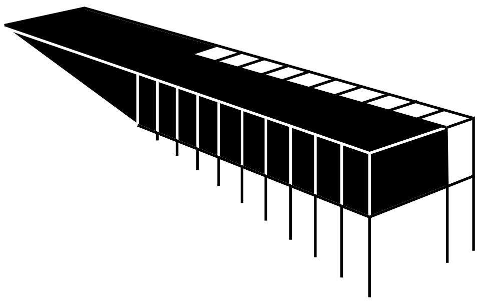


A Distellery

Tectonics: Nature & Landscape

Christoffer Andersen & Nicolai Mai Jørgensen - Grp. 18 - Msc04 Arch. - May 2017

Title
A Destillery - Tectonics: Nature & Landscape

Theme
Tectonics

Authors
Christoffer Andersen
Nicolai Mai Jørgensen

Group
18

Semester
MSc04 Architecture

Thesis duration
1. Feburary 2017 - 18 May 2017

Supervisors
Marie Frier Hvejsel
Dario Parigi

Pages
203 Pages

Prints
6

Abstract

This report represents the work conducted during the Master's thesis at Aalborg University by Christoffer Andersen and Nicolai M. Jørgensen.

The thesis focuses on building in the natural environment, and enhancing the experience hereof by means of tectonic solutions. This is explored through the projecting of a design proposal for a whisky distillery on Iceland.

The scope of the project spans from selecting a suitable site, putting together a program for the building and making the final design proposal for the project.

The project will base itself on an on-site approach were phenomenological experiences goes hand in hand with theoretical readings and quantitative data. This will lay the basis for the design.

The reports culminates in a proposal for a destination distillery located on Iceland in close relation to the natural surroundings. Included in the distillery are spaces for the distilling process itself, as well as for the required utilities and storage. An nonadministrative area, as well as a Visitors Centre with a café, shop and a bar, is also incorporated in the building.
A guided tour through the processes is a central part of the project, connecting to the nature staged through framed views to the outside.

Building in a natural context requires great respect for the surroundings. However, building in an un-built environment can be mutual beneficial for the project.

Contents

Abstract 3
Contents 4
Prolouge 5
Theory 6
Methodology 7
Nordic & Nature 8
Tectonics 10
Iceland 14
Iceland 18
Climate 20
Tourism 22
Energy 24
Distillery 28
The Art of Distilling 30
Whisky Tourism 31
Making Whisky 32
Eimwerk: The Icelandic Distillery 34
The Potential for a Distillery on Iceland 35
Cases 38
Turf Houses 40
Wadden Sea Centre 42
Allmannajuvet Zinc Mines 44
Site 48
Location 50
Analysis Approach 52
Site Description 54
Vegetation & Groundcover 56
Climatic Conditions 58
Context 60
Sections 61
Photographic Notation 62
Programme 68
Users 70
Room Programme 72
Distribution 74
Outcome 76
Presentation 79
Concept 80
Site 84
Elevations 86
Spatial Distribution 90
Plan Drawings 92
Section 96
Front-Stage 99
Arrival 102
Entrance 104
Cafe 111
Malting 112
Distillery 116
Bar 120
Back-Stage 125
Spatial Distribution 126
Administration 130
Detailing 133
Construction 134
Construction Detailing 136
Exterior Materials 138
Interior Materials 140
Ventilation & Heating 142
Structural Details 144
Process 150
Initial studies 152
Further studies 154
Building and landscape 156
Location 158
Form through construction 160
Structural System 162
Plan studies 164
Scale 166
Visitors Centre 168
The Bar 170
Cask storage 172
Detailing 174
Icelandic Concrete 176
Epilogue 178
Conclusion 180
Reflections 182
References 184
List of illustrations 186
Appendix 187
Structural Calculations 188
Loads 191
Dimensioning corrugated steel 196
Dimensioning concrete slab 197
Foundations 198
Bolt Distance 199
Stills and containers 200
Potential air change 201
Fire-strategy 202

Prolouge

Focus
Our conviction is that architecture, tectonic solutions and materiality is capable of enhancing the experience of place.

Through this thesis we desire to gain a better understanding for working with architecture in the natural environment. We believe that by reading and analyzing nature, it is possible to use it as an active participant in the design process. By doing this nature and building can obtain a mutual beneficial relationship, where one enhances the other. Since building in nature, inherently, introduces a foreign object into that environment, it should be done with care and compassion for the spirit of the place.

Through working with a specific building design, we seek to examine methods for analyzing and treating the natural environment as an equal partner in the design process.

Scope of work
The project will constitute in the design proposal for a destination distillery on Iceland.
The prospect of a destination distillery is based on our own initiative, and the reasoning and analysis behind this will be explained through the project. Through analysis, the project will cover researching the placement of a site for the building, as well as the structuring of a building programme.

As the theme for the thesis is tectonics, the structure and construction, will be dimensioned according to relevant regulations. Other technical aspects will be covered on a strategical level.

Motivation
The motivation for designing a distillery on Iceland is to explore the possibilities when working in close relation to nature. Having done many school-projects in an urban context, the thought of building in a natural-setting was interesting.

This lead to Iceland, a country known for its varied nature, becoming the starting point for the project. Since Iceland is a nation of industry and tourism, it became clear that the connection of the two economies could be an interesting approach.

The process of distilling spirits takes a natural, raw material and refines it into a finished product through a series of processes. The connection between a distillery and nature is immediate. Combining these qualities of the distillery with the tourism through a visitors center was seen as a way to connect the different aspects special to Iceland and the focus of the thesis.

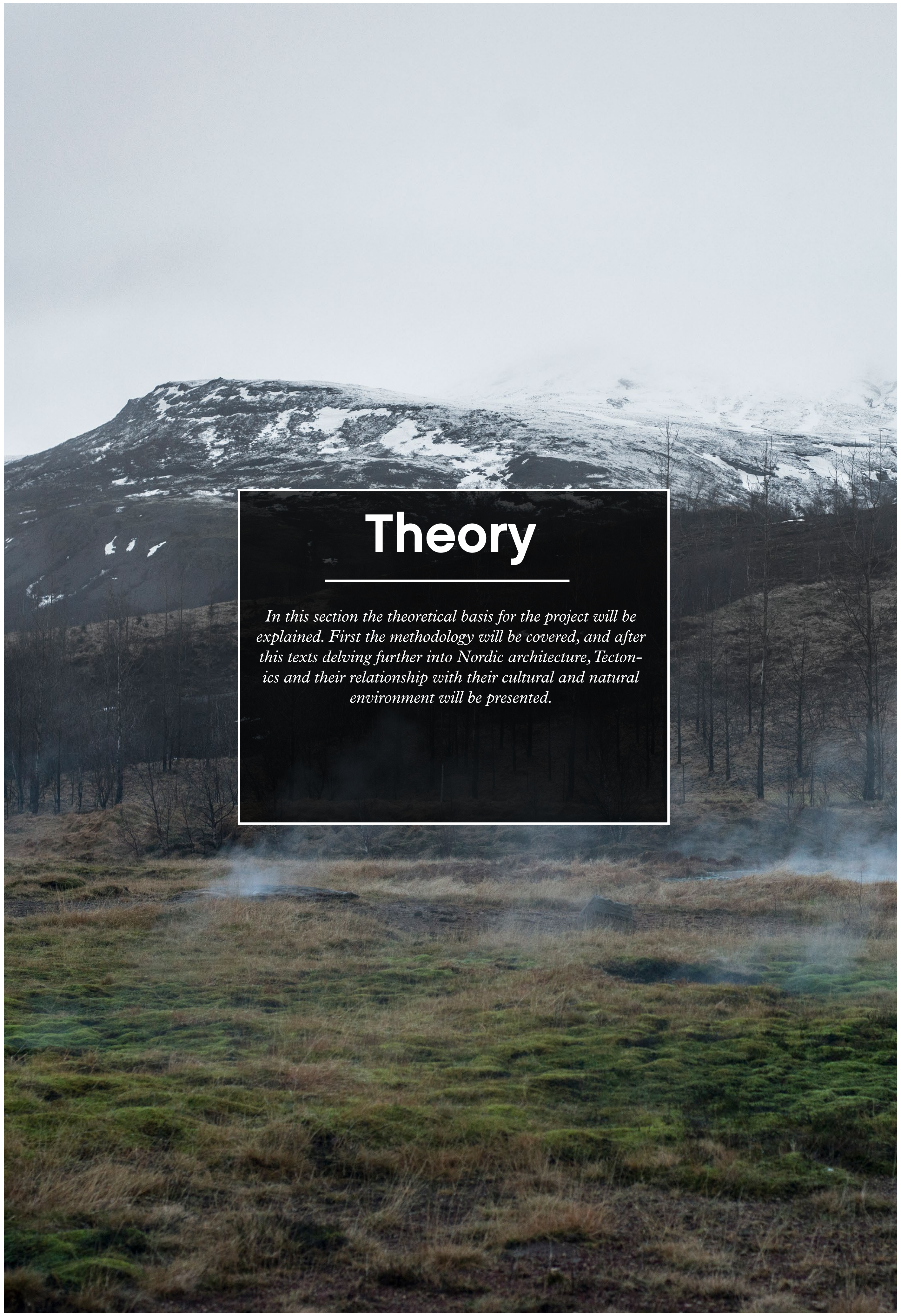
Guide of reading
This thesis-report is divided into three chapters.
As a starting point, the analysis chapter will give an introduction to the theoretical readings of the project. This includes cases, an insight in the distilling process as well as presenting Iceland from a climatic and cultural point of view.

From here, the report moves on to the presentation of the distillery, explaining the location of the site and the placement of the building in relation to nature. After this the chapter will go into detail about the functions for the visitors as well as for the staff, ending with a closer look at the detailing and construction of the building.

The next chapter will go through a selection of the process behind the project. Here some of the investigations leading to the final design such as placement, morphology and structural considerations, will be presented.

The epilogue will sum up the project in the form of a conclusion before reflecting upon the process and the outcome of the design.

Appendix and references will be available in the back of the report.

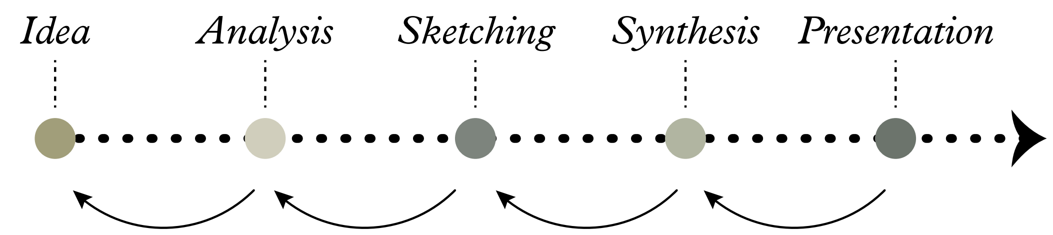


Theory

In this section the theoretical basis for the project will be explained. First the methodology will be covered, and after this texts delving further into Nordic architecture, Tectonics and their relationship with their cultural and natural environment will be presented.

Methodology

The methodology used for the project will take offset in the Integrated design-process as defined by Mary Ann Knudstrup. The goal of IDP is to structure the process and designing with a combined attention to architectural and engineering competencies. Hereby attaining an integrated design solution. (Knudstrup, 2005) **Because the focus of this master thesis bases itself on Landscape, nature, environment and tectonics, an approach related to this theme should be used as measures of evaluation during the process.**



Ill. 1: The Integrated design process

Problem or Idea
Since the aim of the thesis is working in relation with nature. Focus is laid on introducing a building in natural context. Here we require certain precautions when wanting to treat the surroundings with care. Anchored to the problem area is the idea, which is developed throughout the design process.

Analysis
The project will be based on both theoretical knowledge, as well as on-site phenomenological experiences. Going to the site in person, gives an incomparable understanding of reality of the surroundings, as well as the cultural context of the location. This combined with empirical analysis and theoretical readings will serve as the basis for the next phase.

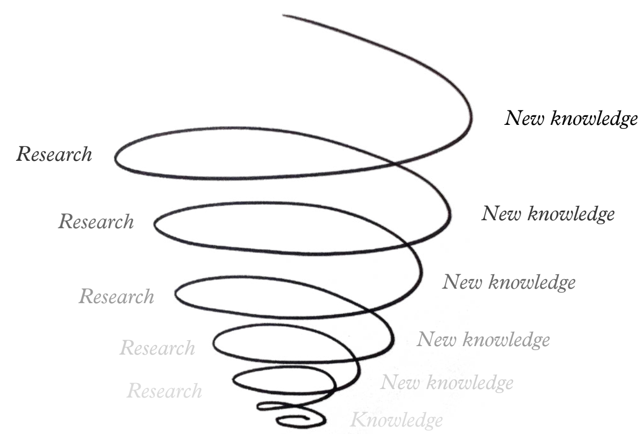
Sketching
The questions raised through the previous phases, is in this project sought to be solved by applying tectonic solutions. Designing a structural system, and using materials in consideration to the existing environment becomes a design driver in the sketching phase. This will be done through investigations in different scale and media. The investigations will serve to give deeper insight used to move the design process forwards.

Synthesis
Here all the aspects of the design will be brought together into a whole design. The different aspects examined should be combined into a project integrating tectonic solutions, with the natural environment, both through technical aspects and detailing as well as spatial qualities and aesthetics.

Presentation
In order to communicate the complexity of the reality, a diverse range of materials must be presented. In this phase, all the qualities in the design must be allowed to come to the surface.

The iterative process
It is important to acknowledge that the integrated design process is an iterative process. This means that as the process moves forward through the different phases new problems or ideas that can redefine the original problem or need further analysis can reveal themselves. Much like the idea of the hermeneutic spiral where ones understanding is continuously evolved by reflecting upon knowledge obtained by trying to solve and understand the task at hand.

"it's architecture's task to enable dwelling, and this task is satisfied by building in resonance with the given place." (Norberg-Schultz, 1993)



Ill. 2 The hermeneutic spiral

Nordic & Nature

Nordic architecture is often defined as something "natural" with a certain sense of reason and moderation. For many decades, Nordic design and architecture has experienced an abundance of success. It seems that this simplicity and sensitivity to quality and detail is something that has appealed to a larger audience than just Scandinavia.

An architecture of the natural

In the search for a definition of Nordic architecture Christian Nordberg Schultz talks about the Nordic Gestalt - a composition of shapes, forms and details that has been created through a long tradition of building. The construction techniques, landscape, nature and climatic conditions of Scandinavia has all influenced this tradition and created an architecture bound firmly to its geographical context.
He starts his work "Nightlands" with stating that light gives Nordic space its character, and that this is a character of moods. This Nordic light is described as diffuse and ever-changing as a result of the cloudy skies and the low-lying sun. Making the climate central to the Nordic environment and hereby it's architecture. *(Norberg-Schulz, 1996)*

"if we maintain that light defines the Nordic character, it is to imply that we understand "climate" qualitatively. Light is conjunctive with weather, and in the North, weather plays a more important role than I the south's more stable world" (Norberg-Schulz, 1996, p.6)

According to him landscape also plays a central role in Nordic architecture. The different styles of regional architecture are described as results of the landscape they inherit. They are both products hereof but also compliment it, drawing out its qualities and amplifying them. Speaking of the Danish gestalt and landscape he writes:

"This is demonstrated in the manner topographic movement and rhythm, presupposing small, low units: earth-hugging, one-story houses with thatched roofs" (Norberg-Schulz, 1996, p.29)

The new Nordic

With what was dubbed "The new wave" in the book "The new wave in Danish architecture" from 2012, Nordic architecture is experiencing a renaissance, where pragmatic solutions, create a new type of architecture. *(Lindhardt Weiss and Vindum, 2012)*

In her essay about Nordic architecture Mari Hvattum writes that contemporary Nordic architects are trying to separate themselves from the "tyranny of place". Referring to the conception that Nordic architecture is often seen as something that is bound by local materials, natural and topographical conditions.

Instead she refers to contemporary Nordic architecture as something that relates more to the cultural and social context of the site. This exemplified by using the Svalbard research center by JVA, that responds to the climatic challenges present in Svalbard, and the industrial past of the area.

"With its copper clad volume, its crevasse like windows, its shiny body and crocked geometry it is not exactly any natural building. It is on the other hand a building which relates immensely to a number of largely cultural affairs… Svalbards science center defies nature more than it imitates, and does not find its closest ally in the arctic topography, but in the mighty remains of Svalbards mining industry" (Hvattum, 2012, p.107-108)

Another example given is their project for the Lofoten turist route at Nappskaret, that with its rail of yellow scaffolding, is a reference to the colour of the beak of the Svartbaken bird that inhabits the area. *(Hvattum, 2012)*

Even though this more figurative interpretation of the context is gaining momentum, the Nordic countries still use its nature as a brand. An example of this is the Nordic embassy in Berlin. Here the Norwegian part designed by Snøhetta has turquoise colored glass emulating the color of Norway's glaciers, a 120 tons peice of imported Norwegian granite making up its south wall, and the Icelandic quarter has turf roofs and lava rock floors. *(Kjeldsen et al., 2012)*

With this new wave of Nordic architecture, social and national culture is taking a larger part in the architecture. The strong connection to the natural environment that has always been a large part of Nordic architecture is transforming into new ways of interpreting environment.

Through this project, we will examine methods of interpreting the natural environment and connecting the building with this. We believe that the pragmatic "new wave" combined with the emphatic approach as described by Norberg-Schulz can work together to obtain a place amplifying architecture that interprets and mediates its surroundings as well as its cultural and social context.

Ill. 3: Nordberg-Schulz's traditional low danish thatched farm.

Ill. 4: Svalbard Science Centre

Ill. 5-6: Nordic Embassy, Berlin

Tectonics

There are two definitions of the word tectonics; One being the so called plate tectonics, a term used in reference to the outer crust of the earth, and the movement of these tectonic plates. The second definition being what is related to the art of constructing or shaping materials.

Evolution of Tectonics

The architectural definition of tectonics originates from the greek word tekton meaning builder or carpenter. Tekton is also closely related to another greek word, technés, meaning the art of creating or fabrication. Techné was in the 17th century released by the word technique, at the time meaning how an artist or a craftsman uses their skill to solve the technical problems of the trade. However, in an architectural context, the word tectonics picks up after the old greek tradition *(Beim, 2014)*.

The german archeologist specializing in architecture, Karl Bötticher, saw tectonics as a way in which material and structural innovations could merge. He divided the term in two; Kernform, representing the form of the structural core, and the Kunstform, representing the artistic outer. His idea was that this new conception was to be the foundation of the new constructions and building systems *(Beim, 2004)*

Gottfried Semper's "The Four Elements of Architecture" was building on Bötticher's ideas, dividing the term even more; the roof, the lightweight enclosure and the mound, all enclosing the hearth *(Semper, 1851)*. Semper's studies in tectonics was based on indigenous building practices and explains the adaption of materials to location, always constantly searching for a new structural principle.

Frampton develops Semper's theory further, and interprets his symbolic and technical principles as the ontological and representational of tectonic form. Ontological being the origin of the given principle and the representational being its function *(Frampton and Cava, 2001)*.

The word tectonics can in extension to this be interpreted as a way to communicate the local conditions - representational and ontological - through tectonic solutions.

The relation between architecture, tectonics and context

As architecture, tectonics is also influenced by its landscape and environment. In Kenneth Frampton's "Studies in Tectonic Culture" he discusses the importance of the site, being the starting point of any project.

"Before transforming a support into a column, a roof into a tympanum, before placing stone on stone, man place the stone on the ground …" (Frampton and Cava, 2001, p.33)."

Here Frampton touches on the importance of settling a building in relationship to its landscape, but in the bigger scale of geography one also has to take into account the regional difficulties specific to the site. Dwellings in the southern regions of Europe have for instance completely different concepts of outdoor and indoor areas. Christian Nordberg-Schultz underlines the contrasting ways of life in connection to location in his publication Nightlands:

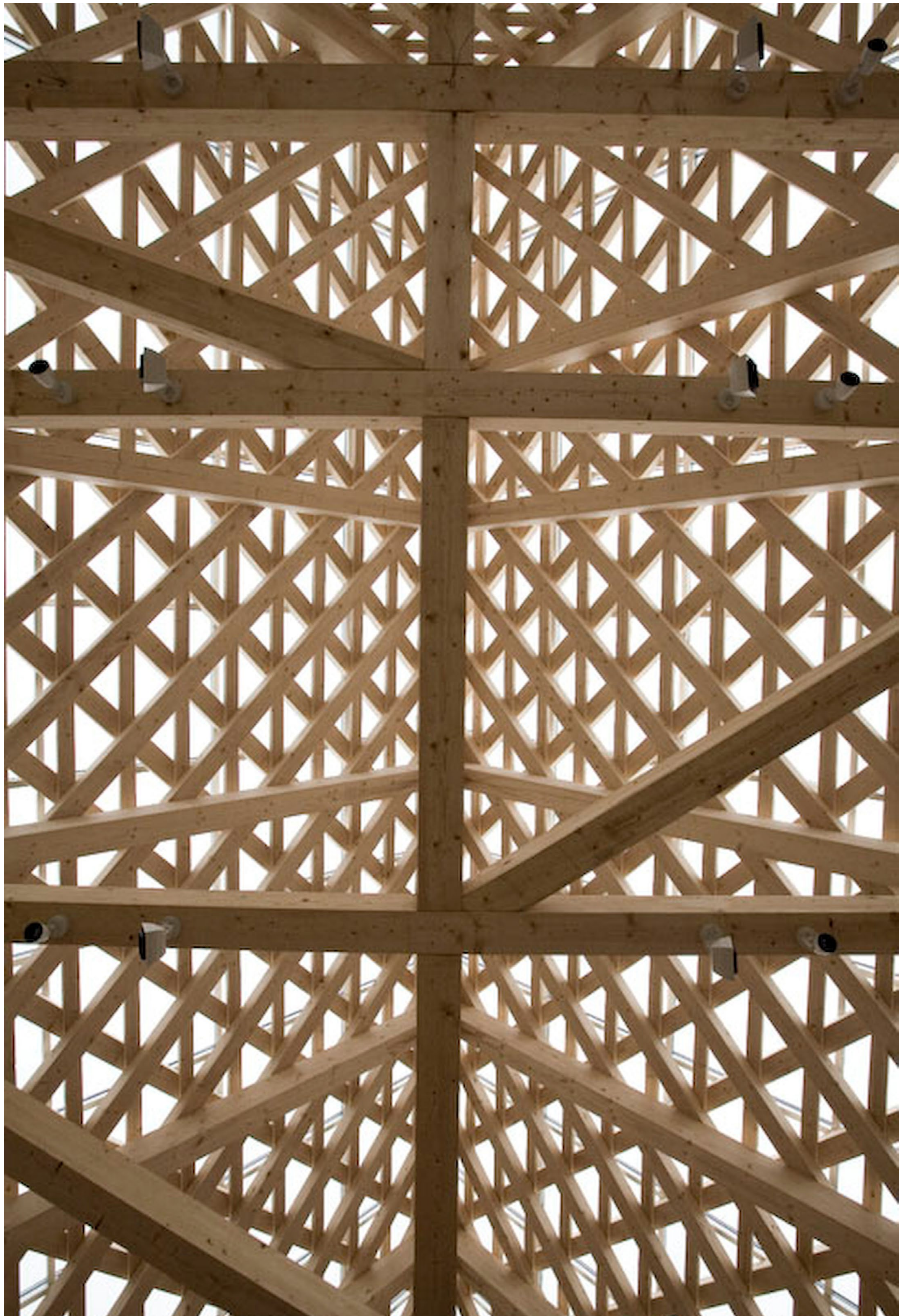
"The word home, as we have suggested, is key to the Nordic. In the north, life does not ensue on the piazza, but in the home, and this entails that intimacy and warmth are more important than representative grandeur." (Norberg-Schulz, 1996, p.22).

With the climate stressing the importance of intimate interior spaces in the Nordic countries this could be seen as a reasoning for the detail oriented nature of Scandinavian design and Nordic architecture.

In his work "Poetics of Space", Gaston Bachelard tries to isolate the concrete essence of intimate space of home through a phenomenological approach. He maintains that the home exists in the polar opposition of attic and cellar. The attic represents the rational shelter from the weather as well as giving shape to the home.

"Geographers are constantly reminding us that, in every country, the slope of the roof is one of the surest indication of the climate. We "understand" the slant of a roof. Even a dreamer dreams rationally; for him a pointed roof averts rain clouds. Up near the roof all our thoughts are clear. In the attic, it is a pleasure to see the bare rafters of the strong framework. Here we participate in the carpenter's solid geometry." (Bachelard, 1971)

Here Bachelard is stating that both the stability and esthetics of the construction as well as the functional origin of shelter, adds to the intimacy and quality of the room.
(Bachelard, 1971)



Ill. 7: Roof at Tautra Abbey - JSA

In order to see the practical appliance of tectonics, it is important to see the relationship between architecture and tectonics. To create integrated design, a model by Mary Ann Knudstrup on Integrated Design *(Knudstrup, 2005)* states that one must let the technical aspects influence the architecture.

However, it is just as important to see that the architecture must be allowed to influence the technical solution. This way one can create a relationship of two parties, and make them dependent on each other, integrated design and tectonic solutions.

We would like to use this as a starting point for this project, basing the architectural form on the tectonics of both the cultural as well as the environmental conditions, letting it be a parameter of design, rather than mere technical solutions.

Tectonics and surroundings

Mortensrud Church is an internationally acclaimed project by the norwegian architectural firm Jensen & Skodvin (JSA). One of the reasons is the projects many different ways to work with tectonics, not just relating to structure, but to the surroundings in which the project is built. The firm is genuinely interested in the process of building, giving them as architects, something to enrichen their practice. JSA states that a true way to design is not just through scale models as a representation of the place, but by actively going to the site, mapping the reality of the project. They furthermore try as much as possible to design the project to match the specific area, in order for the building to tell the story of the surroundings.

Since the Mortensrud Church is situated on the edge of a forest, the firm decided to keep as many of the trees as possible. Leaving the natural vegetation as is. This makes it seem as though the building was there before the trees. Børre Skodvin says in his text "The Complexity of Realness":

"A modern building site often resembles a war zone. With all explosives and heavy machinery, the ground is methodically destroyed and trees are cut down. We wanted to avoid this kind of mass destruction, and rather position the building with an impact that would stop as close as possible to the outside perimeter." (Skodvin, 2014).

By protecting the ground on which the building is built, it allowed the firm to create the project as an extension of the site, rather than reorganizing the area completely. This required the team to come up with tectonic solutions to shape the building by the parameters given by nature.
To facilitate the bedrock, conserving the natural shapes, a site specific structure needed to be designed. The project being restricted by a tight economy, the firm decided to us off-the-shelf units. These were combined to create a flexible system that could accommodate for the different needs set by the site. Not only was this solution cheaper, but it led to more creative freedom.

The construction, despite its flexibility, was of a simple design, enabling it to be constructed in a relatively small workshop with a standard set of tools. The outcome was a very low-tech, rough-looking construction. This construction tells the story of the building, how it is assembled and how it emerged from the natural areas of the site, with that in mind to conserve it. Instead of hiding the construction, the firm managed to convince the client to make it a part of the project, or rather the project.

A rough-looking, hands-on approach to design does not necessarily lead the disruption of aesthetic quality of architectural expression. Skodvin explains further:

"…many projects chose to enclose the structural skeleton within a second envelope to conceal whatever architectural shortcomings this lack of attention might have caused. The result is two buildings: one to carry the loads; another to hide the structure and provide a simple flattened surface as canvas for the architectural expression". (Skodvin, 2014).

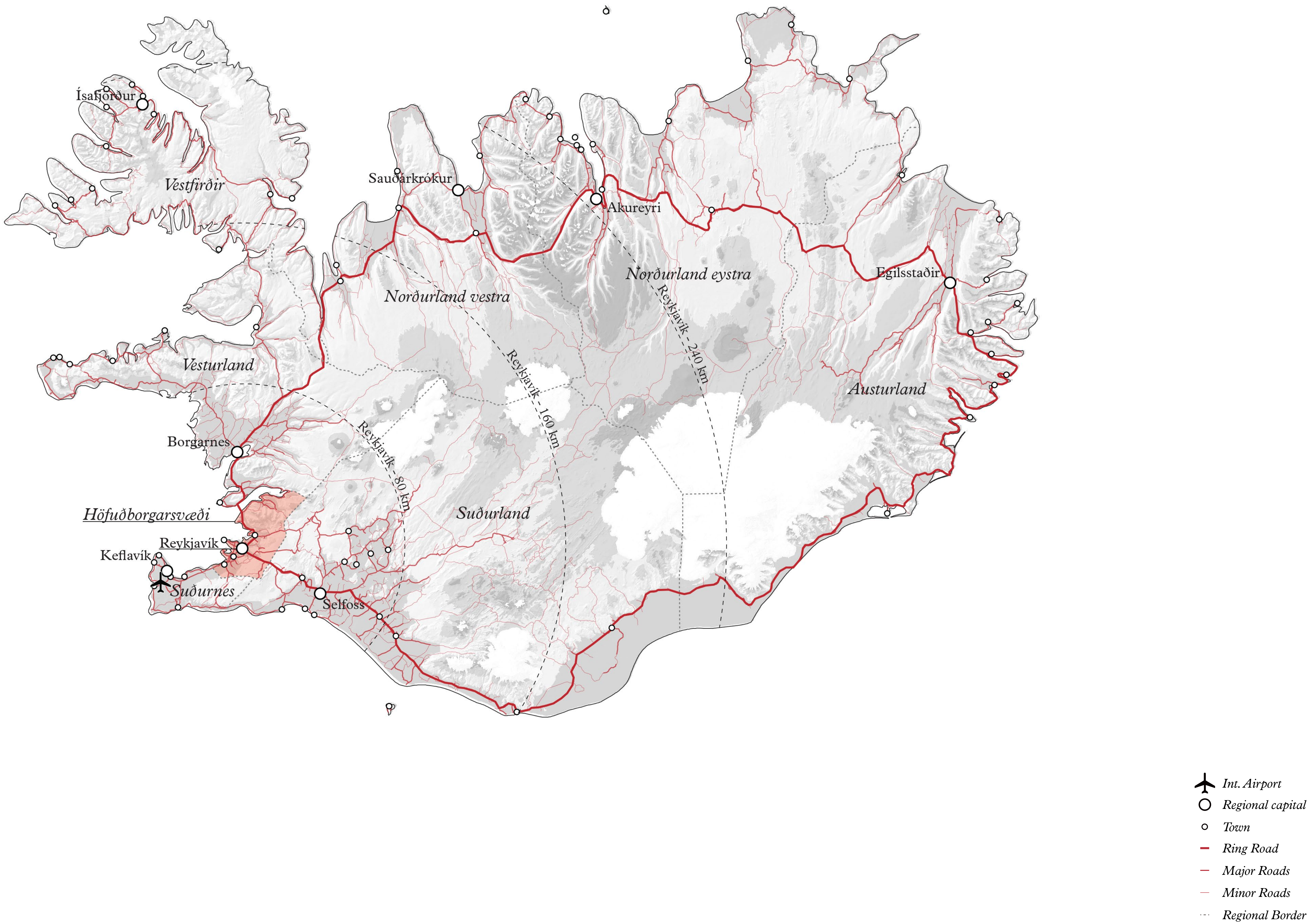
By not using the means of concealing and hiding a construction or other means of structure, a project will present itself through different layers. When allowed to see these layers, depth is added to the project, raising the design to a different level. Furthermore, when a project is allowed the right attention, and adapted to its context, the building will tell a story of its own; the story of the surroundings.

Ill. 8: Site specific structure at Mortensrud Church - JSA

Iceland

To get a grasp of the Icelandic context, and uncover the potentials of the country, analysis and investigations into the different aspects of Iceland has been summed up in a series of short texts and illustrations.

This section will open with an introduction to the country, including general information and history. Furthermore, there will be presented parts of Iceland that are unique to the country, such as climate, energy sources and economy, and it will become clear why it is such a popular tourist destination.



Ill. 9: Iceland, transport and regions

Iceland

Land of Ice and Fire

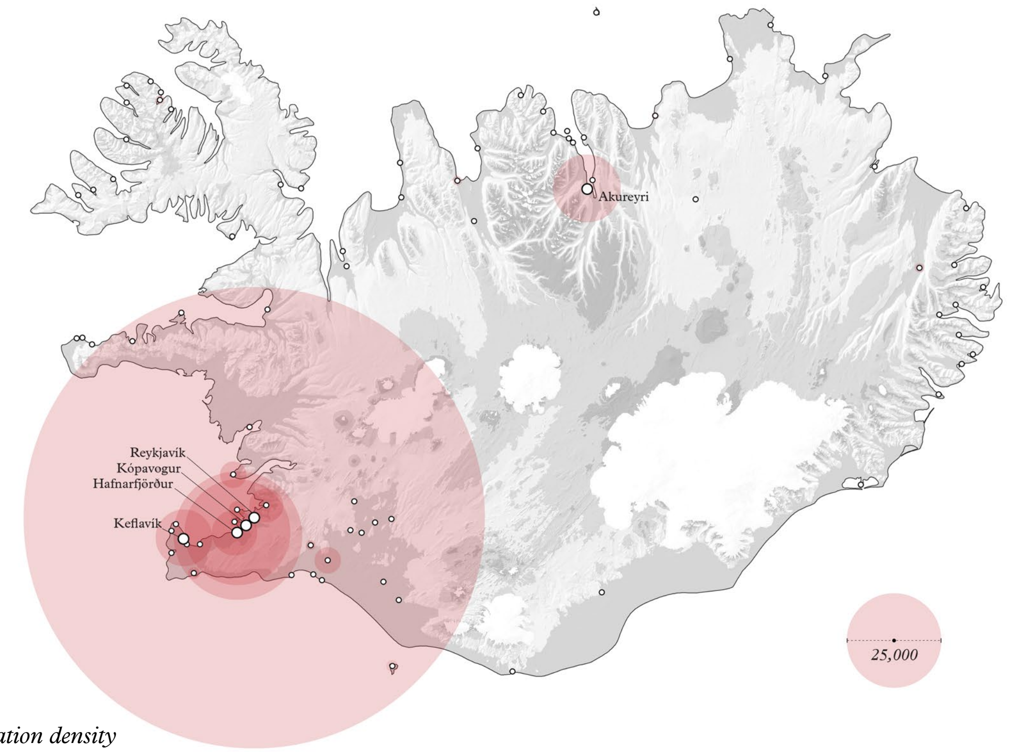
Iceland, also referred to as “The Land of Ice and Fire”, gets its nickname from being situated in the middle of the Mid Atlantic Ridge, right between the North American- and the Eurasian plates, creating hot springs and geysers as well as active erupting volcanoes. At the same time Iceland is covered by of over 10% glaciers, whose melting ice have created rivers and valleys throughout the country.

The country is divided into 8 regions, the largest one being the southern region, natively called Suðurland. Iceland has a little over 300 000 inhabitants distributed over 103,000 km², where the vast majority dwell on the lowlands in the south-western part, close to the capital Reykjavik *(Statistics Iceland, 2017)*.
These areas have relatively mild winters and warm summers, compared to the rest of the country, making it ideal for settlement.

Iceland connects its cities by a main road, going around the country in a loop, with smaller branches reaching out to the peripheral. Due to the harsh weather, many of these peripheral roads close during the winter time.

The first settlers of Iceland arrived some time between the 8th and the 9th century by Norsemen, although some sources say that Celtic monks inhabited the country some time before this, going to the secluded island, seeking solitude and peace . At some point after this, the Norwegian king Harald Hårfagre decided to fuel the population in Iceland with further settlement, shipping men, women and horses to the distant country *(Guðni Th. Jóhannesson, 2013)*. Today’s population at Iceland can be traced back of this Celtic and Nordic origin *(Visit Iceland, 2017)*.

In more recent time, Iceland has for many years made its living of fisheries located close to the sea line. After the industrial revolution aluminium production has been contributing significantly to the nation’s GDP, attributing 29% of all exports in 2007 *(Gugger, 2015)*. The financial crisis in 2008, hit Iceland hard, and after this the country started investing in tourism, offering vast, wild nature to adventurers for a reasonable price.



Ill. 10: Population density

Climate

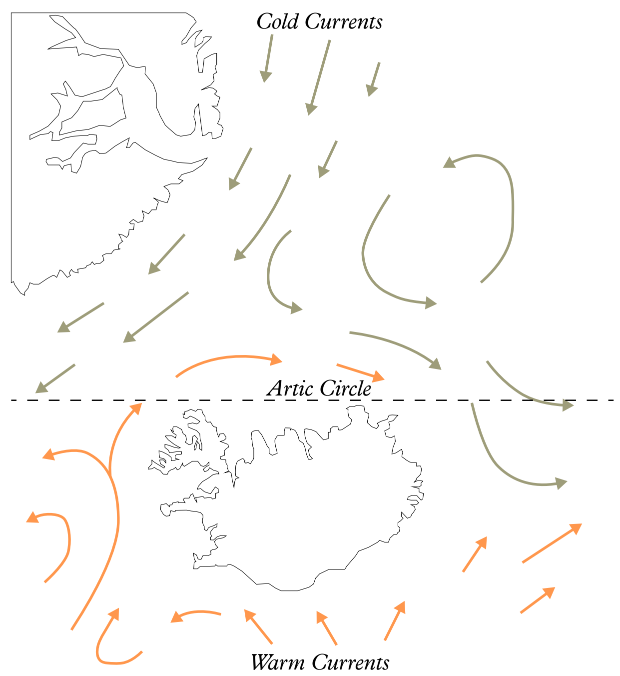
Iceland is situated close to the arctic circle. Because of this placement, the difference between length of days vary greatly over the course of a year. In the northern parts there is midnight sun during the midsummer and all over Iceland you can experience bright nights.

Iceland is also situated between to major ocean currents. The warm North Atlantic Drift passes south of Iceland, and wraps around the western and northern coastlines. A branch of the cold East Greenland Current passes along the eastern coastline. This along with the fact that warm and cold air masses often meet over Iceland, causes a large amount of cyclone occurrences. These cyclones create the conditions for rapid changes in weather and bring with them precipitation and strong winds. This means that in winter temperature can change from +10 degrees Celsius and light wind to -10 degrees Celsius and storming, within a couple of hours.
The mountainous character of Iceland along with the warm and cold ocean currents passing close by, means that there are 2 different climate types present in Iceland. The southern and southwestern coastal regions are warmer and part of the “Subpolar oceanic climate” (CFc). While the northern and eastern parts, as well as the highlands, are part of the Polar Tundra Climate (ET).

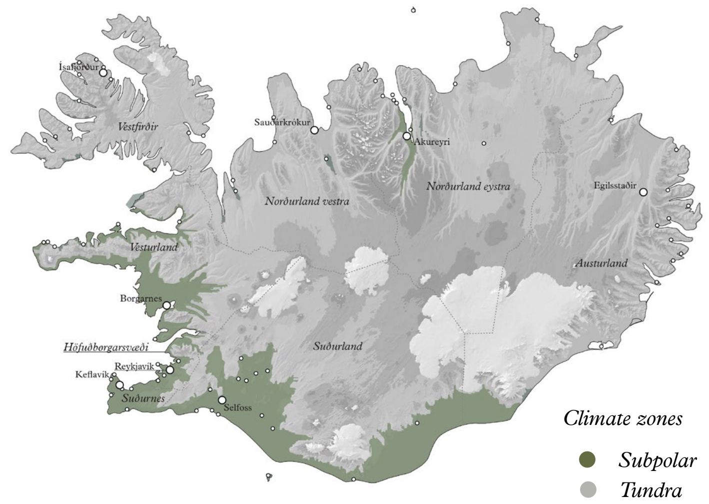
In the lowlands, the yearly mean temperatures in Iceland varies from 2.0 degrees Celsius and 5.7 degrees Celsius, with the southern regions being warmer. Temperature generally decreases towards the inland partly because of an increase of altitude and partly because of less influence from the ocean currents.

The largest part of precipitation falls in the southeastern parts of Iceland, with annual levels going as high as 4000mm on the glaciers and above 1500mm in the lower areas. The northern country is more dry with levels somewhere going as low as 400mm.

Wind directions vary greatly in Iceland, with local conditions such as fjords and other topographical conditions determining the prevailing wind directions. *(Einarsson, 1984)*



Ill. 11: Cold and warm currents around Iceland



Ill. 12: Climate zones

Tourism

From industry to tourism

For the last decade, Iceland has seen a growing interest from foreign tourists. This has been followed up with large investments in the area. Iceland offers vast untouched nature, and moon-like landscapes combined with the country's roots to ancient history, this makes it somewhat of a tourist magnet.

For many years, Iceland has been an industrial nation, basing its economy on aluminum smelting and fishery.

But 2008 turned out to be a fatal year for the nation of Iceland, resulting in bankruptcy, the collapse of the Icelandic Krona being devastating for the traditional major industries. This forced the country to seek other pastures - mainly tourism.

Today tourism is a major part of Icelands GDB, and has been raising by over 30 percent the last four years *(Icelandic Tourist Board, 2017)*. It accounts for more than the aluminium- and fishery industry in foreign exchange, and the numbers are still rising. Revenue from foreign tourists amounted to 208,4 billion ISK, or a little over 12 billion DKK.

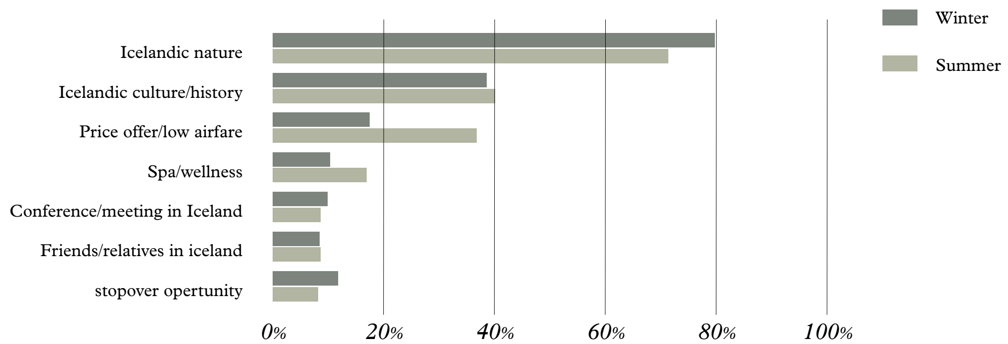
The reason why Iceland has become such an adventure hotspot in the first place, is due to two factors that took the country, and possibly the world by surprise.
After the financial crisis, leading to the collapse of the Icelandic Krona (ISK), prices has been moderate, taken into account that it is a Scandinavian country.

Therefore Iceland has a rich selection of accommodations and places to eat, in addition to its many outdoor attractions. In 2015, 1831 guesthouses had a permit issued by the commissioner. The majority of these are located in the capital region or on the northern side of Iceland.

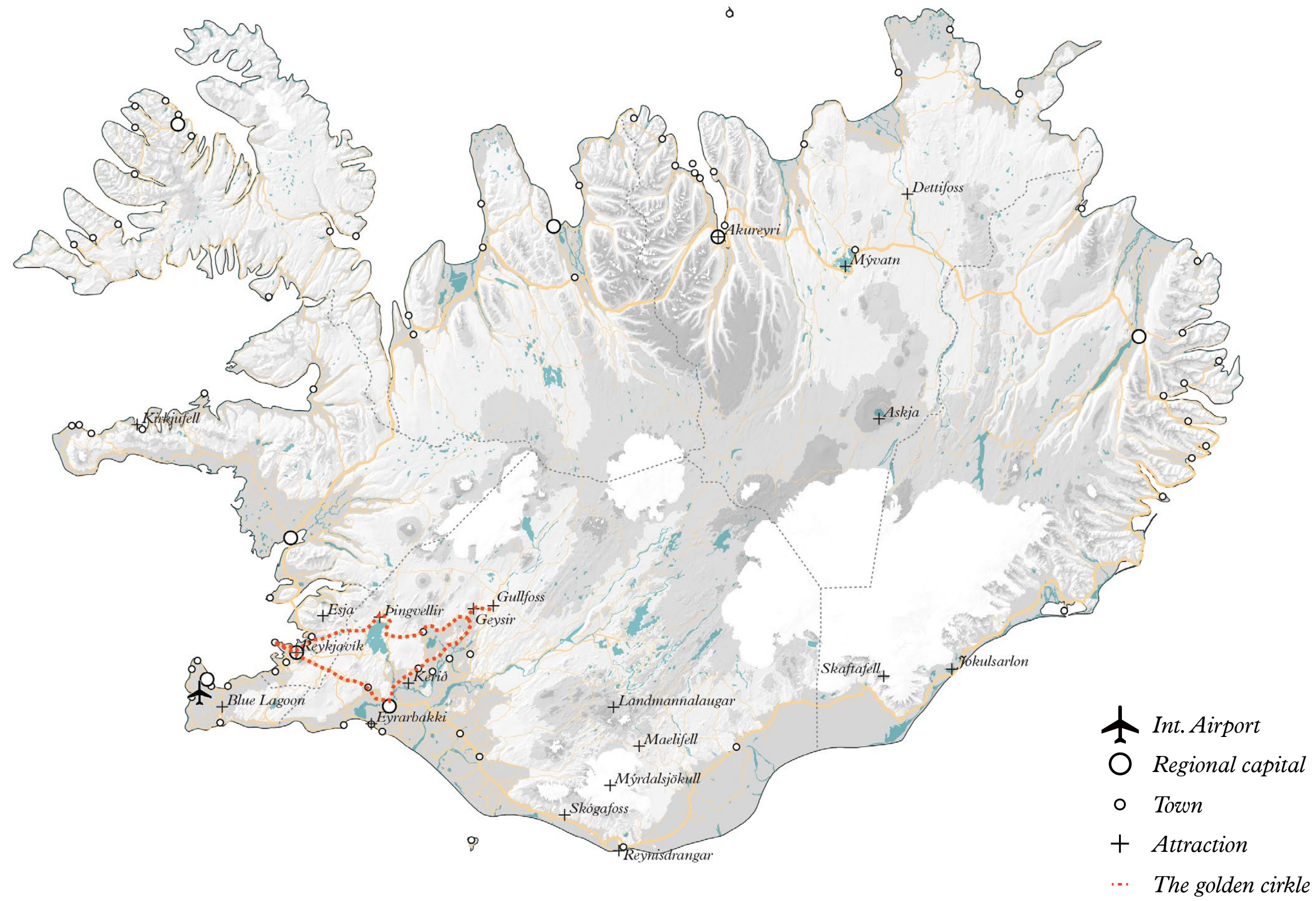
The other contributing factor is the eruption of the Eyjafjallajökull, holding the northern part of Europe on hold for weeks, due to ashes in the airspace preventing planes from taking off at several major airports. This caught the attention of the world's travelers, and media, causing a major rise in tourism.

The largest factor for visitors choosing Iceland as a destination is its nature. Iceland's diverse nature, can almost be categorized as exotic in a Nordic context, with both glaciers, barren stone deserts, and green valleys to name a few of its features. This makes Iceland an unique destination for tourist seeking experiences in nature, the year around.

The tourist route called "The Golden Circle", ties all the most visited tourist attractions together. This tourist route departs from Reykjavik and visits famous attractions like the Gullfoss Falls, þingvellir National Park and The famous Geysir. The route also makes it easy for travelers stopping over in Reykjavik to experience many of the nations major tourist within the span of a day, with buses departing directly from the airport.



Ill. 13: Factors influencing travel (%)



Ill. 14: Tourism and attractions

Energy

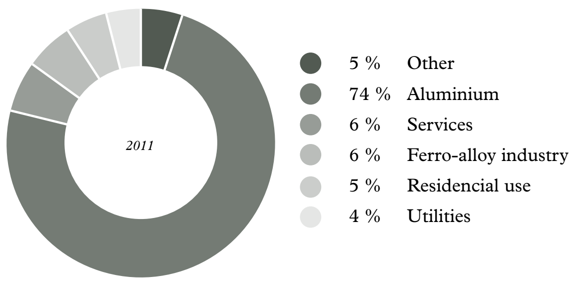
Powered by nature

Iceland is a land where the natural energy resources are rich and many. 99,99% of the country's energy is produced renewable resources. It is also the country in the world that produces the highest amount of energy per capita, by a longshot. This can be attributed to two main factors.

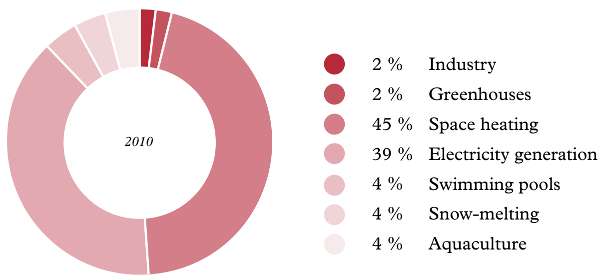
First of all, Iceland is located on top of the Mid Atlantic Ridge, the rift between the Eurasian and North American tectonic plates, this creates a large volcanic zone stretching across Iceland and containing over 200 volcanoes. This causes the geysers and hot springs which Iceland is known for but also several opportunities for utilizing the high temperatures available in these areas for energy production. Iceland has 7 geothermal plants producing 66% of the energy consumption of Iceland. 45% of this energy is used for space heating, and 39% I used for electricity generation.

The other factor is a combination of the mountainous topography and the glacial areas which creates many large, fast flowing, rivers. This creates perfect conditions for hydroelectric plants. These are scattered throughout Iceland generating most of the country's electricity, or to be more precise 73% the remaining 27% is produced by geothermal energy.

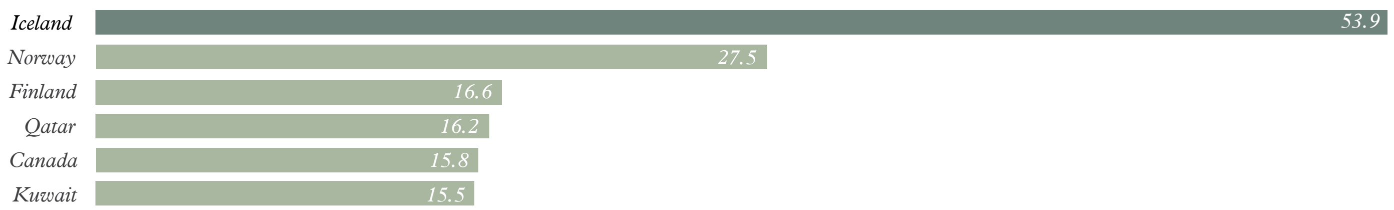
All of this energy generation is being put to use mainly in the aluminium industry of Iceland. An astounding amount of 74% of the 16,569 GWh used in 2011 were used in the production of aluminum. To put this into context the Hydropower plant of Kárahnjúkar produces 4600 Gwh, all of which is used by the Fjarðaál aluminum plant. This could also be used to supply all the homes and summer houses of Iceland with electricity, 5 times over. *(Islandsbanki, 2012)*



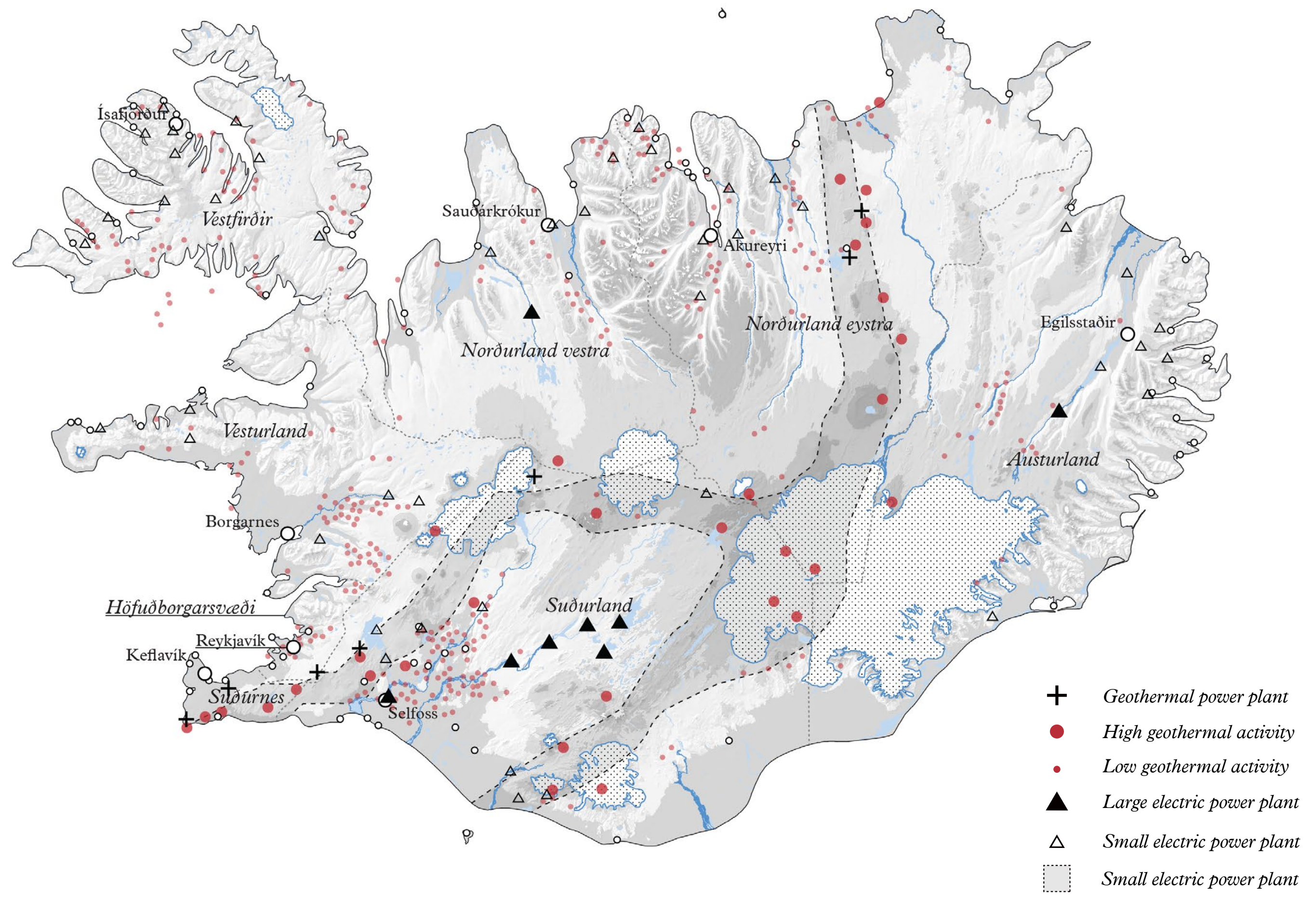
Ill. 15: Hydropower consumption by source



Ill. 16: Geothermal consumption by source



Ill. 17: Electricity generation per resident (kWh/resident), 2011



Ill. 18: Energy sources and Power plants

Summary

Iceland has for a long time been a country in the periphery, making its living of the aluminum- and fishery-industry. Powering the country, is energy coming from almost 100% sustainable sources.

2008 became a turning point in Iceland's economy, leading to a shift in interests. Tourism became the new export, attracting visitors from all over the world.

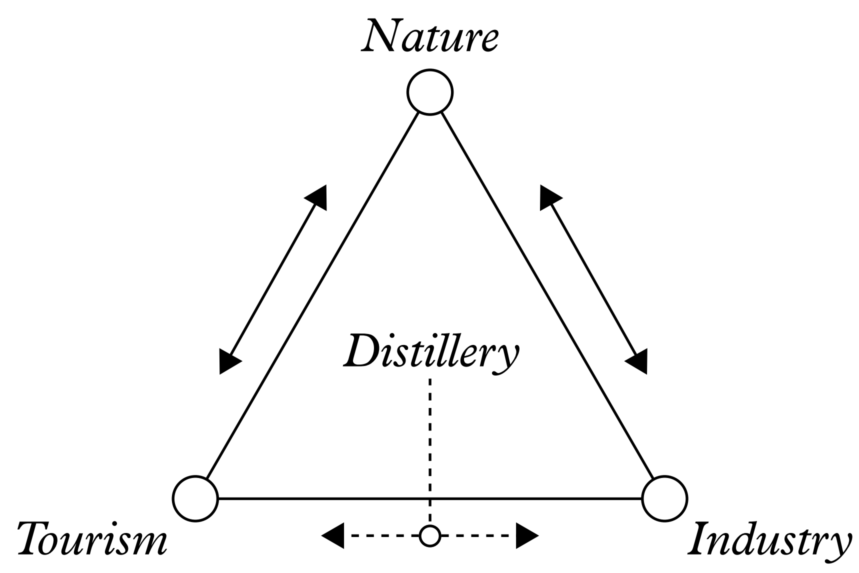
The number one attraction on Iceland, is the country's spectacular nature, having the ability to show its beauty in the summer as well as in the winter.

In this way, Iceland can contribute most of its success to its nature. Both the tourism and industry of the country is reliant upon this. But there is no real connection between the Iceland that is marketed for tourist and the industrial heritage that is a large part of the national identity.

We see the potential for linking these two factors through a destination distillery. This both hints at the industrial identity of nation and invites the tourists into experience another part of Iceland.

In the making of whisky, the natural environment greatly contributes to the final product, in effect of both the recourses required to produce alcohol but also through the environment in which it is matured.

Making Whisky on Iceland creates a unique liquid tied to the nature in which it is produced.



Ill. 19: The Distillery link

Distillery

The following will go in depth with the process of distilling spirits. Starting with a brief history of the art of distillation. Moving on to the modern destination distilleries attracting customers by offering an experience that goes with the whisky. There will be a walk through of the production of whisky - from raw ingredients to finished product. Finally there will be an introduction to the Icelandic distillery of Eimwerk and why whisky production on Iceland is a viable idea and business.

Ill. 20:Whisky maturing

Ill. 21: Stills and casks

Ill. 22: Teelling Distellery

The Art of Distilling

Whisky - A spirit of place

Distillation of spirits is something that has traditions reaching back centuries in time. Currently it is believed that the first distillation apparatus was invented in the 1th century AD in Alexandria. But it wasn't before the 12th century in southern Italy that this was used for the distilling of alcohol. *(Rasmussen, 2014)*

Many local traditions of distilling various spirits have since then evolved. This nature of the distillations relies heavily on the produce available for fermenting. In the Scandinavia Aquavit is the traditional alcohol, produced from either potatoes or grain, and flavored with botanicals. This tradition has also been predominant in Iceland as a result of their Norwegian heritage.

One of the most popular distillation traditions arose in Ireland and Scotland, with the production of whisky. Here the unflavored distilled spirit is put on oak casks and left to age for several years making whisky draw out flavors from the wood.

The fact that whisky is unflavored before put on the casks, makes for a product where the characteristics of the taste comes from the ingredients that make up the spirit, water and grain, and the circumstances of how it is stored, the type of cask and the attributes of the surrounding environment.

This makes whisky a spirit that is inherently tied to the place where it is produced, as the water source, and storage location are integral parts of the flavors. Add local ingredients to that mix and you have a true product of the location.

This is maybe why many new distilleries are popping up around the world. Japanese whisky has entered the scene many years ago, and India also has several. Even Scandinavian whisky distilleries have seen the light of day, several with great success. The Danish distillery of Stauning is upping their production from 30.000 l/year to 900.000 l/year *(Stauningwhisky.dk, 2017)*, and in 2012 the Swedish distillery of MackMyra were appointed "European spirits producer of the year" by the IWCS.

Whisky Tourism

Destination Distilleries

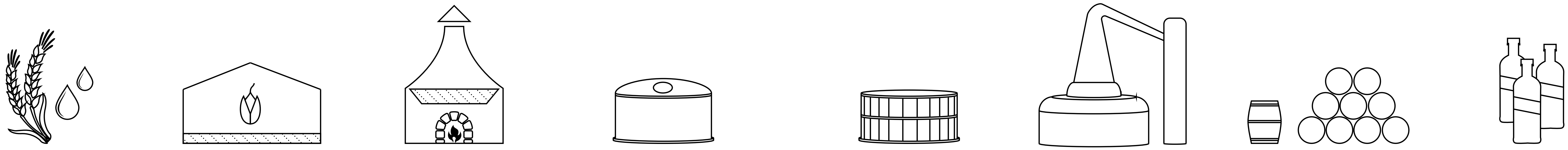
Distilleries have for many years been a contributor to tourism. When going on holidays visiting the local alcohol manufacturer has been a way to get a sense of the local gastronomy. In Scotland 1 in 5 tourists visit a distillery on their vacation *(Visit Scotland, 2015)*, with a total of 1.6 million distillery visitors in 2016 *(Scotsman.com, 2017)*. But this trend is not only happening in motherland of whisky. The distillery of Myken, located on a small island in the northern part of Norway, with only 11 inhabitants, is receiving around 500 visitors a year *(Larsen, 2017)*

One example of a distillery which has embraced the idea of a "destination distillery" is the Teelling distillery in Dublin, Ireland. The distillery opened its doors to visitors in 2015 and produces around 500.000 l of whisky a year. Here the visitors are an integral part of the building, which not only incorporates a shop, where you can buy whisky and merchandise but also incorporates a café and bar open to the general public.

The ides of destination distilleries play into the notion of the experience economy. This term was first used by Joseph Pine and James Gilmore in their article "Welcome to the experience economy" for the Harvard business journal. Here they state that for companies to battle commoditisation, they must add a memorable experience to their product. *(Pine II and Gilmore, 1998)*

"An experience occurs when a company intentionally uses services as the stage, and goods as props, to engage individual customers in a way that creates a memorable event. Commodities are fungible, goods are tangible, services intangible and experiences memorable" (Pine II and Gilmore, 1998, p.98)

Making Whisky



Ingredients

A whisky is made of only three ingredients, grain, water and yeast. These are combined to create the final product. Whisky can be made from several different grain types, this can be barley, rye, wheat or corn. The water is an integral part of the whisky. The flavor characteristics of the whisky is affected heavily by the quality, sediments and other characteristics of the water used. This means that the water supply of the distillery is an integral part of the whisky produced.

Malting

Here the water comes into play again. The first step of malting wetting the grain with water and leaving it to soak for a couple of days. After this the grain is moved to the malt floor, where it is spread out for and germinating. The process of germinating needs a steady temperature of around 18 degrees, but as the process produces heat, the grain is turned to make sure the temperature is even through the layer. The room is furthermore ventilated to ensure the temperature stays even.

Drying

The next step involves drying the Malt. If smoky flavors are preferred, burning peat, wood or other ingredients in a kiln and letting the smoke rise through the malt infuses the malt with the preferred taste characteristic. When the malt is dry, it can be stored and is ready to be used for mashing.

Mashing

The mashing is the process of extraction the sugary content and flavors of the malt. First the malt is milled and water is added. The mixture is then heated to 67 degrees and left stirring for a couple of hours before being cooled to 20 degrees.

Fermenting

The 20 degree worth is now ready for fermenting. Yeast is added to the mash and this is left for 2-3 days fermenting until it reaches an alcohol percentage of around 5-10%

Destilling

The distilling process is where the alcohol is extracted and the notes of the whisky is first forms. There is different ways of distilling, the most common being the double distilling method. Here the wash is distilled, in the wash still, to create what is called a low wine. This holds an alcohol percentage of about 20-25%. This low wine is then transferred to the spirit still where the final spirit is distilled and raised to an alcohol percentage of around 65-70%.

Maturing

The process of ageing the whisky is where the majority of the taste and color is added. The barrels used is made of oak wood. These are often recycled from other alcohol productions such as bourbon, sherry or port that adds different flavor notes to the whisky. The distilled spirit is added to the barrels, and left to age for a minimum of three years before it can be called whisky. As the barrels are porous, this process is heavily affected by the environment in where the casks are stored. With the contraction and expansion of the barrels, caused by shifts in temperature and humidity, taste is transferred to the whisky and the character of the spirit is created.

Bottling

Finally, the bottling of the whisky can begin. The whisky is poured into bottles, ready to be sold to the consumer. After this process the taste of the whisky stops changing as the glass does not react with the finished product.

Ill. 23: Whisky Process

Eimwerk: The Icelandic Distillery

Ill. 24: Eimwerk distelery logo

Ill. 25: Still at Eimwerk

Ill. 26: Still at Eimwerk

Eimwerk is a family owned and run Icelandic distillery producing Gin, Brennevin and Whisky. The idea of the company was formed in 2009. After a lot of bootstrapping they were funded in 2011 and serious production could start. In 2014, they released their first product, the Floki, young malt, named after the first Icelander. The focus of the company is producing high quality spirits made solely of Icelandic ingredients. Contrary to other Scandinavian whisky distilleries, Eimwerk is not trying to create a Scottish whisky on Iceland, but aiming for making the best possible Icelandic whisky.

Today the company resides in a small backyard storage building but despite the humble quarters their success is remarkable. At the moment, they are producing approximately 100.000 bottles of whisky a year of 25.000 LPA (liters of pure alcohol), and are planning to double this by 2018. On Iceland, their product is available in the tax-free shop of Keflavik airport and in the Vínbúð, the Icelandic alcohol monopoly stores, and they are shipping small batches to specialty dealers around the globe.

Given their great success the company is looking to build a new distillery in the coming years. Their hope is to initially scale up their production to 200.000 LPA and the gradually increase to 800.000 LPA. Both the construction costs and operating of this size of distillery will be a major investment and given the nature of whisky making, requiring whisky to mature for a minimum 3 year, makes it a risky one. Here Eimwerk sees a destination distillery as a way to supplement their income stream and the key to making a distillery on a large-scale work on Iceland.

During the project Eimwerk Distillery serves as an external advisor, giving insight into both the distillery business and Iceland, as well as aiding in defining the demands for the practical facilities.

The Potential for a Distillery on Iceland

Ill. 27: Water

What Whisky needs

The key to making a good whisky, is the use of quality ingredients distilled through a series of well monitored processes. The ingredients should preferably come from a local source, making a unique finished product that relates to the place where it is made.

As should be clear by now whisky at it's core needs grain and water, to be produced. During the process peat is usually used to dry the germinated seeds and create malt. Heat is applied to the mash and this is again cooled down using water before being heated again for distillation. This means that whisky production is both quite water and energy intensive.

All the components of whisky making are present on Iceland and in the following short text we will explain why whisky production is on a practical level a perfect fit for Iceland.

Ill. 28: Barley

Water

The water occurring on Iceland, are coming from glaciers and being of excellent quality and purity, and ideal for whisky-distilling. According to the water bottle company Acqua Nordica Ltd in collaboration with Reykjavik Energy (OR), supplying Iceland with drinking-water and geothermic water for heating. A comparison has been made between internationally renowned water-brands, worked out by OR, with Iceland getting the highest total score. *(Ibcbeverage.com, 2017)*

Barley

Iceland has seen an increase in ecological grain production since 1992. *(Statistics Iceland, 2017)* Among the grains produced is Icelandic barley. Barley is a resilient grain that can survive the harsh climate of Iceland, and is suitable for peating as well as whisky-making.

Icelandic "Peat"

Scottish tradition uses local peat or turf to fire the kiln, smoking the malt that in the end flavors the whisky. Even though Iceland also has its wetland-fields with plenty of turf, the complexity of yeast and sediments are far from as complex as the Scottish turf, making it useless for peat smoking.

The Icelanders have a long tradition of curing meat using sheep dung or birch when making the local ham called Hangikjöt - hanging meat. As a substitute for peat, dried sheep dung would therefore be a suitable replacement, making the peated character specifically Icelandic.

Geothermal energy

Heated water is an essential part of the distilling process. Large quantities of energy is required to heat water for used for mashing the malted barley. Iceland's geothermal hot spots supplies cheap sustainable energy for this purpose.

Summary

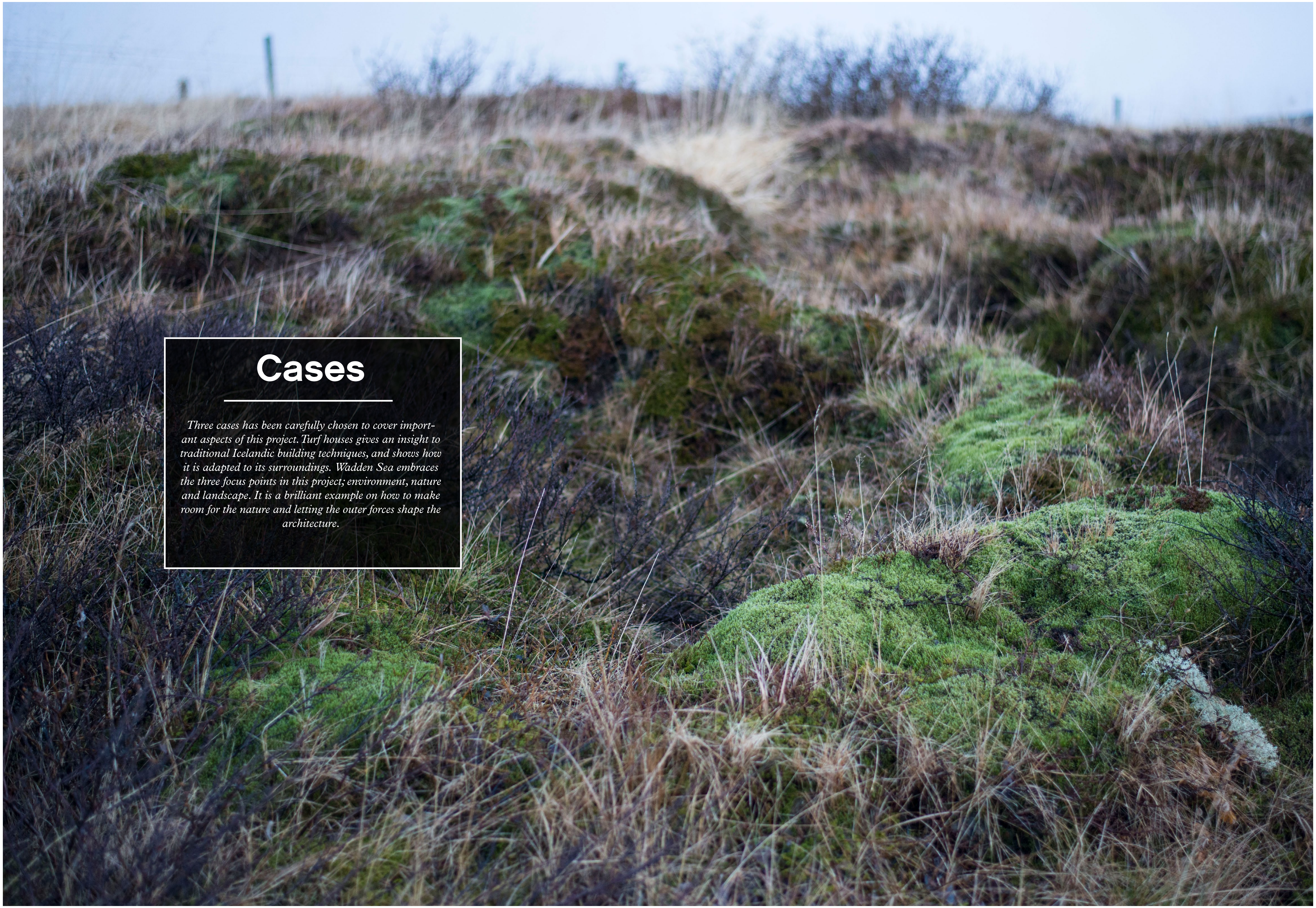
Whisky is certainly a product of its place. The story of how the whisky is created is an integral part of the individual brand, and the story of Iceland adds to this. This storytelling needs to be shown throughout the distillery, making a memorable experience for the visitor.

Building a destination distillery in Iceland is paying homage to industrial culture of Iceland, and introducing this to the tourism that is prevailing.

But it is also a way to create an Icelandic product of high quality that maintains it value even if national tourism subsides

All the resources for making whisky on Iceland are there. Eimwerk distillery has taken advantage of this. They show us that the notion of an Icelandic whisky distillery is viable on a business level, and that tourism can help finance this venture by building a destination distillery.

This page is intentionally left blank



Cases

Three cases has been carefully chosen to cover important aspects of this project. Turf houses gives an insight to traditional Icelandic building techniques, and shows how it is adapted to its surroundings. Wadden Sea embraces the three focus points in this project; environment, nature and landscape. It is a brilliant example on how to make room for the nature and letting the outer forces shape the architecture.

Ill. 29: Turf Houses at Keldur Farm

Turf Houses

Looking for a regional building tradition in Iceland one has to look at the turf houses that are the dominating building form from the 9th century all the way to the 19th.

Because of the harsh climate of Iceland, the lowlands to the south have throughout history been the most inhabited. Here the climate is milder, grass and wetland is predominant and this is where the early inhabitants of Iceland settled.

Being used to work with wood and turf, the Norwegian settlers introduced the tradition of building turf houses in the early 9th century, and adapted it, to the Icelandic climate, providing sufficient shelter throughout the cold, windy winters. The dwellings were constructed with heavy walls of flat stone and a wooden roof construction, all covered with turf. The houses have throughout the years evolved from being completely submerged in the peaty ground, to being more independent, standing on its own, supported by the stone walls and the wooden construction. The insides of the wealthier dwellings were covered with wood paneling, making for a more comfortable interior.

The turf houses provided insulation from the cold climate, being superior to wooden or stone walls. But the configuration of the houses adds to further protect them against their inhospitable climate. The houses are often placed along a central passageway, connecting them. This is configuration is called "gangabær", or a passage-farmhouse. *(Whc.unesco.org, 2017)* The gables are oriented towards the dug down passage which creates shelter for wind and rain. Early farmers also placed their dwellings at the foot of a hill, near a running water source. This further shelters them from the wind and a provides them with a constant water supply close to the settlement. *(Krissdottir, 1982)*.

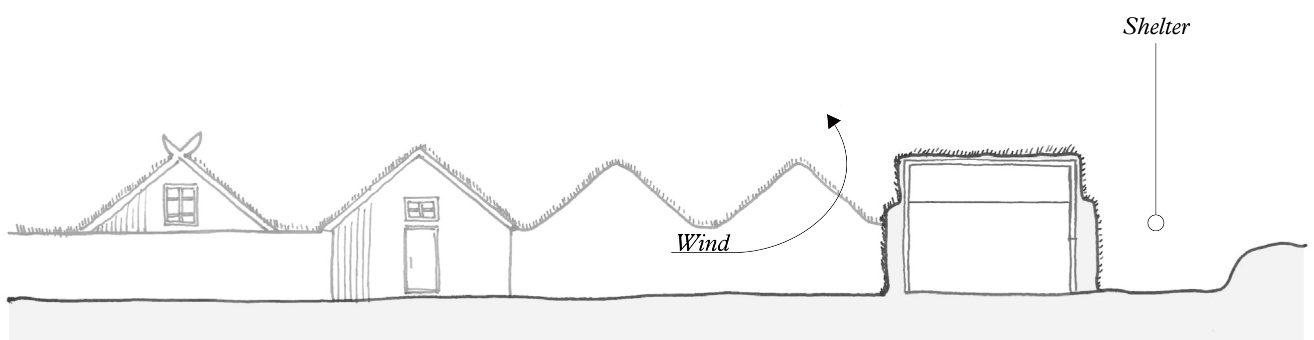
The results is a very low profile dug down into the land and almost growing out of the soil. In this manner, the Icelandic tradition is one of earth, stone and wood.

Much like other Nordic styles the Icelandic "gangabær" reflects the landscape in which it is built. But instead of rising from the ground it is a half-submerged building peeking out of the landscape. The base bound to the ground by its heavy stone walls, and the top creating hills in the landscape.

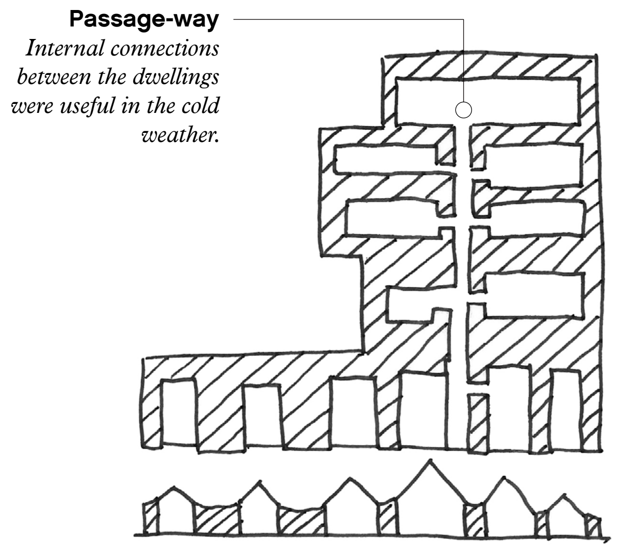
The settling in the ground and placement of the houses are grown out of a practical need for shelter. The materials used refers both to the actual landscape of Iceland, turf and stone, but also the cultural affinity, by the Norwegian settlers, for the use of wood as a construction material and internal paneling. The paneling gives warmth and intimacy to the room, whilst separating it from the otherwise basement or cave like environment.

In the turf house, it is exemplified that the inhospitable and harsh climatic conditions of Iceland have had a large impact on its regional architecture. In this land of strong winds, arctic winters and severe rain the environment holds a more significant and direct role than in the other Nordic countries. Even though the northernmost parts of Norway suffer much of the same climatic conditions, Icelands separation from the rest of the European continent, and lack of trees for shelter, has shaped a very direct and pragmatic response to the environmental difficulties specific to Iceland.

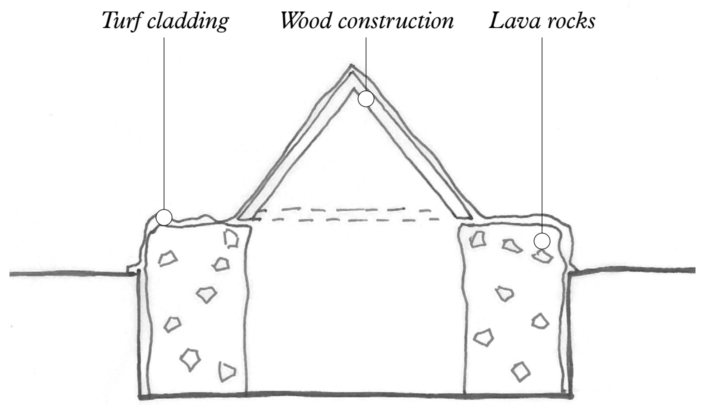

Ill. 30: Turf houses, Glaumbær



Ill. 31: Turf house, long section



Ill. 32: Turf house, internal connections



Ill. 33: Turf house, short section

Ill. 34:Wadden Sea Centre - Dorte Mandrup Arkitekter

Wadden Sea Centre

The Wadden Sea Centre is a visitors center for the Wadden Sea in South Denmark, designed by Dorte Mandrup Arkitekter, that was completed in the beginning of 2017. Its primary function is to work as a gateway, and learning center for Wadden Sea area. It has facilities where education can take place, as well as a museum space where an exhibition teaches visitors about the importance and diversity of nature and birds in the Wadden Sea area.

The Wadden Sea Centre is an interesting case because it examines the local building traditions in a contemporary way, as well as having a strong relation to both the local environment and landscape.

The building is seated in the flat low landscape of the Wadden Sea by drawing a long flat profile, that relates both to the long horizon as well as the flat landscape. The gentle slope of the roof makes the building seem to emerge from the landscape, whilst interpreting the strong wind conditions of the area, by directing the wind gently over the building, instead of stopping it in its path. In this way, the shape both stages and amplifies its surroundings while conveying its environment in a poetic sense.

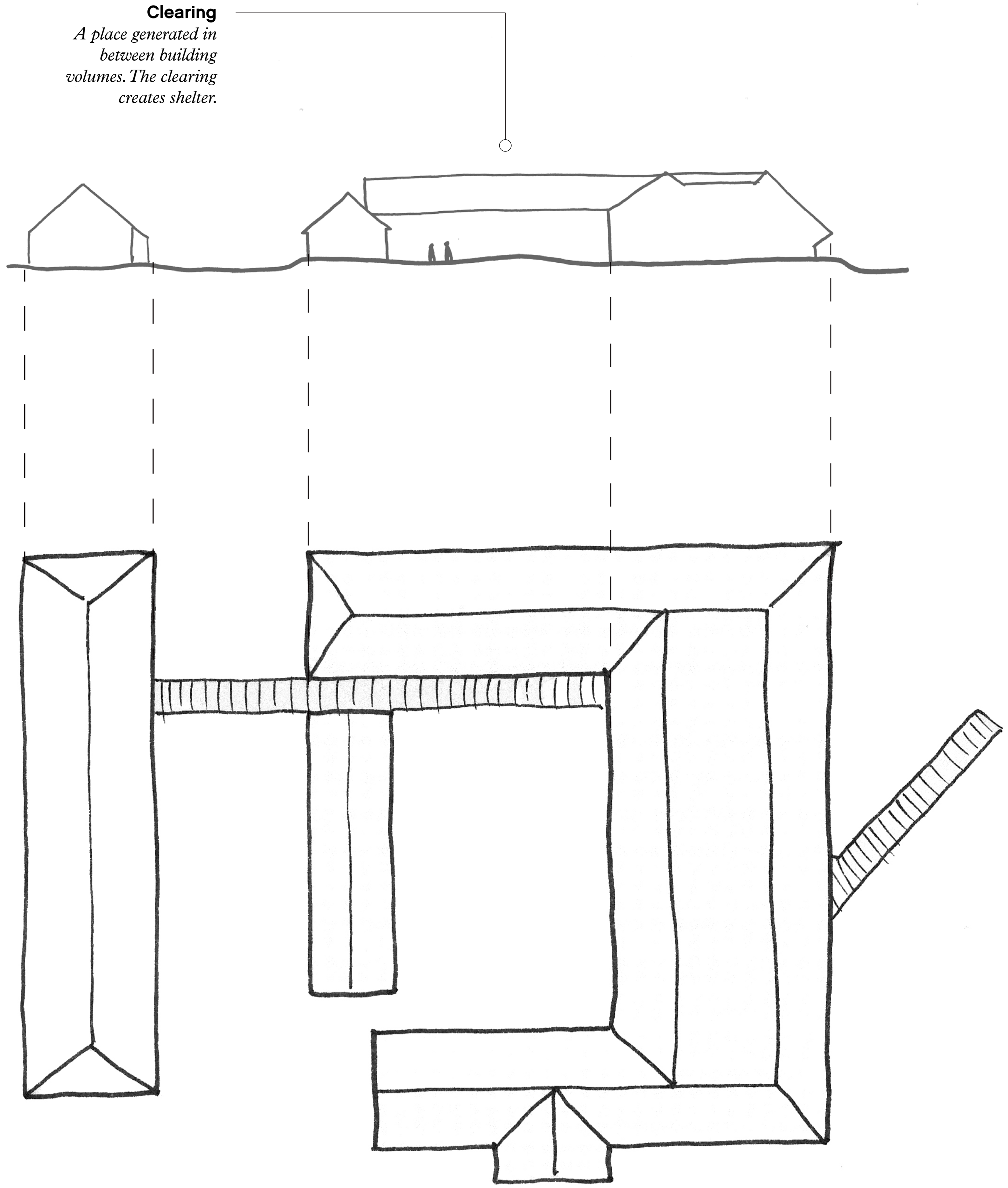
The project is utilizing both the traditions and materials of the local area. By emulating the traditional four-winged thatched farmhouses, the building shelters the inner courtyard from the strong winds predominant along the west coast of Denmark. It poetically creates a sanctuary in the flat harsh landscape. Practically it increases the usability of the outdoor spaces, which otherwise may not be functional for a significant part of the year.

Another trick taken from the surrounding farms is setting the building on a mound. This stages the building but also makes it relatively safe from the many floodings that frequents this low laying area.

The thatched roofs are also reinterpreted into a contemporary solution which utilizes the locally available resource. By using thatching both on the roof and facades the building becomes one object. And the benefit of straw, in an area where the salty winds from the ocean usually leaves façade treatments peeling off in a matter of years, is that it ages well and lasts for many years without maintenance. The straw used is locally sourced and tied by hand to create a façade that is relating to both the traditions, environment and the atmosphere of the area.

The reinterpretation of the Danish "firlænge" and the relationship to the natural landscape of the Wadden sea, makes this case embody what Christian Nordberg Schultz talks about when referring to the low, one story earth hugging Danish houses. But with the plasticity of the thatched surface and the sculptural quality of the roof shape, this profile is brought into a contemporary context.

This crafty way of reinterpreting local building tradition is placing this building just in the right spot between tradition and pragmatism making it an exemplification of how Nordic architecture can maintain its sensitivity to tradition and nature without dwelling in the halls of simple romanticism and nostalgia.



Ill. 35: Wadden Sea Centre, sketch

Ill. 36: Allmannajuvet Zinc Mines - Peter Zumthor

Ill. 37: Allmannajuvet cafe interior - Peter Zumthor

Allmannajuvet Zinc Mines

As a part of the Norwegian National Tourist routes, Swiss architect Peter Zumthor was commissioned to stage the old zinc mines in the small town of Sauda, Ryfylke in western Norway. The tourist routes consists of 18 designated tourist routes through the Norwegian countryside with different thought-provoking installations designed to enhance the natural features of the landscape. The project constitutes of a museum building, a café, toilet- and parking facilities with paths and stairs everything built in the gorge called Allmannajuvet. *(Frearson, 2017)*

Zumthor felt it important to tell the story of "the drudgery of the mining operation and the strenuous everyday lives of the workers" *(ArchDaily.com, 2016)*. This is communicated through the materiality. The dark plywood envelope and wooden construction underlines the workers daily routines in the mines. In the parking lot boundary stonewalls has been masoned with local rocks from the region.

The four structures are composed with three elements; wooden supports, a black box and a corrugated zinc roof canopy. The dark, wooden columns are, compared to the massive black box, slender in its expression, and looks almost like scaffolding. Perpendicular cuts in the black box, makes up the windows and amplifies the massiveness of the box.

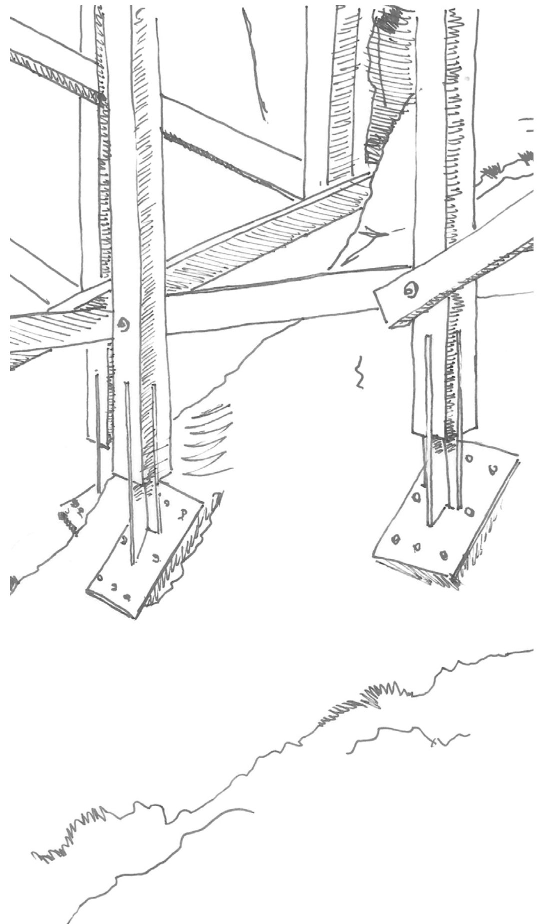
Through these elements one can easily follow Sempers "four elements of architecture"; the hearth, the mound, the enclosure and the roof *(Semper, 1851)*. The roof being made up of a single corrugated zinc plate, sheltering the building from the harsh Norwegian climate, furthermore creating a link to its context. According to Semper, the roof is also represented by the carpentry, in this case being the wooden columns arranged in a rational, stabilizing system. The lightweight enclosure, even though in this case not expressing this in form, is made out of plywood covered with jute burlap. In the case of the café-building, the hearth is the café itself, being the gathering element of the building, protected by the surrounding structure. As for the mound, it is non existing. Given the projects location, in the gorges of Norway, leaving the earth as it is makes for a stronger concept. This also makes it easier to interpret the topography.

The interior walls have been painted in a dark color. This to resemble a gallery - only this is not only a gallery with ancient artifacts - the perforations in the dark walls frames the nature and the view to the outside.

Every building has a different take on how to interpret the landscape; rising from the mountain side, clinging to a hill or being interlocked to a masoned wall. Each enhancing the natural features in a unique way. The tension between the heavy box and the landscape would be much less prominent without the distance between them. This emphasizes the topography of Allmannajuvet and stages the steep hills of the gorge. The structures lift the building from the ground on thin stilts. This gives the construction a very little footprint, expressing carefulness and caution towards the surroundings.

Zumthor's design draws attention to the site's industrial heritage, creating a cultural reference to the Zinc mines of Sauda. The lightweight structure gives associations to temporary constructions used in mine working, having a raw and utilitarian character. This is furthermore expressed in the very rational joinery.

Ill. 38: Allmannajuvet Zinc Mines, sketch



Ill. 39: Foundation detail, sketch

Summary

The case studies shows three different ways of interpreting the site. Each case has a unique location in a natural setting, from the vernacular Turf Houses to the more modern, Wadden Sea Centre and Allmannajuvet Zinc Mines. The cases themselves represent two different epochs of architecture; the traditional and the modern. Even though the cultural reference is clear in the century-old turf houses, built with traditional building techniques, these can still be seen in the modern projects. Both Allmannajuvet Zink Mines and Wadden Sea Centre creates reference, not recreating the days of the old, but linking the past and the present.

Having investigated the three cases, categories in which to interpret them begins to form. The architectural pieces in themselves reflect the place of origin through its materials, form and tectonic solutions to their natural challenges.

The Turf House case, is a piece of vernacular architecture that is adapted to the natural environment in which it is located. Building only with the materials available, having the challenge of creating shelter in a harsh climate. The turf house is seen as a tectonic solution to this. The challenge is solved by digging into the ground arranging a roof made up of timber and turf for covering. The Icelandic turf houses therefore becomes a part of the surroundings in which they are situated. By merging with the very soil it stands on, dwelling and nature becomes one.

Wadden Sea Centre links, through its color and texture, created by its use of materials, to the landscape and the natural surroundings. The Wadden Sea Centre refers to the Danish "firlænget" farm, providing shelter from the wind whilst giving the building a center point. Furthermore, the form is gesturing the natural forces, and appears as shaped by them. Being built on an open field, the building itself is therefore appearing as rising from the landscape. Wadden Sea Centre reinterprets the topographical conditions of the landscape into built form, and works as an extension of nature.

Allmannajuvet Zinc Mines is a new addition to the Norwegian Tourist route. The project's main purpose is to tell the story of the mines through a series of buildings, whilst giving the visitor an experience with nature. Because of the dynamic landscape of western-norway, the buildings reflect the landscape in different ways. The concept is based on a geometric shape, contrasting the natural surroundings in itself. The construction is made out of natural wood, arranged in a structural system. This refers to the scaffolding of the old zinc mines. The supports creates a distance between the ground and the building, emphasizing the sloping surroundings. In addition to this, playing on the contrast between the closed and the open, the interiors provides the visitor with views to the outside, framing the nature.

This page is intentionally left blank

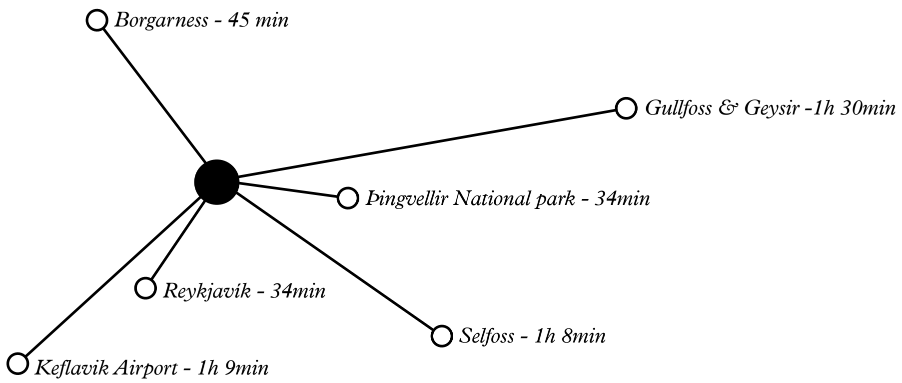
Site

The following will give an in depth-view of the site itself, as well as giving the a sense of the atmosphere of the area.

The chapter starts with the site placement in relation to the Icelandic infrastructure. After this an approach to analyzing the natural environment will be explained.

This is followed by individual analysis and finally this will be summed up in relationship to the approach previously defined.

Location



Ill. 40: Travel distance by car

The site is located just north of the most densely populated area of Iceland. With only 30 minutes to Reykjavik both tourists and staff will have easy access to the distillery. The travel time to the major attractions of Gullfoss and Geysir is just 1 hour and 30 mins, the same as from Reykjavik. If you drive from the site towards these you will pass through one of ice lands major national parks, and tourist attractions, þingvellir. These factors along with the close distance to Keflavik international airport makes the site a good stop for both tourists enjoying a short lay-over on Iceland, as well as a possible de-tour from the "golden circle" tourist route.

Ill. 41: Site Placement

Analysis Approach

Working in the natural environment, with no presence of build environment, we find it necessary to define an approach to analyzing this context. When the goal is to build in resonance with the given site, we first need to identify the aspects composes it.

To analyze the natural environment, it has proved important to structure and simplify the term. To be able to identify the important aspects of this we felt it necessary to divide it into parts. To do this we have chosen to divide this into three categories.

Landscape, Vegetation and Climate.

Landscape can be defined as the sum of geophysical features present. Here both topography, ground surface, water-bodies, and such should be accounted for.

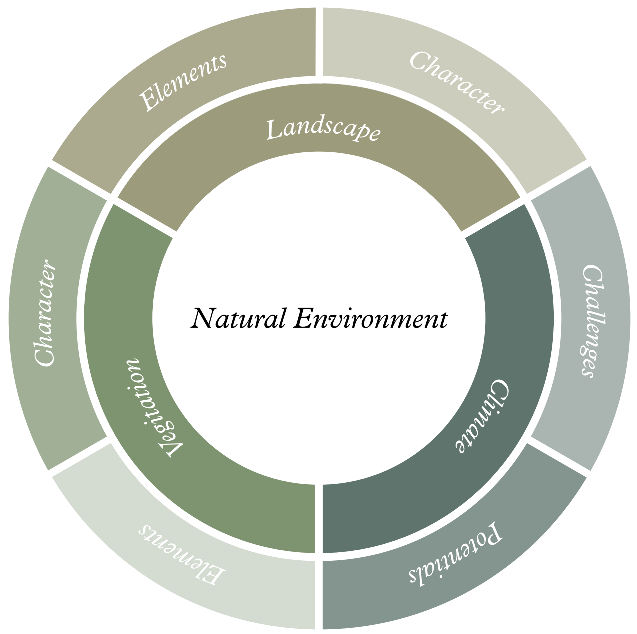
Vegetation refers to the plants, grasses and earth cover they provide.

It is important here to note that both elements on site and in the context, should be taken into account, as the interplay of these are important to get a comprehensive understanding of the whole. By identifying both the individual elements and the character that the interplay of these creates, we gain an understanding of how a building can become part of this.

The last aspect chosen to include is the climate. Here wind, sun, precipitation, temperatures and other relevant climatic factors should be determined. To identify how these can interact and inform the design process we divide this into potentials and challenges.

To achieve this knowledge an on-site approach, topographical studies and climatic data has been applied.

On the next pages this is explored through sections, diagrams, mappings and photographs, ending with a summation of this by mapping it on the analysis model.



Ill. 42: Natural Environment

Site Description

Entrance
The planned area for the new distillery is located 39 kilometers north of Reykjavik, a little over 30 min drive, along the picturesque Hvalfjarðarvegur. While leaving the civilization behind, the road follows the many twists and turns of the fjord, passing several smaller settlements in the form of small towns. The location is remote, yet accessible to travelers and locals, and within short distance of the famous "Golden circle", making it easy to attract tourists. The small hills created by the "roots" of the mountain, allows the visitor to take in the magnificent scenery, while entering the Hvalfjarð-area.

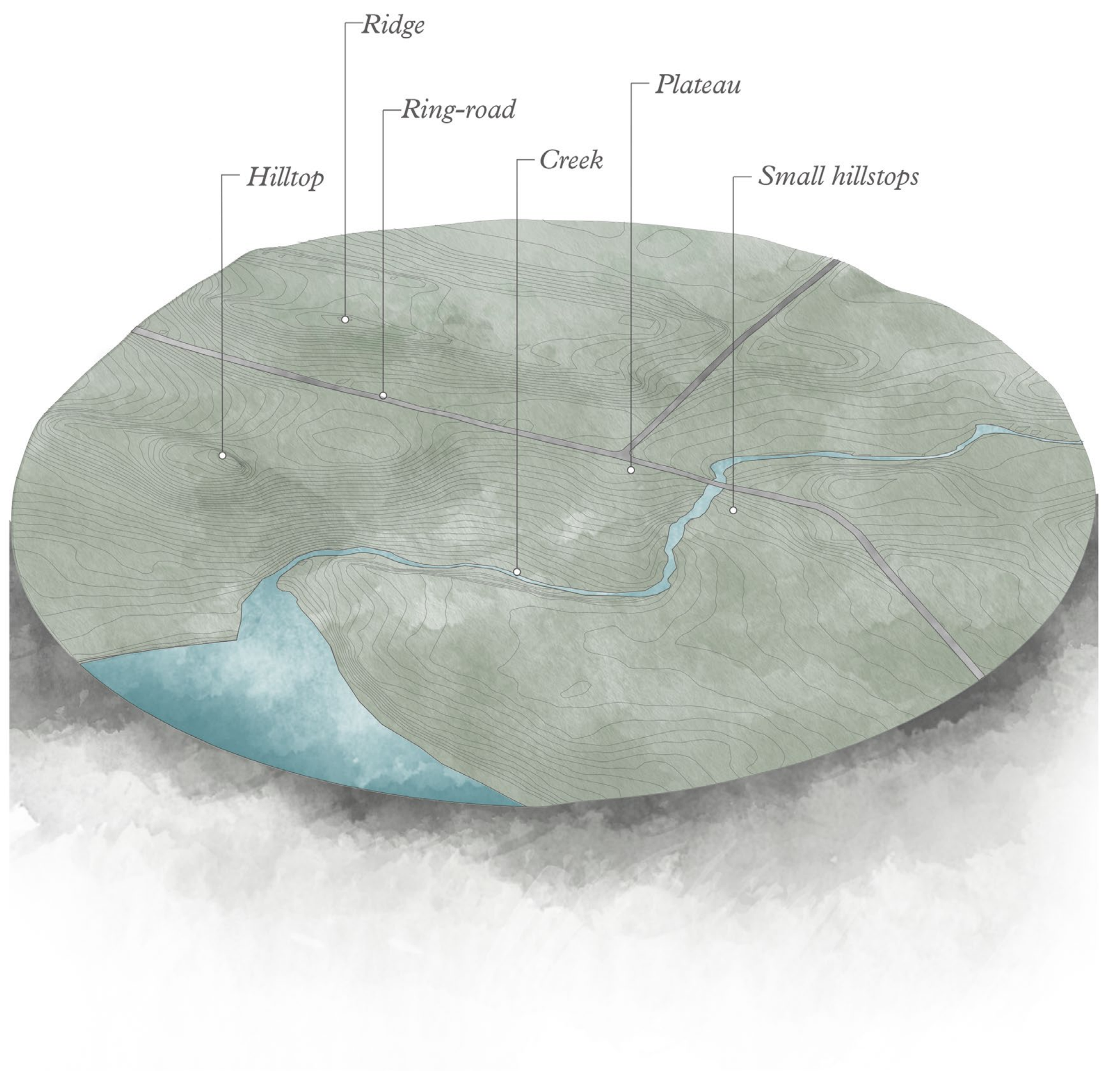
The mountains
The area is surrounded by the dynamic Meðalfell mountain chain to the east, spanning from sea level to staggering 400 meters height, forming a grand enclosure around the location. Being covered in snow in the winter, and a thin layer of green, resilient vegetation during the short summer, adds to the area's color palette. Together with the fjord, the mountain chain frames the area providing shelter.

The farmlands
Between the Meðalfell mountains and the fjord are fertile farmlands - with farms scattered around, strategically located by the foot of the mountains, providing shelter for the farmer- almost hiding in the safety of the mountains. The farmlands makes up a green plateau between the mountains and the fjord. Rivers and creeks of clear water runs from the mountains, and small waterfalls are scattered through the area.

The site
The site itself is situated on a small hill going down from the main road to the sea. Apart from the occasional farm, the vast nature dominates scenery.

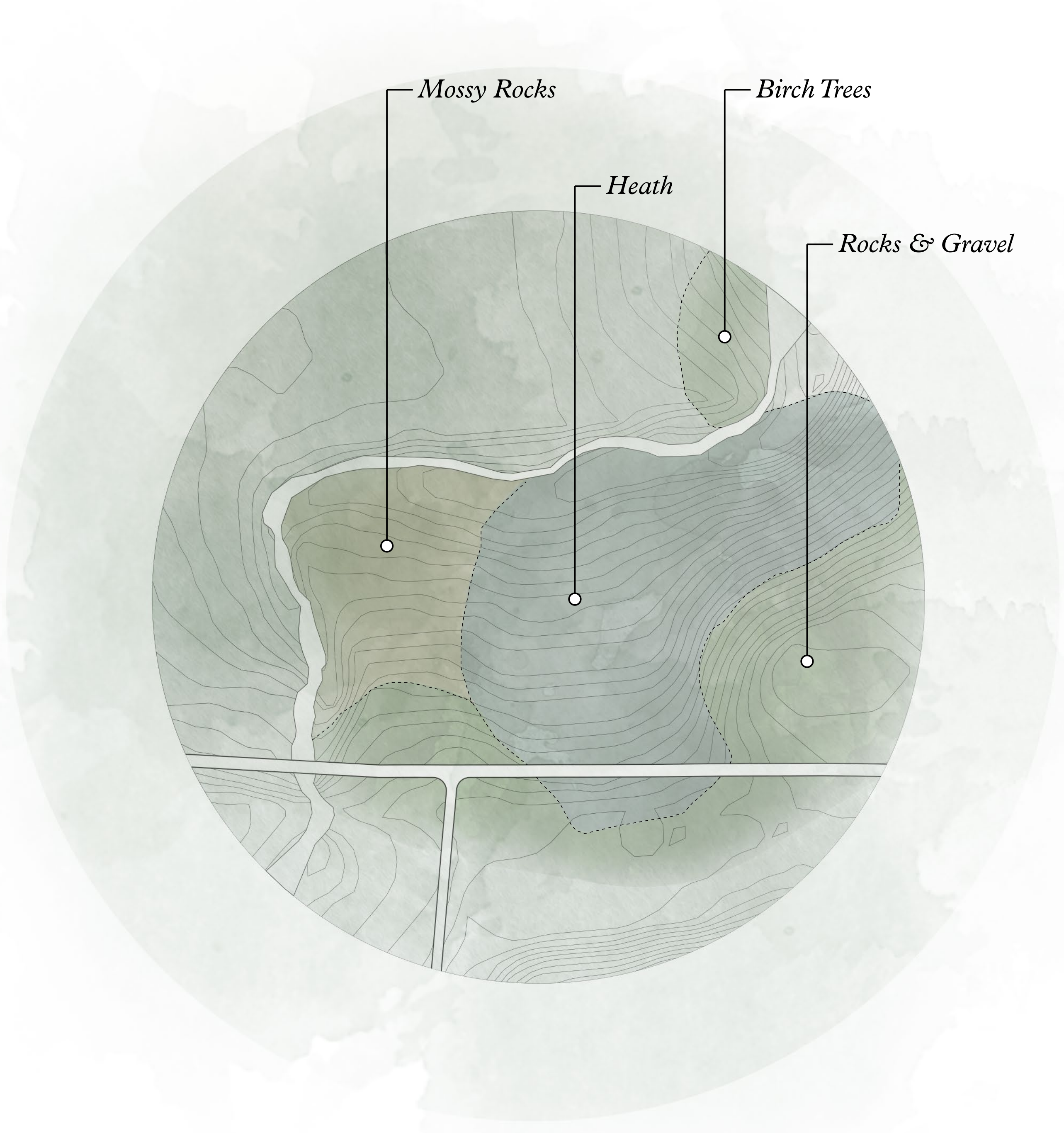
The different landscape-types on the area resembles elements from the Scandinavian nature, such as the mountain chains and the low vegetation of the Norwegian highlands. Nevertheless, the sudden change in vegetation and topography makes it dynamic and unique. The site keeps shifting from soft, grassy hills to rocky areas and small hilltops, having the general character of heathlands dominated by low growing, woody vegetation, interrupted only by moss-grown rocks and grassy heaths. On the eastern side of the main road is a rocky ridge overlooking the site and the farmlands. The same hight is to find on the northern side, creating a reference point on the site, just like a tall building in an urban context used for navigation. On the western end of the site, a grassy hill is blocking the view from the bottom of the slope, down by the creek side.

Central to the site, is a creek of fresh water winding through on its way to the sea. It enters the site through industrial steel tubes, laid down under the main road. The creek varies in width, shifts gradually from 3-4 meter, at the entrance point of the site to 1-2 meters, where the ground is softer. There is a sudden drop in height on the western side of the road, creating a series small waterfall. This is where the water, starting its journey on the mountain top, reaches its final destination, winding its last whorl before blending in with the salty water of the fjord.



Ill. 43: Site elements

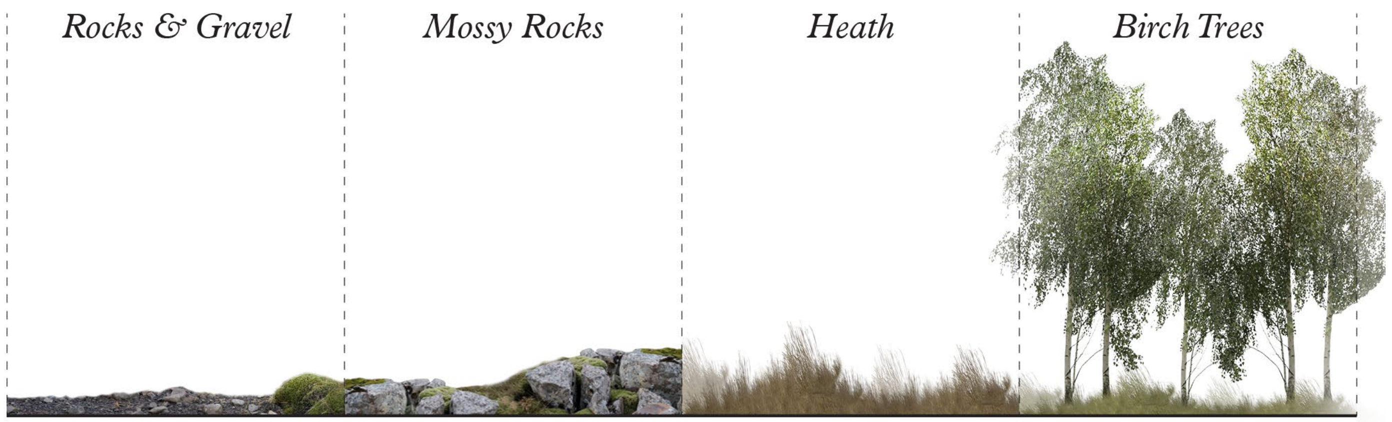
Vegetation & Groundcover



Ill. 44:Vegetation mapping

The constant shifting in vegetation types and landscape formations is what makes Iceland so interesting; from black lava rock-covered moon-landscapes to green lush meadows, and the transformation of the landscapes over the seasons.

The site has many of these variations, with lava rocks, heath plains and even Icelandic birch, one of the few species of wood native to the country. The diagram shown above points out the location of these vegetation types followed by a description.



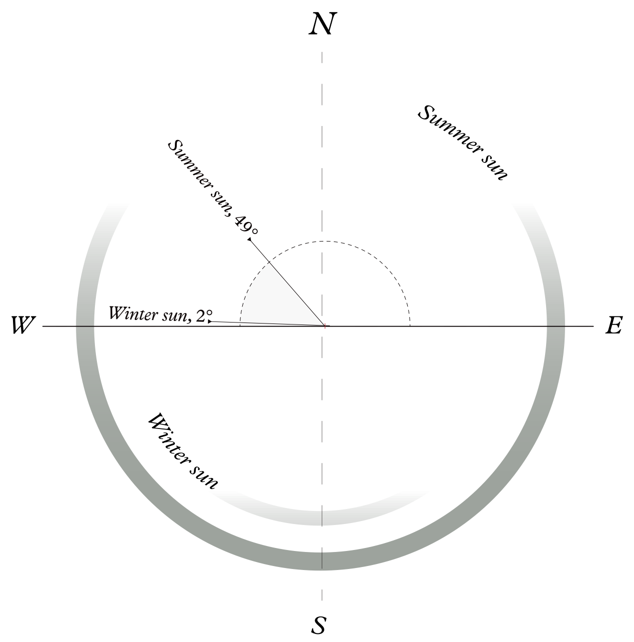
There are three kinds of rocks; igneous, metamorphic and sedimentary. The majority of rocks found on Iceland are igneous, being that it originates from volcanic magma. This group of rocks can again be split into two groups; volcanic- and plutonic rock. Plutonic rock solidifies beneath the surface and volcanic rock solidifies in open air. Given that Iceland is a relatively young country - from a geologically point of view - and haven't had the time to erode yet - the majority of rock are volcanic. (Iceland Institute of National History, 2017)

Moss is the most common vegetation type in Iceland, and makes up for over half of the ground cover. This is due to the unfavorable growing conditions caused by lava rocks and fields of gravel combined with the humid air. This type of vegetation can be found both in the highlands and on the shore.

This type of vegetation are often dry, and appears like small knolls or mounds in variating size from a few centimeters to larger areas of up to 15 meters in height, although this is not very common. Because of the lack of moisture in the dirt, many species thrive here.

Birch trees are native to Iceland and the main species of trees found in the so called woodland and shrub-land. Even though the majority of Icelandic forests consists of birch, other tree-types like rowan and aspen is also to be found, depending on the growing conditions. The density of trees, soil and altitude are factors that decide which trees that are to grow.

Climatic Conditions



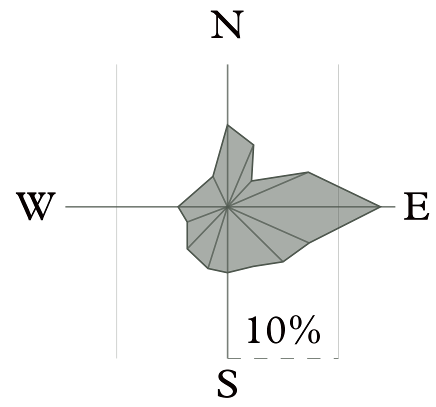
Ill. 45: Sun chart, Hvalfjörður-area.

Sun chart

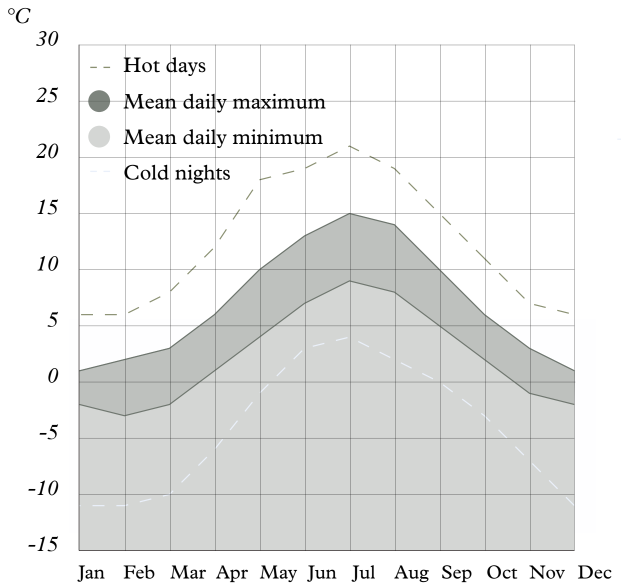
The diagram shows the shifting sun conditions over a year in Reykjavik, Iceland. One can see the low angle of the sun during the winter, causing very little or no daylight hours during the day. The reason for this is Iceland's northernly location, where the majority of the country is situated north of the polar circle, leading to a great difference between the length of the day between summer and winter. This is also what causes the Northern lights which iceland is known for.

Wind

The foregoing displays the wind frequency in the Hvalfjörður-area. The wind in Iceland is in general blowing from the north-east to the southeast. However, local conditions such as landscape fjords and valleys have major influence on the frequencies. Furthermore, considerable seasonal winds influences the frequencies in the summer *(Einarsson, 1984)*.



Ill. 47: Above -Wind frequency, Below -Wind Speed Hvalfjörður-area



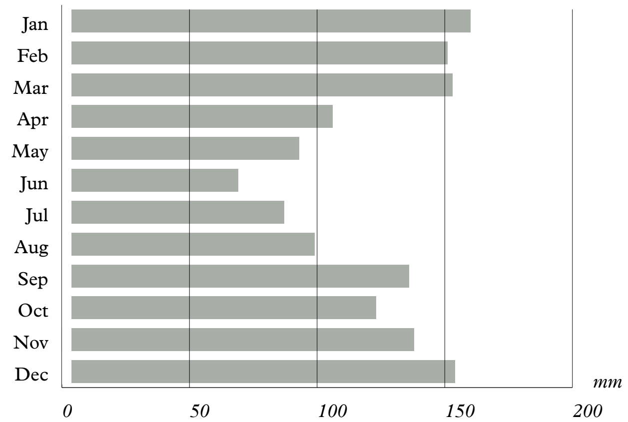
Ill. 46: Monthly temperatures, Holminn

Monthly temperatures

The monthly temperatures are calculated based on a 30-year average. The diagram shows the mean daily minimum and the mean daily maximum, which is the average temperatures on the given month. The temperatures are fairly mild, given Iceland's location, and the temperature keeps for the most of the year above freezing level. This leads to temperate summers and mild winters. This is due to the Gulf stream, heating the waters outside Iceland. In addition to this, the diagram shows monthly extremes.

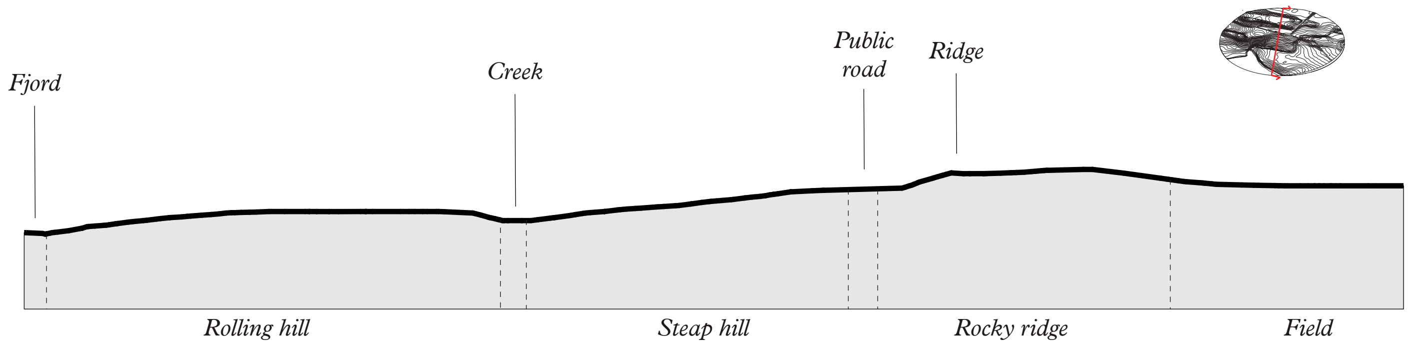
Precipitation

The results for precipitation in the Hvalfjörður-area are taken from the local weather-station at Homlinn, and is sorted in amount (mm) of precipitation per month. This shows that the area is quite rainfull, with most rain falling during the cold months of the year. Compared to Aalborg, DK, in the month of january, the amount is more than doubled (63mm compared to 160mm). The weather types differs greatly from one part of the country to the other, because of the hot and cold streams heating and cooling the country in respectively the southern and the northern side. This leads to cyclones, bringing precipitation and strong winds, and rapid shifts in weather. *(Einarsson, 1984)*

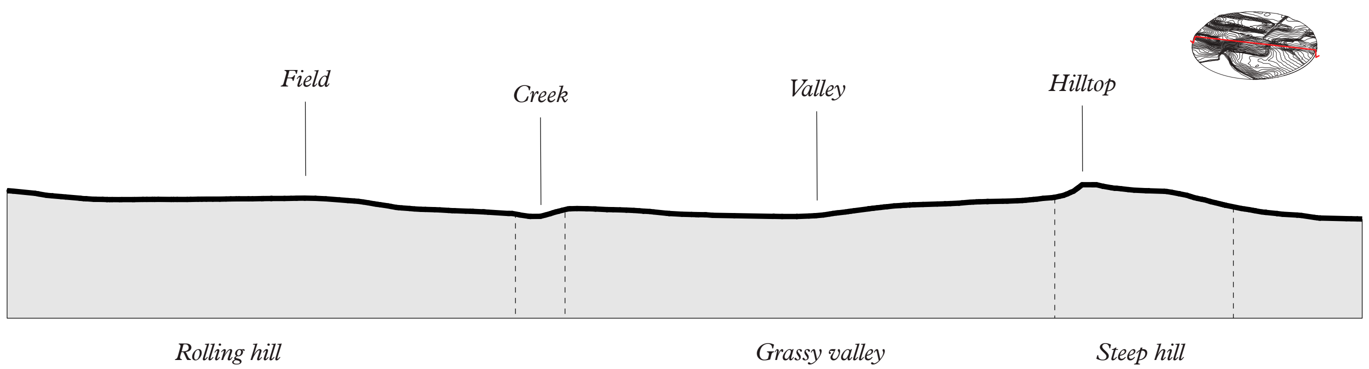


Ill. 48: Precipitation, Holminn

Context

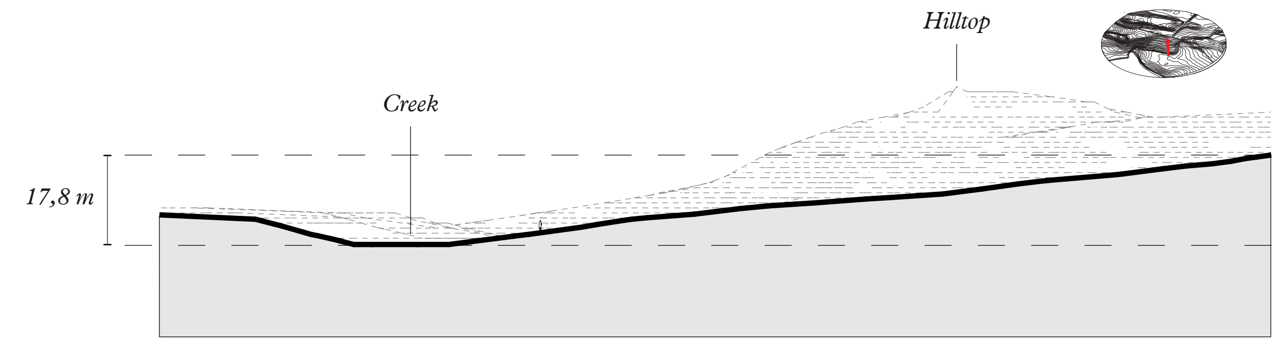


Ill. 49: Site section - 1:5000

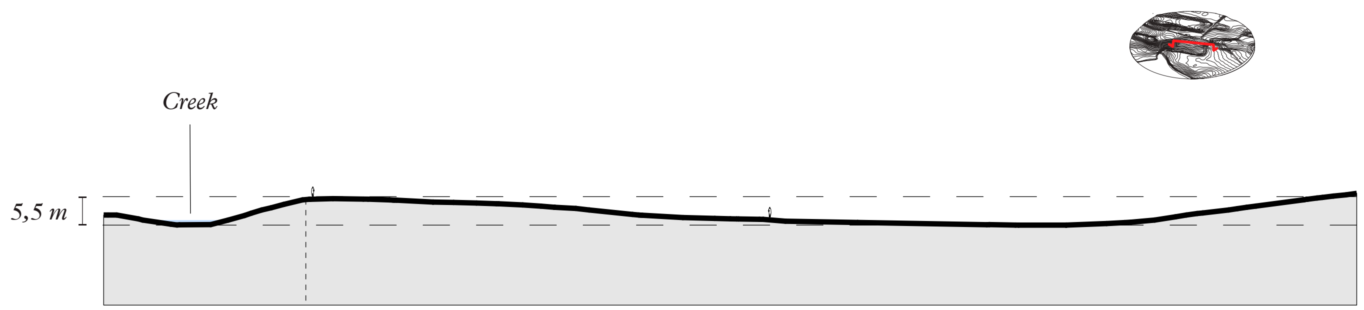


Ill. 50: Site section - 1:5000

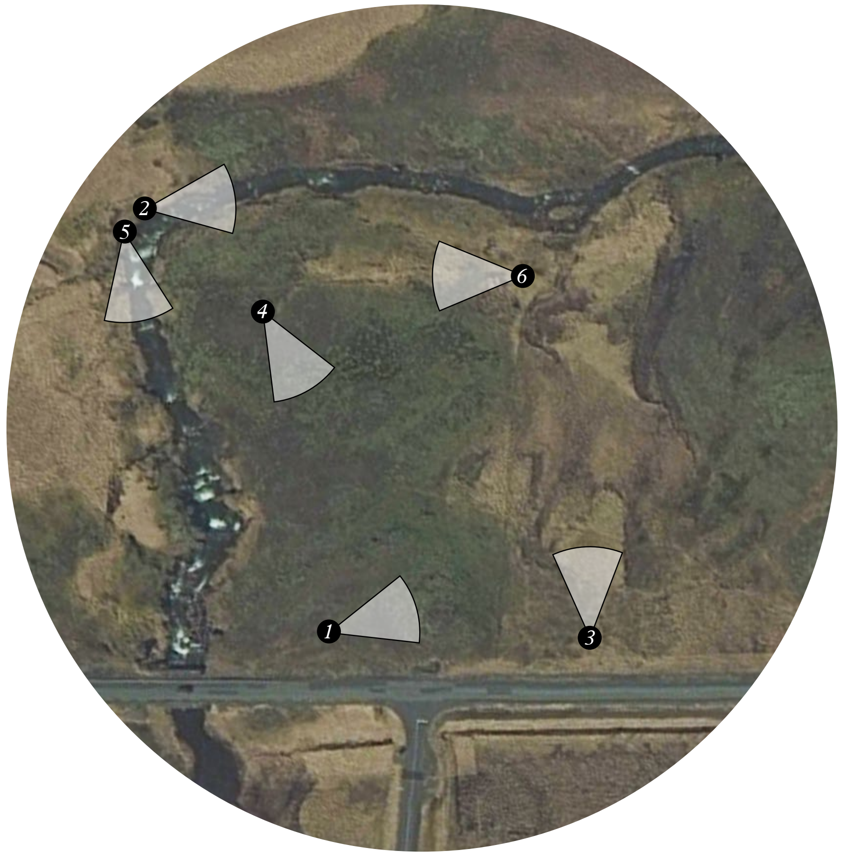
Site



Ill. 51: Site section - 1:5000



Ill. 52: Site section - 1:5000



Ill. 53: Mapping of photographs

Photographic Notation

By using the camera as an alternative to the sketch book, we have sought to capture atmosphere and features of the site. The photographs have been mapped out on an aerial photo of the area and will be presented on the next pages.

1 On top of the plateau a pile of rocks reveal the grand scale of the surrounding mountains

2 The Creek that runs through around the site is separated by a hill towards the fjord

3 *A small valley runs through the site towards and frames a view the fjord.*

4 *Large moss covered rocks cover the slope towards the road.*

5 *As the creek flows down the slope towards the fjord, its white water adds sound and drama to the surroundings.*

6 *The change in vegetation creates borders on the site*

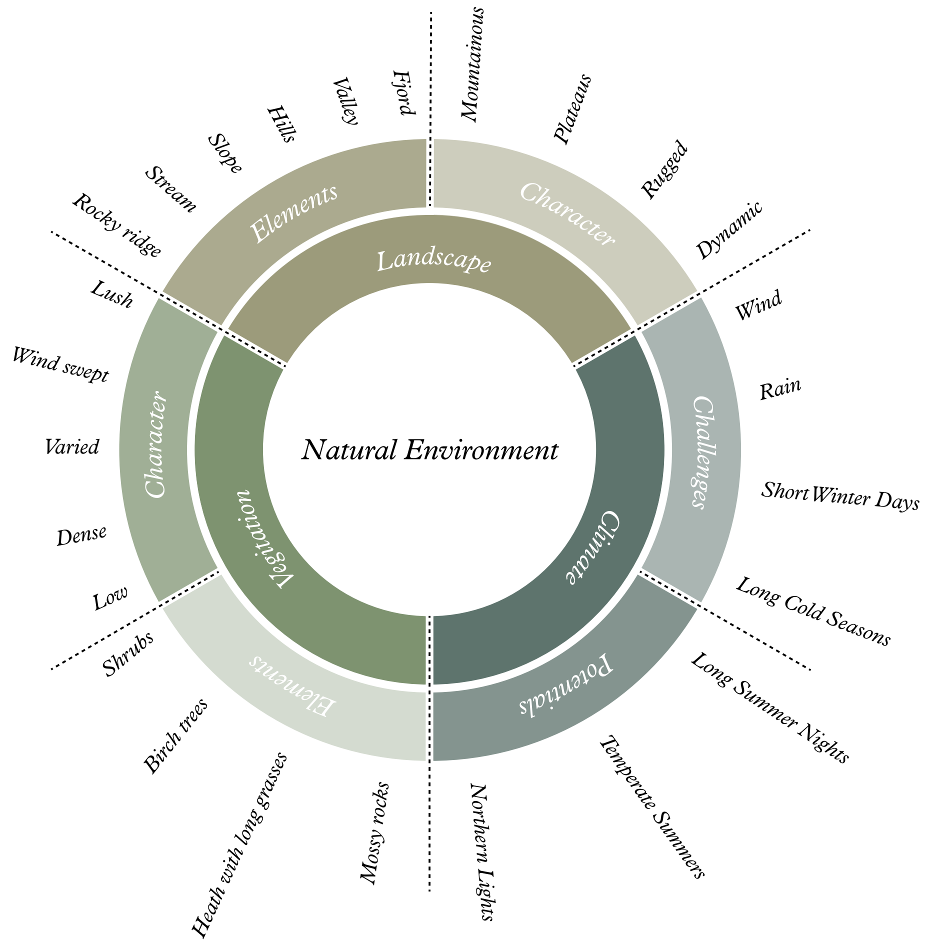
Summary

The analysis show that Iceland is situated in a rich natural environment. The surroundings are greatly varied, not only across Iceland, but on small distances as well. Even on the site chosen for this project one can experience Iceland's many different natural elements, from grassy slopes, to rocky ridges and hilltops.

Facing the south is a view towards a creek of fresh glacier-water. Fields contrasted by tall mountains makes up the dynamic backdrop. The mountains are a part of a larger mountain chain, surrounding the coastal area from the south to the east. To the west, when following the direction of the sloping hill from the ring road, one can experience a magnificent view towards the fjord. This is an endless horizon. When looking towards the north, a complex visual composition appears. The foreground is defined by a slope leading to a hill-top. The creek runs across this view, naturally avoiding the hill, seeking towards the fjord. Large mountains is located in the background.

The vegetation is as varied as its landscape. Lush, grassy heath covers the hill as a green blanket. Breaking with the soft heath are spots of resilient bushes, adding more layers to the surroundings. Areas of mossy lava rocks are located near the road, as well as sporadically spread around the site. This makes up the wind-swept greenery of the site.

The climatic conditions are unique to the area, being locally affected by its surrounding mountain-chain and the fjord, and globally affected by Iceland's northerly location. The weather can therefore shift in an instant. The climate leads to relatively cold winters, as well as moderate warm summers. On the other hand, being close to the polar circle, leads to long summer night and the occurrence of northern lights.



Ill. 54: Natural Environment

Programme

On the following pages, we will introduce a programme for the distillery. There will be an introduction to the users, the size and function of the rooms and in the end an initial concept for the distribution of spaces.

Users

Besides producing spirits the building also needs to fill the needs of the people giving it life. In 2015 1.289.100 people visited Iceland. *(Icelandic Tourist Board, 2017)*
The building should welcome these foreign visitors, as well as the local Icelanders.

The workers and staff of the building are going there every day, and for them the building needs to suit their practical routines.

It is important to incorporate the needs and concerns of the different users to create a building which fulfills its purpose as both a place to visit as well as a place to work.

Ill. 55: Diagram of user categories

Room Programme

To form a program for a distillery on Iceland we decided to take offset in the process of distilling. Based on examination of existing and projected distilleries, functions and production quantity, as well as input from Eimwerk Distillery, space required for a mid-sized distillery producing 500.000 LPA has been estimated. The m² for this is heavily reliant on the size of the required equipment for the processes. (Appendix . 7)To ensure the integrity of whisky as a local product all the steps of making whisky should be done “in-house”. This means making space for the process of malting inside the distillery.

Storage for casks maturation is the most space consuming part of a distillery. These facilities are ever expanding and will keep growing through the lifetime of the distillery. Based on information received from Eimwerk Distillery, and examination of other distilleries, 2000 m2 have been set aside for storage for the first three years of production.

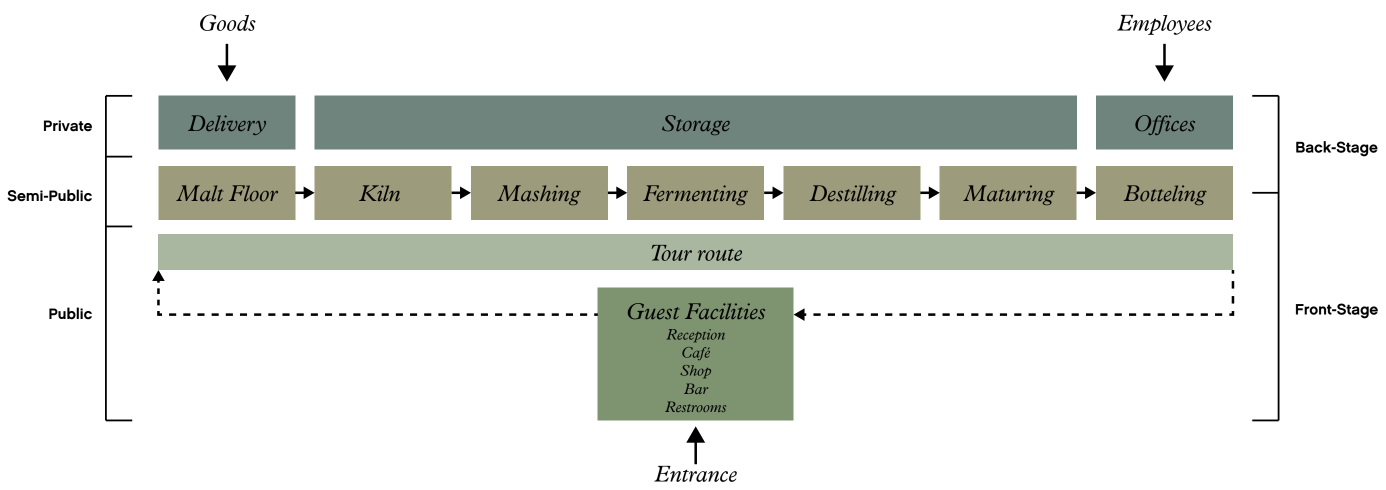
For the project to be reasonable, it is of importance to ensure that the experience economy, the prevailing tourism on Iceland and the destination distillery plays a central role in the building. To add to this a restaurant and bar area is added to the distillery, extending the user group beyond the traditional whisky enthusiasts.
An event space is also added to the distillery, this is usable for release parties or other events related to the distillery business, but can also serve as an alternative venue for local events or gatherings.

To structure this the room program has been divided into four groups. Distillery, Staff, guests and Drink & Dine. To establish an overview of the potential for interaction with both the surrounding nature but also the sensual experiences, areas of interest have been indicated on the schedule.

Group	*Function*	*m²*	*Description*	*Nature Connection*	*Sensous Experience*	*Visitor Access*
Distelling *3120 m²*	Grain & Malt Storage	100	*Area for storage of unprocessed grain and malt*		●	●
	Steeping area	75	*Area for steeping grain, before germination*		●	●
	Malt floor	175	*Area for germinating grain*	●	●	●
	Kiln	75	*Where the kiln is placed and the drying of malt takes place*	●	●	●
	Mash	50	*Where the mash tun is placed*	●	●	●
	Boiler room	40	*For boiler that heats water for mashing*			
	Fermentation	200	*For the washbacks and fermenting process*	●	●	●
	Destillation area	100	*Area for stills and receivers*	●	●	●
	Cask filling	25	*Area used when filling casks*		●	●
	Cask storage	2000	*For storing 3 years of production on casks when maturing*	●	●	●
	Botteling area	50	*For use when botteling*			
	Loading Bay	30	*Covered loading bay*			
	Storage	200	*For storage of general supplies, bottles, cleaning agents, etc.*			
Staff *190 m²*	Administration	85	*Office space for administrative workers*	●		
	Toilets	25	*Toilets and Baths for workers*			
	Changing room	20	*Lockers and changing facilities for workers*			
	Meeting room	30	*Meeting facilities for both inhouse and outhouse meetings*	●		
	Break area	30	*Lunch and break room*	●		
Guest facilities *290 m²*	Reception	15	*Reception area near entrance to building*	●		●
	Toilets	25	*Toilets for visiting guests*			●
	Shop	75	*Shopspace where merchandice and souveneirs can be sold*			●
	Exhibition space	50	*Exhibition space where introduction to tour takes place*	●		●
	Event space	125	*Performative space where special events can take place*	●		●
Dine & Drink *410 m²*	Changingroom	10	*For waiters and chefs to change clothes*			
	Toilets	25	*Toilets for restaurant guests*			●
	Kitchen	50	*Kitchen area*			
	Cooler/Freezer	15	*Cooler and freezer faclities for kitchen*			
	Storage space	10	*Storage of dry goods, kithcen hardware, ect.*			
	Cafe area	100	*Area for cafe*	●	●	●
	Bar area	200	*Bar with tasting area*	●	●	●
Total Area		*4010 m²*				

Ill. 56: Schedule of room programme

Distribution



Ill. 57: Plan distribution concept

Function vs Experience
When doing a project for a destination distillery, several factors comes needs to be addressed. It is an interplay between the functionality of the factory and the experience of a Visitors center.

The Factory
The crucial function of the factory is that the product is able to be produced effectively. This means that the program of functions has to adhere logic of the production line. It has to be arranged in an efficient and orderly manner that makes sure that the daily tasks of the workers are not "disturbed" by the interference of the visitors.

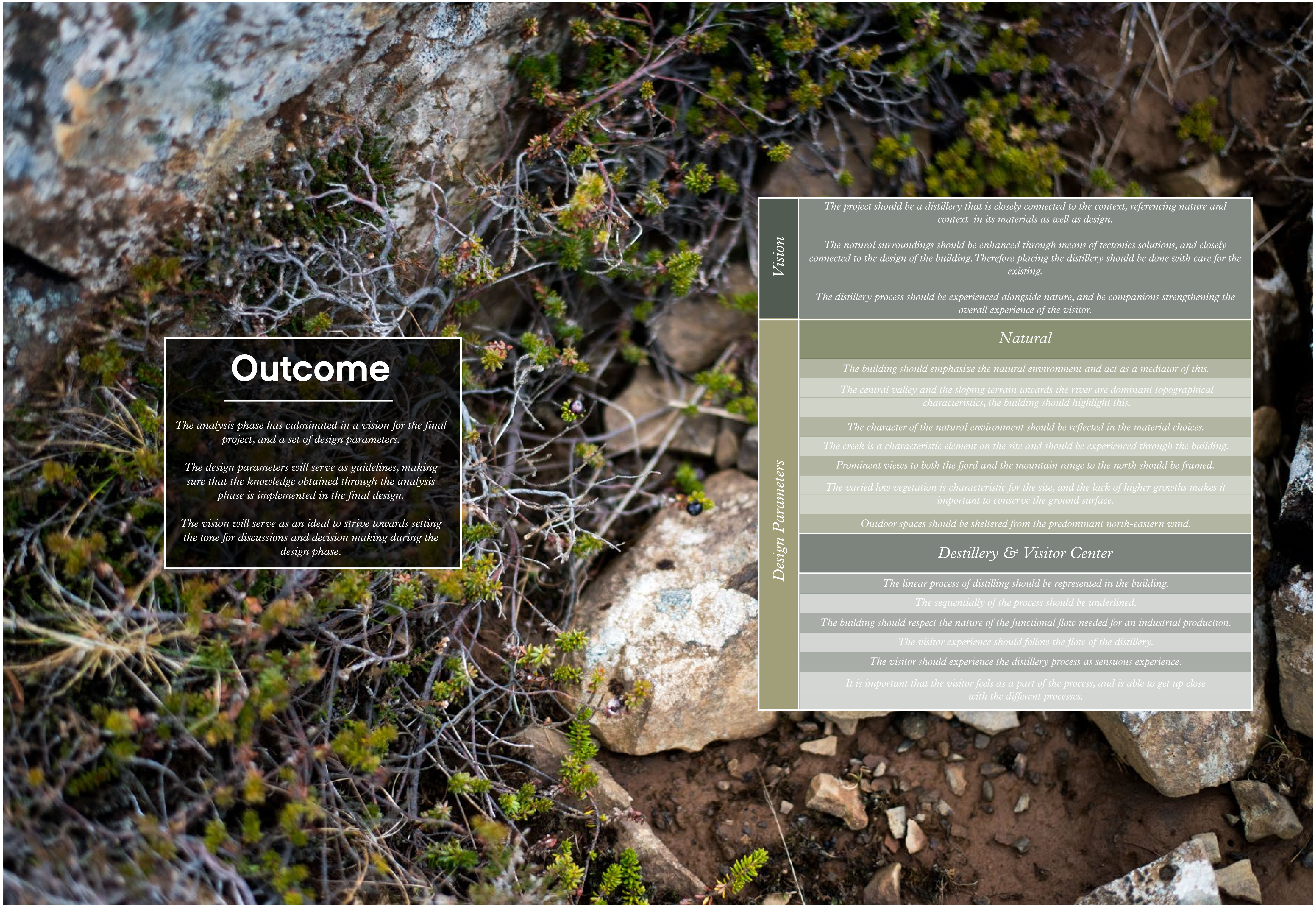
The Visitors Center
The guests visiting the distillery comes to experience the production of whisky in all its aspects. This needs to be an experience of the senses. A distillery is full of different smells, tastes and feelings. The temperature changes from the 18°C malt floor, to the hot, steaming, process of mashing the malt. This needs to be experienced through the tour of the distillery where all the senses has to come into play.

The Process of Distilling
The process of distilling is a linear one. You take something and refine it through several different processes, until you end up with a final distillation of high quality.

These processes happen sequentially through the building. This make for a program where the process divides the functions and requirements for areas into a sequence of spaces that each holds their own part of the process. It is this sequence of spaces that the visitor is guided through and experiences during their tour of the distillery.

By dividing the different functions into public and private areas a logic of programming appears. One can think the organization as a theater, there is a stage were the production process takes place. And a backstage where the worker's facilities, storage and office spaces are placed, ensuring privacy and efficiency in the places where this is needed.

This page is intentionally left blank



Outcome

The analysis phase has culminated in a vision for the final project, and a set of design parameters.

The design parameters will serve as guidelines, making sure that the knowledge obtained through the analysis phase is implemented in the final design.

The vision will serve as an ideal to strive towards setting the tone for discussions and decision making during the design phase.

Vision	*The project should be a distillery that is closely connected to the context, referencing nature and context in its materials as well as design.* *The natural surroundings should be enhanced through means of tectonics solutions, and closely connected to the design of the building. Therefore placing the distillery should be done with care for the existing.* *The distillery process should be experienced alongside nature, and be companions strengthening the overall experience of the visitor.*
Design Parameters	***Natural***
	The building should emphasize the natural environment and act as a mediator of this.
	The central valley and the sloping terrain towards the river are dominant topographical characteristics, the building should highlight this.
	The character of the natural environment should be reflected in the material choices.
	The creek is a characteristic element on the site and should be experienced through the building.
	Prominent views to both the fjord and the mountain range to the north should be framed.
	The varied low vegetation is characteristic for the site, and the lack of higher growths makes it important to conserve the ground surface.
	Outdoor spaces should be sheltered from the predominant north-eastern wind.
	Destillery & Visitor Center
	The linear process of distilling should be represented in the building.
	The sequentially of the process should be underlined.
	The building should respect the nature of the functional flow needed for an industrial production.
	The visitor experience should follow the flow of the distillery.
	The visitor should experience the distillery process as sensuous experience.
	It is important that the visitor feels as a part of the process, and is able to get up close with the different processes.

Presentation

The following part of the report will present the final design.

First the concept will be explained, after this the building will be presented in relationship to its context. Following this plans and sections will be covered before diving into the interior parts and organization of the programme. Lastly the detailing and construction of the project will be accounted for.

Ill. 58:Exterior rendering north elevation

Concept

The line in the landscape.

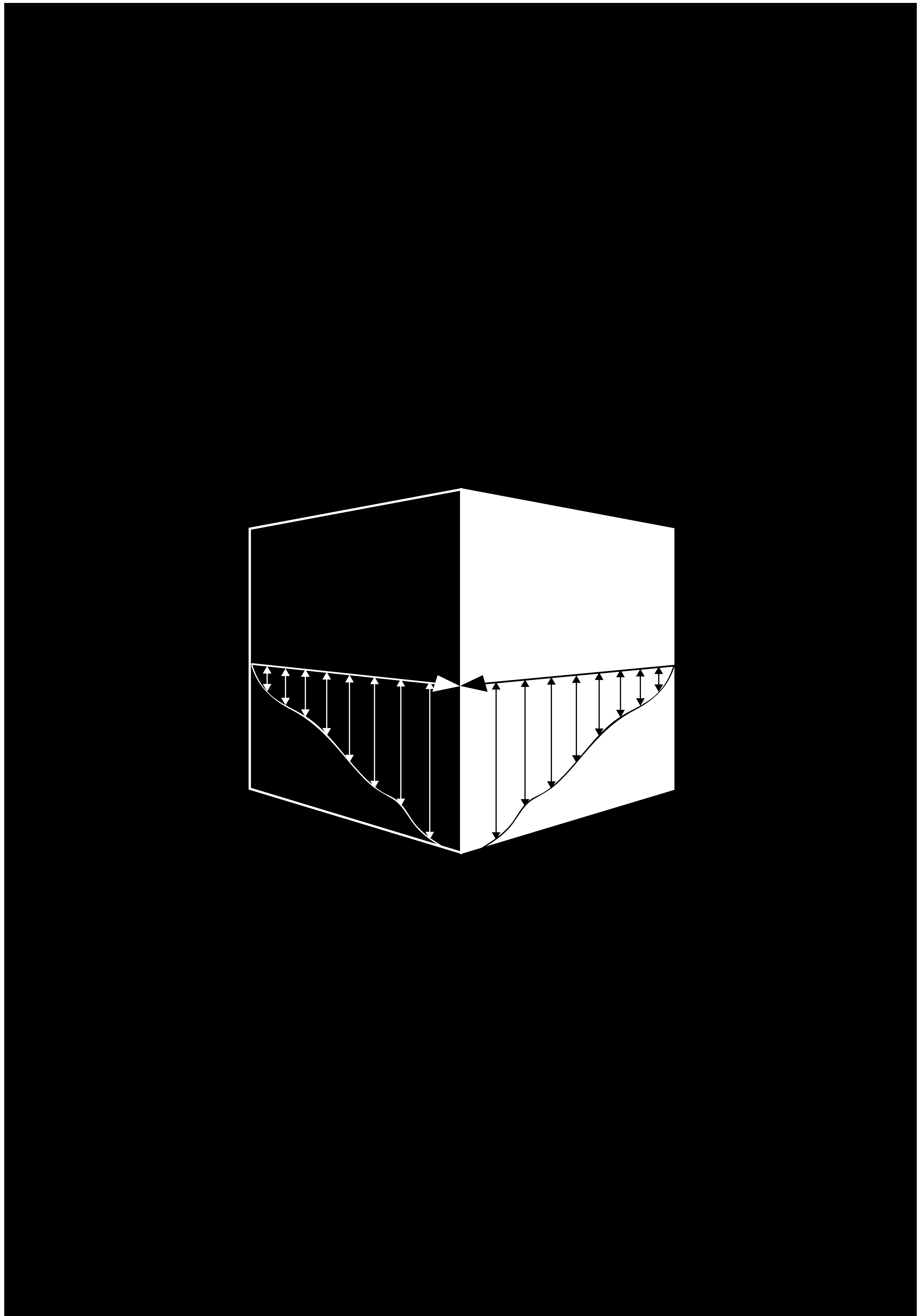
The concept refers to the process of distilling. A line creates a measurable entity on which to relate the unmeasurable surroundings.

A repeating rhythm underlines the difference in the segments of the context and creates a dynamic reaction to the underlying ground.

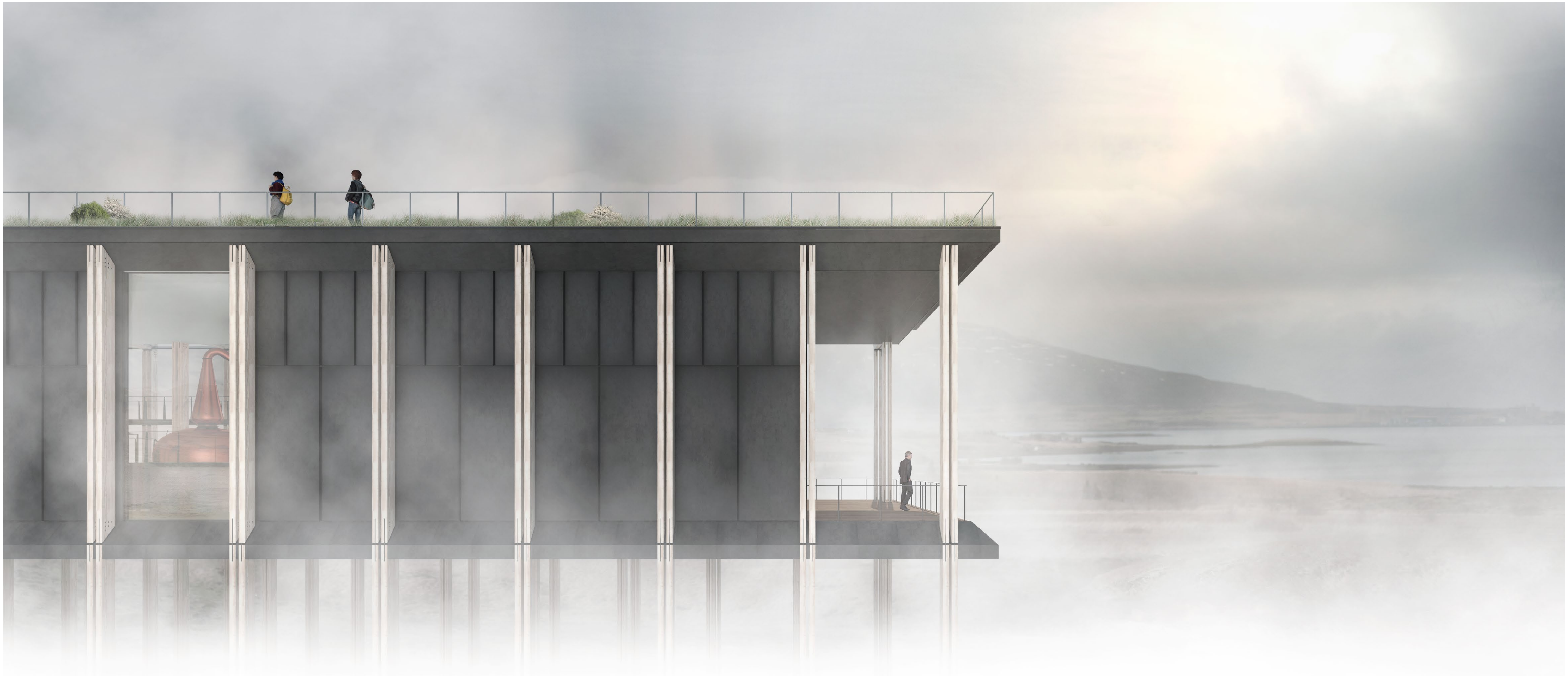
By lightly touching the ground, the building is separated from the landscape.

Tension is created in the duality of the building, presented through the opposites of open and the closed.

Communication between the light and the heavy dominates the symmetry of the line.



Ill. 59: Concept Illustration



Ill. 60: Exterior Rendering

Site

The distillery is located close to the ring-road following the direction of the creek, providing views in three directions. Adapting to the path of the creek, plays with the perception of what came first; the creek or the building. The intersecting angles in the building volume creates a sheltered space. This protects the area the dominant wind whilst making a plateau for the arrival of the visitors. When arriving from Reykjavik, the building reveals itself from afar as a long line stretching out towards the landscape. The grass covered roof makes the building appear as an extension of the landscape which forms an informal vantage point. Here the visitors can experience the surroundings on a new level.

Ill. 61: Site plan - 1:1500

Elevations

The meeting between the building and the ground shifts from cutting into the landscape, to standing on supports. This elevates the distillery and makes it appear as though it is gently laid down on the site.

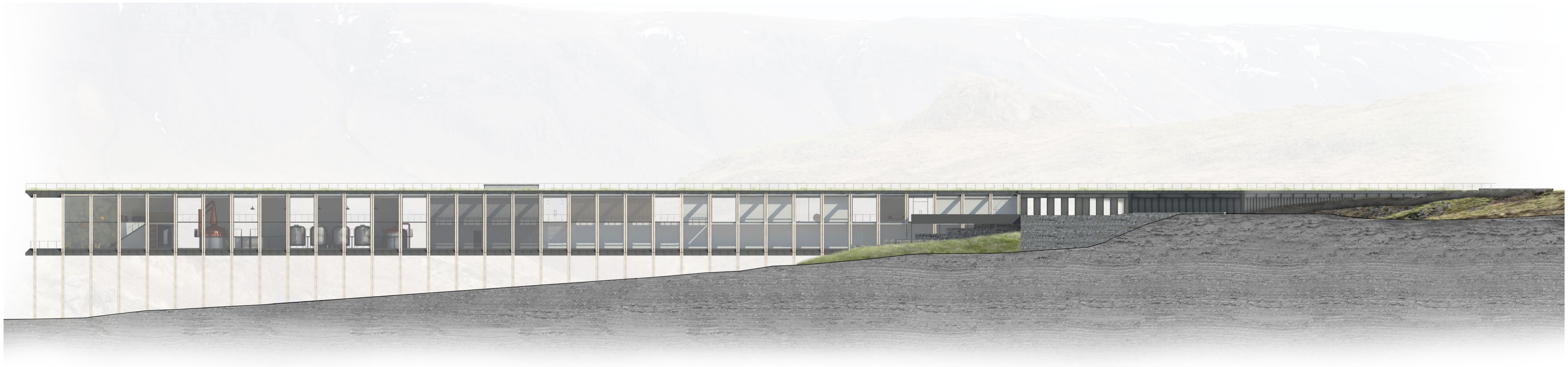
A central part of the facades is the wooden construction. Being placed at a regular interval, it divides the long slender building into sections. The construction therefore creates a rhythm which accompanies the slope of the hill; rising and falling in parallel with the inclination of the site.

The space in between the columns defines the openness of the building. An open section is defined by a window and a closed section is defined by aluminium panels. To the south, a glass gallery opens up towards the side of arrival.

A build up plateau defines the arrival area where parking for the visitors are placed. The plateau is constructed of wide roughly cut natural stones. Masoned into a thick retaining wall.

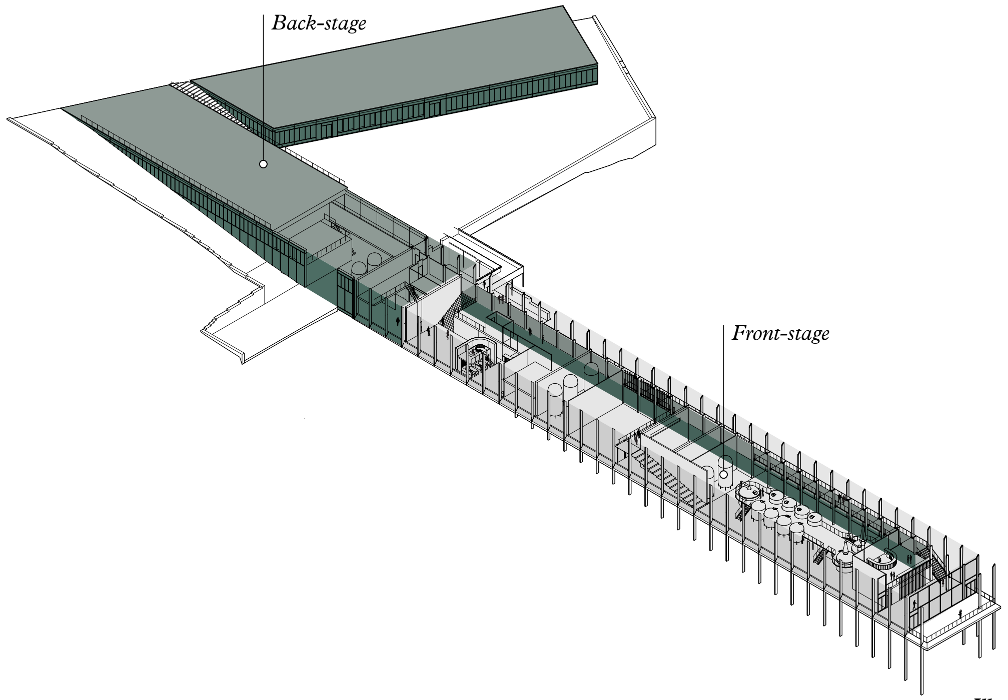
Ill. 62: West Elevation - 1:500

Ill. 63: North Elevation - 1:500



Ill. 64: South Elevation - 1:500

Spatial Distribution

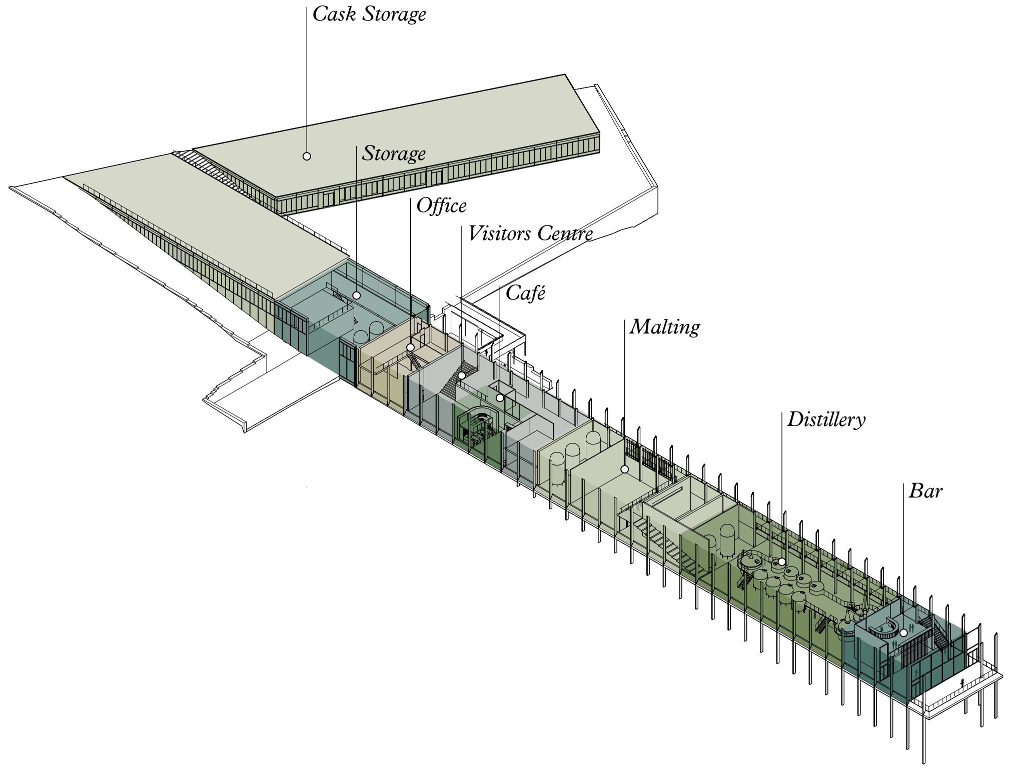


Ill. 65: Front-Stage/Backstage Diagram

Front-stage & Back-stage

The buildings functions can be divided into 2 different categories. The front-stage, where the visitor is shown around and the main distilling process takes place. The back-stage is the machine room of the distillery, here the administration, serving functions, and technical installations are placed.

The front-stage and back-stage is connected by the south-facing gallery, which acts as the main vein of the production on the ground floor, and creates a scenic overview of the distillery, for the guests on the 1. Floor.



Ill. 66: Function Diagram

Functions

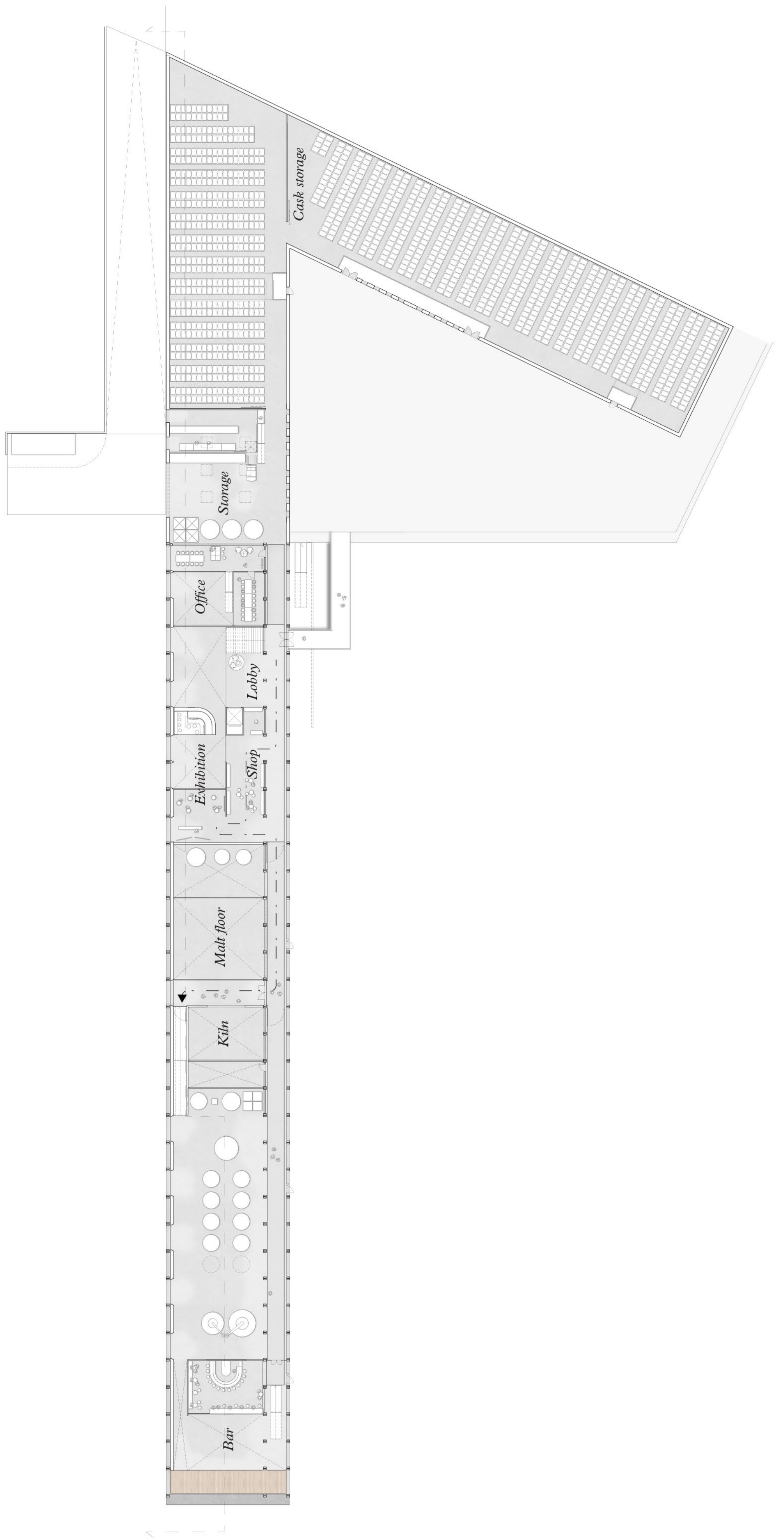
The Different programs of the building are distributed along the southern gallery. Near the entrance the visitors center and café is placed. Here a lobby connects this to the administration towards the storage areas. From the visitors center the distillery functions are placed sequentially towards the western end of the building where the visitors tour culminates in the bar with a view over the nearby fjord.

Plan Drawings

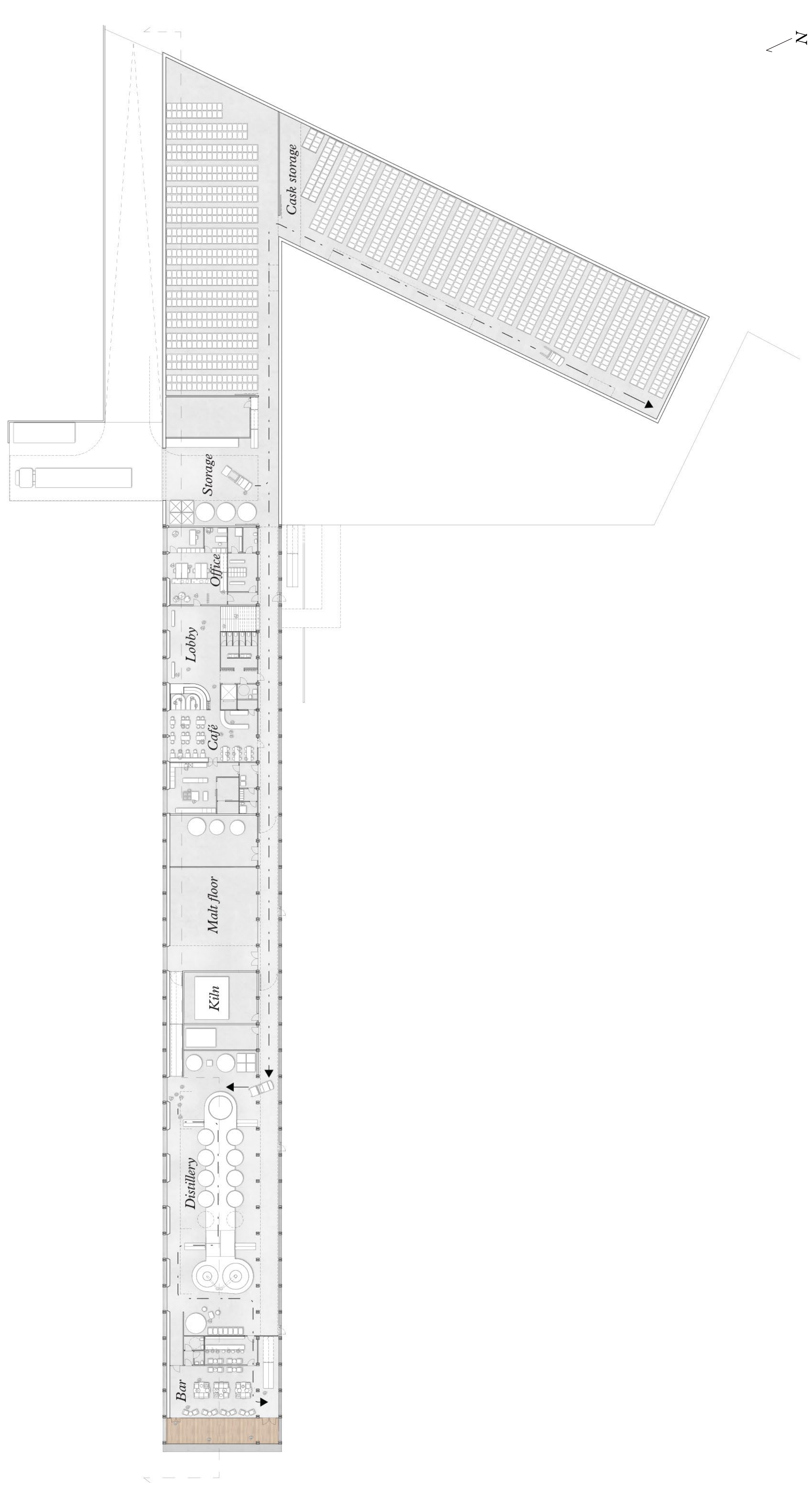
The destination distillery is 187 meters along the northern facade, and spanning from 16 meters wide. The visitors arrives at the site on the parking area, between the distillery and the cask storage. At this plateau one has the opportunity to take a look at the maturing process taking place inside the cask storage. A walkway in the cask storage-area, is conveniently accessed from the place of arrival. Entering the distillery takes place via the bridge leading to the lobby. From here one can easily navigate to the rest of the building.

The goods are delivered via a loading area to the north, accessed by a ramp cutting into the landscape parallel to the building. The storage area has been dimensioned to fit a full size lorry, enabling it to unload deliveries directly to the corresponding containers or storage units. A service hall runs from here through the length of the building, sharing the space with the touring walkway on the level above. Through the gallery, all the processes of the distillery can be accessed.

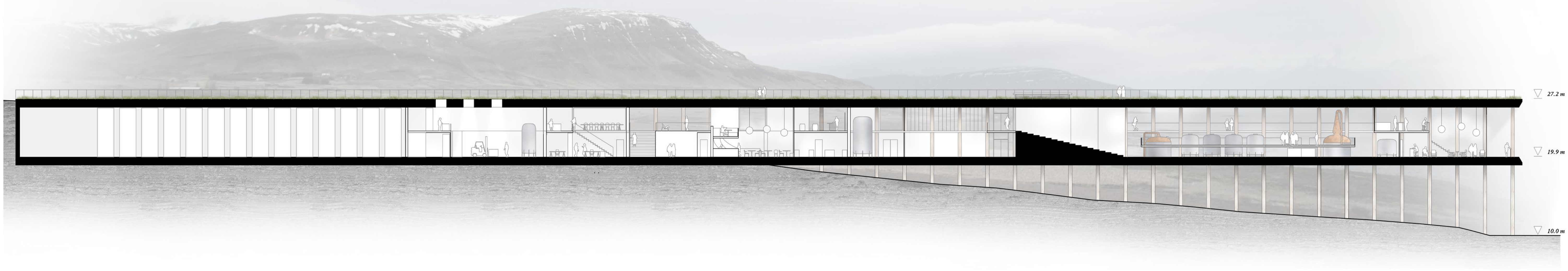
Ill. 67: Plan 1:750 - Roof Plan



Ill. 68: Plan 1:750 - 1. Floor



Ill. 69: Plan 1:750 - Ground Floor



Ill. 70: Longitudinal Section AA 1:500

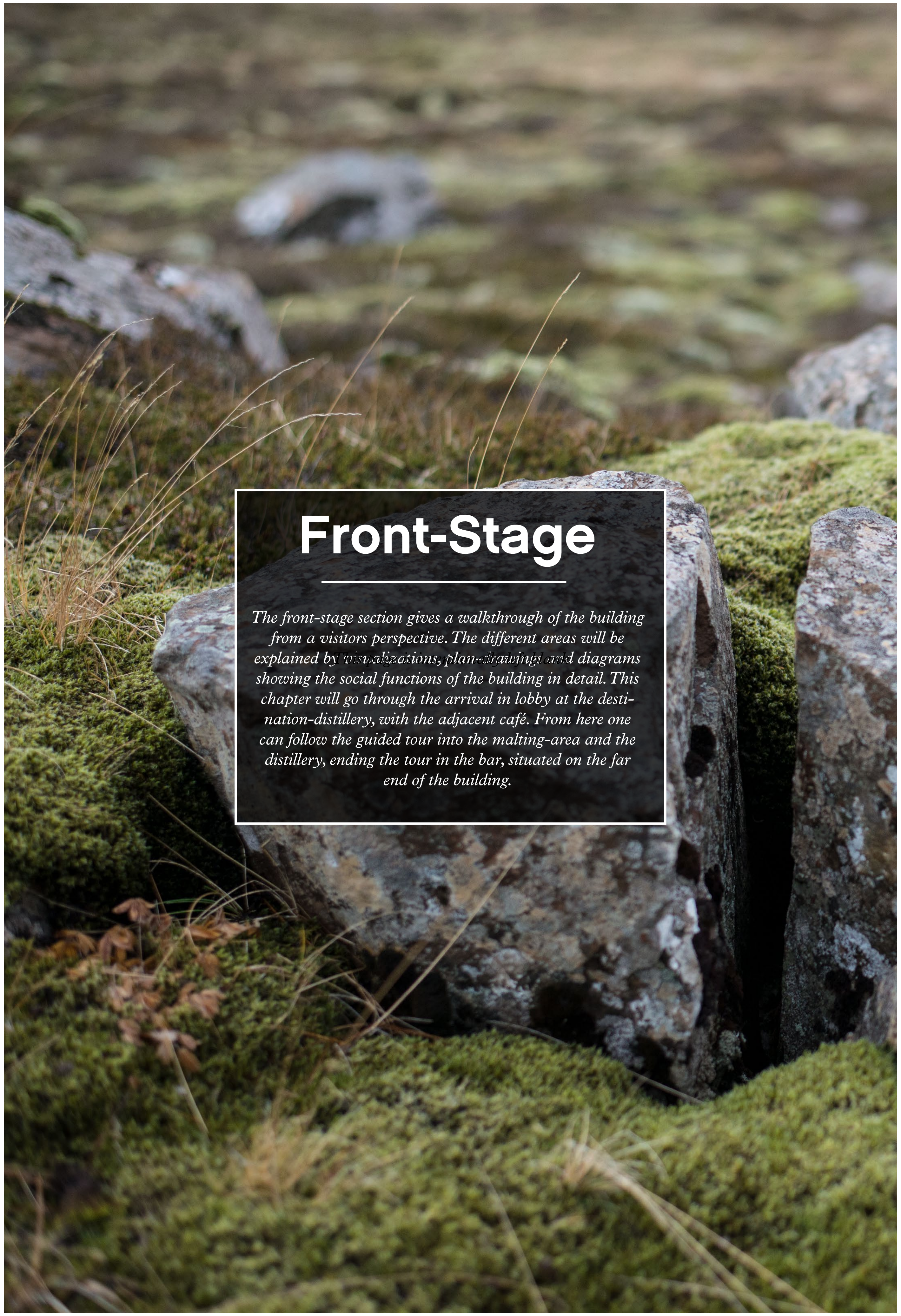
Section

The longitudinal section reveals the duality between combining social- and production-facilities in a destination distillery. The height of the building is defined by the production-functions, requiring a tall ceiling height for the stills.

Introducing human-scale functions in these spaces gives an opportunity to create grand gestures and monumental spaces, playing with the difference in scale and point of reference. On the other hand, dividing the space horizontally by a mezzanine, plan or a walkway, can create intimate spaces.

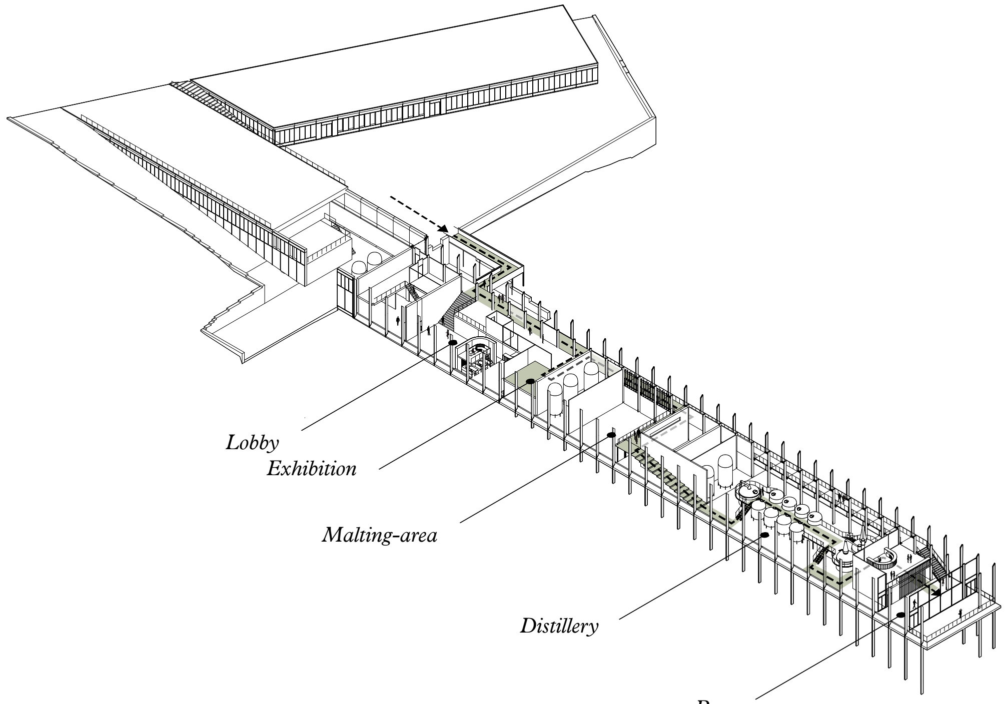
The connection between double high spaces and interposed plans creates dynamic spaces throughout the distillery.

This page is intentionally left blank



Front-Stage

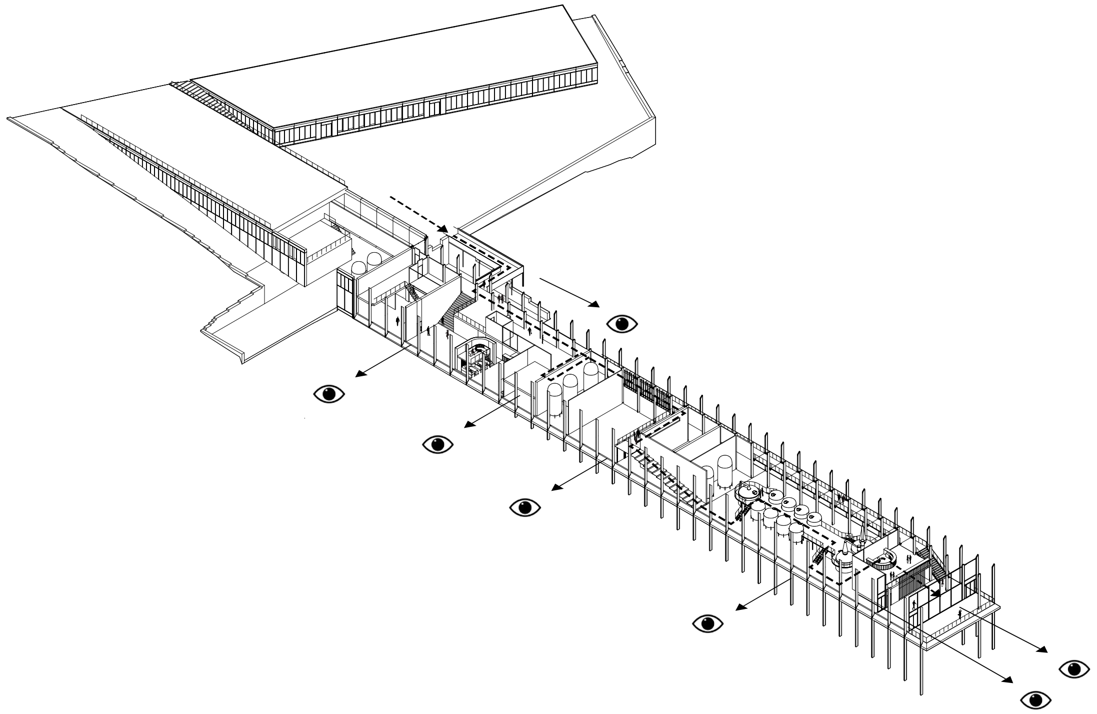
The front-stage section gives a walkthrough of the building from a visitors perspective. The different areas will be explained by visualizations, plan-drawings and diagrams showing the social functions of the building in detail. This chapter will go through the arrival in lobby at the destination-distillery, with the adjacent café. From here one can follow the guided tour into the malting-area and the distillery, ending the tour in the bar, situated on the far end of the building.



Ill. 71: Tour Route Diagram

Walking through the process

When taking a visitor's guided tour, one will walk through the stages of distilling whisky in sequences, following the grain from steeping to distilling.
Rather than being separated from the processes, one gets a close look at how whisky is made, being able to experience the journey of the grain up-close through sensory inputs. This creates a stronger connection between the process and the visitor.



Ill. 72: Views Diagram

Nature as an Intermezzo

Along the guided distillery-tour, the visitor is introduced to different views to the nature. These views are staged through windows placed in relation to line of sight and the process. Like chapters in a book, the nature creates pauses between the stages of the tour.

Arrival

Arriving from Reykjavik the building reveals itself through the transparent glass facade. The guest drives down a small ramp and arrives at a plateau next to the waterfall of the nearby creek.
The entrance is composed as a bridge following the river and orienting the view towards the fjord. A turn towards the distillery leads one into the lobby where a framed view of the neighboring valley and northern mountain range is exposed.

Ill. 73: Exterior rendering south facade

Entrance

When entering the building the lobby creates a distribution space where an overview is established. The black concrete floor and geometric protruding plateau reminds one of the rocky ridge overlooking the valley. A flight of stairs leads down to the lower lobby where nature comes into close proximity.

Ill. 74: Interior rendering lobby

The visitors center is the first thing that greets the guests when entering the building. Here the reception is placed near the entrance, which both serves as a place for buying tickets, and a counter for the giftshop next door.

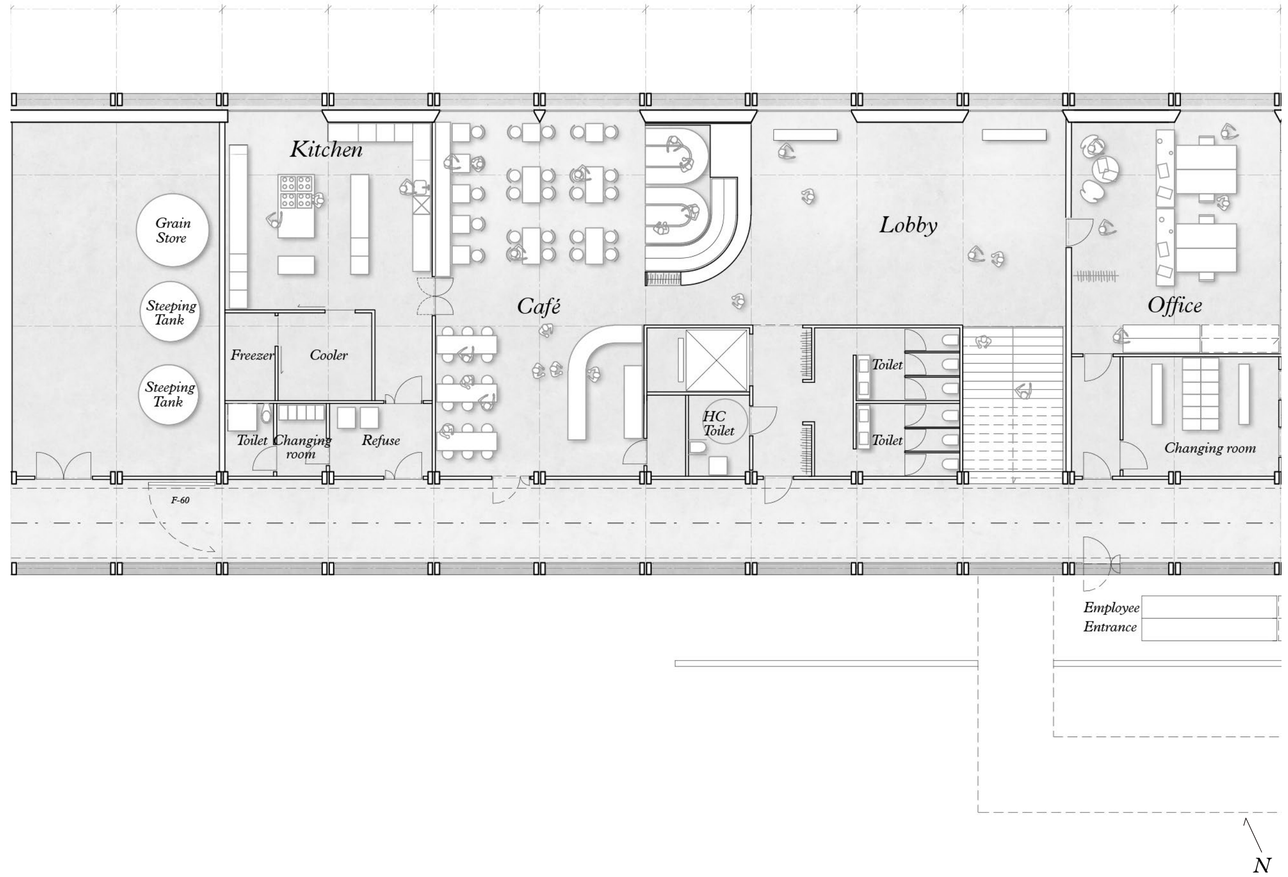
The shop area connects with the exhibition space where tour guests can wait for their guide and here the initial introduction to the distillery takes place.

To the right of the entrance guests arriving for a meeting can enter the administration and a window gives a peek into the storage area of the distillery.

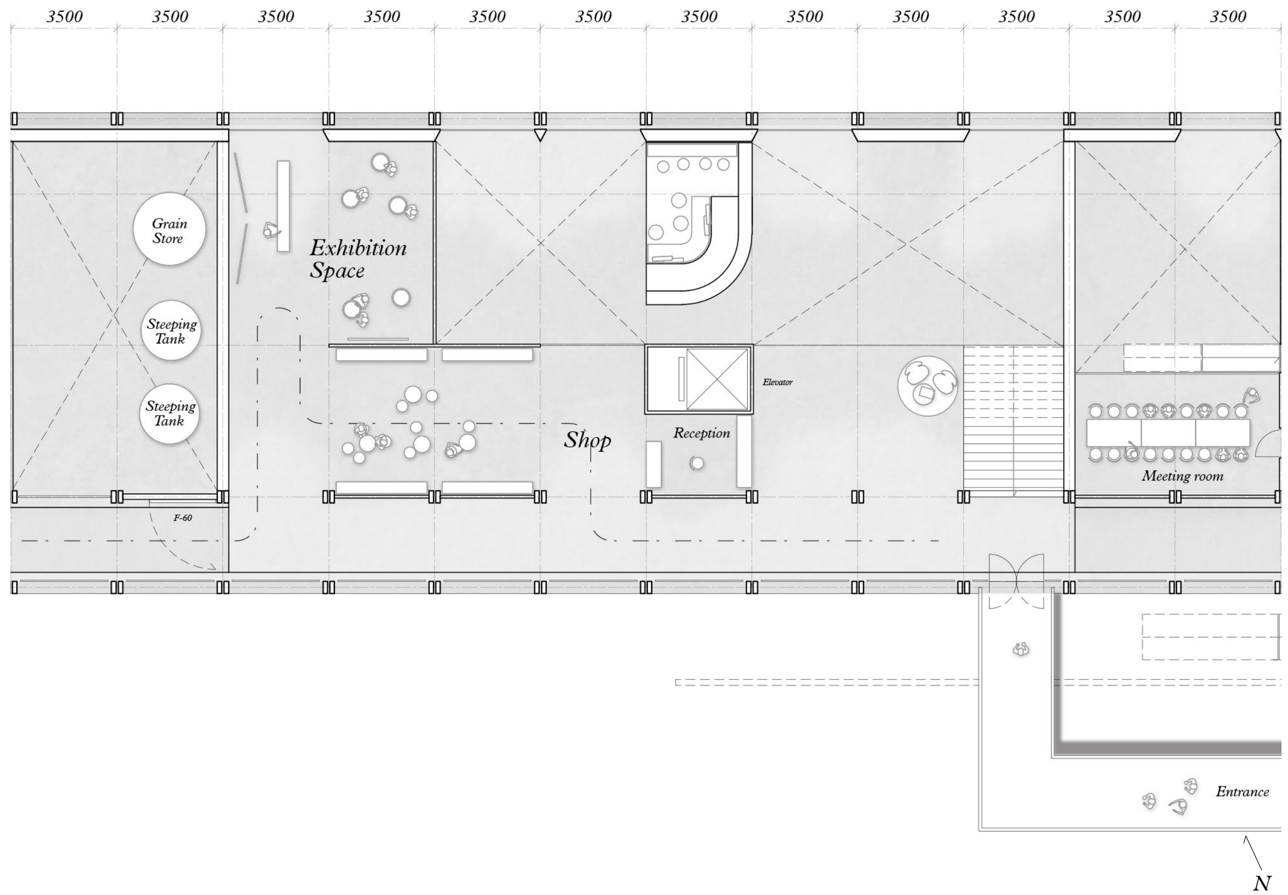
A large staircase leads down to the lower lobby, which also acts as a performative space for events. A black concrete wall flanks the stairs and orients the guests towards the café.

Towards the north large floor to roof windows opens up towards the nature and draws light deep into the building.

The café area is separated from the main lobby area by a curved wall hiding booth seating and creating a mezzanine for the café guests.



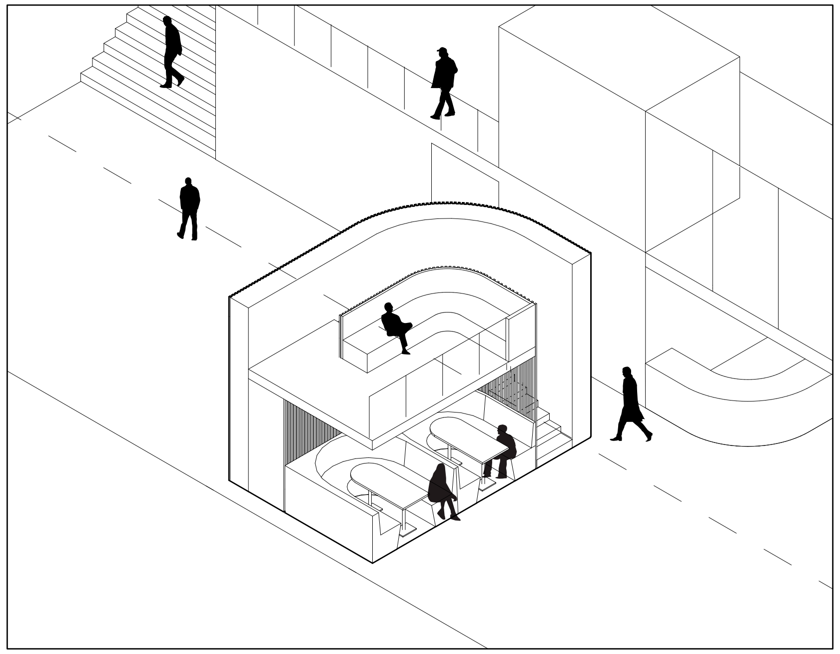
Ill. 75: Ground floor Plan - Visitors Center - 1:250

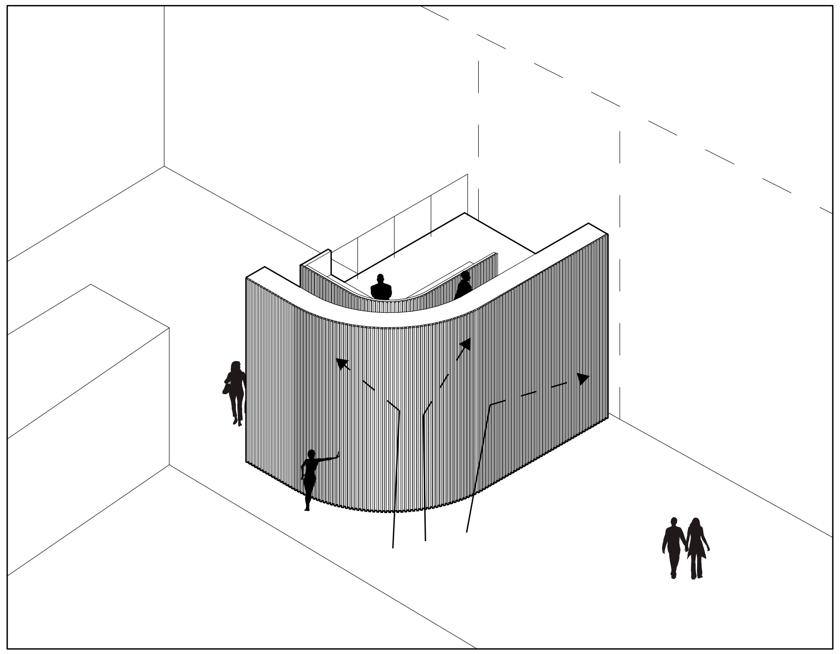


Ill. 76: 1.Floor Plan - Visitors Center - 1:250

As stated earlier the lobby is divided by a curved wall. On the cafe side this creates booth seating. The rounded booth seats create a subtle reference to the wooden casks used for maturing whisky. A rounded stair follows the curvature of the wall to the mezzanine level, where a lounge area, overlooks the café and lobby.

On the lobby side the wall leads the visitor into the café area. But it also acts as an acoustical element. The lamellas are covering a high-density sound absorbent insulation, covered with black felt. The insulation along with the lamellas dispersing the incoming sound-waves helps bring down the reverberation time.
This as well as acoustical ceiling elements, which are present throughout the building, aids the acoustical environment in the lobby, where not much furniture or other acoustical dampeners are present.





Ill. 77: Lobby furniture axonometric drawing

Cafe

In the cafe, large windows create a bright café space, where nature is right next to the visitor.
The booth seating and mezzanine level, along with the lower part under the shop area creates intimate areas, In the otherwise large room.
The height of the room is made branched by pendant lights suspended from the ceiling creating a relatable scale for the sitting guest.

Ill. 78: Interior rendering Café

Malting

The malt floor is the first stop on the tour through the distillery. Here grain is transformed into malt through the germination process. The room is filled with the smell of the wet grain spread on the floor, underneath the mezzanine.

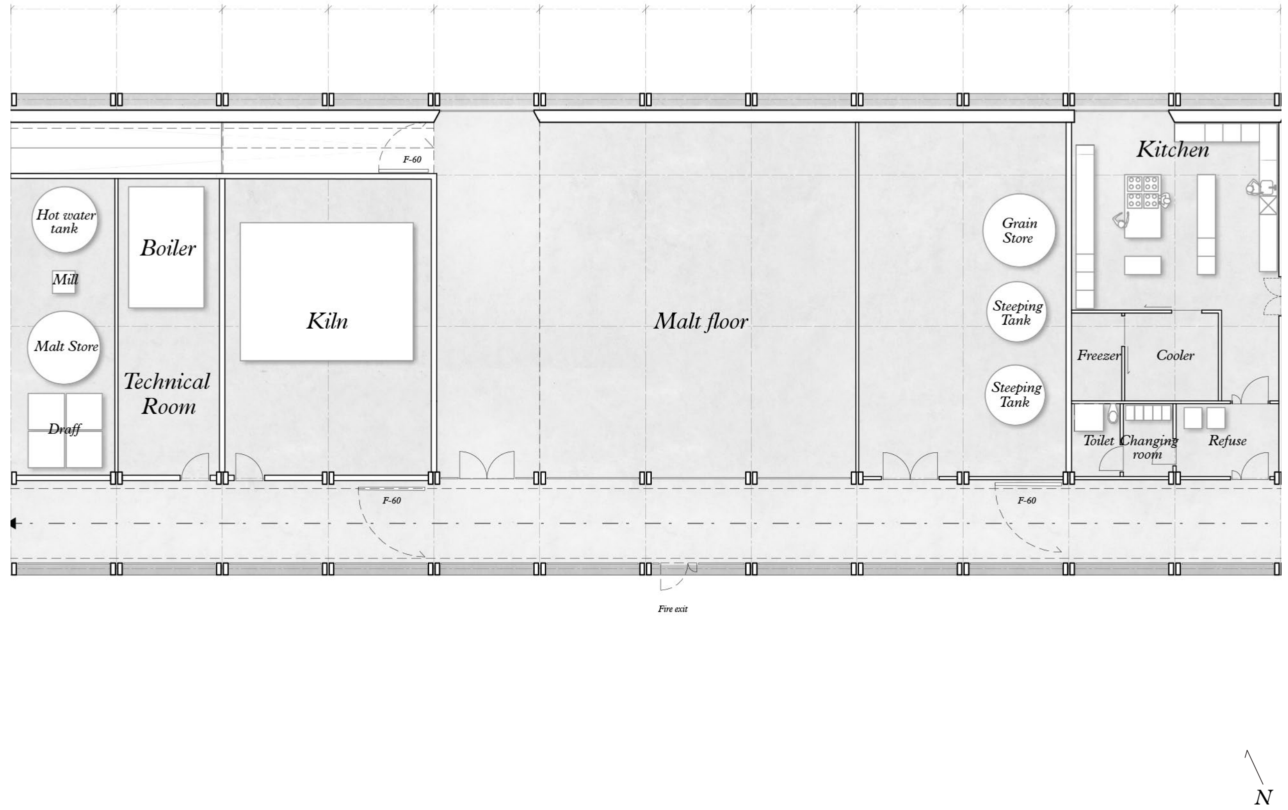
To the left one have a view of the malt being dried in the smoke-filled kiln. And the window at the end frames a view of the creek winding its way towards the fjord.

Ill. 79: Interior Rendering - Malt Floor

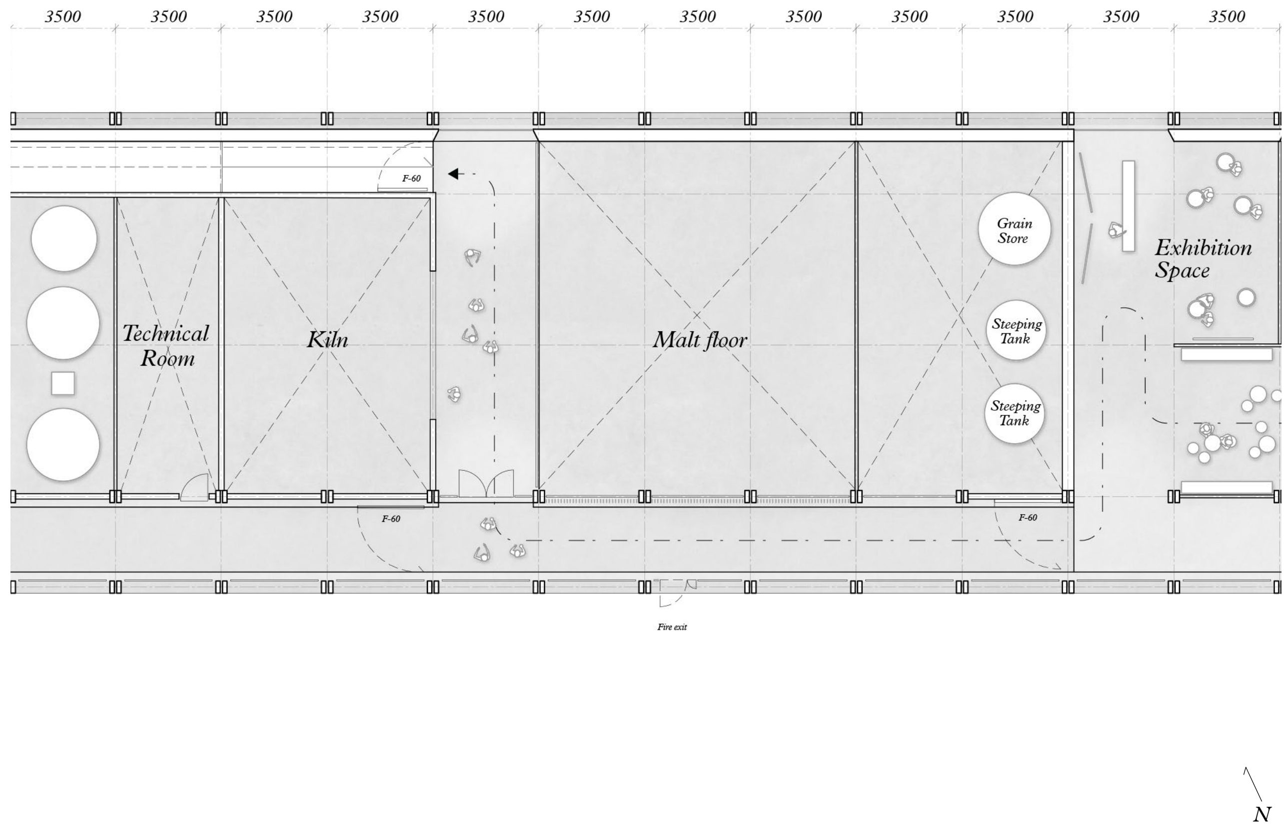
In this part of the building the malting process takes place. To the east the steeping area is placed, here the grain is prepared for germination. From the walkway, the visitor can take a look through the windows at the large steel-tanks holding the grain and water mixture.

The first introduction to the production happens in the malt-floor. Here the walkway branches of and creates a mezzanine level overlooking the maltfloor. Wooden lamellas shade the maltfloor from the incoming sun from the southern gallery, and creates a gradual exposure of the room for the tour guest.

In the middle of the building the kiln is placed next to the malt floor, following the natural route of the grain. On the northern side of the kiln a stairwell leads the visitor down to the distilling floor through a dimmed long stairwell with a large window to the fjord visible at the far end of the distillery.



Ill. 80: Ground floor Plan - Malting - 1:250



Ill. 81: 1.Floor Plan - Malting - 1:250

Distillery

In the distillery, large tanks of copper and steel fill the center of the room. Here the malted grain is transformed into whisky. An elevated central passage runs down along the center of the distillery and puts the guest into close contact with the processes. At the end, the copper stills stand as sculptures signifying the last step in the process before the long maturation period.

Behind these the visitor can get a glimpse into the bar that awaits as the culmination of the tour.

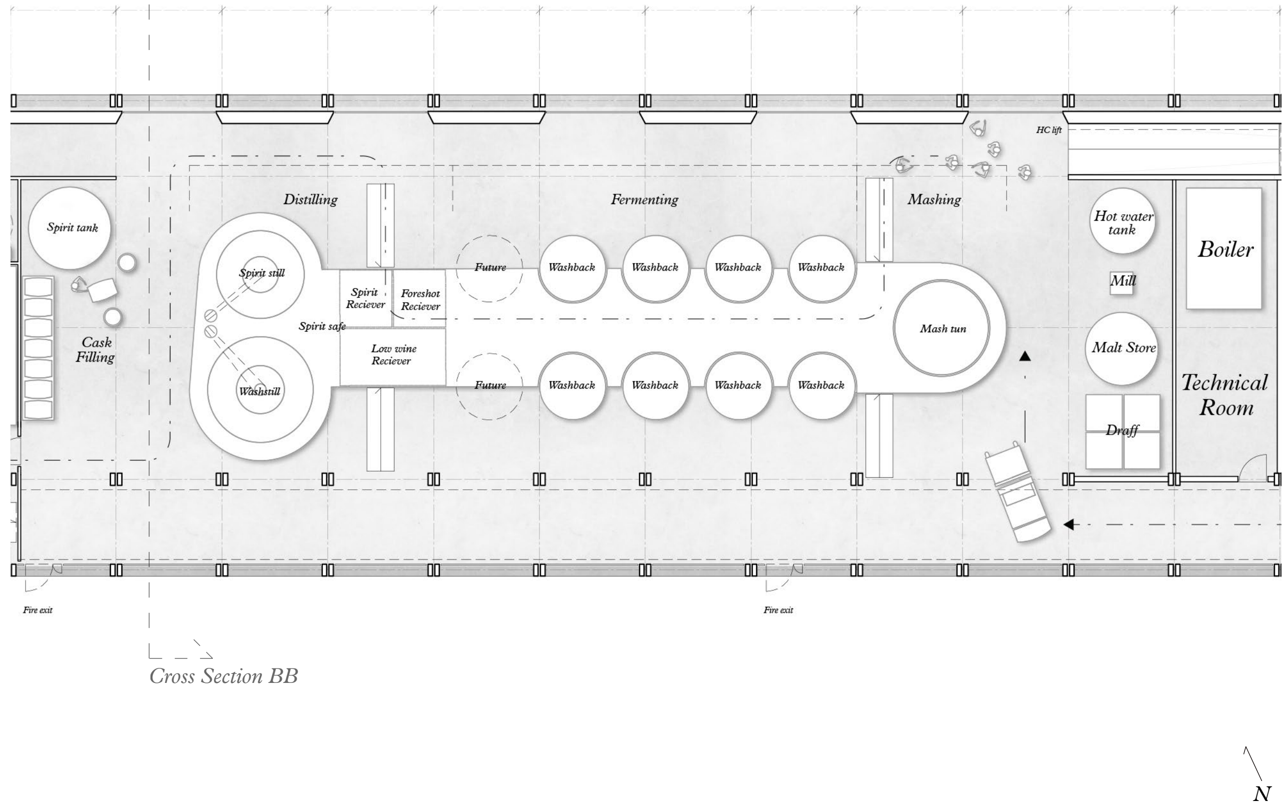
Ill. 82: Interior rendering - Distillery

The distillery floor is where the functionality of the distillery intersects with the visitor's experience. At the eastern end a recessed area contains the necessary storage tanks for the mashing process. This is placed next to the mash tun so it can easily be transferred between the tanks.

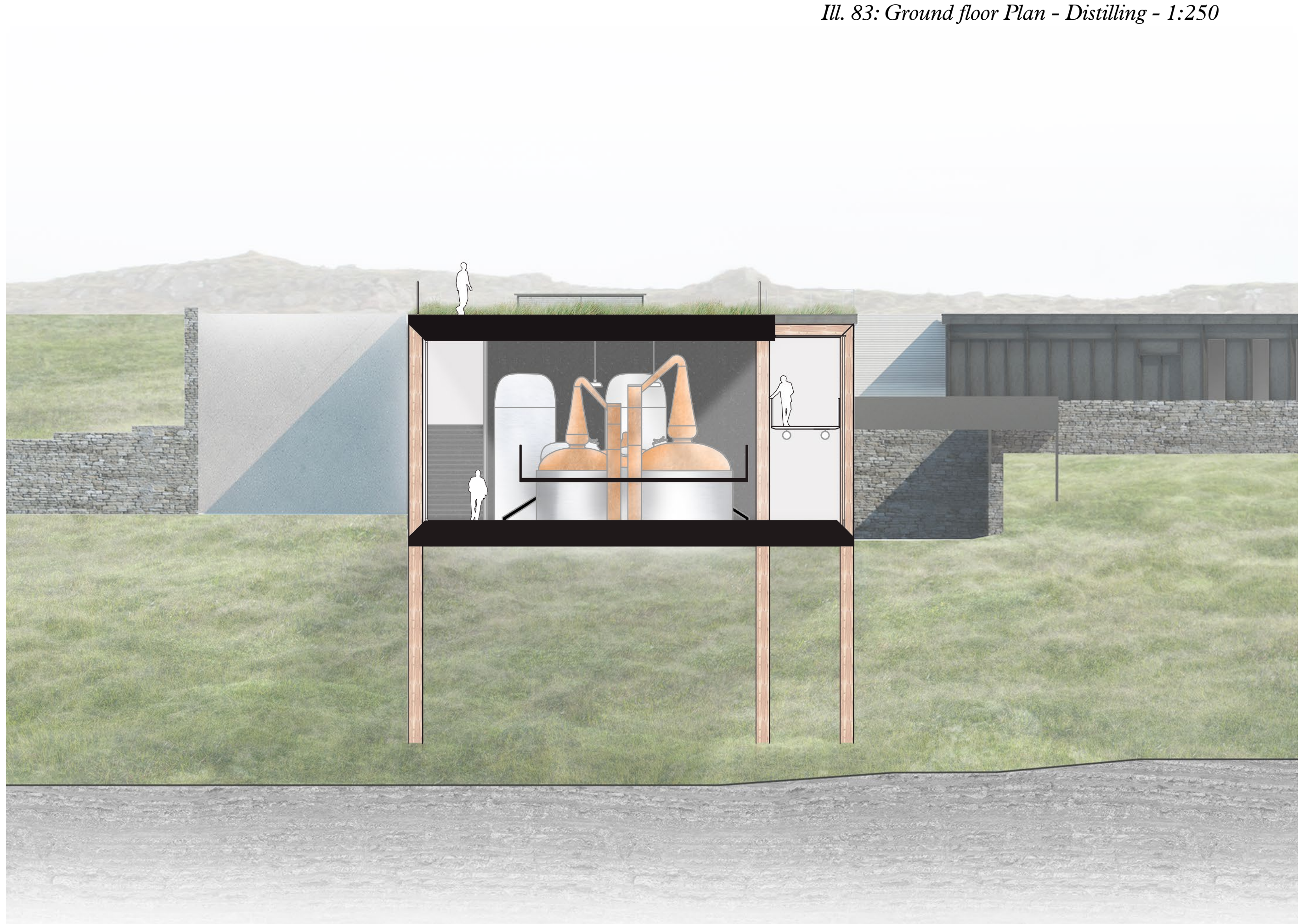
The processes of mashing, fermenting and distillation is arranged linearly along an elevated inspection area between tanks. Here piping and installations are placed beneath, along with the receivers for the stills.

Around the tanks there is ample space for a forklift to navigate, and room for expansion and temporary processes to take place.

At the end of the room casks are stacked on barrel ricks. Ready for being filled and transported to the cask storage for maturing. These are placed next to the entrance to the tasting area of the bar, where the tour culminates in a tasting session of the final product.



Ill. 83: Ground floor Plan - Distilling - 1:250



Ill. 84: Cross section BB- Distilling - 1:250

Bar

The guided tour culminates in the Bar, entering through the tasting area. The tasting area is hidden behind a louvered wall creating an intimate atmosphere where the guide can introduce guests to the different products.

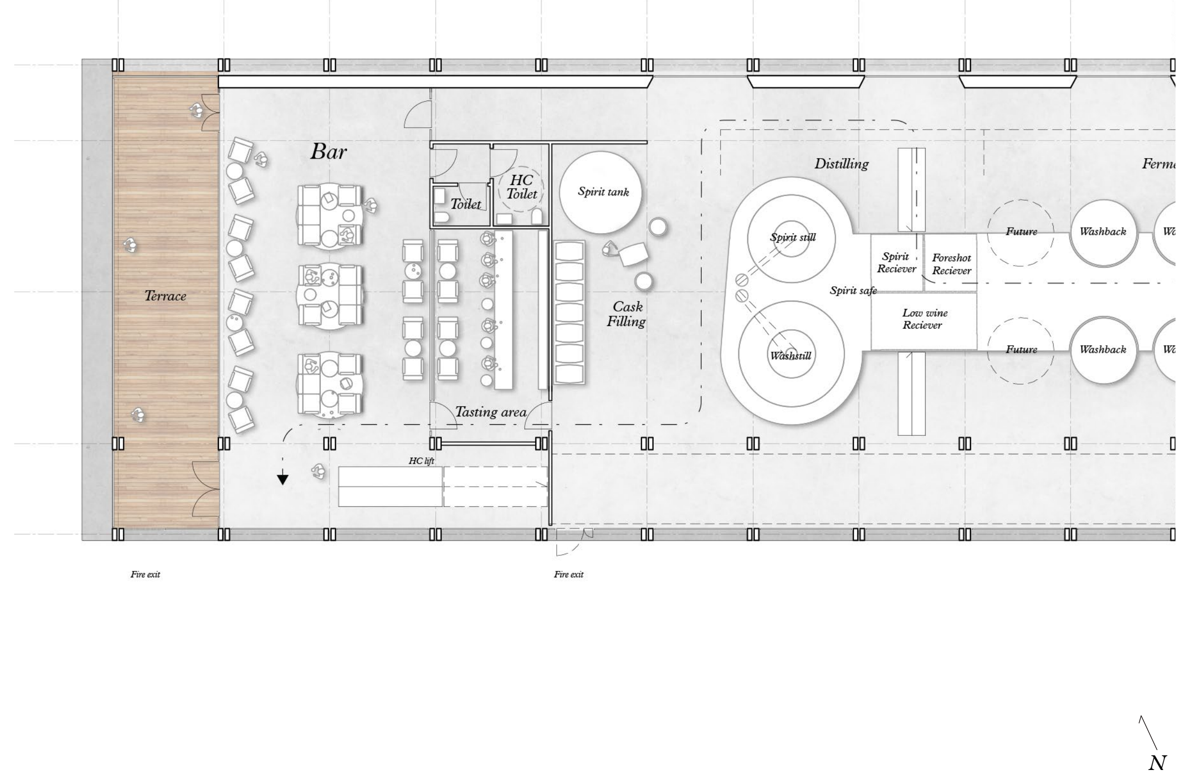
Coming from the tasting are into the lower part of the bar one gets sudden change in scale and a grand view of the surrounding nature through the large glass facades.

Ill. 85: Interior rendering - Bar

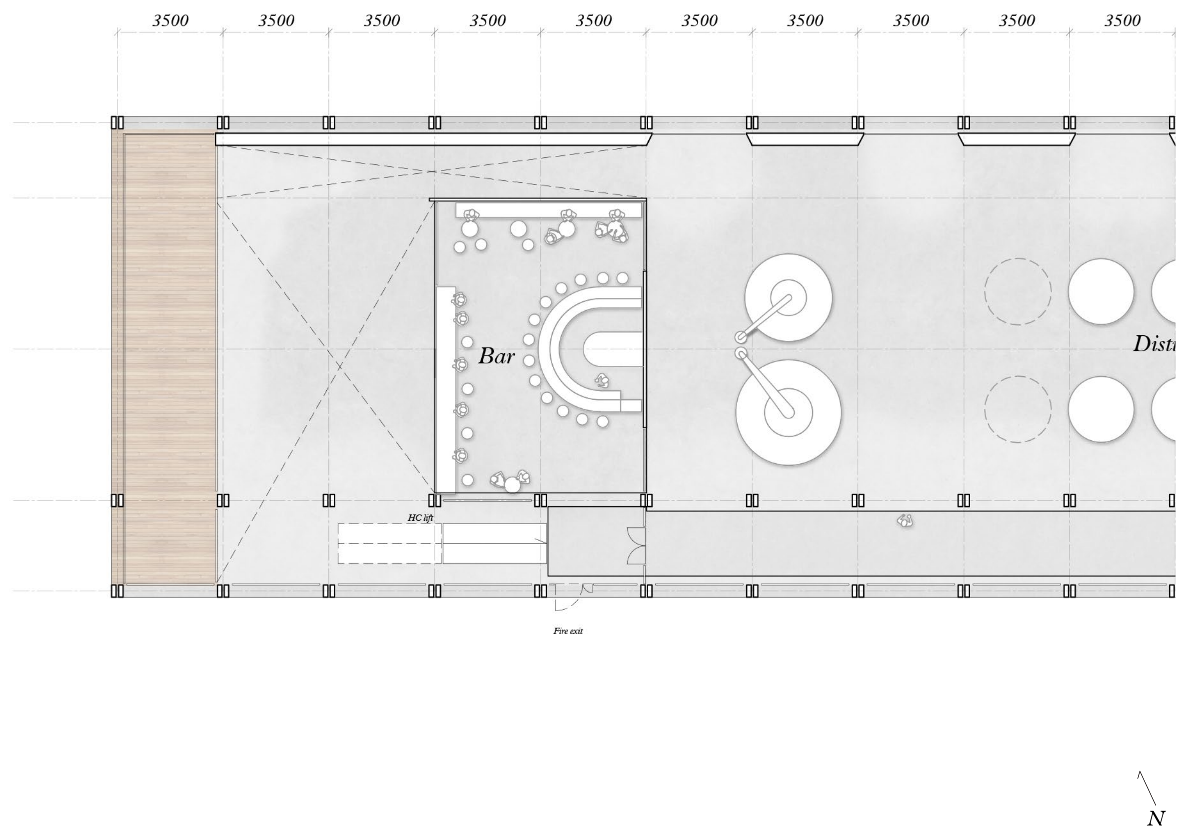
At the end of the building the bar is located. Here a mezzanine generates one part of the bar, the other part of the bar is located on the ground floor. The two levels divide the bar into two typologies; one standing bar-area, on the mezzanine, and a lounge area on the ground floor.

The bar connects to a terrace overlooking the fjord which can be accessed from the lower part of the bar.

When the guests are finished enjoying their whisky they go back following the glass gallery on the first floor. Here they can retrace their steps, and experiences the tour in review, while overlooking the different parts of the distillery from the suspended walkway.

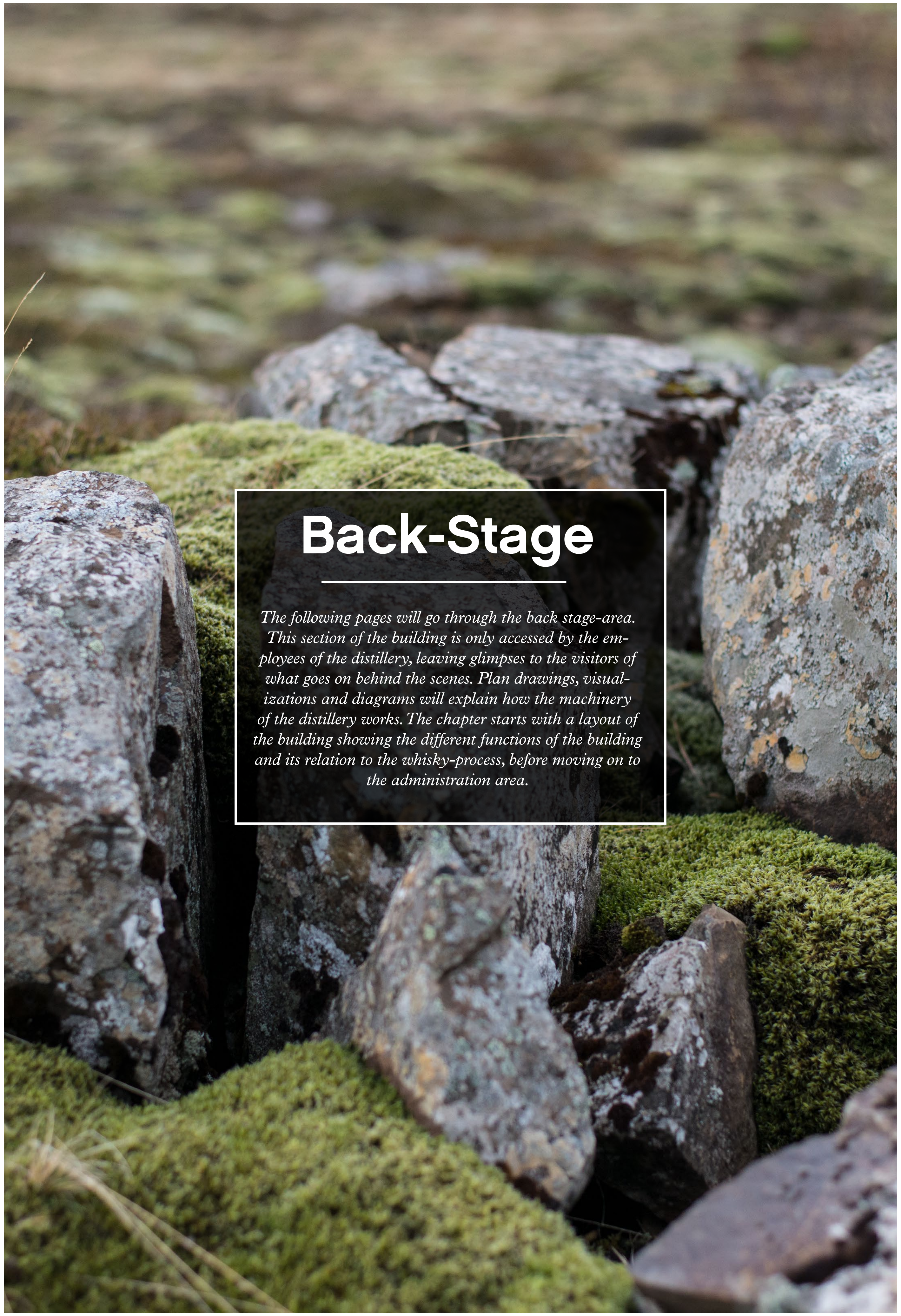


Ill. 86: Ground floor Plan - Bar - 1:250



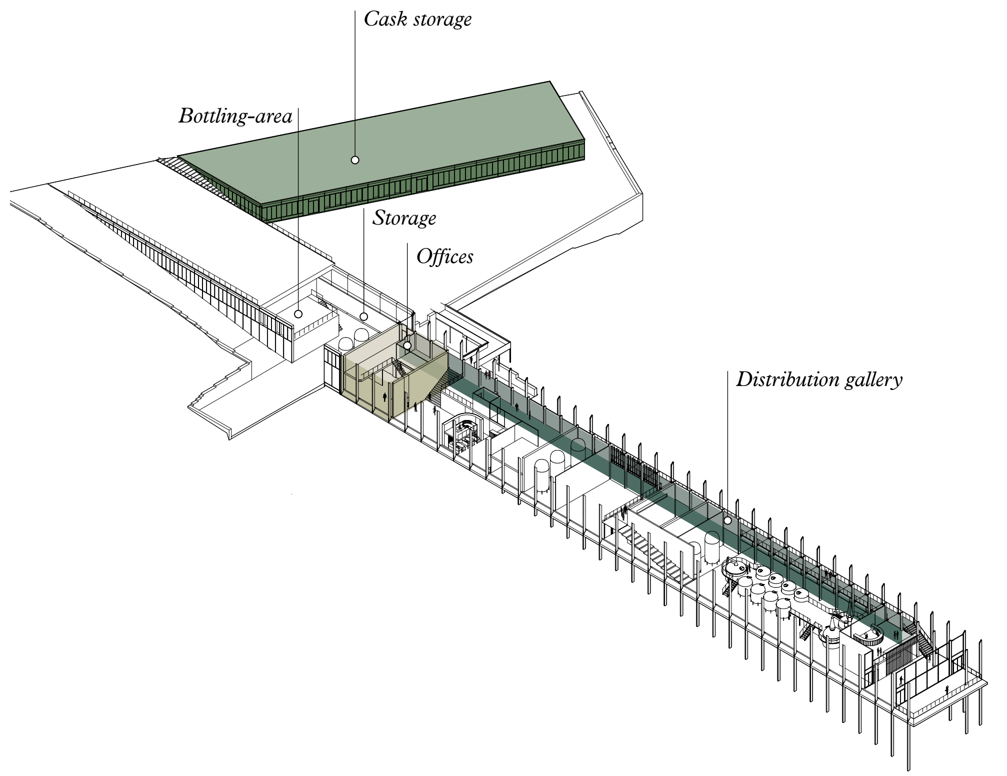
Ill. 87: 1.Floor Plan - Bar - 1:250

This page is intentionally left blank



Back-Stage

The following pages will go through the back stage-area. This section of the building is only accessed by the employees of the distillery, leaving glimpses to the visitors of what goes on behind the scenes. Plan drawings, visualizations and diagrams will explain how the machinery of the distillery works. The chapter starts with a layout of the building showing the different functions of the building and its relation to the whisky-process, before moving on to the administration area.



Ill. 88: Backstage functions diagram

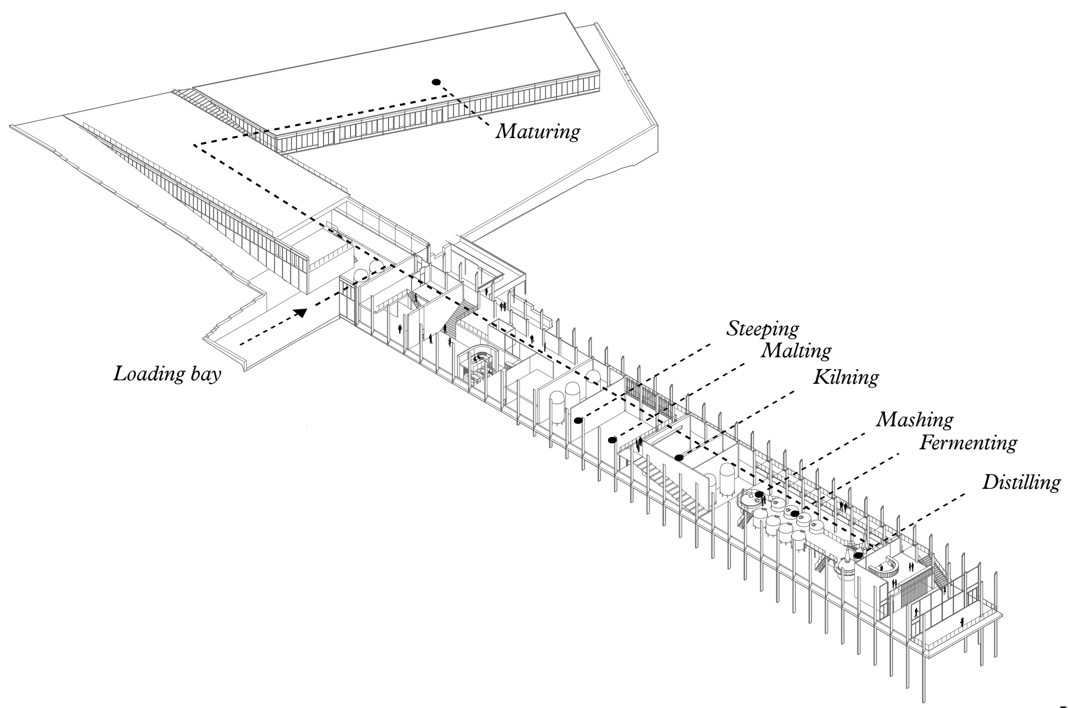
The Functional Backstage

The backstage-area is organized using functionality and logistics as parameters for design.

The goods are delivered to the storage via a ramp on the northern side of the building. In connection with the storage, is a bottling-area. From here a transportation route connects the storage with the different stages of the distillery.

The cask storage is located to the east. The unheated storage provides large areas for storing the whisky after production. This creates shifting temperature, beneficial for the taste of the product.

The administration is located between the lobby and the storage, working as a link between the front-stage and the back-stage for the staff.



Ill. 89: Backstage flow diagram

From Grain to Whisky

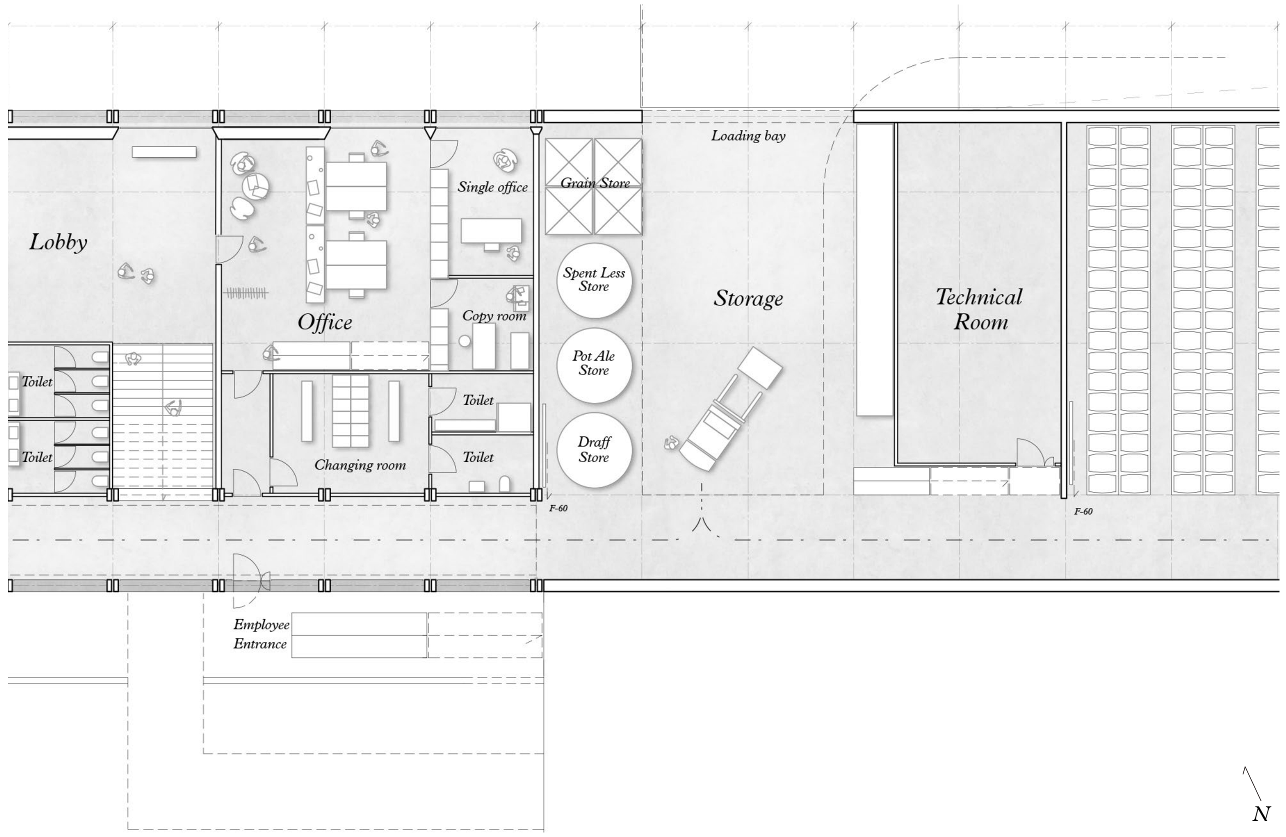
From the loading bay, one can easily follow the path of the grain from delivery to maturing. The different steps of making whisky are organized sequentially in the same order as the process takes place.

The grain is transported from the storage to the different processes via the transportation route in the gallery ending up in the distillery. After being distilled into spirits, the product is filled on to casks, and transported to the cask storage.

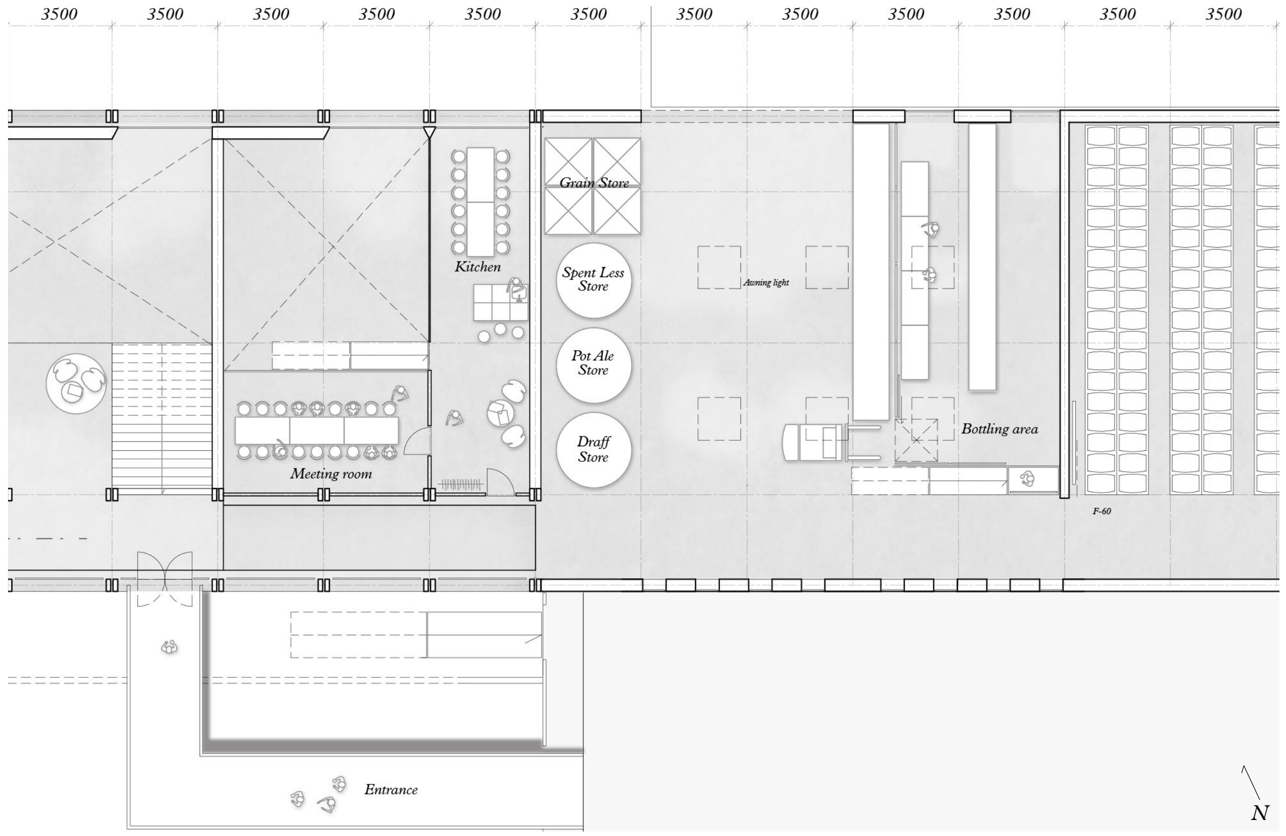
The workers enters through the staff-entrance in the ground floor, with direct access to the changing rooms. From here the employees can navigate to their department. The guests going to a meeting in the administration-area, enters the meeting room through the main entrance,either via the meeting room-entrance on the first floor or through the lobby.

In the storage-area you can find the necessary storage-space with containers for leftovers after distilling, and room for loading and unloading of goods. Included in the storage area is a bottling area. This is located above the technical room.

Further towards the east the cask-storage is placed, this wraps around the building and has storage for the first three years of whisky production.



Ill. 90: Ground floor Plan - Storage & Administration - 1:250



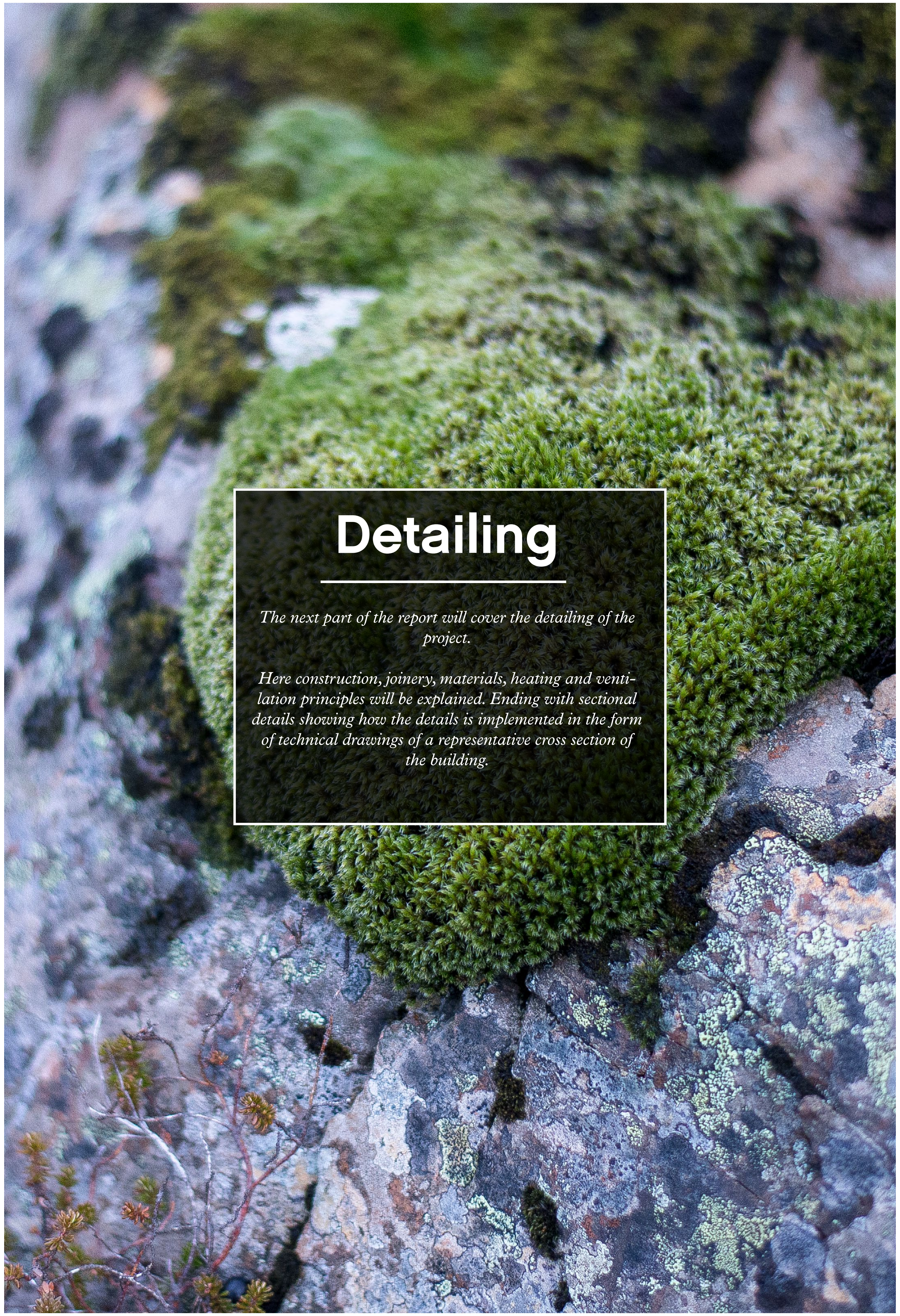
Ill. 91: 1.Floor Plan - Storage & Administration - 1:250

Administration

The administration is situated in light facilities, organized with an open space containing work-stations.
Building integrated furniture creates a semi-transparent wall between the single-person office and the open space. The wall consists of a panel of frosted glass, with shelves placed towards the office space, and an open area in the middle to be used for seating.
On the first floor a break area for the staff is located. In addition to this, a meeting room overlooks the double high space and has a view towards the nature.

Ill. 92: Interior rendering - Administration

This page is intentionally left blank



Detailing

The next part of the report will cover the detailing of the project.

Here construction, joinery, materials, heating and ventilation principles will be explained. Ending with sectional details showing how the details is implemented in the form of technical drawings of a representative cross section of the building.

Construction

The structural system is conceived as a series of frames repeating with a distance off 3.5 meters. This rhythm provides both the facade of the building as well as the division between the gallery and the other functions of the distillery. Each frame element is split into two parts to make the appearance of the construction lighter.

The construction is composed so a stable system is created above ground. This makes it possible to have pinned supports between the pillars and the ground, reducing the size of foundations needed for anchoring the building.

The frame is composed of a wooden structure that lifts it off the ground. The pillars are made of glue laminated timber, quality gl36h, connected with rigid steel joints to provide stability. The columns are made up of two pieces 475mm x 180mm spaced 90mm apart.

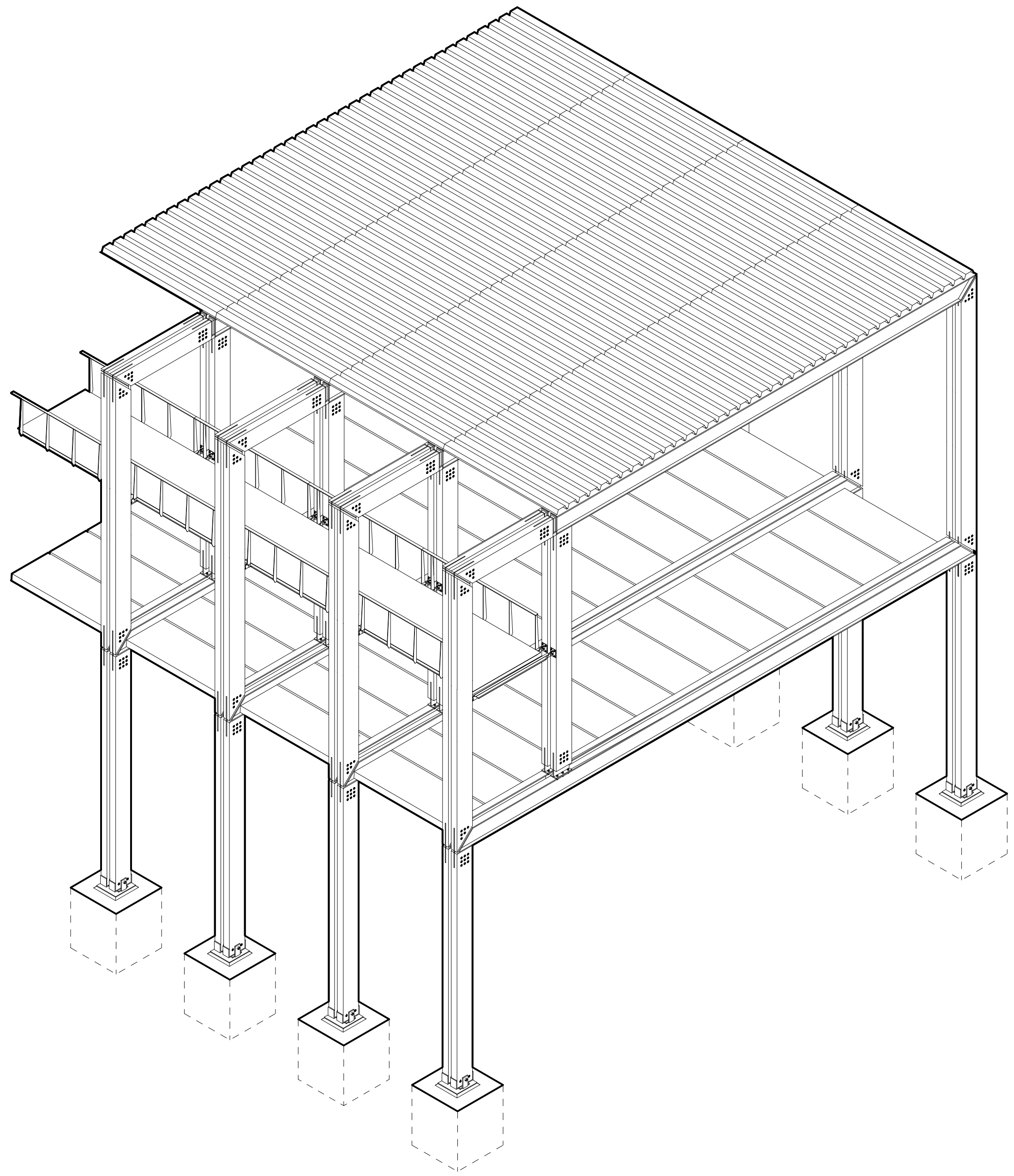
The floor and roof is supported by two IPN 475 steel profiles, that spans between the pillars and carries the heavy load of the of the distillery, and the green vegetation on the roof.

In the gallery, a simple steel walkway is connected to the timber frames. Underneath the walkway installations and piping for the distillery functions, and supplementing mechanical ventilation for areas like toilets and kitchens is placed.

The frames are connected in the roof, with corrugated steel decking, bolted to the steel profiles. In the floor, precast concrete deck elements connect the frames resting on the lower flange of the IPN profile and fixed with rebar pre-welded to the profile and joined with precast elements on site by casting. This acts as structural diaphragms that provides the building with lengthwise stability. The complete construction is anchored into the ground in the eastern end assuring no movement lengthwise of the complete building.

All the dimensions of the individual elements and overall structure is calculated according to the Eurocode regulations by the finite element method in Autodesk robot.

Detailed calculations from robot can be found in appendix 1, and dimensioning of the concrete elements and corrugated steel decking can be found in appendix 4 and 5.



Ill. 93: Construction Axonometric Drawing

Construction Detailing

1.
The construction rests on individual concrete footings. The connection is hinged cross-sectional on the building. As a result of this and the rigid system above ground no momentum is transferred to the footings. This makes it possible for the footings to have relatively small dimensions, 1400mmx1400mm and 1600mm deep. (Appendix. 5)

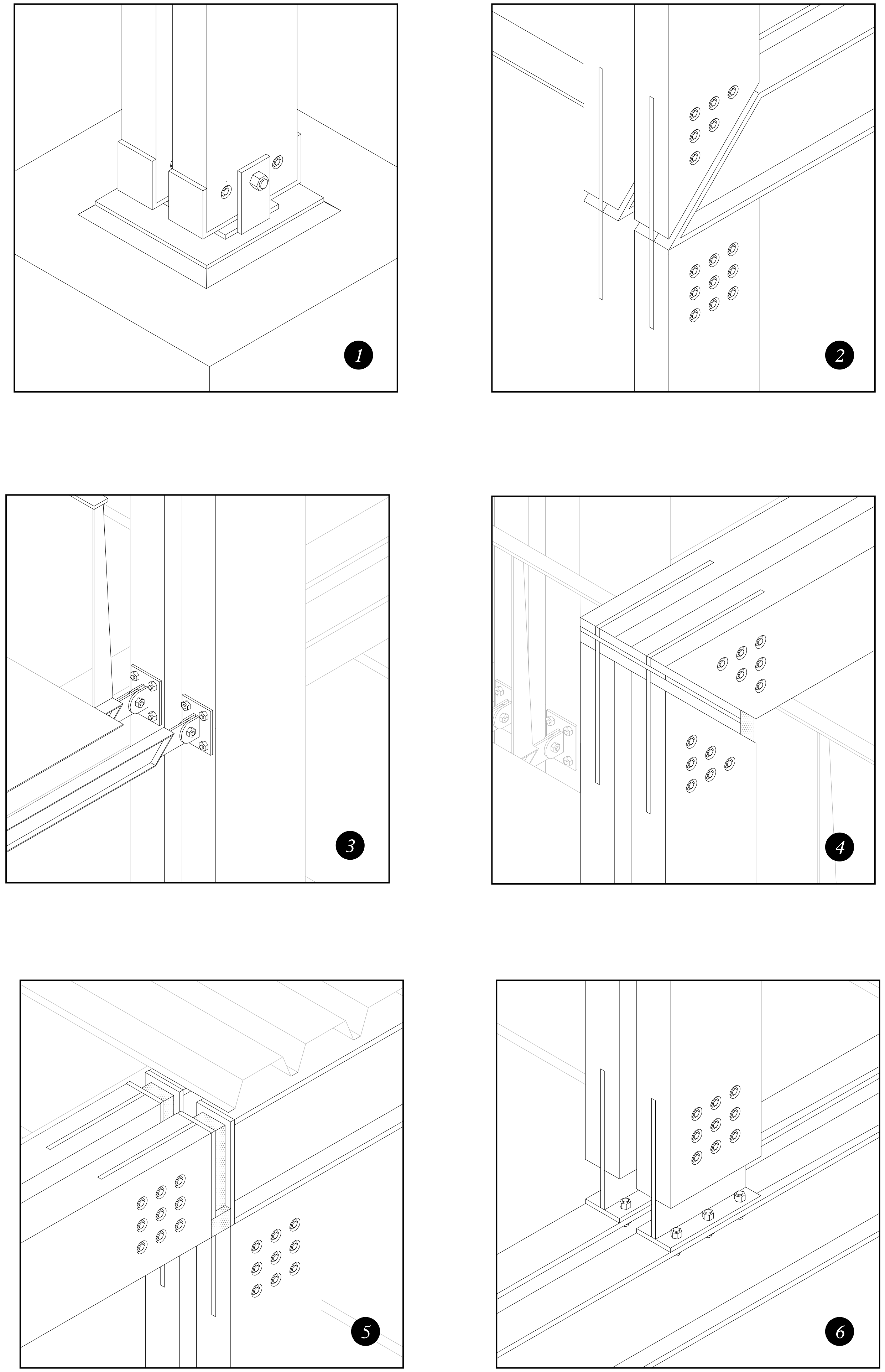
2.
The wooden pillars are connected to the steel frame with M24 bolts spaced 100mm apart according to the regulations in Eurocode 5 (Appendix. 6). The visible joints are offset from the structure by 50mm visually emphasizing the joint. This is made possible by the rigidity provided by the roof and floor, assuring lengthwise stability.

3.
The walkway carried by IPE 100 steel profiles connected to the wooden columns, with hinged joints, reducing the stresses in the connection.

4.
In the upper corner of the southern gallery the wooden beams are connected by a rigid steel joint. Here the joint is once again offset 50mm to emphasize the joinery. Towards the glass side a thermal break is placed so the steel joint does not cross the building envelope.

5.
Where the wooden beam of the glass gallery connects to the steel construction an Isokorb® rigid thermal break element is installed to minimize the conduction through the construction.

6.
The middle column is connected with a steel bracket to the steel construction in the floor. Here the column is offset 50mm of the floor level of the building making the columns “float” over the floor inside the distillery.



Ill. 94-99: Construction Axonometric Callouts

Exterior Materials

The exterior material choices of the building are restrained to wood and black aluminum.

The glue laminated timber construction plays a central role in the facade and is contrasted by matte black aluminum sheets arranged in a repeating geometric pattern. The choice of an aluminum facade is both referencing the Icelandic volcanic underground with its black color but also a nod to the industrial tradition for aluminum smelting on Iceland.

The aluminum facade is a durable choice that can easily withstand the Icelandic climatic, with little to no maintenance. With time the aluminum will weather slightly and emphasize the reliefs of the facade pattern.

When glue laminated timber is applied on the exterior of the building it is important the wood used is of a naturally durable type that can withstand the impact of the environment.

For this reason, Douglas fir glulam is chosen. Douglas fir is a durable wood type that is well suited to withstand the impacts of the natural environment. Overtime the wood will gain a small reddish tint that can add to the character of the building.

Ill. 100: Glue laminated timber

Ill. 101: Aluminium panels

Interior Materials

The interior materials of the building are reflecting the exterior. The glue laminated wood columns are present throughout the building as room defining elements.

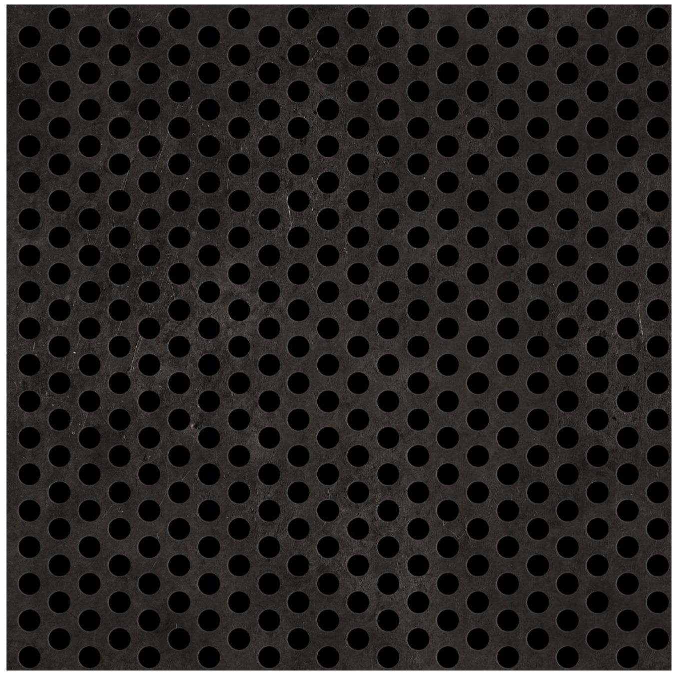
The walkway is composed of perforated metal sheets and steel profiles all finished in black, creating a link to the black aluminum cladding of the facades.

Wooden lamellas are applied on interior elements in both the bar and lobby as well as shading for the malt floor. They create warm elements in the otherwise industrial setting.

The floor and choice walls of the building are of a black concrete developed as part of the project.

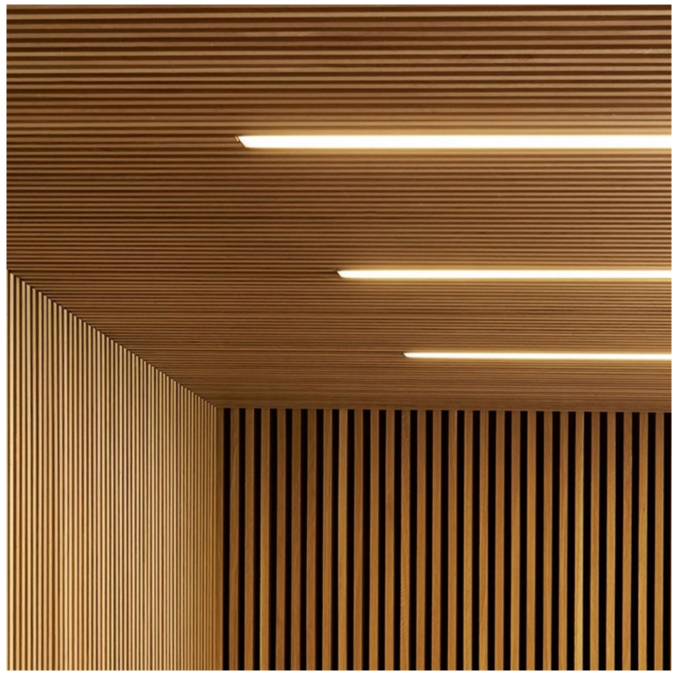
The concrete consists of Icelandic volcanic sand mixed with lavarock pebbles collected on Iceland. The concrete is then mixed with iron oxide to dye the cement used. After this it is polished to expose the aggregate in the mix. This leaves a glossy surface with a deep black tones and small speckles of white showing.

The concrete inherits the qualities of the Icelandic environment and brings it inside the building. Here it is used to create the cave like atmosphere of lobby but also to make a functional flooring for the rest of the building which, with a polyurethane top, can withstand the abuse of the daily wear and tear.



Ill. 102: Perforated metal sheet

Ill. 103: Glue laminated timber



Ill. 104:Wooden lamellas

Ill. 105: Icelandic concrete

Ventilation & Heating

The principles for heating and ventilation for the distillery is based on passive strategies. The gallery works as a passive heating mechanism, generating heat through solar radiation transmitted through the south facing windows. The concrete floor acts as a thermal mass stabilizing the temperature and storing heat. Adjustable exterior solar shading, in the form of textile screens, prevents overheating.

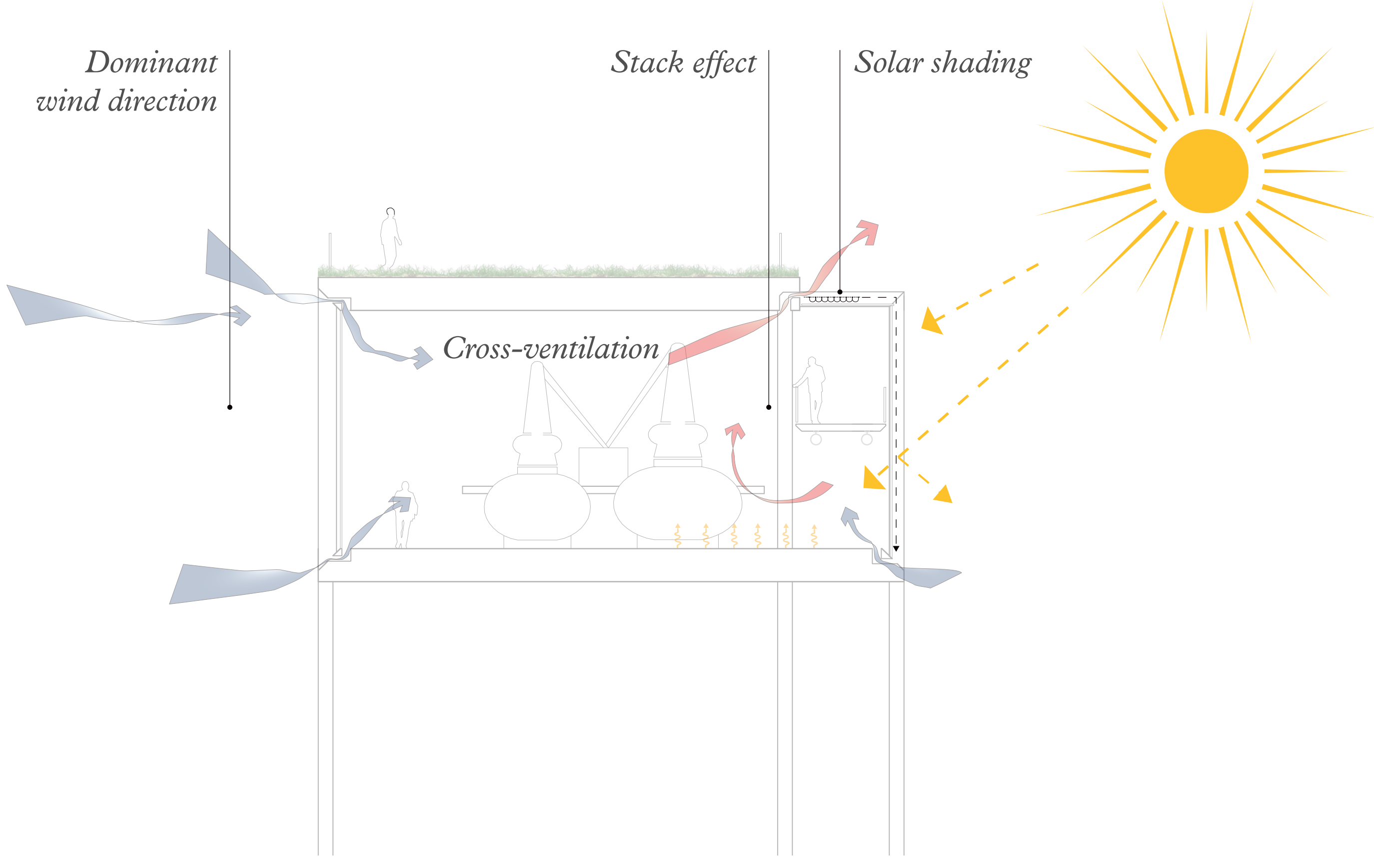
The gallery also acts as a natural ventilation driver. Thermal buoyancy, causes the hot air to rise, and a stack effect is created. The hot air is then let out through ventilation shafts placed in the ceiling.

This combined with the dominant wind direction, on the north side of the building, letting air in through adjustable ventilation drafts in the floor as well as the ceiling on the northern side creates cross-ventilation.

An estimated potential air change has been calculated to assure wind speeds and thermal buoyancy is sufficient (appendix 8). On days with low wind speed, fans are installed in the ventilation outlets, maintaining a sufficient air change.

When heating is needed, the cold air is heated by trench radiators installed in the floor inlets.

Besides acting as general ventilation for the building the cross ventilation principle assures that the malt floor can be kept at the desired temperature.



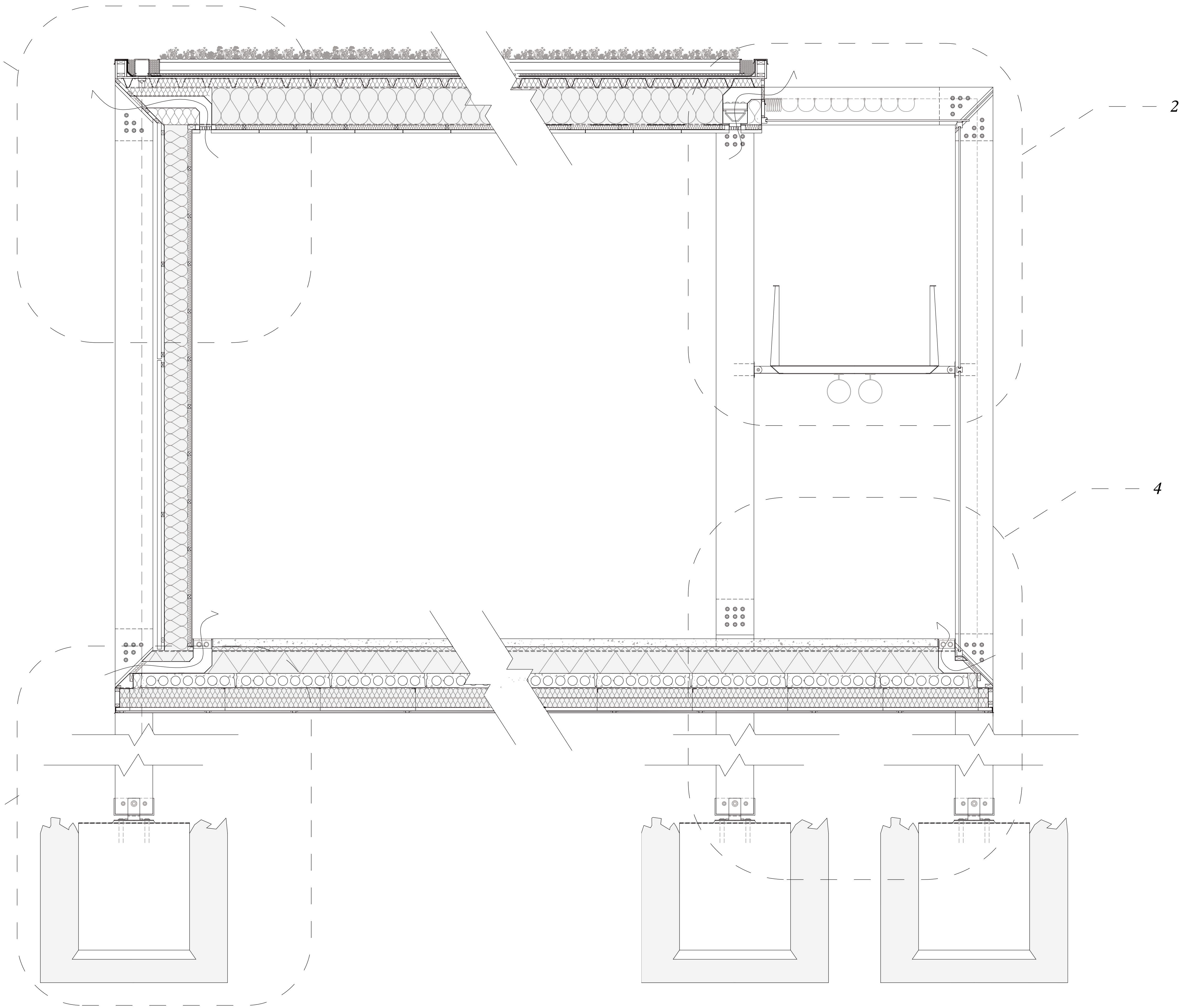
Ill. 106: Heating and ventilation strategy

Structural Details

In the following pages, sectional details of the construction will be presented. It has been chosen to do a cross section through the elevated part of the building. The section lies just in front of the construction and shows how the different layers of the building envelope is composed.

Callouts have been made of the corners of the building. Here one can see how the ventilation principles are implemented in the ceiling and floor of the building, as well as the buildings connection to the ground.

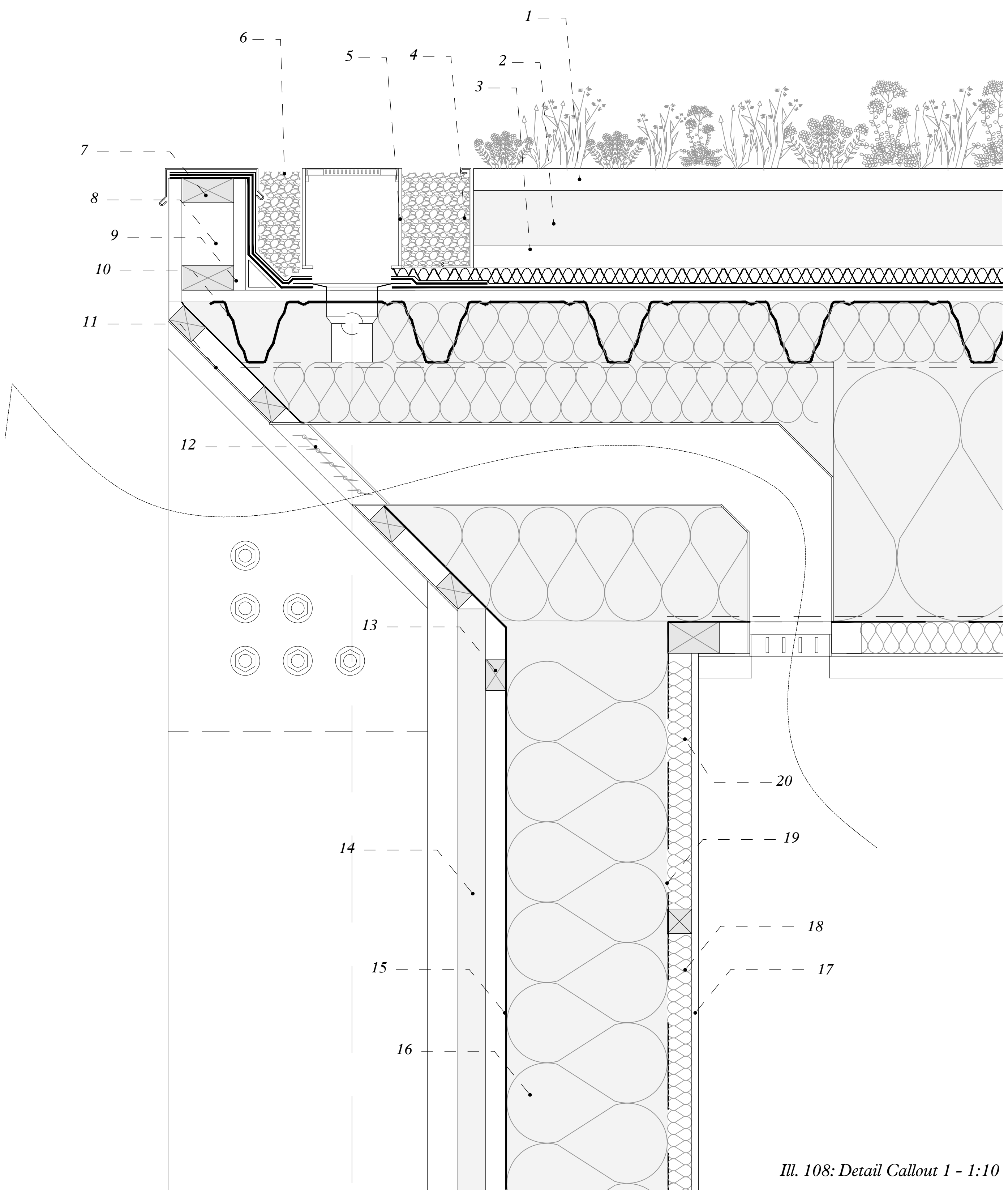
Relevant layers have been marked to show the compositions of elements. These are left out if already present in other sections.



Ill. 107: Detail 1:50

List of contents:

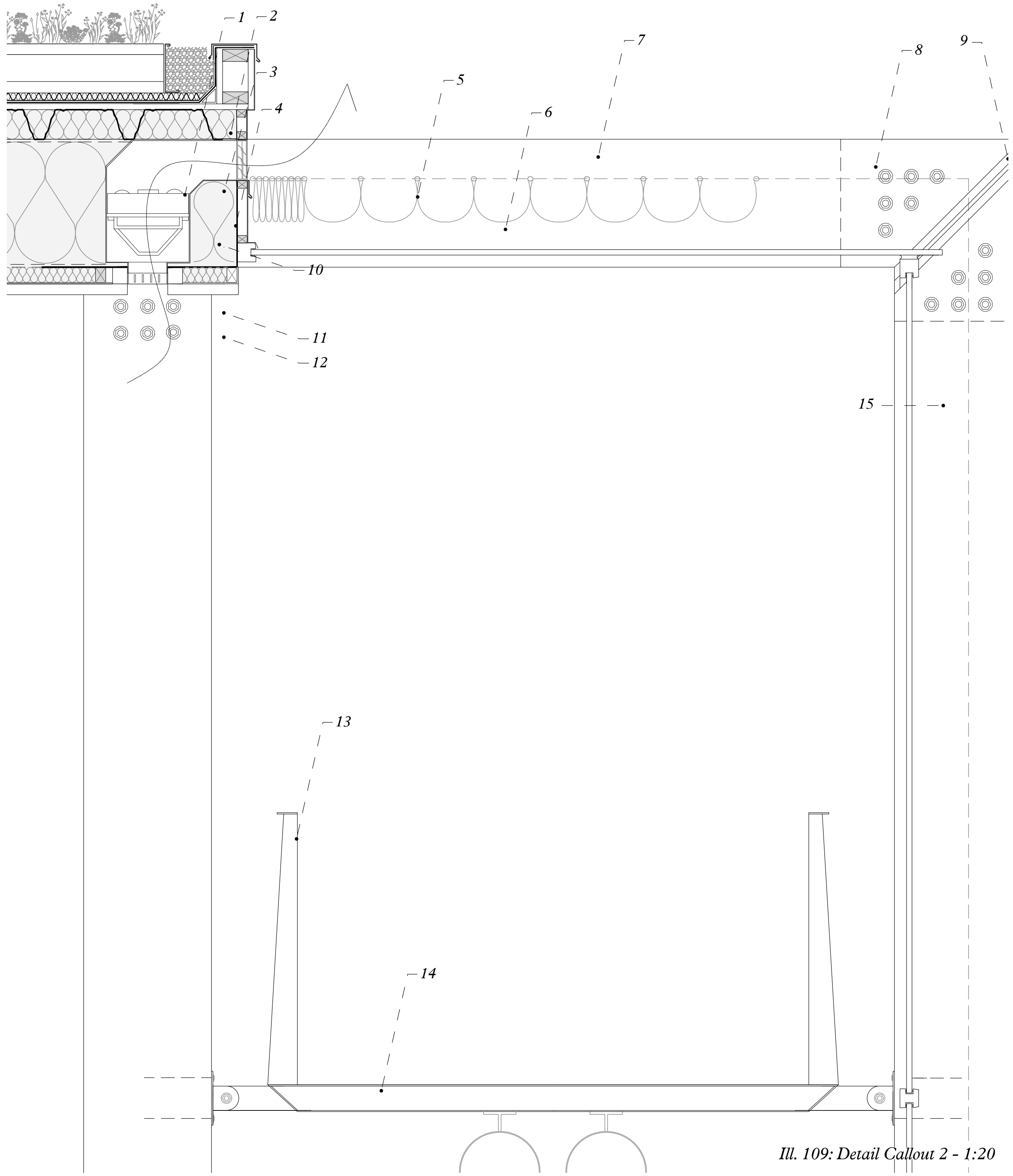
1. Natural soil, turf - 40 mm
2. Vegtech lighweight loil - 100 mm
3. Water absorbing layer, Grodan PP100/40 - 40 mm
4. Draining layer, Nophodrain 220 - 11 mm
5. Root blocking foil, Nophadrain WSB 80 - 0,8 mm
6. Gravel fro drainage
7. Drip edge
8. Plywood panel - 22x226 mm
9. Wooden batten - 95x45 mm
10. Trapeze-panel - Muncholm - EM-110R/1000
11. Aluminium covering - 2 mm
12. Automatic air vent
13. Wooden batten 57x38 mm
14. Aluminium panels
15. Bitumen rolled membrane - 0,5 mm
16. Insulation, Rockwool A-Batts - 300 mm
17. Gypsum wall - 13 mm
18. Insulation, Rockwool Flexibatts - 37 mm
19. Vapor barrier
20. Wooden batten 95x58 mm



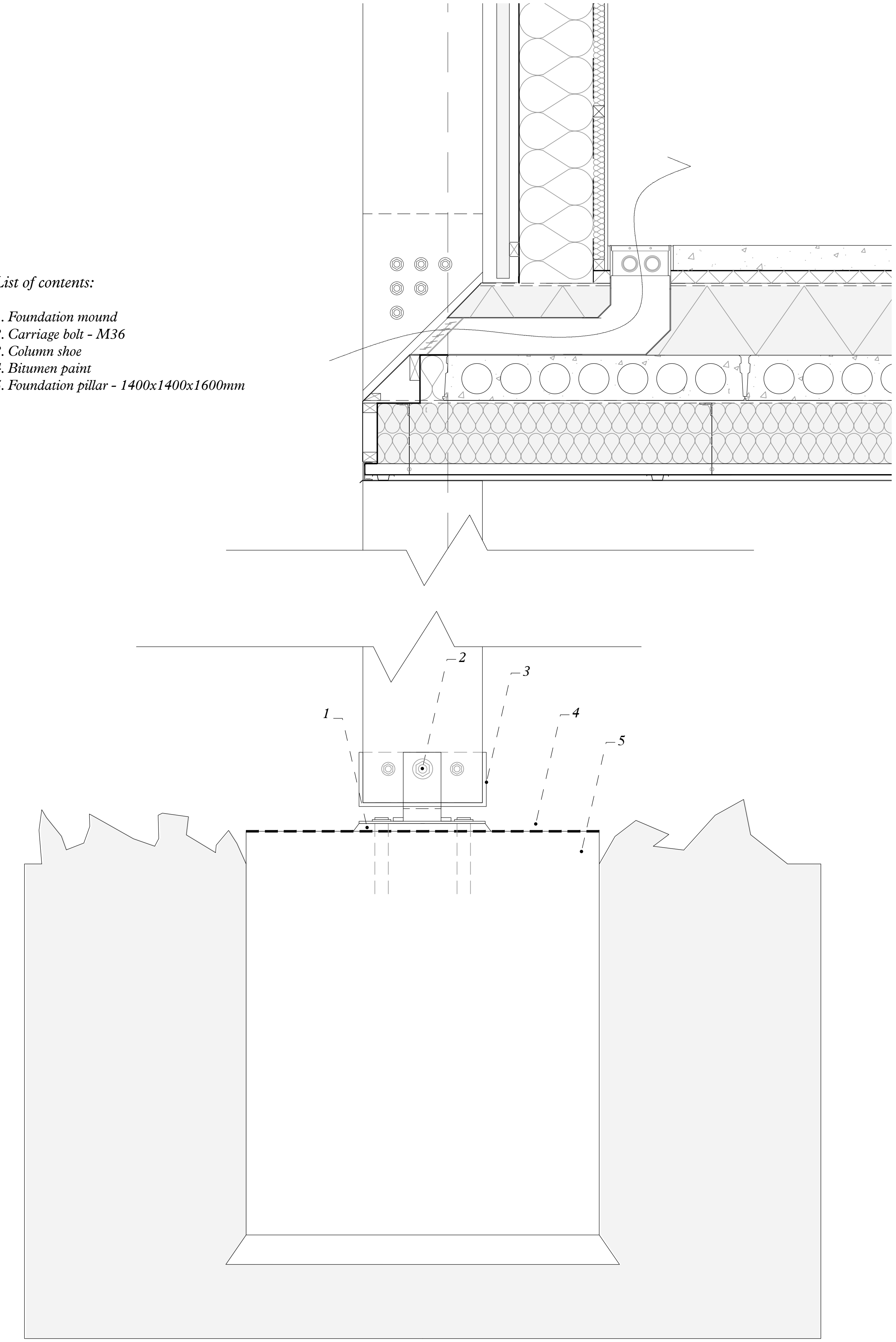
Ill. 108: Detail Callout 1 - 1:10

List of contents:

1. Ventilation fan
2. Wooden batten - 38x28 mm
3. Bitumen rolled membrane - 0,5 mm
4. Window sill, aluminium
5. Window
6. Window glass - 2 mm
7. Glulaminated beam, GL36h 475x180 mm
8. Carriage bolt - M26
9. Metal bracket
10. Wooden batten, 45x45 mm
11. Vapour barrier
12. Acoustic panels, Earmark Direct 40 - 60x60x40 mm
13. Metal banister
14. IPE100
15. Gluelaminated column - GL36h - 475x180mm



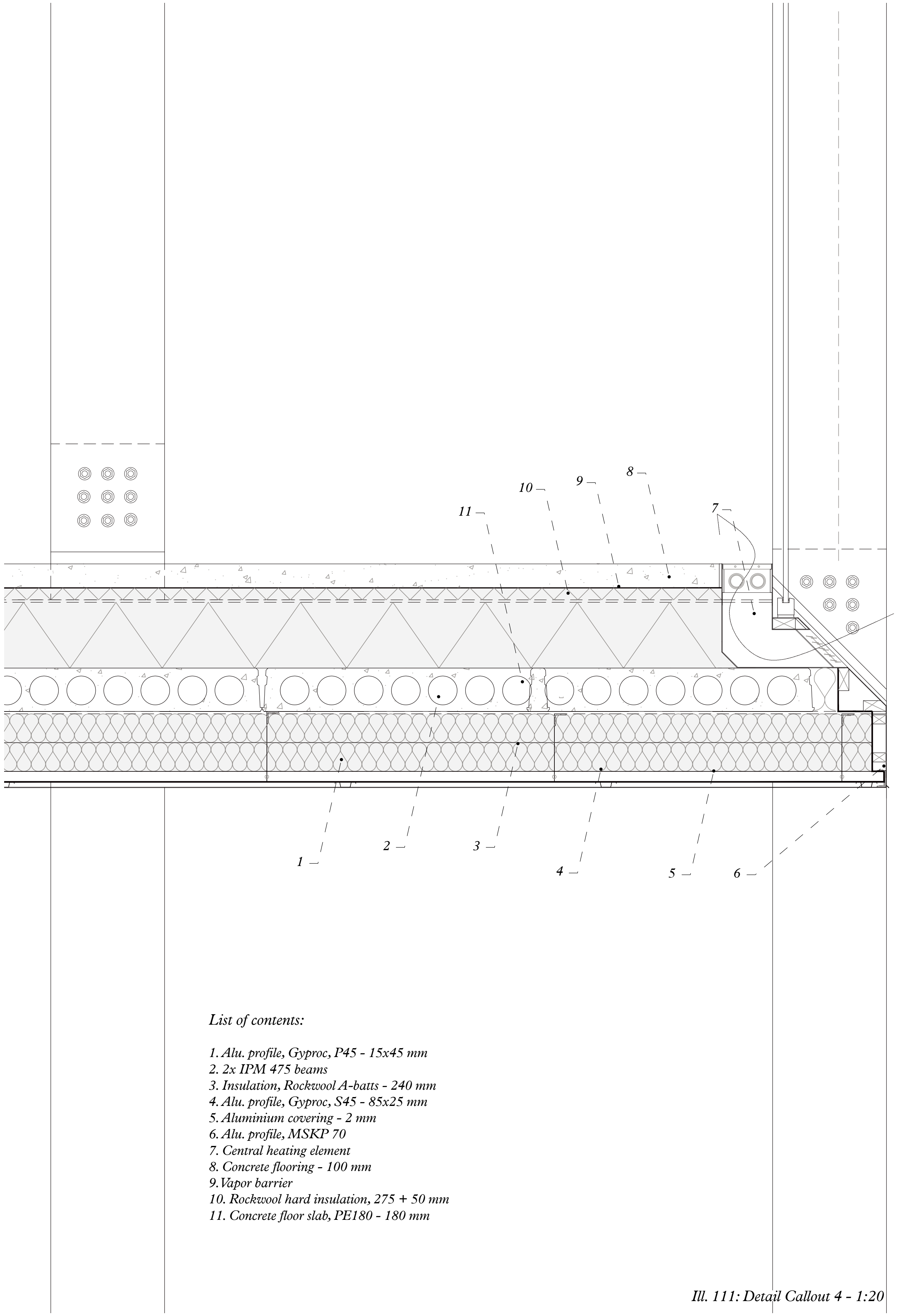
Ill. 109: Detail Callout 2 - 1:20



List of contents:

1. Foundation mound
2. Carriage bolt - M36
3. Column shoe
4. Bitumen paint
5. Foundation pillar - 1400x1400x1600mm

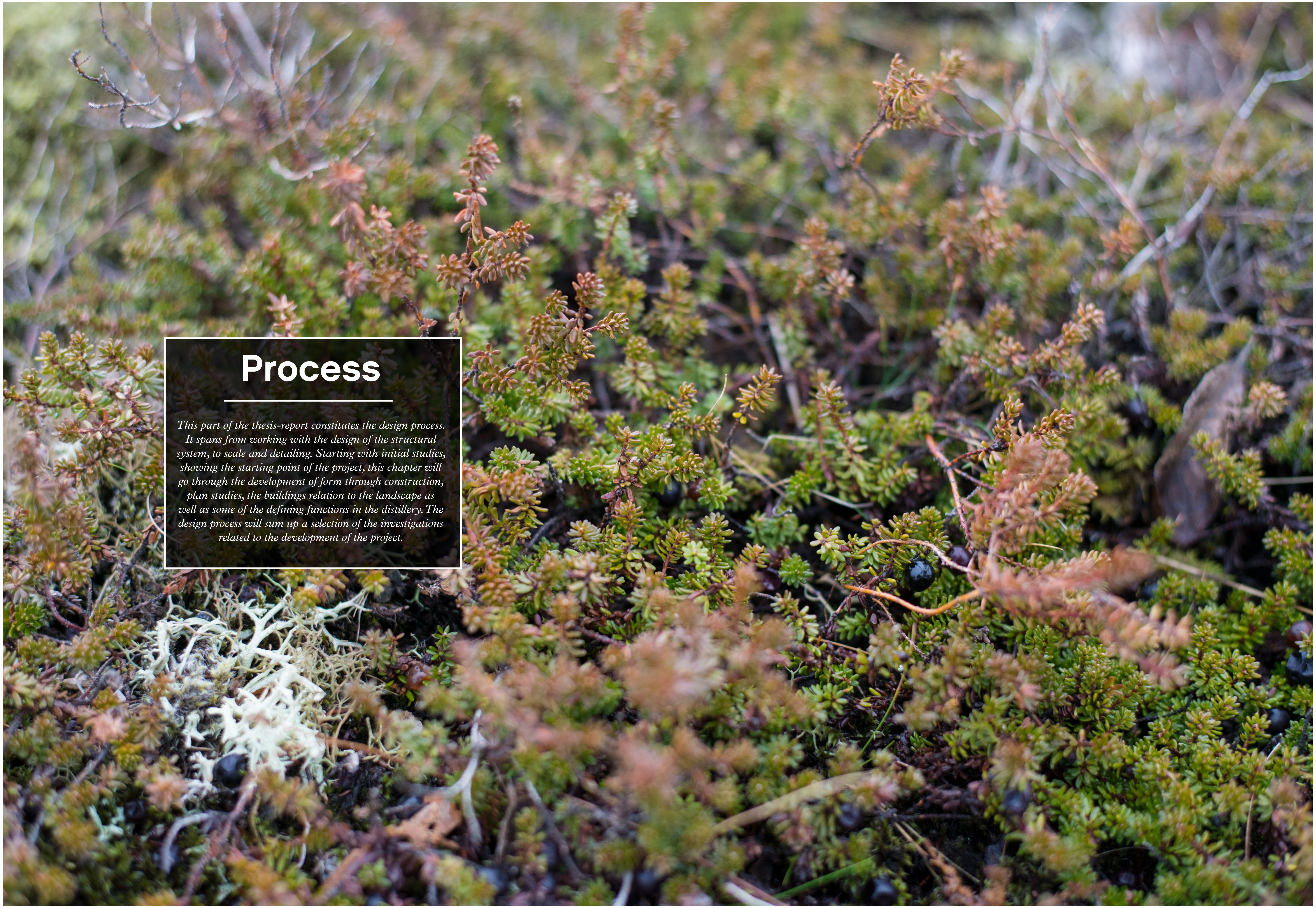
Ill. 110: Detail Callout 3 - 1:20



List of contents:

1. Alu. profile, Gyproc, P45 - 15x45 mm
2. 2x IPM 475 beams
3. Insulation, Rockwool A-batts - 240 mm
4. Alu. profile, Gyproc, S45 - 85x25 mm
5. Aluminium covering - 2 mm
6. Alu. profile, MSKP 70
7. Central heating element
8. Concrete flooring - 100 mm
9.Vapor barrier
10. Rockwool hard insulation, 275 + 50 mm
11. Concrete floor slab, PE180 - 180 mm

Ill. 111: Detail Callout 4 - 1:20



Process

This part of the thesis-report constitutes the design process. It spans from working with the design of the structural system, to scale and detailing. Starting with initial studies, showing the starting point of the project, this chapter will go through the development of form through construction, plan studies, the buildings relation to the landscape as well as some of the defining functions in the distillery. The design process will sum up a selection of the investigations related to the development of the project.

Initial studies

Our approach to design is based on creating geometric shapes in relation to nature. The reason for this is that we seek to amplify the shape of nature, by contrasting the built and the unbuilt. The two languages therefore creates an interesting tension between nature and form. In addition to this, a lot of thought is put into giving the site a direction. This both stages the nature, as well as underlining the natural views to the surroundings. For the first initial studies, different shapes were tested, looking at the communication between the site and the building.

The starting point of the design phase, was to base the building in the valley, sheltered from the harsh climate. The building should not be too far from the road, as well as not being too close to the valley side. The road enables accessibility for visitors and workers. The valley complicates the functional part of the building, since a distillery has the need for goods being delivered by trucks etc. When looking at the topography of the site, one can interpret a natural direction following the slope and the curvature of the hill. Initial site analysis showed that when following the hill, the eye is led to the view towards the sea. This became a design parameter early on in the process.

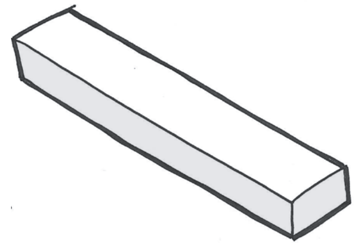
When having such a vast open landscape to accompany, simpler shapes like a square, worked best. Wanting to express the linearity of the distilling process, it was essential that this was reflected in the building shape. To communicate linearity through form, a beginning and an end through form can be beneficial.

Continuity can also express linearity. Continuity as a geometric expression, can translate as a line revolving perpendicular around its own axis, to take the shape of a courtyard. The courtyard has the ability to create a sheltered space in the enclosed loop. Another version of the courtyard is the U-shape. Having many of the same properties as the enclosed courtyard, the U-shape opens up in one side, appearing more welcoming.

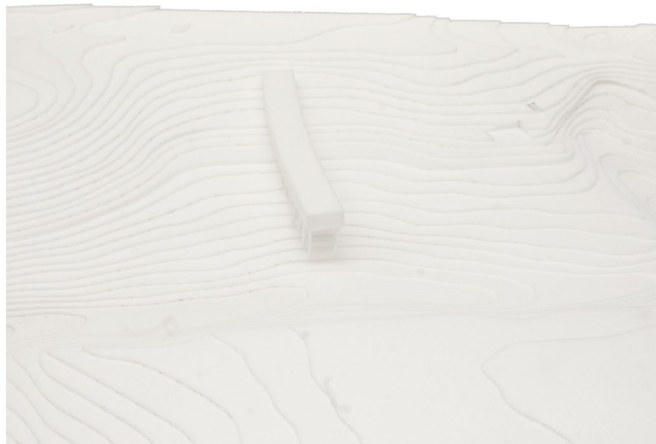
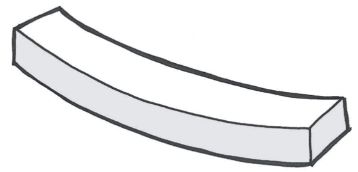
The line express, through its shape a clear start and an end, and therefore emphasis the linearity more clearly. A long straight building in a landscape creates direction parallel to the object. Placed correctly the linear building can also create shelter. Tests were made trying to adapt the horizontal movement of the topography with the building. Especially when working in the valley, the building could be adapted to the curvature of the small elevation between the hill and the creek, bending slightly towards the waterfall. These studies led to a long curved building.

Both the courtyard building and the straight line, communicates movement and could easily house a programme related to whisky production. On the other hand. Setting out to stage the landscape in matters of creating something in harmony or in contrast to the nature, the concept of both the closed and the open courtyard lacks the direction to stage the surroundings, and is neither creating a contrast nor harmonizing with the surroundings. The curved line adapts its shape to the landscape in a horizontal direction. Being curved, the linearity of the distilling process seems weakened, expressing curvature rather than linearity.

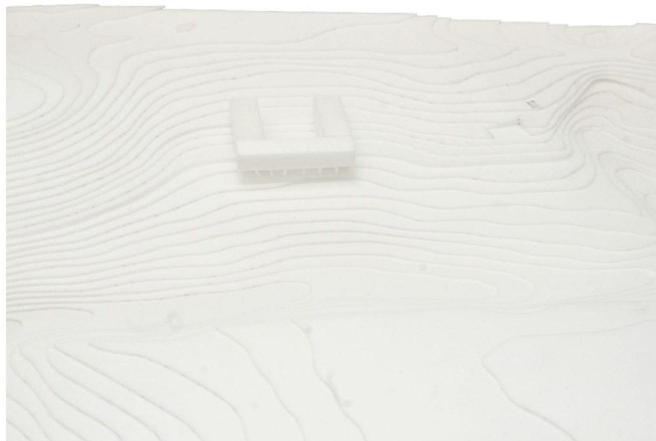
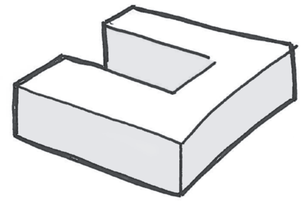
For further studies the straight line was chosen on the basis of the need to contradict rather than adapt the topography. The line is counterweight to the sloping hills of the site, making the site topography relatable.

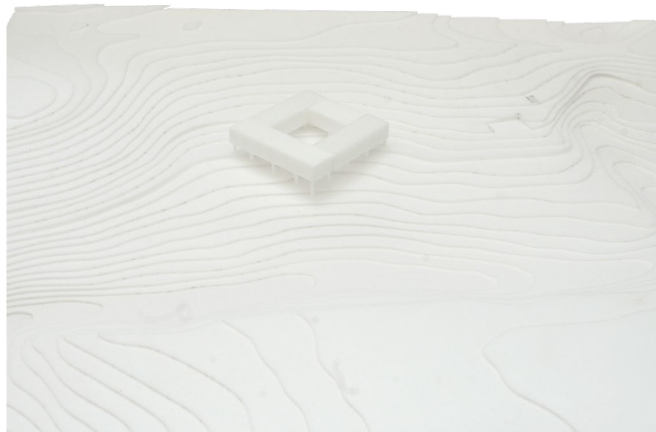
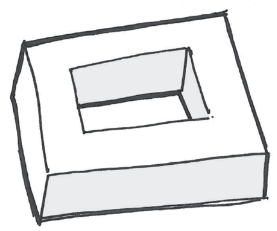
Ill. 112: Styrofoam model - the straight line

Ill. 113: Styrofoam model - the curved line

Ill. 114: Styrofoam model - the U-shape

Ill. 115: Styrofoam - the atrium

Further studies

To develop further on the concept of the line, studies in dimensions, and their relationship with the landscape, were carried out. As a target for this workshop, we sought to find a relation between length, width and height ammounting to 1900 sqm. The height is set to 7 meters, a tall two storey building. The workshop was carried out on a 1:500 topography model.

An excerpt of the workshop is shown:

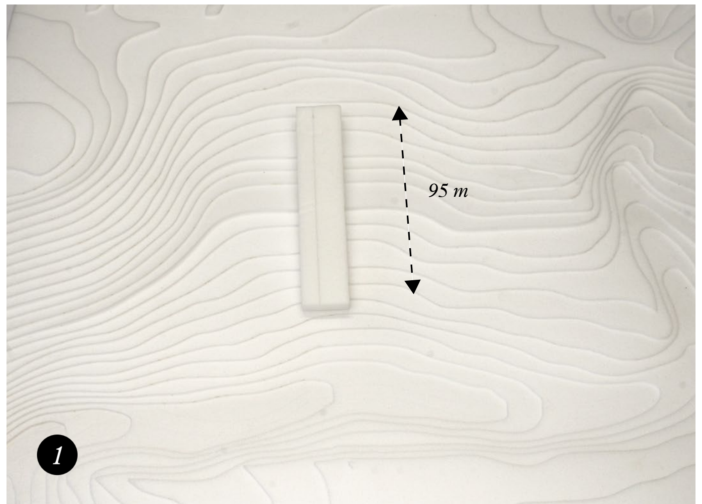
1. (95 m x 20 m) This proposition seems small and short, yet wide, compared to the surroundings. The volume seems overpowered by the landscape. The length of the building relates to its linearity; the shorter the building is - the more it becomes a square, the longer it is - the more it becomes a line. Furthermore, such a form might be suitable for the distilling-part of this programme, less so for the social functions. 20 meter width could potentially lead to daylight problems centrally in the building.

2. (107,5m x 18 m) Expanding the length was the next logical step. A longer building volume has more power over the vast landscape. Increasing the depth of the building to 18 meters is more appealing to the eye compared to the height. The volume could preferably be more slender from an aesthetic point of view.

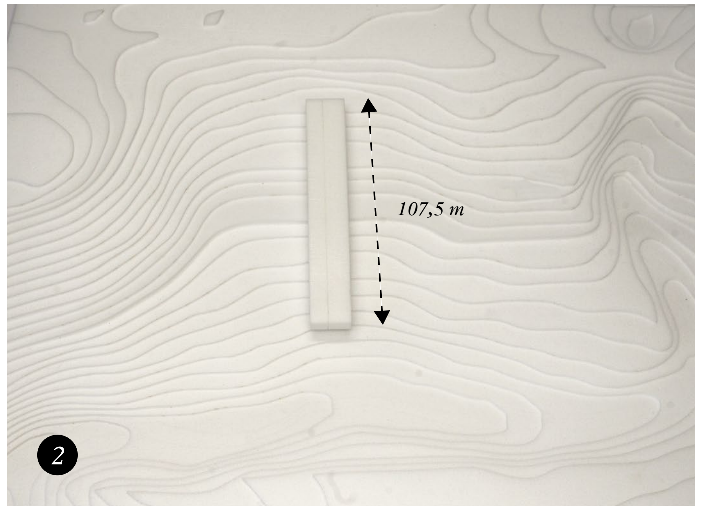
3. (150 m x 13 m) Proposition number three has the same properties as proposition nr 2. This however is even more slender and longer, taking up more space on the site. The concept of linearity becomes more clear since the length and slenderness of the building looks more like a line than a square.

4. 190 x 10 m. This volume is pushing the boundaries of the site taking up vast amount of space. Stretching from the road across the site and over the creek, parting the site in two. This overpowers the site as well as well as interfering with the creek. Wanting to leave as much of the surroundings as is, valuing the features of the natural landscape, making it seemed as "untouched". This is considered as too long of a building for this project. Being only 10 meters wide, it could also lead to issues with space for functions.

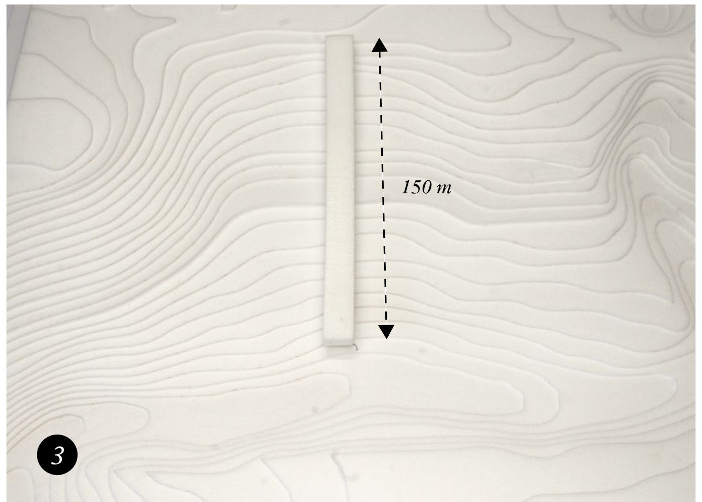
Looking at the propositions, number one and two are deemed preferable. Creating a building that is not overpowered nor overpowering the surroundings is crucial to this project. Doing this whilst at the same time communicating a linearity lies somewhere between the two propositions.



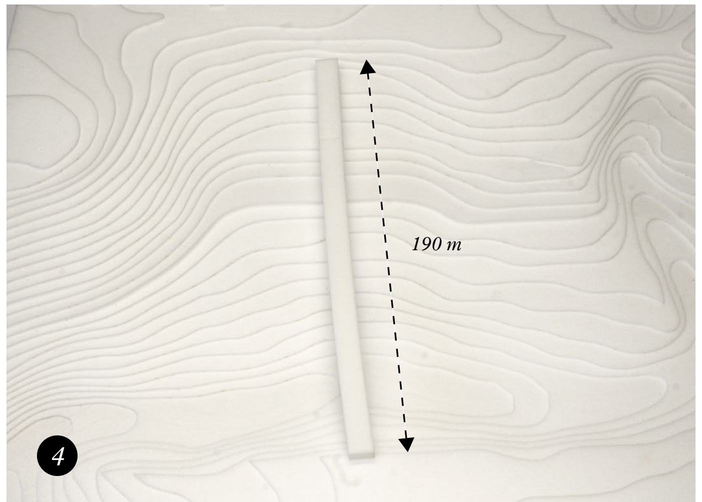
Ill. 116: Styrofoam model, 1:500 - replicating 95x20m (1900 sqm.)



Ill. 117: Styrofoam model, 1:500 - replicating 107,5x18m (1900 sqm.)



Ill. 118: Styrofoam model, 1:500 - replicating 150x13m (1900 sqm.)



Ill. 119: Styrofoam model, 1:500 - replicating 190x10m (1900 sqm.)

Building and landscape

When building on a slope, several challenges comes to mind. How does the building meet the ground? What is the relation between the volume and the site, and how does the building relate to this? As concluded from our theoretical readings, the building should be a natural part of the site, taking up the space it needs, yet treating the surroundings with care.

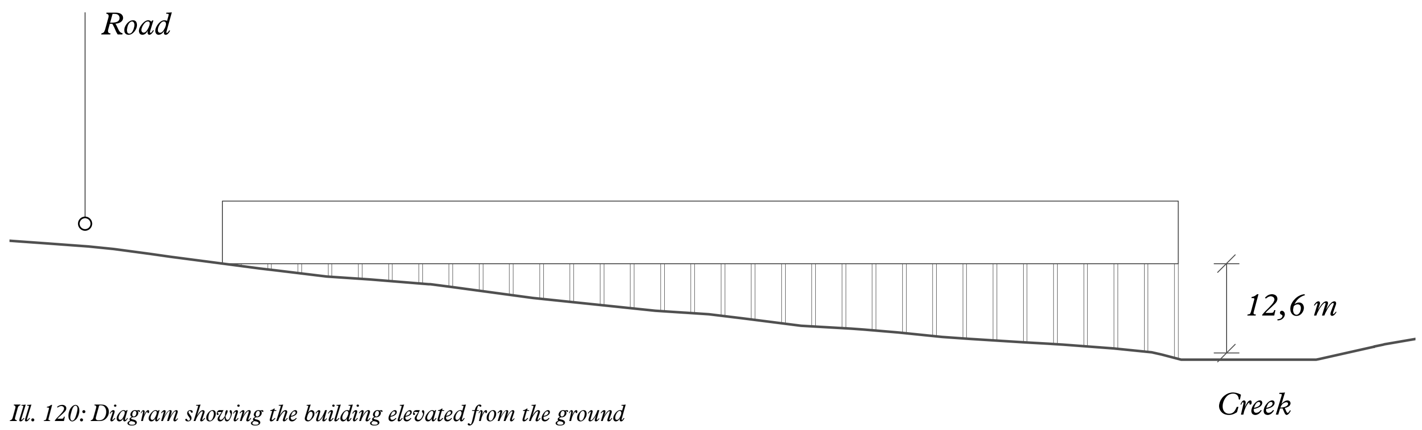
Wanting to reduce the footprint, parts of the building not directly touching the ground is supported by columns. This gives the feeling of it standing on its toes, caring for its surroundings.

The next challenge was related to height from the building to the ground and therefore also the length of the columns. Placing the part closest to the road, in line with the ground, makes for a tall facade towards the road. This obscures the view from the road towards the fjord and surrounding nature.

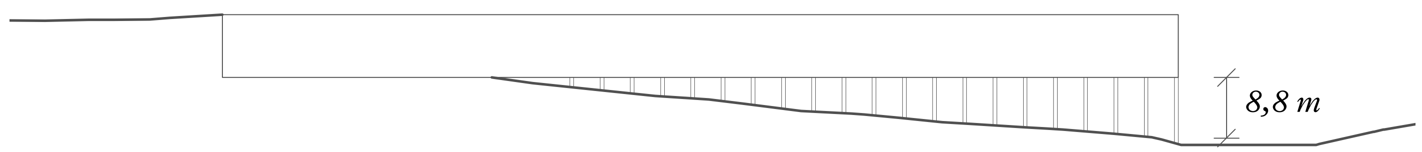
By lowering the back part of the building into the ground, reducing the height at the end of the building. The view is preserved, and the building gains a stronger connection to the site.

The experience from the inside becomes varied throughout the building with nature close outside the windows in the beginning and views to the far horizon becoming prevalent when the building rises from the ground.

Furthermore, it also creates a reference to Icelandic building traditions, and the history of turf houses being integrated into the ground for shelter.



Ill. 120: Diagram showing the building elevated from the ground



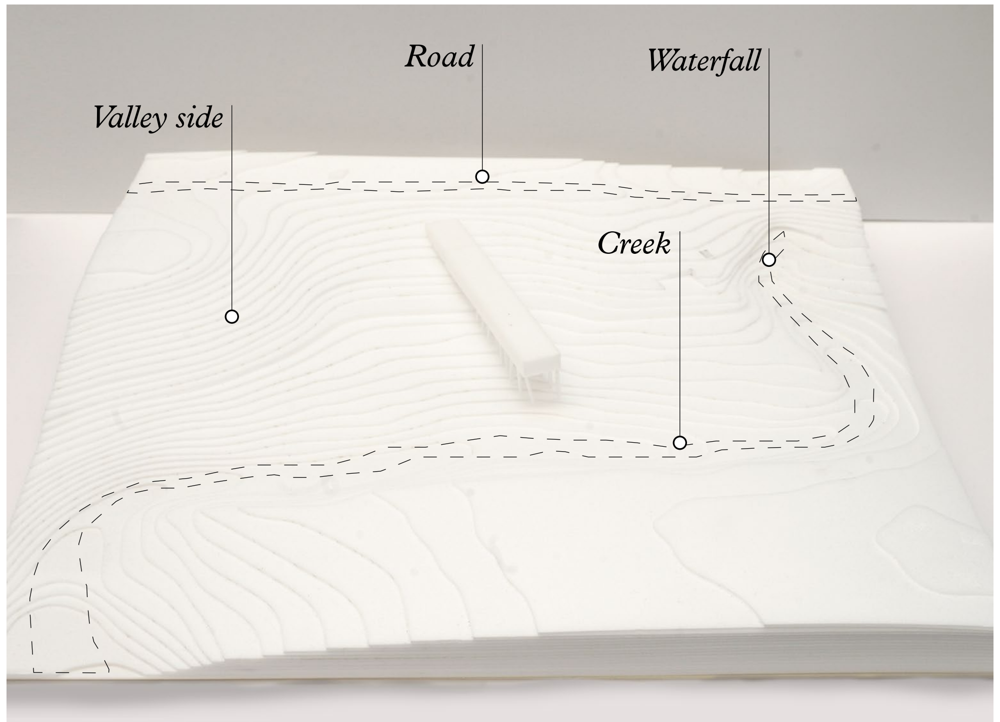
Ill. 121: Diagram showing the building lowered in to the ground

Location

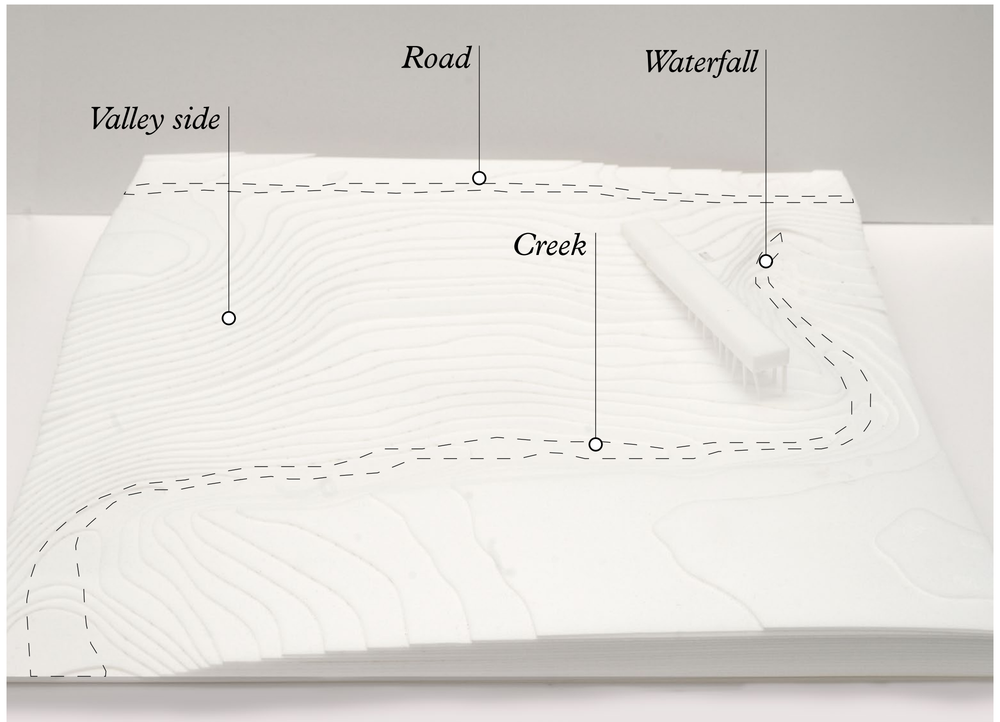
As mentioned earlier, building in the valley was the starting point of the design process. When looking around, several natural features having the potential of being beneficial to the building is left out in this location. With our approach revolving around creating views to nature through the building. The views are not only supposed to create a backdrop for the building, but to compose a full picture with a foreground as well as a background. This means that the natural features on the site needs to be in relatively close proximity in order to enhance the composition of the view.

With the building positioned in the valley the building is seated humbly in relationship to the landscape, and "sheltered" by the surroundings. But one of the sites major potentials, the creek, is hidden behind the hill towards the south.

Mapping shows that situating the building on the southern side of the site can be beneficial. Here one can find a waterfall as well as having the view to the creek. This places the building on a small hill, giving it a lift, enabling a clear line of sight over the ridge between the site and the sea.



Ill. 122: Styrofoam model, 1:500 - replicating the first position of the building



Ill. 123: Styrofoam model, 1:500 - replicating the second position of the building

Form through construction

For the form-studies, it has been important to create a building with a utilitarian expression, readable to the spectator. The project takes inspiration from scaffolding and old railway bridges making its way through the landscape whilst standing on stilts. Nordic building tradition working with wood, also heavily influenced the design process. The goal was to create a rational system that express the forces at play- but also referred to the landscape. Another parameter was to create a sense of lightness, yet expressing safety and security through its construction.

Several different iterations were tested. In the beginning dense scaffolding supported the building volume on top. This created an unwanted separation of building and construction. Trying to wrap this around the volume only made the separation more apparent.

The dense scaffolding seemed to draw focus from the other aspects of the building and was suddenly dominating the landscape instead of emphasizing it.

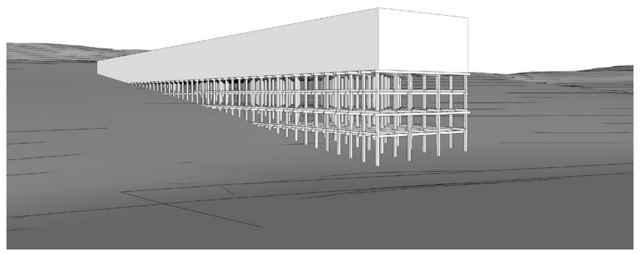
Many different iterations of suspended structures, and large supporting systems, of timber and wind crosses were testes.
Yet all did not reach the expression of lightness wish was sought.
Moving the supports apart from each other, making a system of frames, the structure appeared light. Fewer supports also refines the construction.

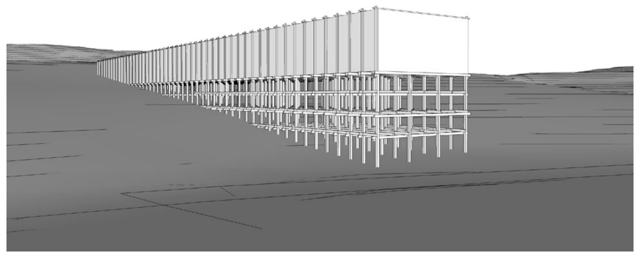
In the end, the process moved on to repeating frames arrayed along the length of the building.

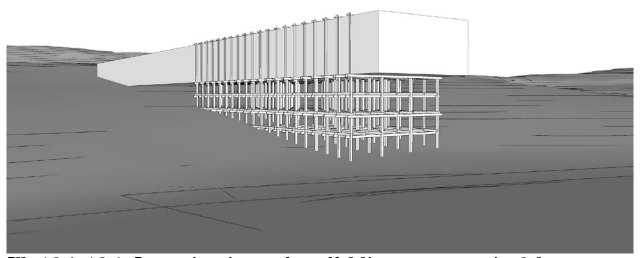
By using the structural system as the frame in which to create space, the construction became room defining. The structural system furthermore seemingly protects the climate screen, playing with perception of construction. This puts the supporting elements on top of the compositional hierarchy.

Working in parallel with the plan layout, a proposition with three columns as supporting elements was chosen. The columns works both as construction-elements whilst defining the gallery of the building, transporting both people and goods to the different functions.

Two of the columns are placed closer to each other than the third one. This breaks the symmetry of the straight line making for a more interesting composition.







Ill. 124-126: Investigations of scaffolding structure in 3d

Ill. 127: Investigation of construction and form through sketches

Structural System

Further studies led us to investigate the performance of the three supports. This was carried out with a parametric model in Grasshopper. Using the "Grasshopper2Robot" plug-in enabled us to export the parametric model to Autodesk Robot, where finite element calculations could be conducted.

Investigations related to the structural system were made in regards to number of supports and placement of these in relation to the building volume. Connecting the performance with an aesthetic character formed the basis on which the decisions were taken.

Wanting to test the performance of the structure, different iterations were made. Two supports, three supports and an iteration of the three support-system with the middle support tilted cross-sectionally, was tested in Robot. This combined with aesthetic considerations made for the basis on which the design was developed.

After having calculated the model in Autodesk Robot, it turned out that all the options are viable, though some show higher overall deformations.

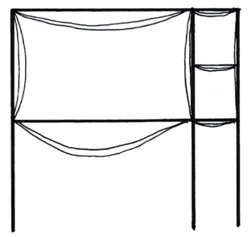
The option with the tilted support distributes lateral forces better, as it is tilted in the direction beneficial to the predominant wind loads. However, the resulting columns would also vary in angles as they got shorter, creating a curving pattern towards the lower end of the building. Resulting in a sudden organic shape introduced into the composition.

The two support option can distributes the forces much like the three supports, but has a lower footprint on the ground.

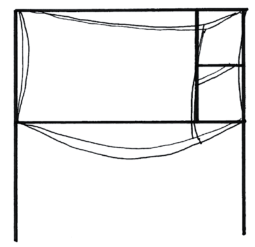
The three support option has a higher footprint than the two other options, but manages to express the interior spaces in the exterior construction. The gallery is followed to the ground and is clearly readable throughout the composition.

For strength in concept and morphology the straight beam with three supports, was chosen.

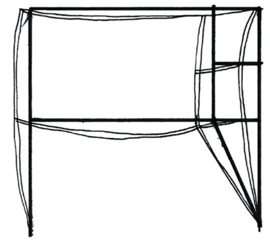
The following shows the iterations calculated in Autodesk Robot:



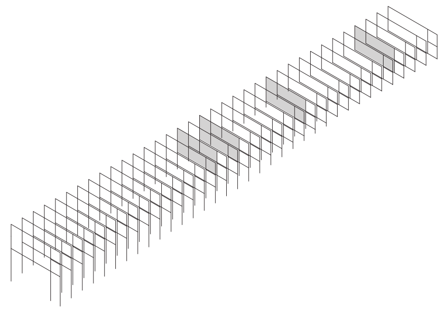
Ill. 128: Deformations, prop. 1



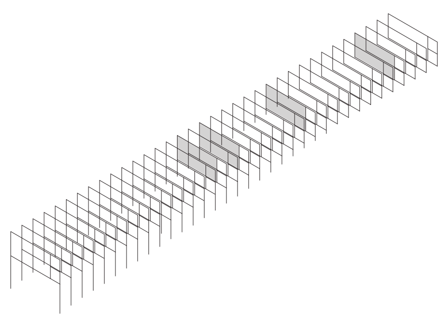
Ill. 129: Deformations, prop. 2



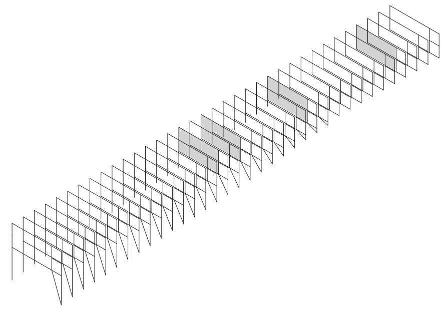
Ill. 130: Deformations, prop. 3



Ill. 131: Structural system, prop. 1



Ill. 132: Structural system, prop. 2



Ill. 133: Structural system, prop. 3

Three supports
Overall deformation is 28 mm.

The forces are transferred effectively to the ground, hence the low deformation. This because the middle column supports the forces from the gallery.

Two supports
Overall deformation is 78 mm.

Having some of the walls in the building acting as diaphragms, leads to loads being transferred diagonally through the system from node to node. Two supports leads to more loads on the element connecting the columns in the gallery.

Tilted third support
Overall deformation is 71 mm.

When tilting one of the columns one should in theory create more stability avoiding the need for fixed support nodes. Instead, because of the vertical forces from the distillery, the construction becomes exposed to lateral forces.

Plan studies

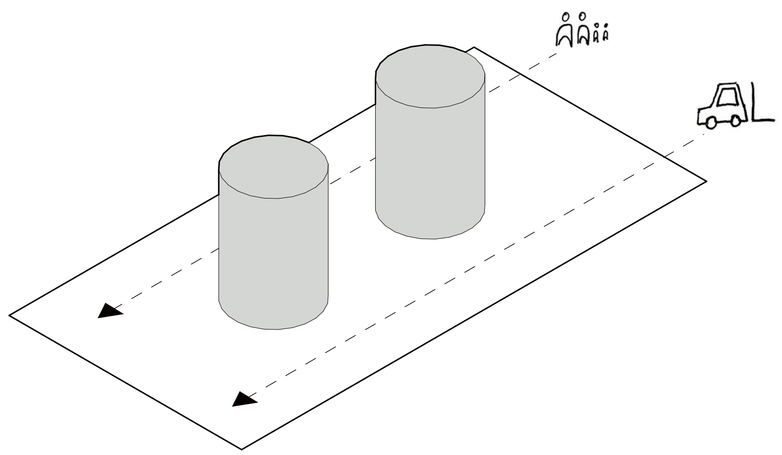
Combining two different programmes, like a distillery and a visitors-centre in one building, creates a challenge of interactions betwwen the to.

The distillery is on one hand a highly efficient programme, having the need for freely transporting different goods from the storage to the many stages in the distilling process. The distillery therefore requires its own of infrastructure enabling it to work efficiently.

Since the project is not only a distillery, it needs to be combined with the social functions of a visitors-centre.

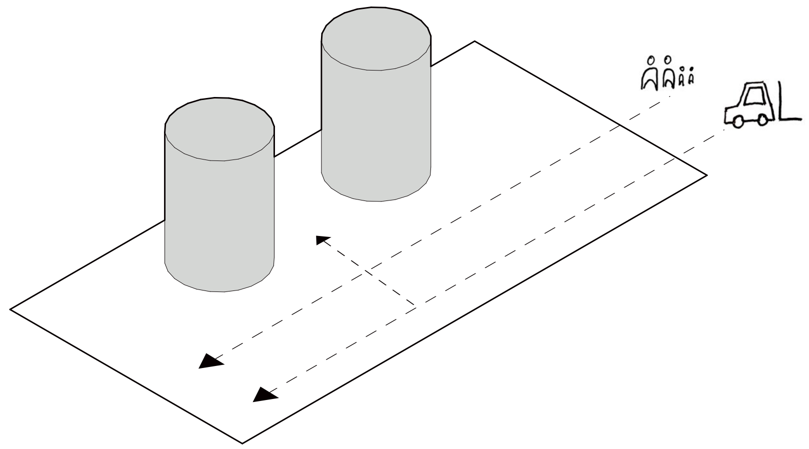
The visitors-centre, and the administrational programmes, has a its own set of rules, that needs to be attended to. It requires for instance places to stay, shops and eat. The plan studies is therefore investigations in how to, in an equally beneficial way, combine the infrastructure of a distillery with visitor- and administrations-related functions.

Working on how to separate the visitors from the transportation for the distillery became defining both for the plan layout, but also for the building itself. Different ways to keep the two functions separated was investigated.



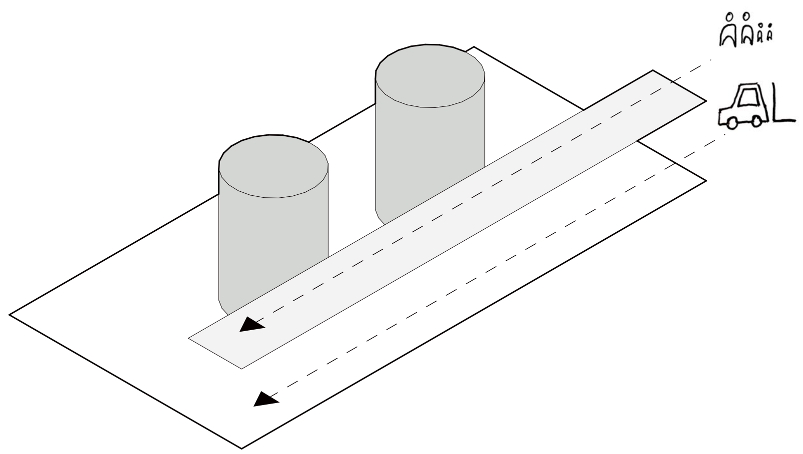
Ill. 134: Plan-diagramme, prop. 1

The functions are arranged in the middle of the building using them as a barrier between the transportation and the pedestrians.



Ill. 135: Plan-diagramme, prop. 2

The pedestrians and the transportation are arranged next to each other. The visitors would create a barrier for the staff, complicating the work in the distillery, and increasing the risk of accidents.



Ill. 136: Plan-diagramme, prop. 3

Having the two programs running above each other, in two levels, solves the design problem. The visitors-route actually take the same path as the grain, only on a different level. Now they can work independently yet still having access the many processes in the distillery.

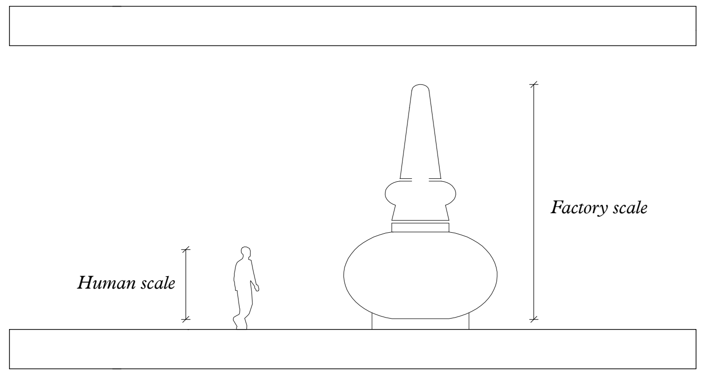
Scale

The interior and spacial studies revolved around adapting to scale. It is important that social functions are not compromised in collaboration with a distillery. Functions such as a bar, café and offices should be able to feel at home in the large scale, and furthermore, having something to relate to in the human-scale. This prevents the spaces from feeling strange and distant. Instead they become intimate, making it easy to create a suitable atmosphere. On the other hand, demanding large spaces is a part of large-scale distilleries. Wanting to give the visitor an authentic experience, combining the large scale and the small scale is of the essence.

Having a mono pitched roof, the distillery becomes the room defining parameter. It requires the most space, one needs therefore to work with ways to adjust sense height in interior spaces. The project presents different solutions relating to both the large and small scale. Investigations of spaces and scale was done using physical models and section drawings.

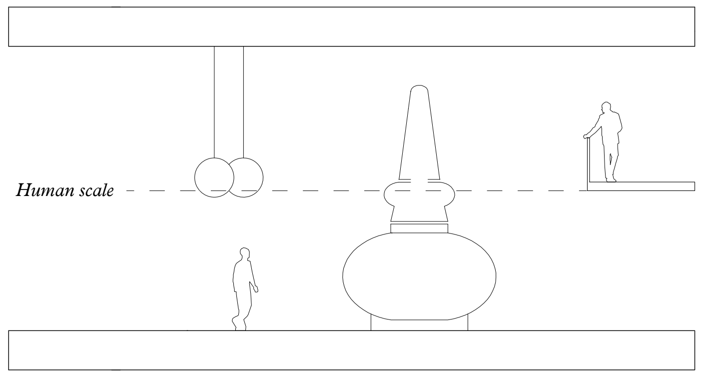
The first thing that comes to mind when dividing space horizontally, is to create a second floor. This is far along the way a good solution, but dealing with a long and slender building volume, the spaces might tend to feel small and narrow. It is therefore important to open up some of the spaces, creating double high rooms, reflecting the difference between the two typologies.

The following will present different ways in which to divide spaces.



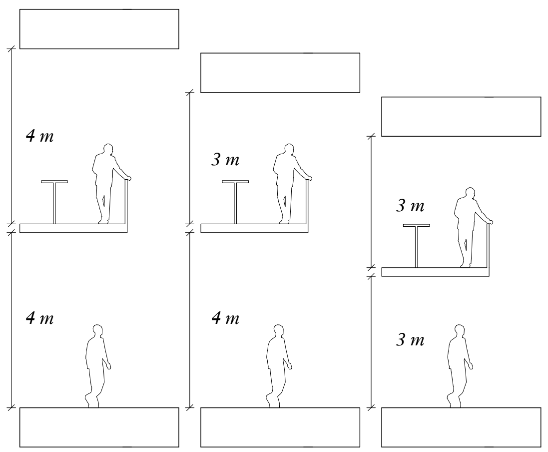
Ill. 137: Cross-section, showing the difference in scale

The height difference between a spirit still and a person is significant. Standing next to an object of this magnitude, makes a person feels small. This can be a good thing in the right context. In a destination distillery, one seeks to create a welcoming and casual, yet industrial atmosphere. The scale therefore needs to be attended to.



Ill. 138: Cross-section, dividing space

Another instrument is to integrate mezzanines in the plan. This creates a relation in human scale, and divides the space horizontally. Light-pendulums is also a good way of working with scale. Providing light to the room, lighting fixtures can also divide space.



Ill. 139: Cross-section, dividing space

The section-diagramme shows different ways in which room heights were tested. Here represented by a mezzanine. This combined with real world references lead to the conclusion that 3m/3m were the best solution to accommodate, both the human and the industrial scale. Creating bot intimate spaces in the single high areas and grand gestures in double height areas.

Visitors Centre

The visitors center is a defined area of the building containing different functions. A lobby ,a reception, a shop, an exhibition area, and a café. In order for the visitors center to work as it is planned, the functions needs to be connected. A central space acting as a buffer area is preferable. Through this, visitors can access the important functions of the building. This space was also required to create an overview, making it easy to navigate when entering the building. In addition to this, we sought to create a relationship with the surroundings, by creating a interesting view to nature from the entrance point.

Arriving at the 1.floor looking down at the lobby was a difficulty. The relatively narrow area created by the gallery amounted in a mezzanine where the entrance situation was crammed. This problem was solved in the final design by expanding a part of the area creating a plateau giving space to the entrance situation.

In this part of the process studies were carried out in physical models to get a sense of both scale and composition of the room.

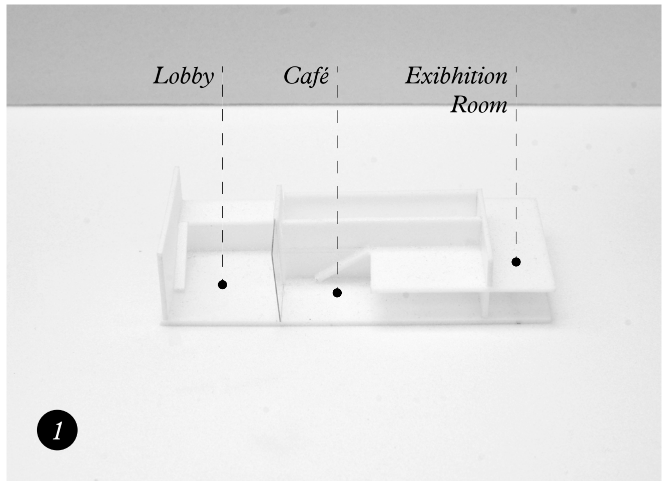
Shown her is an exert of the models created.

1. In this proposition, the entrance leads directly to the walkway. Having to walk along the - compared to the double high lobby - small space in order to get to the reception. Wishing to create a more welcoming entrance, other solutions were examined. The café has been divided horizontally with a mezzanine. This creates more floor area, having the opportunity for expanding the seating to this floor as well. The mezzanine having to accommodate for such a large space, generates what might become a darker area, being overpowered by the room height in the rest of the café as well as in the lobby.

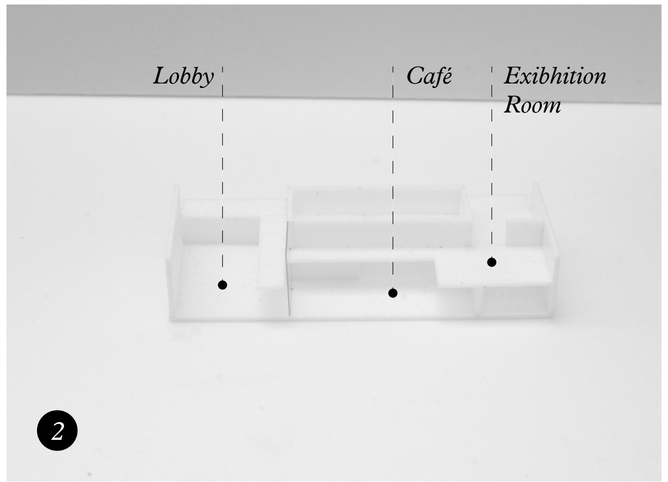
2. This is a version of nr. 1, working with connecting the exhibition area and the lobby by a walkway. The walkway divides the double high space and creates a connection to the exhibition room through the lobby and café.

3. To accommodate for the sudden shifting in level between the café and the lobby, the mezzanine was moved to the other side of the room. This creates a transition between the lobby and the café, going from a low ceiling height to a large ceiling height.

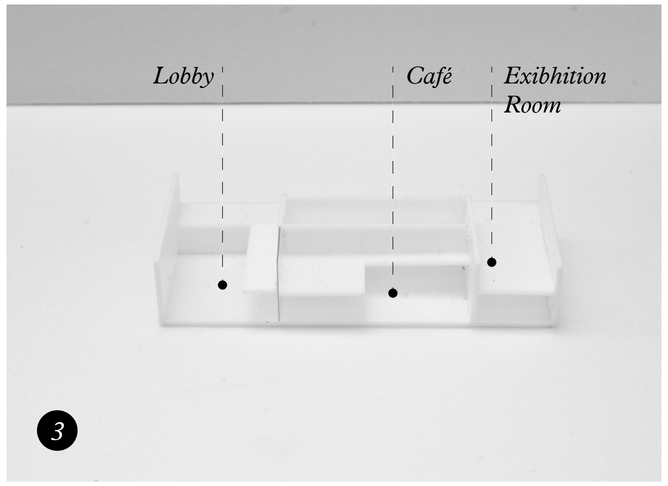
4. This suggestion is a version of nr 3, only with an extended shop-area. This creates a connection between the reception/shop and the café, something that the visitors center could benefit from.



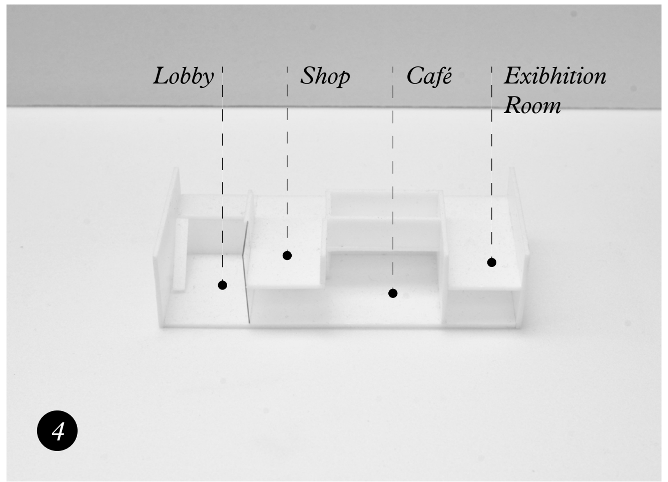
Ill. 140: Styrofoam model, 1:200 - Visitors centre, prop. nr. 1



Ill. 141: Styrofoam model, 1:200 - Visitors centre, prop. nr. 2



Ill. 142: Styrofoam model, 1:200 - Visitors centre, prop. nr. 3



Ill. 143: Styrofoam model, 1:200 - Visitors centre, prop. nr. 4

The Bar

When designing the bar and finding a suitable location in the building for it, different things needs to be taken into consideration.

Being a bar, it has a strong connection to the distillery. This needs to be a space for presenting the whisky produced at the distillery, and proper spaces to do so needs to be provided. The bar requires different types of bar-settings, for different visitors and different atmospheres. Being in connection to the distillery area can benefit the bar, giving the customer a visual reference to where the whisky came from.
The bar and its interior was investigated through plan-drawings and physical models

In the starting phase, the bar was an integrated part of the café, in direct connection to the visitors centre (location 1). This connected the bar to the lobby, with direct access to the entrance.

The second location of the bar at the tip of the building were not initially chosen as it was seen as problematic for the bar guest not taking part in the tour have tor cross through the distillery to get to the bar.

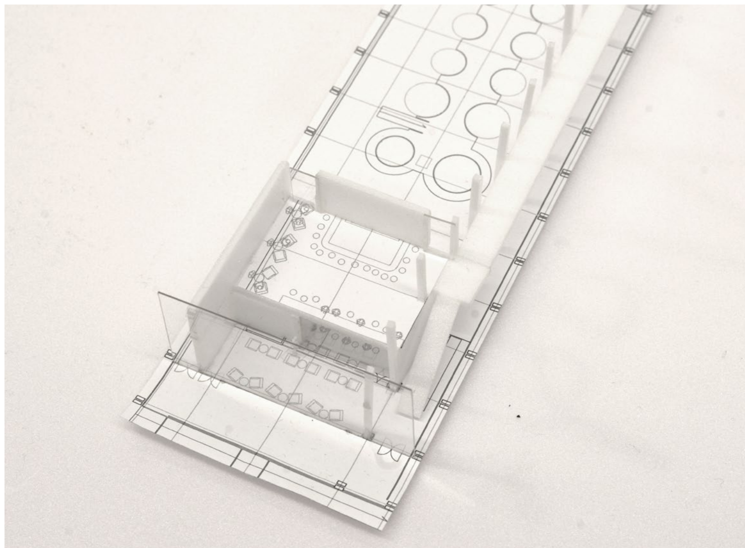
But as the walkway moving the guest on a the 1.floor through the building took form the bar seemed logical to place at the tip of the building. (Location 2)

Placing the bar here has several benefits:

It automatically becomes the climax for on the tour, being led through the bar before starting contemplating returning via the walkway.

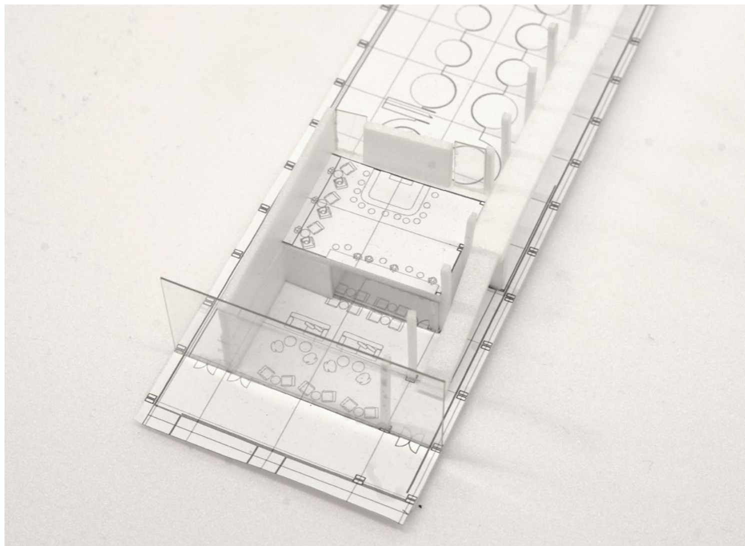
The route, which before was seen as long for getting to the bar, becomes a part of the experience, and a more integrated part of the distillery utilizing the gallery.

The bar has the best view of the surroundings, elevated above ground, without anything to block the view.



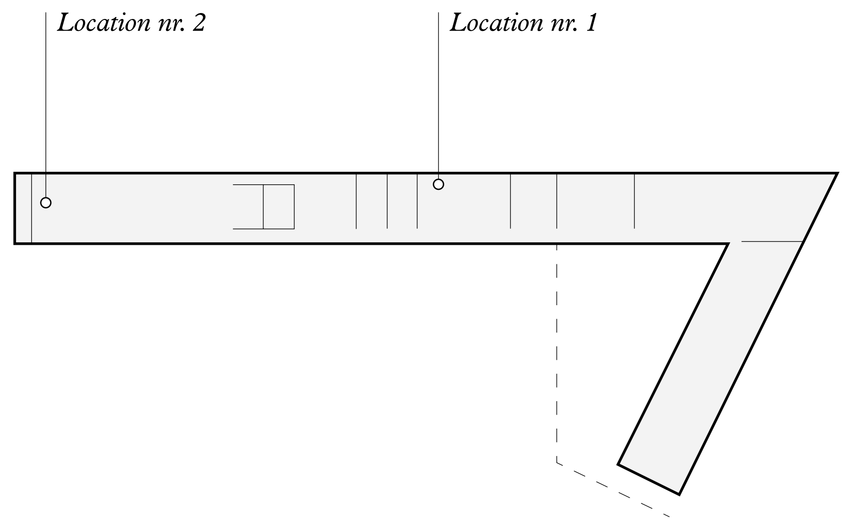
Ill. 144: Styrofoam model, 1:200 - Bar, prop. nr. 1

This model shows a study in the requirement of space as well as the connection between both typologies and the balcony. This proposition is leaving one section only to the casual part of the bar. This leads to a more intimate space. However, comparing the width of the room to the height of the mezzanine, it became clear that it needed more space in order to function as a casual bar-area, and not feel like a wide hallway, instead.



Ill. 145: Styrofoam model, 1:200 - Bar, prop. nr. 2

This proposition investigates the communication between the mezzanine and the larger bar-typology at the ground floor. Having more space to inhabit, enables larger furniture to be used, and group to be spaced out. The relation between the ground floor bar-area and the bar on the mezzanine is more equal.



Ill. 146: Location Diagram Bar

Cask storage

Storing the casks requires vast amount of space, since the casks accumulates over time. In order to call spirit whisky, it needs to be stored on casks in at least three years. This means that after three years, the storage is full from the whisky produced for the last three years. Some of this will be sold as a young malt, and some of it will continue to be stored. It is assumed that another 2000 sqm is required after three years of production. This development will continue, by 2000 sqm every three years. *(Þorkelsson, 2017)*

Handling an ever growing demand for storage, is challenging. Especially when building in nature, wanting to leave as much of the surroundings seemingly untouched. Throughout the design process many different solutions have been tested, trying to come up with a system that can be expanded over the years.

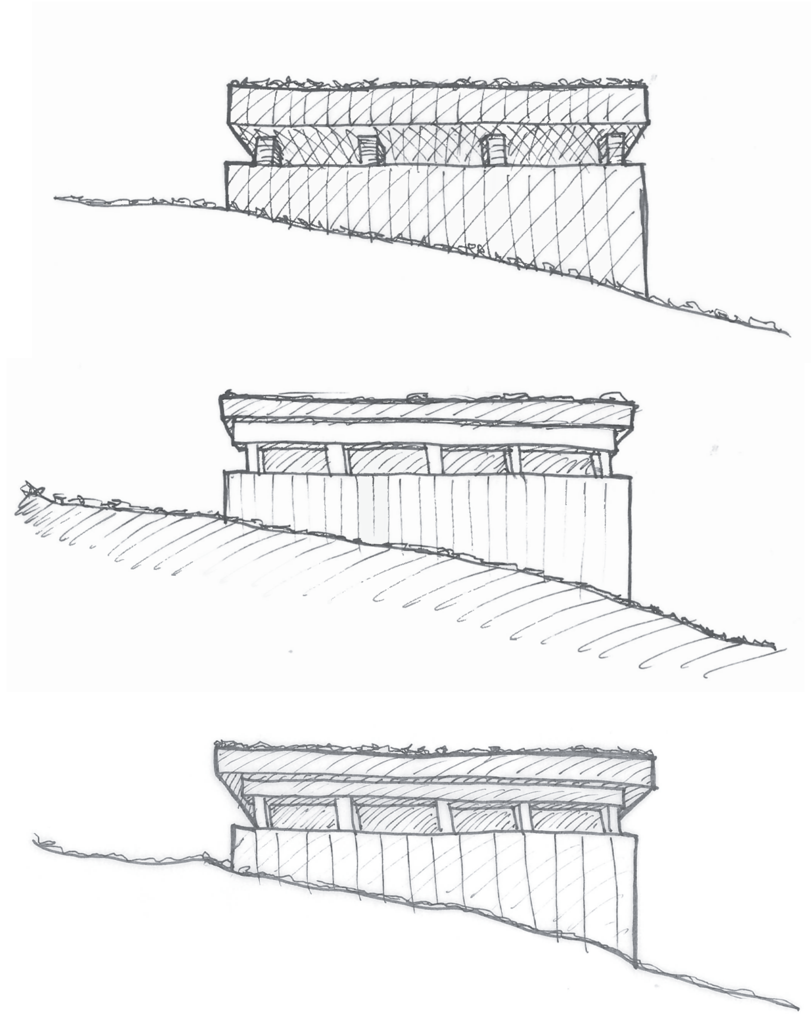
Testing this in plan and models showed that after just 6 - 12 years the site would be crowded with warehouses, which would destroy the very nature which we were trying to embrace.

It was therefore decided to dimension cask-storage for 3 years of storage. This would give the distillery a decent capacity on-site and the ability to show this part of the process to visitors. The rest of the storage would then have to placed off-site on a placement more suited for this amount of warehouses.

The first proposition was a modular system of wooden cask storages. The concept was an easy to assemble wooden construction based on the cask rigs, used for stacking the casks. This construction would furthermore support the roof, with only a few additional columns aligned with the service hall to avoid cantilevering the roof-construction. The design took inspiration from the distillery, mimicking the rhythm of the wooden columns.

It became clear that warehouses scattered around on the site, would quickly start dominate the site. To avoid this, the storages were lowered into the ground, much like the back part of the distillery and the traditional Icelandic turf houses. This gave more attention to the distillery. Nevertheless, having to dig the storages in to the ground, covering them with dirt, seemed counter productive. In time this would affect the natural vegetation of the site, as well as making the communication between the distillery and the topography unclear. Another parameter affecting the project is that from the interior, the cask storages takes up much of the view to the outside. Instead of looking out to the nature, the visitors will be looking at the cask storages.

By designing the storage as an extension of the building, it gives the distillery a spine from which to grow from. By being designed as an extension of the distillery , the cask storages frames the place of arrival, defining the area around the parking lot. This gives a natural entrance point, sheltered from the wind, and visiting the cask storage becomes a natural part of arriving or leaving the distillery.

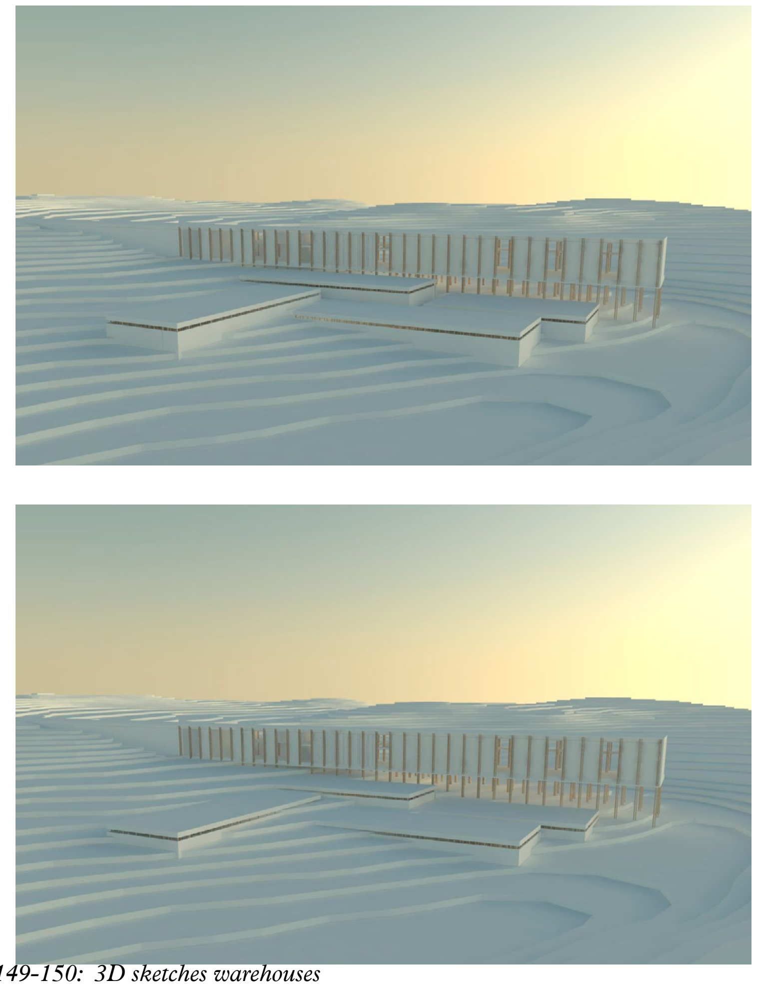


Ill. 147-149: Warehouse sketches

By exposing the wooden construction, the cask storage creates a connection between the cask storage and the distillery. The facade is limited to its squared shape.

By dividing the roof into segments, the construction is emphasized even further. It also gives a lighter expression to the building despite its heavy appearance.

Extruding the roof to make a slight overhang gives the feeling of the roof sheltering the storage.



Ill. 149-150: 3D sketches warehouses

The visualization shows the cask storages being lowered into the ground.

This proposition lowers the storages even more into the ground, to the point of almost being covered.

Detailing

For the detailing of the project, quite a lot of time has been spent on working with the look of the structure. Having mentioned earlier, wooden beams and columns are not just a supporting element, being a part of a larger structural system; the construction is just as much a room defining element.

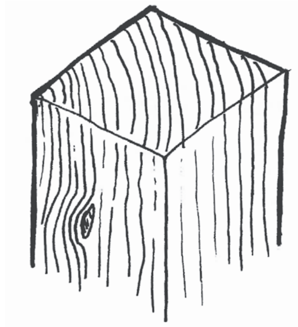
Wanting to give the construction a light character, yet having load bearing abilities, different ways to work with dividing a beam has been investigated. The structure needed to be light in order to work both as an element of interior as well as be strong enough to take up the forces from the building.

For the joinery, many suggestions were looked at. In the start of the design process, having a wood-only construction, led to investigations of how to connect wood both by using wood only, and by metal bolts.

As the investigations continued, and the calculations were simulated, it turned out that the structure needed to be more rigid, having the need to support larger forces. This led to replacing the wooden joint by a steel joint, This having to do with the joints being fixed, and needing to take up moment forces. Furthermore, the wooden elements were on the longer spans replaced with steel beams.

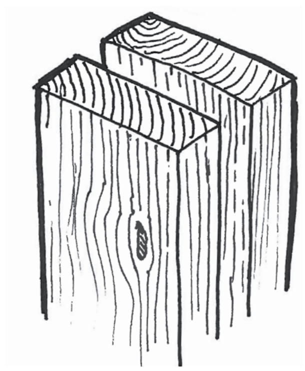
Not wanting to hide the way in which the elements were connected, but rather underlining the shift between the two materials, emphasizing the connection, the joinery needed to be visible. This became an important part of the tectonic expression of the project. The joinery celebrates the connections of the structure, by making space between the timber elements and the metal joint. The dark metal joint underlines this detail and the connection between the beam and the column, yet joining two pieces to one element.

The investigations was made through sketching and 3D-modelling.



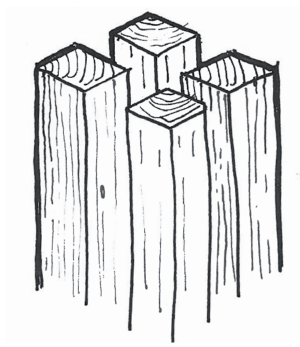
Ill. 151: Wooden column

The process started with a 500x500 mm column. Columns of this caliber can be quite massive, especially in an interior context, making the spaces seem smaller to comparison with the beam.



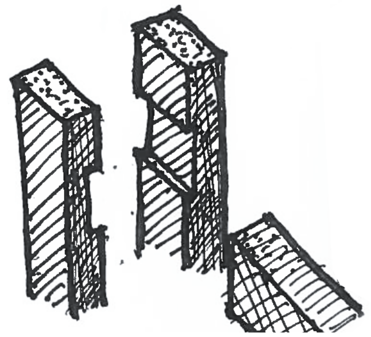
Ill. 152: Wooden column, two segments

One way of making the column lighter, is to part it down the middle, dividing one beam into two segments. The two segments are still inscribed in the 500x500 mm square, giving the same expression of sturdiness as proposition number one.



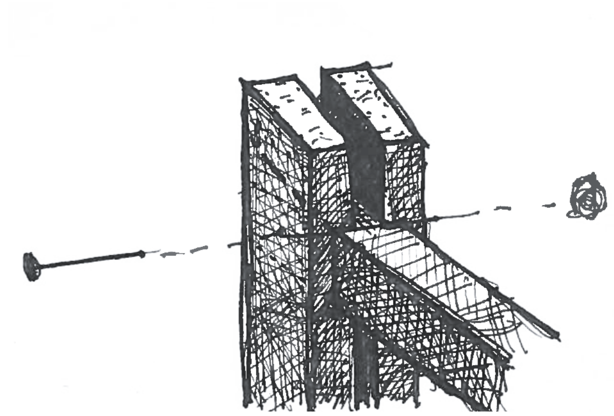
Ill. 153: Wooden column, four segments

Splitting the column once more on the other axis, creates an even lighter expression. It also becomes more fragile, removing much material, and would need an overall larger cross-section.



Ill. 154: Joinery, wooden joint

A wooden connection between two columns and one beam, adapting the columns to the beam by routing it.



Ill. 155: Joinery, bolted

Another way to connect the timber elements is by using steel bolts.

Ill. 156: Joinery, connection between steel and wood

A connection between steel and wood is shown in this proposition. A slit is routed into the column in which a steel bracket is placed.

Icelandic Concrete

To create a material specific to Iceland and the natural environment, it was early on decided to experiment with Icelandic concrete.

The natural environment of Iceland are in many places dominated by the black volcanic underground. It was therefore chosen to try and incorporate this materiality into the project.

During field studies on Iceland, samples of volcanic sand, and rocks were gathered and brought back to experiment.

The goal of the experiment was to create a black concrete which inherited the charterer of the volcanic island yet had a refined character, both suitable for the roughness of the distillery and the more refined areas.

As the travel form limited the amount of material that could be brought back it was decided to mix two batches of concrete one containing regular cement, and the sand and pebbles brought back as aggregates. And one batch where iron oxide was mixed in as well, to act as a dye for the cement and color this black.

The batches were cast in 15cm x 15cm forms to a thickness around 3-4cm. 6 samples were cast in total, 3 of each batch.

After casting, one sample of each batch were left as is. One was acid washed to expose the aggregates. And one was polished to a terrazzo like finish to expose the aggregates and give slight glossy surface.

Sample 1

The samples left as is, had as expected taken on the qualities of the cement. Without exposing the aggregates the samples have the look of regular concrete. One black and one grey.

Sample 2

The second samples which were acid washed started to reveal the properties of the volcanic sand. The particles of black sand peek out of the surface and give the concrete a rough texture, resembling sand paper. The undyed sample becomes much darker during this process as the black sand exposed gives an overall darker surface.

Sample 3

The third sample which were polished revealed both the rocks and sand and creates a pattern with different sized aggregates present in the surface. The texture contrary to the acid washed samples are smooth to the touch and has a slight glossiness to them. The grey concrete now seems much darker and has a clear pattern created by the volcanic pebbles. The black concrete reveals white grains of sand in the surface which combined with the black volcanic pebbles creates a subtle pattern in the dark concrete.

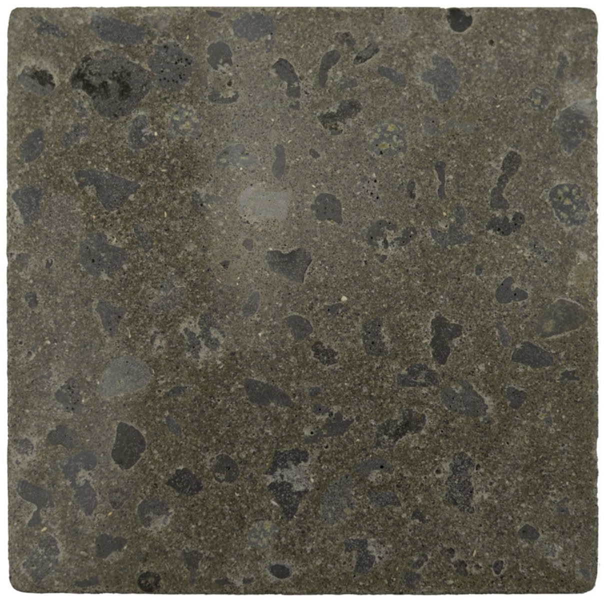
It was chosen to use the dyed concrete with a polished treatment for the final design. The rough texture of the acid treated concrete was seen as unfit for the refined areas of the distillery. The polished concrete was deemed more fitting for both the distillery functions and the more refined areas of the building.

Ill. 157: Undyed concrete - As is out of casting

Ill. 158: Iron oxide dyed concrete - As is out of casting

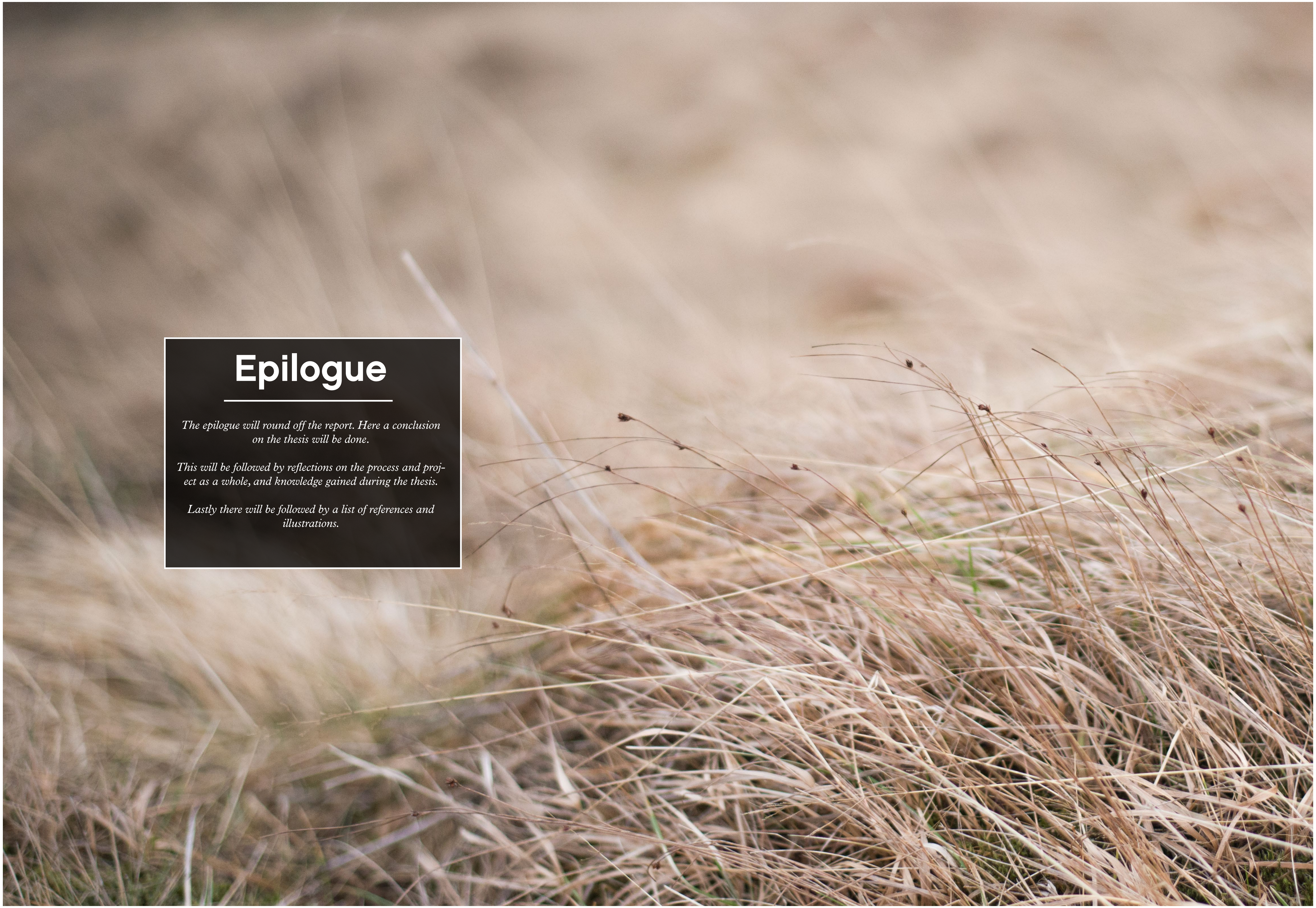
Ill. 159: Undyed concrete - Acid Washed

Ill. 160: Iron oxide dyed concrete - Acid washed



Ill. 161: Undyed concrete - Polished

Ill. 162: Iron oxide dyed concrete - Polished



Epilogue

The epilogue will round off the report. Here a conclusion on the thesis will be done.

This will be followed by reflections on the process and project as a whole, and knowledge gained during the thesis.

Lastly there will be followed by a list of references and illustrations.

Conclusion

Approach
Throughout this semester we have been engaged in working in close relation to nature. Introducing a building into the untouched nature whilst connecting to the surroundings has been the challenge and formed the basis for the design of the project. Establishing a distillery on Iceland makes sense on several levels. On a local perspective, it creates a bridge between industry and tourism, two important factors for Icelandic economy. From a natural point of view, Iceland has all the recourses needed for distilling whisky; clean spring water, sustainable energy as well as local ingredients.
Theoretical readings on tectonics as well as an offset in the Nordic tradition and contemporary architecture, formed the foundation on which the project has been based.

Placement
The distillery is situated along the coastline of Hvalfjörður revealed gradually behind hills when approaching from the south. The project is placed in relation to both Reykjavik and the tourist route, giving it a central yet secluded location.
The building itself is lightly laid down in the windswept landscape, staging the slope going from the road down to the fjord. It's volume adapts to the landscape connecting the surrounding natural elements, by avoiding the creek and settling down on the small hill.

Structure and materiality
The distillery's construction reflects both the interior space, created between its definitions, as well as communicates the topography of the site. This is seen as a tectonic solution to the sites natural challenges. By creating a site-specific solution for the structure, we gain a building formed by its context. The materiality of the project creates references to Nordic building tradition. The wooden construction is given a central position in the project, appearing both as interior and exterior.
The aluminum cladding is embracing the Icelandic industrial heritage. Together with the concrete, specially developed for this project, they reference the local conditions of the surroundings through both color, tactility and spirit.

Organization
The distillery is organized with care for both the human factor as well as production. The gallery connects the different functions of the building, allowing a free flow for both production and visitors. It opens up the building towards the point of arrival creating transparency and readability. The visitors experience the distillery on the same level as the grain used for making whisky – walking through the processes. On the way from grain to spirits, different senses are put into play, amplifying the experience. Along the way, views to the nature are presented. These views part the linear process into chapters. They work as intermezzos of nature, staging the surroundings, and amplifying the tour experience. This along with carefully orchestrated openings brings the nature into play as an active part of the interior of the building.

Perspective
A distillery on Iceland is a project related to the time. Not only in the sense of making a product that takes years to finish, but in the sense of connecting to Icelandic tradition and culture in a larger perspective. Iceland is a country of industrial roots, it has in recent time expanded its source of income to tourism. By linking tourism and industry we believe that, the visitors are given the opportunity to experience the full spectrum of the Icelandic cultural heritage.
This project can also be seen as an experiment of how to connect industrial buildings with nature. Designing large projects in a natural context can lead to an imbalance between the built and unbuilt. Trying to avoid this, we have sought through this master thesis to create a project that exists in collaboration with nature, bringing forth the inherent beauty in which it resides.

Reflections

Prephase
In the beginning of the Project a lot of time was spent getting a grasp of Iceland, and finding a site. Time was spent preparing for the trip there and finding potential sites, through maps and analysis. During the field studies, it was quickly realized that a lot of the initial ideas about placement Iceland were not feasible, due to infrastructure and local conditions, such as the real travel time along Icelandic roads, which are of varying qualities.
Therefore, time spent investigating local climatic conditions, infrastructural placement and other information gathering for the potential sites were wasted. This could have been avoided if the field studies were carried out earlier in the phase.
This goes to show that research and investigations on the theoretical level are good, but cannot stand alone without real world studies and actually exploring the context in which one is working in person.

Distillery research
During the analysis phase the research of the program needed for the distillery proved complex. The scale of the project kept changing, as new functions were discovered, or others were realized required more space. This meant the size of the different functions, were first locked down during the design process. This was most likely the result of little documentation and information on the different requirements needed of the distillery were available. This could maybe have been avoided by doing more in-depth research and visits to distilleries. Using our contact at Eimwerk Distillery, incorporating a potential user in the process more, could also have helped to get a stable foundation to base this information on during the early stages.

Method and process
Early on it was decided to build a detailed model of the topographical conditions present on the site. This proved to be an effective way to get an understanding of the context, and served a large role in the development of the exterior properties of the project.
Unfortunately, the model studies were not as present during the interior development. Spatial studies were mostly done through plan, hand sketches and 3D modeling. More studies in physical models in different scales could have benefited this part of the process. When spatial studies were needed, digital models ended up taking the place of physical ones, as this was less time consuming. Supporting these with physical models could have brought an extra layer to the process. Helping in moving forward the qualities of some of the interior spaces.

Construction
Working with the construction was again mostly driven by sketches and 3D models. Here the parametric model could have played a more active role. The model was mostly used to verify the constructions drawn up in either sketches or 3D. But the nature the very simplistic construction, did not favor many iterations through a parametric approach. Here the focus was instead laid on detailing and joinery, where 3D modeling the joints, and the rest of the construction, gave a detailed approach to this. This added an understanding of how the construction would function not only in section and plan, but also in relationship to the spaces surrounding it.

Building in the Natural Environment
The focus of the thesis was to examine how tectonic solutions could enhance the sense of place and act as a design driver. Here we laid great focus on on-site phenomenological experiences. This was done during our field trip to Iceland in the beginning of the project. Even though we felt well prepared before going there, the site analysis task was overwhelming when we got there. Here a revisit to the site during the later stages of the process would have been preferable. This could help to map natural features found important for the project, and review the conclusions done during the first phases.
In the final project, we believe that the building has become part of the natural environment, but the natural environment has maybe not as directly become a part of the building. The surrounding nature becomes part of the interior indirectly through references in materiality and large framed views. But the real nature is kept at arm length through the building. More spaces bridging the gap between interior and exterior could have been made. This was chosen not to do because of the climatic conditions of Iceland not favoring this, but given more focus maybe this could have been solved.

Sustainability
As the project theme was tectonics sustainability has been given a conceptual role during the process. Iceland is an exciting country energy and sustainability wise and given more time it would have been very interesting to dive into that part of the project. The distilling process gives off a lot of residual heat and we see a potential here to incorporate this into the energy strategy for the building.

Output
Through the project we have learned a great deal about the complexities of building in nature. When no built environment is present it becomes important to notice both the small, and the large things, to get a sense of how they play together to create the atmosphere of the place.

Here we have arrived at the denouement that every site needs its own approach in order for the project to prevail. It becomes important to let the site help shape the built. Adapting the structure and building to the realties of the site. The building and the environment is allowed resonate and amplify each other.

Even though we believe that the nature may not have become part of the building as much as we would have liked, we do believe that the two have arrived at a sense of unison.
In the end, there is of course a lot of things that could have been examined further given time and attention.

The project has certainly given us a better understanding of the intricate composition of nature. Working in a very different context than previously experienced, has developed our methods for approaching building in both an unbuilt and foreign setting.

References

Methodology
Knudstrup, M. (2005). The Integrated Design Process (IDP): a more holistic approach to sustainable architecture. Action for sustainability - The 2005 World Sustainable Building Conference.

Nordic & Nature
Kjeldsen, K., Rank Schelde, J., Asgaard Andersen, M. and Juul Holm, M. (2012). New Nordic - Arkitektur og Identitet. 1st ed. Humlebæk: Louisiana Museum of Modern Art.

Norberg-Schulz, C. (1996). Nightlands. 1st ed. Cambridge, Mass.: The MIT Press.
Lindhardt Weiss, K. and Vindum, K. (2012). The new wave in Danish architecture. 1st ed. København: Arkitektens Forlag.

Hvattum, M. (2012). At skabe steder. In: K. Kjeldsen, J. Rank Schelde, M. Asgaard Andersen and M. Juul Holm, ed., New Nordic - Arkitektur og Identitet, 1st ed. Humlebæk: Louisiana Museum of Modern Art, pp.100-115.

Tectonic
Beim, A. (2004). Tektoniske visioner i arkitektur. 1st ed. [Copenhagen]: Kunstakademiets Arkitektskoles Forlag.

Beim, A. (2014). Towards an ecology of tectonics. The need for rethinking construction in architecture. 1st ed. Stuttgart/London: Axel Menges

Frampton, K. and Cava, J. (2001). Studies in tectonic culture. 1st ed. Chicago: Graham Foundation for Advanced Studies in Fine Arts.

Bachelard, G., Jolas, M. and Gilson, E. (1964). The poetics of space. 1st ed. Boston: Beacon Press.

Skodvin, B. (2014). The Complexity of Realness. In: A. Beim and U. Stylsvig Madsen, ed., Towards an Ecology of Tectonics, 1st ed. Stuttgart/London: Axel Menges, pp.65-77..

Iceland
Statistics Iceland. (2017). Statistics Iceland. [online] Available at: http://px.hagstofa.is/pxen/pxweb/en/?rxid=7253abec-ce94-4d61-b76a-96eea6d456ac [Accessed 6 Feb. 2017].

Guðni Th. Jóhannesson, (2013). The history of Iceland. 1st ed. Santa Barbara, California: Greenwood, pp.4-5.

Visit Iceland. (2017). Settlement and early history. [online] Available at: http://www.visiticeland.com/discovericeland/about-iceland/history-and-heritage [Accessed 7 Feb. 2017].

Gugger, H. (2015). Icelandic lessons. 1st ed. Zürich: Park Books.

Climate
Einarsson, M. (1984). Climate of Iceland. In: M. Einarsson, ed., World Survey of Climatology: 15: Climates of the Oceans, 1st ed. Amsterdam: Elsevier, pp.673-697.

Tourism
Icelandic Tourist Board. (2017). Tourism in Iceland in Figures | Icelandic Tourist Board. [online] Available at: http://www.ferdamalastofa.is/en/recearch-and-statistics/tourism-in-iceland-in-figures [Accessed 6 Feb. 2017].

Islandsbanki, (2012). The Icelandic Energy Market.

Distellery
Larsen, R. (2017). Visitors - 2016. [email].
Visit Scotland, (2015). Whisky Tourism – Facts and Insights. [online] Visit Scotland. Available at: http://www.visitscotland.org/pdf/Whisky%20Tourism%20%20Facts%20and%20Insights2.pdf [Accessed 15 Feb. 2017].

Scotsman.com. (2017). Visitor numbers at Scotch distilleries hit record 1.6m. [online] Available at: http://www.scotsman.com/business/companies/retail/visitor-numbers-at-scotch-distilleries-hit-record-1-6m-1-4199011 [Accessed 15 Feb. 2017].

Mackmyra. (2017). Mackmyra Whisky - Mackmyra. [online] Available at: http://mackmyra.com/mackmyra-whisky/ [Accessed 15 Feb. 2017].

Stauningwhisky.dk. (2017). Nyheder. [online] Available at: http://www.stauningwhisky.dk/index.php/da/seneste-nyt.html [Accessed 15 Feb. 2017].

Rasmussen, S. (2014). The Quest for Aqua Vitae. 1st ed. Cham: Springer International Publishing, pp.79-92.
Pine II, B. and Gilmore, J. (1998). Welcome to the experience economy. Harvard Business Review.
lbcbeverage.com. (2017). Water Quality | Acqua Nordica Ltd. [online] Available at: https://ibcbeverage.com/?page_id=62 [Accessed 22 Mar. 2017]

Statistics Iceland. (2017). Statistics Iceland. [online] Available at: http://px.hagstofa.is/pxen/pxweb/en/?rxid=7253abec-ce94-4d61-b76a-96eea6d456ac [Accessed 24 Mar. 2017].

Turf Houses
Whc.unesco.org. (2017). The Turf House Tradition - UNESCO World Heritage Centre. [online] Available at: http://whc.unesco.org/en/tentativelists/5589/ [Accessed 7 Feb. 2017].

Landgræðsla Ríkisins. (2017). Revegetation and Landcare in Iceland. [online] Available at: http://land.is/revegetation-and-landcare-in-iceland/ [Accessed 14 Feb. 2017].

Krissdottir, M. (1982). Ingolf's pillars: The changing Icelandic house. Lögberg-Heimskringla, [online] p.2. Available at: http://timarit.is/view_page_init.jsp?pageId=2235199&issId=164201&lang=da [Accessed 14 Feb. 2017]

Wadden Sea Centre
Dortemandrup.dk. (2017). The Wadden Sea Centre – a future built on tradition. [online] Available at: http://www.dortemandrup.dk/news/wadden-sea-centre-future-built-tradition [Accessed 15 Feb. 2017].

Vadehavscentret.dk. (2017). Vadehavscentret - Porten til UNESCO Verdensarv. [online] Available at: http://www.vadehavscentret.dk/dk/om-vadehavscentret/vadehavscentret-porten-til-unesco-verdensarv/ [Accessed 15 Feb. 2017].

Allmannajuvet Zinc Mines
Frearson, A. (2017). Peter Zumthor completes buildings for Norwegian tourist trail. [online] Dezeen. Available at: https://www.dezeen.com/2016/06/10/peter-zumthor-architecture-wooden-buildings-on-stilts-tourist-trail-norway-allamannajuvet-mine/ [Accessed 24 Mar. 2017].

ArchDaily.com. (2016). Allmannajuvet Zinc Mine Museum / Peter Zumthor. [online] Available at: http://www.archdaily.com/796345/allmannajuvet-zinc-mine-museum-peter-zumthor [Accessed 23 Mar. 2017].

Semper, G. (1851). The four elements of architecture and other writings. 1st ed. Cambridge: Cambridge University Press.

Site analysis
Eyþór Einarsson. (2005). Flóra og gróður Íslands. In Islandsatlas (pp. 18-23). Reykjavík: Edda.

Hörður Kristinsson. (2010). A Guide to the flowering plants and ferns of Iceland. Reykjavík: Mál og menning

Process
Þorkelsson, E. (2017). Whisky Distillery Iceland. [email].

Appendix
Eksempelsmling om brandsikring af byggeri. (2012). 1st ed. [ebook] Copenhagen: Energi Styrelsen. Available at: http://bygningsreglementet.dk/file/218960/exsamling_brand_vtre.pdf [Accessed 24 Apr. 2017].

Modum Sikkerhetssenter(2017). Modum original brannstige, 4.2 meter (fra 2. etg.). [online] Available at: http://www.modum.com/produkt/modum-brannstige/modum-original-brannstige-4-meter [Accessed 24 Apr. 2017].

Holmes, J. (2015). Wind loading of structures. 1st ed. New York: CRC Press.

Gauti Þorkelsson, E. (2017). Whisky Distillery Iceland. [email].

Betonelement.dk. (2017). Betonelement | 4.1.5 Huldæk, beregninger. [online] Available at: http://www.betonelement.dk/betonelementer/4-dæk/4-1-huldæk-generelt/4-1-5-ny-huldæk-beregninger/ [Accessed 26 Apr. 2017].

Statikeren.dk. (2017). Punktfundament. [online] Available at: http://www.statikeren.dk/sub_pages/geoteknik/fundament/punkt/calculator.php [Accessed 8 May 2017].

K. Larsen, O. (2016). Modeling of natural and hybrid ventilation - 1.

Forkortet udgave af Eurocode 5 - Trækonstruktioner. (2015). 5th ed. København: Dansk Standard, pp.80-83.

Bæreevnetabel for EM-110R/1000. (2017). [online] Hadsten: MUNCHOLM A/S. Available at: https://muncholm.dk/media/wysiwyg/pdf/trapezplader-tabel/em-110r.pdf [Accessed 15 May 2017].

List of illustrations

Any illustrations not listed here are own illustrations

Ill. 1-2 (Own illustrations)

Ill. - 3: Norberg-Schulz, C. (1996). Nightlands. 1st ed. Cambridge, Mass.: The MIT Press.
Lindhardt Weiss, K. and Vindum, K. (2012). The new wave in Danish architecture. 1st ed. København: Arkitektens Forlag.

Ill. - 4:"Svalbard Science Centre / JVA" (2008). ArchDaily.[image] Available at: http://www.archdaily.com/3506/svalbard-science-centre-jva/ [Accessed 14 May 2017].

Ill. - 5:"Icelandic embassy Berlin" (2010). PKdM Arkitektar [image] Available at: http://pkdm.is/projects/embassy [Accessed 14 May 2017].

Ill. - 6:"Norwegian embassy Berlin" (2010). Snøhetta [image] Available at: http://snohetta.com/uploads/project/151/21344039a2811abd9e6ef4166264e77f_2048w.jpg [Accessed 14 May 2017].

Ill. -7: JSA (2017). Tautra Mariakloster. [image] Available at: http://jsa.no/projects/TAUTRA-MARIAKLOSTER-A-Cistercian-nuns-monastery [Accessed 14 May 2017].

Ill. -8:Mortensrud Church - JSA. (2017). [image] Available at: http://www.archdaily.com/1929/mortensrud-church-jsa/5006dd1328ba0d4148000052-mortensrud-church-jsa-image [Accessed 14 May 2017].

Ill. 9-19 (Own Illustrations)

Ill. - 20: Rizzo, V. (2012). [image] Available at: http://kingscountydistillery.com/site/wp-content/uploads/2013/12/about-111.jpg [Accessed 14 May 2017].

Ill. - 21 (Own Illustration)

Ill. - 22: Teeling Distellery (2017). [image] Available at: https://teelingdistillery.com/dublins-new-destination-2/ [Accessed 14 May 2017].

Ill. - 23 (Own Illustration)

Ill. - 24-26: Images provided by Eimwerk Distellery

Ill. - 27 (Own Illustration)

Ill. - 28: Anon, (2017). [image] Available at: http://www.foodnavigator-usa.com/var/plain_site/storage/images/publications/food-beverage-nutrition/foodnavigator-usa.com/markets/barley-always-a-bridesmaid-never-a-bride-getting-this-super-grain-into-the-spotlight/8570588-4-eng-GB/Barley-always-a-bridesmaid-never-a-bride-getting-this-super-grain-into-the-spotlight_strict_xxl.jpg [Accessed 14 May 2017].

Ill. - 29: logjayge (2017). [image] Available at: https://www.flickr.com/photos/50998656@N00/5972374542 [Accessed 14 May 2017].

Ill. - 30-33 (Own Illustrations)

Ill. - 34: Mørk, A. (2017). [image] Available at: http://www.dortemandrup.dk/sites/default/files/styles/max_2600x2600/public/2017-02/56_023_Vadehavscentret_001_H.jpg?itok=0dxil26k [Accessed 14 May 2017].

Ill. - 35 (Own Illustration)

Ill. - 36-37: Berntsen, P. (2017). [image] Available at: http://www.archdaily.com/796345/allmannajuvet-zinc-mine-museum-peter-zumthor [Accessed 14 May 2017].

Ill. - 35 - 99 (Own Illustrations)

Ill. - 100+ 103: Anon, (2017). [image] Available at: https://s-media-cache-ak0.pinimg.com/736x/51/42/94/51429498e305771c9f538275f34e5836.jpg [Accessed 14 May 2017].

Ill. - 101: dugganmorrisarchitects (2017). [image] Available at: http://dugganmorrisarchitects.com/news/item/2014-09/shepherds-building-completion [Accessed 14 May 2017].

Ill.- 102: Knutsen, J. (2017). [image] Available at: http://thetextureclub.com/metal/tilable-dirty-perforated-metal-background [Accessed 14 May 2017].

Ill. - 104: hufton+crow (2017). [image] Available at: http://cdn.home-designing.com/wp-content/uploads/2015/04/wood-slat-ceiling.png [Accessed 14 May 2017].

Ill. - 105 - 170 (Own Illustrations)

Appendix

Structural Calculations

Calculation method
The structural calculations are all calculated by Finite element method in Autodesk Robot. During the project, the "Grashopper to Robot" plugin has been utilized to allow an exportation from a parametric 3D model into Autodesk Robot for calculations.
All members of the construction have been calculated and dimensioned according to the regulations of Eurocode, and have been dimensioned for ULS (Ultimate Limit State) and SLS (Serviceable Limit State).

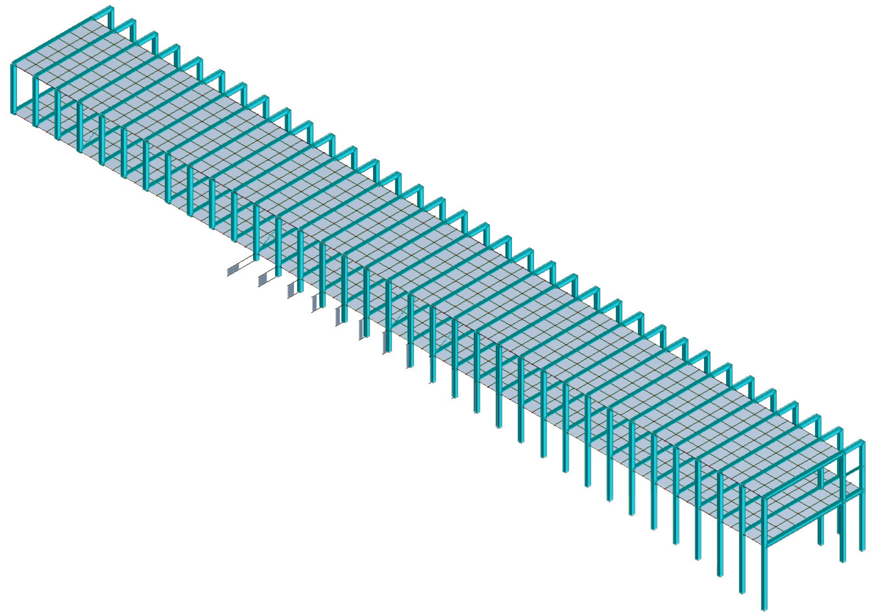
Short Column problems
Early on it was realized that the short columns nearer the part of the building touching the ground experiences what is typically referred to as the "short column problem". This means that because of their short length compared to their width and load, creates very high shear forces in the columns.
This has been solved by releasing the column support in the cross-sectional direction, on the shortest columns. Changing the support type to a "roller" type support instead of pinned. In real life, this would mean utilizing supports which would allow movement along this direction under large loads.

Displacement
The structural displacement of the building is largest when the wind load is dominant. Here the wind forces push the construction towards the leeward side and causes displacement in this direction. The largest displacement of the construction happens in the westernmost part, where the distance to the ground supports, and fixed anchors in the back are largest. The maximum displacement of the structure is limited to 36mm which is deemed acceptable.

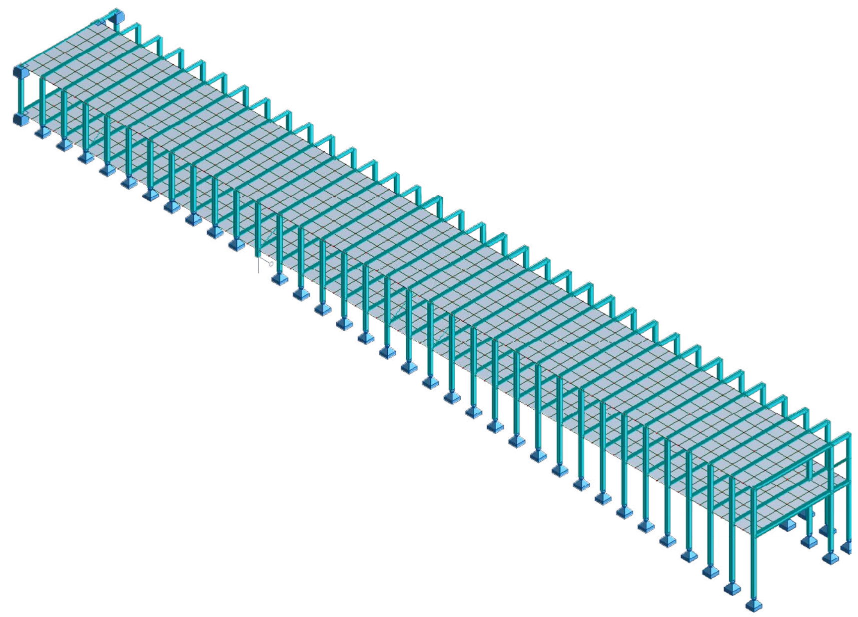
Timber members
The largest forces exerted on the timber members happens under the load combination with a dominating wind load. Here the wind load pushes the construction sideways, which causes displacement in the columns supporting the leeward side of the building. These columns need to, as the rest of the construction, adhere to the SLS, set by the Eurocode regulation, stating that a column cannot have displacement over 1/300 of its length. Therefore, these columns become the dimension defining elements for the wooden part of the construction.

Steel members
In the steel beams SLS one again becomes the defining factor in dimensioning. Here the beams bearing the westernmost part of the distillery defines the dimensions. It is again the dominant wind load combination which exerts most forces on the beams. Here forces transferred through the beams towards the leeward side, as well as the heavy load of distillery creates displacement in the beams, and as they need to adhere to the regulation stating that floor beams cannon have displacement over 1/400 they become the dimensioning members.

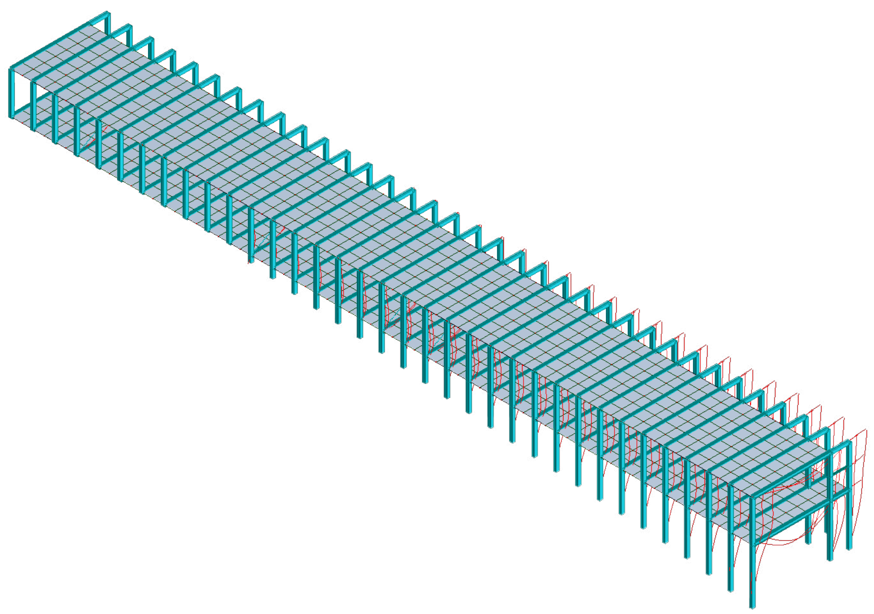
Appendix. 1



Ill. 163: Robot results for Shear forces Max : 0,19 MN/m² Min : - 0,21 MN/m²



Ill. 164: Robot export showing building supports



Ill. 165: Robot results for Displacement Max: 36mm

Member	Section	Material	Lay	Laz	Ratio	Case	Ratio(uz)	Case (uz)
252	OK 2 IPN 475	Steel	67.13	94.39	0.56	5 ULS - Dominant Wind	0.84	8 SLS - Dominant Wind
253	OK 2 IPN 475	Steel	67.13	94.39	0.53	5 ULS - Dominant Wind	0.78	8 SLS - Dominant Wind
254	OK 2 IPN 475	Steel	67.13	94.39	0.53	5 ULS - Dominant Wind	0.78	8 SLS - Dominant Wind
255	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.78	8 SLS - Dominant Wind
256	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.77	8 SLS - Dominant Wind
257	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.77	8 SLS - Dominant Wind
258	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.76	8 SLS - Dominant Wind
259	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.76	8 SLS - Dominant Wind
260	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.75	8 SLS - Dominant Wind
267	OK 2 IPN 475	Steel	67.13	94.39	0.55	5 ULS - Dominant Wind	0.75	8 SLS - Dominant Wind
266	OK 2 IPN 475	Steel	67.13	94.39	0.56	5 ULS - Dominant Wind	0.75	8 SLS - Dominant Wind
261	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.75	8 SLS - Dominant Wind
262	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.74	8 SLS - Dominant Wind
268	OK 2 IPN 475	Steel	67.13	94.39	0.56	5 ULS - Dominant Wind	0.74	8 SLS - Dominant Wind
263	OK 2 IPN 475	Steel	67.13	94.39	0.53	5 ULS - Dominant Wind	0.74	8 SLS - Dominant Wind
269	OK 2 IPN 475	Steel	67.13	94.39	0.55	5 ULS - Dominant Wind	0.73	8 SLS - Dominant Wind
265	OK 2 IPN 475	Steel	67.13	94.39	0.54	5 ULS - Dominant Wind	0.73	8 SLS - Dominant Wind
264	OK 2 IPN 475	Steel	67.13	94.39	0.53	5 ULS - Dominant Wind	0.73	8 SLS - Dominant Wind
270	OK 2 IPN 475	Steel	67.13	94.39	0.55	5 ULS - Dominant Wind	0.72	8 SLS - Dominant Wind
275	OK 2 IPN 475	Steel	67.13	94.39	0.51	5 ULS - Dominant Wind	0.71	8 SLS - Dominant Wind

Ill. 166: Robot results the 20 most utilized Steel Beams

Member	Section	Material	Lay	Laz	Ratio	Case	Ratio(vx)	Case (vx)	Ratio(vy)	Case (vy)
55	OK DRRECT_1_C	GL36h	22.21	21.05	0.18	5 ULS - Dominant Wind	0.13	SLS - Dominant Win	0.89	SLS - Dominant Wind
54	OK DRRECT_1_C	GL36h	23.82	22.58	0.17	5 ULS - Dominant Wind	0.12	SLS - Dominant Win	0.88	SLS - Dominant Wind
56	OK DRRECT_1_C	GL36h	21.01	19.92	0.19	5 ULS - Dominant Wind	0.13	SLS - Dominant Win	0.87	SLS - Dominant Wind
29	OK DRRECT_1_C	GL36h	24.03	22.77	0.48	5 ULS - Dominant Wind	0.07	SLS - Dominant Win	0.87	SLS - Dominant Wind
30	OK DRRECT_1_C	GL36h	22.59	21.41	0.50	5 ULS - Dominant Wind	0.07	SLS - Dominant Win	0.87	SLS - Dominant Wind
53	OK DRRECT_1_C	GL36h	25.81	24.47	0.16	5 ULS - Dominant Wind	0.11	SLS - Dominant Win	0.86	SLS - Dominant Wind
28	OK DRRECT_1_C	GL36h	25.92	24.57	0.46	5 ULS - Dominant Wind	0.07	SLS - Dominant Win	0.86	SLS - Dominant Wind
31	OK DRRECT_1_C	GL36h	21.57	20.44	0.51	5 ULS - Dominant Wind	0.08	SLS - Dominant Win	0.85	SLS - Dominant Wind
57	OK DRRECT_1_C	GL36h	20.10	19.05	0.19	5 ULS - Dominant Wind	0.14	SLS - Dominant Win	0.85	SLS - Dominant Wind
52	OK DRRECT_1_C	GL36h	28.03	26.57	0.14	5 ULS - Dominant Wind	0.10	SLS - Dominant Win	0.84	SLS - Dominant Wind
27	OK DRRECT_1_C	GL36h	28.16	26.69	0.44	5 ULS - Dominant Wind	0.06	SLS - Dominant Win	0.84	SLS - Dominant Wind
51	OK DRRECT_1_C	GL36h	30.13	28.56	0.13	5 ULS - Dominant Wind	0.09	SLS - Dominant Win	0.83	SLS - Dominant Wind
32	OK DRRECT_1_C	GL36h	20.80	19.71	0.52	5 ULS - Dominant Wind	0.08	SLS - Dominant Win	0.82	SLS - Dominant Wind
26	OK DRRECT_1_C	GL36h	30.33	28.75	0.43	5 ULS - Dominant Wind	0.06	SLS - Dominant Win	0.82	SLS - Dominant Wind
4	OK DRRECT_1_C	GL36h	25.54	24.21	0.35	6 ULS - Dominant Snow	0.11	SLS - Dominant Win	0.82	SLS - Dominant Wind
58	OK DRRECT_1_C	GL36h	19.29	18.28	0.19	5 ULS - Dominant Wind	0.14	SLS - Dominant Win	0.82	SLS - Dominant Wind
5	OK DRRECT_1_C	GL36h	24.12	22.86	0.36	6 ULS - Dominant Snow	0.12	SLS - Dominant Win	0.82	SLS - Dominant Wind
3	OK DRRECT_1_C	GL36h	27.44	26.01	0.34	6 ULS - Dominant Snow	0.11	SLS - Dominant Win	0.81	SLS - Dominant Wind
2	OK DRRECT_1_C	GL36h	29.59	28.05	0.32	6 ULS - Dominant Snow	0.10	SLS - Dominant Win	0.80	SLS - Dominant Wind
6	OK DRRECT_1_C	GL36h	23.13	21.93	0.37	6 ULS - Dominant Snow	0.12	SLS - Dominant Win	0.79	SLS - Dominant Wind

Ill. 167: Robot results the 20 most utilized Timber Members

Loads

For the structural calculations, different loads affect the construction. The loads considered are wind, snow, dead and live load. Because of the different programmes in the building, the loads has been divided into three zones: visitors centre, malt floor and distillery. The following constitutes the loads considered in the calculations.

Zone A – Distillery

Area: 633 m2

Dead load
Floor:
Concrete floor, covering: 63,3 m3 * 2000 kg/m3 = 1,9 kN/m2
Concrete slab, PE 180 mm: 3 kN/m2
Insulation, Rockwool 300 mm: 0,07 kN/m2

Wall:
Rockwool hard insulation 0,3 kN/m3 * 87,6 m3 = 0,04 kN/m2
Bitumen rolled membrane: 0,05 kN/m2
Aluminium panels: 1 m3 * 27 kN/m3 = 0,04 kN/m2
Plasterboards: 28 m3 * 9 kN/m3 = 0,4 kN/m2
Windows: 0,52kN/m2

Tanks:
31392 kg = 0,5 kN/m2

Total DL: 6,10 kN/m2

Live load
Category E2, Storage: 7,5 kN/m2

Tanks (content only)
126243 kg = 1238 kN = 1,95 kN/m2

Forklift (FL1): 26 kN/633m2 = 0,04 kN/m2

Total LL: 9,45 kN/m2

Zone B – Malt Floor

Area: 454 m2

Dead load:
Floor:
Concrete floor, covering: 45 m3 * 2000 kg/m3 = 1,9 kN/m2
Concrete slab, PE 180 mm: 3 kN/m2
Insulation, Rockwool 300 mm: 0,07 kN/m2

Walls:
Stabilizing concrete walls, REI 60 – 150mm: 19,26 m3 * 2000 kg/m3 = 0,83 kN/m2

Rockwool hard insulation 0,3 kN/m3 * 59,6 m3 = 0,04 kN/m2
Bitumen rolled membrane: 0,05 kN/m2
Aluminium panels: 0,75 m3 * 27 kN/m3 = 0,04 kN/m2
Plasterboards: 19,37 m3 * 9 kN/m3 = 0,38 kN/m2
Windows: 0,52 kN/m2

Tanks:
Malt store: 1,04 m3 * 7600 kg/m3 = 0,17 kN/m2
Steeping tank: 0,27 m3 * 7600 kg/m3 = 0,04 kN/m2
Heating tank: 0,39 m3 * 7600 kg kg/m3 = 0,06 kN/m2

Total DL: 6,74 kN/m2

Live load
Category E2, Storage: 7,5 kN/m2

Tanks (content only):
41282 kg = 1,78 kN/m2

Forklift (FL1) : 26 kN/ 454 kg = 0,05 kN/m2

Total LL: 9,33 kN/m2

Appendix. 2

Zone C – Visitors centre

Dead Load
Floor:
Concrete floor, covering (2 floors) : 74, m3 * 2000 kg/m3 = 1,9 kN/m2
Concrete slab, PE 180 mm: 3 kN/m2
Insulation, Rockwool 300 mm: 0,07 kN/m2

Wall:
Stabilizing concrete core, REI 60 – 150 mm: 10,44 m3 * 2000 kg/m3 = 0,4 kN/m2

Rockwool hard insulation 0,3 kN/m3 * 30,4 m3 = 0,01 kN/m2
Bitumen rolled membrane: 0,05 kN/m2
Aluminium panels: 0,38 m3 * 27 kN/m3 = 0,02 kN/m2
Plasterboards: 9,88 m3 * 9 kN/m3 = 0,17 kN/m2
Windows: 0,52 kN/m2

Total DL: 5,34 kN/m2

Live load:
Category C3, museums: 4 kN/m2

Total LL: 4 kN/m2

Zone D – Gallery

Area: 443,3 m2

Dead load:

Floor:
Construction, PE 180, slab: 3 kN/m2
Insulation, rockwool – 300mm: 265 m3 * 32 kg/m3 = 0,18 kN/m2
Total DL: 4,23 kN/m2
Live load:

Category E3, storage: 7,5 kN/m2
Forklift: 26 kN/443,3m2 = 0,05 kN/m2

Total LL: 7,55 kN/m2

Zone E - Roof

Dead load:

Area: 1568 m2

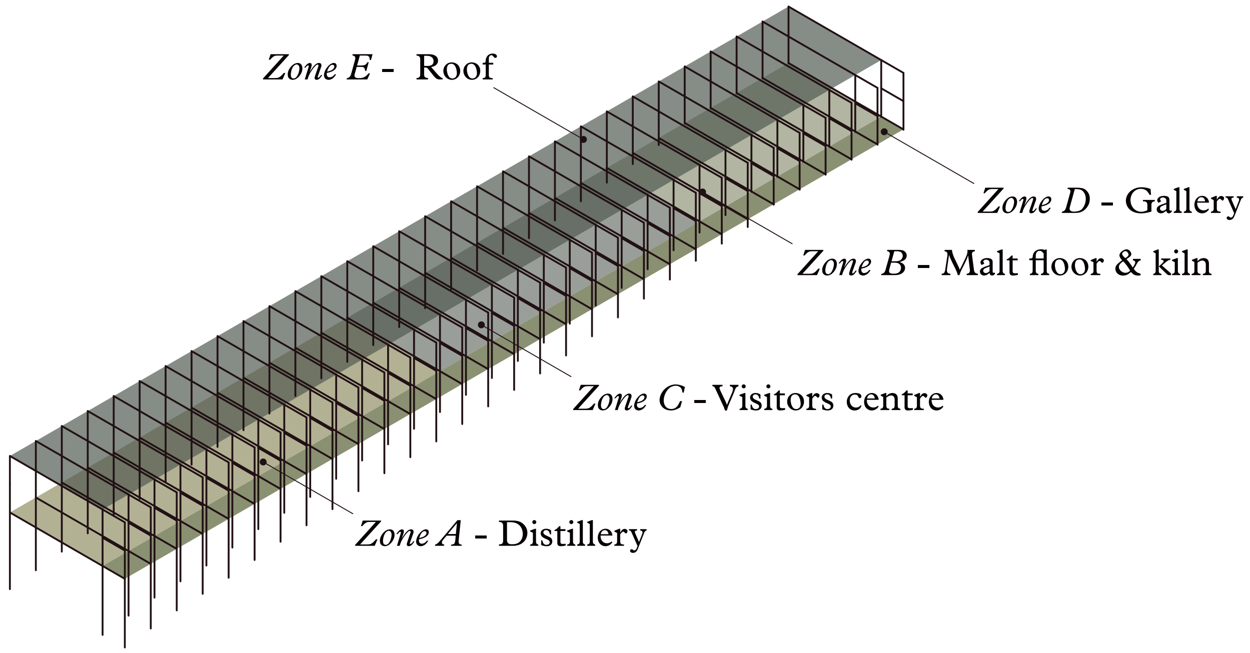
Green roof: 2,45 kN/m2
Trapeze panels, EM-110R/1000 : 1568 m2 * 14,41 Kg/m2 = 0,14 kN/m2
Insulation: 940, 8 m3 * 32 kg/m3 = 0,19 kN/m2

Total dead load: 2,78 kN/m2

Live load:
Category C1: 2 kN/m2

Environmental load:
Snow load: 1,34 kN/m2

Total Load on roof: 3,34 kN/m2



Ill. 168: Diagram showing the distribution of load Zones

Wind & Snow loads

The wind and snow loads have been calculated according to the conditions of Iceland using the standards in Eurocode 1.

Snow load (according to EC1)

The snow load is calculated by:

$S = \mu_i \cdot C_e \cdot C_t \cdot s_k$

$C_e = 0,8$

$C_t = 1,0$

$\mu_i = 0,8$

$S_k = 2,1\ kN/m^2$, *snowload on Iceland (zone 1, Figure C12, EC1)*

$S = 0,8 \cdot 0,8 \cdot 1,0 \cdot 2,1\ kN/m^2 =$ <u>$1,344\ kN/m^2$</u>

Wind load (according to EC1)

Basic wind velocity (4.3.1)
Peak velocity pressure is set to 39,6 m/s. This is based on studies from Reykjavik (Holmes; 2015)

$v_b = C_{dir} \cdot C_{season} \cdot v_{b,0}$

$C_{dir} = 1$

$C_{season} = 1$

$v_b = 1 \cdot 1 \cdot 39,6\ m/s = 39,6\ m/s$

Terrain Category:
0 – coastal areas

Peak velocity pressure (4.5)

$q_p(z) = C_e(z) \cdot 0,613 \cdot v_b^2$

z is measured in 10 m height

$C_e(10) = 3,0$ *(table 4.1, figure 4.2)*

$q_p(10) = 3,0 \cdot 0,613 \cdot (39,6\ m/s)^2$

$q_p(10) = 2883,85\ [m^2/s^2]$

$q_p(10) = 2,88\ kN/m^2$
The most frequent wind direction is NNE (calculated as N), and will strike the long facad of the building facing north.

h = 9,3
b = 133 m, above ground
b = 2h = 18,6 m

e = b or 2h, whichever one is smaller

$C_{pe,10}$ *is used for design of the overall load bearing structure of buildings*

h/d = 9,3/15 = 0,62

<u>*For walls (EC, figure 7.6 and table 7.2)*</u>

A = -1,2
B = -0,8
D = +0,8
E = -0,5

$q_{pA} = 2,88\ kN/m^2 \cdot (-1,2) = -3,45\ kN/m^2$

$q_{pB} = 2,88\ kN/m^2 \cdot (-0,8) = -2,30\ kN/m^2$

$q_{pC} = 2,88\ kN/m^2 \cdot (+0,8) = 2,30\ kN/m^2$

$q_{pD} = 2,88\ kN/m^2 \cdot (-0,5) = -1,44\ kN/m^2$

<u>*Roof (EC1, figure 7.6 and table 7.2)*</u>

e = b or 2h, whichever one is smaller

b = 133

2h = 18,6

H = -0,7

I = +2,0

$q_{pH} = 2,88\ kN/m^2 \cdot (-0,7) = -2,02\ kN/m^2$

$q_{pI} = 2,88\ kN/m^2 \cdot (+0,2) = 0,58\ kN/m^2$

Appendix. 2

Load combinations

In this project three ULS and SLS load combinations were considered. The following shows an example of load combinations for Zone B – malt floor. The the load combinations are calculated without the self weight of the construction, as this is added by the software used.

ULS Dominant wind load:

$\gamma_G G + \gamma_{var} \psi_{0,var} Q_{var} + \gamma_{snow} \psi_{0,snow} Q_{snow} + \gamma_{wind} Q_{wind}$

$(1,35)\ 13,73\ kN/m^2 + G_{constr.} + (1,5)(1,0)\ 10,27 kN/m^2 + (1,5)(0)\ 1,34\ kN/m^2 + (1,5)\ 1,44\ kN/m^2 = 36,10\ kN/m^2 + G_{constr.}$

ULS Dominant snow load:

$\gamma_G G + \gamma_{var} \psi_{0,var} Q_{var} + \gamma_{snow} Q_{snow} + \gamma_{wind} \psi_{0,wind} Q_{wind}$

$(1,35) 13,73\ kN/m^2 + G_{constr.} + (1,5)(1,0)\ 10,27 kN/m^2 + (1,5)\ 1,34\ kN/m^2 + (1,5)\ (0,6)\ 1,44\ kN/m^2 = 37,24\ kN/m^2 + G_{constr.}$

ULS Dominant variable load:

$\gamma_G G + \gamma_{var} Q_{var} + \gamma_{snow} \psi_{0,snow} Q_{snow} + \gamma_{wind} \psi_{0,wind} Q_{wind}$

$(1,35)\ 13,73\ kN/m^2 + G_{constr.} + (1,5)\ 10,27 kN/m^2 + (1,5)(0,7)\ 1,34\ kN/m^2 + (1,5)\ (0,6)\ 1,44\ kN/m^2 = 36,64\ kN/m^2 + G_{constr}$

SLS Dominant wind load:

$G + \psi_{0,var} Q_{var} + \psi_{0,snow} Q_{snow} + Q_{wind}$

$13,73\ kN/m^2 + G_{constr.} + (1,5)\ 10,27 kN/m^2 + (0)\ 1,34\ kN/m^2 + 1,44\ kN/m^2 = 29,16\ kN/m^2 + G_{constr}$

SLS Dominant snow load:

$G + \psi_{0,var} Q_{var} + Q_{snow} + \psi_{0,wind} Q_{wind}$

$13,73\ kN/m^2 + G_{constr.} + (1,5)\ 10,27 kN/m^2 + 1,34\ kN/m^2 + (0,6)\ 1,44\ kN/m^2\ m^2 = 31,34\ kN/m^2 + G_{constr}$

SLS Dominant variable load:

$G + Q_{var} + \psi_{0,snow} Q_{snow} + \psi_{0,wind} Q_{wind}$

$13,73\ kN/m^2 + G_{constr.} + 10,27 kN/m^2 + (0,7)\ 1,34\ kN/m^2 + (0,6)\ 1,44\ kN/m^2\ m^2 = 25,80\ kN/m^2 + G_{constr}$

Dimensioning corrugated steel

As a stabilizing element in the roof construction, this project uses corrugated steel panels. The panels themselves are supporting the green roof as well as the imposed loads on the roof. The dimensioning have been done using the manufacturer Munchholms specifications (Bæreevnetabel for EM-110R/1000, 2017), which are carried out in relation to the regulations statet by the Eurocode.
See calculation below.

Loads on trapeze panels:

Element	*Characteristic value*	*Design value*
Green roof	*2,45 kN/m²*	*2,45 kN/m²(1,35) = 3,30 kN/m²*
Snow load	*1,34 kN/m²*	*1,34 kN/m²(1,5) = 0,60*
Live load, category A	*2 kN/m²*	*2 kN/m² (1,5) = 3*
Total load on trapez-panels		*5,9 kN/m²*

Width to span: 3,5 m

Table from Muncholm, EM-110R/1000:

SPÆND 1-FAG Spændvidde i m		3,00	3,20	3,40	3,60
0,75 mm	1:	3,09	2,90	2,73	2,58
	2:	5,03	4,23	3,60	3,10
0,88 mm	1:	4,34	4,07	3,83	3,61
	2:	6,15	5,17	4,41	3,80
1,00 mm	1:	5,66	5,30	4,99	4,71
	2:	7,22	6,09	5,19	4,48
1,13 mm	1:	7,27	6,81	6,41	6,06
	2:	8,42	7,12	6,08	5,23
1,25 mm	1:	8,92	8,36	7,87	7,23
	2:	9,57	8,11	6,94	5,97

1,13 mm and 1,25 mm are alternatives for. Because of robustness, and the need for the panel to work as a stabilizer in the construction, panel thickness 1,25 is chosen.

Dimensioning concrete slab

Concrete elements from Betonelement, has been chosen for the slabs in the distillery. The following calculation is based on load bearing capacity spreadsheet from betonelement (Betonelement.dk, 2017), which is based on the regulations of the Eurocode.

Width to span: 3,5 m
A PE-element, 180 mm spanning 3,5 m, is not a Betonelement standard, but can be custom made. The width I therefore assumed to be 4,2 m, which is the shortest value in the spread sheet.

Zone A - Distillery
Characteristic dead load: 1,14 kN/m²
Characteristic live load: 9,13 kN/m²

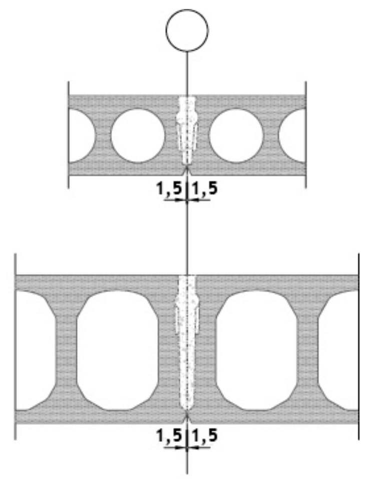
Design load: $1{,}14\ kN/m^2 + 9{,}13\ kN/m^2\ (1{,}5)$
$= 1{,}14\ kN/m^2 + 13{,}69\ kN/m^2$
$= \underline{14{,}83\ kN/m^2}$

1. *Referring to the first row of the table.* M_{Rd} *17,7 kN/m², is well above the design load, meaning it is suited to support the weight in the distillery.*
2. M_{rev} *is the carrying capacity for tearing. The total characteristic dead load is 14,83 kN/m², which is below the capacity of the slab.*
3. M_{bal} *is 2,9. The characteristic dead load is 1,14 kN/m². This means that the amount of reinforcement in the first row of the spread-sheet is sufficient.*

For the slabs to work as a diaphragm, it needs to be grouted according to the DS/EN 1168, anneks D

Bæreevnetabel - PE 180 mm
Bæreevnetabel efter EN 1168, EN 1990, EN 1992

1/2"	3/8"	PE180 spændv. [m]			4,2
0	5	MRd	54,8	q, rd	17,7
		Mrev	49,9	q, rev	15,9
		Mbal	15,7	q, bal	2,9
		VRd	56,0	q, vrd	19,2
		MRd REI 60	48,0	q, rd REI 60	15,1
		Vk, BS60	45,2	q, v REI 60	14,9
0	7	MRd	74,4	q, rd	25,1
		Mrev	59,8	q, rev	19,6
		Mbal	21,8	q, bal	5,2
		VRd	62,0	q, vrd	21,6
		MRd REI 60	66,7	q, rd REI 60	22,2
		Vk, BS60	50,1	q, v REI 60	16,9



Foundations

The foundation has been calculated based on statikeren.dk's webpage, allowing us to create an estimate of the foundations dimensions. (Statikeren.dk, 2017)

Input:

Angle of friction: φ'= 33°, based on the avrage between turf and sand, being close to what exists on the site.

Density of the soil: γ' = 16,5 kN/m3

Overburden pressure is assumed to be: q' = 18 kN/m2

The foundation is set to being rectangular: 1400x1400mm
Length foundation: 1600mm

According to Robot, the column supporting the heaviest piont load is used as a reference when calculation.

Reference: 894 kN

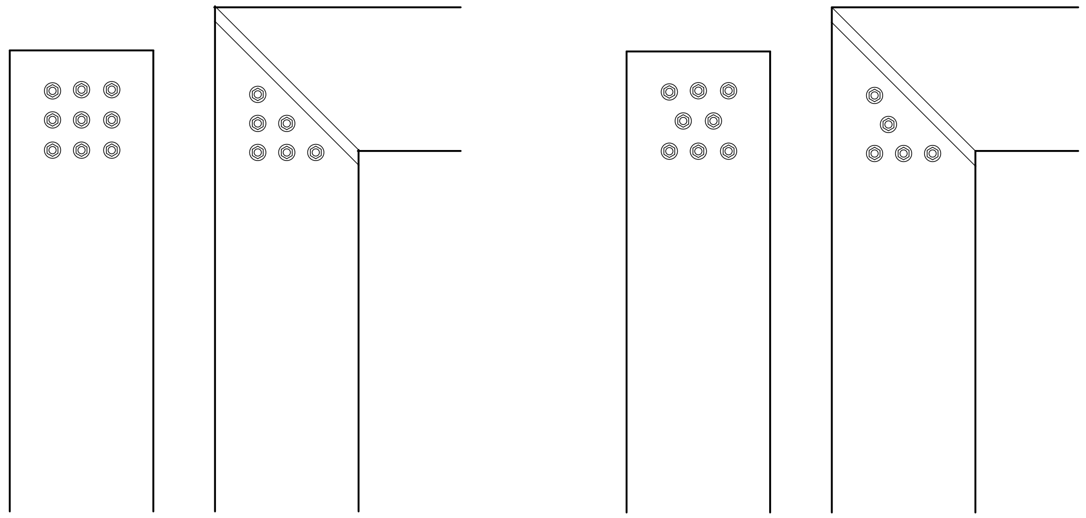
Since the support node is pinned, it is assumed that noe moment forces is affecting the foundation. This allowes for a more slender foundation compared to the node being fixed having to take up moment forces. Pinned nodes reduces the footprint.

According to statikeren.dk, the degree of utilization is 97,14 %

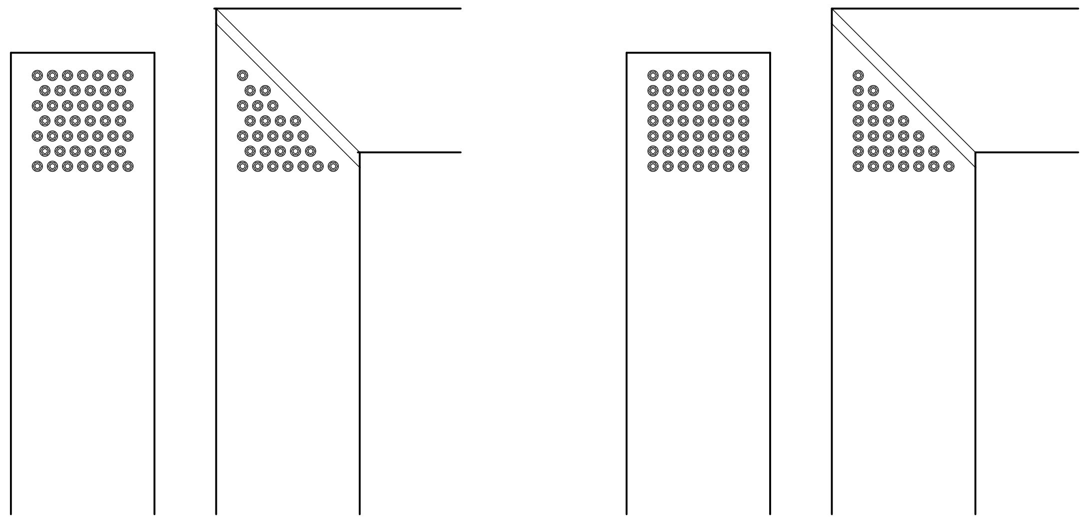
Bolt Distance

The connection is made of M24 bolts connecting the glulam beam with the steel joint.
The bolts are spaced according to eurocode 5, which prescribes that bolts connecting glue laminated timber perpendicular to the grain, should be spaced four times the diameter of the bolt used. (Forkortet udgave af Eurocode 5 - Trækonstruktioner, 2015) **For a M24 Bolt this means 96mm should be the minimum spacing used. The bolts in the connection are spaced 100mm.**

Experiments were carried out with both M16 and M24 Bolts. If using M16 bolts the spacing could be tighter, 48mm, but would also mean an increase in the amount. The M24 bolts were chosen as the amount could be spaced adhering to a more simple pattern and an overall cleaner look.



Ill. 168: Tests of M24 bolt arrangements



Ill. 169: Tests of M16 bolt arrangements

Stills and containers

The following scheme presents the containers and stills used for distilling in this project. The dimensions are based on other distilleries similar to this project, like Dublin Distillery and Torabhaig Distillery. With help from Egill Gauti Þorkelsson from Eimwerk Distillery, the assumed dimensions of the containers and stills has been estimated. (Gauti Þorkelsson, 2017)

Container	Liters	Diameter/square (m)	Height (m)
Mash tun	15500	3,00	2,20
Washback	8000	2,20	4,00
Wash still	12500	3,50	4,60
Spirit Still	8000	2,90	1,20
Spirit Tank	17800	2,75	1,50
Malt store	52200	6,00x3,00	2,90
Boiler	22000	2,50x4,00	2,25
Steeping tank	6700	1,95	2,25
Low wine reciever	6100	2,50	1,25
Foreshot reciever	3800	1,80	1,50
Spent wash	6200	2,30	1,50
Spent lees	6200	2,30	1,50

Potential air change

The Distillery is optimized for natural ventilation through vents in the roof and in the floor. This enables cross ventilation as well as creating a stack-effect by heating of thermal mass. The following calculates the potential air change using the vents provided in the building.

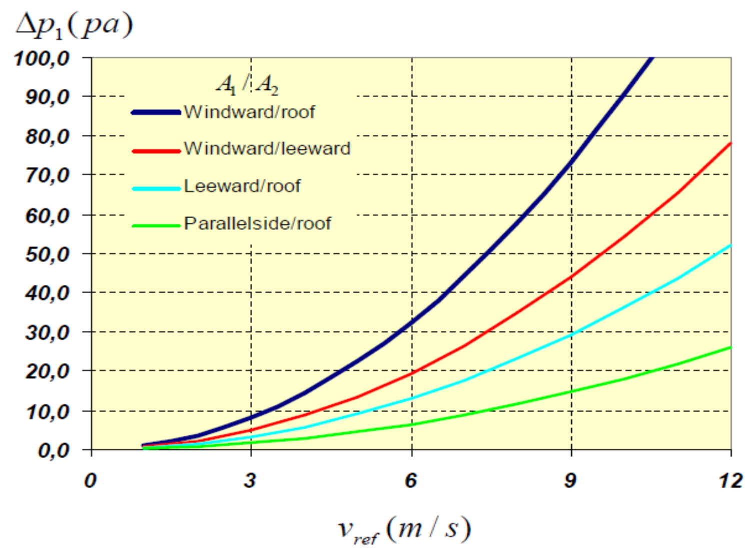
Average air speed west coast of Iceland: 6-7 m/s ≈ 6,5 (Einarsson, 1984).

Low rise buildings (up to 3 storeys)
Length to width ratio: 1:2
Shielding conditions: Exposed
Wind pressure coefficient data:
Wind angle: 0
Face 1: 0.5
Face 2: -0,7

$\Delta p = \Delta C_p \, ½ \, p_u \, v^2_{ref} = (0,7-(-0,2)) \, ½ \, 1,205 \, kg/m^3 \, (6,5^2) = 22,9$

$v_{ref} = 7 \, (m/s)$

According to "natural ventilation_sheet" (K. Larsen, 2016)



			Thermal		Wind			Thermal and wind			
	Eff. Area	Height	Thermal Buoyancy	AFR (thermal)	Pres. Coeff.	Wind pressure	AFR Wind)	Wind pressure	AFR total	AFR total	Potential air change
Unit	m2	m	pa	m3/s		pa	m3/s	pa	m3/s	m3/h	
1. floor, W	1,7	8,7	1,311	2,55	0,06	0,000	0,000	0,000	2,5	9175,5	29,1
1. floor, L	1,7	8,7	1,311	2,55	0,06	0,000	0,000	0,000	2,5	9175,5	29,1
2. floor, W	1,7	15	-1,311	-2,55	0,06	0,000	0,000	0,000	-2,5	-9175,5	-29,1
2.floor, L	1,7	15,0	-1,311	-2,55	0,06	0,000	0,000	0,000	-2,5	-9175,5	-29,1

Potential air change: 29,1 h^{-1}

The calculation proves that the potential air change is more then sufficient for the sensory load and the thermic load in the building.

Appendix. 9

Fire-strategy

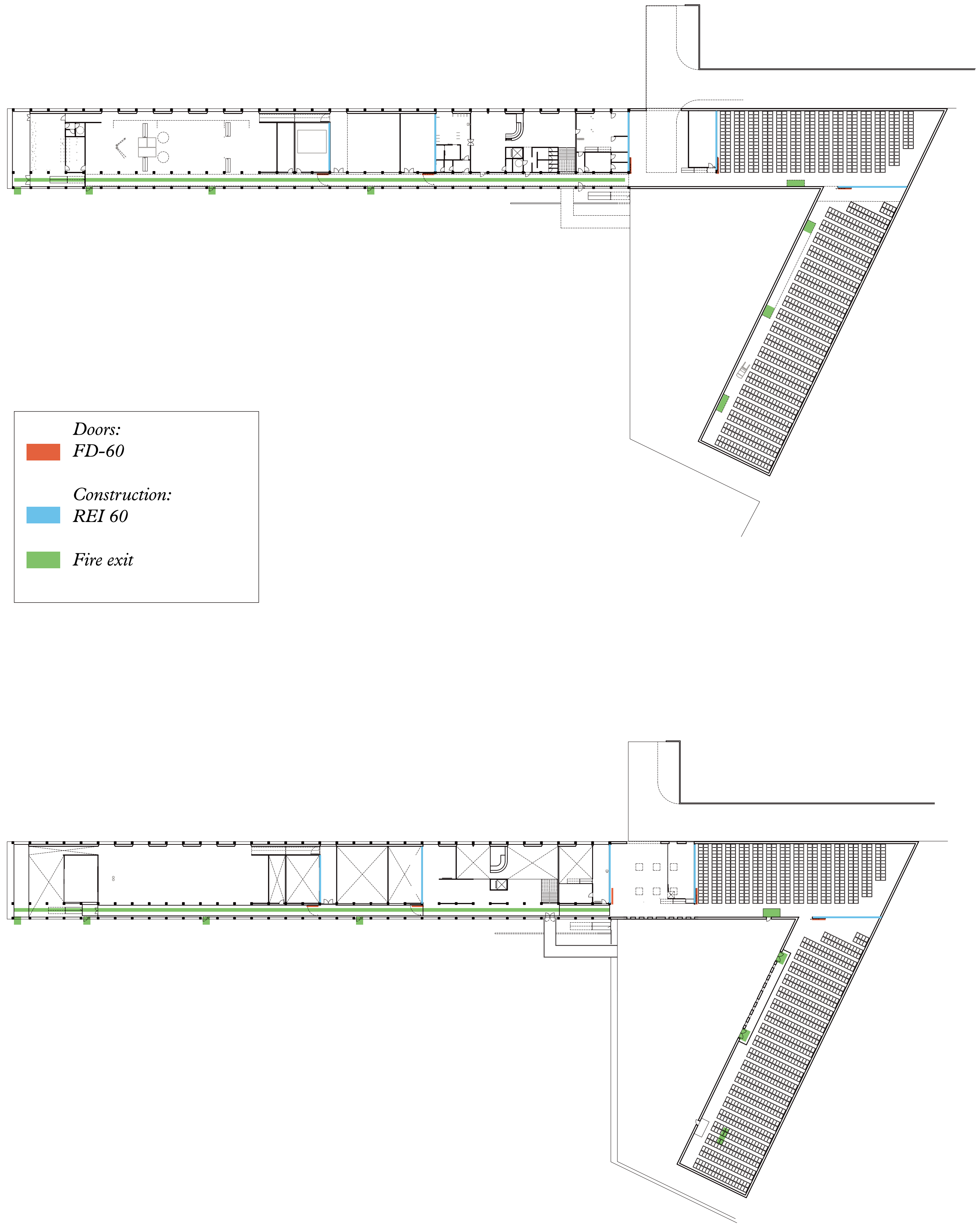
The building is equipped with an ABDL-system. This means that in case of an emergency, sensors will detect the concentration of smoke, which triggers automatic doors to close. The fire resistant doors are placed in the building, separating it, along with fire resistant walls, into fire-zone.

The building is equipped with an escape route spanning the length of the building. This route leads to the four fire exits; Storage-, Visitors Centre, Malt floor and Distillation-area. Fire exits are placed in the recommended distance (25 m) from each other, unless there is 25 meters to the nearest fire-area.

The zones are divided by REI-60 insulated walls, being able to withstand fire for up to 60 minutes. From here one has direct access to a fire exit leading out from the building. Where the building is raised above the ground a Modum fire ladder is mounted on the columns *(Modum Sikkerhetssenter, 2017)*.

The fire resistant doors are classified as F-60. *(Eksempelsmling om brandsikring av byggeri, 2012)*

The fire exits are indicated on the diagram.



Ill. 170: Fire Evacuation Plan