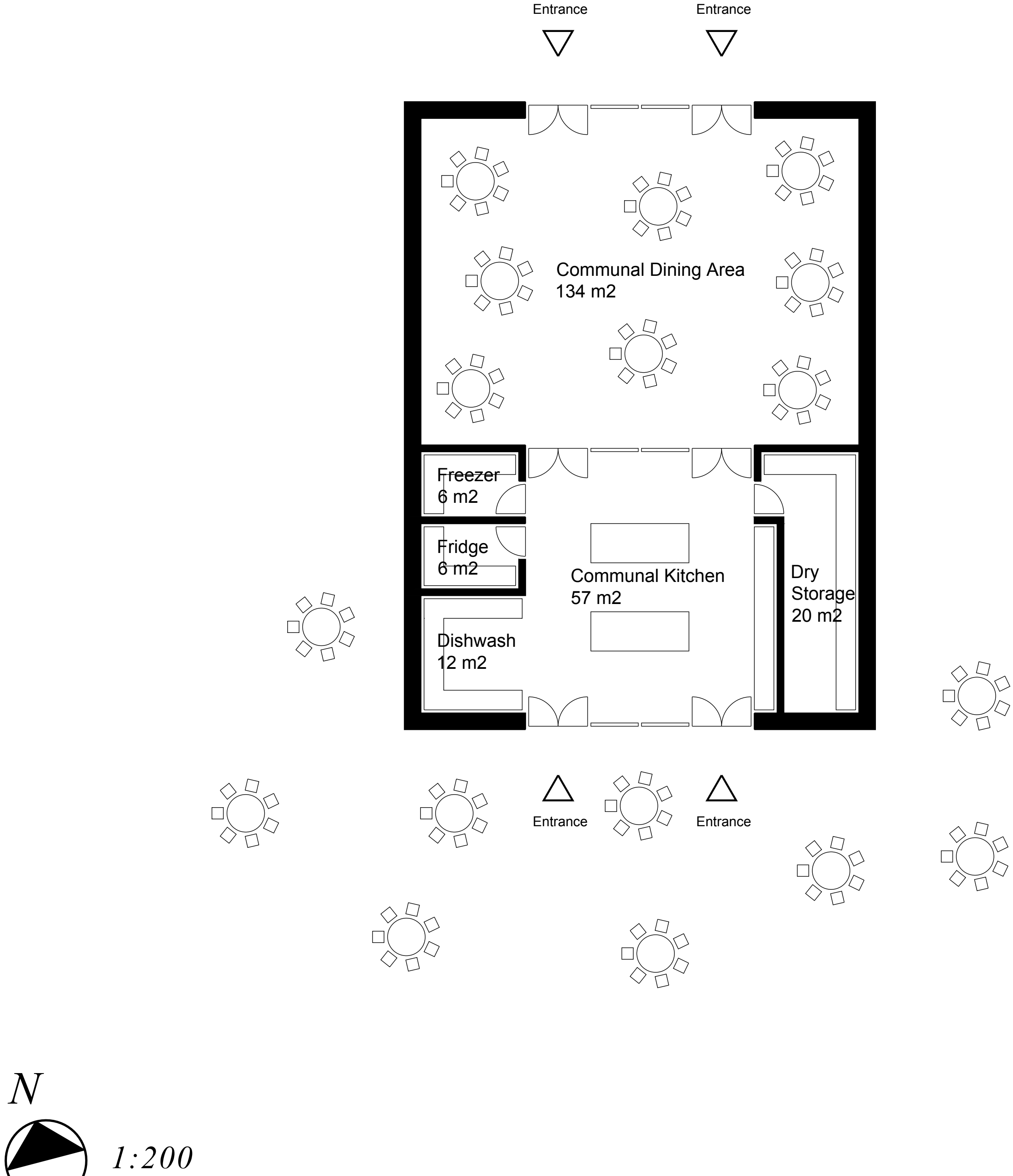
APPENDIX D3.1: PLAN STUDIES - COMMUNAL KITCHEN

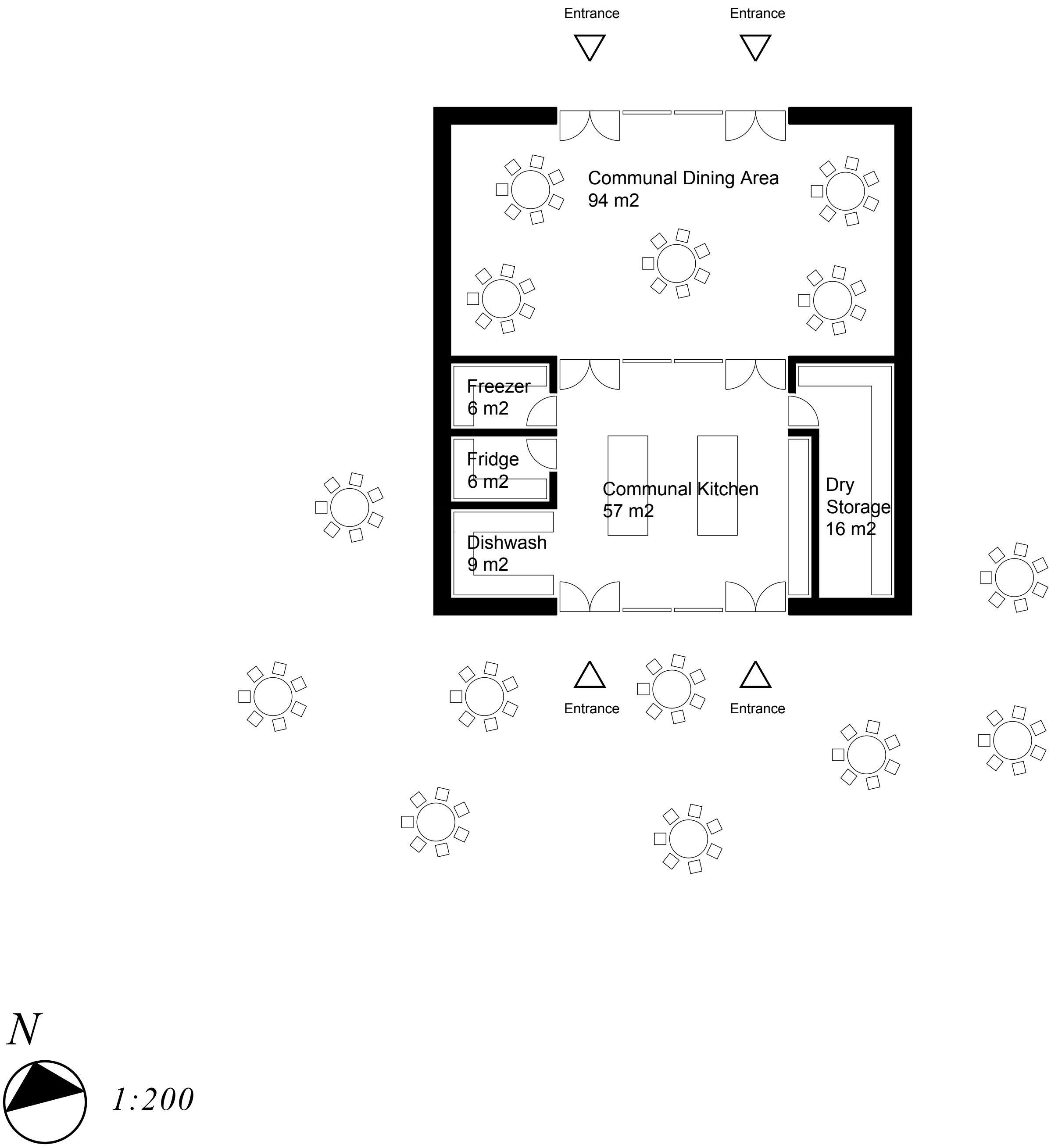


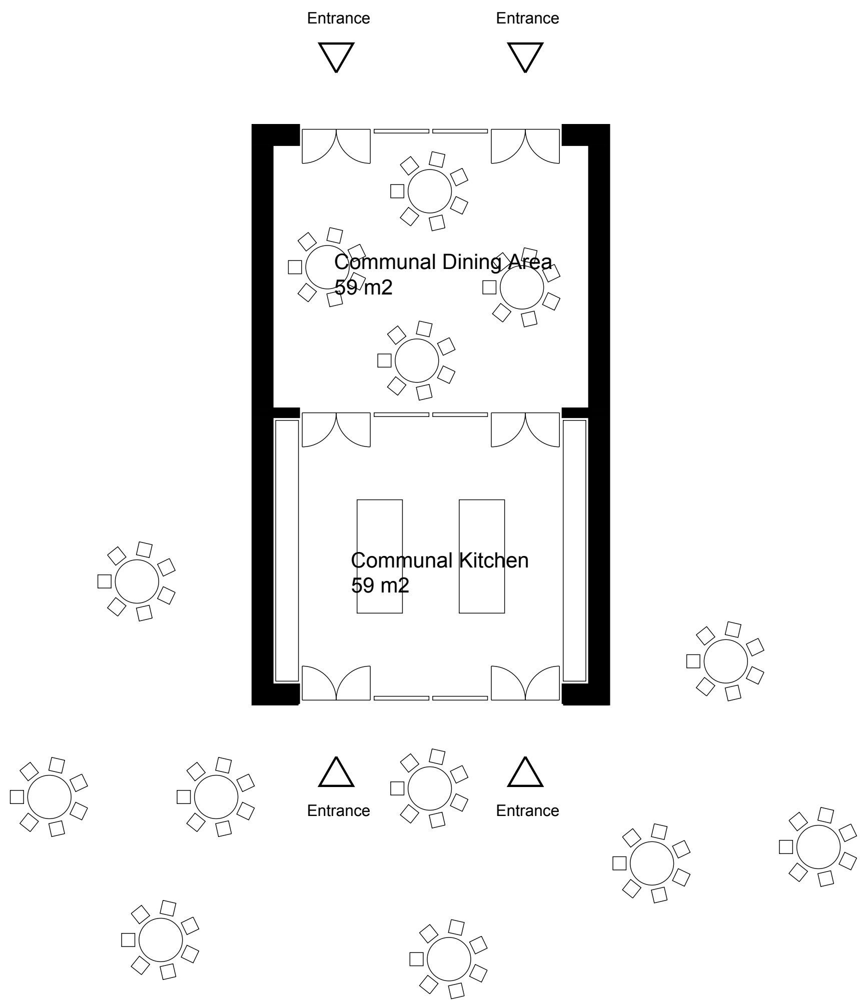


Entrance
Entrance
Communal Dining Area
125 m2
Freezer
6 m2
Fridge
6 m2
Communal Kitchen
99 m2
Dry
Storage
20 m2
Dishwash
12 m2
Communal Dining Area
125 m2
Entrance
Entrance
N
1:200

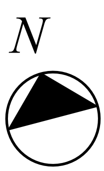

Entrance
Entrance
Communal Dining Area
178 m2
Freezer
6 m2
Fridge
6 m2
Communal Kitchen
99 m2
Dry
Storage
20 m2
Dishwash
12 m2
Entrance
Entrance
N
1:200


Entrance
Entrance
Communal Dining Area
134 m2
Freezer
6 m2
Fridge
6 m2
Communal Kitchen
57 m2
Dry
Storage
20 m2
Dishwash
12 m2
Entrance
Entrance
N
1:200


Entrance
Entrance
Communal Dining Area
94 m2
Freezer
6 m2
Fridge
6 m2
Communal Kitchen
57 m2
Dry
Storage
16 m2
Dishwash
9 m2
Entrance
Entrance
N
1:200



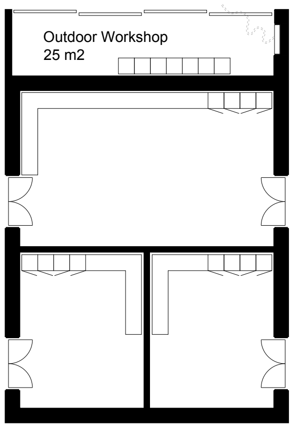
Entrance
Entrance
Communal Dining Area
59 m2
Communal Kitchen
59 m2
Entrance
Entrance

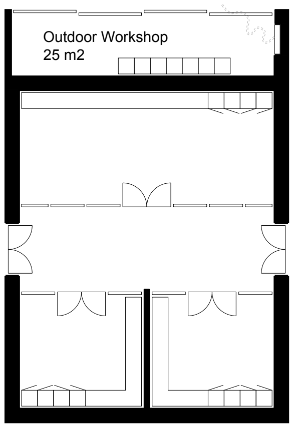


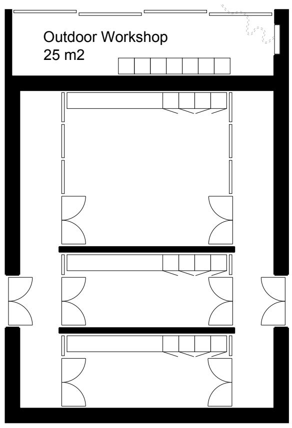
N

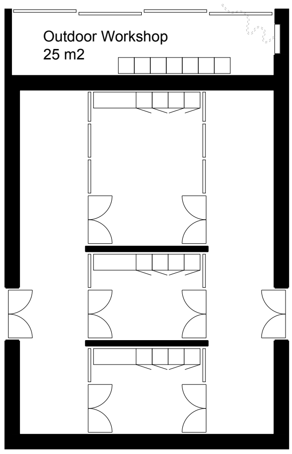
1:200

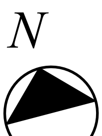
APPENDIX D4.1: PLAN STUDIES - WORKSHOP





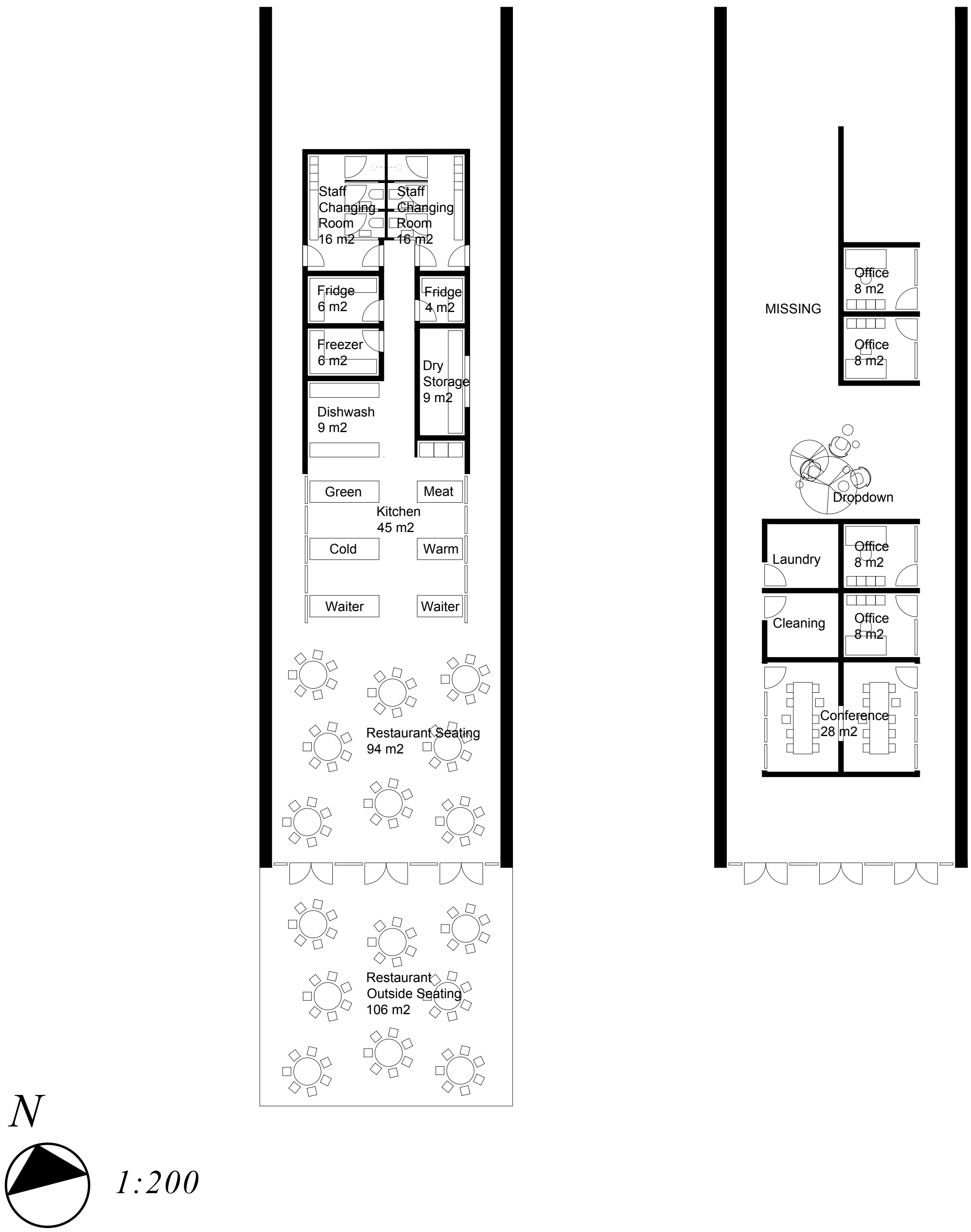




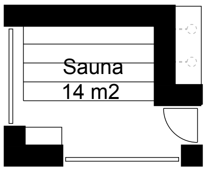


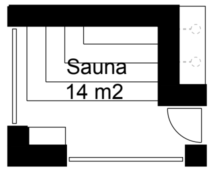
1:200

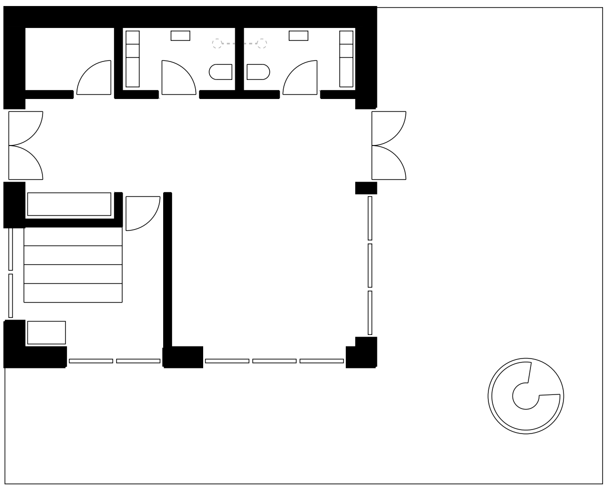
APPENDIX D5.1: PLAN STUDIES - RESTAURANT + STAFF

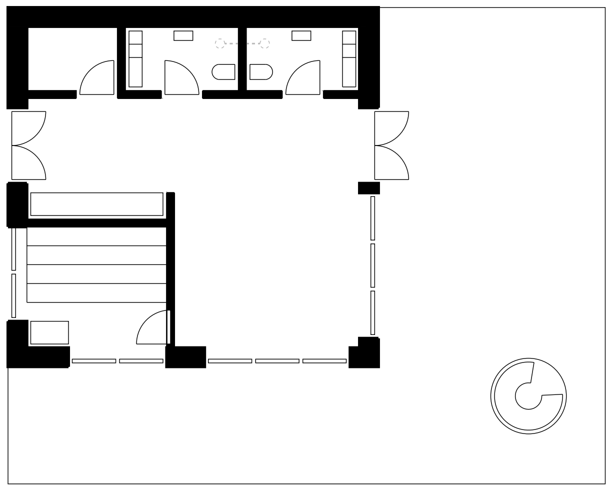


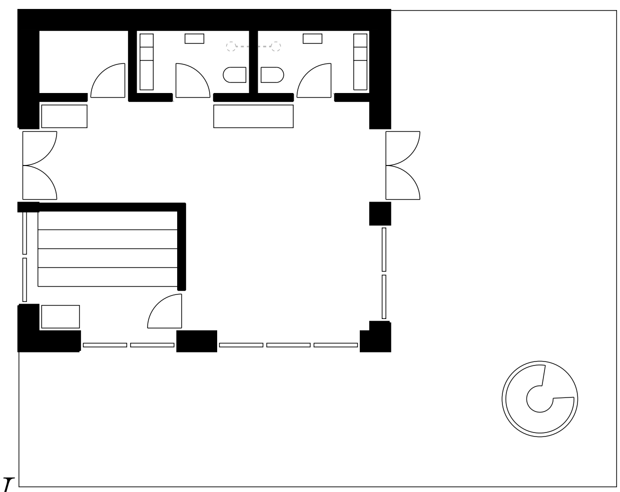
APPENDIX D6.1: PLAN STUDIES - SAUNA

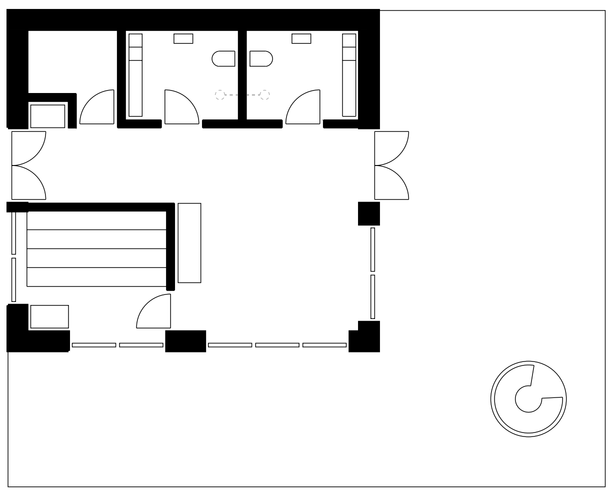


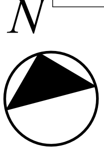












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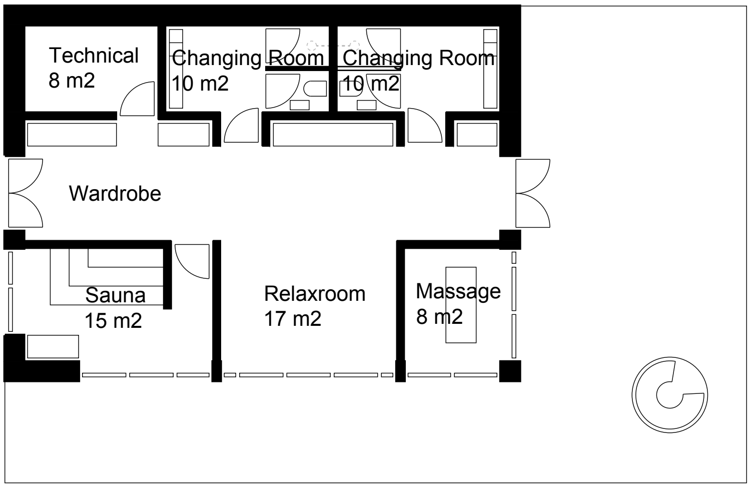
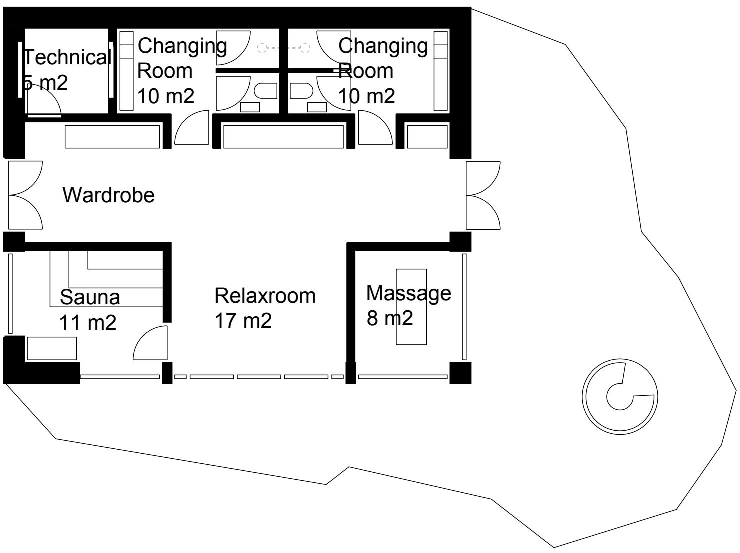
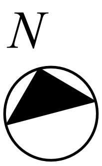
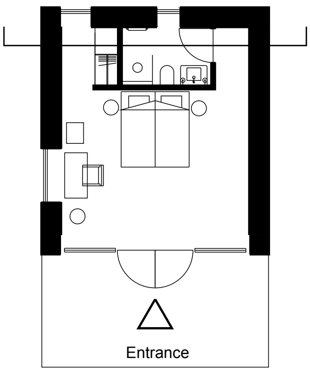

Technical
8 m2
Changing Room
10 m2
Changing Room
10 m2
Wardrobe
Sauna
15 m2
Relaxroom
17 m2
Massage
8 m2

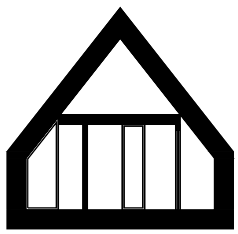

Technical
5 m2
Changing
Room
10 m2
Changing
Room
10 m2
Wardrobe
Sauna
11 m2
Relaxroom
17 m2
Massage
8 m2


N

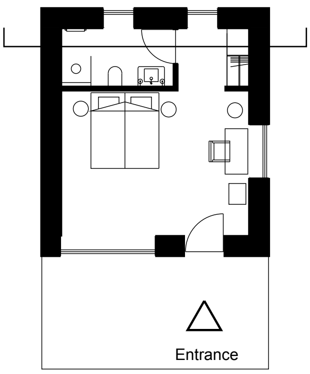
1:200

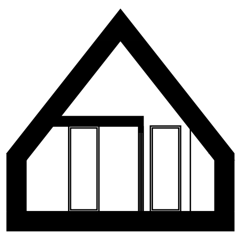
APPENDIX D7.1: PLAN STUDIES - HUTS



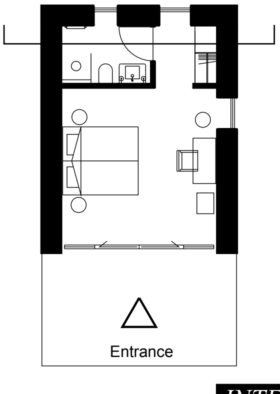


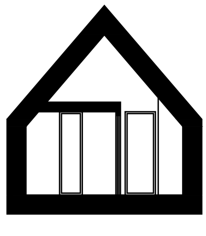
INTERNAL GROSS AREA:
31 M^2





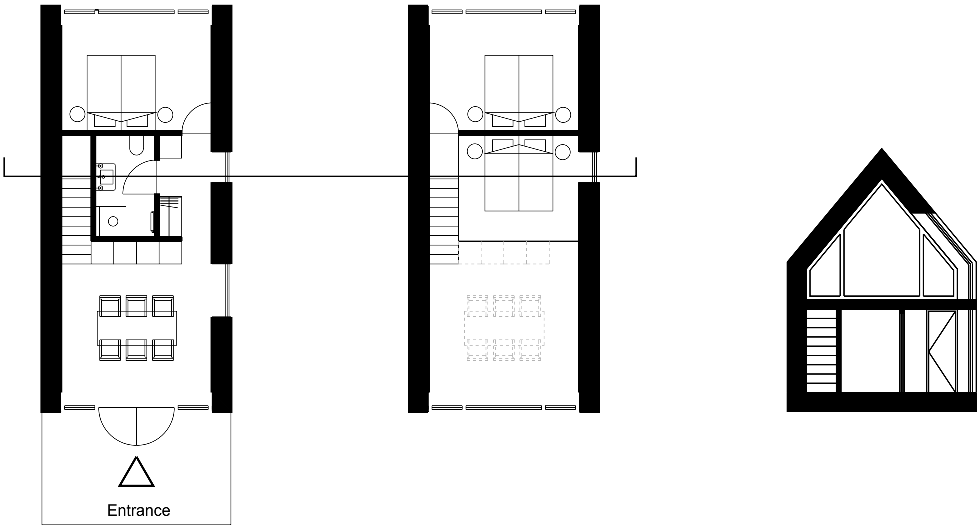
INTERNAL GROSS AREA:
28 M^2



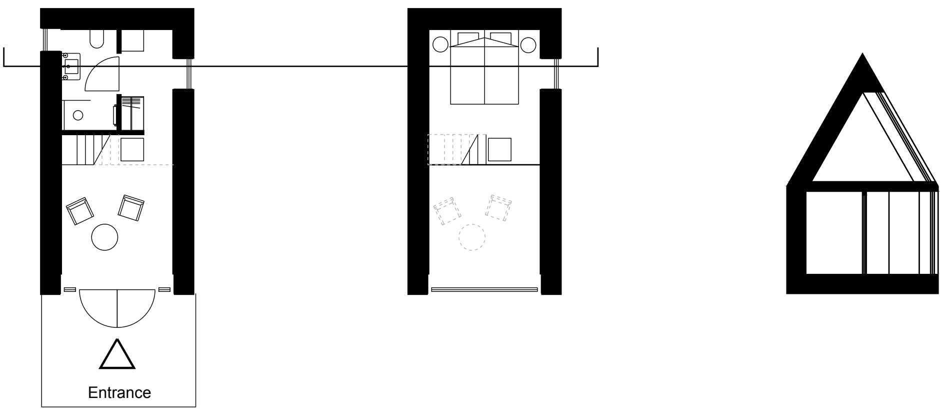


INTERNAL GROSS AREA:
23 M^2

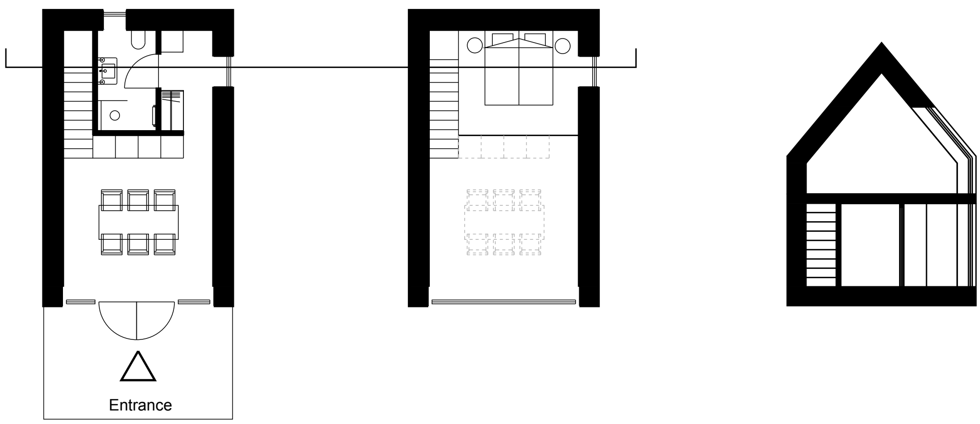
1:200



INTERNAL GROSS AREA:
62 M^2

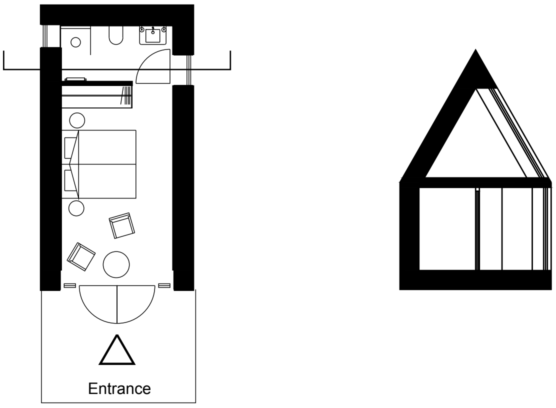


INTERNAL GROSS AREA:
28 M^2

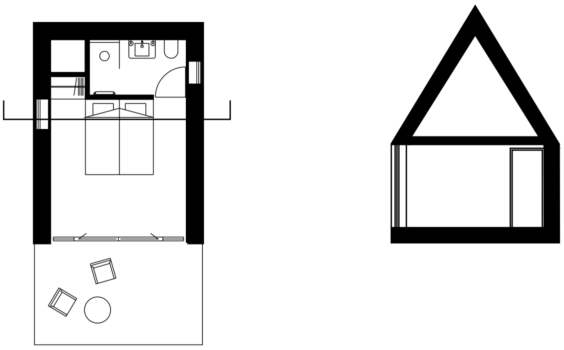


1:200

INTERNAL GROSS AREA:
38 M^2

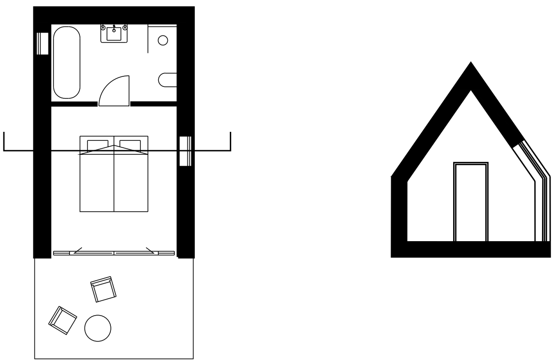


INTERNAL GROSS AREA:
21 M²



Entrance

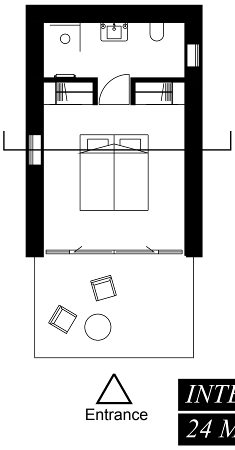
INTERNAL GROSS AREA:
20 M²

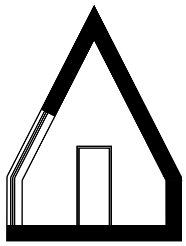


Entrance

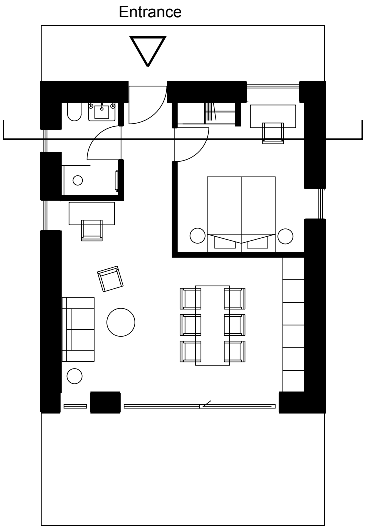
INTERNAL GROSS AREA:
21 M²

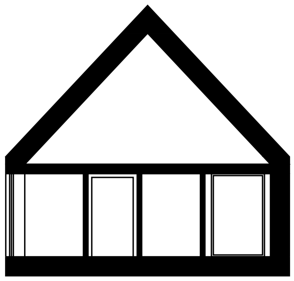
1:200



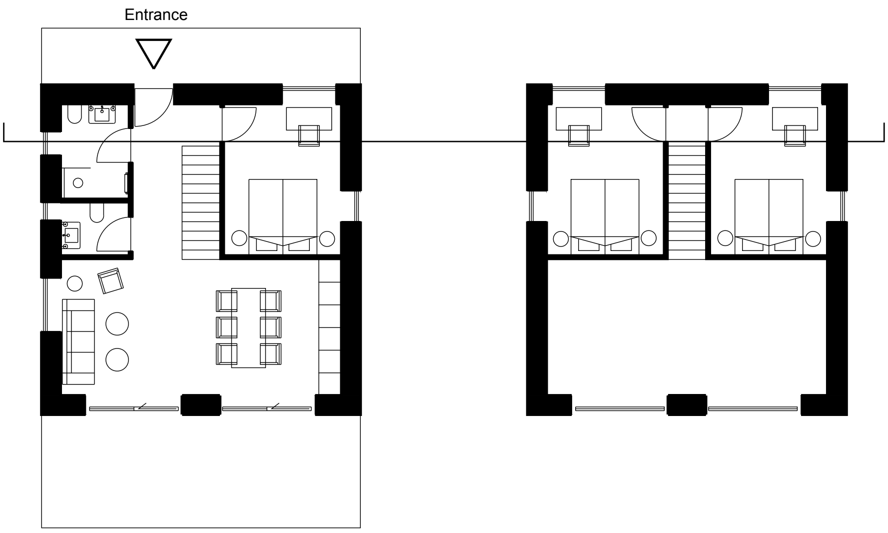


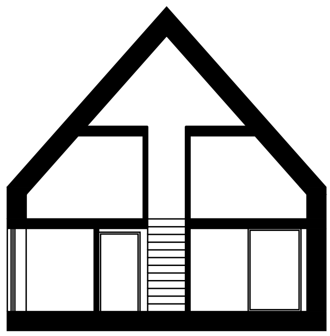
INTERNAL GROSS AREA:
24 M^2





INTERNAL GROSS AREA:
50 M^2





INTERNAL GROSS AREA:
88 M^2

1:200

APPENDIX E1: FACADE STUDIES - 1:200