Northern Bunker Museum

Program, Process & Presentation



MASTER THESIS 2020

This report contains the final programme, process and presentationmaterial. This repport should be read as double-sided PDF, as several of the images cross both sides. All the given material is created by student Nicolai Qvist Krarup stud.nr. 20130846 in cooperation with Aalborg University in spring 2020.

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Nicolai Qvist Krarup

Abstract

The following publication aims to convey the process of a new Bunker Museum for the municipality of Frederikshavn. By the use of different analysing methods for the context, users, and case studies, a programme is formed. In addition, the further process by technical, functional and aesthetically considerations attempts to answer the question of creating an innovative museum that relates to its surrounding context, stimulate senses, and interprets history into architecture. The result is a building that contains three spacious concepts: The Walk, The Blocks, and The Bunkers. Together they form a different experience with several layers of visits, social and environmentally sustainable strategies and humanistic architectural elements that contributes to a sensing building which relates to the past, present and future of the planet.

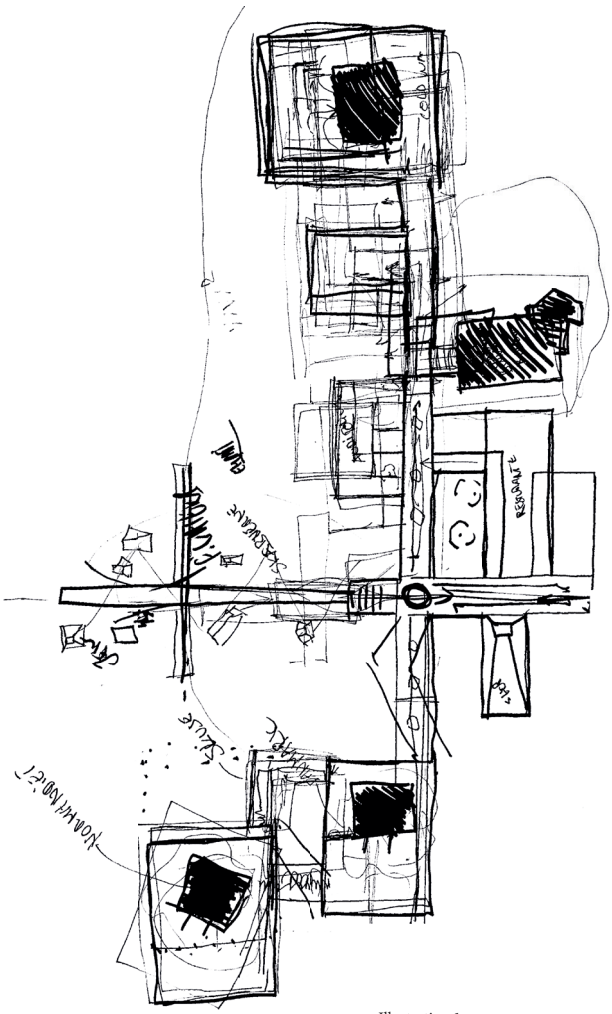

Illustration 1

The Programme

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Programme.



Bangsbo Fort, 2020 Foto: Nicolai Qvist Krarup



Motivation

Through my years of studying Architecture at Aalborg University, I've been introduced to a lot of exciting projects.

The projects have been in different scales, typologies, functions, users, etc. However, common to all of them is a solution to a given problem. An issue we as students or mortals see as an opportunity for change and innovation? In other words, search for a better solution. In recent years, I have been very interested in the importance of buildings to human physiology and psychology. In particular, Social Sustainability and how a building can create living qualities.

We live in an increasingly artificial time. The more unnatural the world becomes, the more we act in search of naturalness. One of the most natural things in this world is our existence. People have always felt a deep need to explain their past and provenance (Videnskab, 2020).

I am motivated by creating architecture that touches the humanbeing and its emotions. A museum is a historical insight into the existence of the past and an obvious opportunity to feel human emotions. However, I see a lack of the latter mentioned. I see a shortage in museums that communicate feelings through architecture. A house that uses the opportunities of architecture to stimulate human senses and thus evoke its emotions. I believe that the right combination of knowledge in social psychology and architecture can create an innovative building that communicates a historical event and the feelings of the past to a much greater extent.

The motivation for drawing the North Jutland bunker Museum thus is partly its unique location and partly the desire for a museum that has a clear vision of creating an emotional journey into the various destinies of the Atlantic Wall and World War II. An emotional journey characterized by fascination and empathy. An emotional journey of people for people who judge your past, touch your present, and enrich your future!

”I am motivated by creating architecture that touches the emotions of the humanbeing. A museum is a historical insight into the existence of the past and an obvious opportunity to feel and understand human emotions.”

Integrated Architectural Design

The following thesis aims to convey the process of a new Bunker Museum for the municipality of Frederikshavn.

A scientific project as this thesis involves a lot of scientific research and architectural studies according to a given problem (Problem based learning). In the process, all the way from a given problem to final design is often a complex process. To ensure a holistic design the process is based on Mary-Ann Knudstrup's Integrated design process (2004). The method is based on an iterative process navigating between five different phases dealing with functional, technical, and aesthetic considerations. The method contains the problem, analysis, sketching, synthesis, and presentation phase.

The Integrated Design Process does not ensure aesthetic or sustainable solutions. It is a platform that makes it easier to control all the different parameters during the process of a project. The starting point of an architectural project at Aalborg University is based on motivation; the motivation may occur because of a need, a wish for innovation, a lack of a specific product, or a need for a better solution. To get a broader understanding of the problem, we use the analytical phase.

Different themes will be studied, that contributes to the topic and enriches with a more detailed understanding. Sustainable and technical principles are getting calculated and analyzed. Serial Vision by Gordon Cullen will be integrated through the analytics phase to gain a better understanding of the site and surrounding context. The microclimate of the site is studied to ensure a satisfactory outdoor climate.

Every architectural project are designed
based on the people who interact with the house. Therefore, interviews and visits to different similar projects and cases occur. This phenomenological approach to the references contributes to a sensing experience.

Throughout the programme, I will in the of each chapter raise architectural design criterias related to the analytical text. The criterias should be relevant to the further design process. The analytic phase is concluded through a number of these design criterias and a problem formulation. This creates a full output for the next step.

In the next phase, the analysis, problemformulation and design criteria will be challenged and integrated into various design proposals. This phase is known as the sketch phase. The sketch phase is represented mainly by analog sketches and modeling at different scales. The analog tools are complemented by digital tools that contribute to the broader integrated design process. The digital devices contribute to an interactive sketch with the opportunity to give a realistic answer to technical, sustainable, and contextual questions.

The next phase is the synthesis phase. This phase ties the ideas from the sketching phase together. The two phases of the process merge and create a third, where the requirements of the program are met in an architectural form that binds usability, beauty, and durability together.

Finally, the project is presented and the problem formulation is answered through architectural visualizations, models, and diagrams in such a way, that all the qualities are well visualized. Furthermore, the presentation should clearly point out how the aims, target values, and design criterias of the project have been fulfilled.

"Recognizing the need is the primary condition for design." – Charles Eames.

Commando lines Phases Tools

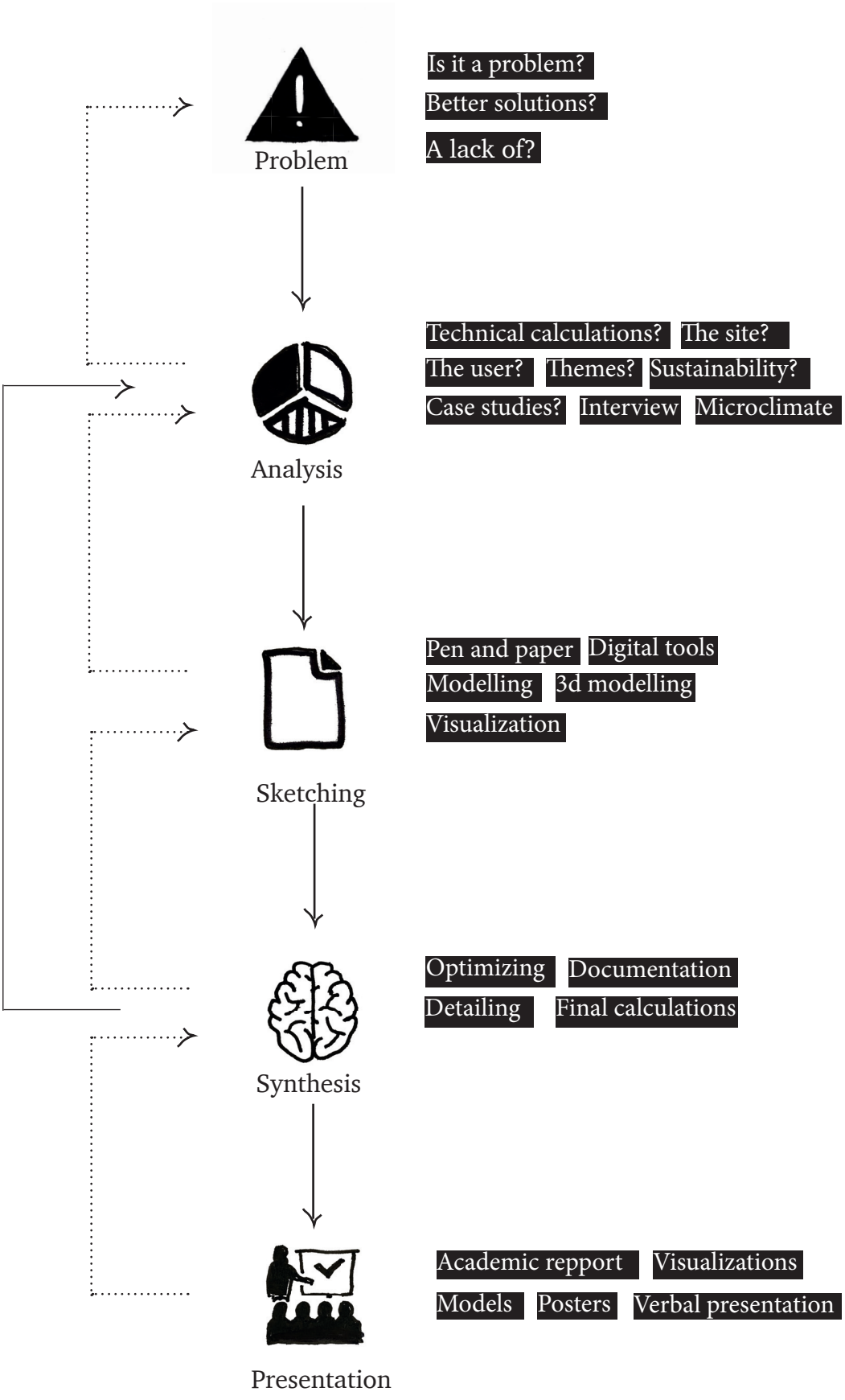


Illustration 2

My vison, my drive, my manifesto

A holistic, personal approach to architecture

Through my years as an architectural student, I've learned and experienced a lot according to the art of architecture. Over the past few years, I have tried to reflect and gradually form my approach to the subject itself and its opportunities in this world.

I think it is essential that we, as graduates relate to the architectural identity that we, as a future architect, take with us and let us motivate by.

Well, we've only been active in the subject for almost five years, but I think that it still creates a good reason to reflect and to ask some essential questions such as;

What truly inspires me?

What do I emphasize in architecture?

Architecture is created by people to people. We, as architects, must master the art of empathy. We need to put ourselves into others' physical and mental state of mind to ensure the ability to see current and future needs. Therefore, I believe that a good architect himself should be in close contact with his feelings and understanding of them.

So- architecture, as I see it, is very closely related to psychology. Therefore, I am passionate about creating architecture that contributes to increased well-being, learning and increased joy of life.

Architecture is also mainly about politics, generalized human view, and social development. It is essential, if possible that the architect carries some responsibility for societal challenges.

It could be healing architectural elements of hospital design or great interaction opportunities in residential buildings, to minimize the global problem of loneliness.

It could also be community-related in the form of the whole climate debate. There is no doubt that this topic has filled much both national and global for the past decade. The construction industry itself is responsible for 39% of total global CO2 emissions, of which 28% is operations, and 11% is materials and construction (worldgbc.org., 2019). It is, therefore, a big part of our responsibility as newly trained architects to use the latest knowledge and tools in sustainable building. And together- form a more green future.

As a person, I am very inspired by nature. All the great and sensual experience of walking in nature inspires me. I think in this time with all this amount of stress nature is an essential element (Ulrich, R.S., 2000). How can we translate it into architecture?

Nature and people are undeniably tied together. Can't one argue that architecture, in its simplicity, distances us as humans from nature? In its basic idea, is architecture and buildings well suited to safeguard us from outside harsh environments? I believe that nature can stage and create beautiful architecture, but architecture can, to that extent, also stage and highlight the qualities of nature's decorative elements.

Art is typically shown in a visual form such as paintings or sculptures. I think the greatest profession of all art is architecture. Art is an emotionally given object. I mean, Architecture has the opportunity to create stronger feelings than a visual art object. The architecture can activate all the human senses and create a multi-sensory experience that can create strong emotions (Pallasmaa, J., 1996).

So, people, society, climate, nature, and art are five elements I emphasize in my architectural approach and will permeate my choices in this thesis.

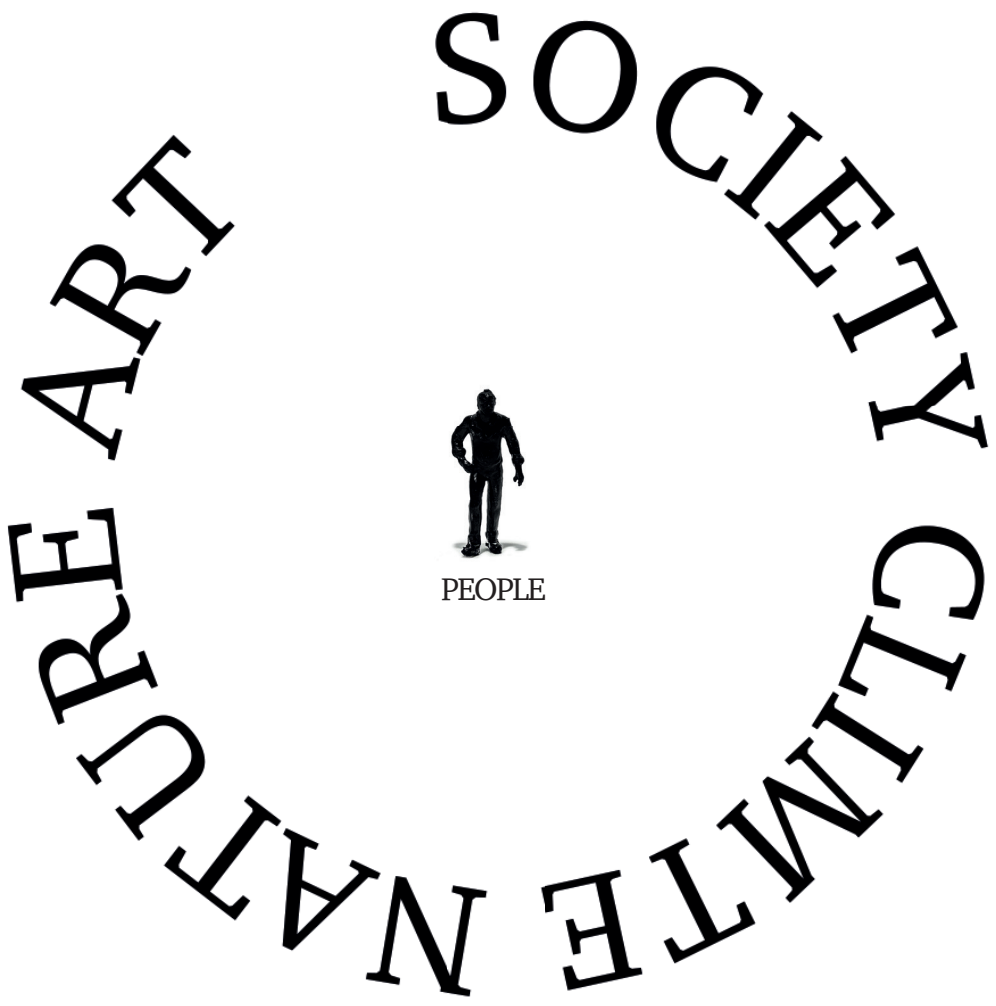


Diagram of the personal approach to architecture

Illustration 3

The learning museum

How rooms and materiality effects learning

The task of a Museum is to create the dissemination of history through insight, learning and impression. Therefore, an essential part of the thesis is to create a learning museum.

Within the world of teaching, there has been a marked focus on text and speech over time. There seems to be a blindness to how space, objects, and materiality influence teaching and learning in general.

The dominant focus has been on the content of teaching; Which items should be highlighted? What subject should be taught? What message should be conveyed, and in what relation to its target audience should it be expressed? The objects and spaces of the teaching slip into the background and appear to become less valuable and unimportant extras (Pécseli, B. 2017: 20).

Museums have the material in the center. It is mainly focusing on the stuff that makes the teaching situation and the exhibits of a museum something special (Boritz, 2012).

If we look at the museological research, over time, there has been an increased focus on the importance of the physical environment for what and how visitors process the learning (Pécseli, B. 2017: 22).

John Falk and Lyn Dierking are two American museum researchers. They find that museum surroundings are considered physically as well as psychologically. The sound, the light, the smell, and the feeling are all influences on the visitor's experience and learning. The sensory impact and understanding appear unconscious and dominant(Falk & Dierking, 1995: 11).
Materiality is thus ubiquitous. It does not tell its stories in the form of experience and recognition. It provides an opportunity to travel back in time and create empathy in the illuminated historical period (Pécseli, B. 2017: 23).

An essential approach to creating a learning museum in Frederikshavn is, therefore, through architectural elements to awaken emotions and stimulate senses.

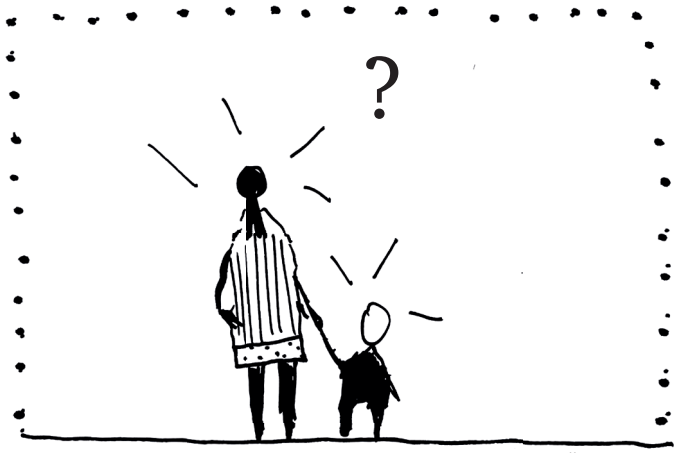


Illustration 4

A chapter of Emotions and Architecture

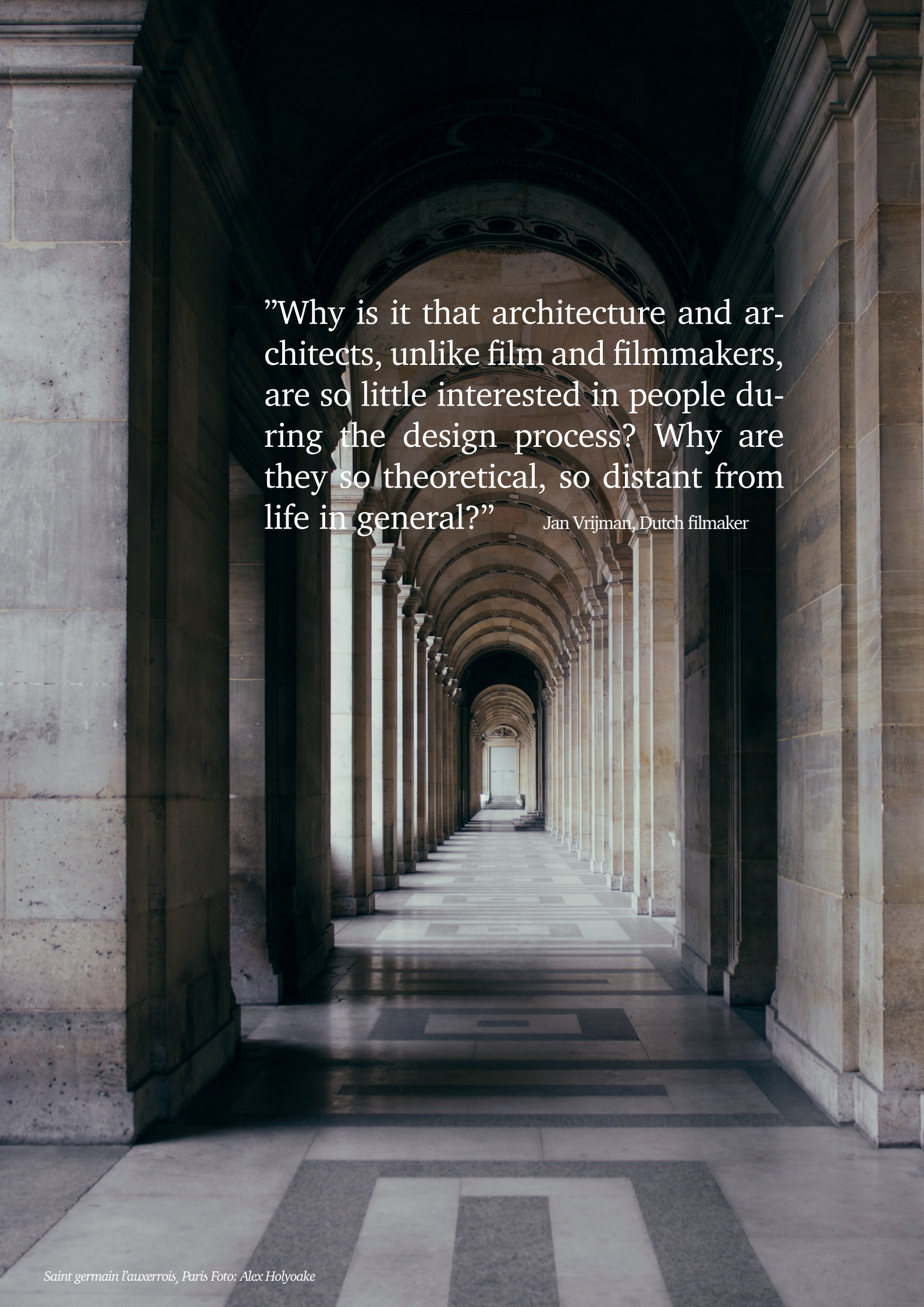
As described in the previous section, the museum must contain an emotional journey characterized through senses and empathy. In the following part, I will focus on some of the areas within this field that have already been researched. I will dive into some of Juhanni Pallasmaa's studies regarding the influence of human senses on architecture; sight, touch and sound.

Based on various reference project visits, I will describe and convey some of Pallasmaa's theories and relate them to a visited project. I will use this method to get a better understanding of using architectural elements to provide the sensory architecture to the project.

The reason why emotions and senses are relevant to explore in the programme is because, it is not obvious that modern architecture holds just that.

Modern architecture has often been blamed for emotional coldness, restrictive aesthetics, and distance from life. The minimalist style has therefore tended to remove the architecture even further from life's historical events. Furthermore, the criticism suggests that architects have adopted formalist attitudes rather than aligning our buildings with the realities of life and the human mind (Pallasmaa, J. 2015: 5).

If we look at the world of art, it is said that art is always the product of the experience of interaction between people and the environment (Dewey, J. (1934: 231). Dutch film producer Jan Vrijman asks the question:



”Why is it that architecture and architects, unlike film and filmmakers, are so little interested in people during the design process? Why are they so theoretical, so distant from life in general?” Jan Vrijman, Dutch filmaker

Saint germain l'auxerrois, Paris Foto: Alex Holyoake

Senses, Architecture and Perception

In the preface of the book 'The Nature of Senses,' describes author Diane Ackerman, what is most amazing is not how our senses can span distances and cultures but how they can span over time (Ackermanm 1991).

The senses can bring us into close contact and connection with the past in such a way that our thoughts would never be able to do (Pécseli, B. 2017: 25). We will suddenly be able to sense the story and have the ability to live in the past. The use of senses can help make the story alive, intrusive, or present. Together, it can make us feel, think, or remember (Pécseli, B. 2017: 25).

The senses have the dimension and depth that opens people's eyes, noses, ears, mouths, and even hands so that they could imagine what a specific place had been to a particular time (Mcrainey, 2010: 160).

In the world of architecture, theorists and architects, as Juhanni Pallasmaa and Peter Zumthor, have used senses as a theoretical concept in their architecture and design. They emphasize that a phenomenological approach to architecture is when material, space, shadow, and light interact with one another. It is awakening the senses and creates a memorable experience (Holl, Pallasmaa, Perez-Gomez, 2006: 45).

Sense of sight and quality of light

Throughout history and according to Plato, the sense of sight has been regarded as man's greatest giving. (Benjjani, W. 2008) It is said to this day, by it is the clearest dominant sense and the most challenged in architecture.

The position of the Dutch architect and professor Juhannis Pallismaa, by architecture, is a multisensory experience. He thinks that a building does not experience isolated images, but as fully integrated bodily and spiritual unity (Pallasmaa, J. 1996). To create a multi-sensory balance, the combination of senses can be challenged. Light plays an essential role in how we experience and sense architecture. Further, Pallasmaa describes the light as a force for how we feel (Pallasmaa, J. 1996). The importance of light in observing architecture is no stranger to architects everywhere. According to the great American architect Louis Kahn, if there is no light, there is no architecture. Light plays the most critical role in conditioning human senses in an architectural space (Kahn, L. 1969).

Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses" — *Juhani Pallasmaa*



Anhalter bahnhof, Berlin.

Light is an essential architectural element. It creates points of focus and directs movement in space. further, light is often used as a material setting boundaries or defining different zones of an architectural space. (AgaPiou, N. 2018)

In this example of the Memorial to the murdered Jews of Europe in Berlin, the daylight creates a direction of movement and emphasizes the use of material.



Memorial to the murdered Jews of Europe, Berlin

Yet, light is an essential factor of perceiving architecture, but shadows are an identical factor. The synergy of light and shadows creates sub-spaces from spaces. This interaction contributes to space with a sense of scale, rhythm, mood, and atmosphere. In this example of Anhalter Bahnhoff in berlin, the shadows create a frame of sight and put a significant focus on materiality.

Illustration 5

The Intimate sense of touch

Although we as individuals prioritize the eye. The visual observations emphasized through touching. The eye is the organ of distance. The touch is the sense of closeness, intimacy, and affection. The eye observes and investigates, where the touch approaches and feels. When light is replaced by shadow, the sense of feeling is enhanced (Pallasmaa, J. 1996).

Neuroscientists, for example, have linked the sense of touch, or somatosensory cortex function to empathic ability (Zaki, J. 2009). Empathy is an important factor in the creation of a museum. The skin senses many details. It senses e,g. texture, weight, density, and temperature (Pallasmaa, J. 1996). In fact, tactility connects us with history and tradition. By touching materials a, sudden experience will get way more intense and evoke our feelings and emotions from the past (Pallasmaa, 1996).



Memorial to the murdered Jews of Europe, Berlin

A great example could be when I visited the Memorial place to the murdered Jews in Berlin, designed by Peter Eisenman. Running and walking between the concrete blocks feeling their cold concrete surface and the curvey rough concrete underneath my feet quickly gave a feeling of disorienting. It contributed to an unpleasant experience of getting lost. This small feeling somehow gave me an idea of the feelings the Jewish may have felt during WW2.



Vadehavscentret in Ribe

Yet, another example of the sense of touching and memorial emotions- By touching the soft, organic, and natural material of Vadehavscentret designed by Dorthe Mandrup, quickly created a feeling and memory to me of walking through the waving and exposed straw along the west coast of Denmark.

Illustration 6

The sound of a feeling

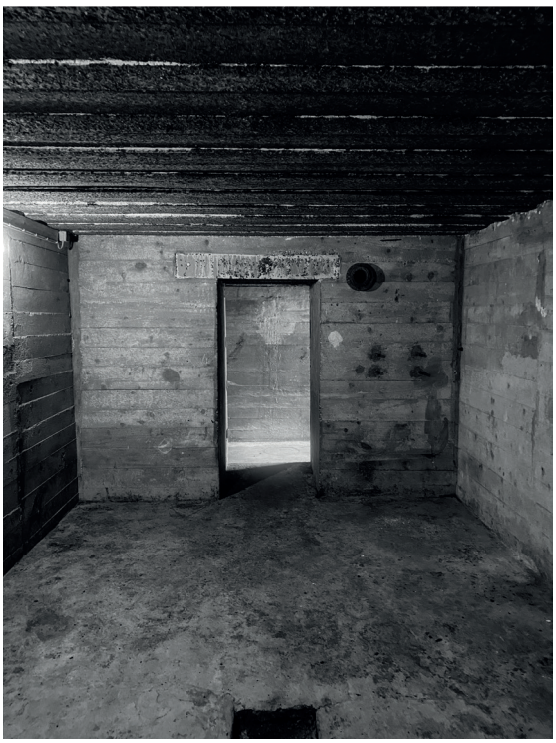
- Juhani Pallasmaa

”The sight isolates, while sound incorporates, the vision is directional, but the sound comes from all sides. The sense of sight targets the exterior, while sound creates an inside feeling. I look at an object, but the sound meets me; the eye reaches out but the ear is receiving. Buildings do not respond to our gaze, with them sending our sounds back to our ears. ” (Pallasmaa, J. (1996)



The jewish museum, Berlin

The Jewish Museum in Berlin has created an almost spiritual room of sound. The height, form, and material of the spaces creates a high reverberation time on the floor of the room, metallic faces representing the fallen Jews during the Second World War. By walking across the room on top of these faces created a massive clicking sound. As you interact with these experiences, you'll get the feeling of discomfort. You'll get the feel of walking on the "screaming" jews. That was/is a strong, memorable, and emotional experience to me.



Bunker 16, Bangsbo Fort

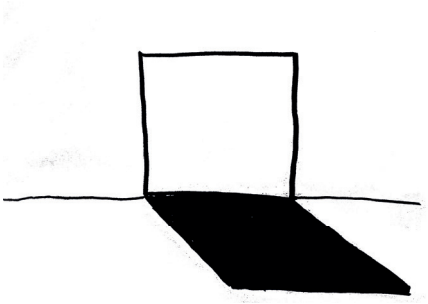
Tranquility in architecture is one of the most powerful auditory experiences (Pallasmaa, 1996). Entering a bunker creates tranquility. Going from the noise of a highway a large amount of daylight and heat from the sun into such a dark, cold, and mushed room creates a tremendous multi-sensory experience. Such a contrasting experience in the number of seconds contributes to a feeling of shelter and isolation.

Illustration 7



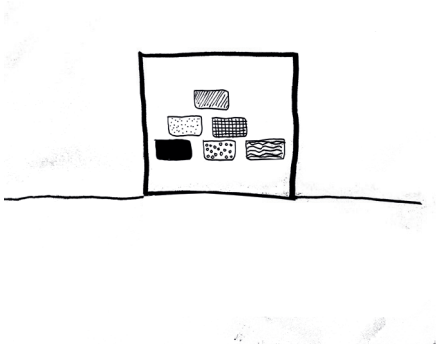
Vadehavscentret¸ 2020 Foto: Nicolai Qvist Krarup

Architectural design criterias



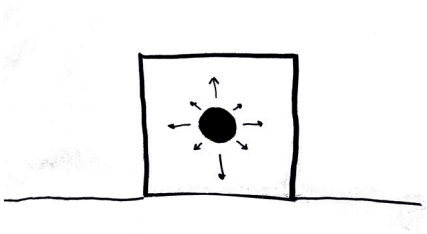
Openings and shadows

Concerning the chapter, the difference between light and shade can be a useful tool for creating sub-spaces, and the contrast can emphasize materiality, etc. Therefore, the work with openings and the opposite must be integrated so that it contributes to a spacious experience.



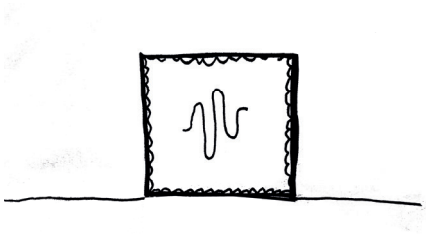
Choice of materials

The choice of materials is essential for all senses—both concerning touch, the absorption of sound, and the aesthetic expression. Therefore, the materials may be chosen for sensory perception.



Light and sense of sight

Light is an essential element of architecture. Light helps to create focus points, direct, invite, or define different zones. Therefore, light is a very important factor in the work of the museum, both natural and artificial.



Sound of the architecture

Sound can be a powerful tool to awaken feelings in human beings. Therefore, it is obvious to use this element in the museum. Sound must be challenged through materials, surfaces, scale, and function.

Illustration 8





Bunker museums in Denmark

Of course, the building site of the project has a significant impact on how the project is to be prepared. In the following chapter, I will delve into the area, the city, and the historical aspects of the grounds. Also, I will take a closer look at the different bunkers of the fort and how they are located, size, materiality, and atmosphere. I will also look at the strategyplan from the municipality.

In addition to the contextual meanings, I will also examine the microclimatic conditions- this will give me an understanding of ex. the possibility of daylight and possibly future comfortable outdoor space.

Around Europe, there are different ways of looking at the bunkers. In the Netherlands, they are often removed for practical reasons. At the same time, in Germany, they are demolished as they are reminiscent of unpleasant war history or are transformed and thus given new life. Elsewhere, they are treated as valuable cultural heritage and used as tourist attractions, as occur in several places in France, Norway, Poland, and here in Denmark. However, some bunkers are also removed for safety reasons. Generally, in Denmark, they have been preserved and thus created several bunker museums around the country. Here they have also become one of the Marguerit-route because of their importance in history and in Denmark (Nordjyllands kystmuseum).



Illustration 9



Illustration 10

Frederikshavn

Part of the northernmost municipality in Denmark

Frederikshavn, formerly called Fladstrand, is the northernmost municipality in Denmark. The city is part of the North Jutland region and has a current population of approx. 23,400 (Frederikshavn Kommune). Frederikshavn is primarily known for its strong competencies in maritime, energy, tourism, and food. Frederikshavn acts as a massive hub for the infrastructure, both on land and at sea.

The ferry port in Frederikshavn has several daily departures towards Læsø, Sweden, and Norway.

Frederikshavn is a climate municipality, which means that sustainability and green change are taken into account in everyday life - both in order of kindergartens to district heating (Frederikshavn Kommune).

More than 5 million tourists visit Frederikshavn every single year. Frederikshavn is, therefore, one of Denmark's most significant tourist municipalities with international events, world-class gastronomy, and cultural life with a global perspective (Frederikshavn Kommune).



Illustration 11



Illustration 12

Bangsbo Fort

Pikkerbakken, Frederikshavn

The fort is located on an 84-meter high plateau on the southern part of Frederikshavn, Pikkerbakken. The fort has a great view of the city and the ocean, Kattegat. In clear weather, you can see both Skagen and Læsø. The fort is possible to see when arriving at Frederikshavn through E45. Furthermore, the fort is closeby the forest of Bangsbo, which are daily visited because of the wild animal life and interesting walking and mountain-bike paths (Frederikshavn Kommune).

The fort consists of a fortification facility, built by the German occupying power during World War II and expanded by the Danish navy during the Cold War. The fort is thus used for two historical periods, which separates the fort from other fortified areas in Denmark. The fort consists of 80 concrete bunkers, 70 of which were built during World War II. The last ten bunkers were built in 1950 by the Navy, which still owns and uses a smaller portion of the fort (Nordjyllands Kystmuseum).



Illustration 13



Illustration 14

NATURAL PROTECTED AREA



Illustration 15

PROTECTED AREA

STRATEGYPLAN FRE.F.20.72 (2015)

The Municipality

STRATEGYPLAN FRE.F.20.72 (2015)

NAME OF THE AREA:	Bangsbo Fort - Project regarding historical dissemination.
CONSERVATION BUILDINGS:	No provisions
OVERALL USE:	Public recreational area.
USE:	Museum for dissemination of Bangsbo fort
LIVING AREAS:	Living and outdoor areas are established as needed
DEVELOPMENT:	Maximum 1,5 floor, maximum 8,5 meters.
CURRENT ZONE:	Landscape zone
FUTURE ZONE:	City zone
SITE AREA:	No provisions
PARKING:	General provisions



Illustration 16

Access

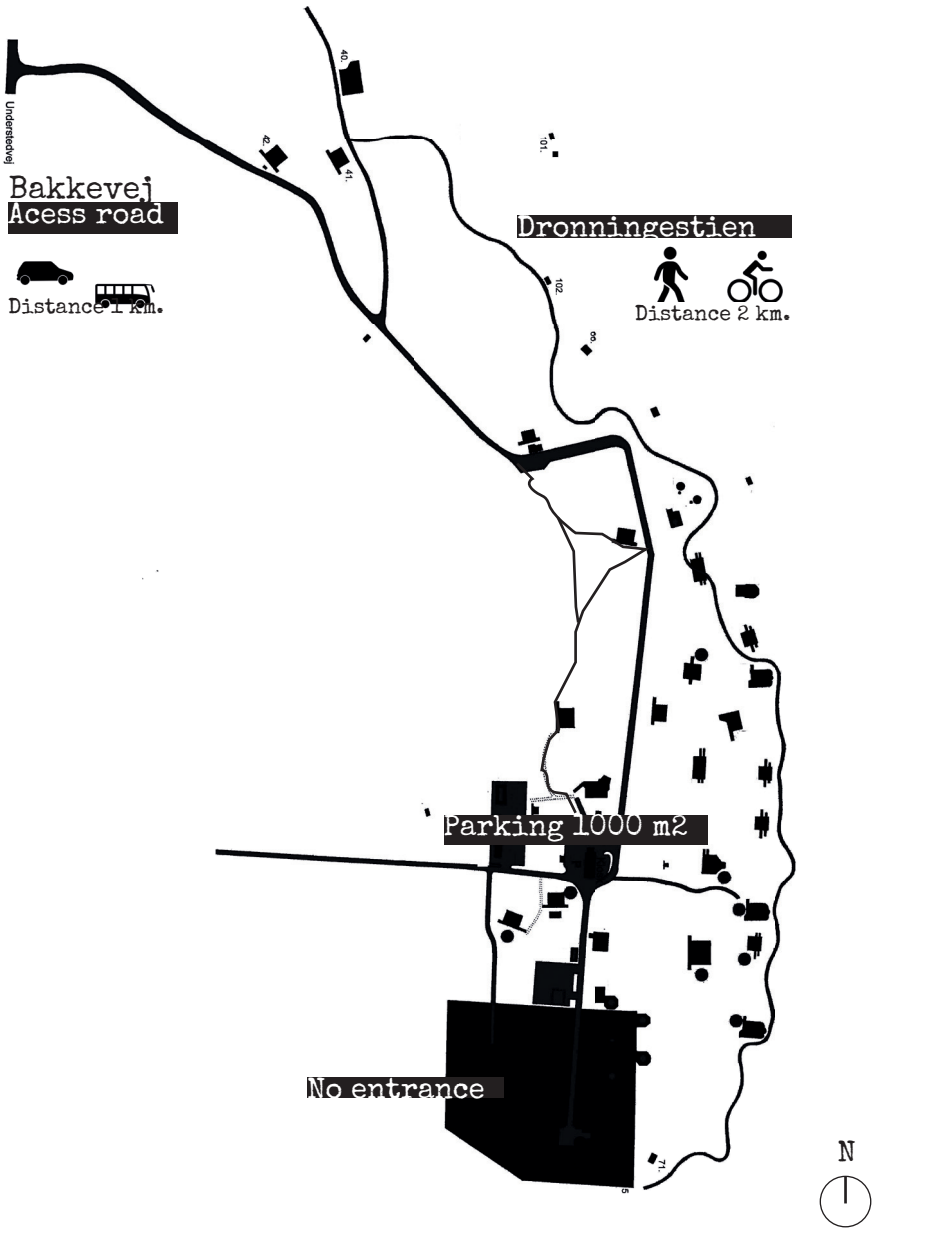


Illustration 17

Bunker typology



Beskyttelses Bunker



Luftværnsbunker



Luftværnsbunker



Mandskabsbunker



Sanitetsbunker



Mandskabsbunker



Kanonbriks



Mandskabsbunker



Ladebunker



Kommandobunker



Ildlederbunker



Skytsbunkers

Illustration 18

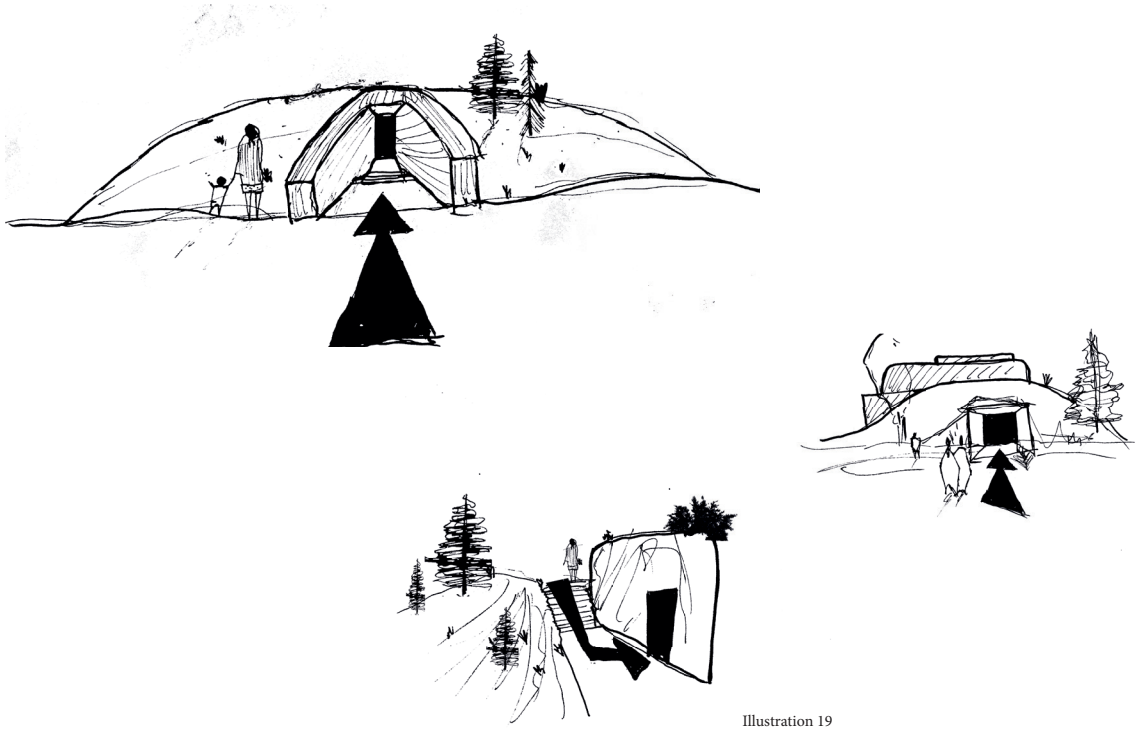


Illustration 19

The Bunkers TODAY

A PHENOMENLOGICAL APPROACH

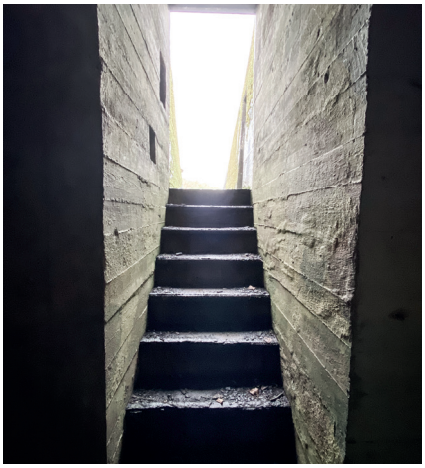
On a cold and humid morning, I visited Bangsbo Fort to sense the experience of those bunkers- that are always available and open to the public. All of them have their independent design, but with several of the types for comparison. The visit offers a strong contrasting experience. Wandering around the exposed, free, green, airy, and enlightened nature and then entering a bunker contributed to a powerful sensory experience.

The heaviness, scale, and acoustics provided a strong sense of isolation, fascination, insecurity, and security. However, one feeling exceeded. The curiosity for more. All available bunkers are empty and partially illuminated by artificial lighting and flooded by rainwater. Although I consider my imagination as good, it was difficult to relate to the story and the precise use of them in a historical perspective.

The bunkers have a strong identity that is hard not to be fascinated by. The cold and heavy materials testify to a powerful and emotionally cold period in history.

The bunkers primarily had three different ways of entering. Common to all of them is that you step into the landscape and entering the bunker underground.





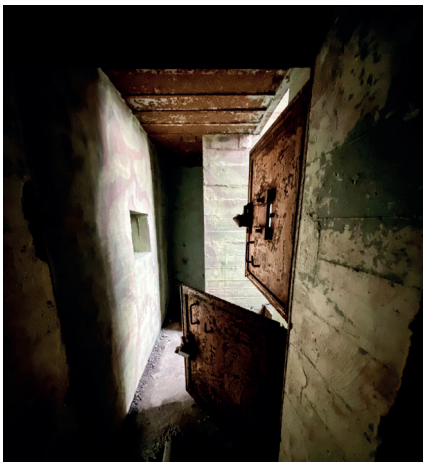




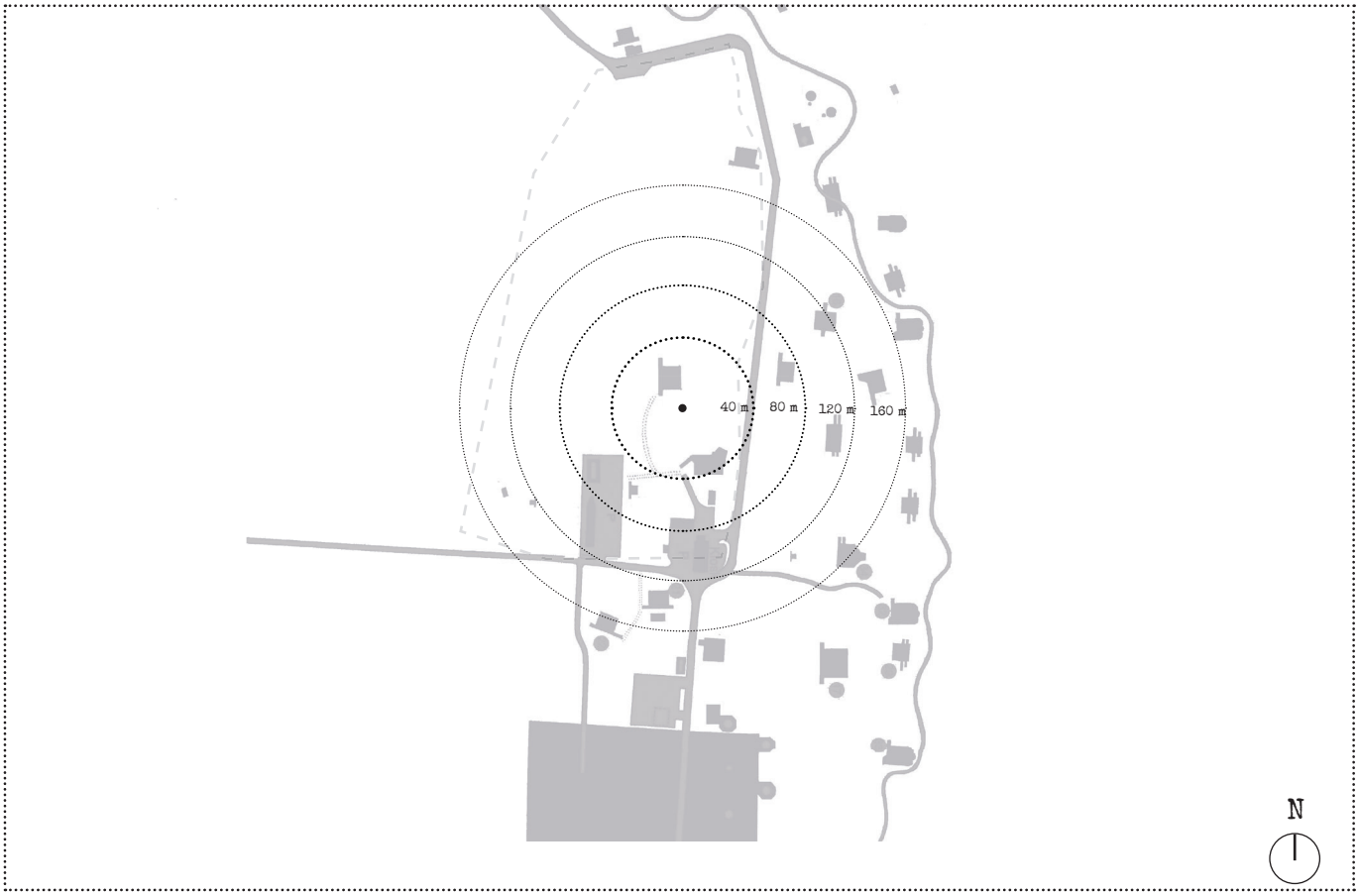





Illustration 20



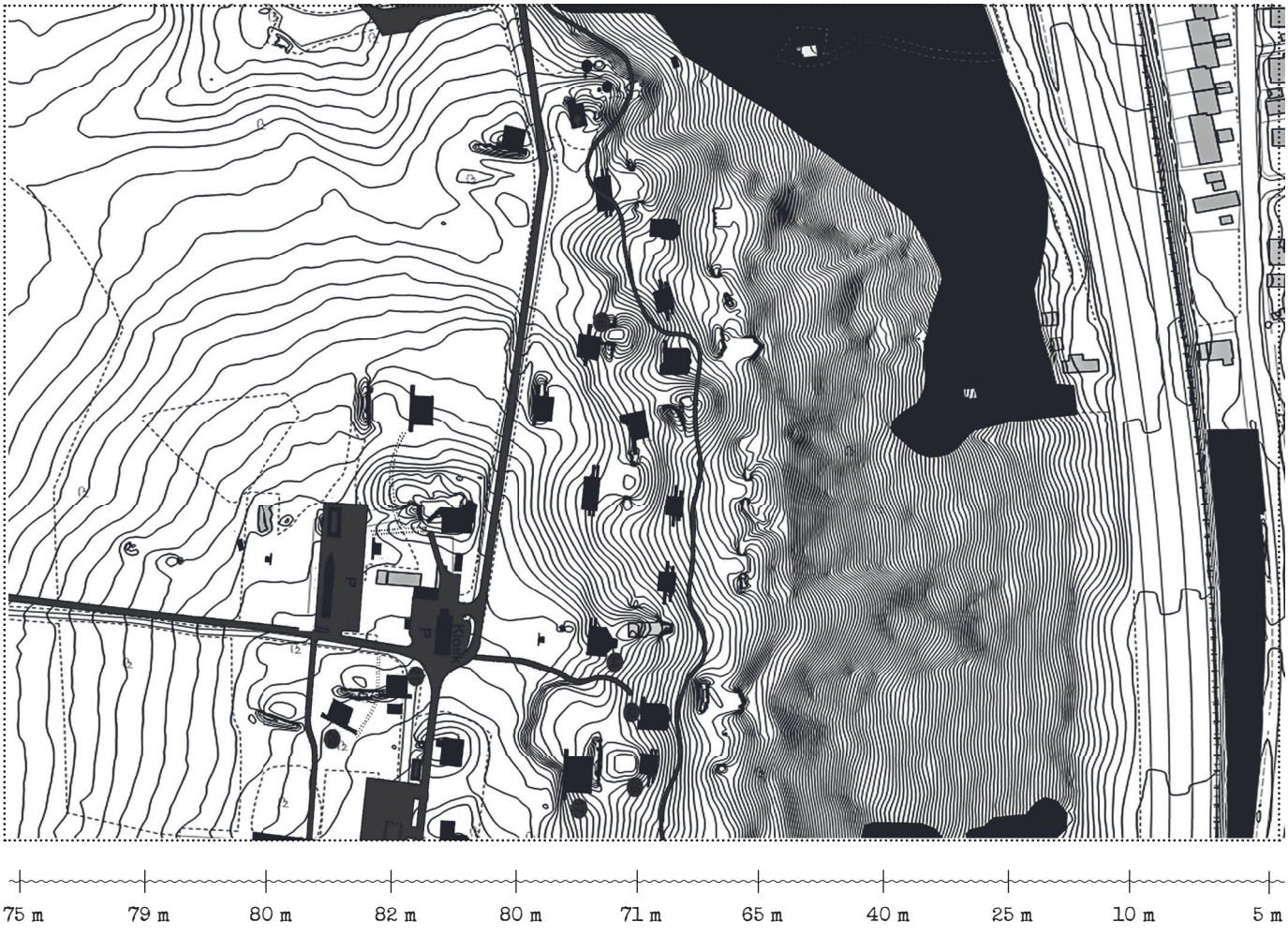
Potential building site
Illustration 21



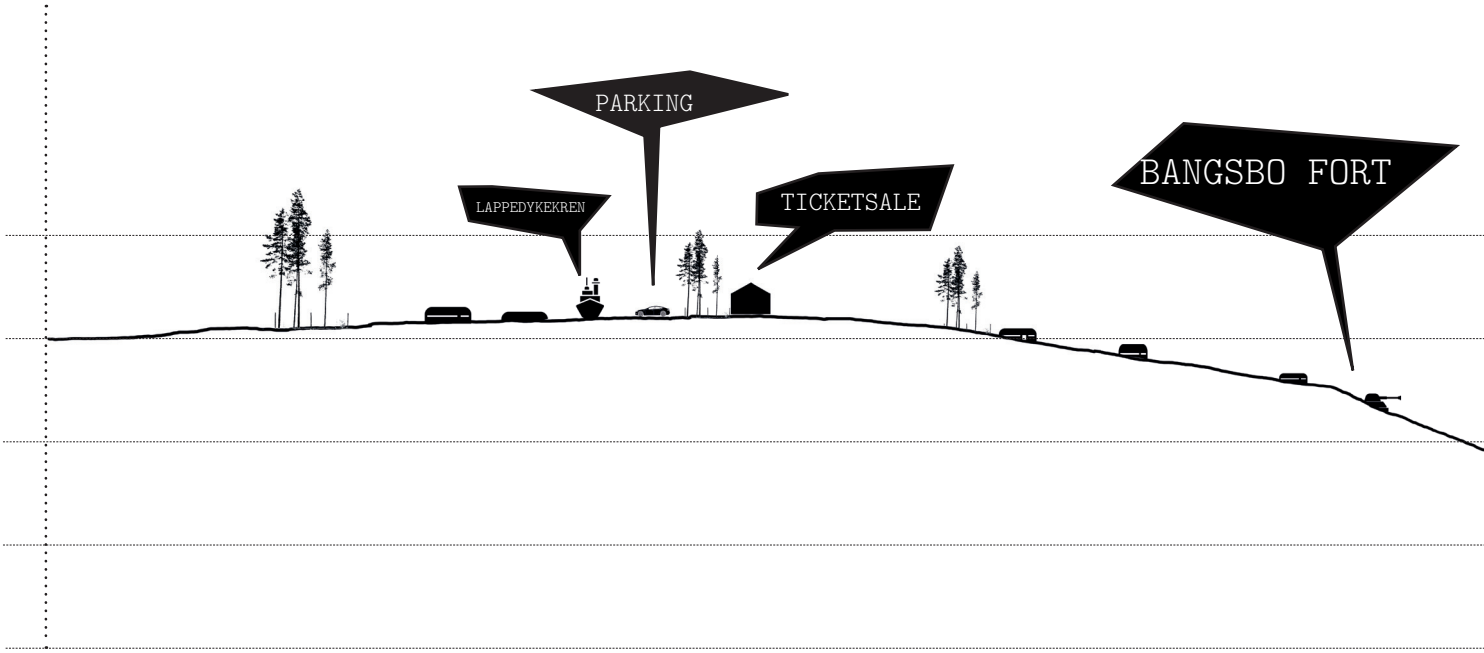
Distance to area
Illustration 22



Active bunkers
Illustration 23



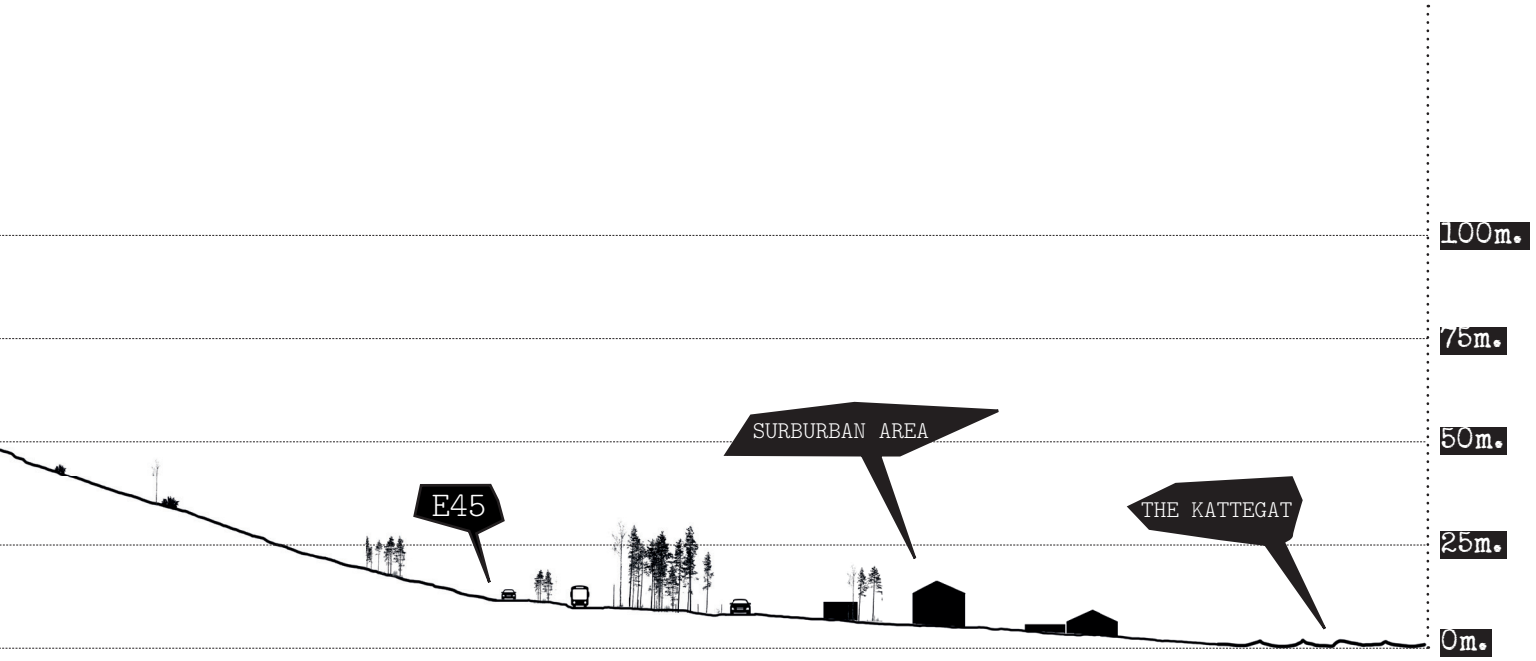
Height above surface (lenght 550m)
Illustration 24



The site in an urban context

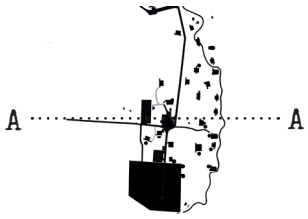
The project site is located 450 meters west of the Kattegat coast and is 80 meters above sea level. The sea and the project area are broken by a residential neighborhood and Europavejen, E45. Parts of the fort are represented on the slope of Bangsbo Bakker. The first bunker is found at just under 60 meters above sea level.

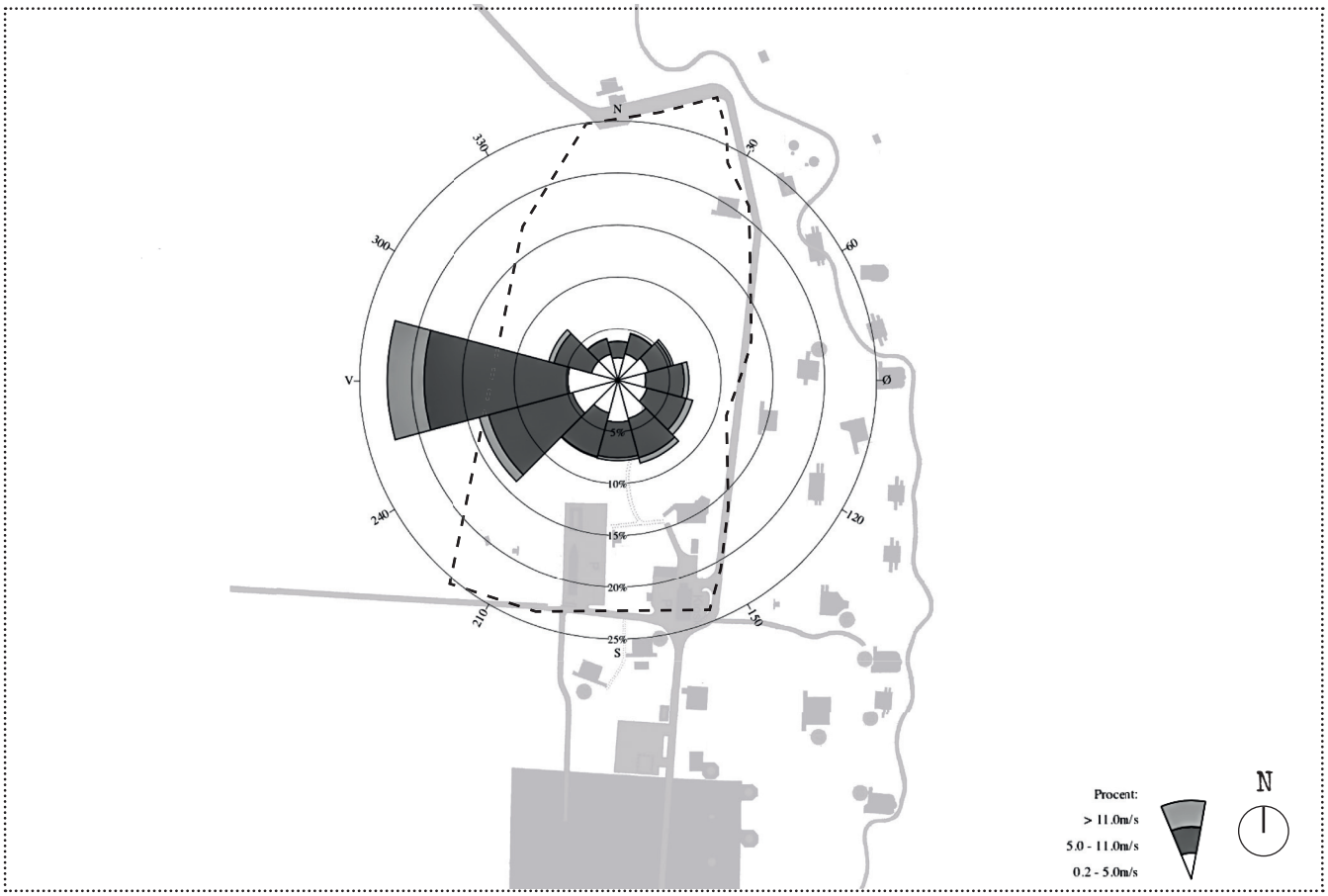
The potential project site is approximately 52,000 m^2 and located between a protected and a nature protected boundary. At present, there is 1000 m2 of parking adjacent to the courtyard with ticket sales.



URBAN SECTION A-A

Illustration 25



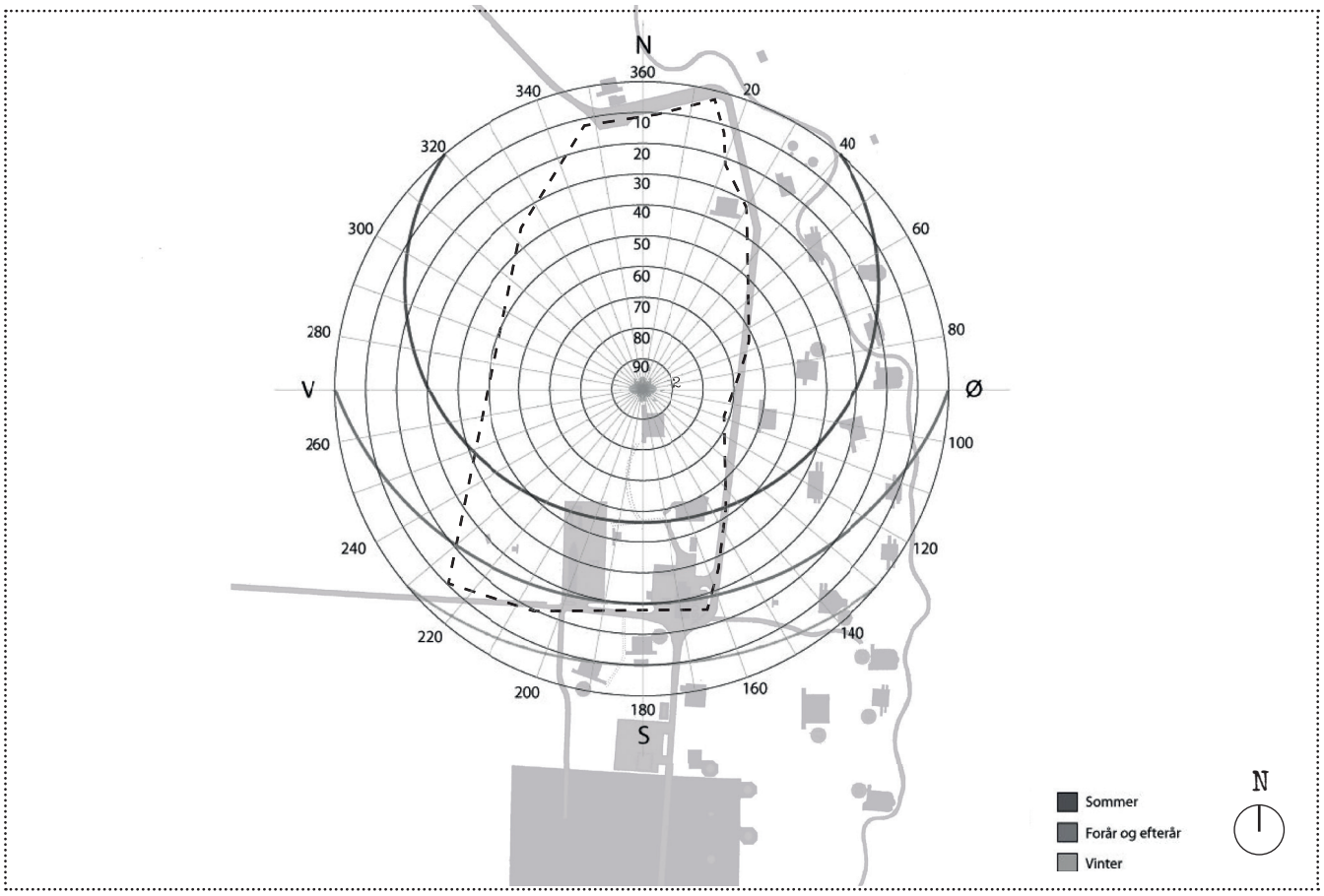


Wind condiition of the site

Illustration 26

The wind conditions

The wind rose from Forsvaret in Frederikshavn based on more than 81.000 observations, shows a dominant wind direction against the west. The wind is coming 22,4 % of the time from this direction. Due to the placement and height of the observation, are the observations not entirely credible, but gives us as architects a reasonable idea.



Sun condiition of the site

Illustration 27

The sun conditions

The illustrations show the sun's path and the angle of the sun according to the season of the year. The sun plays an essential role in reaching a sudden feeling. The sun will be able to create different spacious atmospheres according to the path of the sun at a given time of day.

In order to reach great outdoor spaces for interacting, socializing, or relaxing, the sun is a significant factor as well as windless areas. A combination of the wind and sun is therefore needed to ensure a comfortable outdoor space. The site is relatively open for exposure by the sun.



Illustration 28

Sensing the site

Serial vision- a method by Gordon Cullen

To arrive in the area, you'll have to climb the hill along "Bakkevej." The road is about 1 km long. Upon entering the summit at point 1, the landscape opens up and creates an impressive view of the city and the coast. At point 2, small concrete peaks are visible, which humbly protrude from the green and domed landscape. The bunkers appear as small landscape sculptural elements that give an insight into the historical character of the place. The area is not particularly marked by high greenery and trees, which causes the bunkers to break even further through the landscape.
Further along the 'Dronningestien' (point 3), the first visual experiences of the bunkers appear from below. From the lower angle, the bunkers are significantly more exposed. The movement around the landscape creates a multisensory experience. Nature's sounds, substrates, and lights, together contribute to a pleasant atmosphere. In addition to the bunkers, the area does not create marks for past activities. Point 5 experiences interaction with one of the bunkers in the field. A corridor leads the viewer underground and through the bunker.

From walking around in the illuminated, open, and natural hill to feel the heaviness, scale, illumination, the raw materiality and cold moisty smell of the bunker contributes to a contrasting and sensory experience and bodily understanding of the past.

Throughout the tour, the trip is dominated by the view of the coast and Kattegat. Several of the bunkers roofing, as point 6 of the journey, provide platforms as viewpoints.

The area is simply characterized by minimal traffic noise from the E45. The road along the fort (point 8) is minimally used and ends blindly. The minimum activity from the traffic influences the area to appear perfectly calm and highlights the natural features of the site. Along the entire tour, the countryside is seen in the courtyard with the current ticket sales. The farm is a partially enclosed building, with the use of materiality that reflects the metal from the historical details of the area. The area at point 10 is currently used for parking space. The space appears relatively small and unused. Behind the courtyard is 'Lappedykkeren'. This retired ship is a land-based exercise ship (Nordjyllands Kystmuseum)

From the hilly terrain along with Bangsbo Bakker, the hill flattens out relatively. This area and its flatter terrain, create long views of the open terrain and landscape. From point 12, it is not possible to see the sea and the coastline. In addition, the area at point 12 creates a small steepening in the landscape, which sharpens the possibility of looking out to sea and the city.


1.


2.


3.


4.


5.


6.


7.


8.


9.


10.


11.


12.

Illustration 29

The Materials of the site

The project area is partly characterized by the open countryside and the existing bunkers. The bunkers are constructed of raw concrete. Because Concrete is made up of a mix of natural materials, it allows the human eye to penetrate its surfaces and create and convince us of the truthfulness of the material. (Pallasmaa)

Spacious interior details, guns, and entrances are constructed of steel. All materials are partially rusted and patinated. This patination testifies to its high age, history, and use of them. The materials of the site are therefore plagued by cold and hard materials that contrast with the green natural nature.











Illustration 30

Reflection of the site

Acess by car
Along Bakkevej

Dominating wind
Wind from west 22, 4 % pr. year

Green area
Calm area with alot of trees

View to sea
Great view to Kattegat and the city

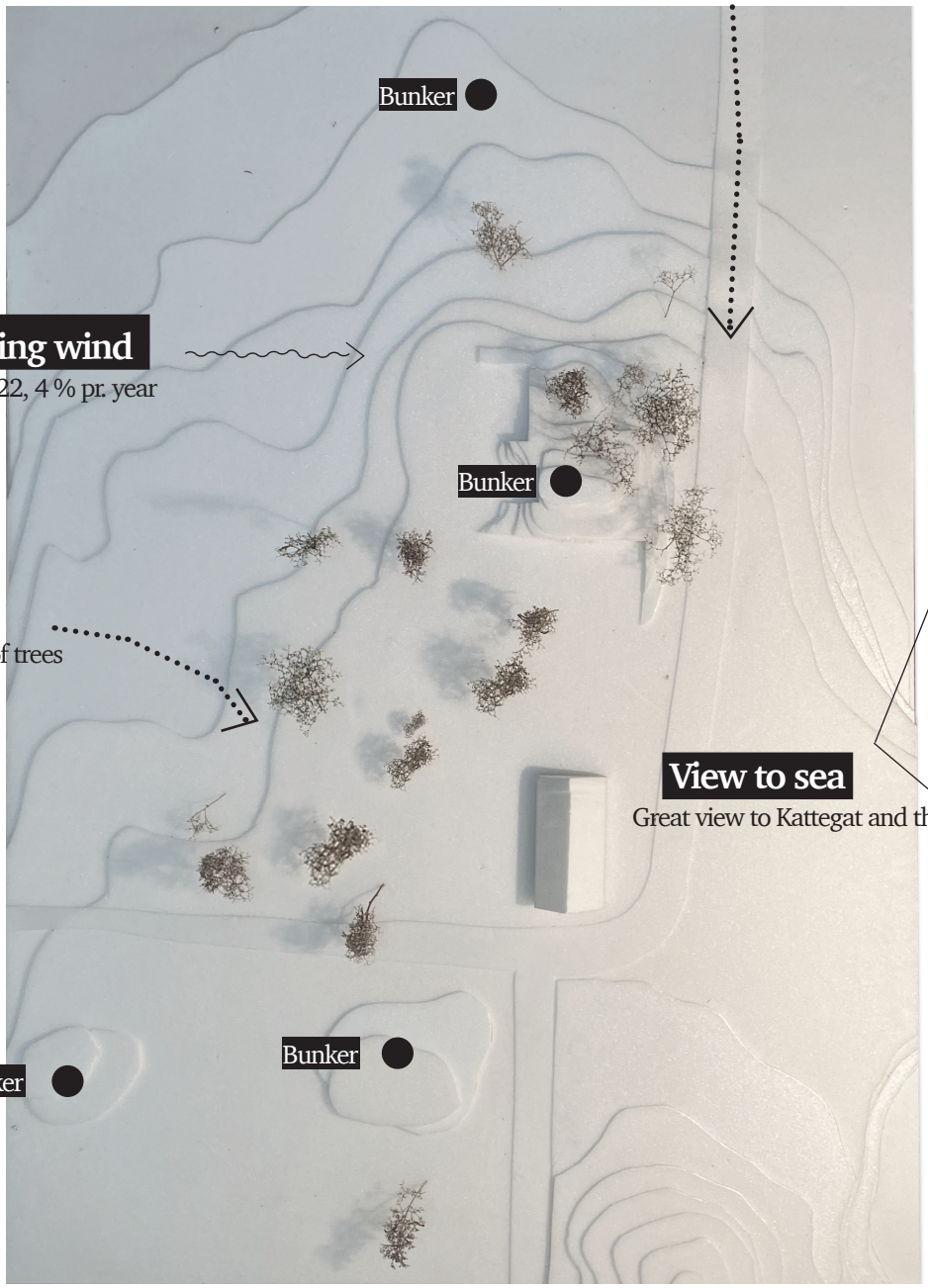


Illustration 31

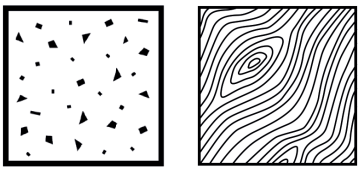
Contextmodel 1:200

Architectural design criterias



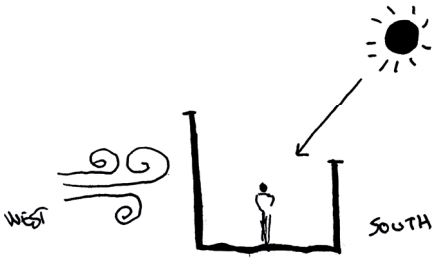
Keep up Authenticity

When working with a museum, it is important to create authenticity. Authenticity must reflect the reality that has been in the past. Therefore, the (ticket sales building) must be preserved and bunkers must be detailed and integrates underground.



Contextural Materials

The upcoming museum will cultivate the materials from the context and the existing bunkers. Therefore, the project must especially incorporate wood and concrete.



Outdoor area

Due to the dominant wind direction from the west, future outdoor spaces must be shielded. In addition, an opportunity for sunlight should be created to ensure comfortable outdoor spaces



Embracing Views

The site area consists of some hugely beautiful views of nature and the ocean against the east. Therefore, the house must cultivate these opportunities and create a clear frame to penetrate nature and the view where it's possible.

Illustration 32





Bangsbo Fort, 2020 Foto: Nicolai Qvist Krarup

The dream of a new museum

Nordjyllands Kystmuseum

The coastal museum was created in 2009 by a merger of Sæby Museum, Bangsbo Museum, and Skagen By- and Egns Museum. The museum has four main sections: the Coastal Museum Sæby, the Coastal Museum Bangsbo, the Coastal Museum Bangsbo Fort, and the Coastal Museum Skagen.

Director and head of research for North Jutland's coastal museum - Henrik Gjøde Nielsen wants a new dissemination center for North Jutland. The center aims to strengthen the museum's position regionally but in particular nationally and internationally in relation to coastal culture and concerning the history of the Atlantic Wall. Henrik dreams that North Jutland's Coastal Museum will create an attractive and innovative museum product that has international reach and puts research and dissemination in a renewed perspective. The customer mission is to put coastal history in a meaningful perspective and convey it through thought-provoking fates.

From an architectural perspective, Henrik's wish is that the coming building is a fusion of landscape and landscape elements, especially bunkers, where central themes slip in and out of each other in a chronologically and thematically connected narrative.

The project must be between 2000-5000 m^2 and must include research, experiences, depth, and amusement. In addition, a wish for conference and company opportunities and possibly accommodation at the fantastic bell unit.

In this chapter, I will try to analyze and structure some of the employees that will take place in the house. I will examine what needs each one may have and, from there, conclude which architectural elements can be taken into the sketch phase.

In addition, I will read and understand the topics that need to be highlighted in the museum and how they can be placed concerning others. Every item in a museum deserves a space that best embraces and reinforces it, which is why these items will have a significant impact on the future architecture of the building.

The Museum wants real stories from real life. These tales contain several emotions that the museum must formulate in the best possible sense. Therefore, it is crucial that, as an architect, I get to know these characters as best as possible and try to understand what feelings played out during the exhibited periods.

For each type of core person, I will conclude the four most dominant emotions and take this further into my sketching process. Here I will interpret and draw them into concrete architecture.

Furthermore, I would like to focus on the visitors who have special requirements for a public building like this. Here, I will communicate the architectural criteria that will ultimately contribute to a versatile and socially sustainable building.



Bangsbo Fort, 2020 Foto: Nicolai Qvist Krarup

Illustration 33



Map of the Atlantic wall in Europe

Illustration 34

The Atlantic Wall

A theme to be told

One of the themes to be exhibited in the museum and related to the told fate stories is the history of the Atlantic Wall.

The Germans built coastal fortifications from the years 1942-45. They were found on the northern and western European coastlines. In 1941, Germany was in a bipartisan war following the unsuccessful attack on the Soviet Union. Hitler then ordered that the so-called "Neuer Westwall" should be built along the German-occupied coasts from southern France to northern Norway (Gyldendal, 2010).

The purpose was to build a so-called iron chain of fortresses, which means coastal batteries, to ensure that no ship could get close to the coastlines. A large number of bunkers surrounded all the coastal batteries. (Nordjyllands Kystmuseum)

In Denmark, the Atlantic wall took place from the eastern coast at Frederikshavn across Skagen and down to the German border (Gyldendal, 2010).

Construction of fortifications in Denmark started as soon as the German occupation reached the coast of Jutland. The number of installations was carefully strengthened and adjusted to the threat that the German leadership felt that Germany was in control of Denmark (Atlantvolden, 2020).

Five thousand two hundred bunkers were cast in Denmark retailing 800 bunkers designed and built-in mold stone. In total, it amounted to 6,000 bunkers in Denmark (Danmarkshistorien, 2017).

In addition to the coastal batteries, bunkers, and barbed wire, the German occupation also provided miles of so-called Czech hedgehogs to stop possible arriving vehicles (Nordjyllands Kystmuseum).

In addition, 1.4 million mines were planted along the west coast of Jutland and posed a great danger to life by walking in these areas. (Danmarkshistorien, 2017).



Blokhus Strand, 1943 Foto: Aalborg Stadsarkiv



Illustration 35

The Cold War

The successor to World War II

The Cold War defined the period between the end of World War II in 1945 up to 1989 at the fall of the Berlin Wall. The conflict was political and stood between the superpowers, the United States, and the Soviet Union. The name 'The Cold War' came because the two never got into direct armed confrontation. The Cold War led to numerous crises and conflicts that could easily have turned into a devastating nuclear war (Faktalink, 2019).

In 1945, the navy in Frederikshavn took over Bangsbo Fort. The fort is said to have its heyday during the years 1952-1962 as a coastal fort during the Cold War. The task is to protect the waters off Frederikshavn and the city's harbor. The area consists of 70 bunkers listed during World War II and ten bunkers (red points at the illustration above) built by the Navy from 1951-54. In addition, the fort was modernized with radar and air defense cannons (koldkrig-online, 2019).



Bangsbo Fort 1949 Foto: Nordjylands Kystmuseum

Stories to be told

The task of the upcoming museum is mainly to convey historical perspectives and events through various narrative fate stories. The house must be based on four different types of authentic stories that all took place during World War II. The stories must represent the war and the influence of the Atlantic Wall for North Jutland, Bangsbo Fort.
By contrast, fates from critical hotspots in Germany, France, and Poland must also be communicated and included in the exhibition.

Based on an iterative process and dialogue with the director and researcher in WWII Henrik Gjøde Nielsen, the next sections are made up of 4 characters based on actual emotions. All personas are based on a ”broad” character - to accommodate the various emotions. Each persona is concluded through illustrations of emotions to be used later in the design of an upcoming museum.

This section aims to understand, relate, and further convey these feelings through architecture and its inclusive possibilities. The guest should gain some of the same feelings as they felt.

Personalize a story

Narrative process of life




GERMAN SOLDIERS




FREEDOM FIGHTERS




DANISH JEWS





REGULAR DANISH PEOPLE



Bangsbo Fort, 1952 Foto: Nordjyllands Kystmuseum

”Heil Hitler”

The story of the german soldiers



Illustration 36 Photo of Batlle of Stalingrad 1942



Illustration 37 Photo of A Nazi soldier on the western front in 1944.

It was very different how German soldiers were emotionally affected by World War II. What usually determined it depended a great deal on where they were sent for service. The German soldier undoubtedly suffered from the madness of greatness under Hitler's Nazi leadership. This type of soldier was often emotionally cold, unpredictable, and possessed of power. These soldiers raped and murdered throughout the war, and are considered the typical Nazi soldier.

Another type of German soldier is the opposite of the aforementioned. A soldier forced into war. A soldier who hates war more than anything else, but is forced to murder for his survival. A soldier who would most like to be around his family far away from the horror and violence the war brought.

The third type was most often found in a country like Denmark. This was the kind who hoped to be part of the war, to fight for his fatherland- but ends up in a bunker in North Jutland. This type was often bored and tried to be in a good dialogue with the Danes, to get the best out of the time (Nordjylland Kystmuseum).



Excitement

Alot of german soldiers characterized by excitement during WW2. They simply just enjoyed the power.



Hate

Some soldiers was driven by hate. They were actually criminals in german uniforms. They hated the jews.



Worried

Some soldiers were very worried about their family, and had a hard time fighting during the war.



Bored

A part of the german soldiers in Denmark bored immensely much due to the inaction.

”I rather die”

The story of the freedom fighters



Illustration 38 Photo of A Freedom fighters at Bornholm 1945.



Illustration 39 Photo of Freedom fighter Hans Jørgen Christian Andersen

The Resistance Movement formed its foundation in England in the summer of 1940, also known as the Special Operations Executive (SOE).

Their primary task was to provide resistance to the German-occupied countries of Europe and the Middle East. The opposition could consist of sabotage, demonstrations, and liquidations of Germans in service. In Denmark, in particular, their task was to keep the German troops in the country as long as possible.

A majority of railway sabotage took place to delay German troop transports in their journey from Norway through Denmark to the Western Front (History of Denmark, 2012).

The typical opponent during the war was civil and driven by a love for the fatherland and a response to the German occupation in Denmark. The Danish resistance movement was not very large and did not consist of many members. Many were driven by adrenaline and in the search for justice.

Some resistance people felt compelled. If they did not contribute to justice, then no one else did either. Others knew captured Jews and had witnessed the cruelty caused by the Germans.



Excitement

Likes adrenaline and are are the type of people who search and pushes the limits.



Disgust

Witness to how Nazis treated the jews and contributed to some form of revenge and justice.



Forced

”Well if I dont do it, noody else are doing something”.



National love

A big amount of love to the country. Dont want the germans to overtake it.



”They can take my life, but not my hope”

The story of the vulnerable Jews.

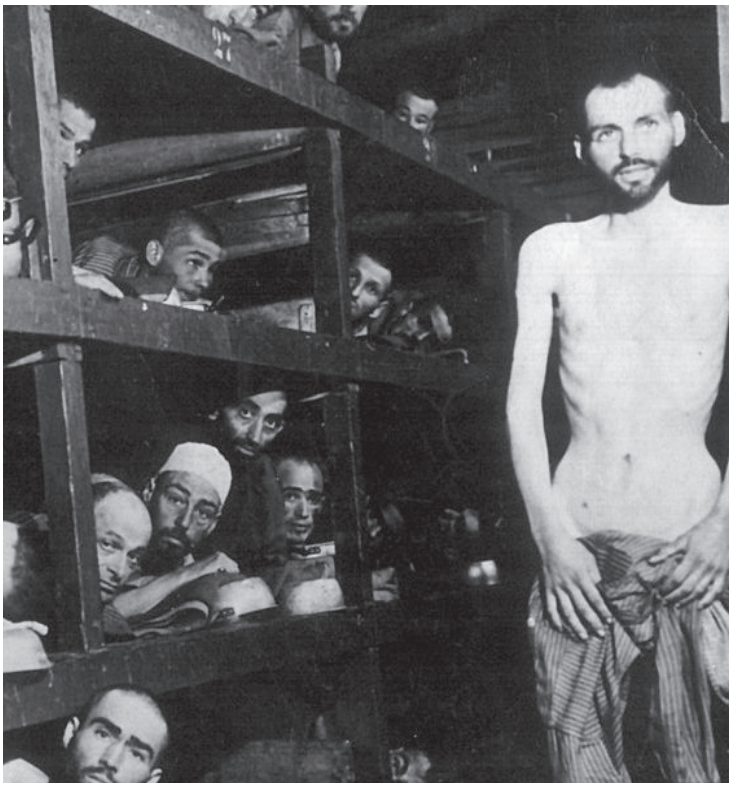


Illustration 40 Photo of Prisoners from one of the Nazi concentration camps during World War II



Illustration 42 As a child, Paul Aron Sandfort was deported from Denmark to Theresienstadt.



Illustration 41 Photo of Danish jews escapes to Sweden

About 6 million Jews were killed during World War II. Including men, women, and children. They formed a very complex and diverse group, both financially and socially. Therefore, some of the Jews were extremely wealthy and had high education with previous placement in good, significant positions. Some were even renowned scientists or famous musicians and artists. Other Jews were small traders, artisans, and laborers, who were considered poor. According to the Nazis, they had one essential thing in common: Jews and did not belong in what was Hitler's Europe (Folkedrab, 2019).

Half of the Jews who died were killed and murdered in extermination camps; the rest died of hunger, disease, and exhaustion in concentration camps (Folkedrab, 2019).

In 1943, the German occupying forces planned action against the Danish Jews. About 500 Danish Jewish men, women, and children were taken prisoner and sent to Kz camps. Most of the Danish Jews managed to escape to Sweden (Folkedrab, 2020).



Scared

Throughout the war, unforgivable episodes arose for the Jews. This resulted in constant fear for whats next.



Repression

The Jews were consistently dominated by the Nazis just as superior Germans were just as oppressed the Jews felt



Powerless

The Jews' power was near zero. They were dominated by the people's government and continuously had to be controlled.



Emptiness

The Jews lost their homes, possessions, professions, and their families. This contributed to a huge emptiness.

”He is so charming”

The story of the ”new” danish people



Illustration 43 Photo of 5 danish soldiers on the morning 9. april 1940



Illustration 45 Photo of a danish woman together with a german solider



Illustration 44 Photo of 2 girls are taken to the Copenhagen courthouse.

The mentality of the Danes during the war was very different. Some reacted very negatively to the Germans. Others gave them gifts and invited them to football games. Some women fell in love with the German soldiers - others were the so-called ”field mattresses” and lusted for power. However, very few were happy about their existence. The vast majority of Danes acted passively. They were simply trying to get the best out of the situation (Nordjylland Kystmuseum).

Throughout the war, the negative attitudes towards the German soldiers increased. Many Danish men were scared and nervous about being forced out as soldiers for the German defense (Kaarsted 1991:217, 222, 231).
Another factor that filled the Danes during the war was the blackout. Blackout introduced on April 9, 1940, by the German occupying power (2verdenskrig.dk). The Danes had to darken their homes and limit all outdoor lighting, to make it difficult for enemy aircraft navigation (2verdenskrig.dk).

As a Dane, you also had to deal with the many English and American planes. These planes were often shot down by the Germans and crashed into cities and surrounding oceans. The air war contributed to a civil fear (2verdenskrig.dk).



In love

Some ladies felt in love with the german soldiers during the occupation.



Restraint

Alot felt restraint because of all the the things the germans has take away.



Shame

Alot felt shame for doing nothing



Anxiety

”Will we end like the rest of europe? What is happening next?”



Bangsbo Fort, 2020 Foto: Nicolai Qvist Krarup

Target Group

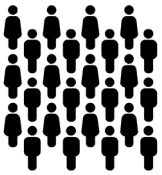
Lets ensure social sustainability - the ones with speciel needs



CHILDREN 0-12 YEARS



DISABLED



GROUPS



THE HIKERS

Illustration 46

A public building, such as a museum, must know its target audience before the design phase starts. In this case, the North Jutland Coast Museum wants a house that caters to the broad target group, thereby creating a house with space and stories that provide to “everyone”.

Thematically, the contents of the museum must accommodate different types of exhibitions. Other bunker museums in Denmark, e.g., Hanstholm Bunkermuseum, are dominated by manly visitors.

The museum’s inspector blames the theme of the museum - war, gunpowder, and bullets. This theme may seem difficult to change, as it is a World War II museum. But how can we create a house that captures the female audience as well?

It is as mentioned earlier, North Jutland’s Coastal Museum’s wish, that the house must contain fate stories as the primary focus of the exhibitions.

These stories are an obvious opportunity to enhance the experience for women audience and, as previously described, create emotional experiences.

In the work of a public building such as this case, it is necessary to consider more than the thematic design actively. Different audiences have and may have differentiating architectural needs.

I want a sustainable Museum- Therefore, we need to consider social aspects, to ensure a universal design that pleases everyone.

In order to ensure a building that has accessibility and usability for everyone, it will be necessary to examine what needs the so-called ”outer groups” have and may have.

The next section describes four different user groups that set their requirements for a public building and in this case, a museum.

For each user group, the needs are identified, which should be further included in the design phase and the construction of the building program.

THE NEW GENERATION

Many museums are considered by educators to be solely a place where small children can eat their packed lunches. Both pedagogues and museums find it difficult to see what they can offer the youngest children (Pécseli, B. 2017: 2) Can we change this problem by using the right architecture and elements?



Children 0-12 years



Scale

The exhibitions must have a child-friendly scale that caters to their understanding.



Signs

In a museum depicting World War II can hold eerie experiences or details. Therefore, it is important to emphasize these areas (Tirpitz).



Interaction

An important thing for children is to be able to integrate with the exhibitions. And gain understanding through the use of the child's senses (Pécseli, B. 2017).

SUSTAINABLE SOLUTIONS

To ensure the possibility for disabled persons, do we need to create a house that is accessible for some and great for all. In such a case, we create universal design.
Accessibility is all about how democratic equality and respect for our differences as humans. (handicap.dk)
It is important to minimize inequality in society and thus also accessibility in different buildings.



Disabled people



Accessibility

Friendly surfaces, toilets and exhibitions that is accessible for walkers and wheelchair users.



Café / Restaurant

A lot of elderly and disabled people pleasantly visits and uses the cafe (Helle Ølgaard, Tirpitz).



Places to sit

Short distance between zones with seating.

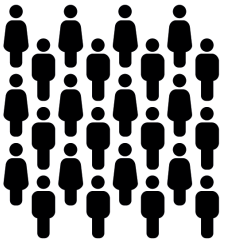


Way-finding

The museum must be easy to navigate in and great possibilities to orientate

THE GROUPS

Museums are often visited by larger groups of people (Helle Ølgaard, Tirpitz). It may end up being groups in the form of tourist buses, school classes or associations visiting the house. To accommodate this atypical audience, the house must be designed by principles of:



Groups 4-12 people



Scale

The exhibitions must have a sudden scale or area to ensure bigger amount of vistors.



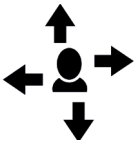
Places to gather

Larger groups typically divides into smaller groups and meets along the way. Places to meet is therefore important.



Auditorium

Larger groups often comes to the museum for lectures og movies. (Tirpitz)



Orientation

To ensure great meeting points for the groups, they must be easy to navigate and orientate in the house.

THE IGNORANT PEOPLE

In the area near the site of the upcoming museum, there are many hiking trails. Routes like the locals and especially the tourists make great use of it (Frederikshavn Kommune). Walking in Bangsbo Forest and trips to the Fort along the current 'Dronningestien' creates an obvious opportunity to integrate this 'path' into the design and make unaware visits to the area insight into the new museum's content.



HIKER / NATURE



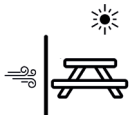
Insight

The building layout may hav windows or paths through the museums to ensure insight.



Bunkers as shelters

Ensure accessibility to the existing bunkers in the area. Create the oppertunity for longer stays.



Outdoor areas

The building must create great outdoor and comtorable areas.



Look-out areas

Create great lookout-points in the area.



Cook/Kitchen staff



Museums Manager



Cleaning staff



Scientific Researcher



Attendant



Guides



Receptionist



Janitor

Illustration 47

The Staff

The ones behund the factory

To ensure a socially sustainable construction, it is necessary to relate to the daily uses of domestic employees. It is essential to create a healthy and sustainable environment that creates joy, happiness, and creativity in their everyday life.

A museum houses many different types of staff. All kind have their particular working day, with the use of different spaces throughout the day.

To gain the best possible insight into employees' working days and the use of various spaces, an exemplary timeline for their day in the coming house has been visualized, based on interviews with visited museums and in the dialogue with Nordjyllands Kystmuseum.

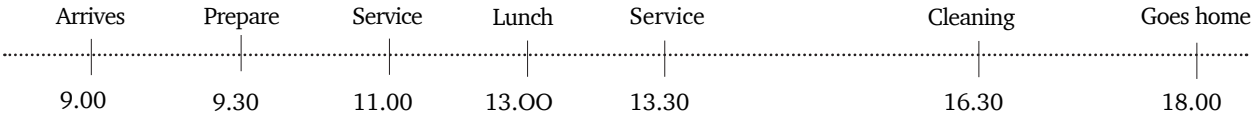
In the following sections, each employee is analyzed to the best and will end with a conclusion containing 2-4 key elements that play an architecturally significant role for their daily needs.

Cook/Kitchen staff

2-3 persons



In the upcoming museum, there is a desire to get a cafe and associated staff. The staff must be primarily associated with the kitchen and the café area. The number of staff depends on demand. This project is based on a number of 2-3 people. based on related projects and Nordjyllands Kystmuseums wishes.





kitchen

The cook and the kitchen staff needs a kitchen to prepare food for the café.



Central location

The Kitchen may occur central in the museum. It should be possible to visit outside the museum's exhibitions.



View to outside

To ensure the health and wellbeing of the kitchenstaff, they should have views to the outside greenery and daylight (Ulrich, R.S. , 2000).



Storage

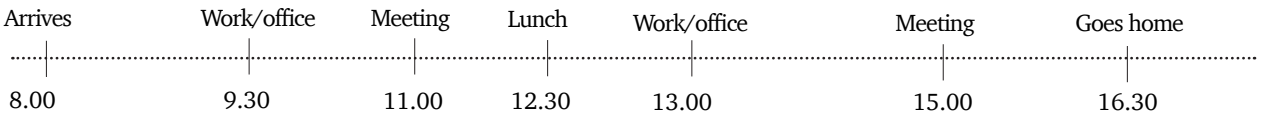
Storage spaces is needed for products, equipment etc.

Museums Manager

1 person



The museum manager is the museum's superior. He is responsible for staffing, events, the press and the daily operations of the museum. Besides, the director is also responsible for the exhibitions in the house. The manager is very important in the process of a new museum. He/she is the go-to person for architectural needs and obviously knows the museum best.





View to outside

To ensure the health and wellbeing of the Museum Manager, they should have views to the outside greenery and daylight (Ulrich, R.S. , 2000).



Meeting room

Meeting room is needed for approx. 12 people.



Private office

They Manager needs a private office for the most of his daily work.



Staff area

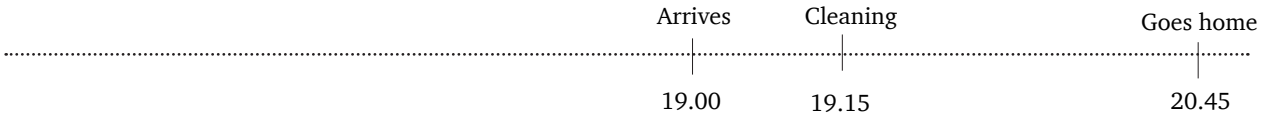
Area to ensure privatelife for lunch, and space for printers etc.

Cleaning staff

2-3 persons



The cleaning staff is simply necessary to ensure a comfortable and pleasant building. They don't need much of specific spaces. This type of staff is not only affiliated with the museum, but they are also an external company that sends out a number of staff to a specific number of projects.





Storage

Space for smaller cleaning equitpment is needed.



Cleanable surfaces

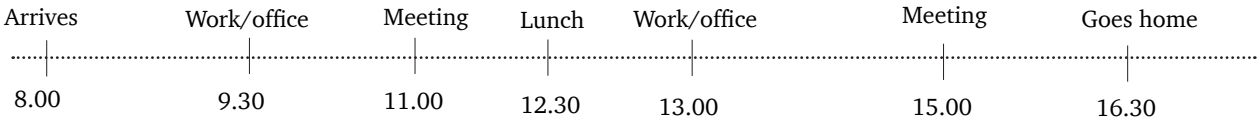
The projects should consist cleanable surfaces in the choice of materials.

Scientific Researcher

1-3 persons



In this type of museum, a scientific researcher is associated and has their daily jobs in such a place. This person is researching in the themes of the museums. They could be associated with a university.





View to outside

To ensure the health and wellbeing of the Researcher, they should have views to the outside greenery and daylight (Ulrich, R.S. , 2000).



Auditorium

The researcher takes part in large lectures both public and for other researchers only. He needs a larger space to ensure this opportunity.



Private office

They Manager needs a private office for the most of his daily work.



Staff area

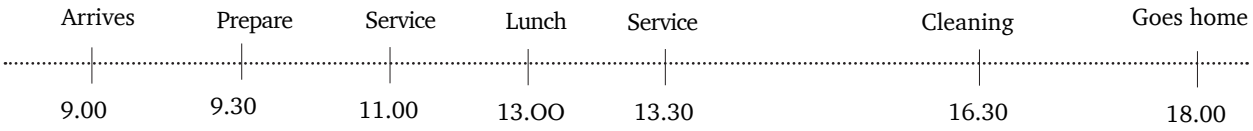
Area to ensure privatelife for lunch, and space for printers etc.

An Attendant /Security

1-3 persons



In such a public building as a museum, an attendant is needed. In a museum, a lot of important objects are obtained. The attendant's daily job is to ensure nothings is mistreated and every guest is behaving properly.





Surveillance

The security needs a room for all the surveillance screens etc.



Staff area

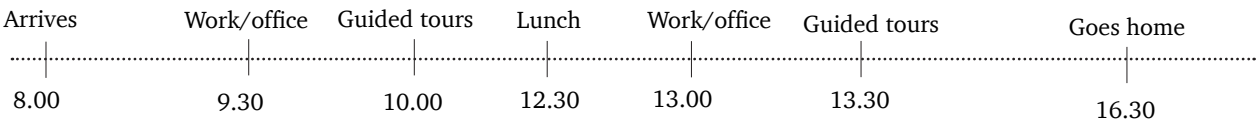
Area to ensure private-life for lunch, toielts etc.

A guide

1-4 persons



A guide is an important group of associated in a museum. They take care of guiding tours and preparations of the same. The guides are often hired in the period of time according to the season.





Flexibile office

The guide needs a private office for preparing and arrange tours.



Auditorium

The guide attempt to have larger lectures for interested guests.



Places to gather

The house needs points and spaces to gather in bigger groups.



Staff area

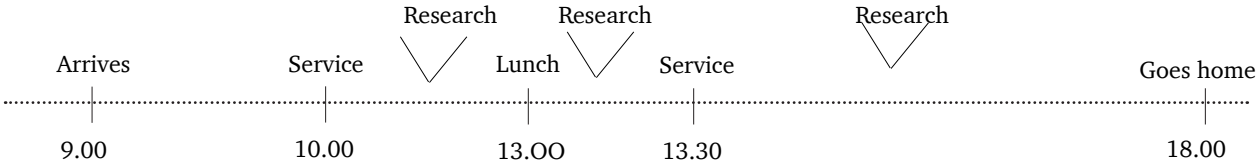
Area to ensure private-life for lunch, and space for printers etc.

Receptionist

The Receptionist is the go-to person in the form of information, tickets, etc. When entering the building, This person has to be easy to find and easy to access. The Receptionist has a position of service for the guests, but she will also create smaller research products when no visitors entering the house and needs her help.

1-2 persons







Receptiondesk

An easily accessible desk.



Central location

Has to be centrally placed- to be easy to find.



View to outside

To ensure the health and wellbeing of the Receptionist, should have views to the outside greenery and daylight (Ulrich, R.S. , 2000).



Flexible office

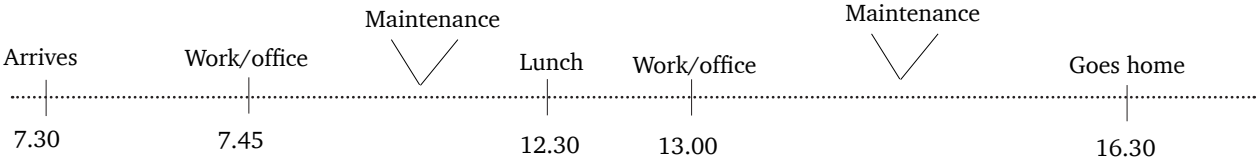
There has to be an office area connected to the reception when no activity in the house.

The Janitor

1-2 person

The Janitor handles daily renovation and maintenance tasks. His day can, therefore, fluctuate a lot depending on the amount of wear and tear, etc. He is also responsible for ordering goods for the house and therefore needs a daily office space to carry out these tasks.







View to outside

To ensure the health and wellbeing of the Janitor, should have views to the outside greenery and daylight (Ulrich, R.S. , 2000).



Workshop area

To be able to adopt the task of repairs and maintenance, a workshop is needed



Private office

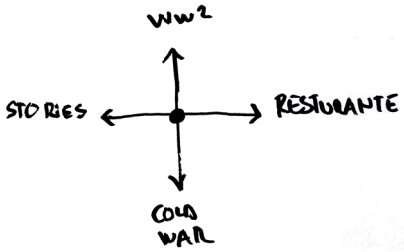
They Janitor needs a private office for some of his daily work.



Staff area

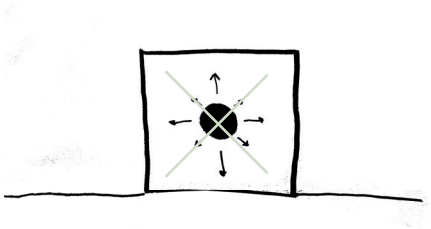
Area to ensure private-life for lunch, and space for printers etc.

Architectural design criterias



Orientation and themes

In order to take advantage of the possibility of creating synergy and diversity between the themes, as well as giving visitors a free choice of the subjects, the museum must be divided.



No direct light

The majority of museum materials and objects may not receive direct daylight as they become relevant in their quality and lifespan. Therefore, the exhibition rooms must be designed so that they are best avoided.

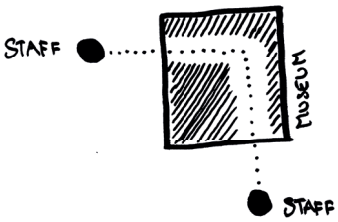


Illustration 48

Staff penetrates museum

To create the right synergy between the employee and the museum, the employees must not be isolated at one end of the building, but rather be forced through the building several times a day. It is made based on quality, of being part of life in the house.



The Jewish museum in berlin, 2020 Foto: Nicolai Qvist Krarup



The connection between architecture and exhibition

In the creation of a museum, as a designer, you have to investigate or try to understand how the architecture affects the exhibited objects and how the exhibited objects affect the architectural experience. In order to get a broader understanding, I decided to analyze previous research in this field. In this chapter, I will try to get an overall knowledge and use this strategy to analyse the visited cases further in the programme.

In the paper ”MUSEUM BUILDING AND EXHIBITION LAYOUT” by Kali Tzortzi, the author raises three main questions to the relation between architecture and exhibition: Make the spacious design a difference, and if so, what a difference? What significance does the curatorial intention have? What dimensions of our experience of museums are determined by how galleries and objects are spatially organized?

In trying to answer these questions, different museums are analyzed. Three general things are distinguished: Sequencing sequences and gathering spaces. Informational and social functions. The spacious design and exhibition methods. Here I will collect some of the points that are added in relation to the three overall themes through schematic and simple illustrative diagrams. These diagrams make it a lot easier to understand the different underlying spatial structure, which relates to the organisation of movement (Kali Tzortzi, 2007).



The Jewish museum in berlin, 2020 Foto: Nicolai Qvist Krarup

Illustration 49

PLAN **SCHEMATIC DIAGRAM**

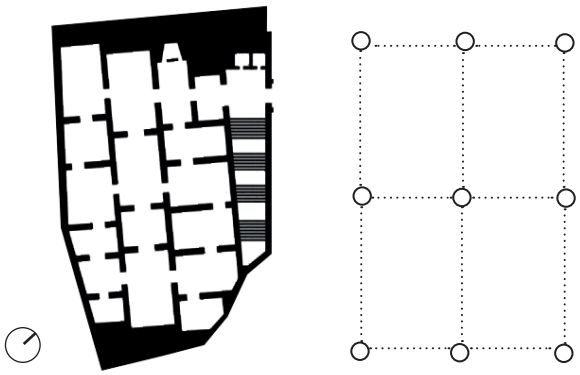
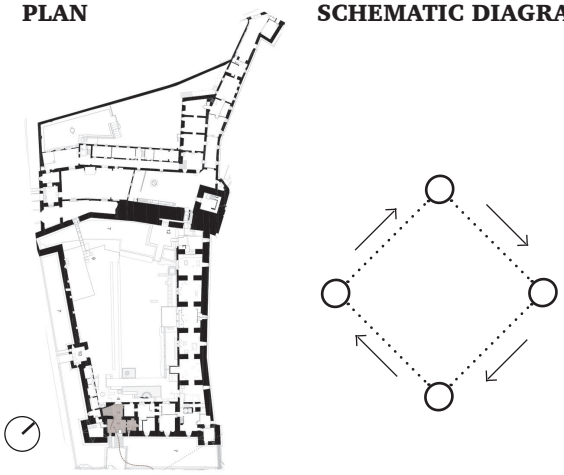


Illustration 50

PLAN **SCHEMATIC DIAGRAM**



Sainsbury Wing

The planning strategy for the extension to the National Gallery in London, the Sainsbury Wing is represented by the schematic diagram. The layout of this house makes it impossible to visit in an ordered order. The layout is up to a journey of discovery with a coincidence in the pattern of movement and exploration. The Sainsbury wing does not have a so-called gathering room. The so-called recurring space in sequence, which is described as the space for co-presence and social meetings.

However, it can be argued that the interrelationships of many spaces increase consciousness and create a majority of visual encounters, thereby creating a primitive form of socialisation.

Long axes cross the building in its length and breadth. These axes provide constant clues to the contents of the museum and contribute to a large stream of visual information in addition to the space in which it is located (Kali Tzortzi, 2007).

Castelvecchio Museum

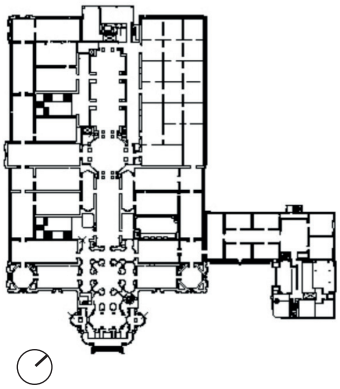
This layout and design of the Castelvecchio Museum in Italy constitute a single ring which contains a tight pattern of space and a sequence of which the visitor must follow without the possibility of changing course. It contributes to strict rules in the movement pattern and thereby powerful control of the exploration pattern.

We can call it a compelling museum on a daily basis, where you, as a visitor, are guided by the building and can, therefore, be regarded as the diametrical contrast to the Sainsbury Wing. Castelvecchio also does not have the gathering room and only adds social experiences at a local level. However, it can be argued that short and local meetings are amplified.

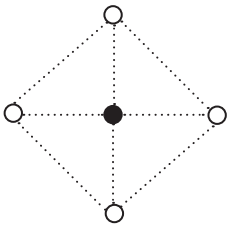
This project is focused on highlighting unexpectedness and surprise. It does so through short axes, directional changes, and non-revealing lines of vision. In order to experience this museum's objects and information, the visitor is forced to move around the house and gradually receive new surprising impressions (Kali Tzortzi, 2007).

Illustration 51

PLAN



SCHEMATIC DIAGRAM



Tate Britain

This layout contains a primary sequence and sub-sequences. The sub-sequences constitute discrete experiences that are dependent on the central axis since one is forced to return to the same room regularly. This space is called the gathering room or gathering place. It is more than the social collector; it is the reference point of the house and creates orientation. In other words, it can be defined as the museum's core of the integration, and, by implication, being the room with the most accessibility, it maximizes the opportunity for social meetings and higher movement.

But what does the shape of this common axis mean? In the layout for Tate Britain, the axis does not organize the entire house. The collection of spaces on both sides of the axis structures independent routes, thus allowing exploration of the museum completely independent of the axis.

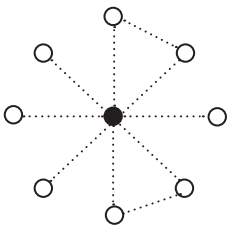
This practically allows the group to split up and run into each other several times during the round of the museum (Kali Tzortzi, 2007).

Illustration 52

PLAN



SCHEMATIC DIAGRAM



Pompidou 4. floor,

In this example, the assembly space acts as the major transverse axis and a well-defined route. Through this axis, sub-sequences of exhibition spaces branch out. These exhibition spaces always require that visitors return to the central axis.

The fact that the sub-sequences require a route back and forth in the exhibition spaces allows it to reflect on the context of the exhibition objects through this repetition.

The assembly room and its solution create a consistent overview, clarity, and orientation. This feeling creates a clear opportunity for self-control in meeting the possibilities.

Visited cases

Being able to create a sensing, learning and inspiring museum, I had to sense some examples myself. It was a tremendous and phenomenological experience that raised a lot of questions and thoughts for further reflection. During my visits, I beforehand had set up a meeting with the manager of the museums. This meeting created a deeper insight into the factory behind the museums and helped me get a bigger picture of the architectural solutions. In the next chapter, I dig into three examples of museums representing the Atlantic Wall and World War 2.

Finally, for each case, I point out immediate qualities and challenges based on my own experiences and in the dialogue with the manager. Further, I will analyze the different plan solution orders of the synergy between the architecture and exhibition of the project.



Illustration 53

Bunkermuseum Hanstholm

A PHENOMENLOGICAL APPROACH



Illustration 54

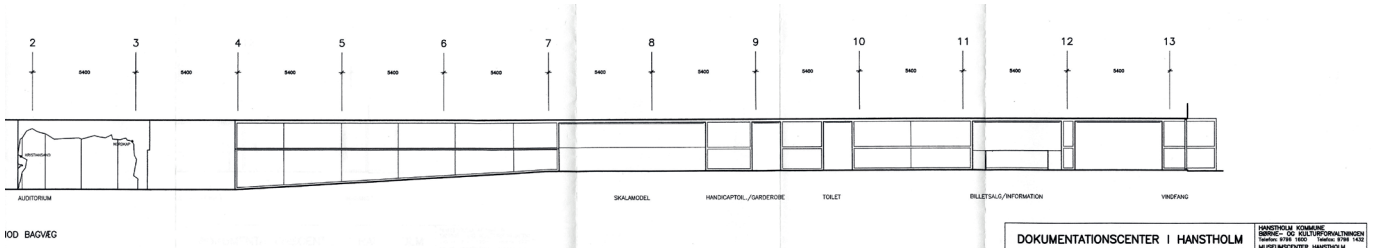


Illustration 55

The Bunker Museum in Hanstholm consists of two main house documentation centers and the museum bunker. The documentation center was designed by the Cubo studio back in 2001 and is approx. 1000 m^2. The building is located as a line in the landscape with large windows facing west. The documentation center consists of two main elements - an “open” audience-oriented section, which sneaks along the slope and a “closed” research section, which lies behind. The bright center forms a sharp and deliberate contrast to the old bunker. Upon arrival, a simple concrete construction is experienced, with related material to the theme. When I enter the building, I quickly experience a quick overview of the ”journey” that I, as a visitor, must go through. There are two options; I can visit the old bunker or take a tour of the documentation center. The distinction between the two possibilities arises at the stairs.

The documentation center appears bright and explanatory. Space is broken by a line of toilets and smaller exhibition spaces, thus creating an automatic route around the building. At the end of the room is the so-called auditorium. This circular shape breaks the stringent geometry of the room, leading to optional circulation and involvement.

The long lines of sight and the light incident in the exhibition contribute to predictability and orientation. The exhibition consists of panels, standing objects, screens, and glass boxes. The entire exhibition requires literary reading - there are very few interactive screens and additional experiences.

The space is not characterized by authenticity. There are some intriguing objects on display, but my senses are not characterized by empathy and empathy for the few told fates. It helps me to be very objective with the exhibitor and emotionally distanced. I do not recall my experiences in the exhibition as something surprising or attractive. What impressed me most was the hallway in the ”closed” part of the house. The narrow and relatively high hallway marked by a fantastic skylight gave me a spacious, different experience and could create emotional associations to isolation during the war.

In the associated cannon bunker, the experience is different from the exhibition. Here the rooms are partly authentic. The rooms are marked by posters, reconstructions of beds, bombs, and dolls, which create associations with the life and thoughts of the past.









Illustration 56

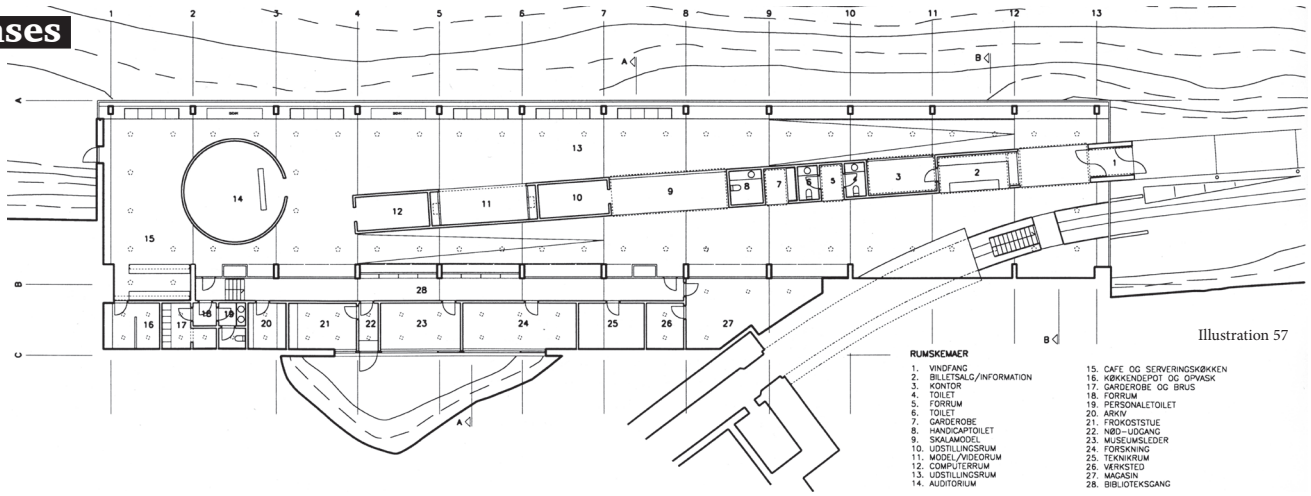
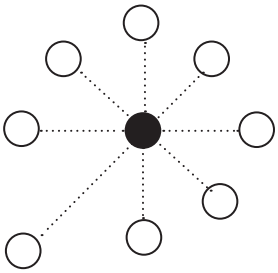
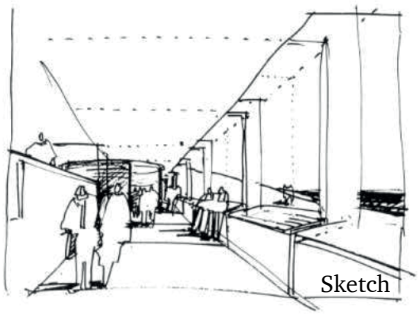


Illustration 57

Schematic Diagram





Sketch

The documentation center is characterized by representative materials that create clear associations. It is mainly constructed in concrete, with details in steel. In the exhibition, wood is used as space for exhibition objects and creates a nice contrast to the other materialities and also helps to soften the cold and hard materials. The exhibition building is equipped with ventilation systems. Blowing takes place through grating strips along the glass facade. The view is done in two vertical shelves placed in the back wall towards the staff aisle. Other rooms are heated with radiators. A coherent axis forms the layout of the museum. The axis is the primary main sequence in the building, which forms the basis for most of the house's exhibit objects. Along the main sequence, very small sub-sequences are found in the central circulatory nucleus. Unlike Tate Britain, for example, the fixed closed core now forms circulation. Tate Britain consists of the precise reverse layout strategy, where ample social space is centrally located. In this case, this open space folds around a central core. This solution creates the basis for the social gathering room to contribute to orientation and circulation in the building. This circular axis characterizes the visitor for a guided tour with minimal opportunity for discovery. It is almost impossible not to follow along in this house.

Based on my own experiences and experiences from visiting the Bunkermuseet Hanstholm - and further based on an interview with museum inspector Jens Andersen, I have concluded several challenges and qualities for the house:

QUALITIES

- Accesible
- Easy to orientate
- Material composition
- Staff facilities
- Contrast new vs. old
- Integration of landscape
- Good involvement of existing bunkers

CHALLENGES

- Lack of entrance gate for objects
- Bad indoor climate
- Audience only men
- Objects- not receive daylight
- Lack of flexibility
- Lack of interaction
- Lack of exploration
- Forced experience
- Lack of sense-telling
- Quickly over
- Lack of differentiated space experiences
- Too much gunpowder and bullets, no focus on women's experience.



Bunker Museum Hanstholm _ 2020 Foto: Nicolai Qvist Krarup

TIRPITZ, Blåvand

A PHENOMENLOGICAL APPROACH



Tirpitz , 2020 Foto: Nicolai Qvist Krarup

Illustration 58

Tirpitz is designed by the Danish renowned design studio BIG (Bjarke Ingels Group). The project is 2800 m2 and opened back in 2017. The vision for the museum was to merge a lot of current museums, which were scattered in Varde and the surrounding area. The design team even calls this project ”a sanctuary in the sand that acts as a gentle counterbalance to the dramatic war history of the site in Blåvand on the west coast of Denmark.” (Archdaily. 2020)

Next to the historic bunker was a World War II construction site. This building site enabled the Varde Museum to build a new museum in such close relation to the free and open landscape. Upon arrival in the area, the historic bunker clearly appears. In the background, there is a natural elevation in the dune landscape. Later, four contrasting carvings are created in the dune, which together forms a central outdoor space for the museum. You are able to climb the building freely and get an overview of the house, the area, and insight into three rooms of the exhibitions. The materials are related to the current bunker and, with the large characteristic windows, form a stark contrast to the surrounding nature.
The first room you meet is the reception and the cafe. This is characterized by being underground. The ceiling height is 2.3-2.6 meters and there are no direct windows associated with daylight.

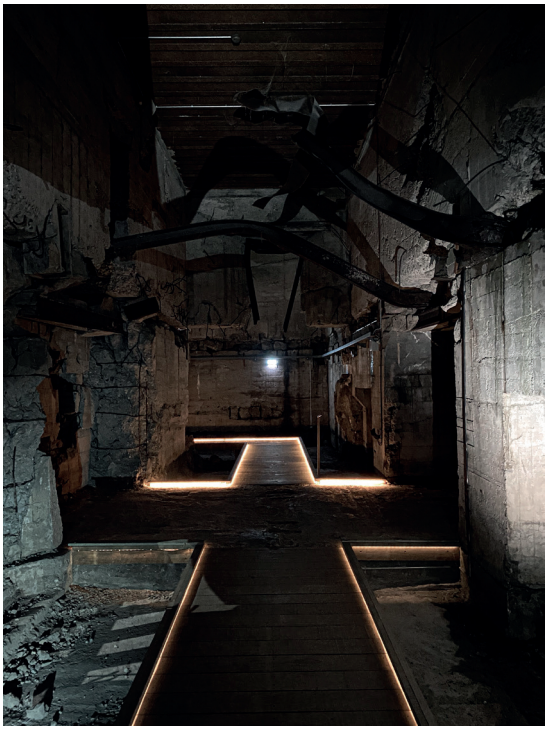
However, a naturally lit exhibition space can be considered from the restaurant and provide insight into the museum’s experiences.

From the reception/cafe, a staircase leads down to the museum’s exhibits. Here four axes are formed. In the middle of the axes, a gathering space is created for four options. This room is enriched exclusively with artificial light in various types. The material is characterized by black steel and concrete. Through the axes and the social rooms, one experience consists of the exhibition ”AN ARMY OF CONCRETE” This room is large, bright, and open with several bunkers, each acting five different stories of lives during the war.

However, it is quickly found that the entire exhibition is a setting, and all the stories are fictional. So even though it is a beautiful setting, with the opportunity to experience storytelling after storytelling, it carries a great deal of plastic and fiction. The other two exhibitions,” THE GOLDEN OF THE SEA” and ”THE HIDDEN WEST COAST,” have similar spaces and exhibition concepts. The last room differs from the rest as it has alternating exhibitions twice a year.

The social room is distributed in one of the axes next to the bunker Tirpitz. The bunker stands in stark contrast to the other buildings. It is cold, empty, and just a little illuminated by artificial lighting.







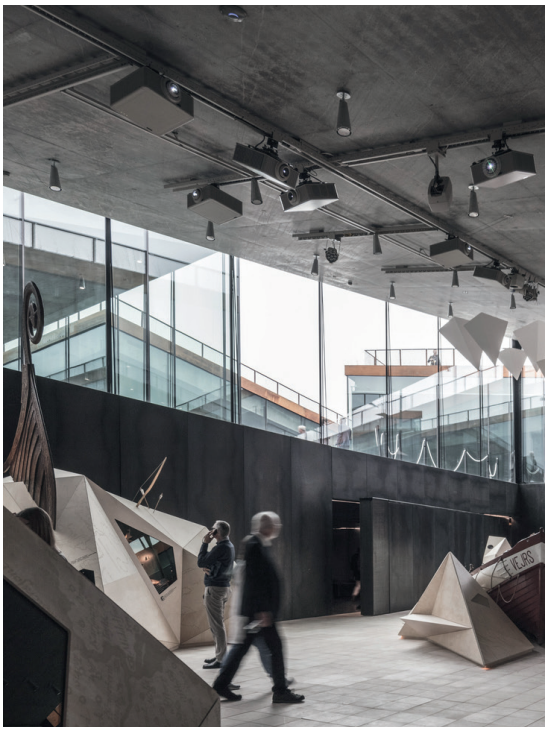


Illustration 59

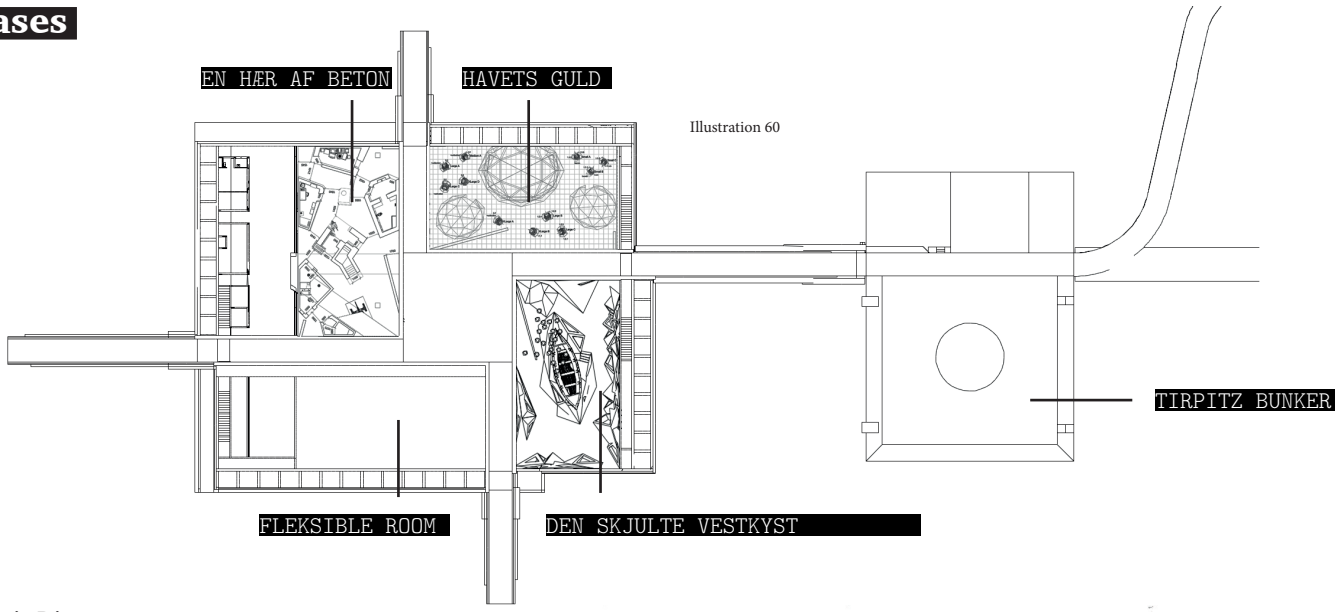
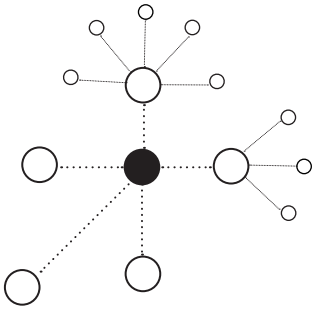
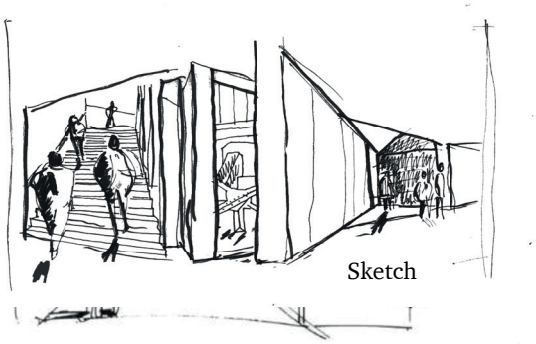


Illustration 60

Schematic Diagram





Sketch

The bunker formed the framework for a sensory experience that made it relatable to stay in the bunker. The sound of dripping rainwater, the cold and humid temperature, and the high reverberation made the experience authentic and a bit eerie, in a positive way.

If the bunker had sound effects (such as Germans talking), photographs, or possessions to the actual WWII soldiers, it would have created a truly unique experience.

The layout of the building is characterized by the social gathering space. From this space, four axes are distributed—these axes branch out into four compartments and a long stretch towards the Tirpitz bunker. The axes are only minimally used for display objects. They are used as a landmark, distribution, and break area. Based on their own subjective experience, the axes are almost identical, thereby creating oriental confusion. Furthermore, these areas can be considered as the primary sequence of the house and branch into four spacious sub-sequences.
The entire building strengthens the challenge pattern and allows the visitor to explore the house independently. The sub-sequences, in two of the coincidences, allow for further sub-sequences consisting of entire exhibit objects (reconstruction of bunkers in an army of concrete).

Based on my own experiences and research from visiting Tirpitz - and further based on an interview with Museum Director Helle Ølgaard, I have concluded several challenges and qualities for the house:

QUALITIES

- Aesthetic
- Used material
- The integration in landscape
- Daylight as guidelines
- Involvement of existing bunkers
- Humble intervention
- Explorative opportunities
- Public access
- Integrated for flexbility
- Social spaces

CHALLENGES

- Lack of authenticity
- Too different exhibitions
- Lack of guidelines
- Too artificial
- Too fake
- Lack of accesibility
- Daylight on object
- Lack of staff area



Tirpitz , 2020 Foto: Nicolai Qvist Krarup

The Jewish Museum in Berlin

A PHENOMENLOGICAL APPROACH



Illustration 61

The Jewish Museum in Berlin was designed by architect Daniel Liebeskind. The museum opened in 1999 and is 15,500m2.
In 1987, the Berlin government formed a desire to bring the Jewish presence back to Berlin after World War II. Daniel Libeskind's design is based on the conceptual and expressive design to represent the Jewish lifestyle before, during, and after the Holocaust (Archdaily, 2020). Throughout the design, Liebeskind wanted architecture to convey some of the feelings that the Jews found themselves in. Feelings such as absence, emptiness, and invisibility should be represented in the house's spatial experiences (Archdaily, 2020).

The entrance to the museum takes place through the old Baroque museum. An underground corridor links the Baroque Museum to the extension building. Here you'll meet the museum's three routes. The three routes are characterized by sharp lines, tight geometry, and very few exhibit objects. The routes form the basis of the distribution area and experiences through the Holocaust, German history, and emigration of Germany.

The various rooms in the building are composed of cold reinforced concrete broken by partially light walls and details in steel.

Several rooms in the museum are empty, dark, and only broken by a bit of daylight through smaller windows. The reinforced concrete and 40 meters room height contribute to a considerable reverberation. These elements enhance the feeling of emptiness, but also hope. The hope is placed in the daylight. The room gave me the impression that the light was to find ahead and, thus, hope. Daylight plays a significant factor in the experience of the house. A bright space creates focus on the shadow and darkness, whereas against a dark space, focus on the light. Imagine an illuminated canvas in a dark movie theater. The light seems safe, attractive, and challenging.

The most emotional space in the building represents all of these elements—a 66-meter high void lined with concrete, which forms an overwhelming cold atmosphere. The only light in the room emanates from two slits in the ceiling.

The floor is covered with 10,000 iron pieces shaped like faces and is a symbol of the falling Jews. The experience was tremendously influential. Being able to interact with the exhibit, by treading on these iron surfaces, created enormous ringing sounds that could be associated with screams from the Jews.
Another experience is the so-called Exile Garden. The exile garden consists of 49 high concrete columns -









Illustration 62

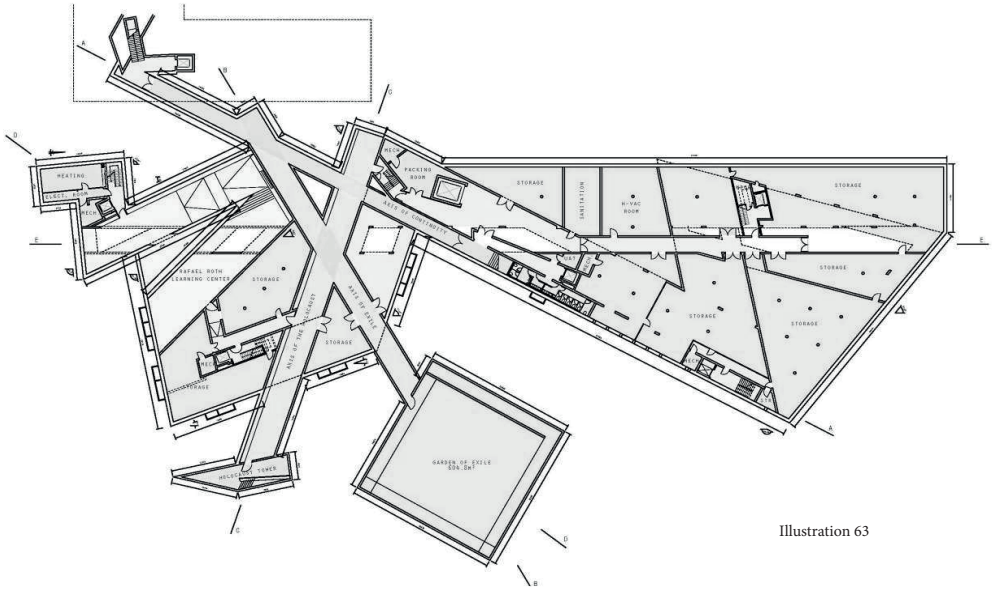
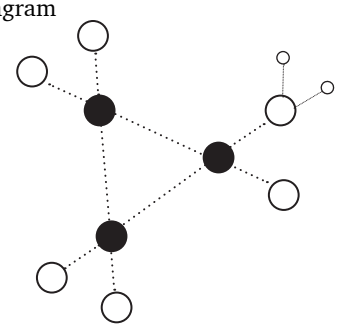
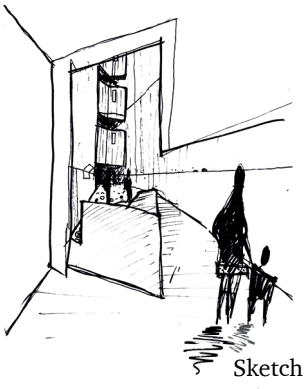


Illustration 63

Schematic Diagram





Sketch

which is planted on top. The columns create an orientation confusion and can impress the visitor with the feeling of being lost. The effect and design of these columns can be associated with Peter Eisenman's monument to the Jews. Stopping and looking upwards creates a moment of orientation and calmness. The house's architectural tools such as, materials, scale, and use of daylight, contribute to an emotional and multi-sensory journey, which is fully remembered in the soul.

Three main axes drive the layout of the building. These axes are distinct options for exploring the house. These axes can be considered as the primary sequence of the project. At the end of the axes, different spacious experiences arise. Each axis represents their thematic gallery with small branches of sub-sequences along the way. The highlight of the axes is seen as the blind spot at the end of the routes.
The axes are connected in several places and broken by visual intersections. The social space of this layout can be found in the nodes of the axes. Here the groups meet and distribute around the house.

Practicality, the house contains an overwhelming, emotional, and surprising "suprise" at the end of the thematic route. "The suprise forms an overall conclusion to the stories told along the way.

From my own experience in the house, I have formed several qualities and challenges:

QUALITIES

- Aesthetic
- Materiality
- Scale
- Use of daylight
- Explorative opportunities
- Overwhelming architecture
- Contrast
- Sensing spaces

CHALLENGES

- Lack of authenticity
- Lack of storytelling
- Lack of accesibility
- Lack of orientation

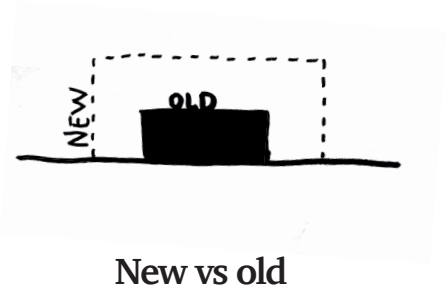


The Jewish museum in berlin, 2020 Foto: Nicolai Qvist Krarup



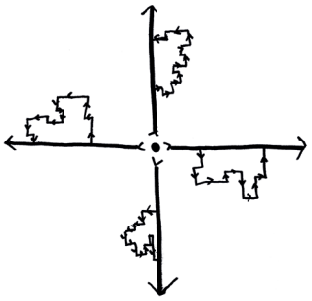
TIRPITZ , 2018 - Archdaily

Architectural design criterias



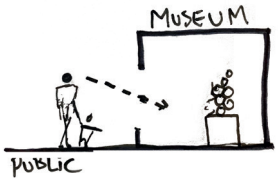
New vs old

The museum needs to embrace and reinforce existing bunkers. The new museum must contrast with the finesse of the materials and be erected in smooth concrete.



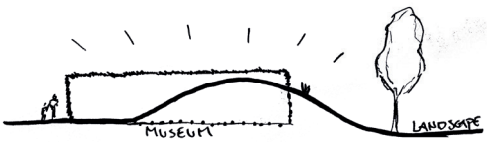
Opdagelse og overblik

It should be easy to navigate around the museum. In addition, you must have the opportunity to explore. There must be different options and places in the house with a forced course.



The public museum

The house must not only give something to the museum, but also to the whole area. Therefore, the house must have the opportunity for public insight in various places in the house.



The role of landscape

The museum must be integrated with the landscape and create a building that slides between above and below ground. This must be done with the greatest possible contrast, to support the spacious difference that must appear.

Illustration 64

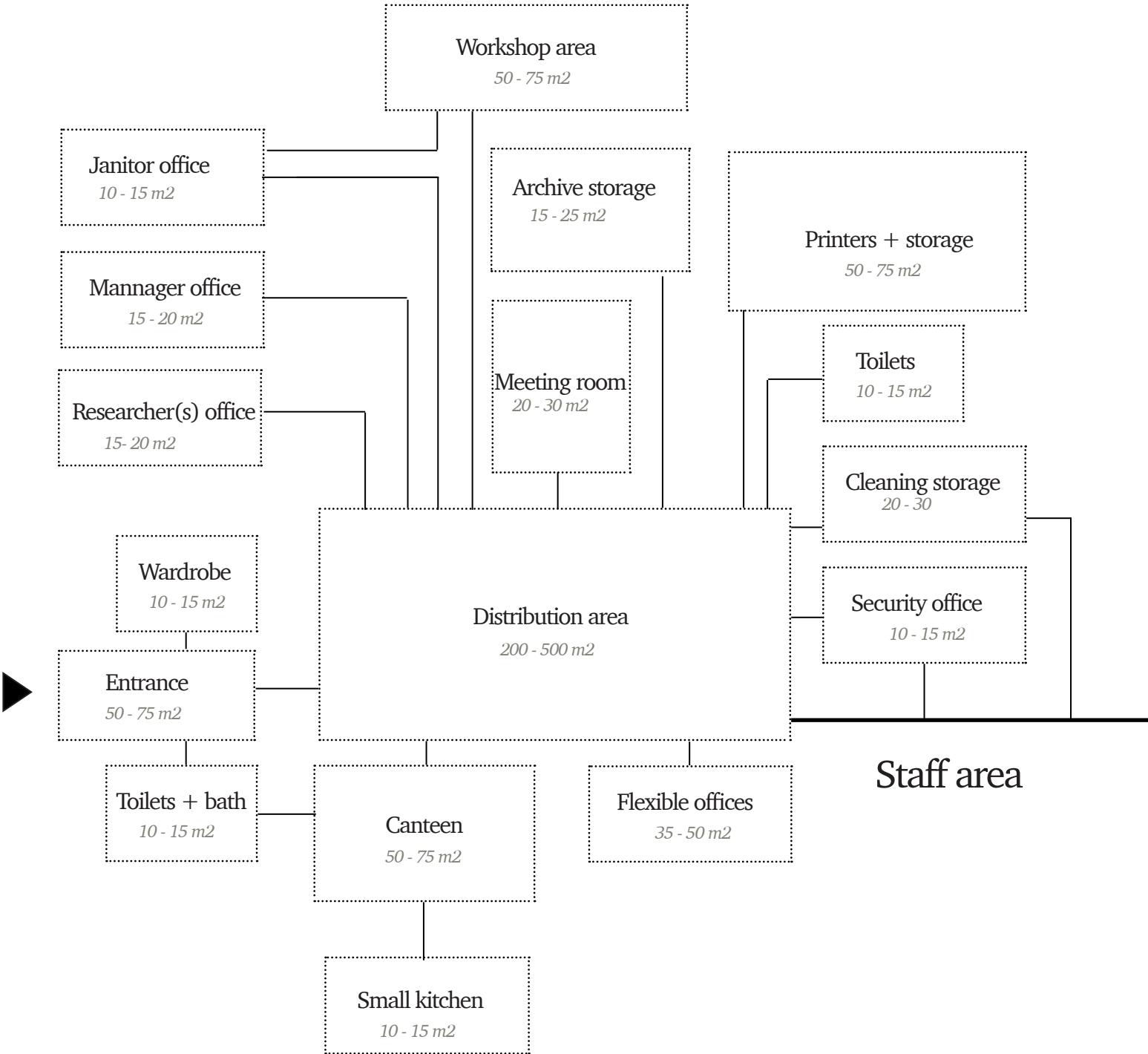


Bunker Museum Hirtshals 2020 Foto: Nicolai Qvist Krarup



Diagram of functions

As part of the conclusion for the program, a so-called functional diagram can be designed for the upcoming museum. The rooms are located in the current right connection to each other with the approximate sizes the rooms must-have. This connection and size may change throughout the design process, but is currently the starting point for starting a plan layout.



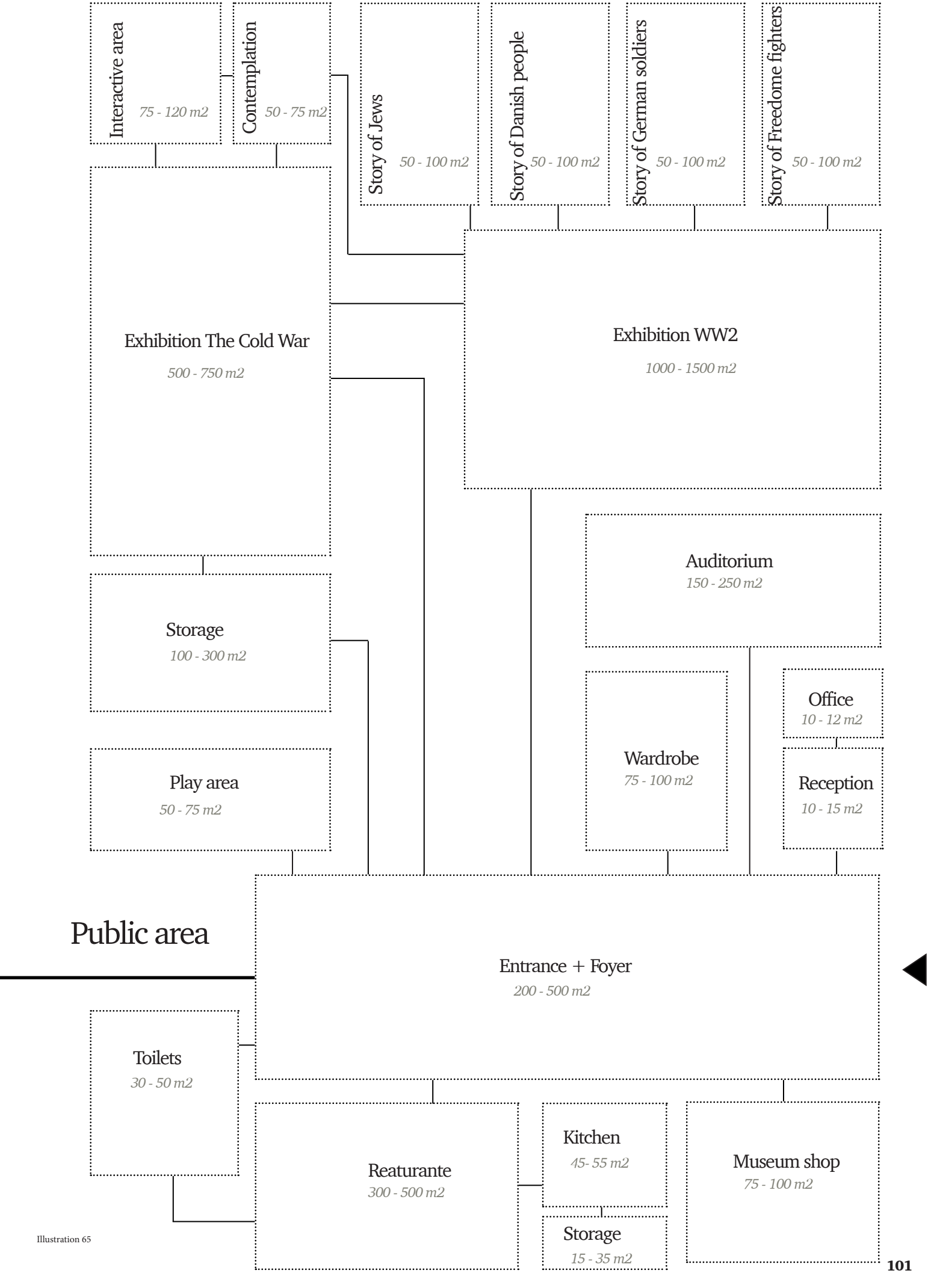


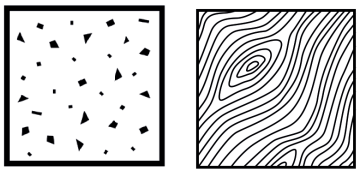
Illustration 65

Overall architectural design criterias



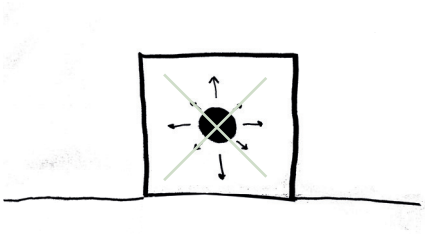
Keep up Authenticity

When working with a museum, it is essential to create authenticity. Authenticity must reflect the reality that has been in the past. Therefore, the (ticket sales building) must be preserved, and bunkers must be detailed and integrate underground.



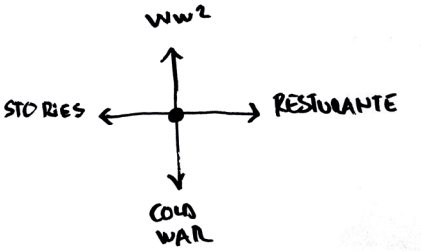
Contextural Materials

The upcoming museum will cultivate the materials from the context and the existing bunkers. Therefore, the project must especially incorporate wood and concrete.



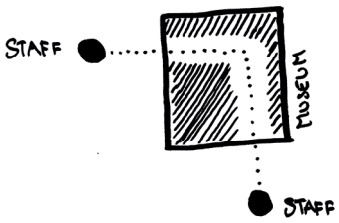
No direct light

The majority of museum materials and objects may not receive direct daylight as they become relevant in their quality and lifespan. Therefore, the exhibition rooms must be designed so that they are best avoided.



Orientation and themes

In order to take advantage of the possibility of creating synergy and diversity between the themes, as well as giving visitors a free choice of the subjects, the museum must be divided.



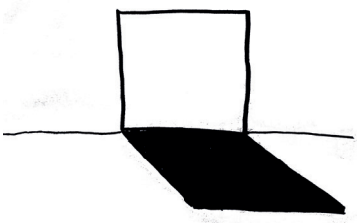
Staff penetrates museum

To create the right synergy between the employee and the museum, the employees must not be isolated at one end of the building, but rather be forced through the building several times a day. It is made based on quality, of being part of life in the house.



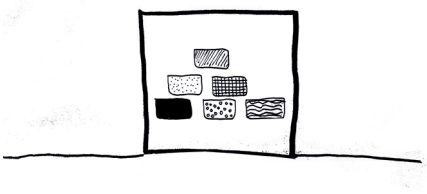
Embracing Views

The site area consists of some hugely beautiful views of nature and the ocean against the east. Therefore, the house must cultivate these opportunities and create a clear frame to penetrate nature and the view where it's possible.



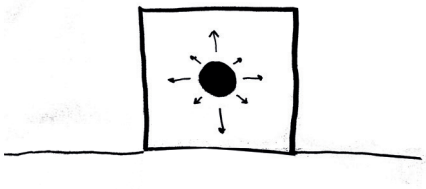
Openings and shadows

In relation to the chapter, the difference between light and shade can be a good tool for creating sub-spaces, and the contrast can emphasize materiality, etc. Therefore, the work with openings and the opposite must be integrated so that it contributes to a spacious experience.



Choice of materials

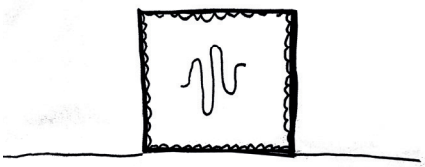
The choice of materials is essential for all senses—both concerning touch, the absorption of sound, and the aesthetic expression. Therefore, the materials must be selected for sensory perception.



Light and sense of sight

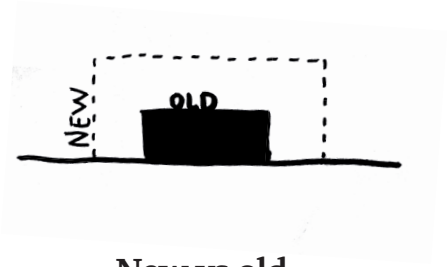
Light is an essential element of architecture. Light helps to create focus points, direct, invite, or define different zones. Therefore, light is a very important factor in the work of the museum, both natural and artificial.

Illustration 66



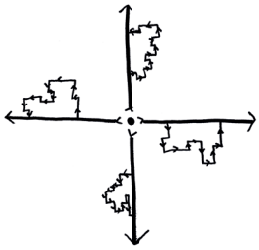
Sound of the architecture

Sound can be a powerful tool to awaken feelings in human beings. Therefore, it is obvious to use this element in the museum. Sound must be challenged through materials, surfaces, scale, and function.



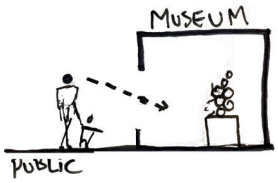
New vs old

The museum needs to embrace and reinforce existing bunkers. The new museum must contrast with the finesse of the materials and be erected in smooth concrete.



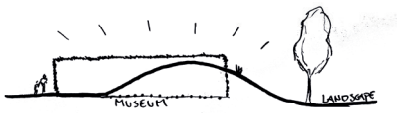
Discovery and overview

It should be easy to navigate around the museum. In addition, you must have the opportunity to explore. There must be different options and places in the house with a forced course.



The public museum

The house must not only give something to the museum, but also to the whole area. Therefore, the house must have the opportunity for public insight in various places in the house.



The role of landscape

The museum must be integrated with the landscape and create a building that slides between above and below ground. This must be done with the greatest possible contrast, to support the spacious difference that must appear.



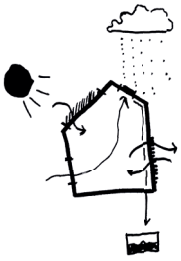
Contrasting spaces

The building must have contrasting spaces and atmosphere that surprise and put the story in the right perspective



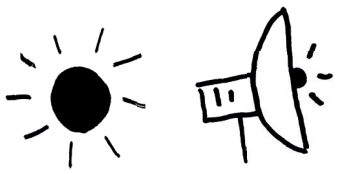
Integrate Bunkers

The existing bunkers the building site must as far as possible be included in the construction and further in the overall concept.



Passive strategies

Integrate sustainable solutions in architectural design choices. The building must meet energyclass of 2020, with only passive strategies.



Artificial and daylight

The daylight factors must be on >3% average in staffrooms, resturante and more. The design must be aware of the use of artificial lights. And create exhibition rooms, that will be able to control daylight if nessacary.

Illustration 67

Problem formulation

Based on the overall programme, the following problem formulation is extracted and formulated. It will be the focal point of the further process and will be answered later in the presentation.

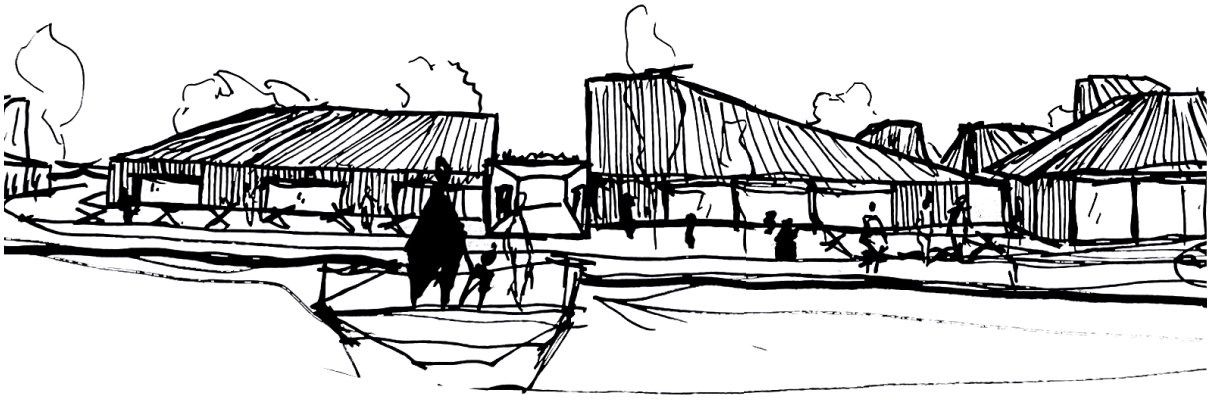


Illustration 68

How can I design an innovative and learning Bunker museum in Frederikshavn that relates to its surrounding context, stimulate senses and interprets history into architecture?



Process.



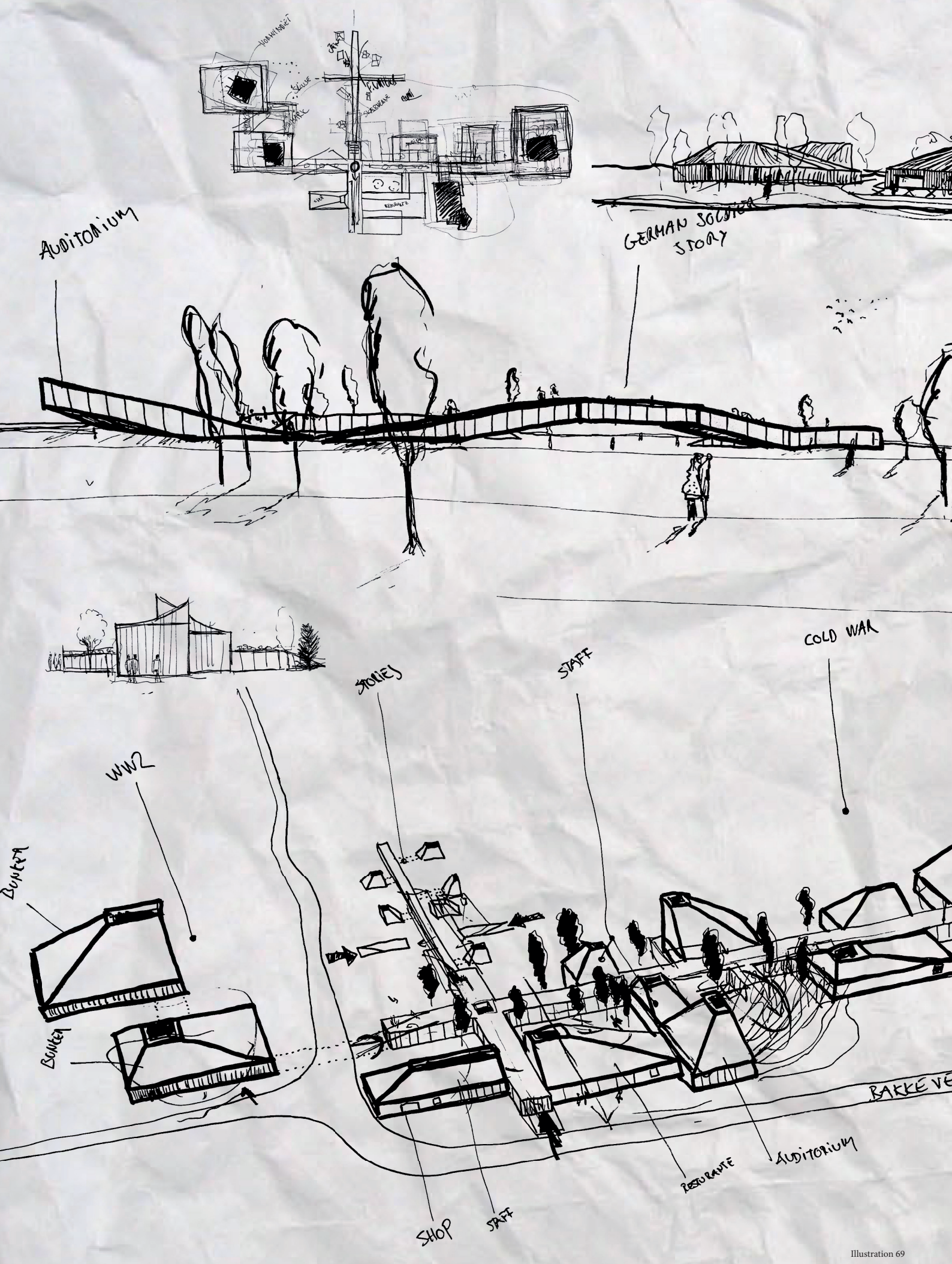
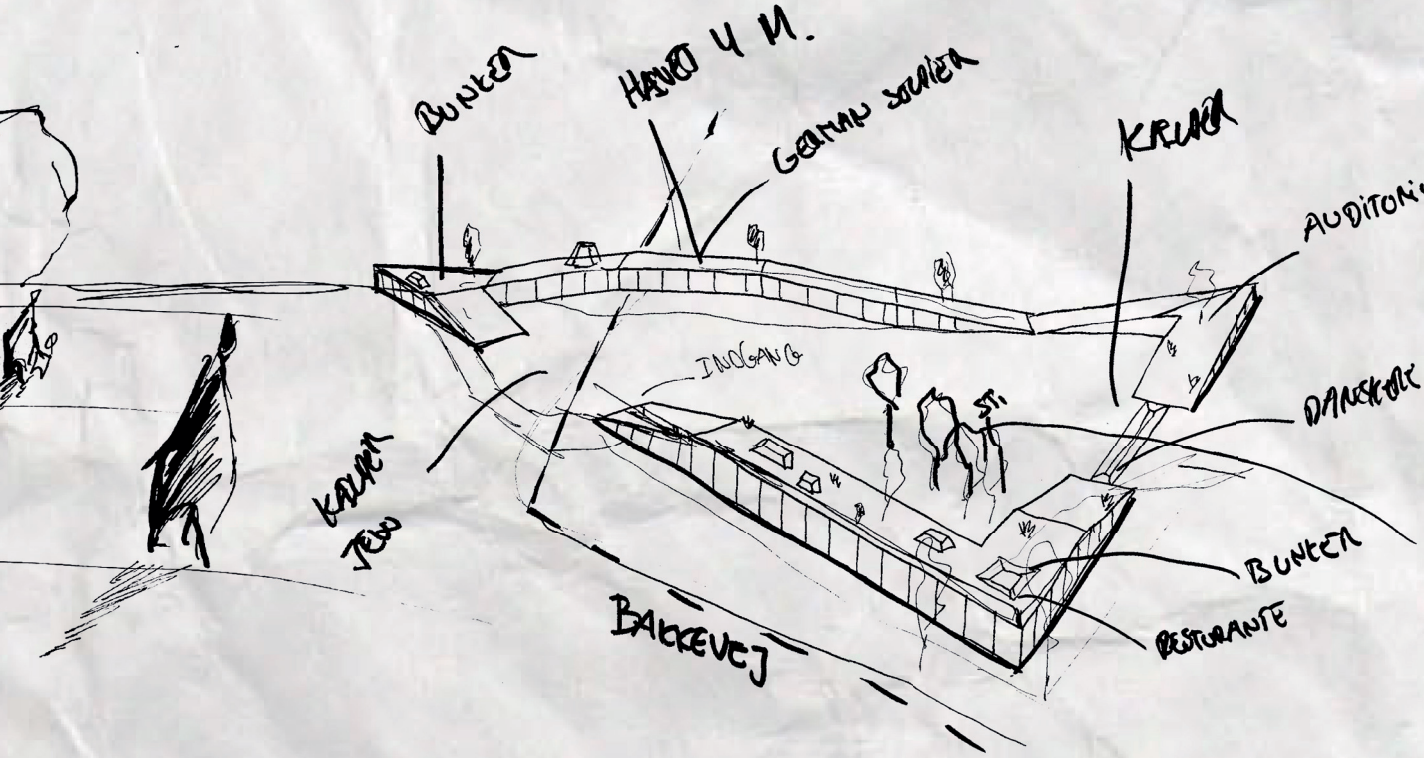


Illustration 69

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HAVET 4 M.
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INDGANG
DANSKER
KRIGER JØD
BUNKER
RESTURANTE
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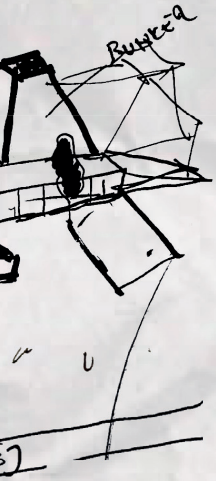
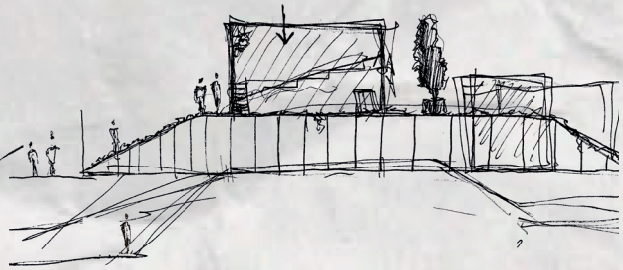
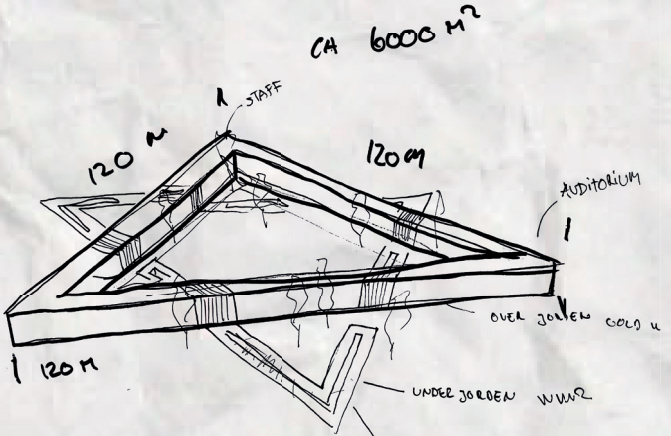

Bunker

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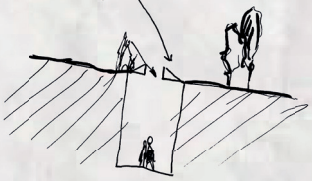
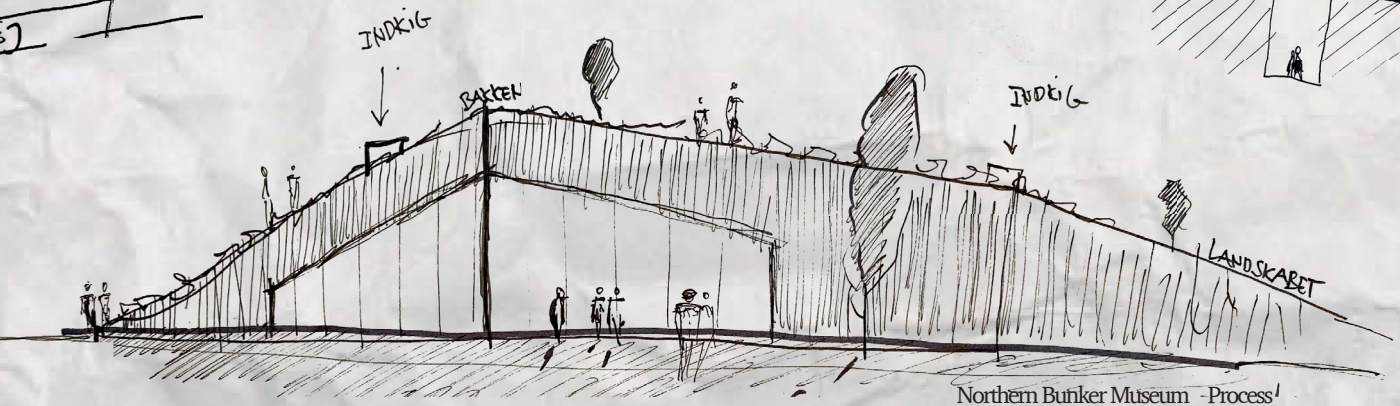



INDKIG
BAKKEN
INDKIG
LANDSKABET

Forming the idea

Various ideas and thoughts have been sketched and tested based on the previous program and associated problem formulation and design criterias. In this phase, in particular, areas of arrival, functions, parking, the museums connection to the site, as well as the building's overall expression has been studied. One of the pervasive concepts in the sketching phase and proposals is the spacious experience of nature and the countryside together with the movement around the bunkers in the area. In addition, all the sketch proposals also form the basis for the contrasting experience that arises in the meeting with and in the bunkers underground.

Sketch 1, 5, and 7 on page 111, the building has taken the form of the location of the bunkers on the site. The triangle forms a course with a node at each end. In these nodes, the bunkers are located. The distance between the bunkers is approx. 100 meters, and therefore creates a huge number of square meters of a course and thus a large house. It also contributes to integrating the other exhibitions in these areas. The process creates a relatively forced experience for the visitors. The form creates a circulating course, which provides minimal opportunity for discovery and exploration.

In examples 2, 3, and 8, the building is much more integrated into the landscape. The building provides the basis for a further course of the pathway across the roof ridge. These examples create a building that can be related to the ”hill”. The building becomes a natural extension of the landscape and makes contact with 3 of the site's bunkers.

The examples are fundamentally based on different approaches to integrating bunkers, landscapes, courses, and functions. The sketches to the right represent simplified diagrams of precisely these aspects.

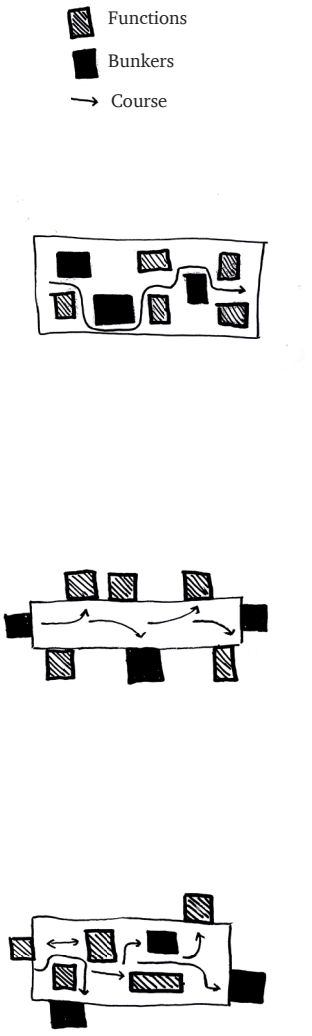
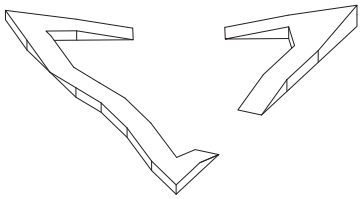


Illustration 70



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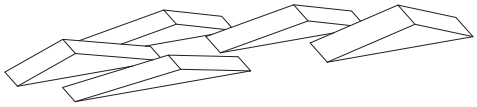

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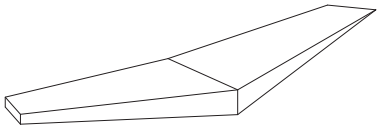

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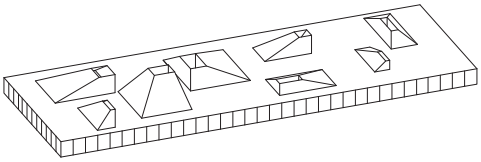

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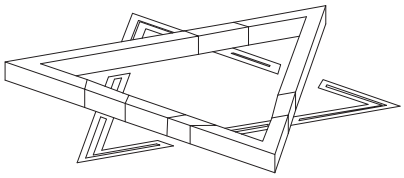

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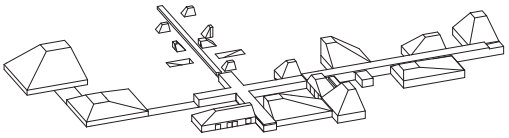

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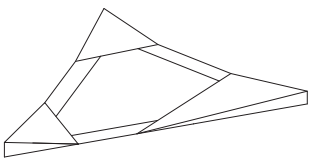

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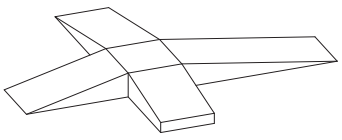


8.

Illustration 71

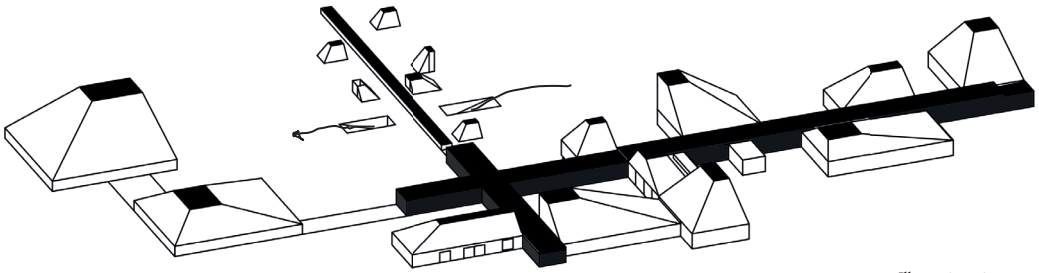
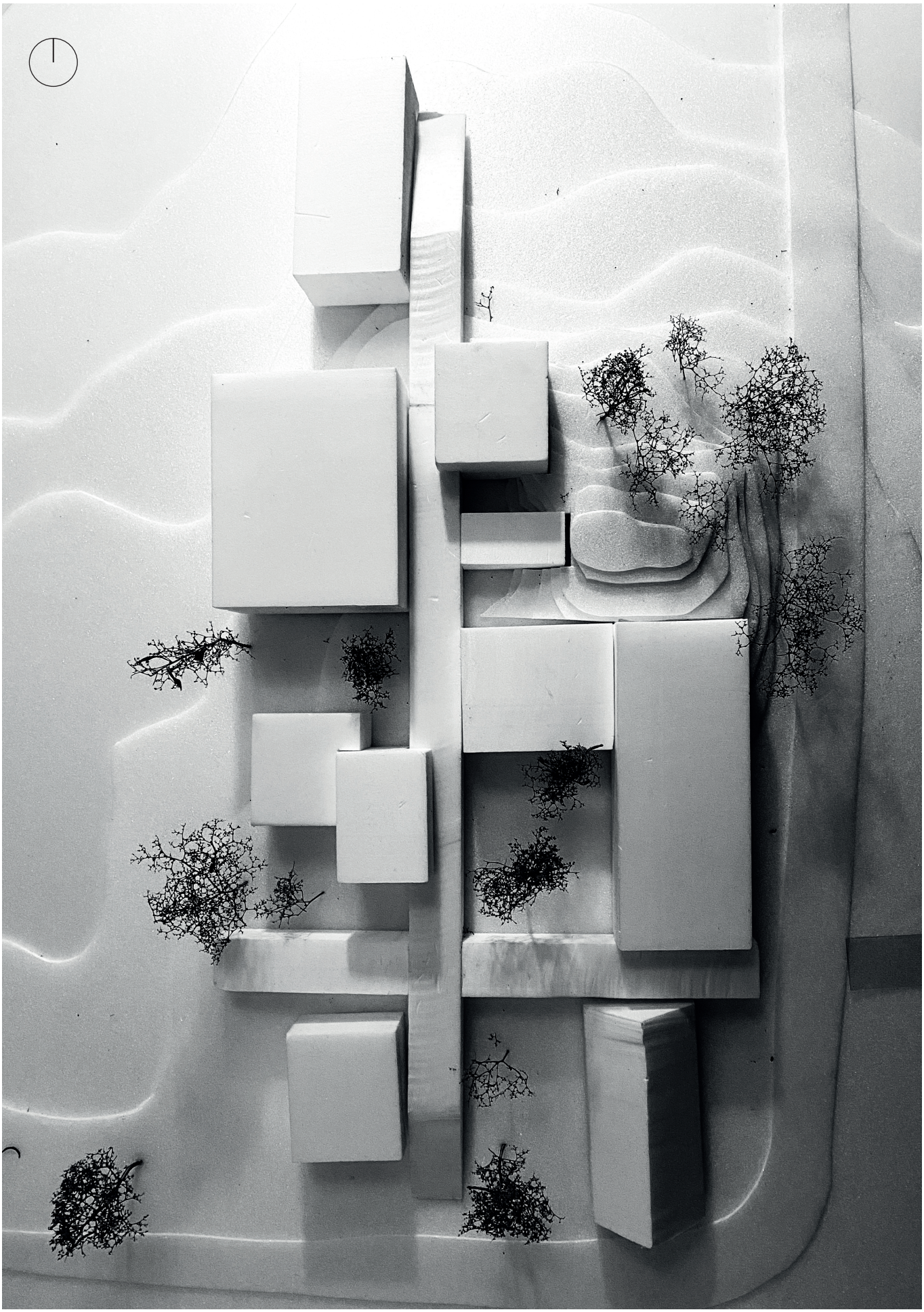


Illustration 72

In further processing, **sketch 6** is chosen. This concept creates a clear formal expression concerning the two spacious experiences in the house, of which a walk in nature and the spacious experience of the bunkers. This concept forms a clear, strict line in the landscape, which is distributed to the bunkers on the site. This line creates a natural way to orientate, and creates at the same time, an opportunity to explore the thematic topics that interest the individual target group. The further forms are intended as substantial contrast-filled volumes with minimal daylight due to the need for thematic artificial lighting, etc. This concept incorporates the old farm which is located on the site and which the North Jutland Coast Museum wants to preserve and which at the same time fits well with the desire for the authenticity of the area.

To the right the current process model is illustrated, in which various shape volumes are tested in relation to functions, scale, and user group. In the next phase of the process, a further focus is placed on the target group and the employees in the house and their specific needs in the house, as well as technical considerations and integration thereof.



1:200 process model

Illustration 73

Forming the idea

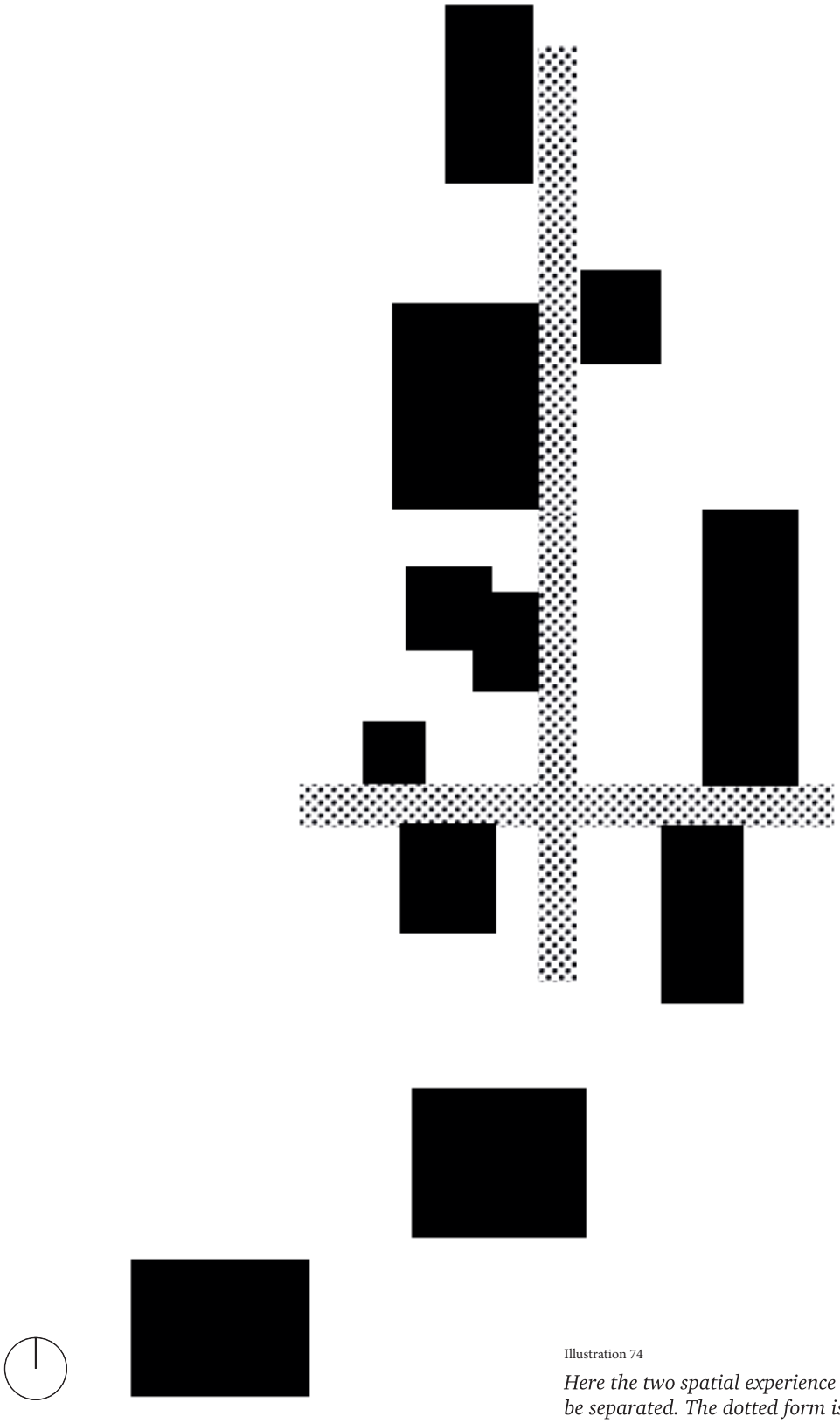


Illustration 74

Here the two spatial experience is illustrated and can be separated. The dotted form is ”The walk,” and the black volumes are ”The Blocks”.

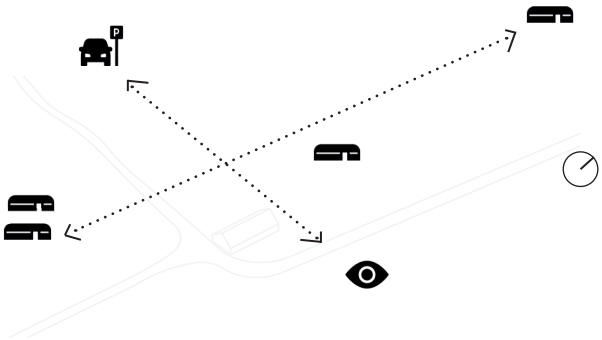


Illustration 75

Addaption to site

In order to create the best relationship with the site, based on the existing bunkers, parking, and the view towards the ocean- sightlines have been formed for the development.

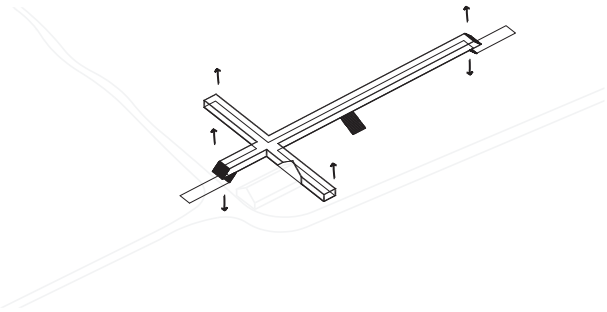


Illustration 75

Integrating landscape and sightlines

To accommodate the possibility of getting down into the existing bunkers, construction is partially above and below ground.

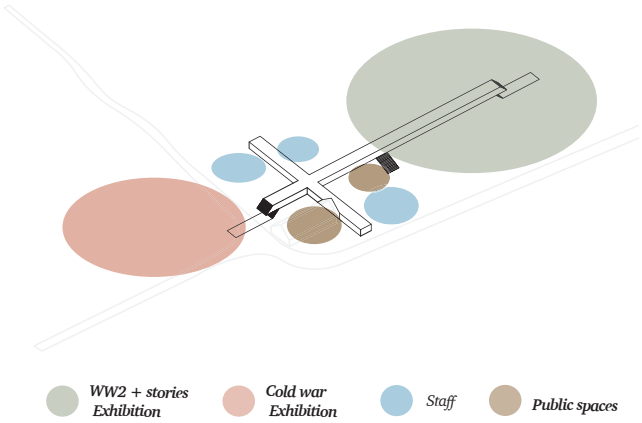


Illustration 76

Functions and zones

The target group, the site, moods, and the zones are placed in relation to the lines. These zones form the basis for a number of functions and spacious experiences that are composed of the function diagram and thus the relation of the rooms to each other.

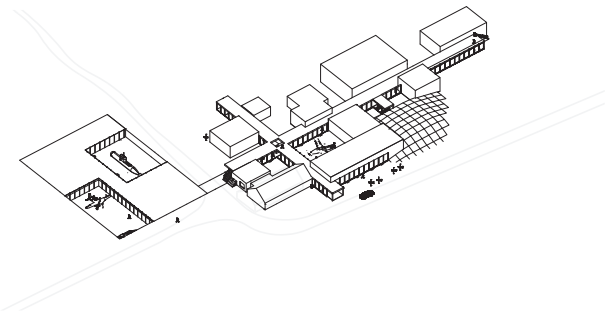


Illustration 77

Volumes

Based on the room program and the target group, different volumes have been prepared, which form the basis for the future process for space.

The Staff

In the further process, the functions and distribution of the employees are analyzed. The needs of the various employees from the program are incorporated and practiced. The employees who cooperate must have ample opportunity for a fluid dialogue during the day. Depending on the function of the house, the employees can use the entrance to the house, which best belongs to their location in the museum. The position and relation of the employees are determined according to the function diagram. Employees must have their work department (s); however, it is crucial that the employees also are forced a bit centrally around the building. They need to experience daily activity during their lunch break and not just be isolated at an enclosed-end in the house. The canteen is located in relation to the kitchen. The canteen also acts as a gathering point for all employees in the house.

The next page shows a diagram of the current development and distribution of overall functions and how the various employees use the layout from parking to office etc. The different types of work are defined according to their color.

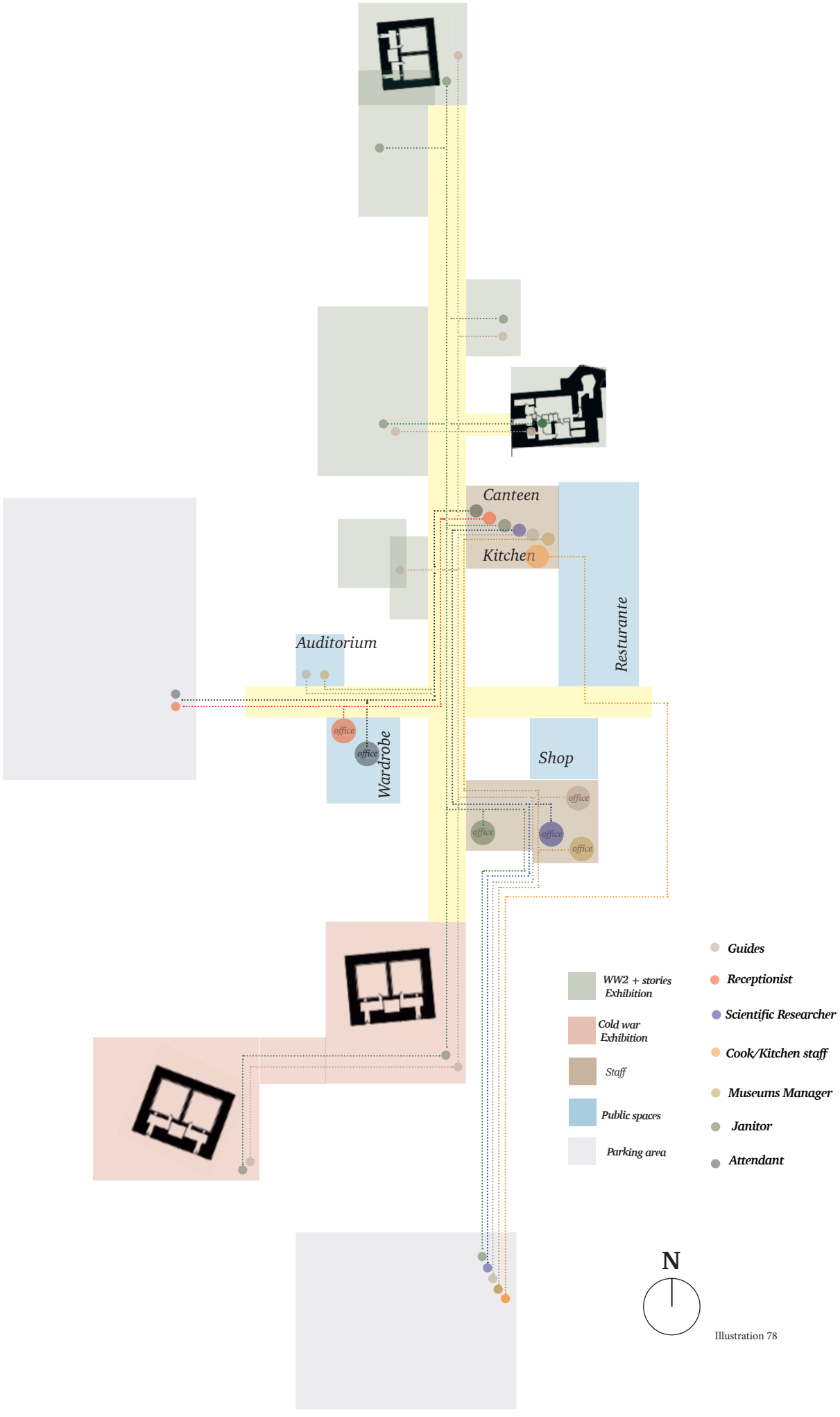


Illustration 78

The visitors

In a museum like this, there will always be visitors with different points of interest. The layout is designed with the best possible use, a clear way of orientation, and an opportunity to discover different parts - as seen in the diagram on the next page. It must address the interests from the beginning.

Relatively quickly in the layout, the house branches into four different options. If you are interested in the Cold War, you will be able to make that choice. If you are interested in World War II, you will be able to make that choice. If you are interested in presentations in the auditorium, you will be able to make that choice, and if you need a break halfway, then you can enjoy lunch in the cafe and/or visit the museum shop.

It is also possible to simply visit the shop and/or the restaurant if you wish. There is a possibility of the entrance to the museum at various places in the building. There is the main parking area to the west, where most ancone are managed to originate. Employees in the house will be able to park in the parking area to the south. People walking in the area upon arrival from the Queen's Trail on the hill will automatically be guided through the entrance to the east. Here, this target group will be able to visit the restaurant, shop, or get an insight into what the museum holds.

The different types of visitors will cross each other several times in the experience around the building. This also helps to split up the groups and meet at a later point. It will also be communicated further on the next couple of pages.

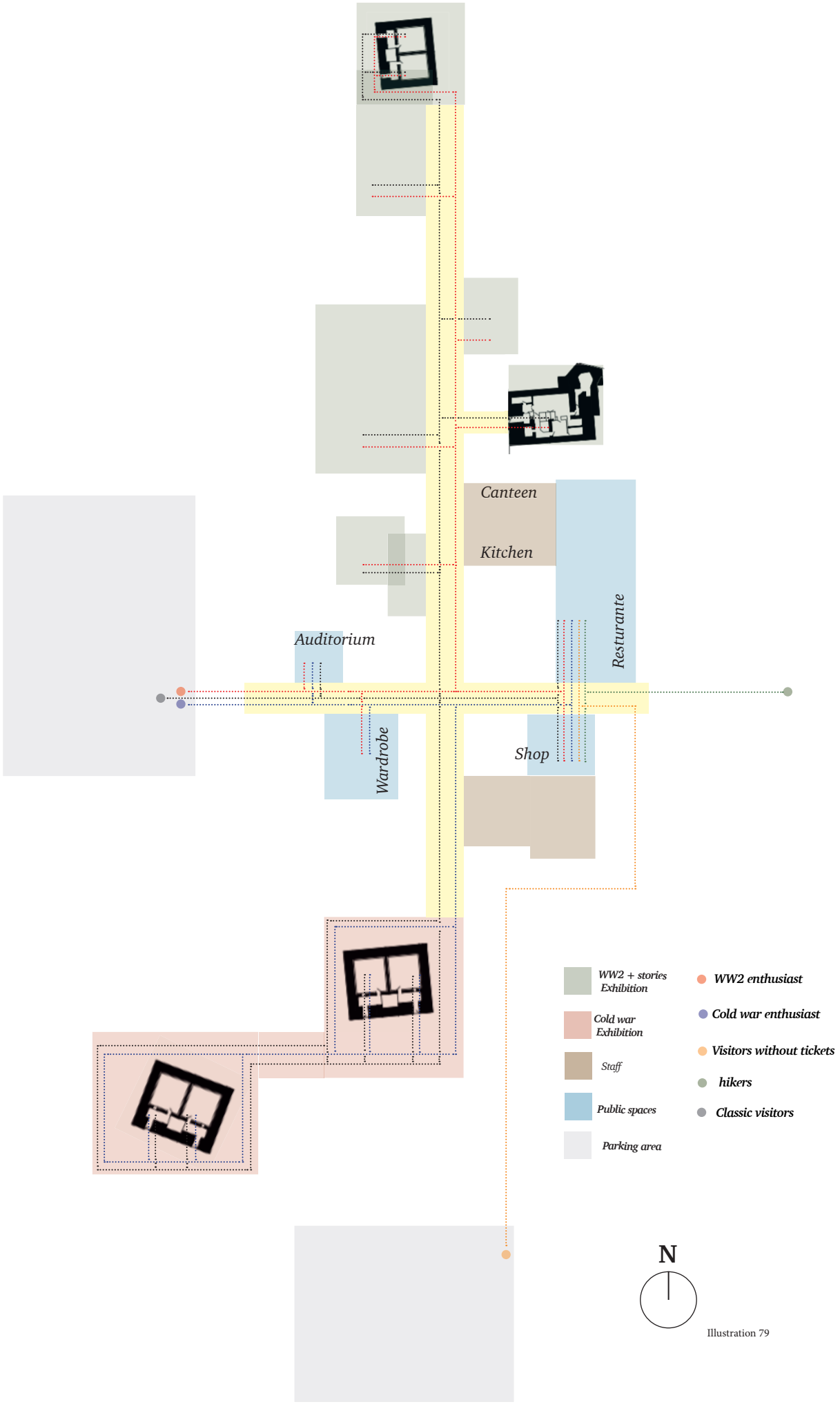


Illustration 79

The users needs

The diagram on the next page illustrates some of the requirements implemented in the physical layout, based on the analysis from the program.

As the mapping of the site in the program (p. 46) shows, it is a very planted area. It has thus been utilized - all employees have a view of the green. ”The Walk” will also be characterized by the greenery several times to both sides, to emphasize the concept. Places to sit were also an important part of the target audience. Therefore, areas for seating and places to gather should be integrated.

The diagram also shows the different parking areas and the specific need in an area like this. First and foremost, to ensure not to block the road to the west, and thus also limit the possibility of parking, the contact to the bunkers against the south established like the one to the North, underground. The bunkers are placed 3.5 meters underground and can therefore conveniently be visited underground.

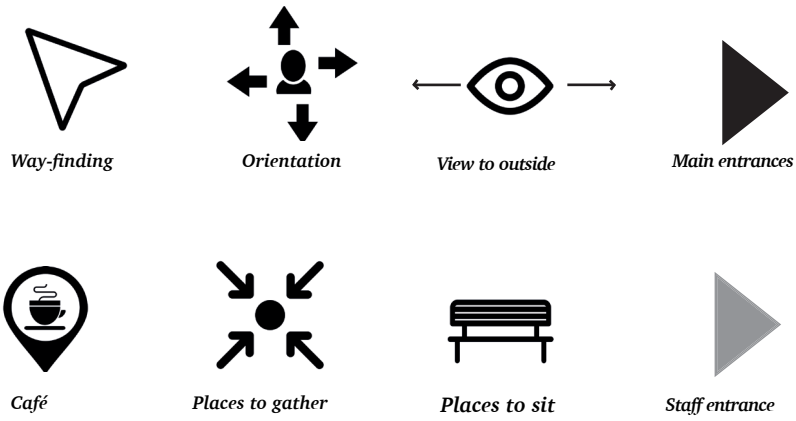


Illustration 80

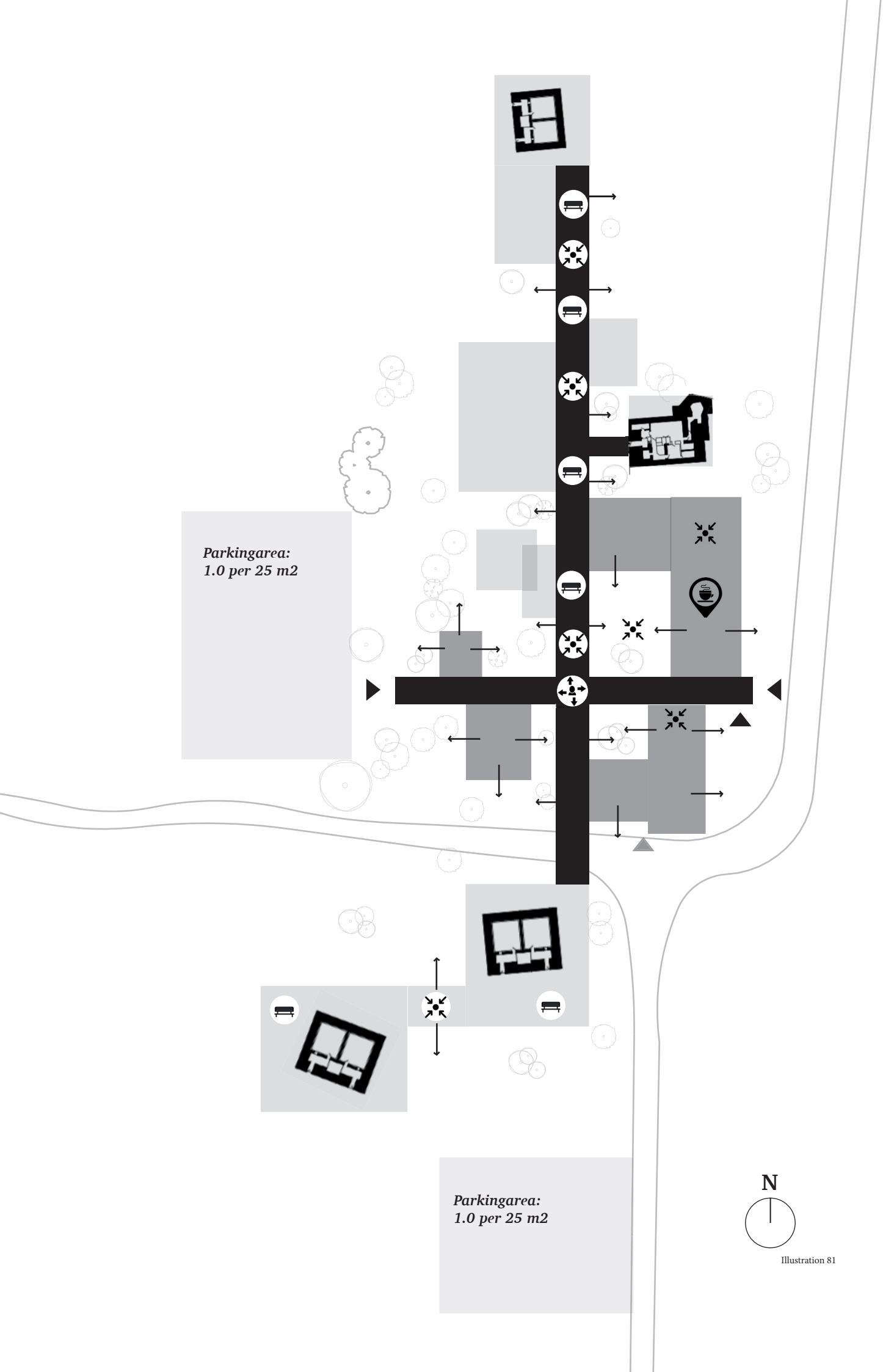


Illustration 81


The Walk
”Inspired by the nature surrounding the fort”



Illustration 82

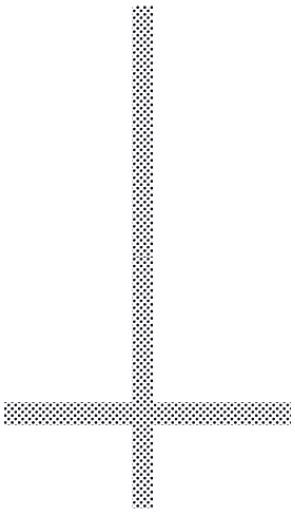


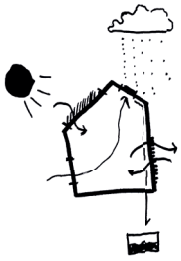
Illustration 83

The designing of the Walk

The Walk is the space that connects the visitors to the functions in the house and is based on several points from the design criterias.

Visiting Bangsbo Bakker and Bansgbo Fort is based on the perception of a walk in the nature between the different and through the bunkers.

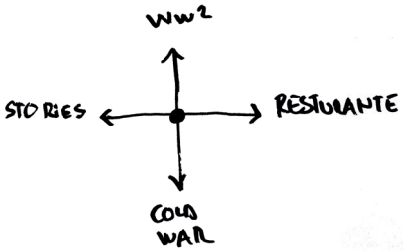
This experience must be created by the use of material, views, and functions. Although a lot of different analysis is made to ensure a sustainable and comfortable building according to the indoor climate and sustainable practices. In the upcoming pages, the design is challenged and calculated in different ways to ensure the best possible design. In the meantime, the design of the ”blocks and the use of existing bunkers are formed- see the next chapter.



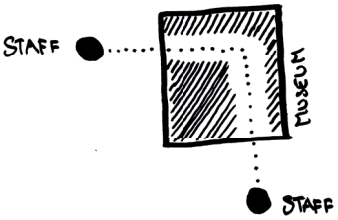
Passive strategies



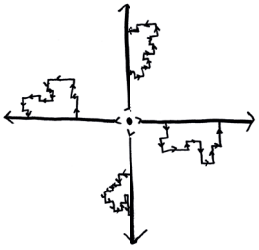
Embracing Views



Orientation and themes



Staff penetrates museum



Discovery and overview



Integrate Bunkers

Illustration 84

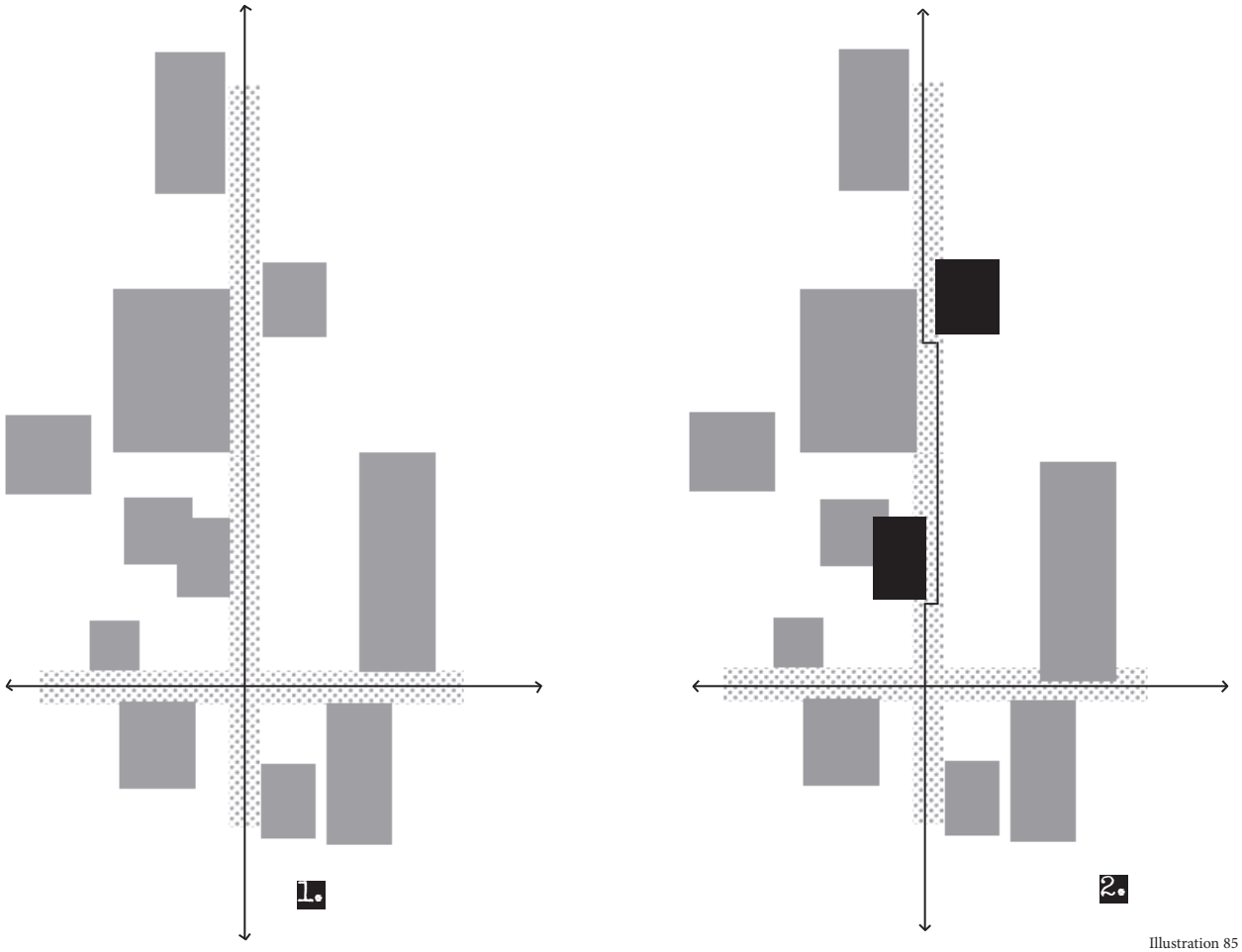


Illustration 85

Sightlines and paths

As described several times, the design of the layout needs to be able to orient themselves to read ”part” of the building’s course. However, it is also not desirable that the building should be too readable and thus reduce the experience of exploration and surprise. Therefore, various methods have been used to create this dynamic and exploratory environment humbly without making it complicated. This page shows diagrams 1 and 2. Diagram 1 shows a clear course with long sightlines from north to south and from west to east. Diagram 2 illustrates different displacements of the ”blocks” penetrating ”The Walk” from north to south. The sightline from west to east is maintained free to emphasize the unique view of the ocean.

To the right, sketches and models of the different concepts are shown.



Illustration 89

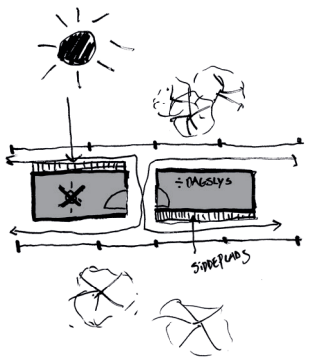


Illustration 86



Illustration 87

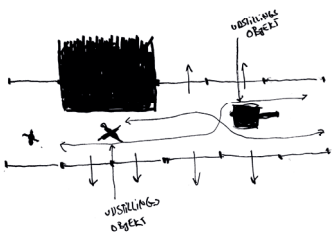


Illustration 88

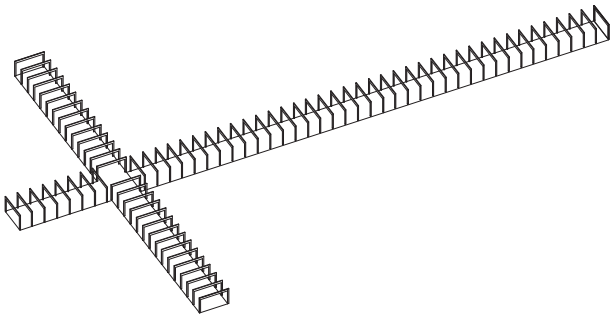


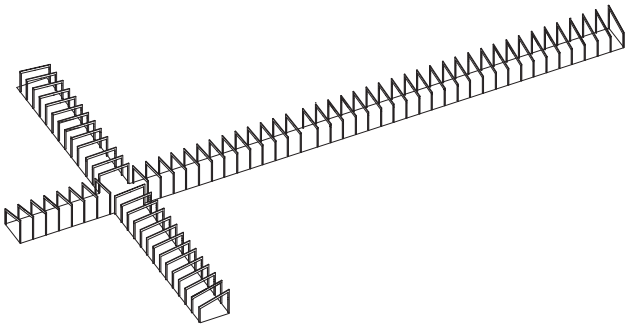
Illustration 90

The formgiving

During the first part of the process, the focus of the design has been primarily on the two-dimensional layout. In the next phase, I will explore and test various three-dimensional solutions in the wake of the previous choices.
Both analog and digital tools have been used to explore different forms and tools. Above is the working model in scale 1: 100. Working on this scale, contributed to an increased understanding of the spacious perception, experience, and connection with the further building components.

A part of the desired expression for The Walk was elements representing the surrounding nature, such as the constructive, the materials, and the possible views. The constructive system must increase the expression of ease and be designed as wooden structures with ample opportunity for views and windows. On the next page, see Figures 1 and 2. These illustrations illustrate some of the three-dimensional designs tested.





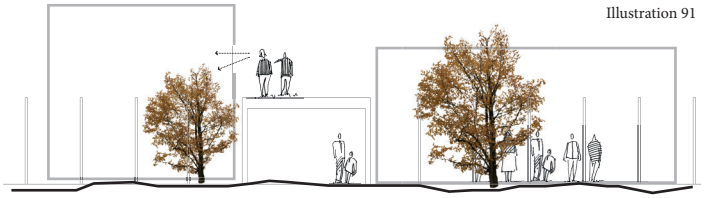


Illustration 91

1.

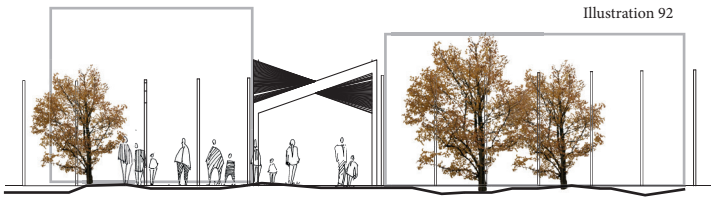


Illustration 92

2.

Solution 1; The simple flat roof solution will form a good connection with the additional building components. In addition, the design must be able to attract hikers and other people from the trail over the ridge. Over this course, an opportunity for insight into the museum's exhibitions must be constructed. This is the wish that has arisen based on the many people who are walking in the area. This solution should be able to give this target group (hikers) a taste of what the museum contains and consists of, thus creating a curiosity for more.

The flat roof also creates a humble link to the other buildings. The additional building components should create the dynamics of the construction. 1: 200 model on p. 127.

Solution 2; This solution creates a varying spacious feeling depending on where you, as a visitor, are located in the building. It creates a dynamic as well as a fluid course with an exciting, constructive expression. This solution does not create the same opportunity to interact with the roof as solution 1. From a sustainable perspective, this solution contains far more specially produced elements as well as more material in its entirety.

For the further process, the **solution 1** is chosen. It is chosen because of a more humble expression, less material consumption, and functionally fits the vision of hikers in the area. In the next pages, the constructive system is investigated further.

Illustration 93



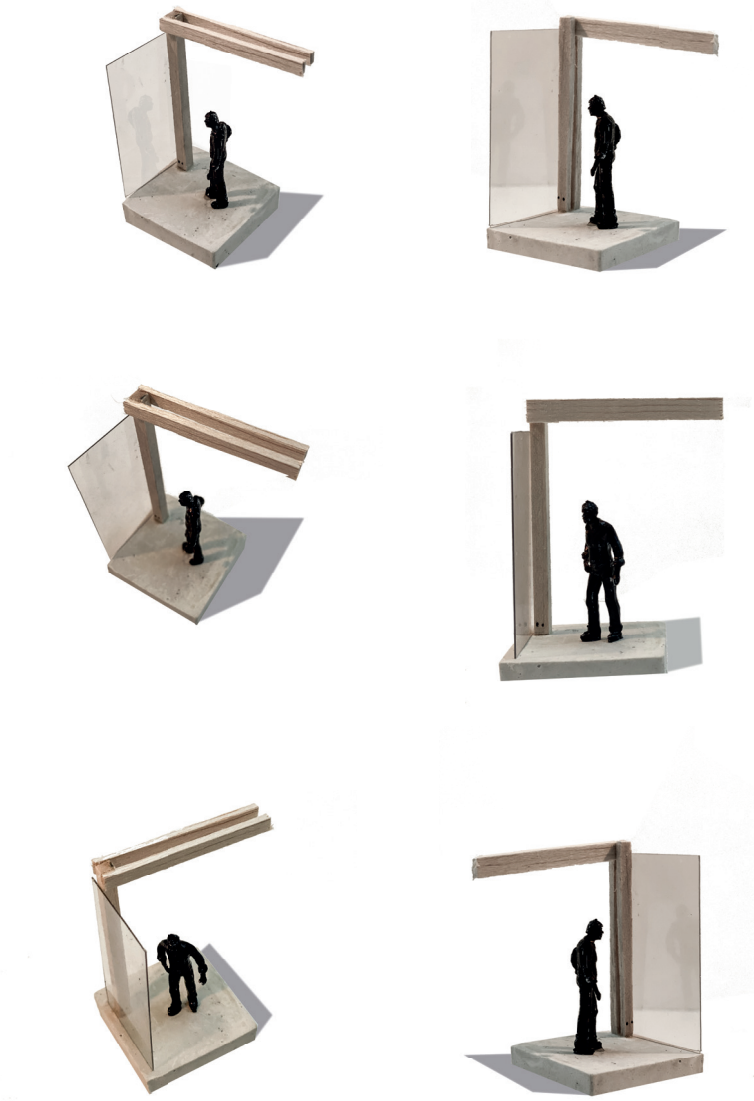


Illustration 94

Constructural detailing

The structural system is a dominant visual element in "The Walk." Therefore, different versions of the composition and terms have been tested. Above is a selection of different 1:50 models. To create such a minimalist look without too many impressions.



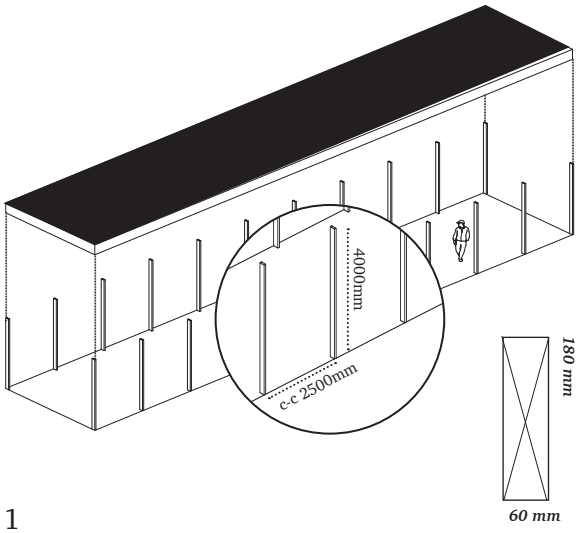
Illustration 95



Illustration 96

Constructural detailing

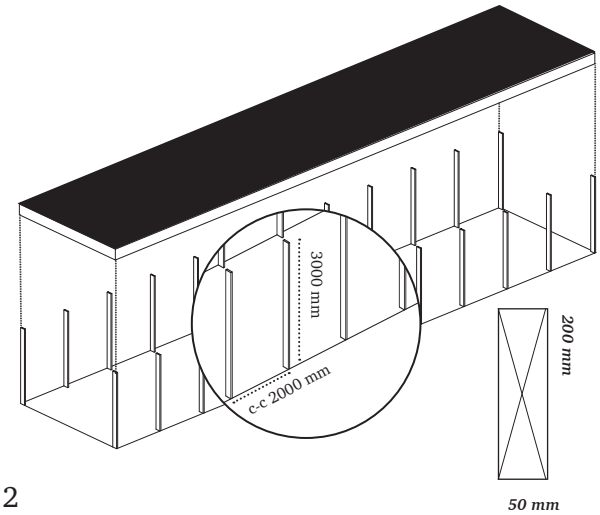
In the further process of designing the visible columns, the carrying capacity of the column is assured depending on the type of wood, the length of the column, the distance in between, and the cross-sectional dimensions of the column. The load-bearing capacity is calculated on the basis of various loads, slenderness, compressive strength, and compressive stress. On the next page, you will see the selected dimensions. The expression in ”The Walk” should basically appear easy and elegant, but at the same time, the columns must have a good utilization rate. The choice felt on **type 1**. This type is in structural wood C18, which is much cheaper than glulam (GL32). The length of the columns is 4000 mm and with a c-c distance of 2500 mm.



Type 1

Wood Type;	C18
Lenght;	4000 mm
Distance;	c-c 2500 mm
Cross section	180 mm x 60 mm
Carrying Capacity	$\frac{2,7 \text{ Mpa}}{1,3 \times 6,66 \text{ Mpa}} = 0,31 < 1$

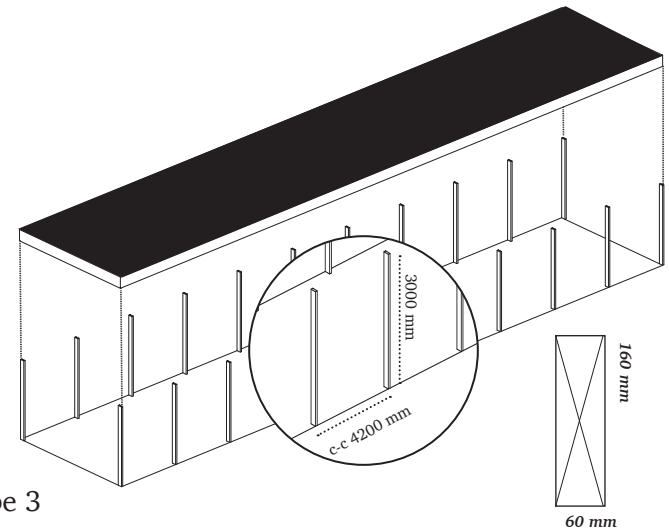
Illustration 97



Type 2

Wood Type;	GL32h
Lenght;	3000 mm
Distance;	c-c 2000 mm
Cross section	200 mm x 50 mm
Carrying Capacity	$\frac{1,96 \text{ Mpa}}{0,83 \times 16 \text{ Mpa}} = 0,15 < 1$

Illustration 98



Type 3

Wood Type;	GL32h
Lenght;	3000 mm
Distance;	c-c 4200 mm
Cross section	160 mm x 60 mm
Carrying Capacity	$\frac{3,6 \text{ Mpa}}{0,83 \times 16 \text{ Mpa}} = 0,27 < 1$

Illustration 9



Illustration 100

The glazing

The number of glass influences several different factors in relation to the indoor climate. To ensure a satisfactory indoor climate and energy requirements for the building, different percentages of glass have been tested (see next page).

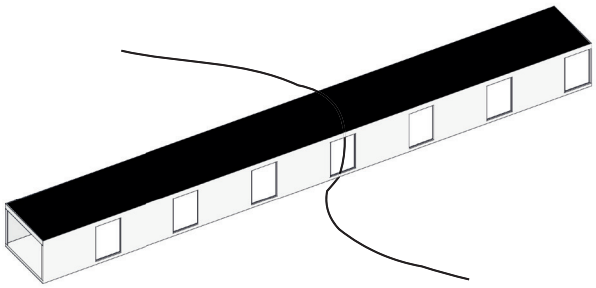
The choice landed on **type 3** as it is essential for the concept, to appear open, light, richly illuminated, and with the opportunity for as much look to the outside nature as possible.

The thermal indoor climate is affected, by the amount of heat loss through the glass and especially at the joints surrounding the window. However, larger amounts of window area can create an increase in the opportunity for the use of solar heating. Solar heat can have a significant influence on the heat balance of the room depending on the type of the window, as well as its orientation. This has been shown by calculations and the use of Be18 to ensure the right influence and balance.

Furthermore, this amount of windows also influences the atmospheric indoor climate, including the use of natural ventilation. Natural ventilation contributes to an increased saving of the added energy for cooling and is, therefore, a widely used method in sustainable buildings.

In addition, this solution increases the visual indoor climate both given nature but also the amount of daylight by an average of 6%.

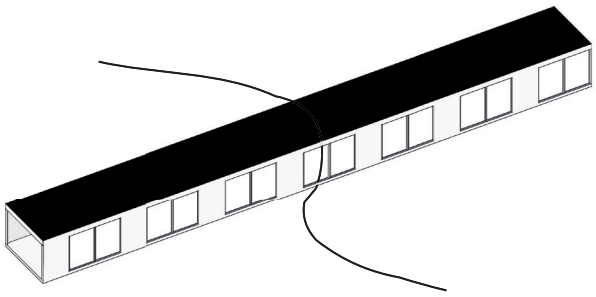
The negative consequence may be the acoustic indoor climate as the amount of glass is so high. Glass has a hard surface and, therefore, does not absorb the sound to a great extent. The next few pages will test the rest of the room's materials to ensure a comfortable acoustic and visual indoor climate.



20 % Glazing;	236 m^2
80 % Wall;	958 m^2
Heat loss	4972 W
24 hour average	21, 2 (July)
Energy Frame:	21,3 kWh/m^2 year
Daylight Average:	2,9 % daylight factor

Type 1

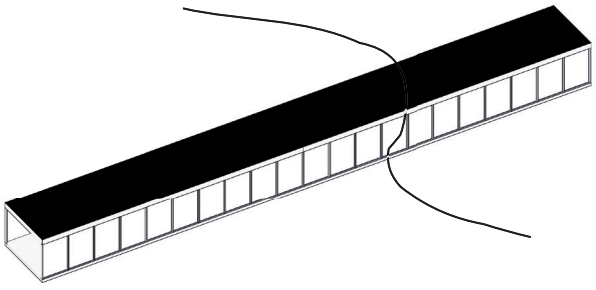
Illustration 101



30 % Glazing;	355 m^2
70 % Wall;	827 m^2
Heat loss	7526 W
24 hour average	21, 3 (July)
Energy Frame:	21,9 kWh/m^2 year
Daylight Average:	3,5 % daylight factor

Type 2

Illustration 102



40 % Glazing;	486 m^2
60 % Wall;	696 m^2
Heat loss	10886 W
24 hour average	21, 4 (July)
Energy Frame:	22,3 kWh/m^2 year
Daylight Average:	6 % daylight factor

Type 3

Illustration 103



Illustration 104

The material detailing

The absorption of different materials depends on the absorption coefficient of the individual materials. This coefficient depends on the power of Hz. Different calculations based on selected materials determine the reverberation time of the room. The purpose of ”The Walk” is to have as reasonable reverberation time as possible - neither too high nor too low. Too low can create an insulating feeling, and too high can create unnecessary noise and thus affect the comfort of the room.

The choice has fallen on **type 2**. This composition of materials creates a coherent pleasant indoor climate in terms of acoustics, indoor environment and the intent of the concept. In addition, wood as a material is significantly more sustainable concerning the material life cycle.





Floor; Concrete

Ceiling; Wood Panels

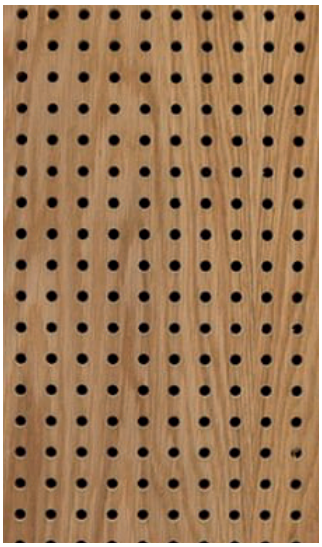
Wall; Glass

Daylight Factor; 8,2 %

Reverberation time; 0,7 s.
Average for 125-2000 Hz

Type 1
Illustration 105





Floor; Wooden floor

Ceiling; Wood Panels

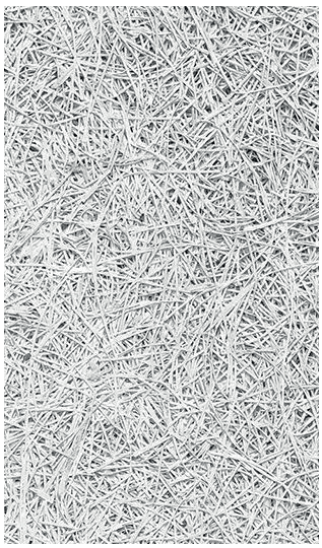
Wall; Glass

Daylight Factor; 7 %

Reverberation time; 0,55 s.
Average for 125-2000 Hz

Type 2
Illustration 106





Floor; Concrete

Ceiling; Troldtekt

Wall; Glass

Daylight Factor; 5,5 %

Reverberation time; 0,5 s.
Average for 125-2000 Hz

Type 3
Illustration 107



Illustration 108

The Ventilation Strategy

In the integrated design process, it is relevant to devise a ventilation strategy. The choice of the ventilation system and ventilation principle must be taken into account. Ventilation is an essential part of the atmospheric indoor climate and thus creates the possibility of a satisfactory result of air quality.

People's perception of the atmospheric indoor climate depends on factors such as odors, dust, gases, vapors, and relative humidity. To maintain a satisfactory indoor climate, it is necessary to supply a lot of fresh air as well as throw the "old" away. In this way, air exchange is created, which maintains a satisfactory stationary substance balance (Supply air = delivered air). It is, therefore, necessary to calculate the air change. The lighting depends on the dimensions of the room, the air quality experienced, and the sources of pollution. For "The Walk," the total air change is currently 1.35 h-1. This result can be used for the design of the ventilation pipes in the building and the overall energy demand.

In order to maintain the comfort state and the balance between the supply of fresh air and the polluted air, the ventilation system must consist of supply air and exhaust. There are two different ventilation principles, namely "displacement ventilation" and "mixing ventilation." For The Walk, **mixing ventilation** is used. This principle allows for the mixing of air throughout the room. The air is renewed and continued in line with the ventilation system's intake and exhaust. The system is also known as dilution ventilation as it continuously dilutes the air as the pollution in the room is diluted (Energi Wiki).

The heat supply has to be integrated into the design to ensure a comfortable thermal climate all year.
For The Walk, the heat supply along the windows must be used in the same fashion as the above picture illustrates. This is an elegant solution that fits in with the minimalist look.

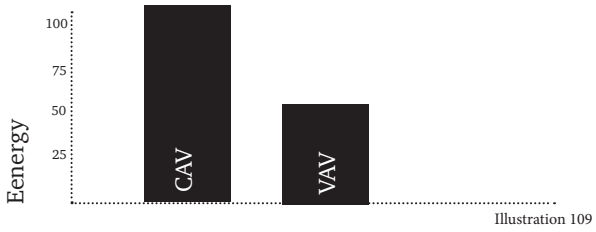


Illustration 109

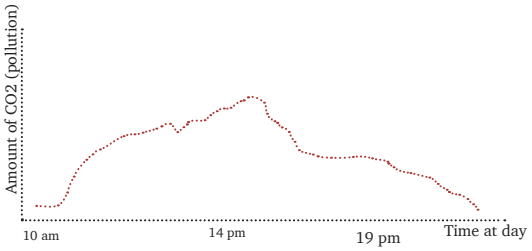


Illustration 110

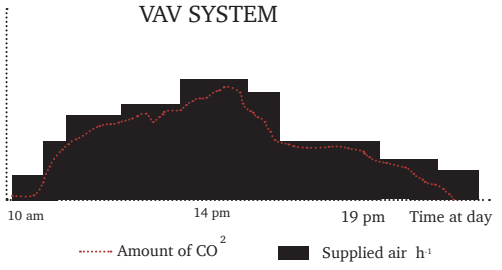


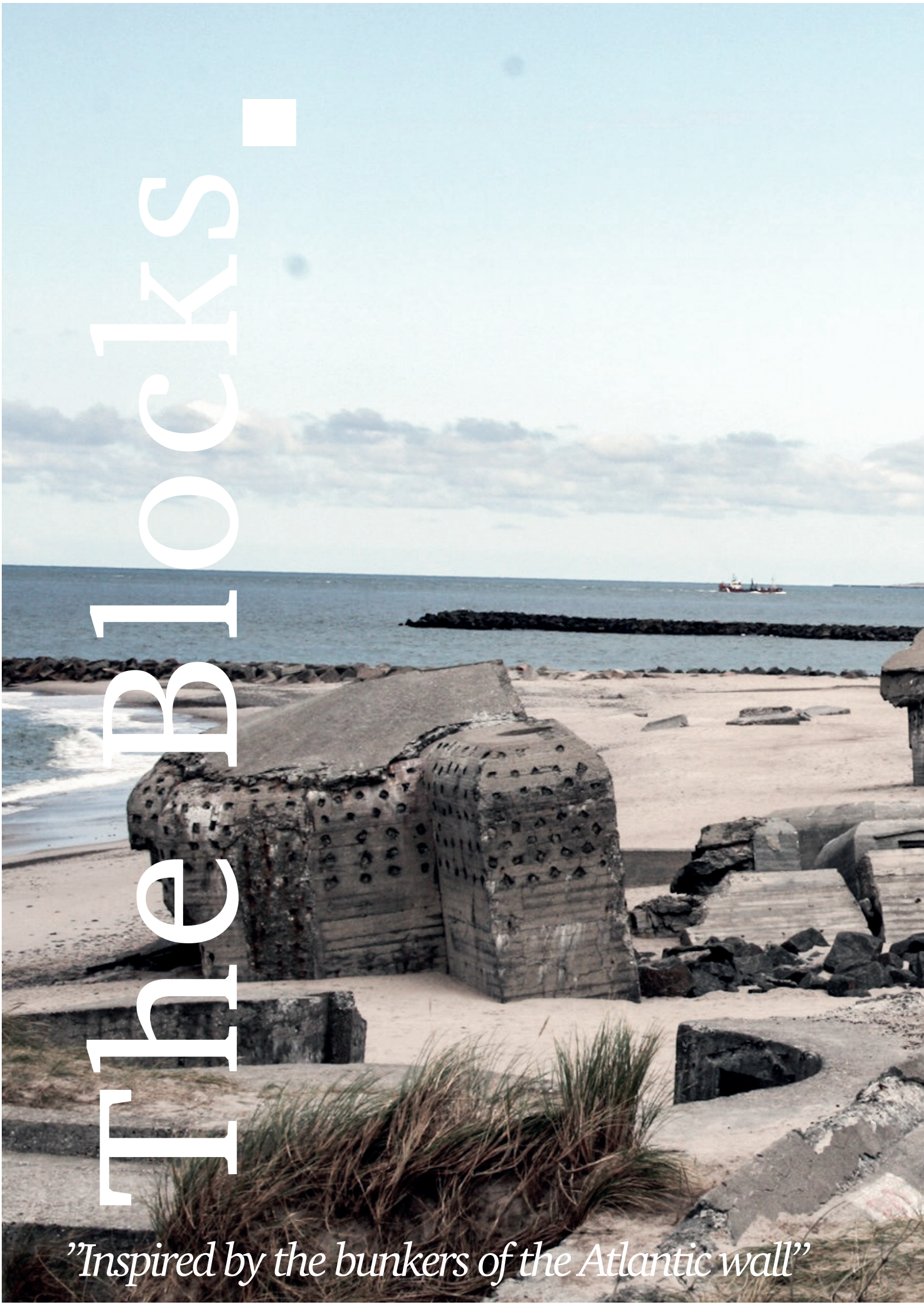
Illustration 111

The choice of ventilation system

When designing a ventilation system, there are primarily two different types; CAV and VAV. These systems have different ways of regulating the air. In a museum, it is difficult to predict the specific amount of load. The load of vapors from materials is constant, but the number of visitors varies hour by hour and day by day. This excludes the possibility of CAV (Constant air volume), as this system is most often used for uniform needs.

A VAV (Variable air volume) system can vary the air volume by 20-100%. I further adapt to the amount of load. The disadvantage of this system is more expensive installations, but as the graph on the right illustrates, the energy savings are considerably greater in length (Exhausto.dk, 2020).

The Blocks.



”Inspired by the bunkers of the Atlantic wall”



Illustration 112

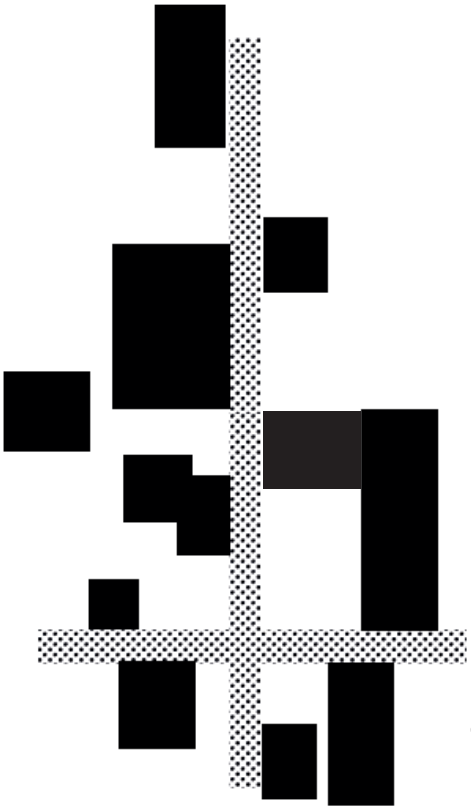


Illustration 113

The design of The Blocks

”The Blocks” is defined as the remaining part of the building. These building components are bound together by The Walk. The rooms have different functions and must, therefore, be processed differently in different ways. The overarching strategy for The Blocks is that they must act in contrast to The Walk. The bunkers of World War II must inspire them in its heaviness, repetition, and relative interrelationships. The Blocks consists of exhibition rooms, staff functions, wardrobe, auditorium, restaurant, and kitchen.

Exhibition spaces represent the thematic parts of World War II. Each component must be processed and detailed to reflect the emotions that the exhibited fate stories represents.

The feelings must arise from different sensory impressions advanced in architecture.
In addition, location, relation, and expression must be worked out so that they work best and, at the same time, create a beautiful and cohesive exterior. To ensure a comfortable and overall sustainable construction, the indoor climate and energy requirements will be examined.

The restaurant can be considered a critical space, with large external and internal loads. This space will, therefore, be analyzed, tested, and processed based on the best possible scenario, architectonic, technical, and climatic.
All of these building components and spaces will be introduced and detailed in the following chapter.



Illustration 114



Illustration 115

The design of The Blocks

Various analog and digital model studies have been conducted to investigate the design language of The Blocks. The forms have been studied based on several design criterias, including coherence, relation, dynamics, and, as a whole, and the interaction with The Walk.

One of the more important criteria is, in particular, the ability to control the amount of daylight. As a starting point, the exhibition spaces on the paper should have as little daylight as possible, in order to avoid wear on the museum materials. However, daylight plays an essential role in the perception of architecture and a necessary tool for the sensory perception of a space. The integration of daylight, therefore, has to be processed so that it only creates qualities for the rooms. This can take place in the interior design of the rooms and exhibitions, but also the incorporation of openings in the climate screen.

Skylights are an excellent tool for creating an exciting spacious atmosphere. They only contribute light without a look at the context

Therefore, one of the pervasive criteria for the design language of ”The Blocks” has been the roof slope and the inclusion of skylights. In addition, the imprint in the shapes is square, with only 90-degree angles. This contributes to more functional spaces and a better overall expression of the buildings. Based on the different shapes, the choice has fallen to **shape 10**. This shape is entirely square and simple. The decision in this form has been chosen. It is based on the requirement from local plan, the minimalistic and humble expression, their physical relation to the actual bunkers , and final, the connection with The Walk.

Foam workshop

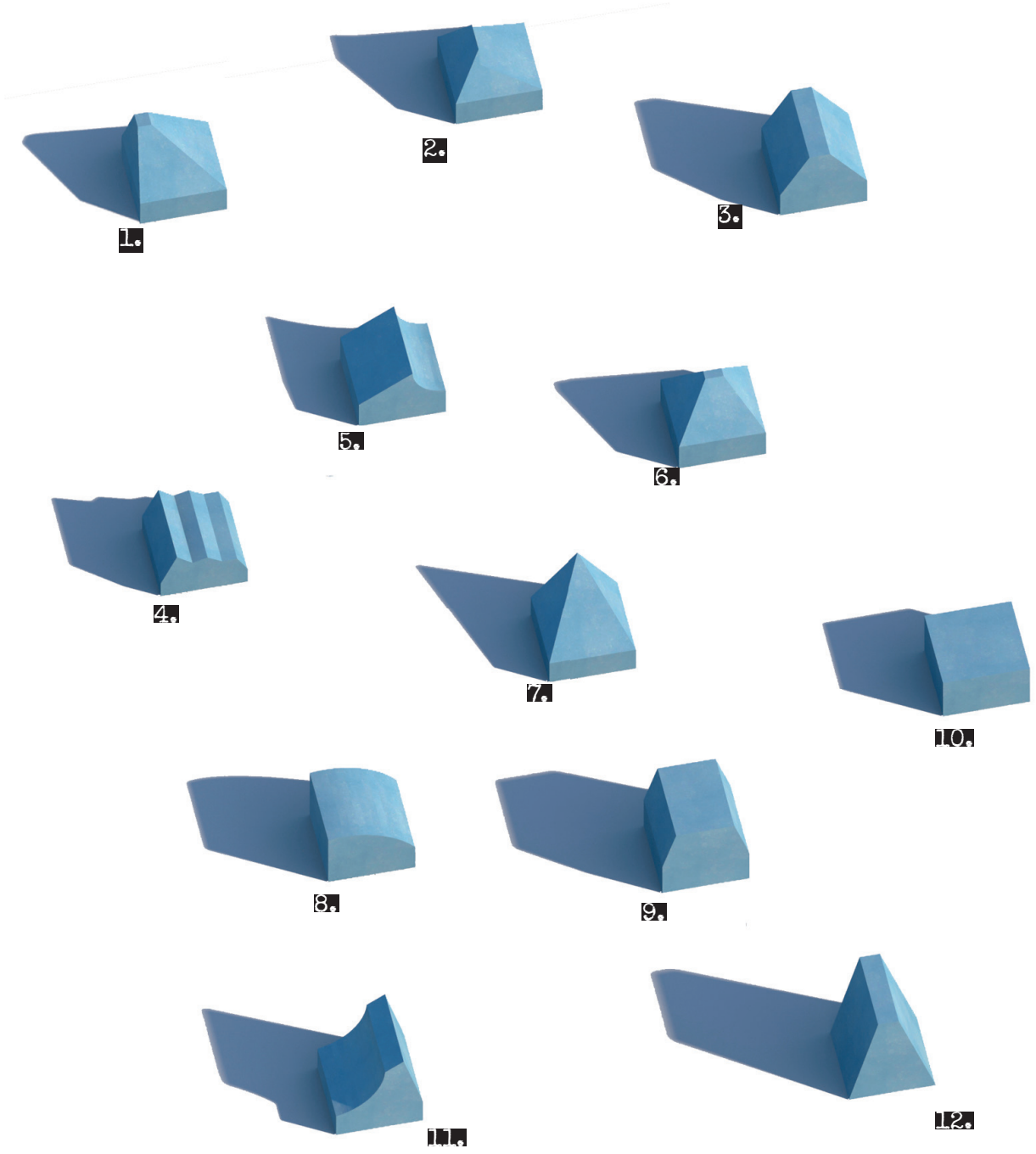


Illustration 116

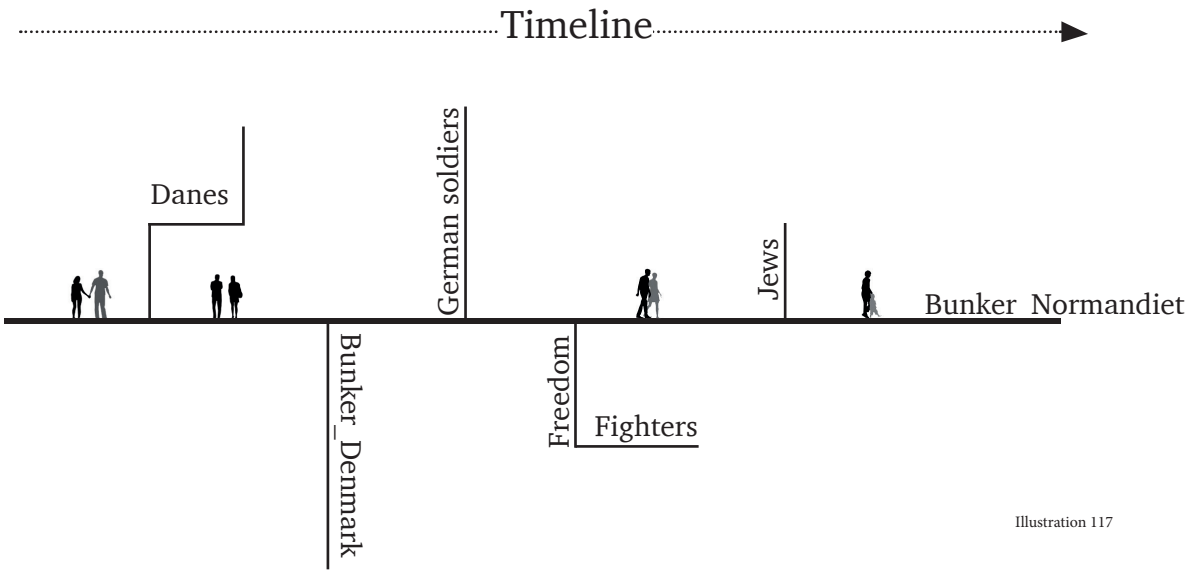


Illustration 117

Placement of fate stories

One of the museum's most important tasks is to create the right story. In this case, The story is partly World War II and its many destinies. The position and relation between these thematic narratives are therefore necessary to process. The course must start with the gentle tales, including The Danes, the occupation, and The Germans' path to power. In between is The freedom fighters to be found together with The Jews. This location is made in the attempt to create a total narrative over a time, which consisted of vastly different and dramatic events that start out mildly and ends dramatically. In addition to the exhibition spaces, the associated bunkers must illuminate various thematic events. The first bunker you encounter will represent the experience of a quiet and sometimes boring war in North Jutland. The last bunker associated with the Jews must represent the time in Normandy, thus illuminating one of the focal points of the war. This creates a narrative with insight into the many facets of the war.

Also, to the thematic context, the rooms must be positioned correctly in relation to the context and experience of The walk. It is primarily looking for nature. To the right are illustrative diagrams of this process. Diagram 1 illustrates a location that alternately looks east and west. Diagram 2 shows a less predictable look using exhibition space on The Walk. The unpredictability can help create different spacious experiences and, thus, a more dynamic course between the exhibition spaces. However, solution 2 can also create narrow paths and, therefore, a particular hassle for more significant visits. The answer in **Diagram 3** is chosen as it creates alternating views for both sides at the same time as areas characterized by look and lighting for both sides of the building.

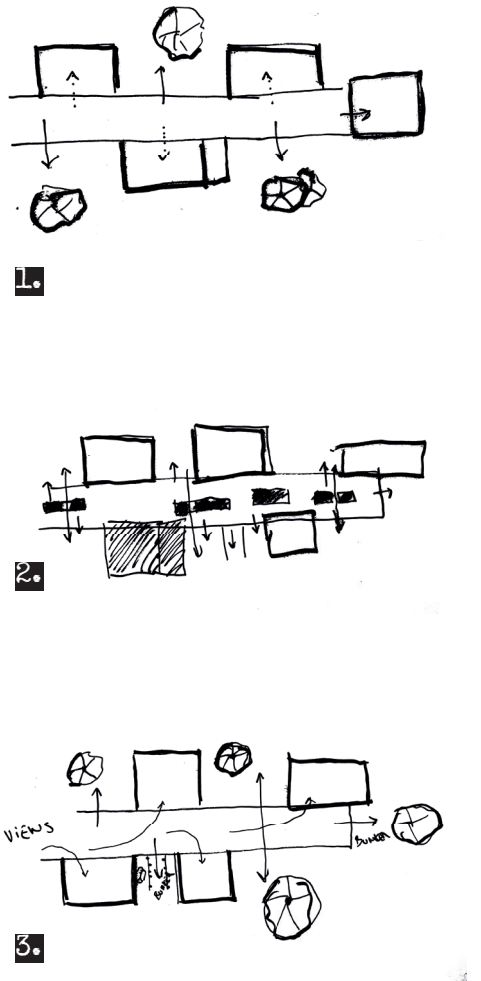


Illustration 118



Illustration 119



Illustration 120

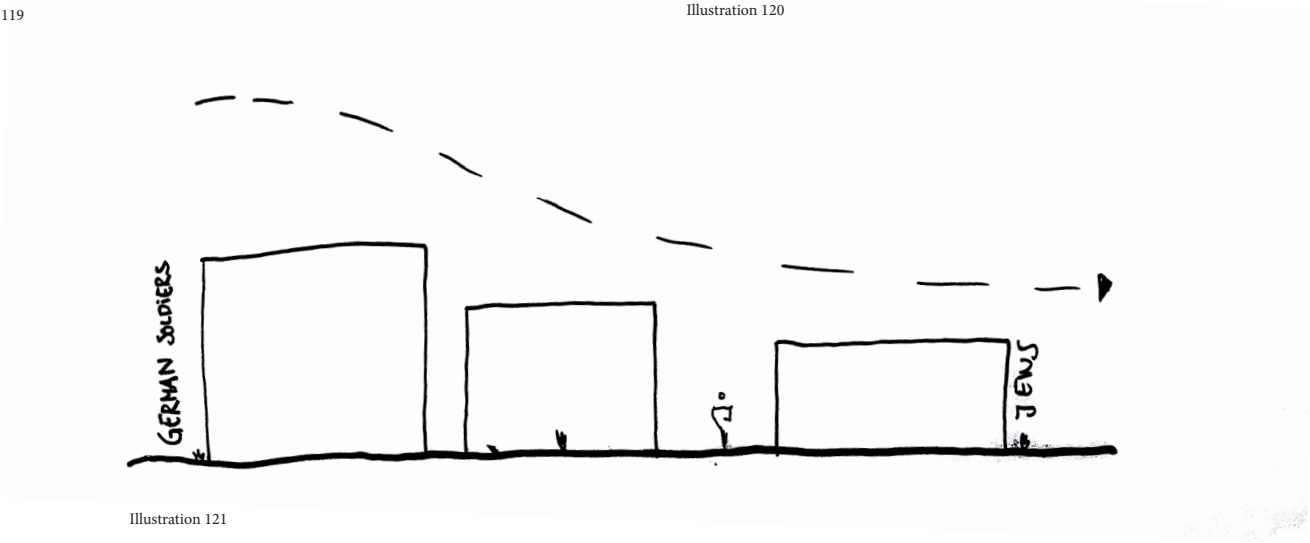


Illustration 121

Scale and functions

The expression externally may reflect very humbly what role the various exhibition spaces play in the overall building. It is not intended that the individual exhibition spaces should radiate the many emotional details of materiality, openings, etc.

All the exhibition spaces must appear simple, mysterious, coherent, and arouse curiosity for the content. Therefore, the scales of the spaces and the height must contribute to an overall dynamic composition that relates to the context and at the same time radiates the power of the spaces; from the high Block of The German soldiers to the low one to The Jews.

Daylight



Illustration 122

Daylight can cause curiosity. Where does the light come from? The light must also be used as an essential tool for fascination.

Windows

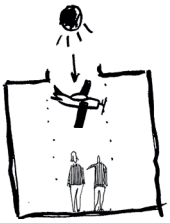


Illustration 123

A centrally located window in the arrival room should contribute to the experience of the airmen over the sky during the occupation.

Labyrinth

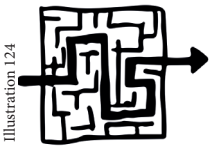


Illustration 124

A labyrinthine course should contribute to the experience of, ”when does it end,” ”where do we end up?”.

Scale

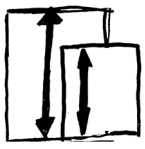


Illustration 125

A high space can create air, overview, and orientation. A lower room can create the opposite.

Temperature



Illustration 126

colder temperatures can create an unpleasant feeling and contribute to an unpleasant sensation.

Darksness



Illustration 127

The contrast between light and dark can contribute to strong sensory experience. In this case, darkness must represent dark times

The space of the danish people

Based on the program of fate narratives, the above is an architectural interpretation of architectural instruments that can force several emotions that, in this case, the Danes during World War II had to feel and experience. Various spacious images have been interpreted and analyzed in the journey towards the right design. Physical models in 1: 100 and 1:500, respectively, have been a useful tool in understanding the inclusive possibilities and the integration of the above strategies and elements.

In particular, the challenge for the design lies in the fact that the rooms must have some flexibility. The architecture, again, must act as overall aids in staging the narrative that the later exhibition team must process. However, overall elements can be included, so that it does not limit the future possibilities of the room.

Furthermore, as an architect, I must set the overall framework for courses, indoor climate, etc. The path of the exhibition must be both exploration and some guidance. In addition, this course must have an overall structure in the narrative. Therefore, elements are used for an overarching course and story for the exhibition. In this case, the tour starts with an illumination of the occupation on April 9. This part must have room for discovery and exploration. The next part is to highlight the uncertainty that arose during the takeover of power. The Danes feared where this should be honored and were partly characterized by anxiety.
Further on, the fascination for the force and the soldiers arises. The facility contributes to the many crushes that took place between Danish women and German soldiers. The last part of the process must shed light on the liberation and the uncertain, but somewhat brighter future.



Illustration 128



Illustration 129

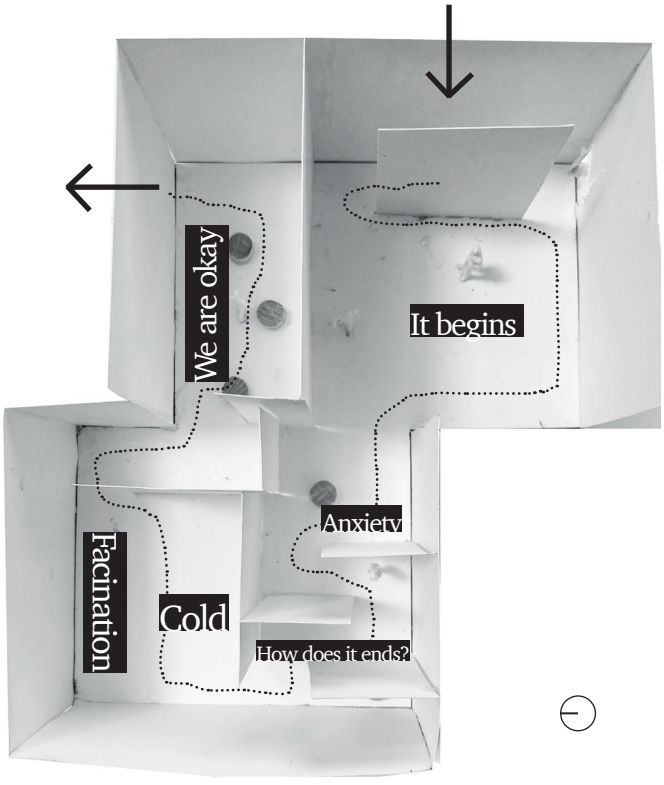


Illustration 130



Illustration 131

Daylight

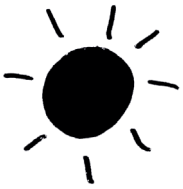


Illustration 132

The sun must act as a point of interest. From the first floor, it should shine like a mighty power, which should appear attractive and comfortable.

Levels

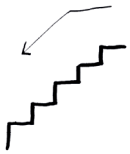


Illustration 133

The stairs should illustrate the decline of the Germans and give the observant an experience of the downturn.

Height



Illustration 134

Increased room height should emphasize an experience of emptiness.

Temperature



Illustration 135

Temperature can help create the cold and the feeling of uncomfortable.

Transparency



Illustration 136

To illuminate the superiority and feeling of Germans being better than other individuals, the floor is made of glass in a simple place.

Darksness



Illustration 137

Darkness must illustrate the downturn and uncertainty as well as emptiness.

The space of The German soldiers

In the process of creating the exhibition room, it was relevant to illuminate some of the periods the German soldiers and the Nazis, were a part of. Above are some of the architectural initiatives that will create these moods and emotions. The rooms must have a historical timeline. The rooms must illuminate both the beginning, the greatness, and the downtime of the Nazis.
The beginning was marked by the fact that especially naive young people were fascinated by the confidence and energy they held. However, the Nazis were increasingly cold-blooded and possessed of power.

The vision is to use daylight as an attraction in various combinations. Centered in the room stands a monumental, sculptural, and majestic staircase. The stairs look attractive and are lit in an otherwise dark room. The materials must be cold, heavy, and fascinating.

When you climb the stairs, you are in the heyday. Here, there is a temperature comfortably, a plentiful amount of daylight, and an exciting overview.

On the ground floor, a staircase leads down to the German downpour. This staircase is narrow, high, and long. Above, you can see silhouettes that are on the first floor during the heyday. This transparency symbolizes the superiority of the Germans.
When you are in this room, you feel inferior. The stairs lead you underground. At the end of the stairs, it gets cold, empty, and dark. This space represents the end and their loss of the war.

This exhibition must, therefore, represent all the feelings and periods that the Nazis and Germans underwent during World War II.

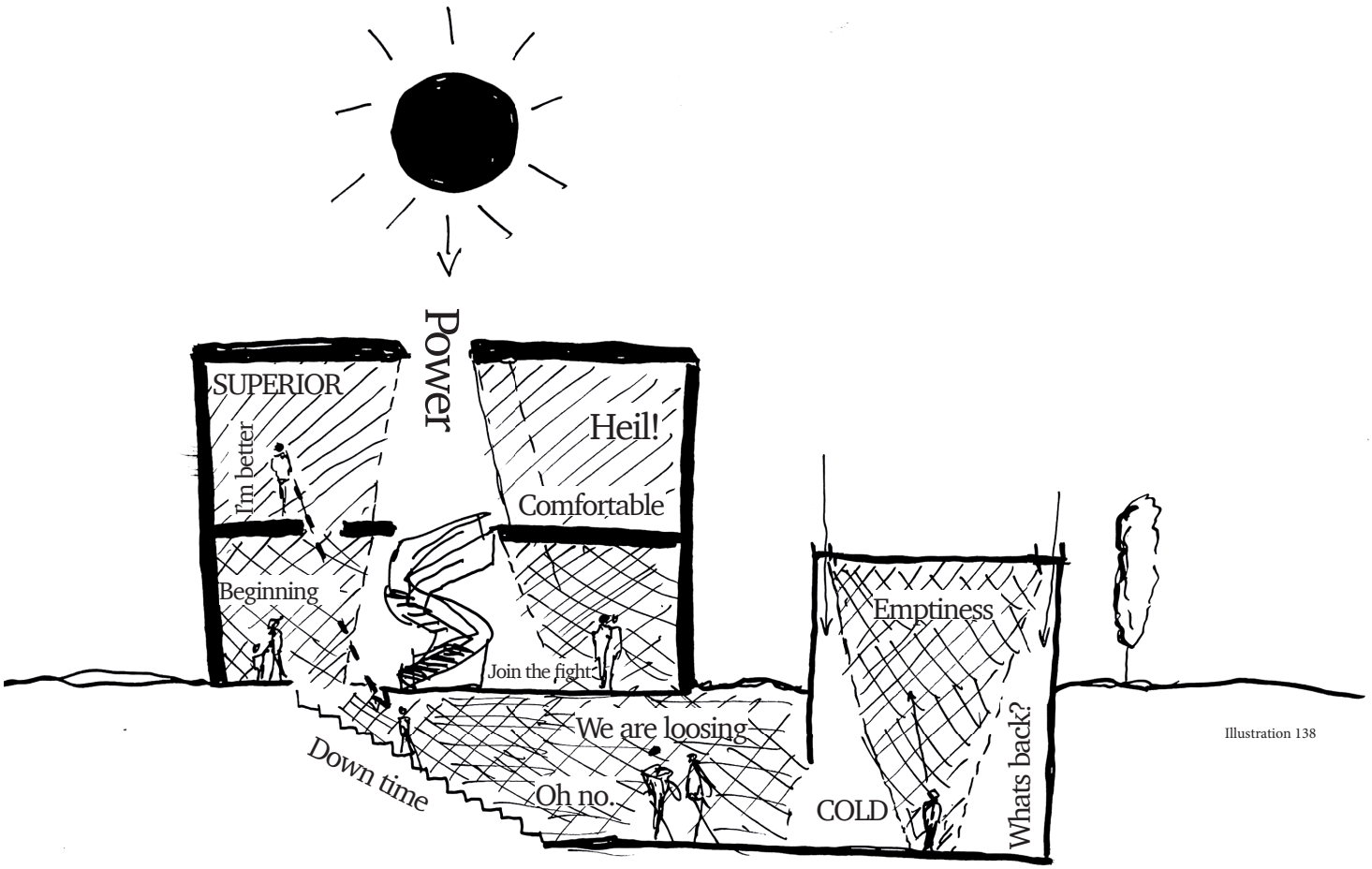
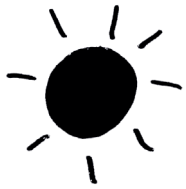


Illustration 138

Sketching the story

Daylight

Illustration 139



Small cracks of daylight must represent hope. The darker the room, the less hope.

Narrow

Illustration 140



Narrow spaces must represent the claustrophobia they may suffer.

Height

Illustration 141



High spaces must help to represent emptiness and inferiority.

Temperature

Illustration 142



Temperatures can help create both comfortable climates but also uncomfortable.

Levels

Illustration 143



Ramps with downward slope must represent the uncertainty and experience of a periodic downturn.

Forced

Illustration 144



Moving down a ramp can force one to follow that route. This solution must represent powerlessness and coercion.

The space of The Jews

In the preparation of the exhibition spaces for the Jews, a significant focus is placed on the tragic fate 10 million Jews had. The focus may be on their lives before the war, with all the privileges they had. To represent this part of the exhibition, the exhibition space starts open, bright, and comfortable. Around the corner is a crack of daylight. This crack leads the viewer through the period from the occupation onwards.

Here, the journey begins through narrow, high spaces, which slowly have a declining rise. As space becomes tighter, colder, and deeper, their fate becomes more and more tragic. The narrow courses have a labyrinthine path that represents the uncertain Jews. Halfway through, a cold void occurs. This void is cold, dark, and contains the exhibition for the concentration camps.

The narrow course continues and ends out small and high. The opening is now underground, and the encounter with one of the bunkers occurs.

In continuation of this space is the monument to the deceased Jews. This room should represent all the lost Danish Jews that took place. The space must commemorate the deceased and provide a basis for a new beginning.

Skylights represent new hope. The light flows down the tree, which stands planted in ash on the floor. This natural life represents hope for a brighter future.

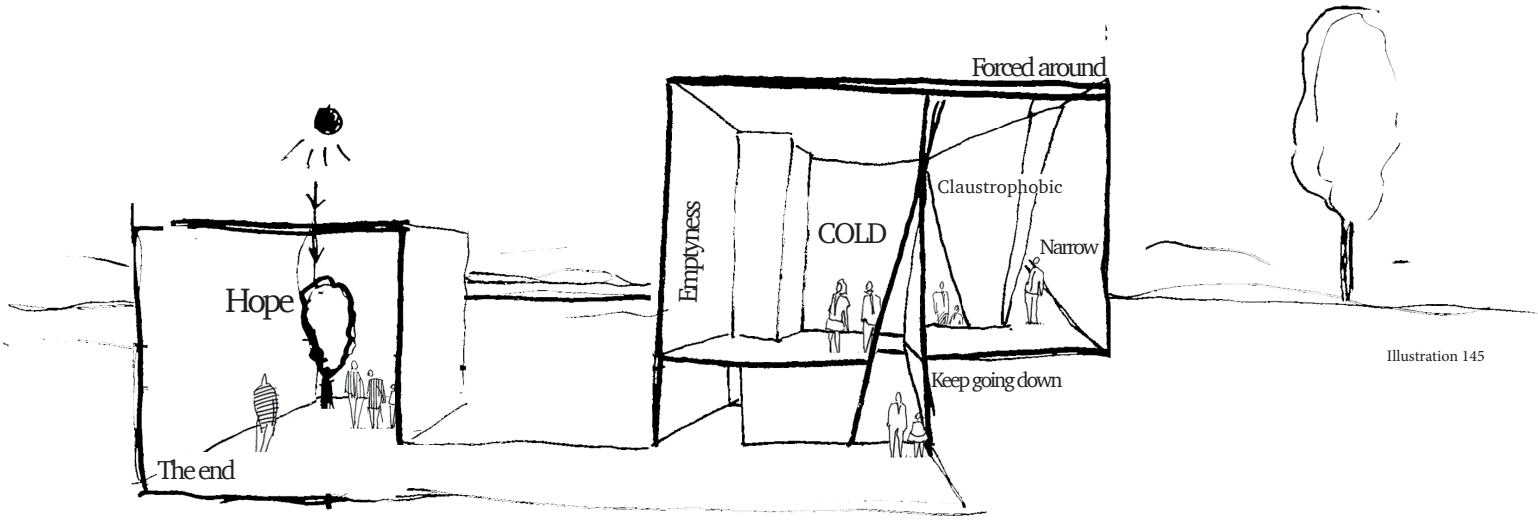
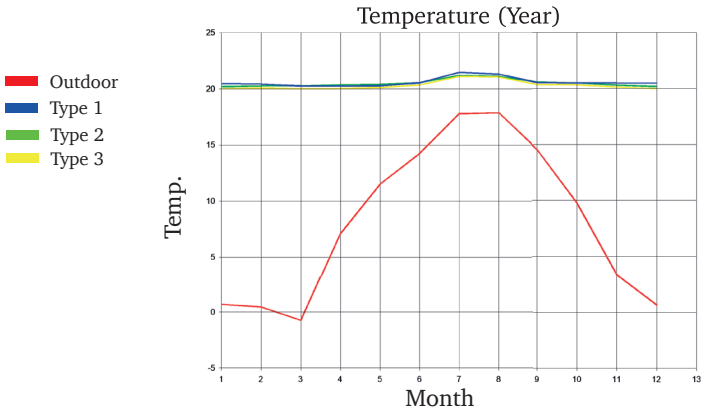
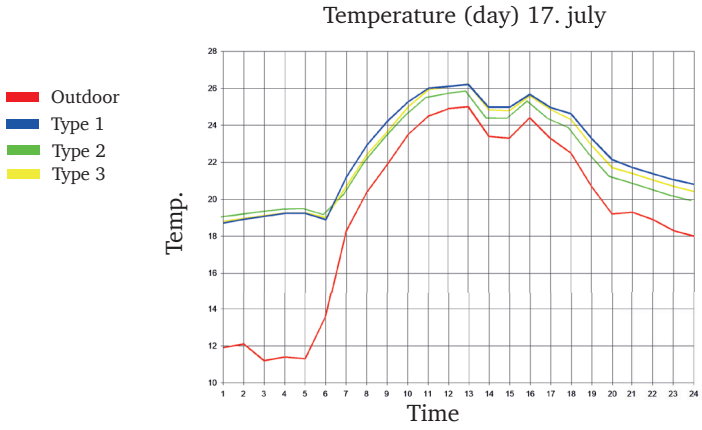
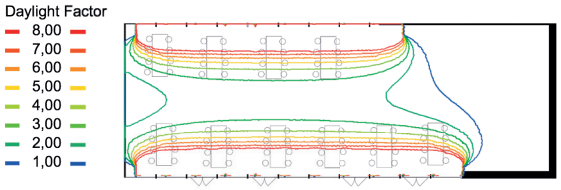


Illustration 145

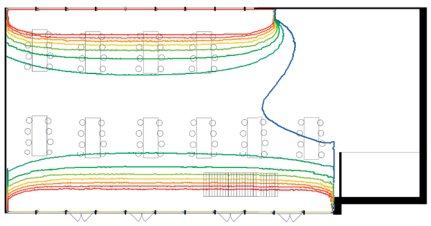
Sketching the story



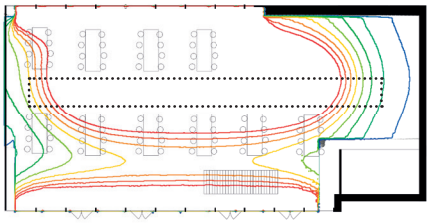




Type 1



Type 2



Type 3

Illustration 146

The Restaurante

As mentioned earlier in the section, the restaurant is considered one of the critical spaces in the overall development. It is critical because of its large internal and external loads. To ensure a comfortable indoor climate, the restaurant has been analyzed, detailed, and processed.

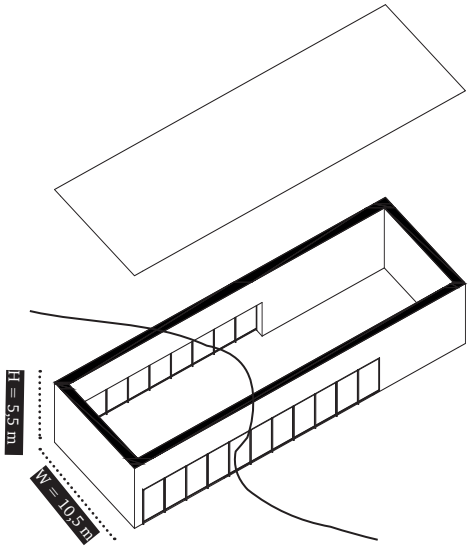
As the next page illustrates, the restaurant has evolved from type 1 to 2 and then to **type 3.** The architectural intention of the restaurant is to have a well-lit living room, with ample opportunity for a view of the fantastic nature and ocean.

Type 1 is developed based on the overall expression, the desired square meters, functionality, and indoor climate. The space is dimensioned from the outside, to ensure natural ventilation as an excellent sustainable alternative for cooling in the summer months. The number of glass in type 1 has previously been analyzed in BSIM to ensure the proper comfort level in the room.

The excellent view associated with the restaurant is split by the arrival road (Bakkevej). Type 2 has been developed to create a completely, utterly, and fantastic outdoor space for the restaurant—type 2 braids ”The Walk” around the front of the building. The room is thus extended by 4 meters and with an increased ceiling height of 2 meters.

This increased volume of space creates a better thermal indoor climate, as shown on the above graphs 37 hours above 26 degrees and only 7 hours above 27 degrees.

Finally, skylights integrate into a better visual indoor climate with a better daylight factor. This implementation of an opening in the roof creates a higher level 3 of solar heat. But by using calculation and analysis, the indoor climate consistently adheres to a maximum of 100 hours above 26 degrees and 25 hours above 27 degrees Celsius, which is also due to the increased opportunity for stack-ventilation.

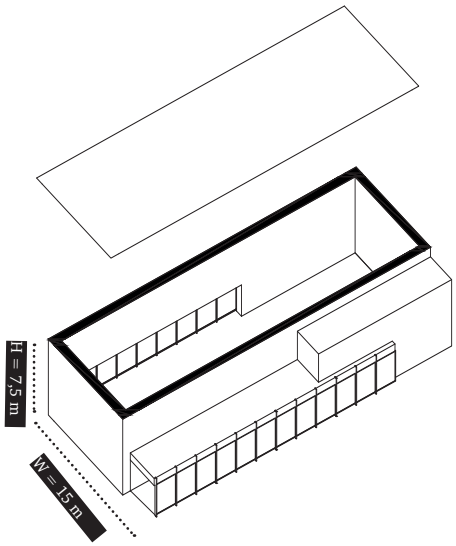


Type 1

Natural ventilation / Cross ventilation W<5 x H = 10.5 < 26

Hours above 26	118 hours
Hours above 27	52 hours
Energy Frame:	23,5 kWh/m^{2}year
Daylight Average:	4,9 % daylight factor

Illustration 147

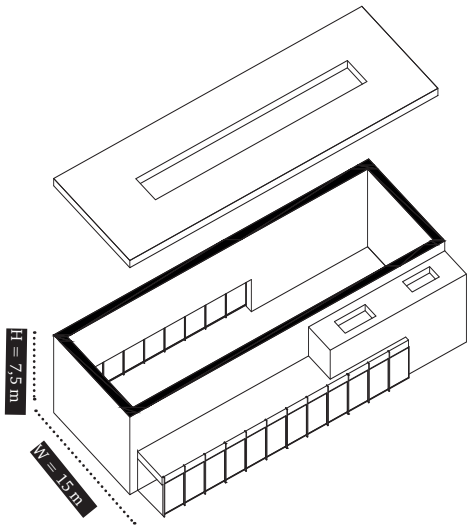


Type 2

Natural ventilation / Cross ventilation W<5 x H = 15 < 37,5

Hours above 26	37 hours
Hours above 27	7 hours
Energy Frame:	23,5 kWh/m year
Daylight Average:	3,9 % daylight factor

Illustration 148



Type 3

Natural ventilation / Combined (stack + cross)

Hours above 26	70 hours
Hours above 27	25 hours
Energy Frame:	24,2 kWh/m year
Daylight Average:	10 % daylight factor

Illustration 149

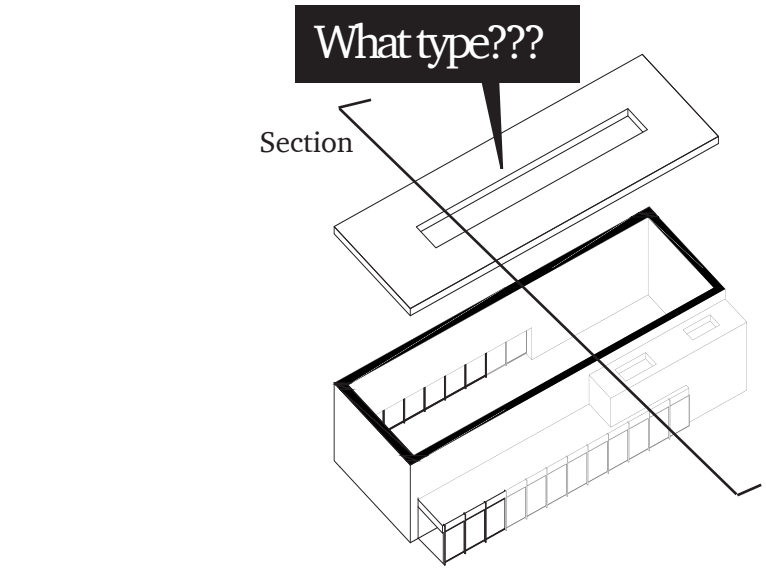
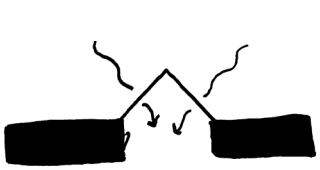
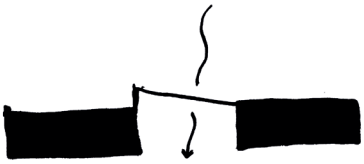


Illustration 150



Type 1



Type 2

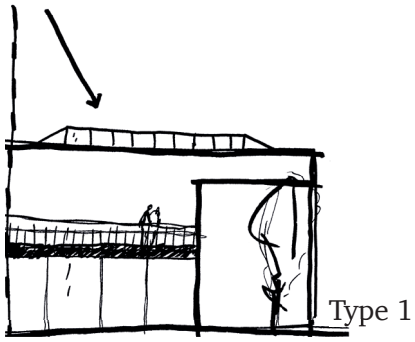
Hours above 26	61 hours	Hours above 26	68 hours
Hours above 27	17 hours	Hours above 27	21 hours
Daylight Average:	9,1 % daylight factor	Daylight Average:	9,8 % daylight factor

Detailing of the opening

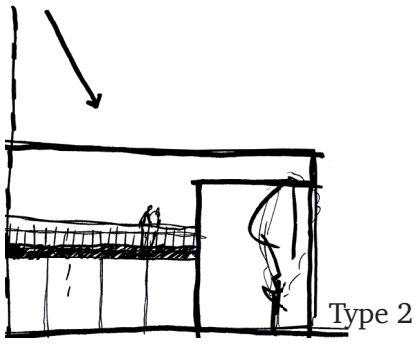
In further detail, two different types of solutions to the skylight are examined and studied. The angle of the window is decisive for how much solar heat is transferred to the indoor climate, as well as the amount of daylight to the room.

Therefore, for both types, the thermal and visual indoor climate is investigated. The result for both models is relatively close to each other. However, the choice must also be made based on the spacious experience and the aesthetic. The choice falls on **type 2**, as this solution matches the minimalist expression. Also, the window cannot be seen from below, thereby supporting the cubic expression of the settlement.

Finally, a simplified part of the overall design process of the restaurant is shown on the next page.



Type 1



Type 2

Illustration 151

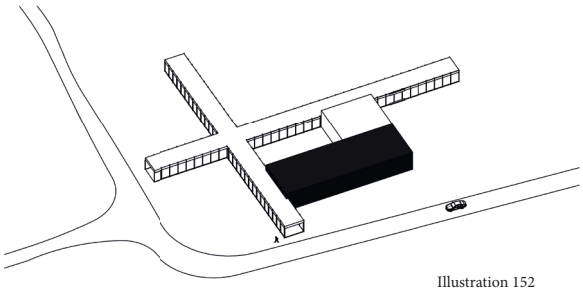


Illustration 152

Volume

The volume of the restaurant is determined based on the context, needs, and size.

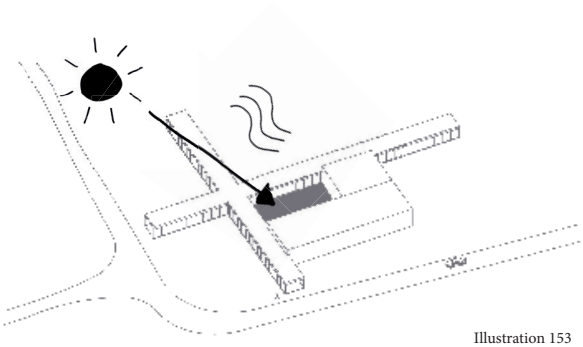


Illustration 153

Outdoor area

The volume further creates an outdoor shelter for the dominant west wind in the area and with ample opportunity for daylight. See Appendix.

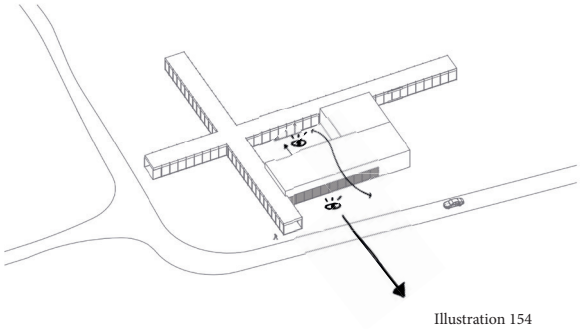


Illustration 154

Indoor climate

In order to create the best relationship with the site, based on the existing bunkers, parking and the view towards the ocean, transpaency and windows have been formed for the development.

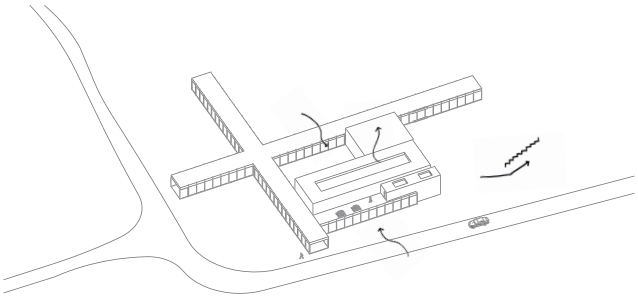


Illustration 155

Optimized

Based on the details regarding atmospheric, visual and thermal comfort on the previous pages, the restaurant is optimized for the following.



Illustration 156

The Facade

The many Regelbau bunkers that were constructed during World War II are all constructed of form worked concrete. Formwork is a method of shaping the concrete from a specific shape that can withstand the pressure that arises during the process. Most of the bunker was molded in the shape of horizontal wooden boards.

The wood structure has left its clear imprint in the cast concrete, and despite the hard and homogeneous material, the impression forms a dynamic and charismatic expression.
This term and method are very characteristic of the bunker's appearance. Therefore, different patterns are interpreted and challenged to study the potential of the upcoming facades of The Blocks. Some of the newly interpreted versions are shown in the illustration on the next page.



Illustration 157



Illustration 158



Illustration 159



Illustration 160



Illustration 161



Illustration 162

Facade studios

In order to create a single and aesthetic facade related to the bunkers in the area, nine different interventions have been studied. Common to all nine is the material. Formwork of horizontal and vertical wooden planks cast in the concrete with different colors, depth, and size has been tested. In addition, the combination with another material has been introduced - including mirrors and wooden slats.

In this process, it has been important to examine the formwork visually, to ensure a certain quality of the facade. A facade formulated concrete can radiate, dull, cheap, and industrial - therefore, the challenge was to create a simple and minimalist facade of high quality.

The final choice has fallen to **solution 6**. This solution is not in the formwork of concrete, but rather larger sheets from Cembrit. The panels are on a scale that represents a less monumental expression along the facade. The plates are rectangular in a vertical position. This emphasizes the verticality of the building. The boards are complemented by vertical wooden slats, which create an elegant relationship with The Walk. In addition, slats create small breaks, which at all creates a more dynamic facade. Overall, The Blocks will appear clean, individual, and of high quality that creates a different and exciting overall development.



Illustration 163



Illustration 164

New vs old?

To preserve and ensure parts of the place's authenticity and from the past, the farmhouse is integrated into the new building. The house stood there before the war entered and stands there as ticket sales today. The house gets new features and requirements, which means that the house is being renovated. However, the shape and materials are retained. When new construction is to meet an old one, it must be done with the utmost respect and with the best imaginable opportunity to stage the gold of the past.

On the next page, the measures taken by the house are illustrated to create the best connection to the new building and its new spacious features.

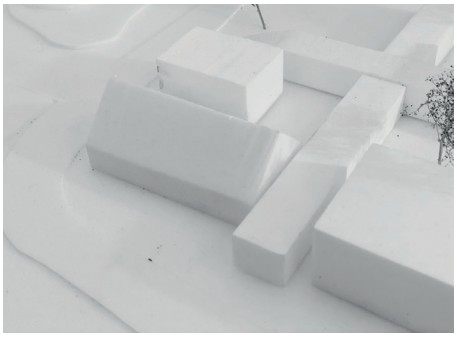


Illustration 165



Illustration 166

Simmilar openings

To ensure the right relationship between the farmhouse and the new museum, the openings in the buildings are the same, shape, materiality, and size.

Keep up the scale

In order to create the right respect and relation to the courtyard, the new building is on a scale that relates to the old one.

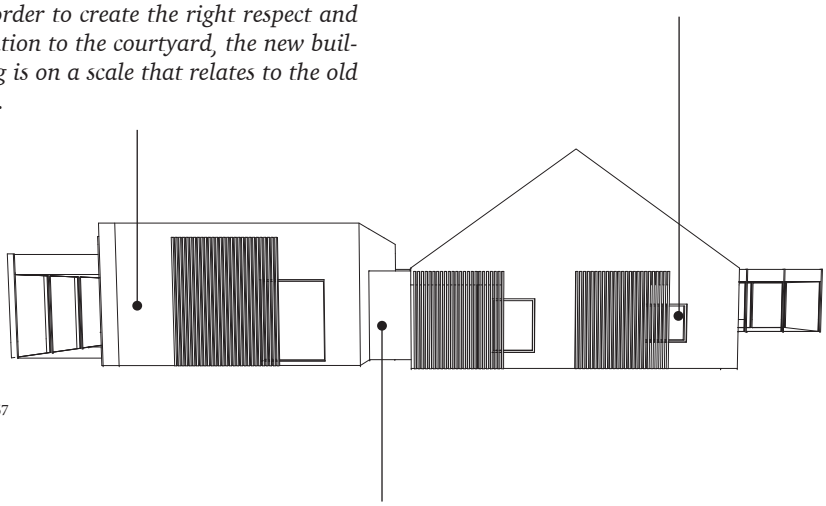


Illustration 167

Glassy connection

In meeting the old building, it is worth supporting the building's earlier independence and thereby creating a transparent coupling. A glass box connects the new with the old.

Connecting to The Walk

The farmhouse connects elegantly and efficiently to The Walk. It creates the same relation to the house as the museum's further development.

Adding wooden details

To create a relation to the remaining part of the building, details are added to the facade. Including External shading of wooden lamellas to ensure a comfortable indoor environment.

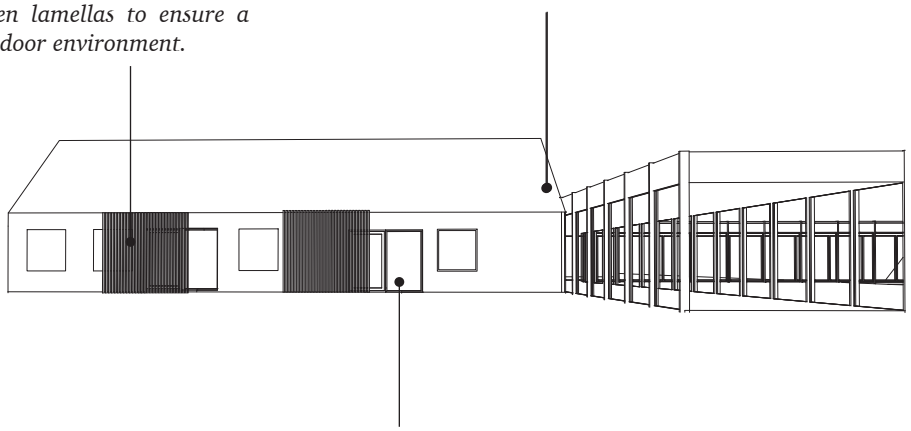


Illustration 168

New windows and doors

To ensure a building with a satisfactory indoor climate, the house is renovated, and new low-energy windows with significantly less transmission loss are added. Besides, the house has new features and functions that require multiple openings.


The Bunkers
”Experience the reality of the bunkers”



Illustration 169



Illustration 170

Emphazise the bunkers

”The Bunkers” represent the allready existing and historical bunkers on the site. In the next section, the detail of the two bunkers’ furthest to the south will be based. Common to all bunkers in the area is that they are 3-4 meters underground. The associated new building must, therefore, embrace the basement bunkers.

This excavation will result in less authority for the area, but in return, the new building will be able to be staged and embraced in the piles with the greatest possible respect.

There is not one of the 80 bunkers in the area that illustrates the bunkers’ full understanding. Both of its construction, materiality, surface, and monumentality. Which is why I think it will be an obvious choice for such a bunker museum. From a technical point of view, this area of the building thus requires a completely different approach and processing of indoor climate and various sustainable initiatives.
Therefore, the forthcoming section will shed light on how I incorporate various architectural aspects in order to make the design and building as sustainable, aesthetic and functional as possible with the focal point of the exhibition potential this entails.

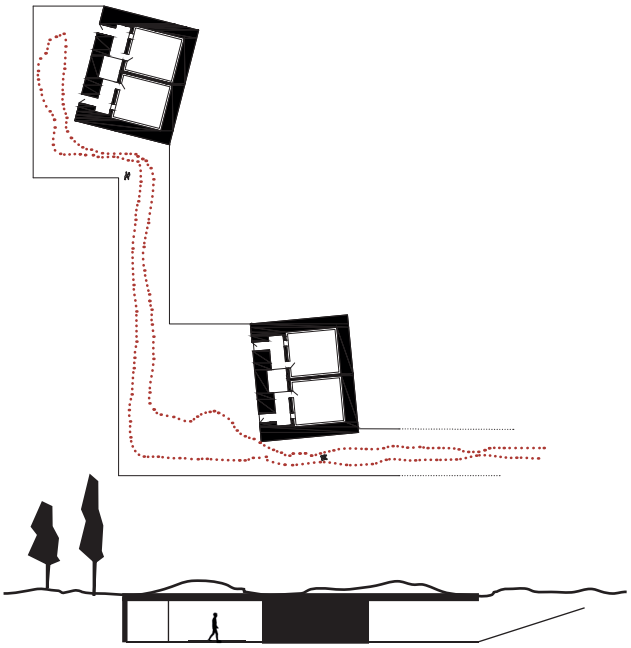


Illustration 171

1.

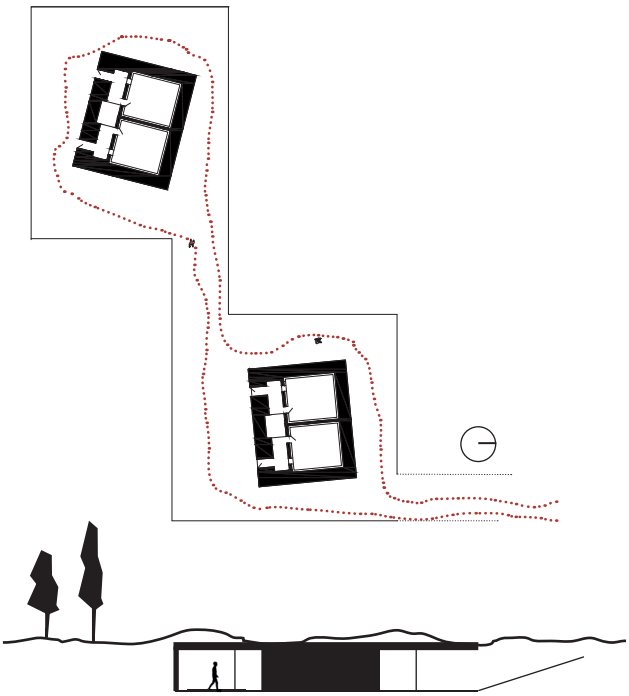


Illustration 172

2.

The flow

One of the important points for the museum is that it has a relatively simple and well-organized exhibition. The Walk greatly helps to create the various options in the house and thus also the opportunity to explore. In general, the exhibitions must also contain some form of thematic process, such as the preparation of the exhibition spaces for the four fate stories.

Above are two different principles of flow. Diagram 1 illustrates a non-circular flow that forces the viewer to experience the exhibition two grays. Whereas diagram 2 creates a circular flow. The flow allows you to see and experience new things while not creating too much traffic in opposite directions. In addition, it gives full insight into the mass, shape, and weight of the bunker.

In the following two pages, I will analyze the best possible solution of the indoor climate, including the thermal and visual, as well as its importance for the overall energy needs of the building. This is done based on **diagram 2**- the circular flow.
Based on the results, I will choose the best conceivable solution that meets the requirements but also utilizes the sustainable principles that may be found.

Natural ventilation / SINGLE SIDED

Hours above 26	189 hours
Hours above 27	150 hours
Energy Frame:	33,9 kWh/m^{2}year
Overtemperatures:	14,8

In this solution, a three-meter-wide shaft is dug around the south and east facades. In this way, natural light is created as well as the opportunity for single-sided ventilation. This solution contains such a large amount of glass that, despite solar heat, creates a large transmission loss and overtemperature.

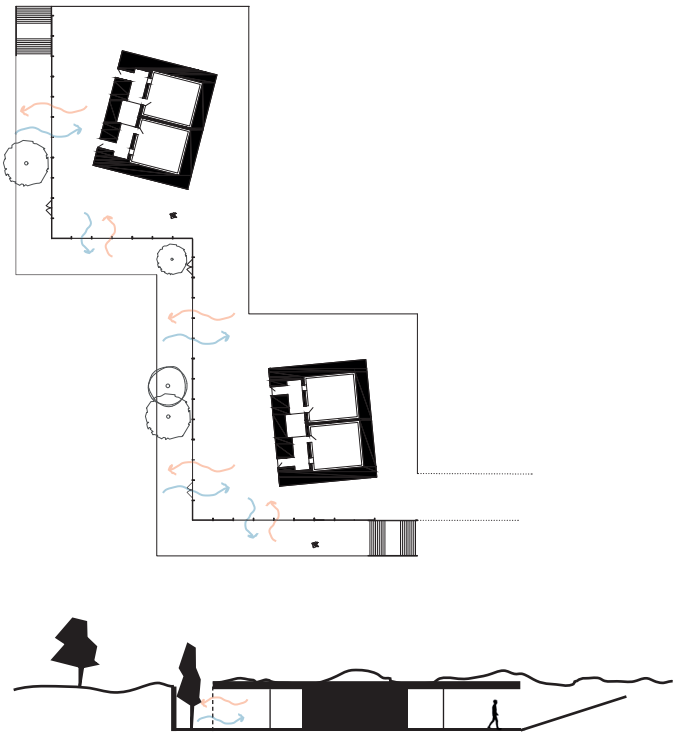


Illustration 173

Natural ventilation / Cross ventilation + single sided

Hours above 26	105 hours
Hours above 27	64 hours
Energy Frame:	32,1 kWh/m^{2}year
Overtemperatures:	13.0

For this solution, the amount of glass is reduced and added to the north. At the same time, it creates a larger excavated area with more direct lighting and the possibility of both cross- and single-sided ventilation. This solution still holds too high demands on energy requirements and, at the same time, overlaps the exhibition possibilities, as most museum objects cannot withstand direct daylight.

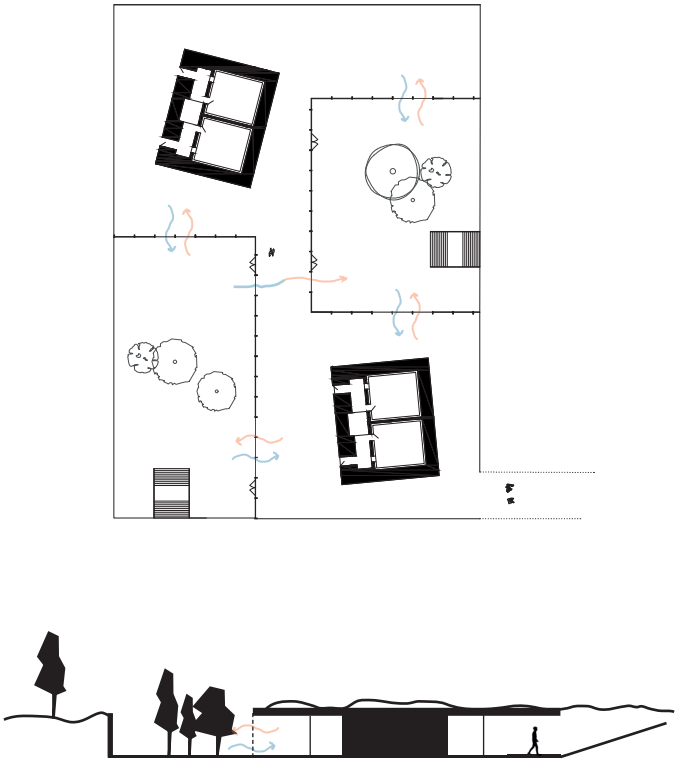


Illustration 174

Natural ventilation / Stack ventilation

Hours above 26	45 hours
Hours above 27	19 hours
Energy Frame:	24,2 kWh/m^{2}year
Overtemperatures:	3,2

To accommodate energy and limiting direct daylight, skylights are integrated around the piles. These skylights create a minimal footprint on the surface of the site and reduce the high transmission loss.

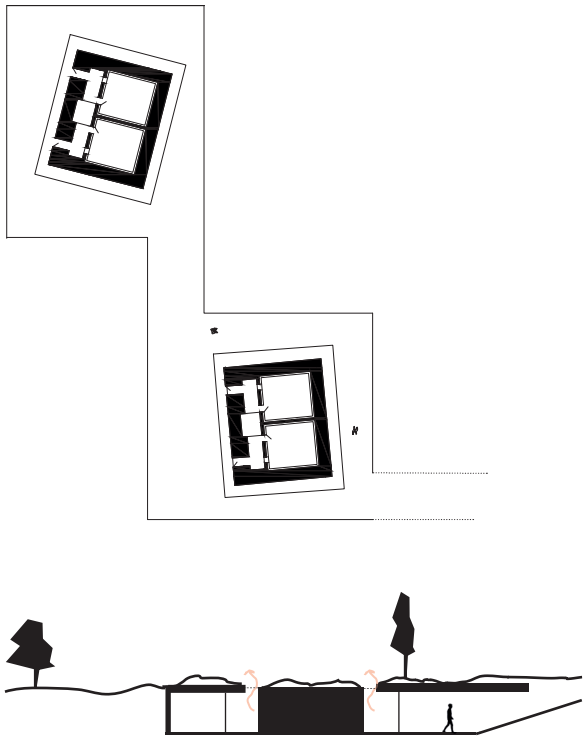


Illustration 175

Natural ventilation / Stack ventilation (Combined)

Hours above 26	38 hours
Hours above 27	17 hours
Energy Frame:	23,9 kWh/m^{2}year
Overtemperatures:	0,0

The final and chosen solution consists of skylights, like the type above. In addition, small outdoor courtyards are integrated. These allow for Stack ventilation and allow for some breathing room and some daylight in the rooms. Also, this solution creates the best further starting point for energy and indoor climate.

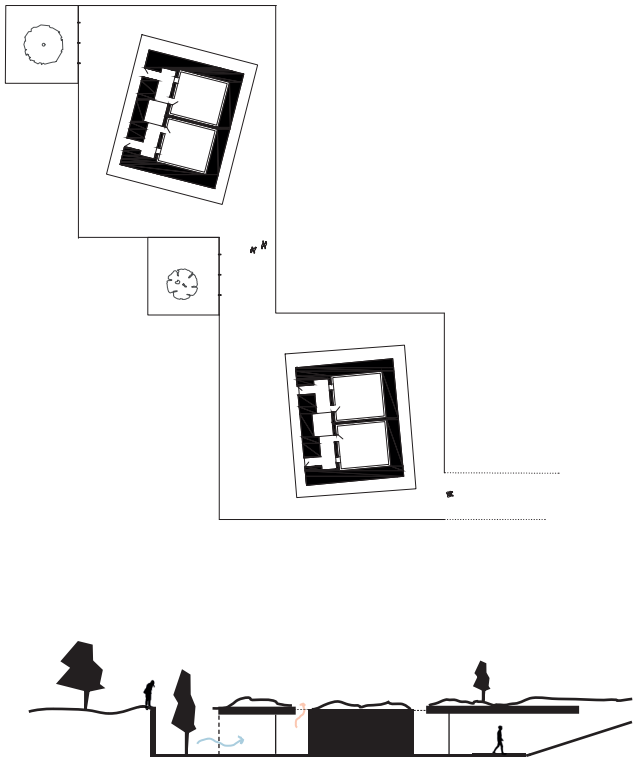


Illustration 176



Illustration 177

Daylight analysis

Based on the studies on the previous pages, the picture above illustrates how the space is intended. The daylight against the bunker creates a staging light that focuses on the bunker's surfaces, details, and grandeur. Direct daylight is however as earlier described harmful to museum objects. In addition, a darker atmosphere is desired that enhances the experience of being underground.
Therefore, I need to investigate and study the amount of direct daylight so that we secure space with the desired options and qualities.

The next page shows analyze of the amount of daylight based on four different sizes of the opening. The final size is **type 1**. The type has a sufficiently large amount of light along with the opening. At the same time the solution also accommodates the adjustable amount of daylight in the other part of the room as desired.

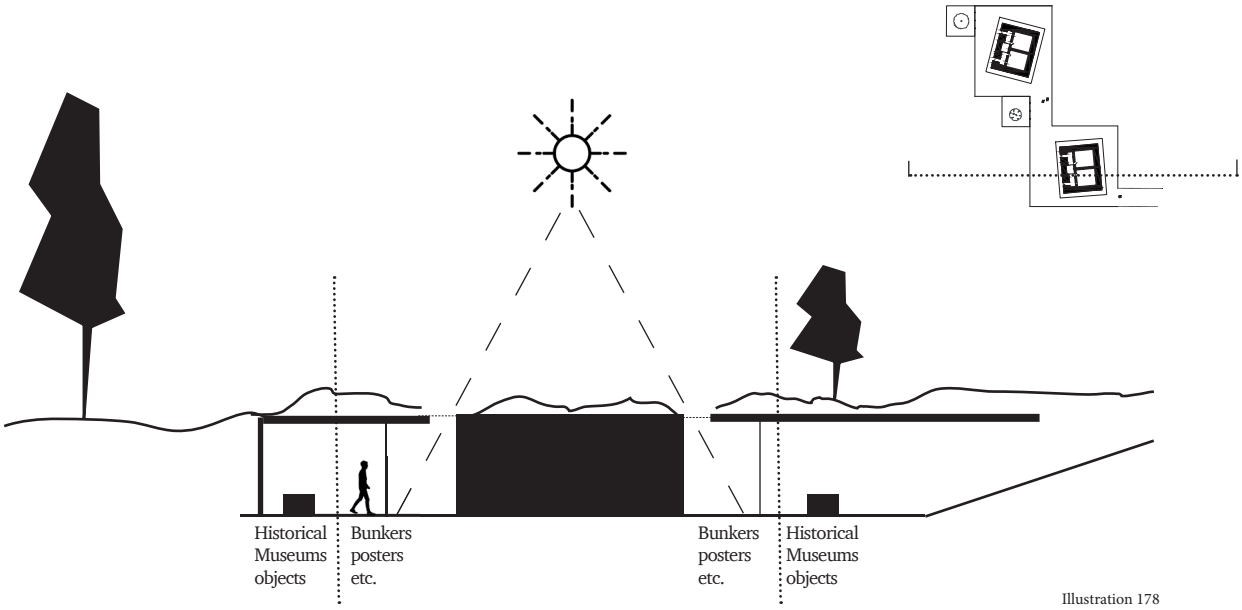
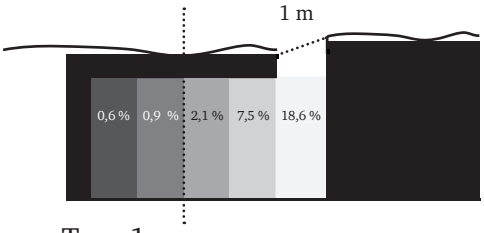


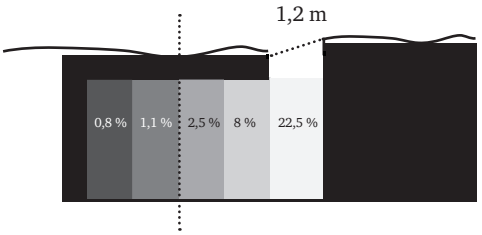
Illustration 178

Daylight analysis



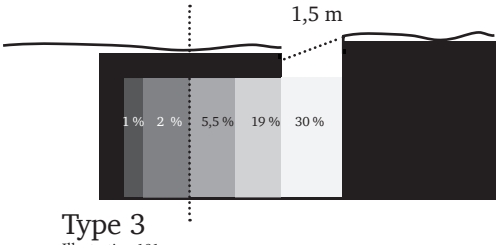
Type 1

Illustration 179



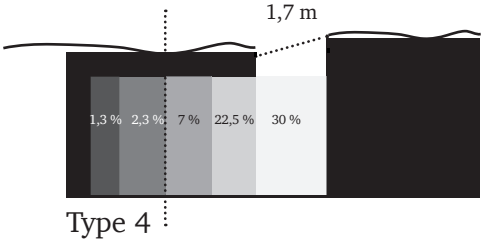
Type 2

Illustration 180



Type 3

Illustration 181



Type 4

Illustration 182



Illustration 183

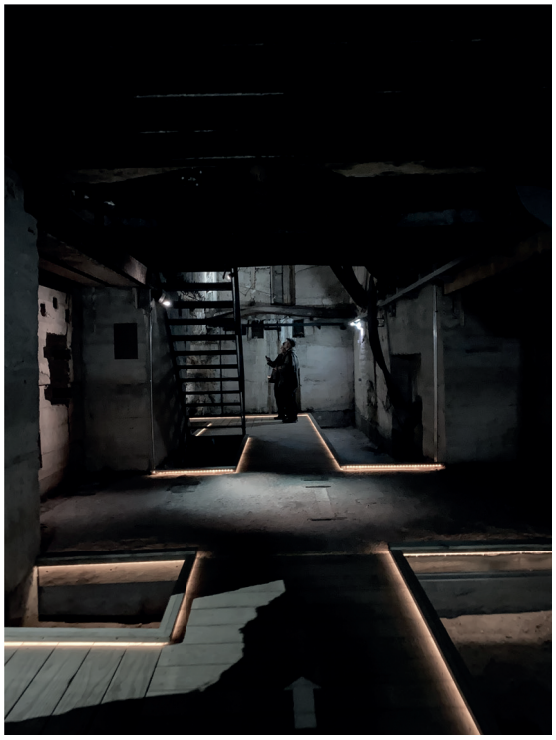
Inside the Bunkers

A big part of the experience in the building is to experience the historic bunkers. The mood, decor, and content inside the bunkers are essential to consider as it all contributes to an overall experience.

The way of exhibiting is very different from museum to museum. The four various proposals are shown on the next page. The vision for the contents of the bunkers in the Northern Bunker Museum is a thematic diversity. There are two bunkers in the Cold War exhibition and two for World War II. The bunkers representing World War II exhibit must contain two themes. The first is the experience of the war in North Jutland - here, a calm, comfortable atmosphere with German music and talk is intended. The second bunker farthest to the north is to exemplify the time in Normandy. It is in high contrast to the other one. It must represent the fierce battle of noisy sounds, panic, and chaos.

Based on the types on the next page, **type 3** is chosen. This type is as commonplace as possible, which illuminates the time, content, layout, and mood during wartime. This type creates the highest imaginable authenticity.

Type 1



The bunker in Tirpitz stands in stark contrast to the rest of the exhibition. It is empty, dark, cold, and only partially illuminated with artificial lighting.

Type 2



In Hirtshals, there is only one bunker, which consists of exhibition material. This bunker is open to publicity and can only be considered from a distance.

Type 3



This unknown example holds excellent authenticity. The room is cluttered, crowded, and most likely as it was during the occupation.

Type 4



The large bunker in Hanstholm is characterized by an interior with overall items such as beds, tables, etc. It holds some authenticity but also appears relatively set upt.

Illustration 184

Northern Bunker Museum

PRESENTATION



Illustration 185

MASTER THESIS 2020

This report contains the final presentation material formed on the basis of the program and the process. This presentation should be read as double-sided PDF, as several of the images cross both sides. All the given material is created by student Nicolai Qvist Krarup stud.nr. 20130846 in cooperation with Aalborg University in spring 2020.

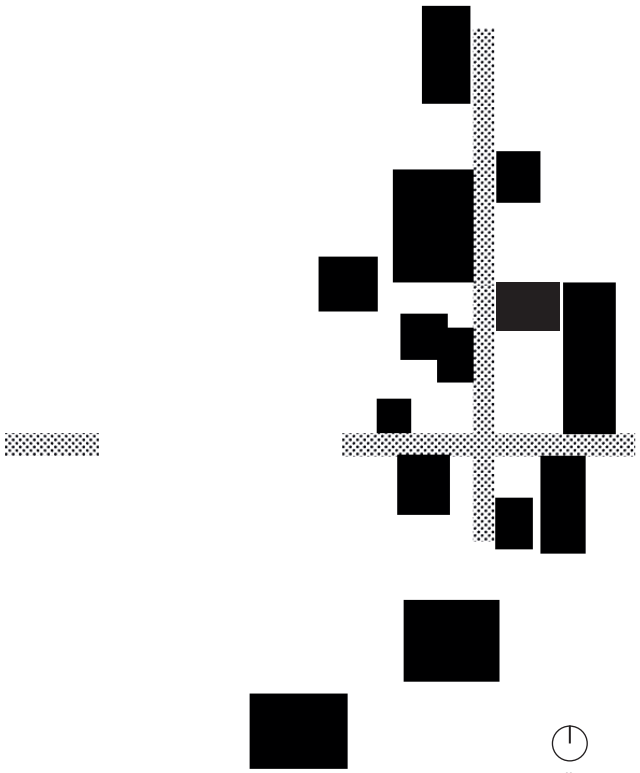


Illustration 186

Size: 4650 m2
Place: Pikkerbakken, Frederikshavn

Above is the diagram of the entire building. The black boxes represent The Block, and the dotted course represents The Walk.

”Go a head, sense the building”

Press the link below ↓

https://youtu.be/uwv7PH89gIA

A Brief Story
The museum of the future

The new Northern Bunker Museum builds on the ideology of creating an innovative, learning and multi-sensory cultural building that illuminates part of our common history and puts the themes in a whole new perspective through the use of architecture.

A museum's greatest vision is to create stories that enrich, touch, and reflect on the past, present, and future.

I have seen a myriad of museums all over the world that do not exploit the potential of architecture and its elements and effects. A countlless of museums around the world uses artificial elements to create a false reality focusing on reality.

In this project, historical monuments from the war are included and highlighted throughout the design as well as the potential of daylight, materials, indoor climate, etc.

Therefore, this project will focus on some of the theories described by Juhannis Pallasma in his book Eyes of The Skin. This project is my answer of how to handle it and translate it into practice

In addition, the project embraces its historic location, highlighting the site's myriad qualities and potentials. The project creates connections and contrasts, which together contribute to contextual synergy.

The project has incorporated several sustainable solutions, which together create a construction that meets the Building Regulations requirements for 2020 and further contains several health-related solutions.
The architecture of the museum interacts with the people and buildings, but especially the people in between.
The house creates the framework for an inspiring and experience-rich workplace, where employees become a natural part of the museum's daily flow.

This museum will be able to create international reach and place Frederikshavn on the global map of bunker museums worldwide.
This presentation is based on the attached program and sketch phase, consisting of an iterative and analytical approach and process.

In addition, a thank you is sent to the principal supervisor Michael Lauring and Claus Topp for an instructive process and sparring.

I wish everyone interested, a pleasant read.

”A museum based on an emotional journey of people for people who judge your past, touch your present, and enrich your future!”

Introducing Northern Bunkermuseum

A museum of the future

The Northern Bunkermuseum is a new iconic cultural building that integrates four real bunkers and brings the Cold War and World War II from a renewed perspective.The Museum is born out of the idea of complete integration of history- past, present and future as well as people, buildings, and nature. The building will contribute to an increased experiential tour of the landscape mediated through open and contrasting architecture, focusing on the many stories of the war.

Meet a building that exudes mysticism, monumentality, naturalness, and power- Enter the many experiences of the house- then you'll get a multi-sensory and knowledge-enriching adventure that not only touches you personally but also as a race.

Illustration 187




”Mmm, mysterious”

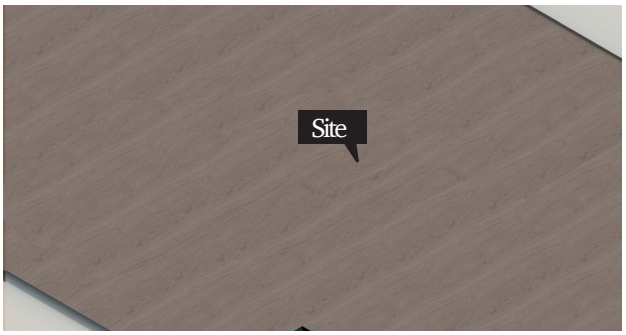


Illustration 188

The site

The site for the project is located at Pikkerbakken in Frederikshavn, more detail can be found in the program.



Illustration 189

The way of entrance

The only arrival route to the area is Bakkevej. The road forms a crossroads at the site.

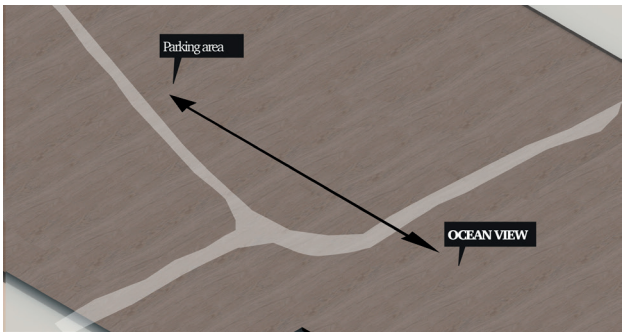


Illustration 190

The first connection

The parking takes place on the west side of the site. To the east there is view to the city and the Kattegat. The project must establish contact and sightlines between these two points.

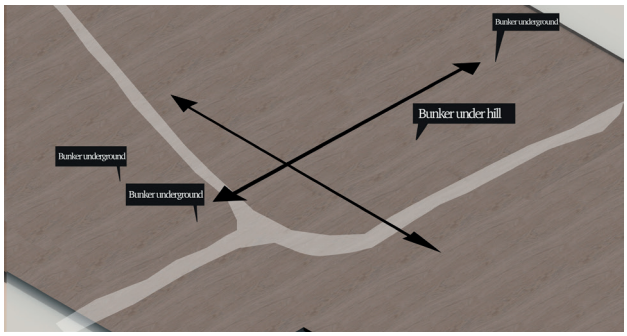


Illustration 191

The second connection

Within the site area are 4 different bunkers. Two pieces underground to the south. One underground to the north and one under the landscape to the east. These four bunkers are connected to a north-south line in the landscape.

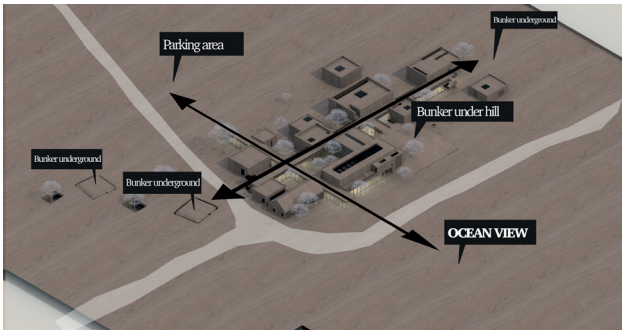


Illustration 192

The building

The two lines create the starting point for the building's layout.

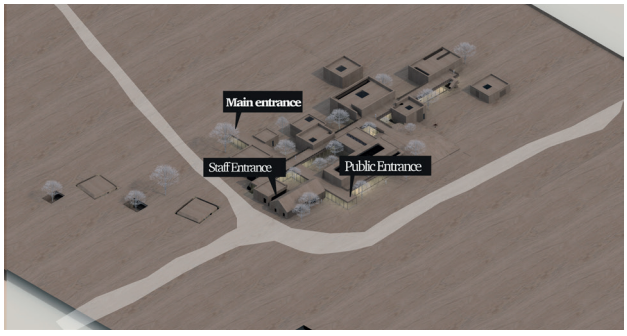


Illustration 193

Entering the building

The museum has three different entrance options. Main entrance from the parking lot, Public entrance in extension with the pathway of the existing outdoor museum. Staff Entrance is for employees only.



Illustration 194

The Walk

The Walk is the arrival and distribution area of the building. This part is characterized by a lot of views to nature, daylight, sightlines, and overview.

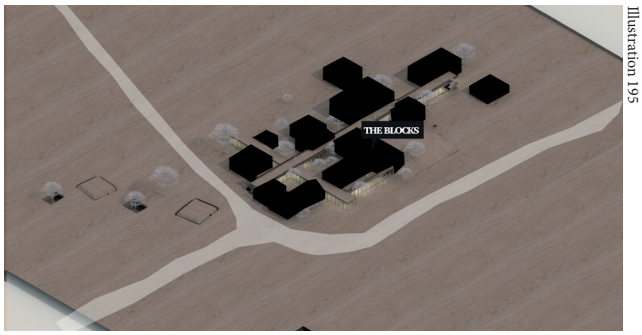


Illustration 195

The Blocks

The Blocks represent exhibition rooms, restaurants, meeting rooms, etc. They are characterized by simplicity, dynamics and functionality.

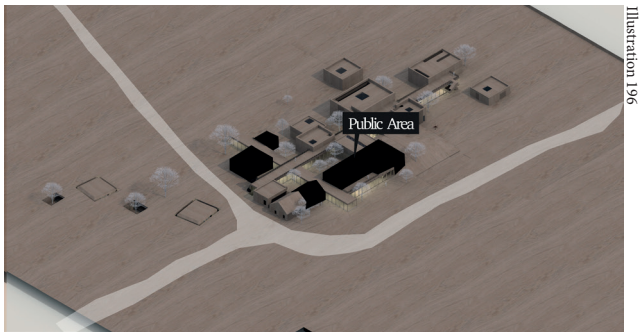


Illustration 196

The Public part

The public part is the part of the building that does not require a ticket. There is the opportunity to enter a lecture at the auditorium, or visiting the restaurant if you want a great dinner with an extraordinary view. It is also possible to visit the shop, which can be worthy of visiting after experience the public outdoor bunkers surrounding the museum.

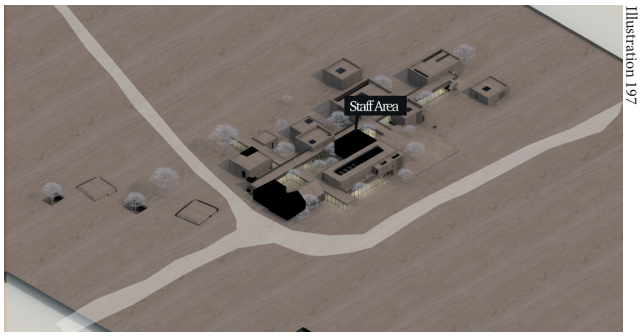


Illustration 197

The staff part

This part is located partly in the farmhouse and in the new part of the building. The employees have a unique view from their offices. In addition, they have dining facilities at the other end of the house, so they are an active part of the entire building.



Illustration 198

Exhibition one

The northern part of the building is the World War II exhibition. This part is primarily above ground. However, there are two bunkers integrated which are under the landscape.



Illustration 199

Exhibition two

The southern part of the building is the exhibition that represents the Cold War. This part is exclusively underground and two existing bunkers are integrated in this exhibition.

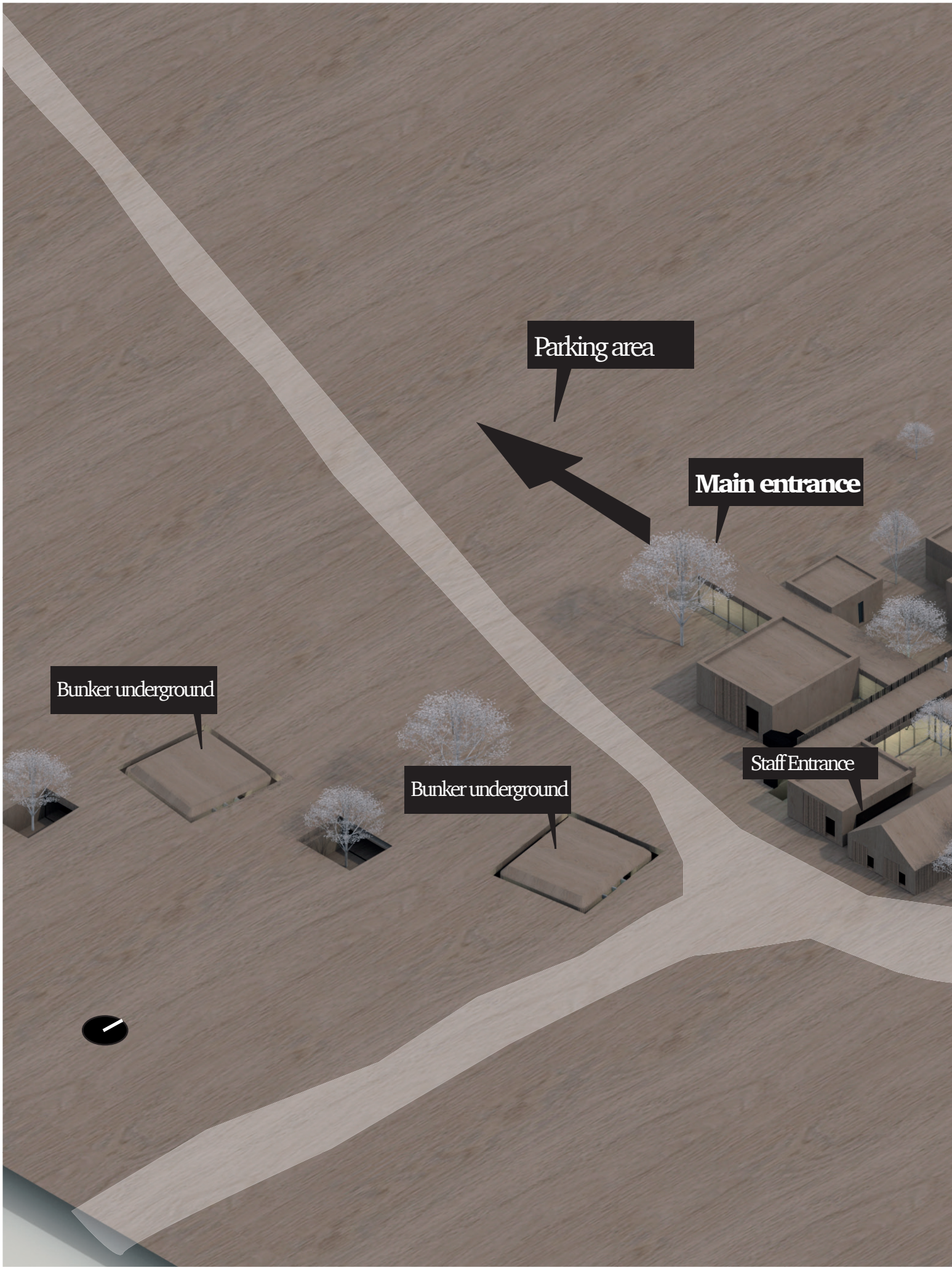

Parking area
Main entrance
Bunker underground
Bunker underground
Staff Entrance



Illustration 200

This photo illustrates the museum's overall development. The total building is 4650 m2. The building has three entry options depending on the type of visitor represented.



The floor plan for this building is structured from two lines, which together form The Walk. These lines connect the urban context and the existing bunkers.
Farther south, you are led via a stairway underground to the Cold War exhibition. At the opposite end is also a staircase, which represents the Monument to the deceased Danish Jews and the existing bunker of World War II. The connecting spaces called The Blocks are placed so that they form different spacious themes. Between them are a constant look to nature and the surrounding landscape. To the far east is the restaurant. The restaurant is designed with large windows facing the sea. Furthermore, the restaurant creates space for outdoor living in the shelter of wind and weather, with space for outdoor dining.

In this space, it is further possible to interact with the museum part. It is possible to see all the movements in The Walk. Due to the many lookouts in The Walk, you are always informed of where you are.



1:500

Illustration 201


Cold War



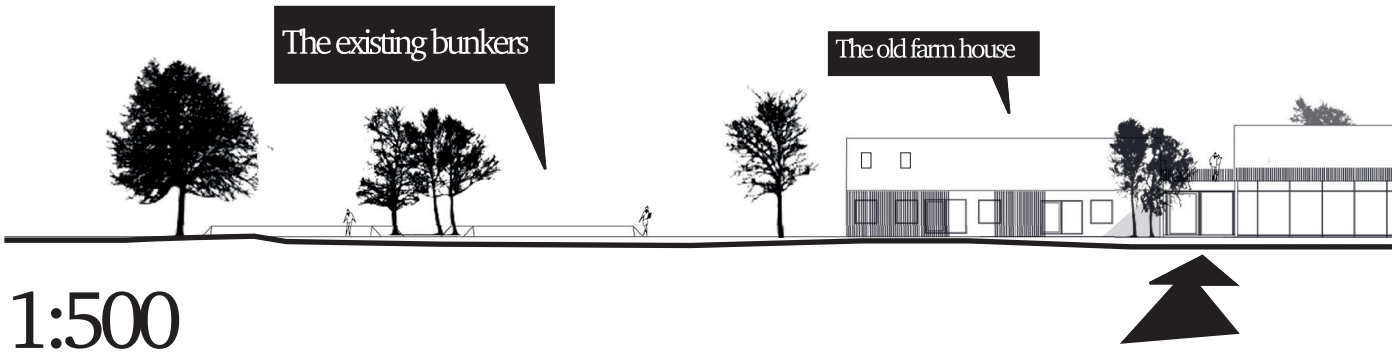
1:500

Illustration 202

What you meet
- Entering the building site

The building's appearance is dominated by the monumental boxes, which contrast with the growing greenery of the landscape. These boxes are called The Blocks. The Blocks are inspired by the bunkers of World War II in its heaviness, material, repetition, and relative interrelationships. The Blocks represent a large part of the exhibition in the museum. The Blocks is in every way in contrast to what we call The Walk.

The Walk is inspired by the surrounding nature and the experience of wandering in the landscape between the bunkers on the site. The Walk is constructed of wood and contains a great deal of transparency, insight, and views to the outside nature.



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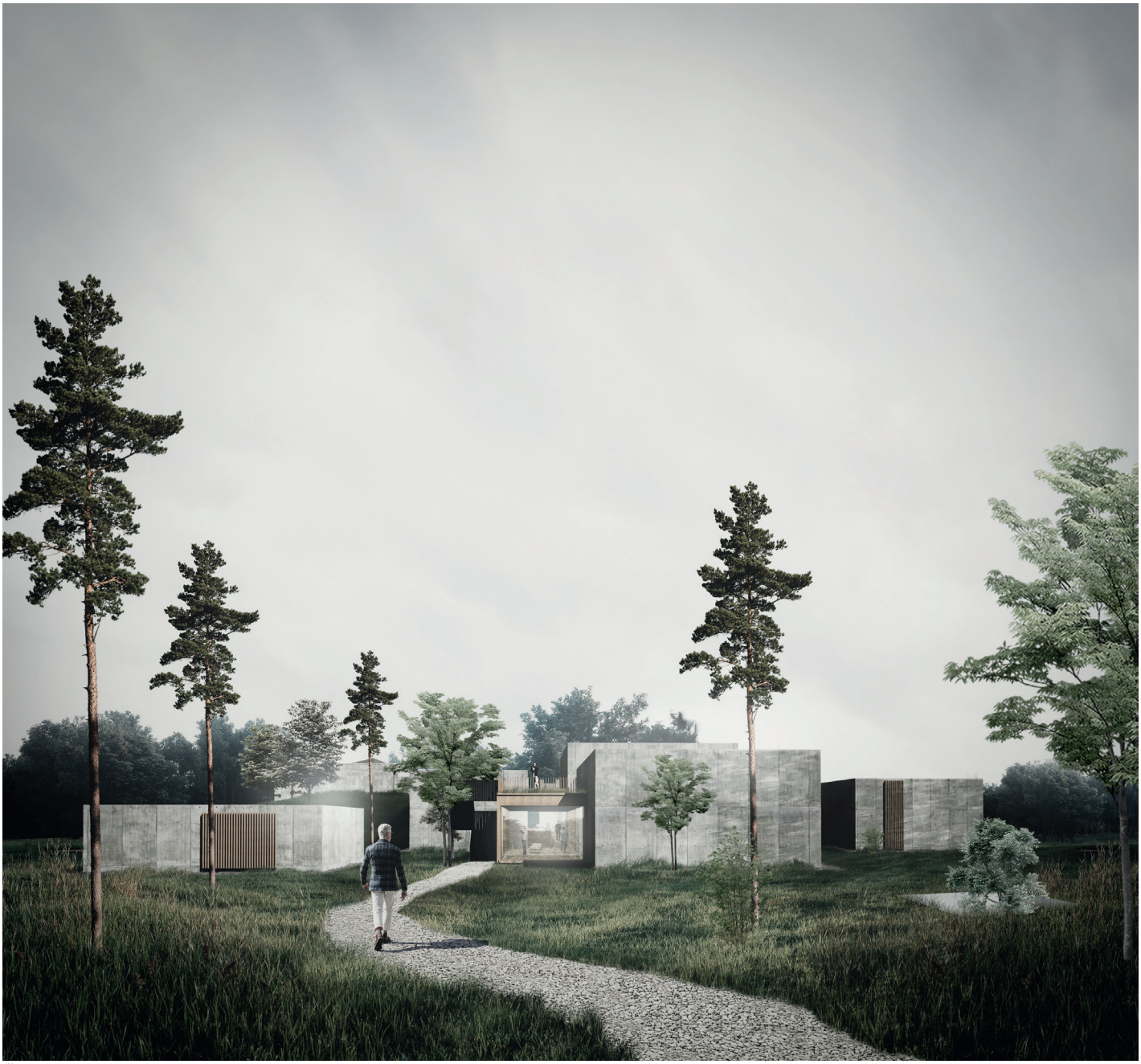


Illustration 203

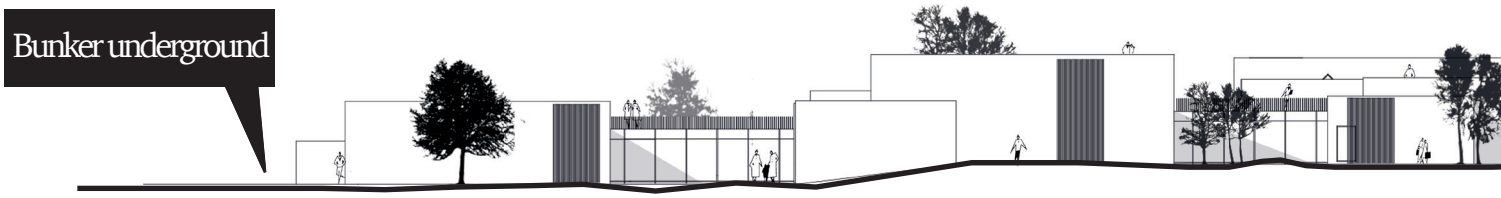
Above is a visualization of the arrival at the building along the path from the north.



East

Illustration 204

Above is the facade from the east. Here you will see the reduction of building volumes from south to north. This decreasing height represents the power of the exhibition's themes during the war.



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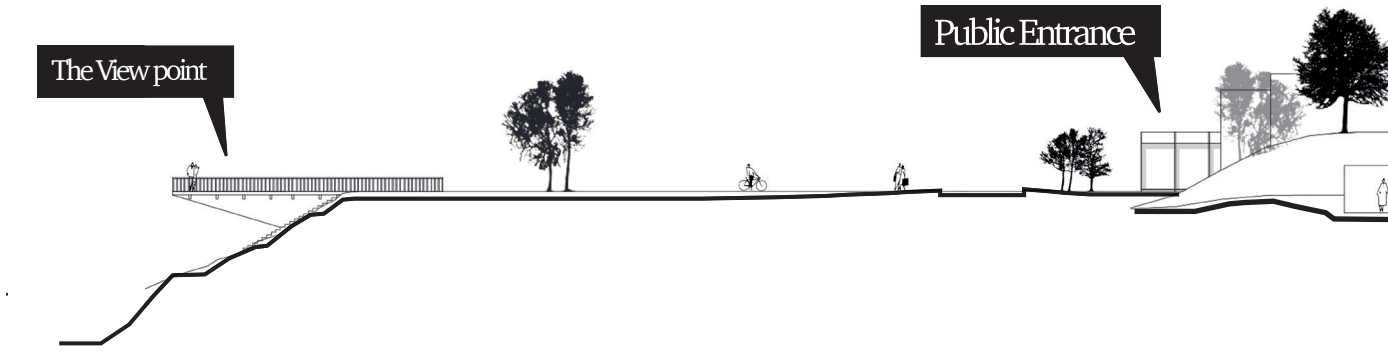

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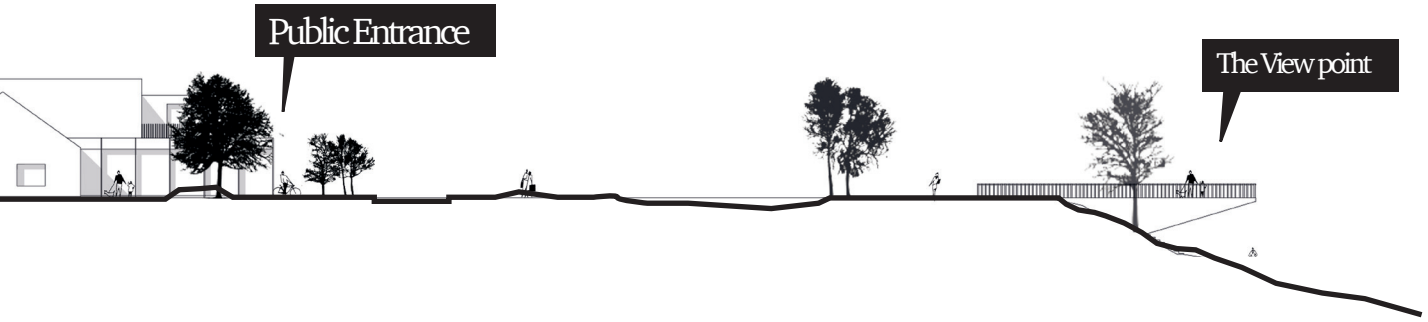
The number of glass influences several different factors in relation to the indoor climate. To ensure



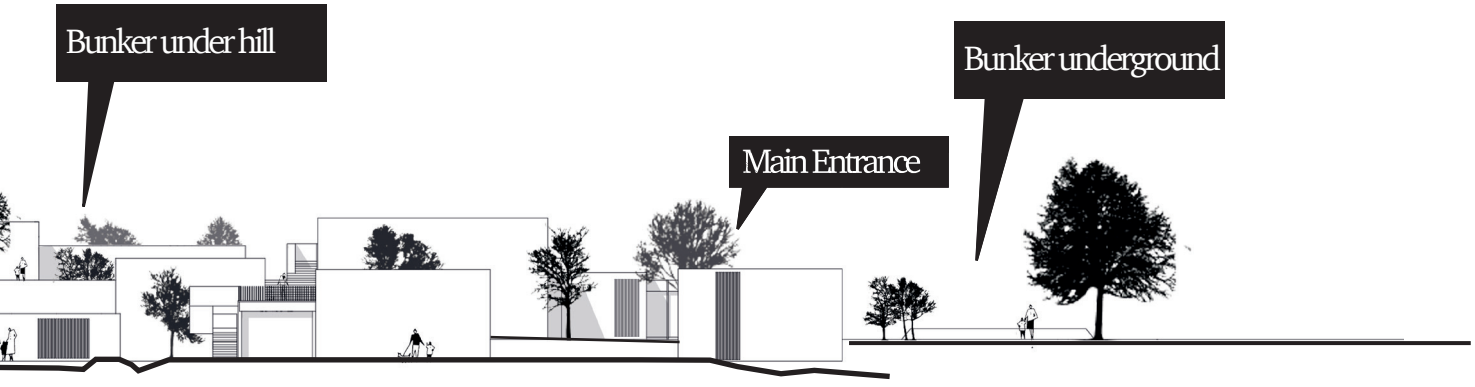
West

Illustration 205



South

Illustration 206



North

Illustration 207

Public

The public part is the part of the building that does not require a ticket. There is the opportunity to enter a lecture at the auditorium, or visiting the restaurant if you want a great dinner with an extraordinary view. It is also possible to visit the shop, which can be worthy of visiting after experience the public outdoor bunkers surrounding the museum.

When developing a building, an area of the city is taken - in this case, a very historic and unique space. Therefore, this building must be able to give something back to the town and not the least Federikshavnerne.

To be able to do that, the building is partially open to the public. The restaurant is the place where the public, visitors, materials, light, and nature meets and merge into a unified space. This is the place where The Walk and The blocks meets and connects.

The room is 360 square meters and has a 15-meter skylight that spans along with the ceiling. The windows make open contact with the context, and further to the east; they create an absolutely unique view towards the city, the bunkers, and the sea. Also, there are openings both to the east and west—openings to the outside courtyard and terrace.



Above is a visualization of the arrival to the restaurante.

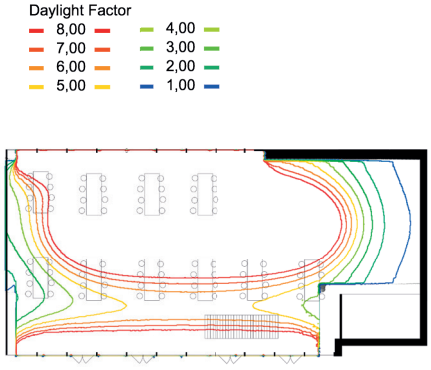


Illustration of the daylightfactor

Illustration 208

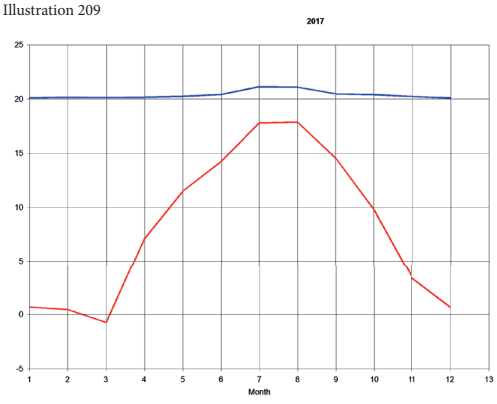
The dimensions, windows, and materials of the room are all chosen based on functional, aesthetic, and technical studies. This result is achieved from the best possible synergy in between.
The plants and especially the plant wall contribute to a better indoor climate. In particular, it creates a better atmospheric, visual, and acoustic environment.

To the right two graphs are illustrated.

Graph 1 shows the temperature of the restaurant compared to the outdoor temperature.
Despite the great variety outdoors, the restaurant stays below the desired- and has 68 hours above 26 degrees and 21 hours above 27 degrees. Graph 2 illustrates the concentration of CO2 on a critical day in February. Co2 occurs based on the materials and people's load. The critical day in February is chosen as no natural ventilation is used during this period.

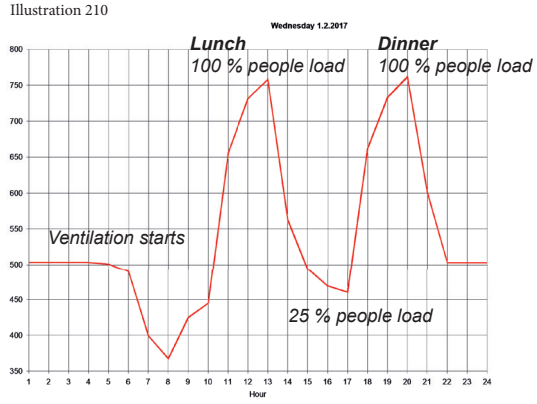
Illustration 211

Illustration 209



Graph 1

Illustration 210



Graph 2


”Wow, it is real”



Illustration 212

This visualization illustrates, among other things, the plant wall, the green oasis, and the staircase upstairs to the outdoor room on the first floor.

The Walk

”Inspired by nature, surrounding the fort”



Illustration 213

Visiting Bangsbo Bakker and Bansgbo Fort is based on the experience of a walk in nature, between the different and through the bunkers. The Walk is my answer to embracing this extraordinary opportunity of being a part of nature and the city.

The Walk is a light and simple construction that hovers slightly over the landscape. The Walk connects the context, the bunkers, as well as people and nature.

The Walk is the break between the exhibitions. It is the space where you take a rest, meet and, distribute around the building. The Walk’s long line of sight and views to the landscape provide constant orientation and overview for a visitor.

It allows visitors to split up and quickly meet again. The Walk takes advantage of the site’s phenomenal views and scenery.

As you move around in The Walk, you embark on a sensory journey around nature’s levels both above and below ground.

The Walk quickly creates an understanding of entrance possibilities and gives the visitor a sense of the house from the start. The vision for The Walk was to create a transparent element that contrasts with all the ”closed” spaces in a museum.

Illustration 214





Illustration 215



Illustration 216


”Ill join the meeting in a minute”
ELEVATOR


German soldiers
The Jews



Illustration 217



Illustration 218


Wardrobe


The Restaurante
The View point

The meeting between The Walk and The Blocks is essential to create high architectural quality. The two parts are in contrast with each other. The Blocks are heavy elements that meet The light Walk. The meeting should be as elegant and appear as light and contrasting as possible.

To create this effect, the meeting is constructed with a shadow around the construction. This shade creates a light and elegant clutch. The solution is generally for all collection points in between The Walk and The Blocks.

The Blocks

The Walk

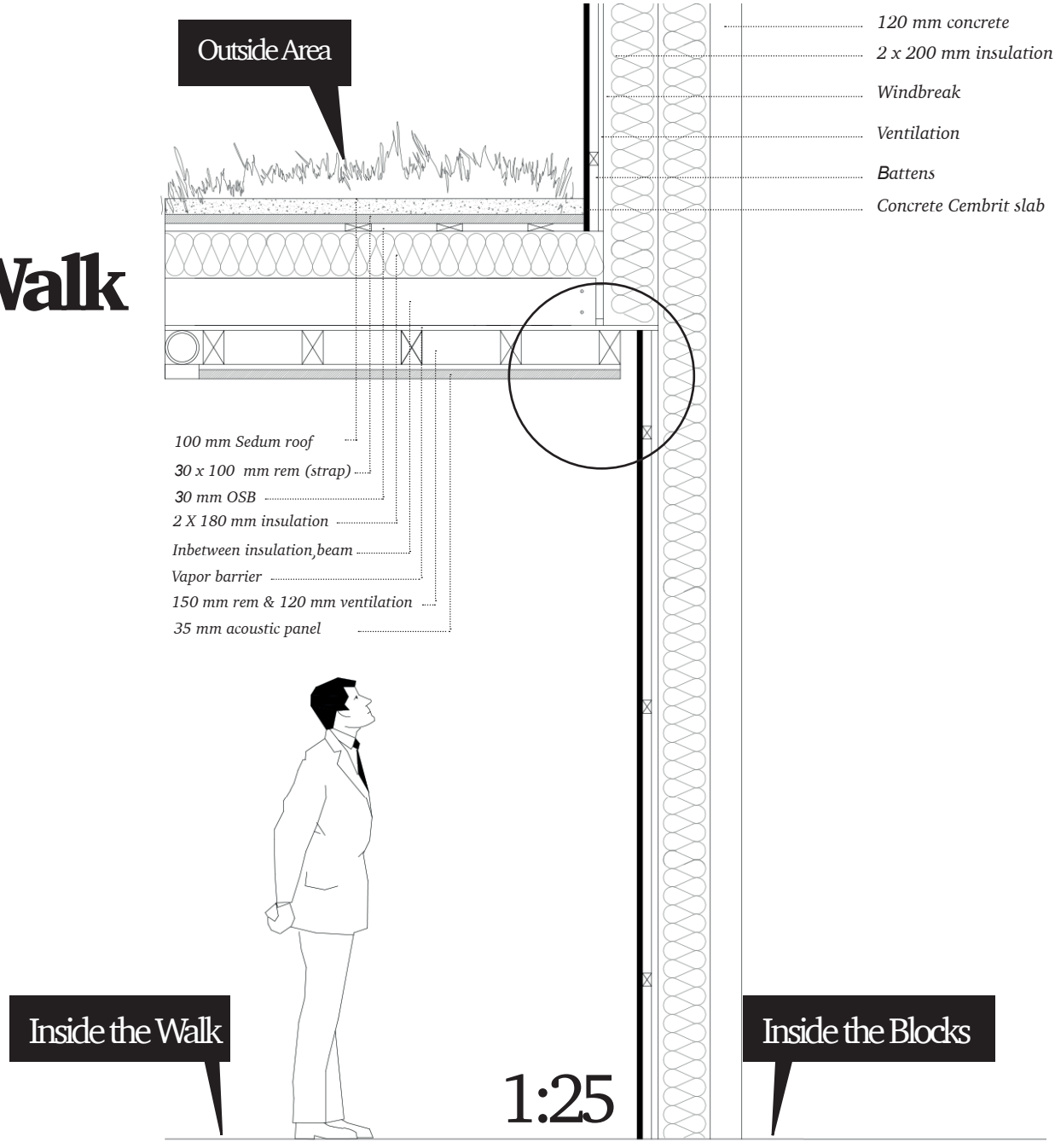


Illustration 219



Illustration 220

To ensure that The Walk technically had the carrying capacity to solve the intention of the construction, the dimensions and center distance of different columns were studied in the process. The structure appears light, airy, and simple. The frames of the windows are integrated into the construction. In this way, the window creates as few impressions as possible and even closer contact with the urban context and the surrounding nature.

The Walk is designed with the ventilation principle of mixing ventilation. This principle supplies and exhausts the air into the ceiling. Further, this principle creates the possibility of mixing the air throughout the room. The air is continuously renewed in addition to the ventilation system's intake and exhaust. To ensure well-integrated heating in the room, Convectors have been installed into the floor, which provides a comfortable thermal indoor climate throughout the year.





Illustration 221

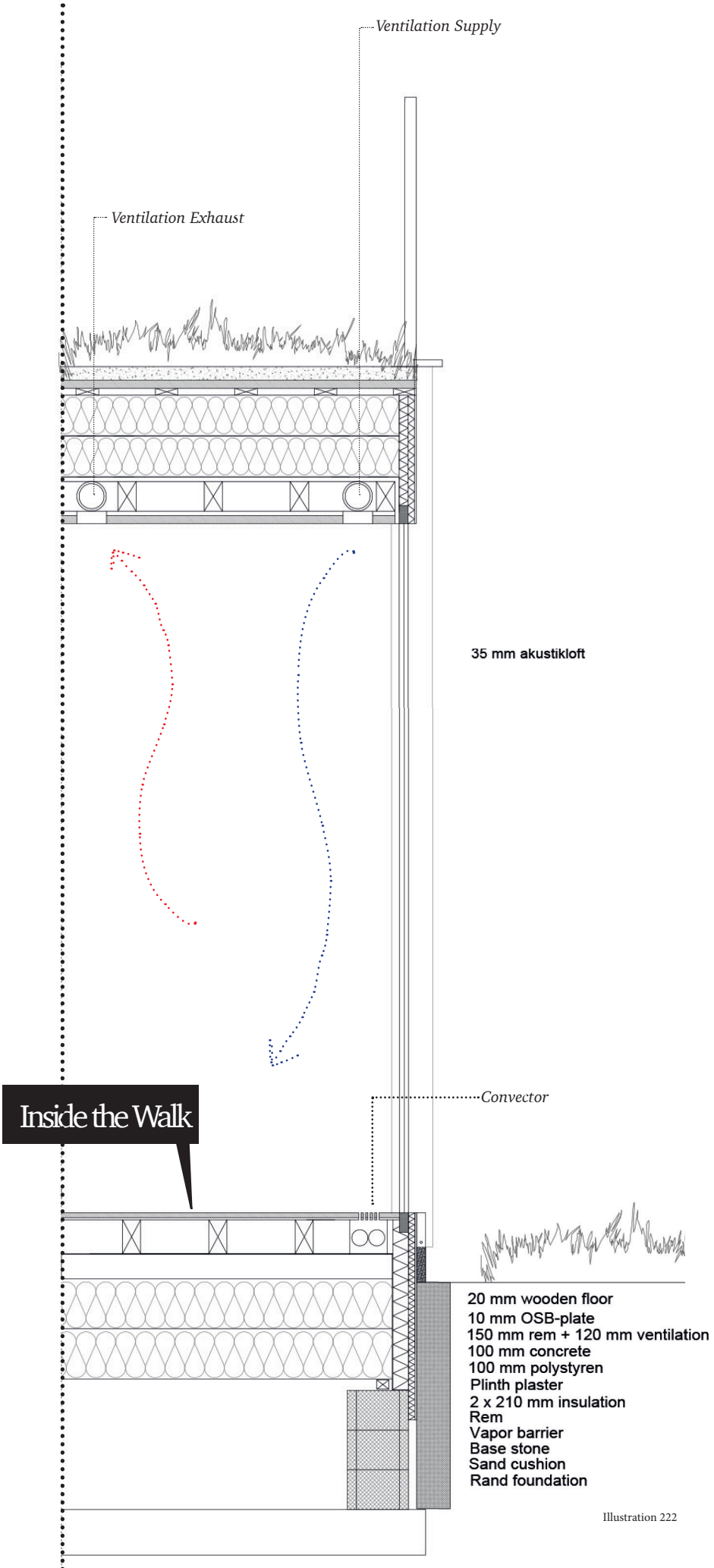


Illustration 222

Inviting people -
Connecting the city

The ViewPoint makes connections and collections. It creates connections between the city, the museum, other bunkers, and nature. It collects people and creates an overview of the bunkers, contributes to a more manageable route through the outdoor museum.

The ViewPoint makes it physically easier to climb the hill from the bunkers up to the museum. It is a natural extension of the museum. The ViewPoint invites to the Museum, and the Museum invites to The ViewPoint. Furthermore, it is a humble urban intervention, which creates focus on the museum when you, for example, arrive as a tourist to the city by E45 or by ferry. In addition, it gives something to Frederikshavn and the public.

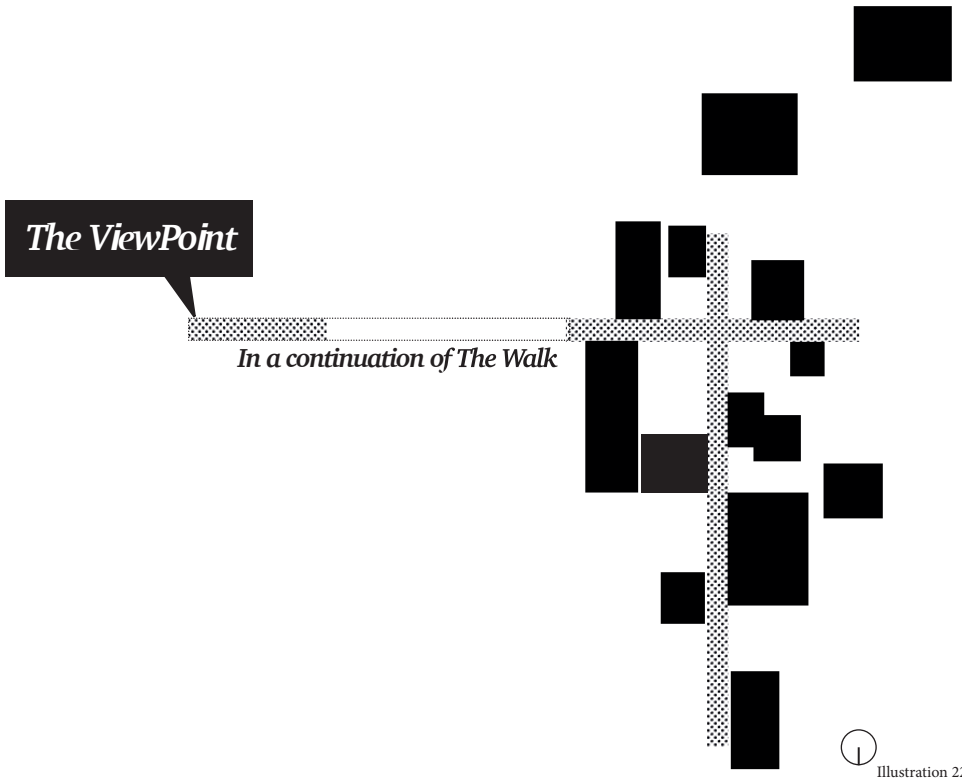


Illustration 222

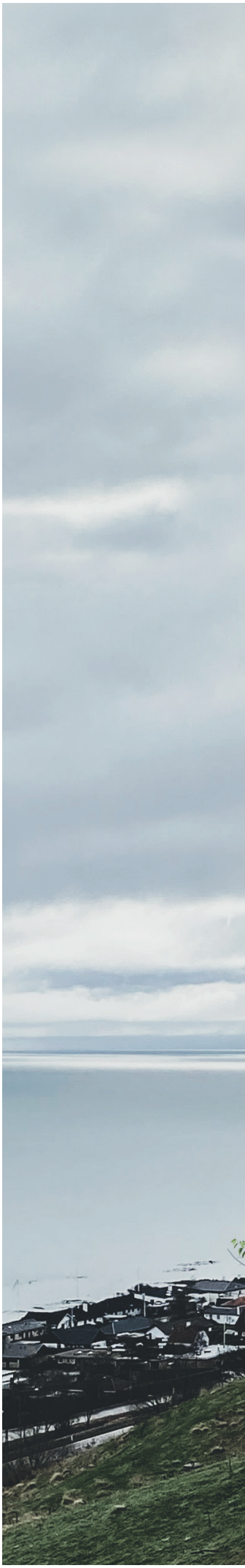
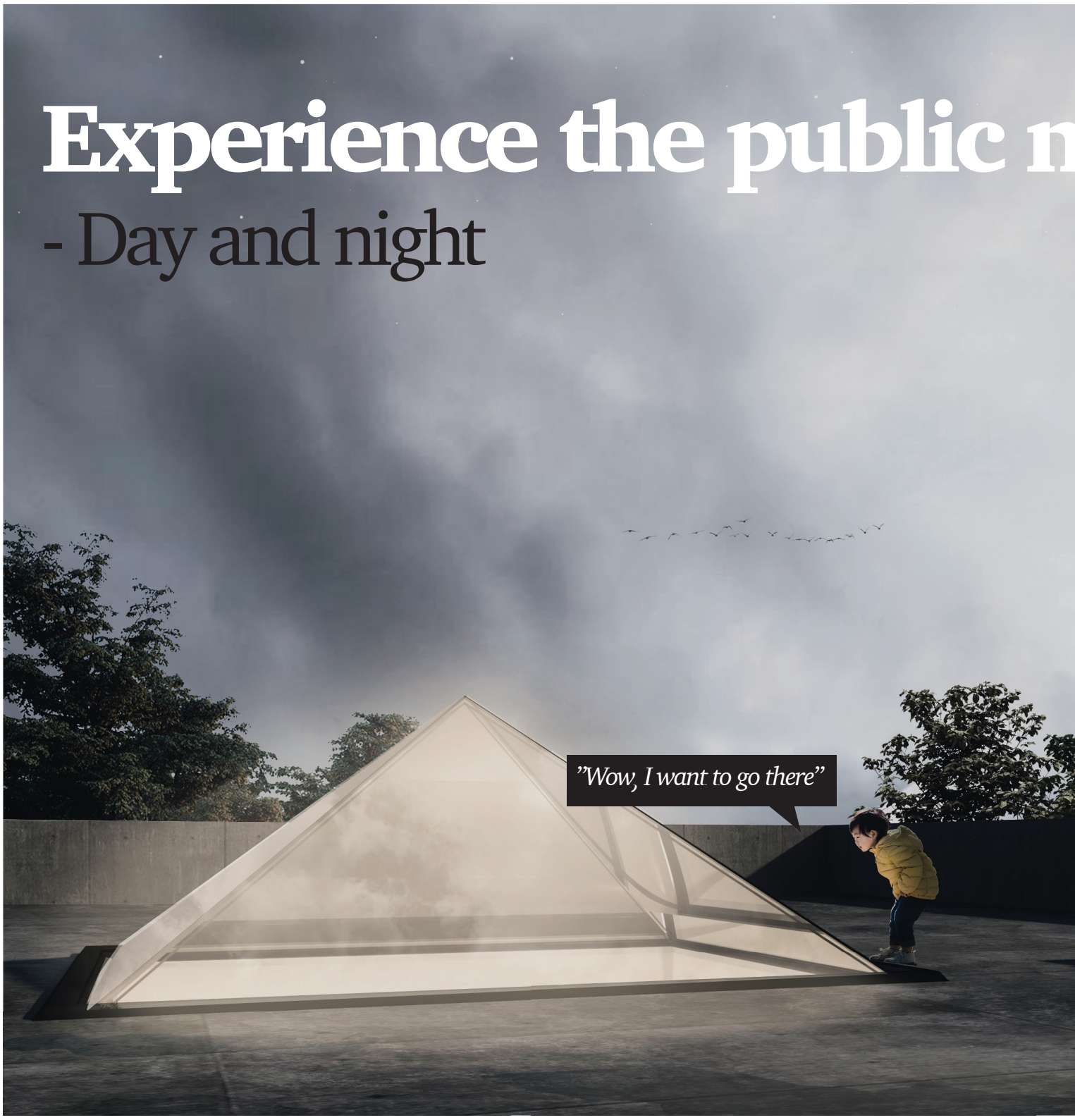




Illustration 223

Experience the public n
- Day and night



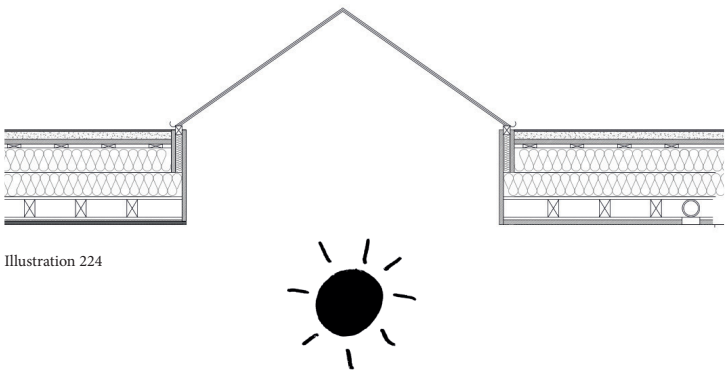


Illustration 224

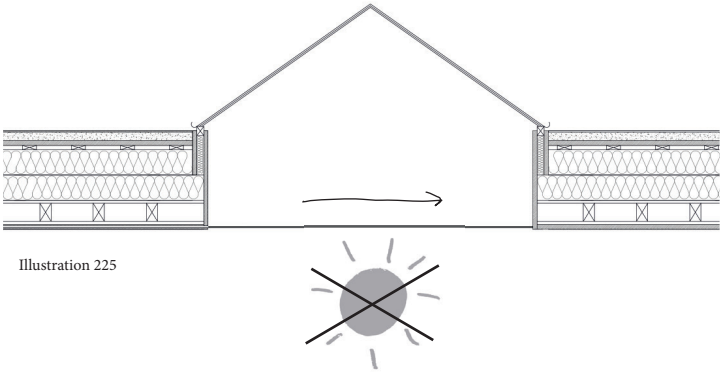


Illustration 225



Illustration 227

The site area is characterized by longer paths with the connection between the different areas and the bunkers. These areas are actively used by people walking in the area. This is because of the historical aspect of the site, and the free view of the sea and city.

To accommodate this target group, and to ensure outdoor urban qualities in the area, the existing path going from the north are integrated (see possibly p.36 in the program).

If you take the stairs from the northern end of the museum, you'll get an even more beautiful view. Take a walk across the building and immerse yourself in the picture and discover the closed blocks opened and get an insight into the museum's exhibitions. Interact with the building and get a taste of the content, which might arouse the interest and curiosity for more. Bring your packed lunch. Enjoy it, at another height with another view, in the shelter of the wind.

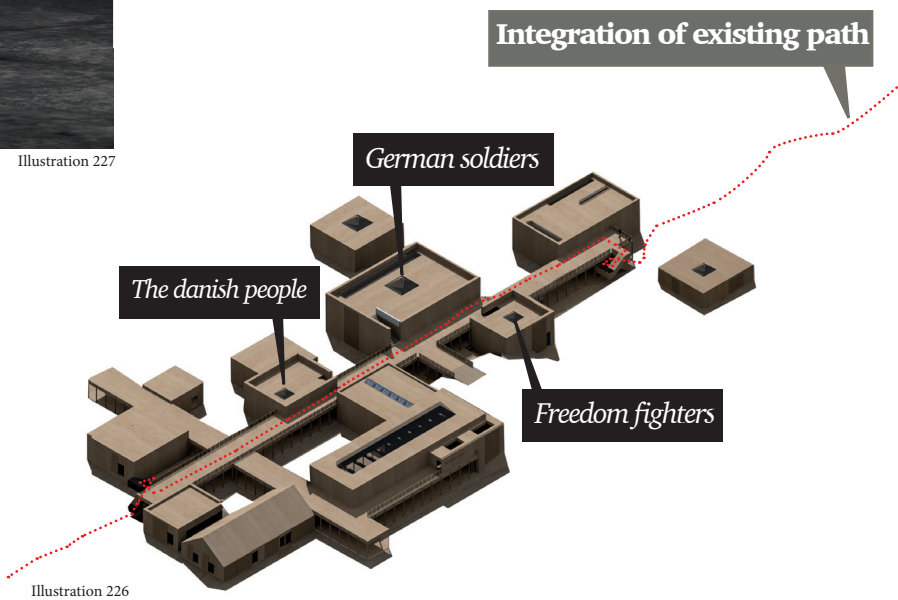


Illustration 226

The skylights into the exhibition rooms have a double meaning. In this project, I repeatedly advocate the use of architectural elements in the museum to create sensory atmospheres, but, should the need for the exclusive use of artificial lighting arise, the windows are intended to be constructed with built-in indoor shading.

This shade makes the windows invisible in the interior and thus shuts off all possible daylight. An example of this solution is seen in the illustrations on the left. It is essential for every designed building to become flexible in order to match future needs.

The Blocks

"Inspired by the bunkers of the Atlantic wall"

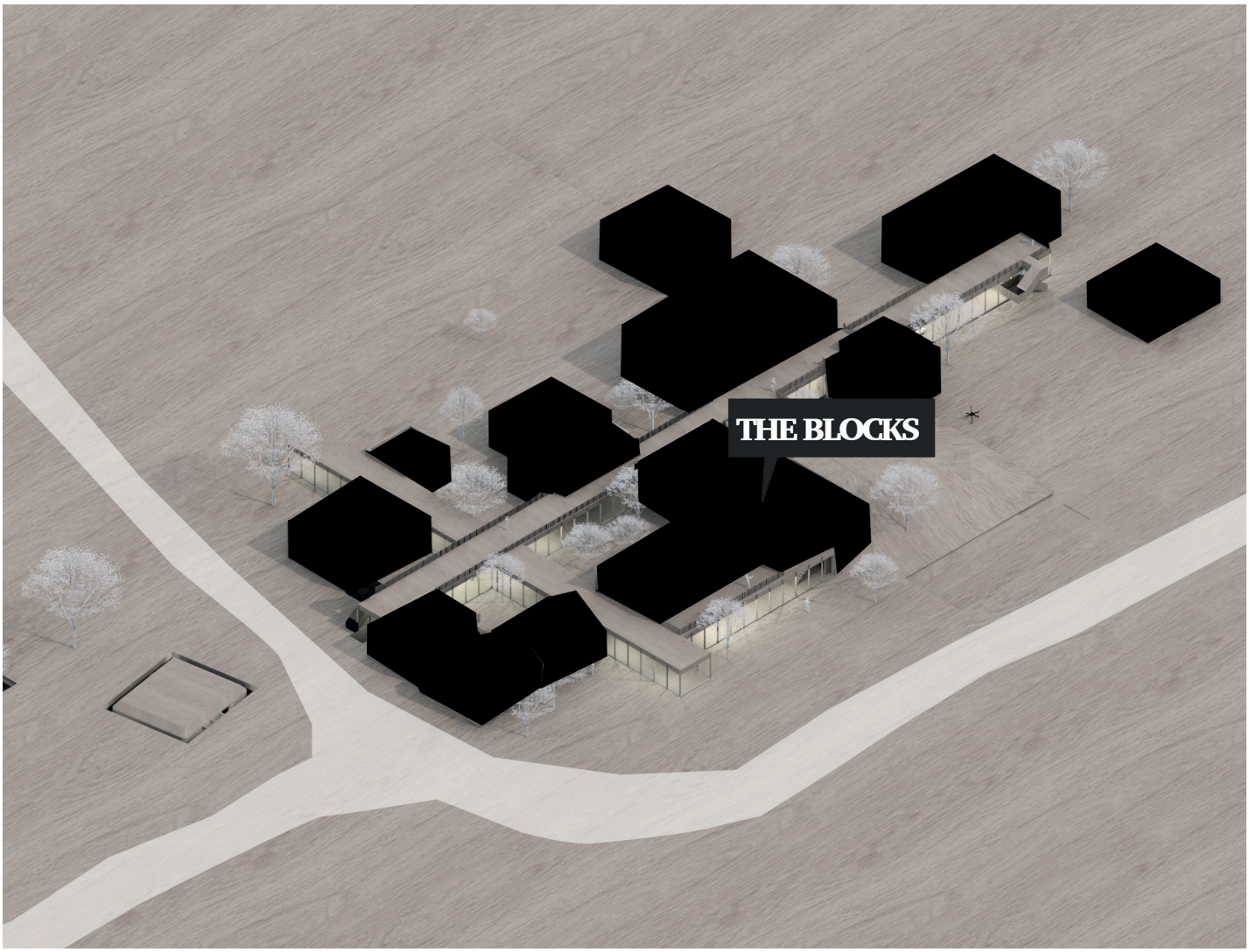


Illustration 228

The Blocks represent the uncertainty and mystery of the building. From the outside, it is not possible to view the content. However, in the interaction with the roof, a small taste can be obtained, as seen on the page before this one. The Blocks is an interpretation and translation of the many thousands of bunkers that took place along the Atlantic Wall in Europe. They are monumental, simple, fascinating, and repetitive—the Blocks contrast with the transparency, scale, and materiality of the rest of the building.

They are claddered with concrete slabs and contain individual areas of stained wooden slats which break down the scale. It easily and elegantly ties the building together into one whole unit. The Blocks creates a construction that, in addition to the two tight lines of The Walk, represents a dynamic construction that breaks and relates to the natural landscape elements of the context. On the following pages, the part of The Blocks that contains the exhibition is presented.

For each room associates a phenomenological experience of the space described in bold.

In addition, it contains a brief descriptive text according to the thoughts behind the final product.

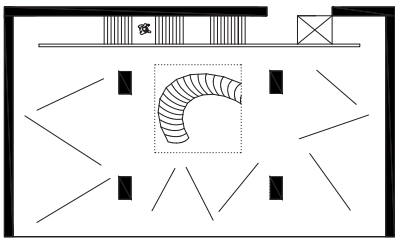
Illustration 229



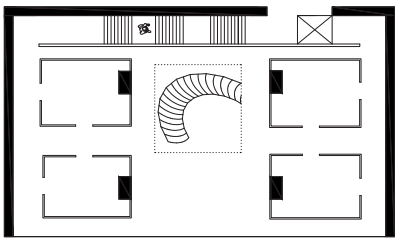
The ones to be told -
Experience real lifes stories

“I enter the monumental and fascinating space. The materials are cold, smooth, and gradually mirror my silhouette in the concrete surface of the floor. I am drawn to the light. The light creates curiosity for more. What is hiding around the corner? The fascinating staircase, centrally located in the room, is illuminated. I’m getting attracted. I examine.”

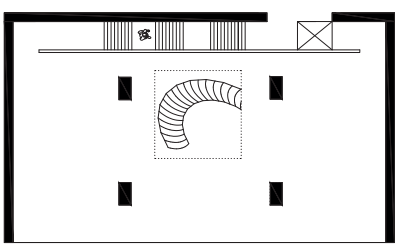
“I feel confused and stand in a paradox. The many raw materials form coldness, but the temperature is comfortable. At each touch, I sense smooth cold surfaces that are both comfortable but, at the same time, repellent. I wonder, what is behind the illuminated corner?”



Example 1



Example 2



Example 3

Illustration 230



To the right is a visualization of the showroom on the ground floor.

Illustration 231

The exhibition space for the German soldiers and the Nazis is based on flexibility, fascination, and sensory perception. The space is designed based on the idea of a flexible exhibition space, which creates opportunities for different spacious options, but with the same experience of quality.

The previous page shows three different examples of how the room could be arranged. The space thus creates an opportunity for the exhibition to develop over time. The space is designed with a thematic storyline. The ground floor houses the exhibition for the beginning of the Germans in World War II.

The vision is to use daylight as an attraction in various combinations. Centered in the room stands a monumental, sculptural, and majestic staircase. The stairs acts attractive and are lit in an otherwise dark room. When you climb the stairs, you are in the heyday. Here, there is a temperature comfortably, a plentiful amount of daylight, and an exciting overview.

The dimensions and materials create a massive space. The materials are hard, cold, and continuous. The concrete creates a relatively high reverberation, which creates a dramatic atmosphere where you are forced to walk on toes, and time to time will fell uncomfortable.

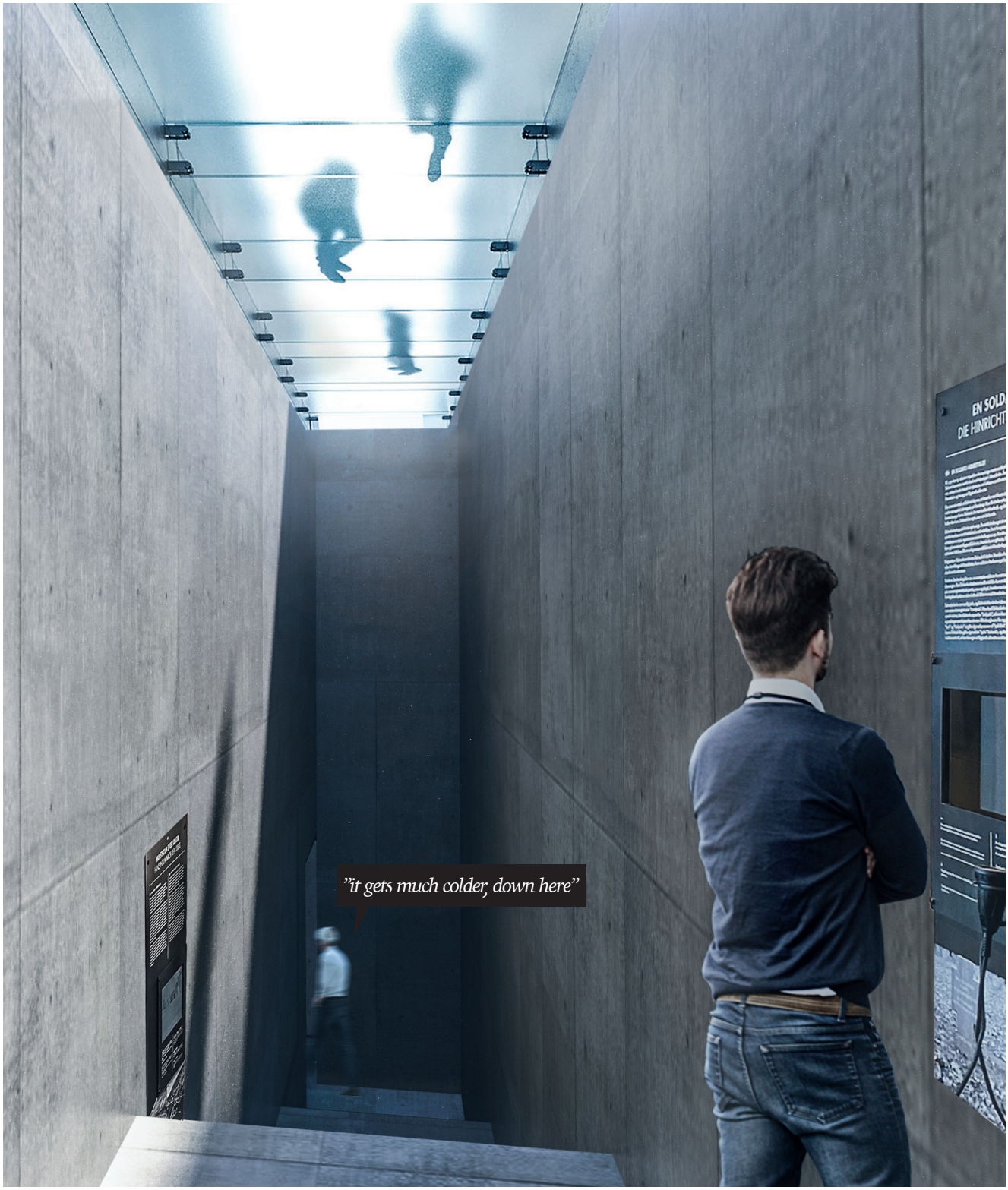
Throughout the room are the effect-giving skylights, which humbly penetrate the rooms with varying daylight. The mood and atmosphere change depending on the season, the weather and the time of day - and alternately provide different spacious experiences.

Daylight is your guide around the exhibition for the Nazis and Germans during the occupation.



Illustration 232

A visualization of 'The Hall way of oppression'.



The Hallway of Oppression

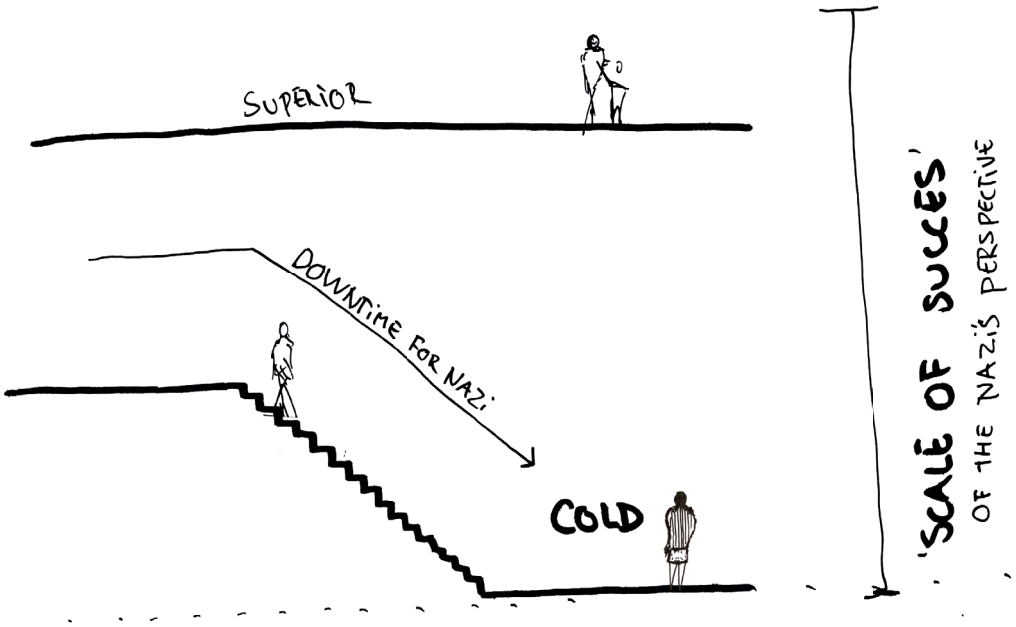


Illustration 233

“Behind the corner, I am now placed in an extraordinary hallway. I feel overwatched. I feel strangely suppressed. I sense human silhouettes above me. They step on me. They do not care. The space is narrow, loud, and claustrophobic.

I don’t feel like going down the stairs. My curiosity drives me. It gets colder, darker, and even higher- The space suddenly seems more narrow than before.

I open the door. The cold hits my face. This must be the end of something cruel or the start of something bigger. ”

The Hallway of oppression is a narrow and high walking area. The corridor area focuses on how the Germans felt superior, higher ranking, and deceptive. The room must, with its semi-transparent ceiling, create a feeling to be stepped on. Clear silhouettes appear in the glass and illuminated by the skylight. When walking above, you are not aware of how you dominate the people below.

Take the stairs down and get an experience of a colder and darker climate in a room that appears more and more narrow as you descend underground.

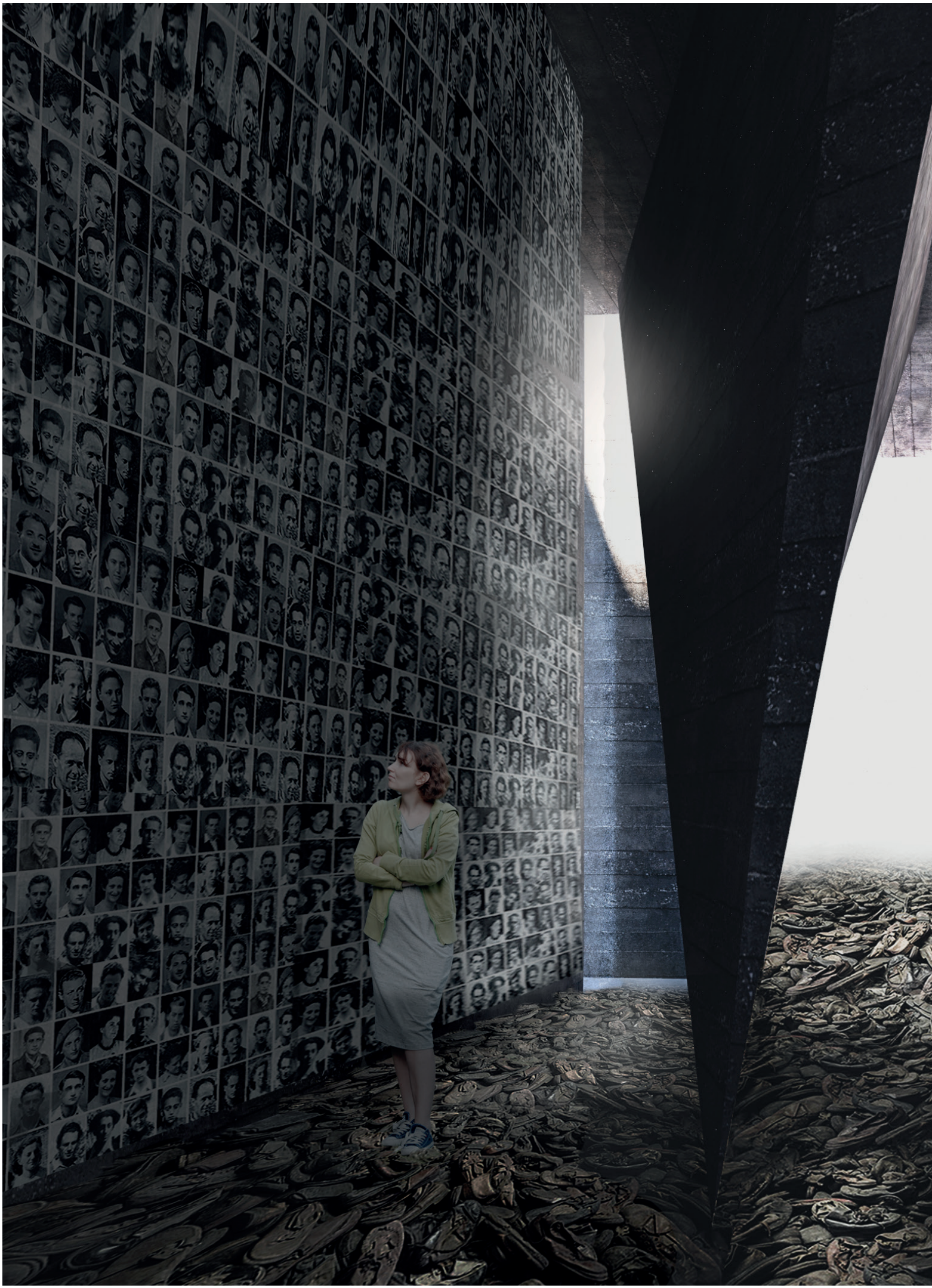




Illustration 234

The Power of Hope

A jewish disaster

This exhibition represents the Jews during World War II. The room is designed with a course that creates uncertainty and curiosity. The tilt of the floor forces you forward. The experience should focus on some of the feelings the Jews went through; uncertainty, claustrophobia, coercion, anxiety about what lies ahead, and powerlessness.

The space forms a historical course of time. The start is marked by life before the war, and the many losses of life mark the end.



Illustration 235

The A shape of the room represent hope for brighter future.

“I find a dark crack in the innermost part of the room. A labyrinthine course appears—a path which slightly becoming more and more claustrophobic.”

”A narrow crack of light emerges in the ceiling. The light focuses on the materials in the room. They are raw, cold, and scratching by touch. I am somehow forced through. It goes down. The floor is made of glass. Under the glass are shoes filled. It’s uncomfortable. I round the corner. It only gets more claustrophobic. Where does this route lead? How does it end?”

Memorial to the Danish Jews

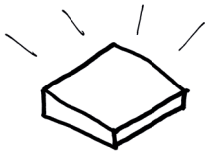


Illustration 236

How to handle such a tragedy

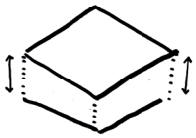
This is the space where the exhibition throughout is characterized by architecture. In the movement around the tragedy for the Jews, the visitor ends up in this room.

The room represents the dead Danish Jews during the war. A space that is meant to symbolize loss, but at the same time give rise to renewed hope.



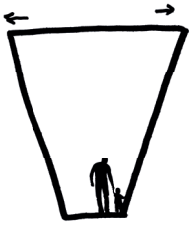
Each stone represent a died danish jew during ww2.

Illustration 237



The size of the stone represent the age of the died jew.

Illustration 238



The A shape of the room represent hope for brighter future.

Illustration 239

“I arrive in a high room. The room is marked by cracks of light. Here it is quiet. I immerse myself in the many shifts and surfaces of the stones. The floor is ash. I don’t feel like stepping on it. I tread the stones. I intergrade with the stones.

A fragile tree rises illuminated or gently from the ashes. I’m fascinated. I feel the renewed hope.”



”Embrace the essence of actual authenticity”

The integration of the bunkers has a significant impact on the overall design of the museum. One of the museum’s roles is to convey the war and not least, the historical perspective that lies in the bunkers.

The area consists of as many as 80 bunkers, but none of them appear, or as enlightening as these.

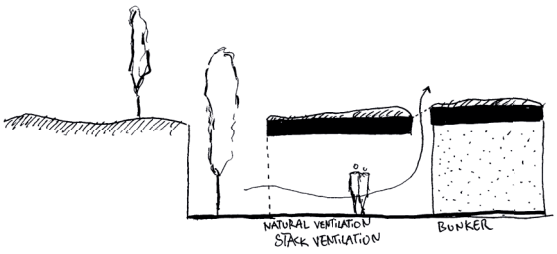
The museum is designed to embrace the quality, size, and material of the bunkers. The bunkers are lit in otherwise dark rooms. They appear as sculptural elements that are open to further exploration.

Join a different experience - underground. These spaces have a combination of materials that give the visitor the experience of total isolation. The ceiling and floor are made of acoustic elements, which contribute to a very low echo sound.

In order to ensure an overall sustainable construction, several passive strategies are integrated into the design. Small exterior oases create gaps and breaks in the floor plan with the possibility of invite daylight, air, and greenery into the building and further possiblity to escape in case of fire.

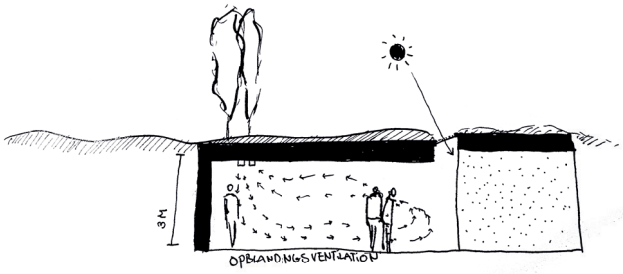
In addition, the oases contribute to the use of natural ventilation.

Real Bunkers
- Real experiences



The room is designed to utilize the possibility of natural ventilation including Stack ventilation.

Illustration 240



This part of the building uses the principle of ventilation like The Walk- called mixing ventilation.

Illustration 241

Energy and indoor climate

24 kWh/m^2 per year

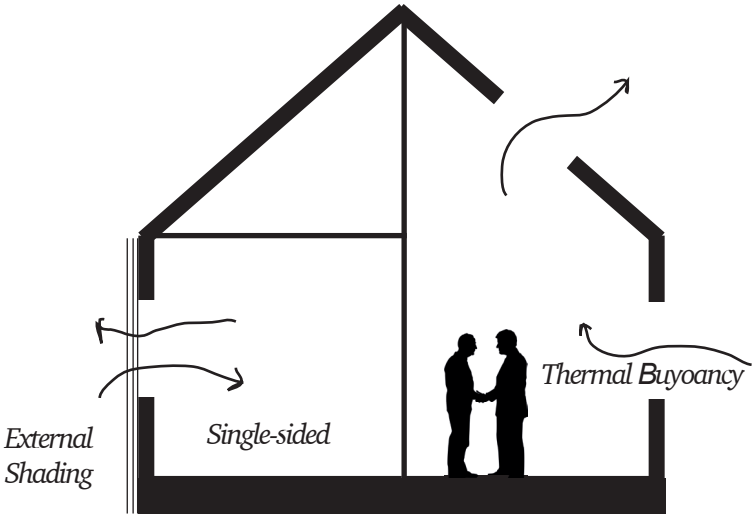
During the process, the program Be18 is used. The program contributes to an estimate of the building's current energy needs, and to ensure that the building complies with the energy class of the Building Regulations 2020.

When designing and new construction, it is essential to have as low an energy requirement as possible. Therefore, architectures are continuously adapted to ensure a sustainable building project.
The energy demand is particularly affected by the building's indoor climate.

Different strategies have been used to ensure as little energy demand as possible. The loss of transmission through the climate screen is reduced. The construction is designed with the excellent insulating ability and thereby a low U-value. The accumulation ability, such as the ability to retain energy, is also used. Therefore, heavy construction in concrete is used in more significant parts of the structure.

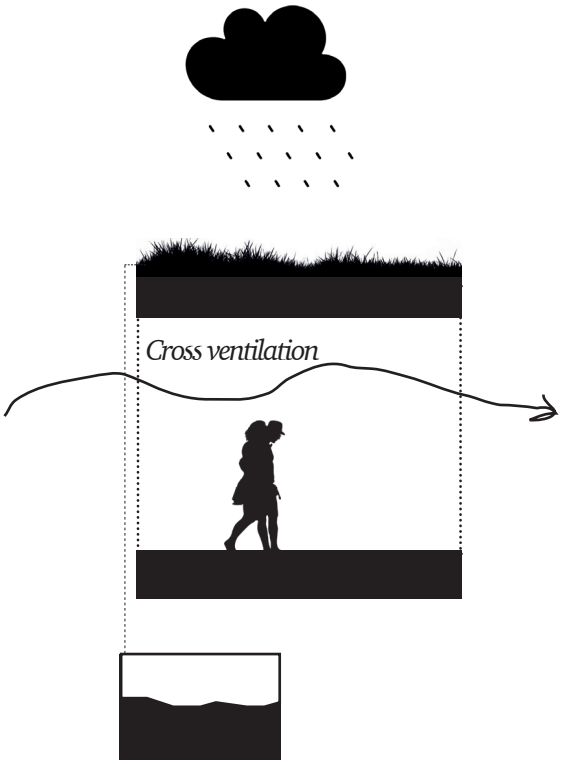
Natural ventilation is integrated into most of the building. Natural ventilation lowers the energy requirement for cooling, which is necessary for comfort in the summer months. Different strategies have been applied depending on the room's dimensions and functions and will be seen on the next page.

In addition, building windows have been continuously balanced between added heat, daylight factor, natural ventilation, and views. In some cases, external shading is integrated to regulate the amount of solar heat. The final balance and with the use of several passive strategies, the total energy demand for the whole building is 24 kWh / m^2 per year. This means the buildings are within the energy frame.



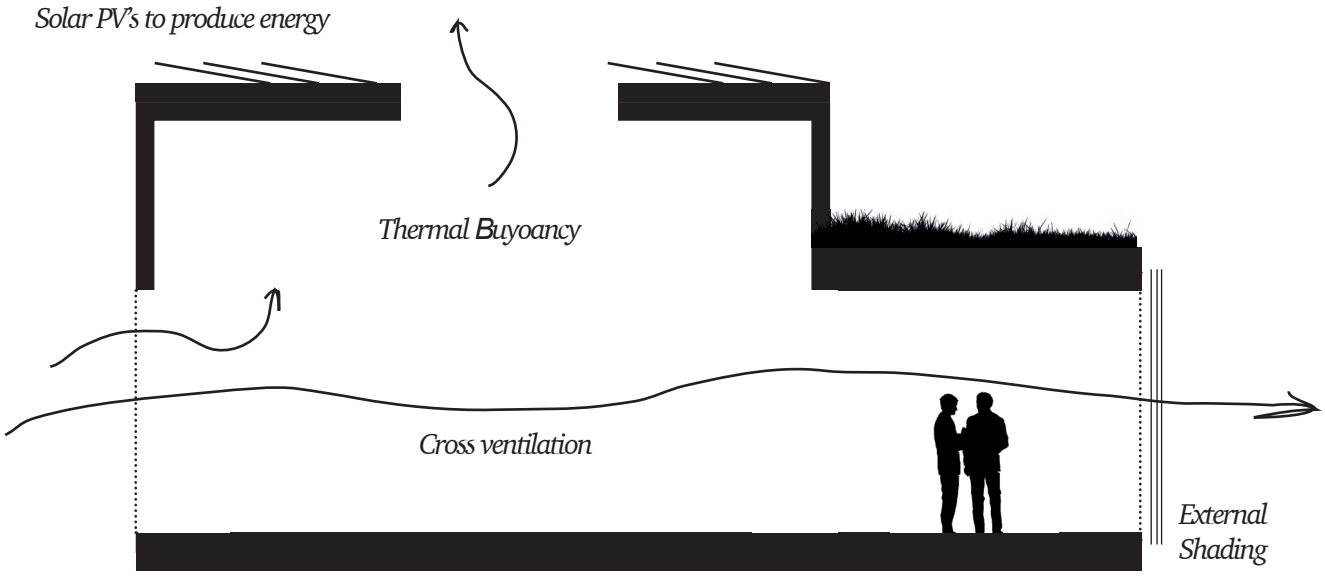
The Farm House

Illustration 242



The Walk

Illustration 243



The Restaurant

Illustration 244

Mechanical Ventilation
The Ventilation Strategy

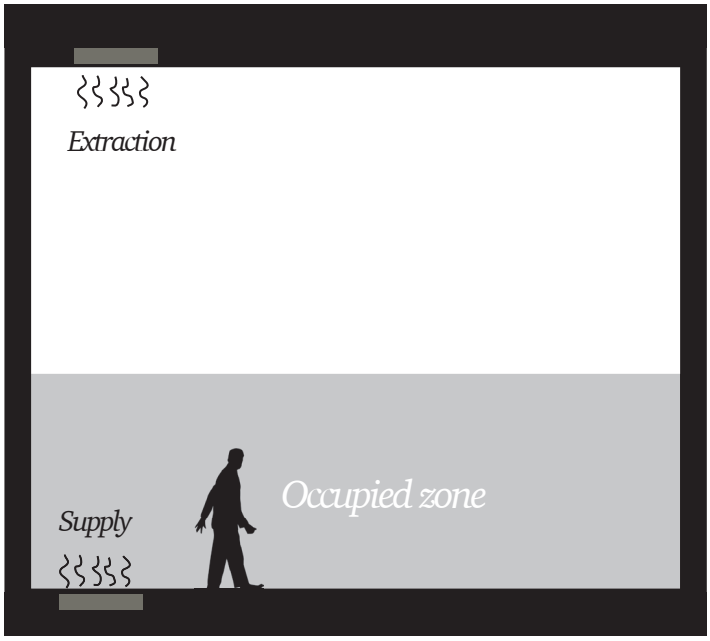
Along with the thermal comfort, atmospheric comfort plays a significant role in the work of the indoor climate in the museum. It is necessary to filter a quantity of fresh air and to remove an amount of air to maintain a satisfactory indoor environment. This balance is called the stationary fabric balance (supplied =removed).

A mechanical ventilation system has been developed based on functions, load profiles, and comfort requirements.

From the beginning, the ventilation principles of the rooms have been incorporated to ensure a good layout of the ventilation system. Displacement ventilation is used in the exhibition rooms and is supplied through grilles in the floor and removed by luminaires in the ceiling. Mixing ventilation is used for The Walk and for The Bunkers and supplies and exhaust through the ceiling. Since the load profile is so variable day to day, hour to hour, all units in the house are a VAV system.

The layout strategy is based on symmetry and as short channels as possible to create as little pressure loss as possible and thus save energy.

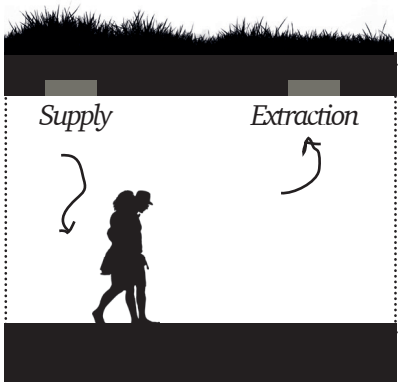
In the next few pages, the overall air change for each room can be detected, along with the location of the engineering room and the layout of the mechanical ventilation pipes.



Displacement ventilation

The Exhibitions

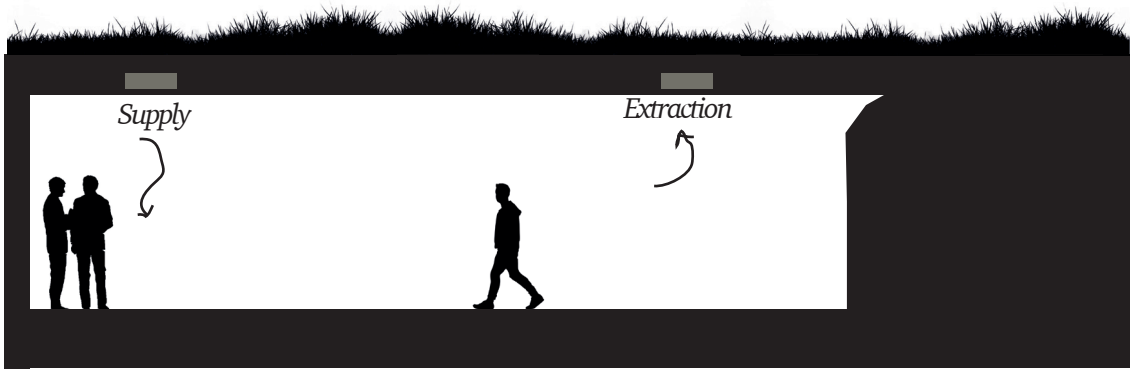
Illustration 245



Mixing ventilation

The Walk

Illustration 246



Mixing ventilation

The Bunkers

Illustration 247

Mechanical Ventilation
Layout - Tech room 1

Air Change rate

4885 m3/h

Bunker 1: 387 m3/h
Bunker 2: 387 m3/h
Technical room: 196 m3/h
Rest: 3915 m3/h

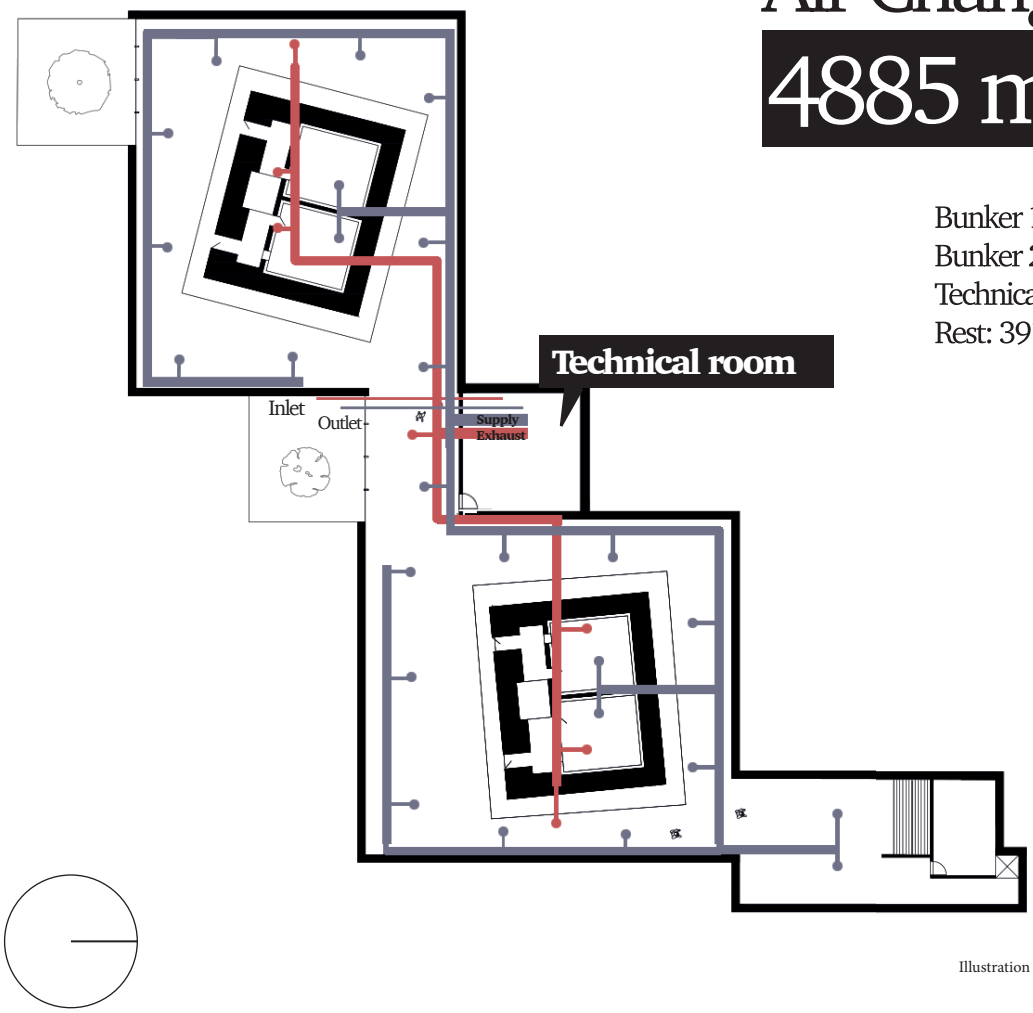


Illustration 248

Layout - Tech room 2

Air Change rate

7688 m3/h

Museum shop: 855 m3/h
Staff area: 1271 m3/h
Wardrobe, secretary & toilets: 762 m3/h
Auditroium: 1400 m3/h

The Walk: 3400 m3/h

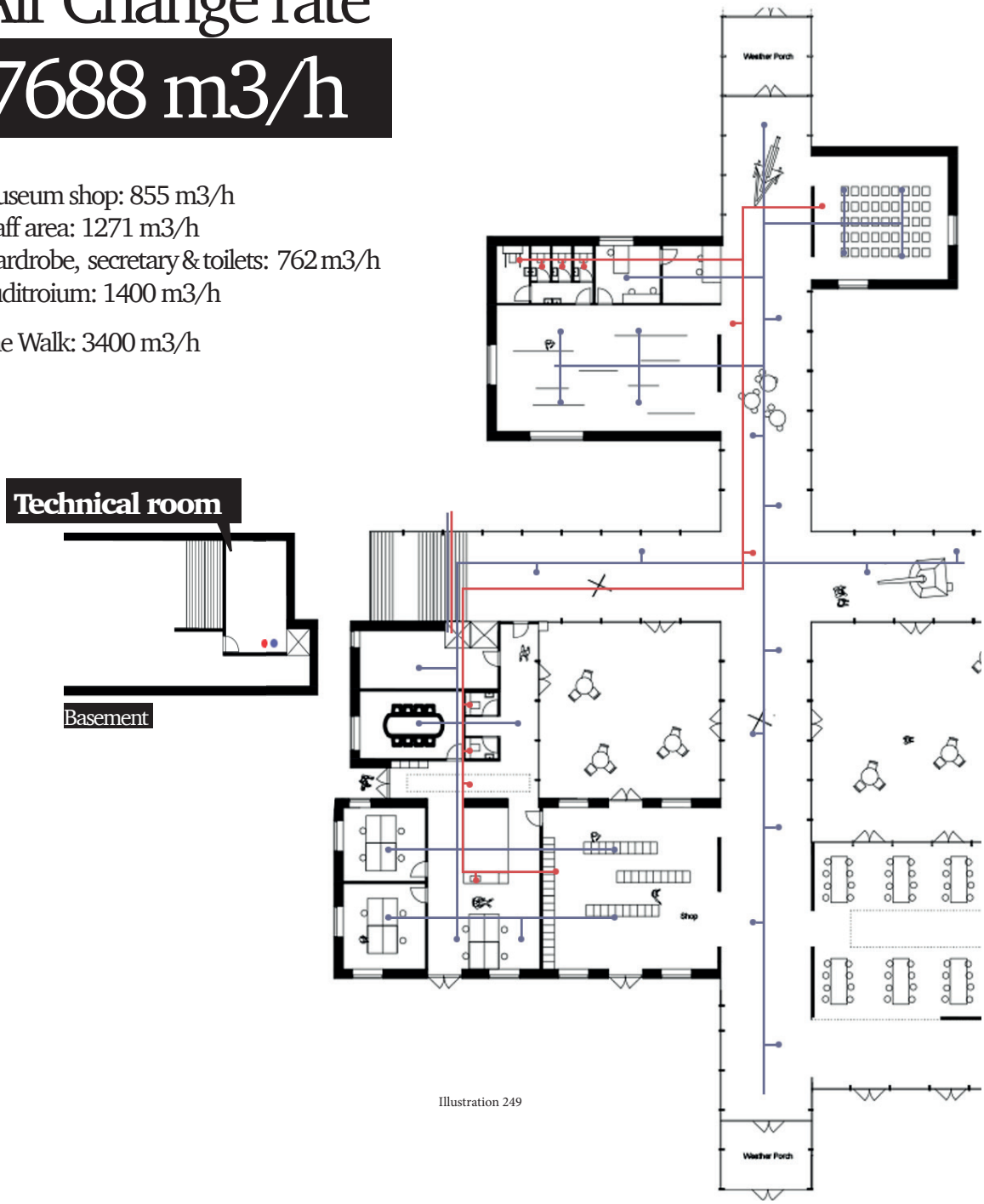


Illustration 249

Layout - Tech room 3

Air Change rate

15238 m3/h

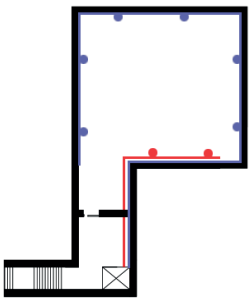
Restaurante: 6071 m3/h
Kitchen: 246 m3/h
Canteen: 178 m3/h
Storage: 210 m3/h
Technical room: 111 m3/h
Exhibition Great danes: 1800 m3/h
The Walk: 1096 m3/h

Aggregat 1: 9712 m3/h

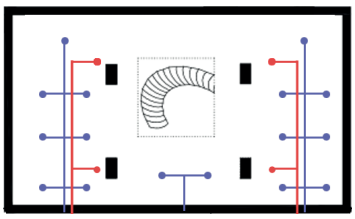
Bunker: 504 m3/h
The Walk: 1195 m3/h
Exhibition Germans: 2793 m3/h
Exhibitions Freedom fighters: 1034 m3/h

Aggregat 2: 5526 m3/h

Basement



1. floor



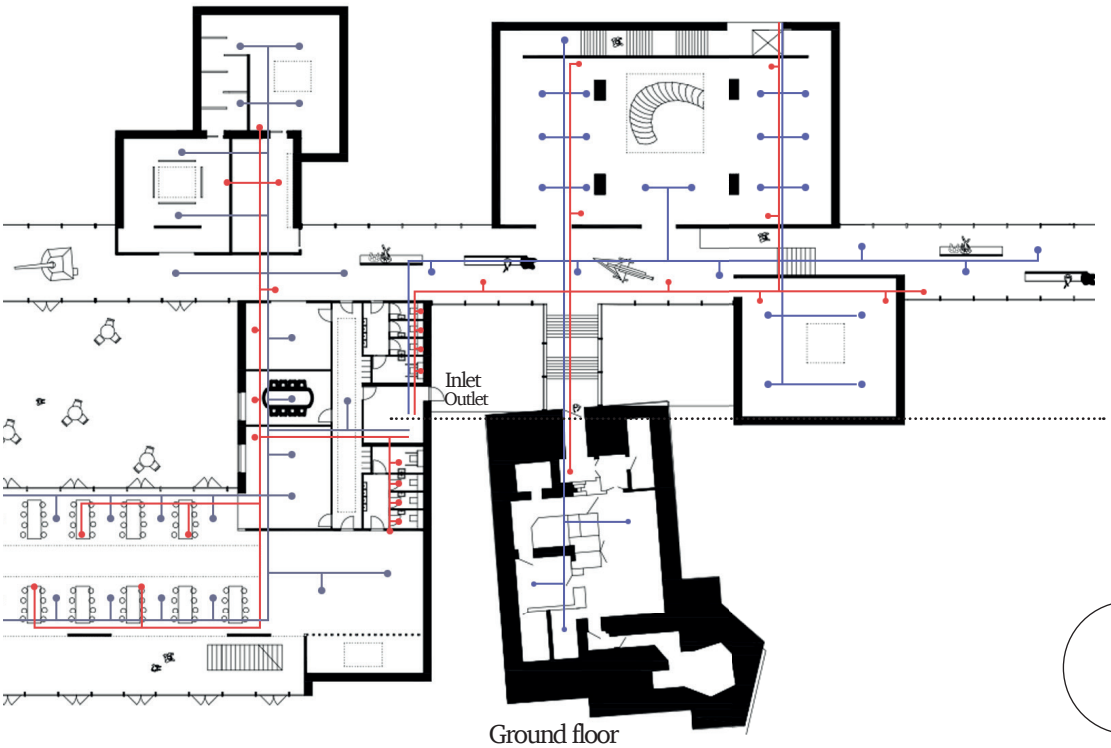


Illustration 250

Layout - Tech room 4

Air Change rate

5698 m3/h

Bunker 1: 387 m3/h
Exhibition Memorial: 591 m3/h
Technical room: 196 m3/h
Exhibition Jews : 1825 m3/h
The Walk: 642 m3/h

The Rest: 2057 m3/h

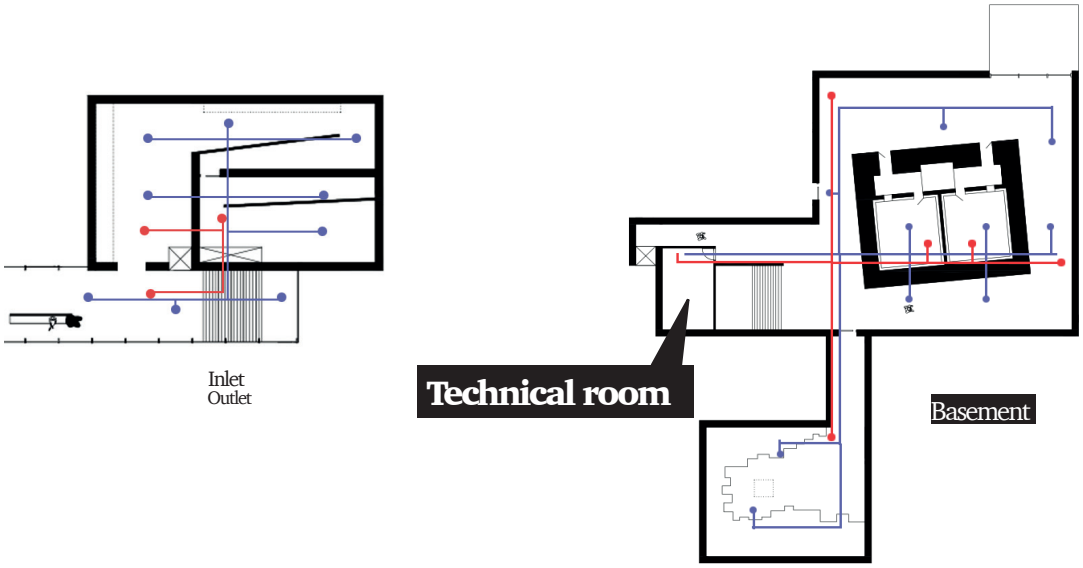


Illustration 251

Not heated area ■
Reaching a sensing experience

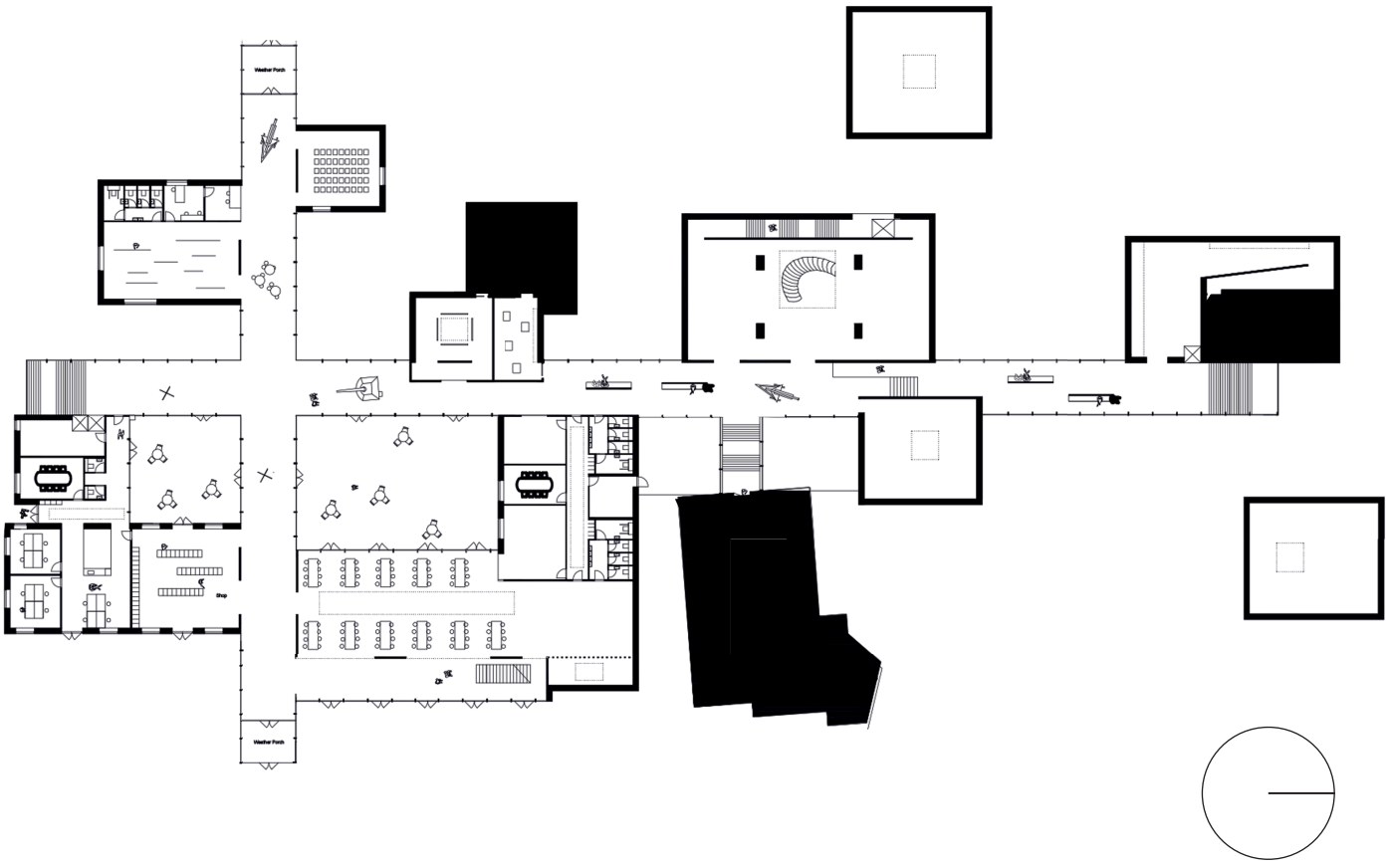
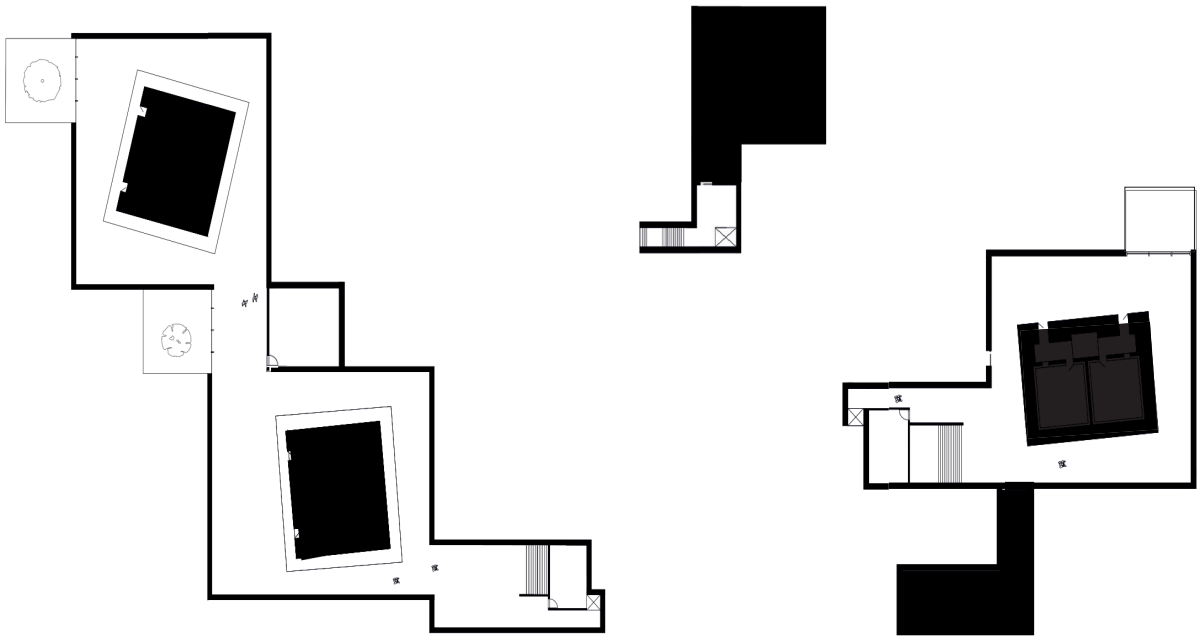


Illustration 253



Reaching energy demand
Reaching a zero energy building

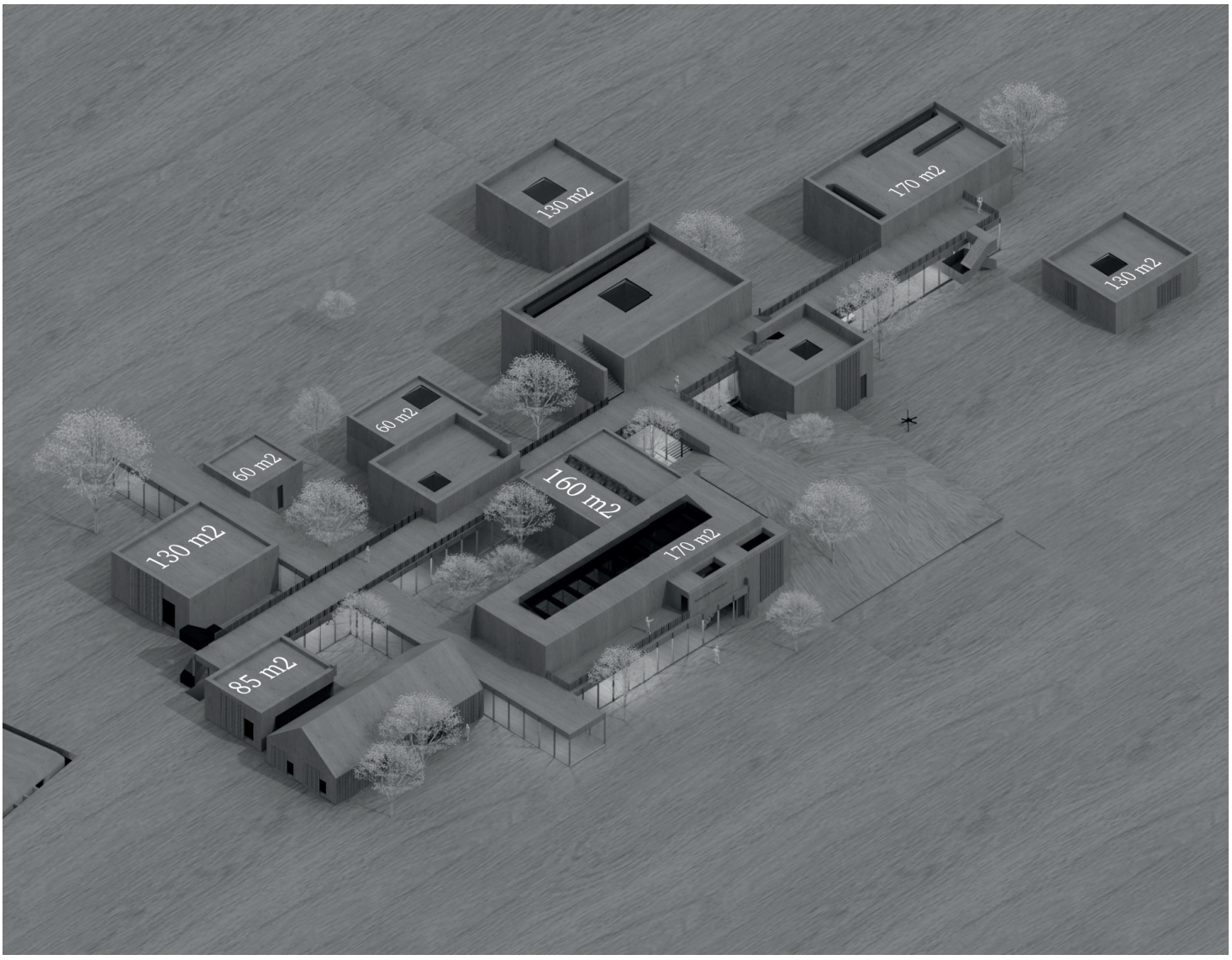


Illustration 254

In order to ensure a zero energy building, the building must also be able to produce electricity. As seen earlier, we have managed to get the construction within the energy frame of 24 kWh / m2 per. year. Which lives up to the intent of the building. One way to get the buildings to produce energy is by adding solar cells. This is just an illustration of its possibility of integration. In the design, I do not have a desire to fill the building with solar cells, as I do not think it contributes positively to the building's history and architecture. However, if desired, it can be added. By using the flat roofs of the museum creates the possibility to add 1095 m2. Appendix 4 shows the calculation for the need for solar cells. Here, a total demand of 923.3 m2 has been calculated

923,3 m^2

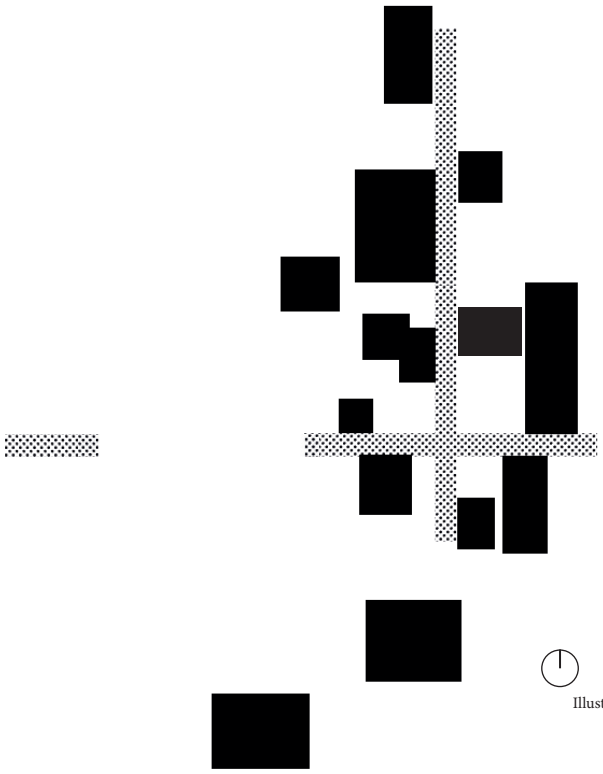


Illustration 255

The Conclusion

Based on the problems formulated in the program, this museum is an attempt to answer them in the best possible way. The Northern Bunker Museum is a new cultural center that can improve the conditions for tourists and residents of the city.

The Northern Bunker Museum is a house for people, by people representing the past of the people. By the use of architectural elements has the project successfully achieved a humanistic and learning building that activates the senses of the observing people and translates true stories into true feelings. The final design of the building enhances the experience of the area's history and connects people, culture, and nature.

The design has interpreted and translated the current values and qualities into a new one. The result is a building that contains three spacious concepts: The Walk, The Blocks, and The Bunkers.

The Walk is an attempt to preserve the scenic experience of the site. The Walk has become the space that connects, collects, and orientates. It is the building's node, entrance, and core.

The Blocks represent exhibition rooms, restaurants, meeting rooms, etc. Simplicity, dynamics, and functionality characterize them. They are the translation of the bunkers that serve the Atlantic wall. They are heavy, large, closed, and fascinating. They are portraying surprises and mystery. Moving around the building, you will always be able to see which of The Blocks you arrive at - but the content is always completely different, contrasting and surprising.

The Bunkers is the involvement of the existing bunkers on the site. The Bunkers are a unique insight into the bunker's construction, weight, and materiality. This contributes to a whole new way of looking at the bunkers of Bangsbo fort.

Overall, the museum has resulted in a public building, which contains several layers of visits. Further, the structure comprises several sustainable strategies for both social and environmental sustainability, which ensure a building that relates to the past, present and future.

The Reflection

The overall reflection of this project took place before, during, and after the final result of the design. In order to make the right final design decisions in the process, it has been necessary to consider the benefits and consequences by any possible choice. Some choices have resulted in solutions that are necessary to reflect on.

This project's sustainable scope has focused heavily on social aspects, such as sensual perception, wayfinding, and orientation.
The use of passive strategies for environmental sustainability has also been integrated into the design.

The focus has especially been focusing on the upcoming building's relation to history and context. Thereby spaces representing the inside and outside of the bunkers have been a significant part of the design phase.

The questions is simply; In these times, would it have been more appropriate to design a building that was far more sustainable in the choice of materials and to create a building with a better sustainable profile according to the Life Cycle Analysis?

Should the construction have been designed so it could be separated (disassembly)? Is there necessarily a need for that many square meters? Should I have created a building with a smaller footprint?

Should I have studied alternative methods that could have provided some of the same spacious atmospheres in other more sustainable materials?

A significant part of the project's vision has been to use architectural elements to highlight emotions that relate to the content of the museum. It can be argued that with architectural eyes, this is the right approach. But is that, in fact, an overly naive thought?

Should the rooms have been far more enclosed, for less daylight? Does an exhibition team require a greater degree of freedom for controllable artificial lighting? Has my grip and vision as an architect been too dominant?

Another critical issue is the use of the historical site. Should I have designed a building that preserves nature and which preserves the authenticity of the place? The construction could have taken place to a greater extent, underground, which could represent one large bunker.

Many of these thoughts are continually being addressed. These subjects can be worthwhile to form experiences from and take further into my work as an future architect.





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