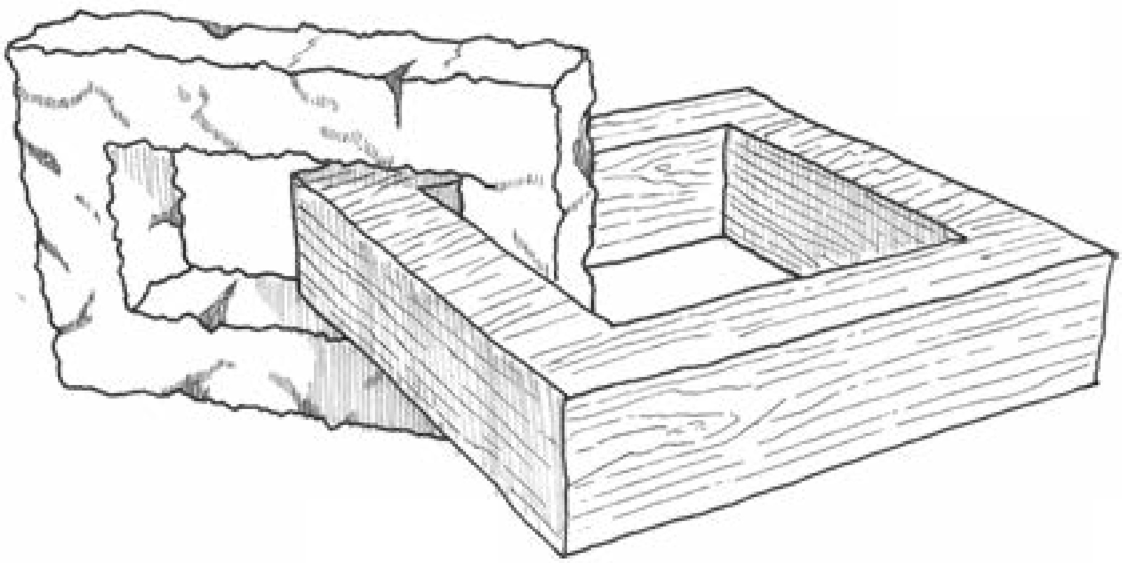

Atlantic Sounds

A Music Conservatory For The Faroe Islands

Colophon

Project title:	Atlantic Sounds: A new music conservatory for the Faroe Islands
About:	Master Thesis, Msc04 ARCH. Department of Architecture & Design Aalborg University
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Rói Heinason

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Ramus Christensen, May 2018

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Rói Heinason, May 2018

Abstract

FO

Hendan serritgerð er gjørd av bólki 18 á 10. lestrarhálvu á Arkitektur & Design - Aalborg Universitet og snýr seg um sniðgeving av einum tónlistaháskúla í Føroyum. Innan verkætlanina eru ynski um at skapa rammur fyri vøkstri og menning av tí einskilaðu tónleikamentan, sum er í Føroyum, hóast eingin háskúli er.
Verkætlanin er á Raktanga, tann sunnasti oddurin av vestara armi av Skálafjørðinum á Eysturoynni. Orsøkin handan serritgerðina kemst partvíst av teimum eygleiðingum og ivasemi sum blivu gjørdar av nútíðar føroyskari byggilist og viðgerðini ið landslagið far. Verkætlanin roynir tí, gjøgnum eina tektoniska greining, at hyggja aftur til ta siðbundnu byggilist, ið er í Føroyum fyri at síggja, hvussu ein einstakur, nútímans og sermerktur føroyskur byggisiður kundi sæð út. Verkætlanin viðvíkir eisini, hvussu ljóðviðurskifti kunnu nýtast sum sniðgevingar amboð, gjørt gjøgnum eina sokallaða "Multi-Objective" optimering, har ljóðviðurskifti, konstruktión og útsjónd øll verða sett saman fyri síðani at skapa tað besta sniði.

DK

Dette afgangsprojekt er udfærdiget af gruppe 18 på 10. semester Arkitektur & Design - Aalborg Universitet og omhandler designet af et musikkonservatorium på Færøerne. Med dette projekt ønskes det at skabe rammerne for at videreudvikle den enestående musikkultur der allerede eksisterer på færøerne på trods af at der ikke findes tertiær musikuddannelse i landet.
Projektet befinder sig på spidsen af "Raktangi" en græsklædt tange ved den vestlige del af udmundingen ved fjorden Skálafjørður på den sydlige del af øen Eysturoy. Motivationen for dette afgangsprojekt stammer til dels fra observationer og skepsis af den samtidige færøske byggekultur og dens behandling af topografi. Projektet søger derfor inspiration i en tektonisk analyse af traditionel færøsk arkitektur for at give et bud på, hvordan unik nutidig færøsk arkitektur kan udformes. Projektet beskæftiger sig yderligere med brugen af akustik som et arkitektonisk formgivende element igennem multi-objektiv optimering, hvor arkitektoniske, akustiske og konstruktionsmæssige parametre bliver brugt til at finde en form der er optimal for alle aspekter.

ENG

This master thesis is made by Group 18 of the 10th-semester Architecture & Design - Aalborg University and deals with the design of a music conservatory on the Faroe Islands. The aim of the project is to create the framework for further developing the unique music culture that already exists on the Faroe Islands, despite the absence of tertiary music education in the country.
The project is located at the tip of "Raktangi" a grassy tongue of land at the mouth of the fjord Skálafjørður on the southern part of the island of Eysturoy. The motivation for this thesis originates in part from observations and skepticism of the contemporary Faroese building culture and its treatment of topography. The project, therefore, seeks inspiration in a tectonic analysis of traditional Faroese architecture to create an example of how unique contemporary Faroese architecture can be designed. The project further deals with the use of acoustics as an architectural design element through multi-objective optimization where acoustic and structural parameters are used to find a form that is optimal for all aspects.

Table of Contents

Guide of Reading

Fig. 1. Photo from Plateau. (o.i)

This booklet is divided into four chapters, describing each phase of the project. The first chapter details the information that laid the foundation for the rest of thesis. This includes geographical and cultural analyses, architectural theory and finally an initial concept that leads to the presentation of the project. This part is introduced by several overarching concepts before showcasing the project through plans, sections, elevations and 3D renderings. The presentation is followed by the process, where the development of selected parts of the project is being showcased. Finally, the epilogue will conclude and reflect upon the project within an educational context. The booklet will additionally have a list of all relevant references and an appendix of additional information.

Where foreign or little-known words or terms are used, a small explanation can be found in the left column of each page. This column is additionally used to clearly describe the content and origin of all illustrations and give credit to the owners of the intellectual property. Illustrations made by the authors of this thesis, will from this point be marked with (o.i.) for "own illustration"

Motivation

A great part of the motivation for this thesis comes from both authors experiences as architectural interns on the Faroe Islands. Our stay at two different Faroese offices meant an immersion into a building culture that is on a very manageable scale where one can quickly gather extensive knowledge on how building cases are handled in the specific context.
With this experience in mind, there was a huge potential for the Faroe Islands as a context for a master thesis, both due to the dramatic setting, but also due to various challenges in the Faroese building industry that present themselves as a point of departure when creating the overarching thematic scope of the thesis.

Building on the Faroe Islands
As the Faroe Islands themselves has neither architectural nor building engineering educations, many Faroese people pursue higher educations in Denmark. While seeking academic knowledge, experience and careers abroad is predominantly a good thing, one must acknowledge that university programmes are, at least to some extent, adapted and rooted to the culture and context in which they are taught.
It can, therefore, be argued that this has created a perhaps involuntary "import" of a predominantly danish contextual awareness and building vernacular into a context that is so widely different than that of Denmark and, as a consequence, the Faroe Islands have lost their once widely applied building tradition.

Additionally, the Faroe Islands only recently implemented energy demands into their building regulation. As a first step, the energy demand is only set at 70kWh/m2 per year + 2200kWh per year/ heated area compared to Denmark's 20kWh/m2 per year. While energy efficiency will not be a main focus of the thesis it is worth noting how this has created a building culture where energy inefficient buildings are considered the norm and further a building practice that perhaps lacks an environmental and sustainable way of thinking.

Point of departure
These observations made during both internships pointed towards using a tectonic analytical approach to draw experience from traditional Faroese architecture and how people used to build in this harsh environment. As building materials were scarce, the traditional Faroese building method had to rely on the efficient use of material and surrounding to create shelter. Therefore a point of departure for the project will take inspiration in Kenneth Frampton's thoughts on "critical regionalism" and will be to investigate and interpret potentials found in traditional building, to create a contemporary building dogma that is more conscious of environment, climate, material and in this way, seek to reactivate the architectural vernacular that has been forgotten in recent years.

Both authors have since April 2017 been affiliated with the research project "Urban Tranquility" and worked in the area of parametric room acoustic workflows. And as such a parallel point of departure will be the further development and implementation of new acoustic simulation software in collaboration with the Department of Civil Engineering at Aalborg University.

Designing a music conservatory was seen as a way to combine the themes of environmentally informed tectonics and acoustic simulation in design processes in one building type. This choice was only strengthened by the fact that a music conservatory would add to the already thriving music culture in the Faroes that is already growing at an ever-increasing rate.

Methodology

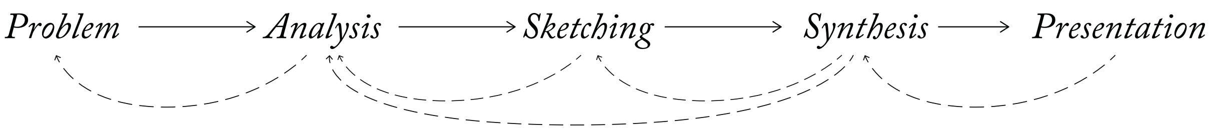


Fig. 2. The Integrated Design Proces as described by Mary-Ann Knudstrup (Knudstrup, 2003)

IDP - "The integrated design" (Knudstrup, 2003) describes a design process in five stages with the main goal of creating holistic building design through the integration of aesthetic, functional and technical aspects. The method emphasizes the iterative loop where one backtracks and adjusts throughout the phases as new problems arise and new knowledge is gathered. The initial phase, The Problem, details the foundation of the further work as the task at hand is being formulated. The second phase, The Analysis Phase, serves to be the basis for the upcoming design as knowledge is obtained through various analysis methods to create an understanding of the design conditions. This knowledge is used in the third phase, The Design Phase, where proposals are created and tested based upon previously defined design conditions. Going back and forth between sketching, analysis, and problem, one arrives at the fourth phase, The Synthesis Phase, where the material from previous phases are incorporated into one coherent design, where aesthetic, functional and technical aspects integrate are clearly visible. Finally, the fifth phase, The Presentation Phase, is where the final project is presented as a result of the previous phases still with the possibility of going back to previous phases.

IDP only describes the design process as a theoretically never-ending circle where the design would get better and better as more knowledge is gained and more loops are done. In reality, however, time is an important factor in any project that must be taken into account. The fact that any project is limited to a finite number of iterations means that careful considerations must be made in order for the design process to stretch over as much of the time frame as possible. When moving from conceiving ideas to testing design, the time it takes to complete an iterative loop will inevitably increase, as the synthesis of design requires thoughtful implementation of multiple parameters at once. Computational simulation is a powerful tool in terms of making well-informed decisions regarding the direction of the design. However, the creation of simulation models, simulation time, calculation time etc., acts as a bottleneck when dealing with the integration of technical aspects of architecture as each iteration in the process often requires a completely new set of simulation models, as well as added calculation time.

Optimizing the workflow of all parameters would have an indisputable effect on the design process as this would allow for more time to explore the architectural search space and in an ideal world, ideas would be able to be tested immediately after inception, a notion described quite precisely by Airbnb's technology lead Benjamin Wilkins:

"The time required to test an idea should be zero" (Airbnb.Design, 2017)

As a portion of this master thesis is based upon the development of new acoustic simulation software within the framework of parametric modeling, it is important to acknowledge the effect that simulations have in a design process. While simulation, in general, can be an incredibly effective tool in an iterative process, it cannot be understated that one must be aware of the quality of the input data and simulation model, as faulty or inaccurate inputs will inevitably cause unusable outputs. It is important to note that any simulation or calculation software is close to unusable without adequate knowledge of the calculations behind it, as one must always be critical of results.

The notion of using computational methods in an extensively informed design process is discussed in the paper Integrated Design Processes by Sequential Primary Generators by Isak Worre Foged. The paper discusses how software systems become more fluid and robust in their functionality as computational handling power increases, but it is argued that a gap between the free conceptual-based design process and the problem-based constrained building information process exists even though they should ideally inform each other. While parameter informed design supports the integrated design philosophy, it is argued that increased use of computational methods and implementing a multitude of parameter sets that relate to the design problem may halt the combination of systematically informed, yet creative and impulsive design process. (Foged, 2018)

"It is easy to see that, with the increased use of computational tools, this kind of event[computational search] is being used more and more, and the part of design that is left outside of the designers control is always bigger and bigger. However, at the end of the random event, the designer always has the choice to take or leave the result. The designer is obliged to decide how the rest of the design process will evolve, if it will be defined by the information found during search or not."

(Echenagucia, 2013:66)

The paper suggests an approach of integrating technical aspects into a creative process with the use of primary generators sequentially integrated into three key phases, element, system, and formation, with the intent of segregating aspects to allow for better integration. This is seen as a way to balance the artistic and concept-based approach with the integrated building sciences that are necessary in contemporary and future architecture (Foged, 2018)

Within the research of the paper, this approach is applied to three case courses in a university setting. In the last case, it is noted that 69 percent of students found the use of the method increased their amount of iterations and 90 % reported an increase of their skills and knowledge in parametric design. However, 78 % noted that their difficulties with implementing the techniques and methods were caused by a lack of knowledge or experience with digital parametric modeling, which challenges the notion that computational design processes limit the creative process. It is thus argued that with increased knowledge, competencies and skills in parametric one could potentially enable a similar fluency in a generation of creative iterations to that of more traditional means like sketching and physical models. (Foged, 2018)

The EMRT software package that is being developed as part of this thesis, will be a step towards creating a more efficient workflow when dealing with acoustics in a design process. The software will implement Nvidia's OPTIX Ray tracer as its main engine, utilizing the GPU instead of CPU and will cut the simulation time up to 90 times(Parigi, 2017:609). An iterative loop will, therefore, be made with much less effort, enabling the use of acoustics to be implemented much earlier and much more freely in the process. Whenever an automation process is involved in a design process, the designer's control is often part of the discussion. In a traditional point of view would argue that the automated process gains some form of authorship of the design (Echenagucia, 2013:60).

But like any part of the design process, the designer always has a choice in how the rest of the design process will evolve even if part of it has been made by an automated process. If the results are not satisfactory the designer must actively decide against the results, reformulate and regenerate new solutions or embark on an entirely new process (Echenagucia, 2013:66). In this regard, the final quality control lies with the designer. While increased speeds and more efficient tools is a leap in the right direction, it is of utmost importance to realize that the most efficient solution to any given design challenge might not possess the wanted aesthetic qualities

While not a peer-reviewed paper, a methodology based on IDP with a time aspect included is described in the master thesis "NEW HOME: A First Martian Habitat" by Antonia Pohankova and Marek Podlaha. This methodology called the TMIDP (Time Management Integrated Design Process) is developed to structure the design work in order to use the timeframe as efficiently as possible. (Pohankova and Podlaha, 2017:12) The method is divided into three main phases. The Kickoff serves as the initial phase where the task at hand is understood. The Design Phase is where the iterative process takes place and the project advances towards a solution. Finally, the Acceptance phase occurs close to the deadline when there is no more time left to advance the project. These phases are divided into seven stages, five of these being the phases from IDP. These seven stages are represented as circles with the surrounding surface representing the unaddressed complexity of any given phase. The first circle, the task, is where the design brief is being understood and a program is being developed. As shown by the surrounding surface, there is already some unaddressed complexity at this stage as there is unfamiliarity with the project. The second stage the analysis where one discovers the challenges and focuses that need to be addressed through the design. In this stage, the largest amount of complexity of unanswered questions is added to the project. In the next five stages largely based on the IDP, this complexity is being addressed through iterative loops. (Pohankova and Podlaha, 2017:12) It is important to approach the Line of Over Ambition to ensure the strongest possible project within the given timeframe and additionally, it is crucial to make as many iterations as possible and thus it is important to stretch the design phase over a majority of the timeframe. (Pohankova and Podlaha, 2017:12)

This expanded system will be used as a way to structure a complex project to make the most of the limited timeframe. In order to move forward at all times, it is especially important to do the task stage as thoroughly as possible, so the understanding of the project itself will not have to be revisited at a later stage.

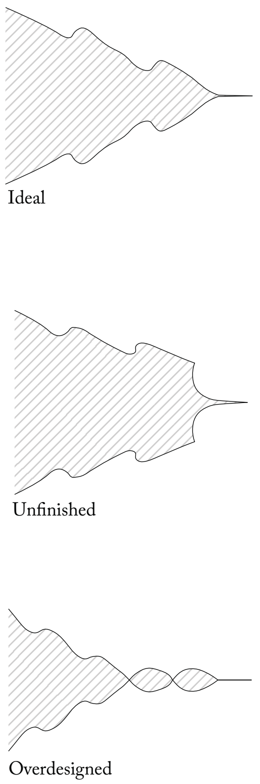


Fig. 3. (Above) Variations of the design process (Pohankova and Podlaha, 2017:12)

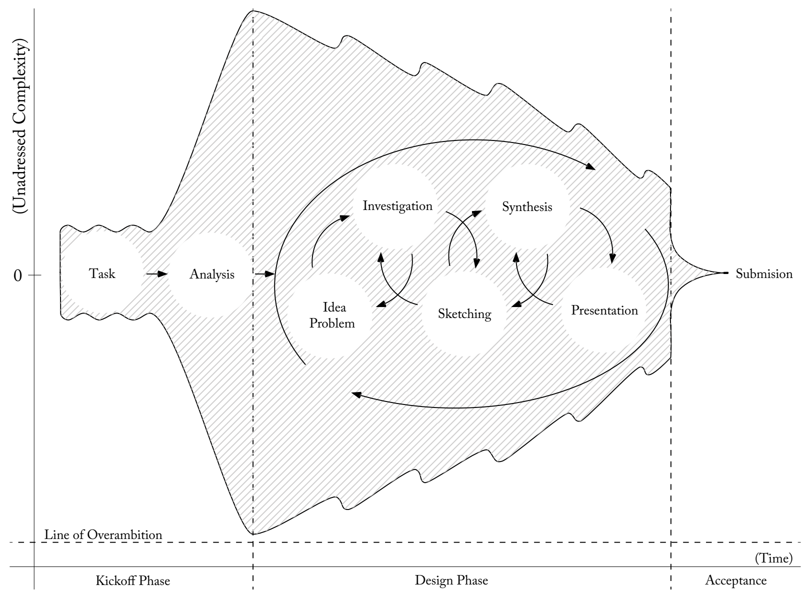
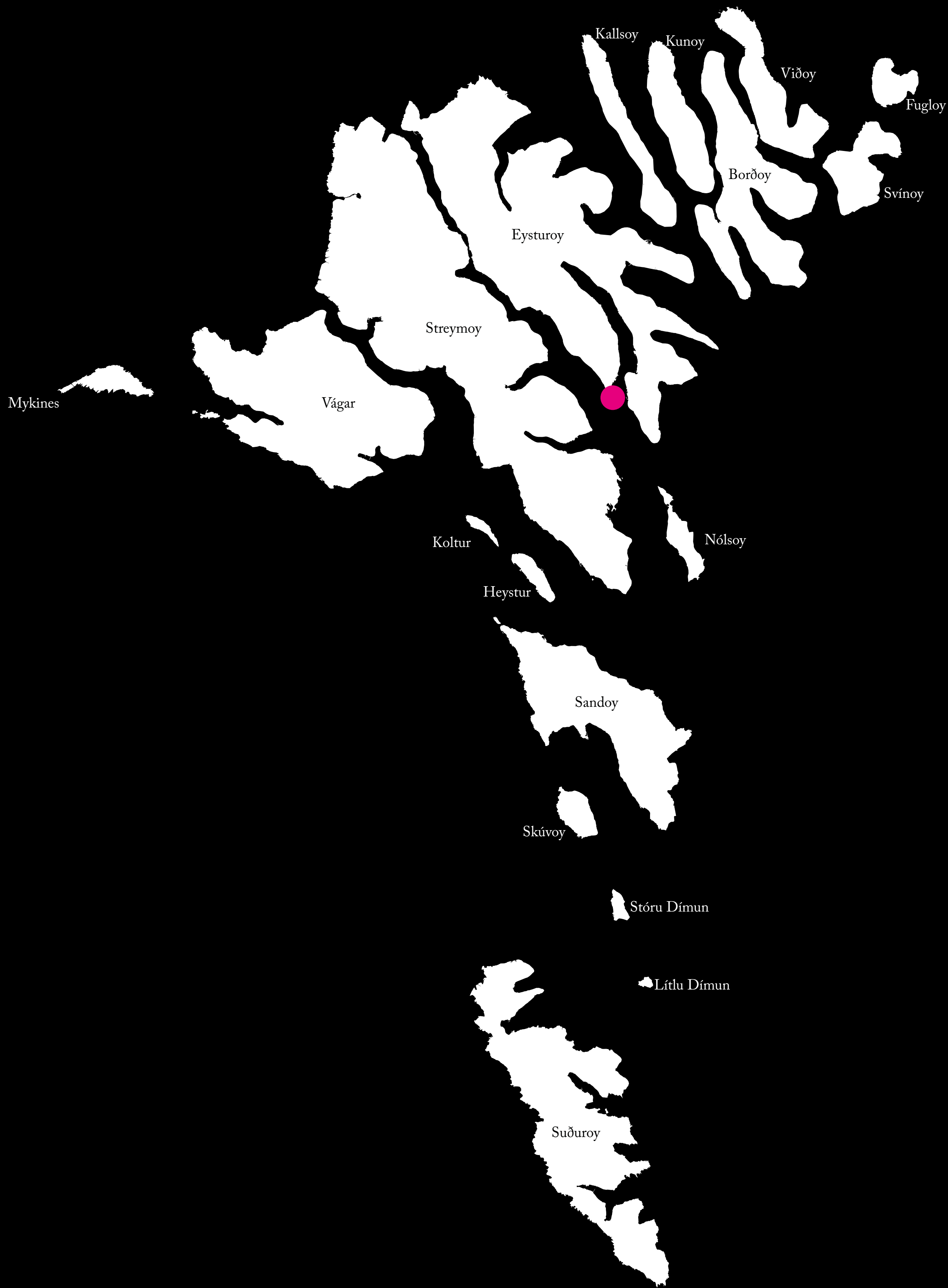


Fig. 4. (right) The TMIDP Method. (Pohankova and Podlaha, 2017:12)


Kallsoy
Kunoy
Viðoy
Fugloy
Borðoy
Svínoy
Eysturoy
Streymoy
Vágar
Mykines
Koltur
Heystur
Nólsoy
Sandoy
Skúvoy
Stóru Dímun
Lítlu Dímun
Suðuroy

The Faroe Islands

Fig. 5. The Faroe Islands, with the site highlighted. (o.i.)

"Far out in the gleaming ocean lies a small leaden-colored land. In proportion to the immense ocean, this tiny rocky land is like a grain of sand on a ballroom floor. Yet beneath the looking glass, this grain of sand is a whole world of hills and valleys, bights and fjords, and houses with people."
(Heinesen, 1950)

Isolated in the middle of the North Atlantic lies a land of unfathomable beauty with its own unique cultural identity. The archipelago was forged by volcanic activity, creating a landscape that seems to rise from the ocean.
This geological origin is very visible to this day and is clearly seen in the Faroese coastline, with its tall, jagged and uninviting rock formations. These cliffs are the home to countless birds, some of the only indigenous wildlife on the islands and an important part of the Faroese diet to this day. The inner fjords are however shaped by glacial movements and contrast the coastline by having a much more gradual slope towards the much calmer water. As the fjords as sheltered by mountains, nearly all settlements on the islands lie in connection to a fjord, and thus the geography has in large shaped the Faroese culture, self-understanding, and way of living.

The Faroe Islands are in many ways a land of contrasting scale. Having its own political and economic system, own language and culture, and its own football team that competes with much larger European nations, makes it a full-scale country. All this in a very small geographical area of 1400 m2 with only 50.000 people.
While the geographical size is small, it is easier to feel infinitesimally smaller when standing in the untouched nature amongst awe-inspiring mountains, imposing cliffs and sweeping fjords.

The Faroe Islands have described as "untouched by time" and while the country has strong ties to its history and traditions, it is however still a modern society with all the amenities of any other western society. The largest city Tórshavn is a thriving capital like any other. With only 12,981inhabitants (Statbank, 2017) it is often referred to as the smallest capital in the world, as it has a wide variety of cultural offers and institutions like any other metropolis but on much smaller and condensed scale.

The Ocean

The rivers they run, dancing down the mountains.

Turns to waves in seas of blue and motion.

The water is cold but soft and kindly giving life to all.

Embraces all the living.

- Marius Ziska, "Going Home"

The ocean is an entity that gives and takes. Since the first humans settled on the Faroe Islands the ocean has been the livelihood of the inhabitants. Before the introduction of domesticated sheep, fishing and to some degree whaling, has been the primary source of nutrition and continues to play a huge part of the Faroese cuisine to this day. In the words of the Faroese musician Marius Ziska, the ocean is connected to all life in this harsh climate. Yet the ocean can also be unforgiving. Countless Faroese men throughout history have lost their lives on the sea while trying to provide for their family and their community. Wives and children have been left without a husband and a father. This harsh reality has shaped the Faroese as a determined and resilient people with a will to survive against all odds. This duality of the ocean is perhaps also why the ocean inspires such awe in the human mind, not only on the Faroe Islands but across the globe. When faced with the sea, man is reminded of the scale of the world around him. The vastness and serenity of a calm sea can with its rhythmic and quiet sound inspire and soothe the human mind. Simultaneously, a rough sea at a windy coast, the roaring sound of crashing waves creates a sense of awe and might and perhaps insignificance. The ocean is one of the very few things that man has not tamed and has no control over and one of the very few places on earth that is left to be fully explored. The ocean has such a draw because it doesn't care about man or his problems. It doesn't care about rent, relationships or careers. And it is huge. When standing at the right beach, the ocean fills the entire periphery and from one's feet to forever into the distance and makes man insignificant. In that regard the ocean is dispassionate.

You stand in front of it with the intent to make it your subject. Yet it makes you its own.

In a historical context, the main form of transportation has been by boat. An old Faroese saying even says: "Bundin er bátleysur maður" (bound is the man without a boat) a testament to the importance of sailing in a time where a lack of roads made the terrain itself hard to traverse. The impact that the ocean has had on the Faroese culture is even expressed in their love of sports. The national sport Kappróður (boat racing) is beloved by most Faroese and the annual championship held at the national day Ólavsøka is attended by tens of thousands. The boat that is used is a uniquely constructed competition boat found nowhere else in the world and as derived from the traditional boats once used for transport and fishing.

Fig. 6. Crashing waves at the cliffs of Gjógv, Eysturoy. (o.i.)

Community aspects

Fig. 7. "Aftur av jarðarferð" (Return from funeral) 1937. Oil on canvas. 236 x 173 cm by Sámal Joensen-Mikines. Scan graciously provided by Lisasavn Føroya.

In such an isolated and harsh climate the notion of community has been a vital part of the Faroese culture and self-understanding. With an overall population of only 50.000 people primarily distributed in small villages, inhabitants are more likely to know each other and be aware of the community they reside in. This uniquely Faroese sense of community is, paradoxically, perhaps most clearly seen in the grindadráp (pilot whale killing) - a highly organized and traditional catch that is executed on a communal level. When a school of whales is spotted, the community will drop everything and come together for the common good. After the initial beaching of the whales, a district administrator will calculate the share of meat and blubber each person will receive and distribute tickets to participants, all according to the number of people who participated in the hunt and the amount of whales caught. After handing out the tickets, people who share a whale will then butcher the whale together. The distribution is based on solidarity, it does never involve money of any kind and it is done as equally as possible.

Typically residents in the area will receive a share even if they did not participate in the hunt and is an especially important supplement for low-income families.(Whaling, 2017)

Accounts of this communal sharing go back to 1584 - presumably the longest continuous record of any use of wildlife in the world. (Whaling, 2017)

The loss of a member in such a small tightly knit community is of course very tragic, and is expressed in the way that Faroese people deal with death and funerals. Funerals are often attended by the entire village and the local church is typically filled to capacity, often overflowing.Before the introduction of cars, distant relatives would often travel long distances by boat to attend a funeral meaning it was customary to provide a meal and accommodation after a funeral. While accomodation is no longer expected, a warm meal is still served before coffee and cakes. These communal aspects can also be seen in something as simple as the radio where all deaths on the Faroe Islands ara announced daily.

Kvøldsetur

1 (trad.) Evening seat [moment of rest after the day's work]

2 (mod.) Literary and musical evening

Due to the harsh climate, interaction is often confined to indoors especially during winter. Much like it's Nordic neighbors this has created an indoors or "at home" culture. Visits to friends and family are often unplanned and casual. Often, one simply enters without knocking and shoes are removed once inside. It is then customary for the host to serve tea or coffee with cake or cookies. In a historic context this interaction between family and neighbors was referred to as Kvøldsetur and is most often used when describing the long winter evenings spent indoors where less strenuous activities such as carding, spinning, and knitting would be performed, but also forming the setting of traditional faroese storytelling, oral literature and singing (Green, 2012). This has not only formed this very unique social gathering form, but also helped sustain the Faroese language, history and literary history in times when the language was outlawed.

Faroese Music Culture

"There is nothing more to be said or to be done tonight, so hand me over my violin and let us try to forget for half an hour the miserable weather and the still more miserable ways of our fellowmen." - Arthur Conan Doyle, The Five Orange Pips. (Doyle, 1891)

The "at home" culture was of tremendous importance in terms of creating and preserving Faroese language, oral literature, and musical traditions. This has spawned a uniquely Faroese music experience fittingly named "Hoyma" - an old Faroese word for Home held annually in the village of Gøta. During this event, ten local families invite anyone interested into their homes and set the stage for 20 local musicians. People walk from door to door to witness raw and intimate concerts, all performed unplugged and without lighting systems (Visit Faroe Islands, 2016). A new interpretation and rejuvenation of the old concept of "kvøldsetur". The artist themselves are of a wide variety ranging from Grammy-nominated singers and classical guitarists to reclusive folk heroes with Dylan-esque status (Stewart, 2014). While the music plays a tremendous part of the experience, the act of walking from door to door in the dead of winter, getting offered a schnaps at every door, interacting with locals and meeting new friends, is of equal importance.

Kvæði
Heroic ballad, folk ballad

When examining the Faroese music tradition one cannot avoid perhaps the most characteristic Faroese song form; the "kvæði", long and stanzaic heroic ballads that details the pre-Christianized time of the Faroese history, closely related to the Icelandic sagas (Green, 2012:44).

Føroyskur Dansur
Faroese dance or "Chain-dance"

Skipari
1 (sj.) Organizer, person in charge of the arrangements

2 Leader of the singing/chanting (of a Faroese chain dance)

3 Shipmaster or captain

The Skipari is expected to know the entire kvæði by heart and sets the rythm and speed of the dance.

These ballads were sometimes with a length of several hundred verses and were often performed and taught to the next generation during the "kvøldsetur". The audience was knowledgeable in the ballads and would correct the singer if he or she would deviate from the known text. (Green, 2012:47). Closely associated to the kvæði is "Føroyskur Dansur" that is mostly danced at special occasions and accompanied only by singing. People join together hand in hand to form a circle and one person, the "Skipari", leads the song while the dancing crowd sings along during choruses. In earlier times this form of song and dance was incredibly prevalent in many aspects of a Faroe Islanders life, ranging from celebratory events to a way of keeping warm after treading the icy waters after a whale slaughter. It still is a large part of the culture, it's common to see this dance at weddings and other social gatherings, some schools will include it as an extracurricular activity and also do it for particular days of the year, most school children know multiple kvæði by heart.

As mentioned, the dances were only accompanied by singing as musical instruments were quite rare in the Faroe Islands, especially outside of Tórshavn up until late in the 19th century, where the Dane Georg Caspar Hansen came to the country and began teaching various instruments (Green 2012:51).

This led to instrumental music gaining popularity throughout the 20th cen-

Fig. 8. Høgni Lisberg(Acoustic Guitar) and Benjamin Petersen(Electric) performing at Hoyma 2014. Picture by Krístríð Tyril.

tury, until becoming a staple of Faroese life.
The Faroe Islands today have a thriving music scene that still has a heavy focus on live performances, perhaps because of the heavy tradition of performing for the community. On any Friday or Saturday, one can expect to find high-quality live music in virtually any bar on the Faroe islands, no matter the size. Additionally, there are numerous concert venues where paid concerts are held with more established artists. Despite the small size of the country, the Faroe Islands have a domestic record label TUTL with a roster of over 500 releases since 1977 (Faroe Media, 2017) and with the aim to spread the Faroese Music profile across the globe.

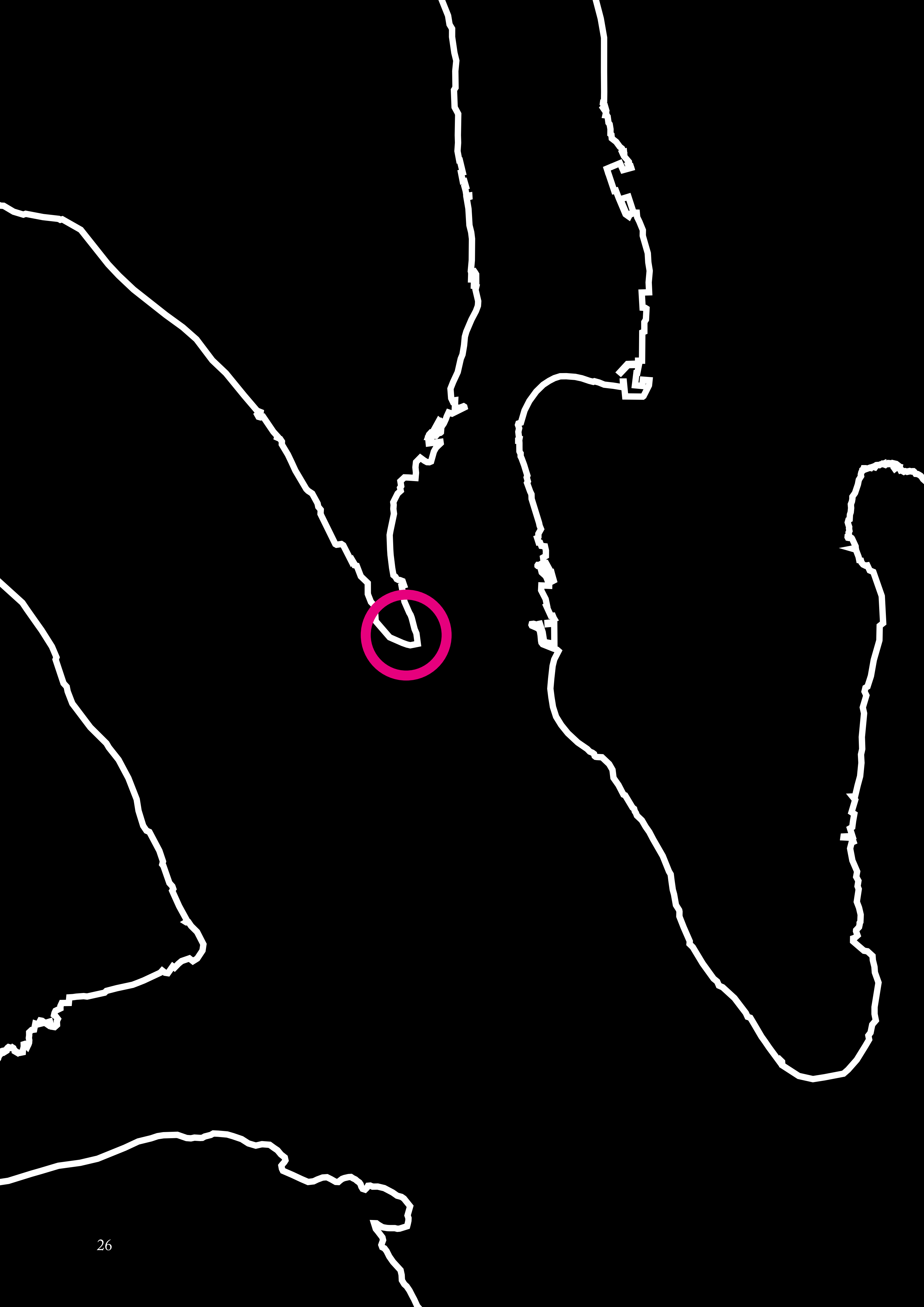
While the country's most renowned artists are undoubtedly Teitur and Eivør who both have enjoyed long international careers, other lesser known artist has also enjoyed international acclaim. Within the niché of metal, the Viking metal band Týr that like the traditional kvæði draw heavily on Viking sagas and mythos must be mentioned. Greta Svabo Bech is another notable artist, who was the first Faroese Musician to be nominated for a Grammy for her work with Canadian producer Deadmau5 (Bech, 2016).

Infrastructure - Eysturoyartunnilin

Fig. 9. The route of the Eysturoyatunnilin connection Hvítanes, Streymoy to Strendur and Runavík, Eysturoy. (o.i)

Eysturoyartunnilin is an ongoing tunnel project connecting the two biggest islands of Eysturoy and Streymoy, scheduled to be opened in 2019 or 2020. With its 11 km, it is gonna be the longest of the three undersea tunnels on the Faroe Islands. The tunnel has an undersea roundabout that directly connects Hvítanes close the capital Tórshavn to Strendur and Runavík on opposing sides of the Skálafjørður, hereby making it easily accessible for a large portion of Eysturoy and will increase mobility for not only the average Faroese person but also public administrations and companies. Due to the large number of jobs and companies located in Tórshavn, the Eysturoyartunnilin is expected to shorten the daily commute by up to an hour and a half for several thousand people. (Eystur- og Sandoyatunlar, 2016)

With the general addition of tunnels on the Faroe Islands, both under and above the sea, up to 90% of the Faroese population is connected through one network of roads marking a giant improvement of the Faroese business, cultural and social life (Eystur- og Sandoyatunlar, 2016). Specifically, Eysturoyartunnilin will decrease the travel distance from Tórshavn to both Runavík and Strendur from 55 kilometers to only 17 kilometers and shorten the time from 64 minutes to only 16 minutes. Additionally, the drive from Tórshavn to the second largest city Klaksvík will be shortened from 68 to 36 minutes. (Eystur- og Sandoyatunlar, 2016). It can further be argued that when the driving distance becomes a significantly smaller factor, new areas of the Faroe Islands where the population foundation was previously too low, will suddenly become viable due to an increased availability of services. After the completion of the Eysturoyartunnilin up to half of the Faroese population will live in an area where the driving distance is insignificant. Further, it may prove to be a catalysator for of the villages outside of Tórshavn, as housing is significantly cheaper in these areas of the country and thus it may be a viable option for many families to settle in these areas while still retaining the option of being close to the opportunities in the capital.



The Site - Raktangi

Fig. 10. Location of site, at the mouth of Skálafjørður. (o.i)

Place and history

"Raktangi" is a tongue of land situated in the southern part of the island Eysturoy. The land formation darts into the Atlantic ocean and forms one half of the entryway to Skálafjørður - the Skála Fjord. Like most of the Faroe Islands, the rugged landscape consists of grass and moss covered basalt with scattered rocks of varying sizes, dropped from the glaciers that once carved through the landscape.

Historically, the site has been used by local farmers as grazing grounds for sheep, a role it continues to have to this day. Local accounts also tell that the villagers of Strendur used the exposed rocks in the far northern part of the site to dry fish during summer. The only structure that is present on the site is a small shed that once stored the dynamite that was used in a nearby quarry.

Arrival - departure

The mountainous terrain of the Faroe Islands has shaped the infrastructure into one where roads sometimes have an abrupt end when mountains prohibit the road to continue. This is the case on the southwestern part of Eysturoy meaning that the site is exclusively accessed from one direction. The new tunnel will also become a part the arrival experience for anyone other than the people living in the northern parts of Streymoy and Eysturoy.

As Tórshavn is the cultural center of the Faroe Islands and contains approximately 40% of the population of the country, one must consider the experience of going from this busy and relatively densely populated urban area to the remote area of Raktangi.

Fig. 11. The view towards Streymoy and the western "arm" when leaving the site. (o.i.)

After leaving Tórshavn by car or public bus, one must drive north along the rocky eastern coast of Streymoy. During this drive, the small Island of Nólsoy can be seen floating above the Atlantic just outside of the capital. When approaching Hvítanes, it is actually possible to see Raktangi and thereby giving a preview of the arrival before the Faroese scenery is cut off by going into the tunnel. After eight dark minutes under the Atlantic ocean reemerging is done in the village of Strendur, the settlement closest to Raktangi. While Strendur is a relatively small village of 808 inhabitants it has a large school, an old traditional church, a local doctor, a frequently used community house and is perhaps best characterised by its thriving industrial harbor with two fish processing factories.

Fig. 12. Northeastern view towards the village of Strendur. (o.i)

On the site

After driving along the coast through Strendur one arrives at the opening of the Skálafjørður before being greeted by a lonely narrow road that leads onto the tongue of land. Parking can be done at a memorial for local sailors lost at sea before it is ultimately necessary to continue by foot past the old dynamite house onto the most southern part of the landmass. Here, on the edge of a cliff, the true face of the Faroe Islands reveals itself. The sound of the crashing waves on the rocks below mixes with the faint sound of bleating sheep, yet it feels as though there is silence. And while a variety of villages can be seen towards east, west, and north, the site feels uninterrupted as man-made structures seem to fade away in the presence of the mountains that inspire a sense of might into the human mind. A feeling that is well described by the tourist board "Visit Faroe Islands"

Fig. 13. Photo showing the western side of the site

"Sometimes during the summer, when you experience sharp contrasts of light, or during the winter, when mountains and slopes are black and white with snow, you may think that Nature herself has given shape to the greatest pieces of architecture in the Faroe Islands.

At this scale of observation, houses and buildings scarcely exist, and you have to turn on the binoculars of your mind to see any sign of human constructions in the overwhelming structures of the landscape." (Visit Faroe Islands, 2016)

While the vast scale of the surrounding views on the site is easy to appreciate, the site offers intricate detail to be explored. One of the most interesting features of the site is the fact that the eastern and western sides of the narrow piece of land possess two very different characteristics due to different degrees of erosion. The Eastern side contains a steep cliff with exposed black basalt in varying textures ranging from smooth to jagged - a testament to how the rock was formed by volcanic activity in a distant past.

The western side, however, has a much more gradual slope that ends in a plateau close to the ocean where sheep can find shelter in a seyðaból. Where no rock is exposed the site is covered in numerous different types of moss and grass in various lengths that offer a soft underlay and a stark contrast to both the color and texture of the Basalt. The grass and moss take on a wide variety of colors depending on the season, ranging from deep emerald green in the summer to yellowish brown in the winter.

Fig. 14. Conceptual section of the site, showing the stark contrast between the two sides.

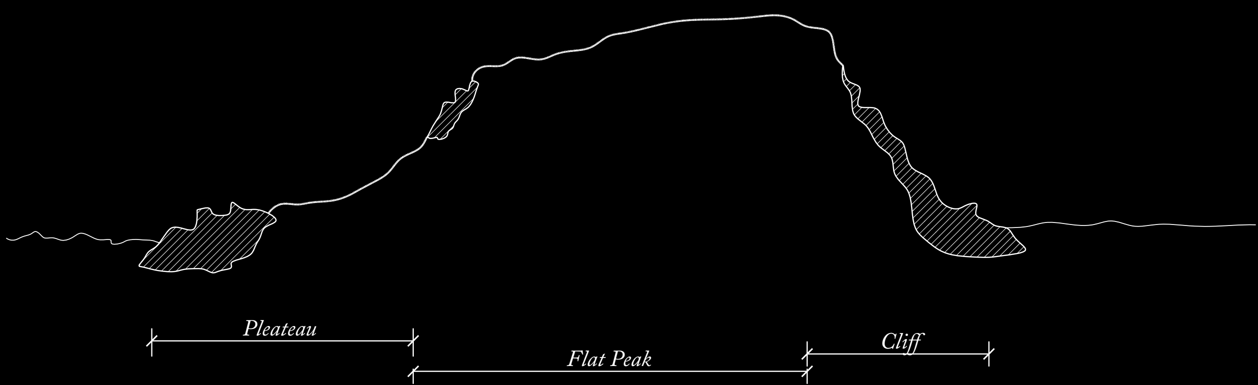
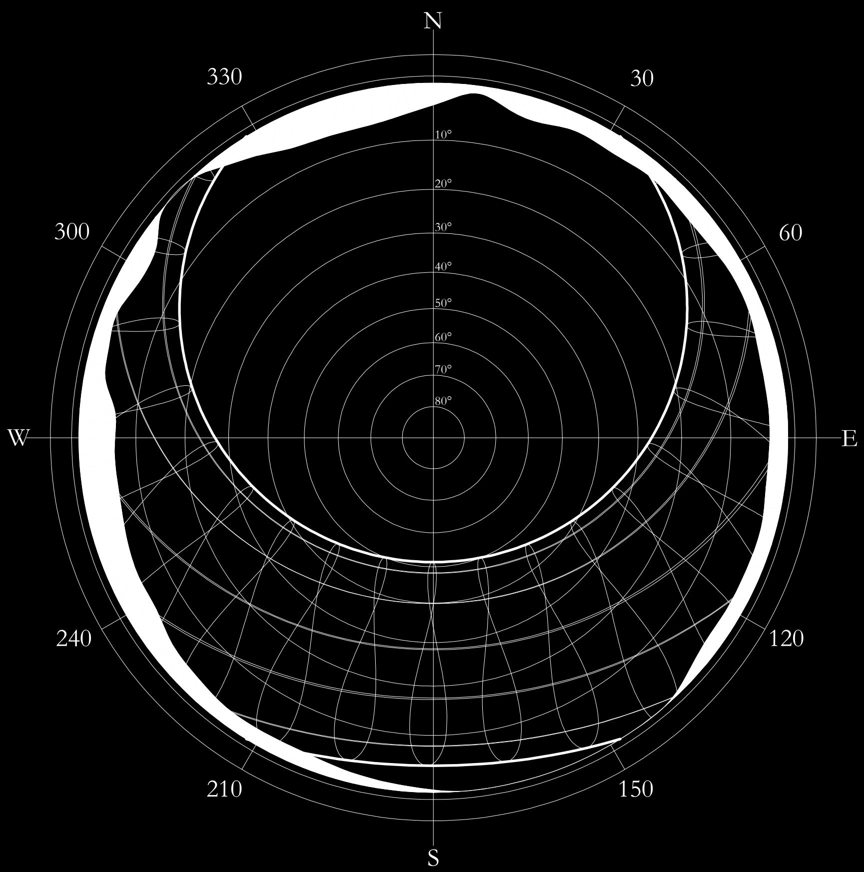
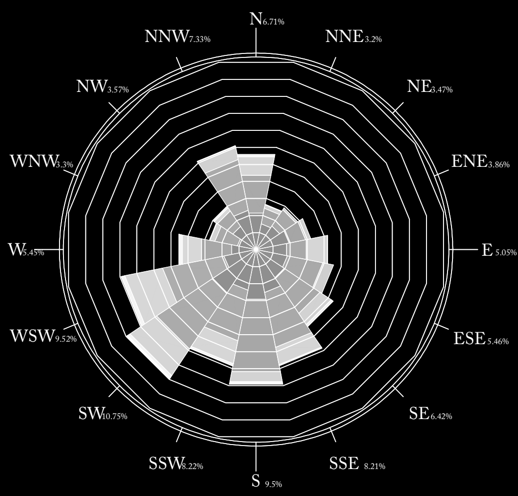
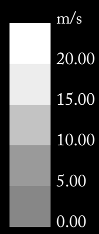

Pleateau
Flat Peak
Cliff

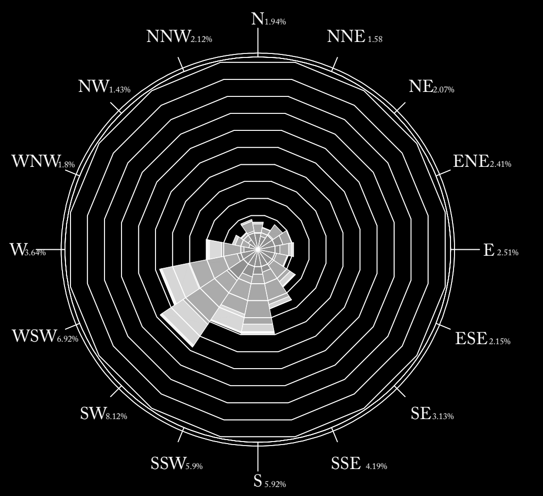
Fig. 15. Panorama towards the south from the site.



Sun-Path Diagram - Latitude: 62.09°
Terrain Shading mask Applied







Wind-Rose
Raktangi_Strendur_Faroe Islands
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 0.00% of the time = 0 hours.
Each closed polyline shows frequency of 1.2%. = 105 hours.

Wind-Rose
Raktangi_Strendur_Faroe Islands
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 0.00% of the time = 0 hours.
Each closed polyline shows frequency of 1.2%. = 105 hours
Conditional Selection Applied:
Wind Speed > 0.2 m/s
and Dry Bulb Temperature > 6˚
4890.0 hours of total 8760.0 hours (55.82%).

Weather and Climate

Introduction

With a location as remote and as northern as the Faroe Islands, it is no surprise that the weather brings a few challenges with it. The North Atlantic sea creates harsh winds and very diverse climate settings, even on a daily scale. However, the North Atlantic also creates a strong warming influence with the Gulf Stream, making for a surprisingly mild climate, temperature wise. Though weather data is plentiful there has not been done any design reference years or any weather files fit for simulation. The data that will be shown is, therefore, a weather file created with the ShinyWeather web application created by Lukas Rokka(Rokka.shinyapps.io - Shiny Weather Data, 2018). The application combines the MESAN dataset(SMIH) created and maintained by the Swedish Meteorological and Hydrological Institute(SMHI), with the SMHI STRÅNG(STRÅNG) radiation modeling system data.

Fig. 16. Solar path diagram with shading mask from the surrounding terrain applied.(o.i)

Solar situation

With a northern latitude, the Faroe Islands have a large contrast between the summer and winter solar conditions. Whereas 21st of June has 19 hours, 45 minutes between sunset and sunrise, days during the winter can be as short as 5 hours. Further complicating the issue is the surrounding terrain. The eastern "arm" of Skálafjørður is quite low and does therefore not create shade in working hours(8-16). Because of the extreme difference in sun angle between seasons, there will be a great challenge in creating a daylight environment that will provide as much daylight quality as possible in the winter and summer without creating excessive glare or overheating in the summer.

Fig. 17. Windrose diagram.
Left: Windrose for the entire year of 2013
Right: Windrose showing the dominant winddirection for times when outside temperature is above 6 degrees C.

Wind

As one might imagine the Faroes are a windy place, 10+m/s winds are close to a daily occurrence and its power can be felt throughout the Islands. Being in the North Atlantic the dominant and troublesome wind direction is mostly South Western, with some northern winds in the wintertime. Looking at the wind data, assumptions can be made that can be further explored with the Grasshopper plugin Ladybug, a climate data analysis tool package. This tool allows for the data to be explored in a much more user-oriented way than otherwise possible. The second windrose is one created by filtering by temperature, in this case showing times where the outside temperature is above 6 degrees, where the outdoors have the potential of becoming comfortable spaces, and thus showing the dominant wind direction to shelter the outdoor spaces against. Inversely it also shows the wind direction most likely to carry cold air into the building, possibly excessively cooling the building.

Traditional Faroese Building
A Tectonic Perspective

Much like the German architect Gottfried Semper has done before in his extensive writings about the origins of architecture, much invaluable information can be found in going back to the primitive conditions from which the first architectural forms of the Faroes came from.
Semper wrote "The Four Elements of Architecture" (Semper, 1989), as an attempt at creating a universal theory of architecture. The book divides architecture itself into four distinct elements: the hearth, the roof, the enclosure and the earthwork, exploring their origins in ancient crafts across all indigenous structures.

The hearth, framework/roof, enclosure and the earthwork are as relevant in the Faroes as they are everywhere else, the way they differ though might be in the way in which the definition of these elements can become blurred and in some ways blend together, something that will be discussed in the case study on Kálvalíð.
The definition of tectonics has many answers, and research is constantly adding and modifying what this umbrella term defines. Gottfried Semper's legendary treatise is noted as one of the first and primary arguments for the field of tectonics, Semper describes the primitive elements of architecture and further groups them in two groups; the stereotomic and the tectonic, with the mound and hearth being placed in the first and the enclosure and framework/roof being placed in the second. Semper's work has been further developed and analyzed, perhaps most famously by Kenneth Frampton in his book Studies in Tectonic Culture(Frampton, 1995) defining tectonics as the poetics of construction. The joint between the stereotomic and the tectonic becomes a vital part of this branch of tectonics, where the quality of architecture is formed in this joint. This has, perhaps unsurprisingly, created a fascination with the architectural and structural detail. Frampton goes further and explains that the quality is based on the joint between three converging vectors; topos, typos, and tectonics(Frampton, 1995:2) or in other words: Site, Type, and Tectonics.

Topography
"Before transforming a support into a column, a roof into a tympanum, before placing stone on stone, man placed the stone on the ground to recognize a site in the midst of an unknown universe: in order to take account of It and modify it. As with every act of assessment, this one required radical moves and apparent implicity. From this point of view, there are only two important attitudes to the context. The tools of the first are mimesis, organic Imitation and the display of complexity. The tools of the second are the assessment of physical relations, formal
definition, and interiorization of complexity". - Vittorio Gregotti (Frampton 1995:8)

When discussing the tradition of house building in the Faroes it becomes a necessity to mention earthwork. This all-important part of any building was essential for the success of the building. Many of the considerations that current building techniques and building technologies have made obsolete, or at the very least have "freed" architects from, were essential for the traditional builders. Wind, elevation, sun, and waterways all were essential considerations before placing valuable resources into preparing the site(Stoklund, 1996:45-47).

Critical Regionalism

"The Fundamental strategy of Critical Regionalism is to mediate the impact of universal civilization with elements derived indirectly from the peculiarities of a particular place. It is clear from the above that Critical Regionalism depends upon maintaining a high level of critical self-consciousness. It may find its governing inspiration in such things as the range and quality of the local light, or in a tectonic derived from a peculiar structural mode, or in the topography of a given site." (Frampton,1996:21)

As eloquently put by Kenneth Frampton, the architectural approach of critical regionalism is to counter the lack of identity of a place that is a condition following the international style, yet it also is very critical of the whimsical or ornamentation of other approaches that were created as an opposition to the International Style. One should however not confuse critical regionalism as a blunt following of local architectural vernacular, rather, it is an evolutionary approach, searching to increase the interaction between the world culture and the universal civilization, i.e. the global and local languages of architecture. It would be illogical and against the notes of effectiveness to reduce the architectural search space into that which ones local vernacular holds true, rather it is important to adopt the progressive nature of modern architecture, yet hold true to the culture in which one is building.

Tabula rasa
(noun): Clean slate

Frampton also goes in depth with earthwork, calling the tabula rasa tendency of modernization to reduce the intricacies of a local topography into a flat site as a gesture which aspires to that of placelessness. Rather, Frampton proposes to follow a method of "in-laying" the site, finding an expression for the idiosyncrasies of the site without sentimentality. As with topography, the heavy-handed modernistic approach to architecture is also evident in its approach to climate and light; rather than a reaction to the local forces of the climate, modernism seeks out universal solutions to local problems. It is therefore vital when adopting a modern architecture that one stay critical about its universal qualities. Emphasis should be put on the tactile and tectonic aspects of architecture as a way of resisting the domination of universal technology.

"The Tactile and the tectonic jointly have the capacity to transcend the mere appearance of the technical in much the same way as the place-form has the potential to withstand the relentless onslaught of global modernization." (Frampton, 1996:29)

Fig. 18. Illustration displaying the relation between natural rockforamtions and the traditional craft of drymasonry. (o.i)

Many parallels can be drawn with the domination of modernism in the world and the application of Danish architectural values in the Faroes. With Danish architecture school being the primary breeding ground for the Faroese architect, a similar dissonance can be seen between the applied or imported style and the tradition of Faroese building. Much like an invasive species, the imported values of the Faroese architecture has created an ill-fitting architecture, one that has not allowed the local traditions to evolve into the modern era, but rather killed them off completely.

Availability of materials in the Faroes
In a country completely barren of any trees, it stands to reason that timber fit for construction would be in short supply. While imported timber was seen as very expensive the citizens had other sources of wood, namely in the form of driftwood(rekaviður). Large logs and sections of wood would be found on beaches and there are accounts of whole houses being built solely with driftwood. Wood as a highly praised object can also be read in one account of Anton Wilhelm Brøgger: "A boat crew once sailed from Vágur, Suðuroy to the village of Saksun, Streymoy to collect a single log that had washed ashore. The boat crew spent three days bringing the log to their home village, but in the end, there was enough material to build an entire farmhouse" (Brøgger and Jóannes, 1937)

Considering this lack of timber one would imagine that the local building traditions would be centered around a minimal use of timber. This is not the case in the Faroes, timber is, though mainly within the residential houses, used extensively. So extensively in fact that the traditional Faroese house is, in reality, a timber house, with an enclosure of stone(Fig. 1) (Stoklund, 1996: 58).

The Faroese building method is an evolution of the West Norwegian methods of building. The Faroese house has, in reality, most of its parallels with the middle age Norwegian Stave Churches, with large columns in the corners and a circuit of wood beams with rafters being placed on these beams to carry the roof.



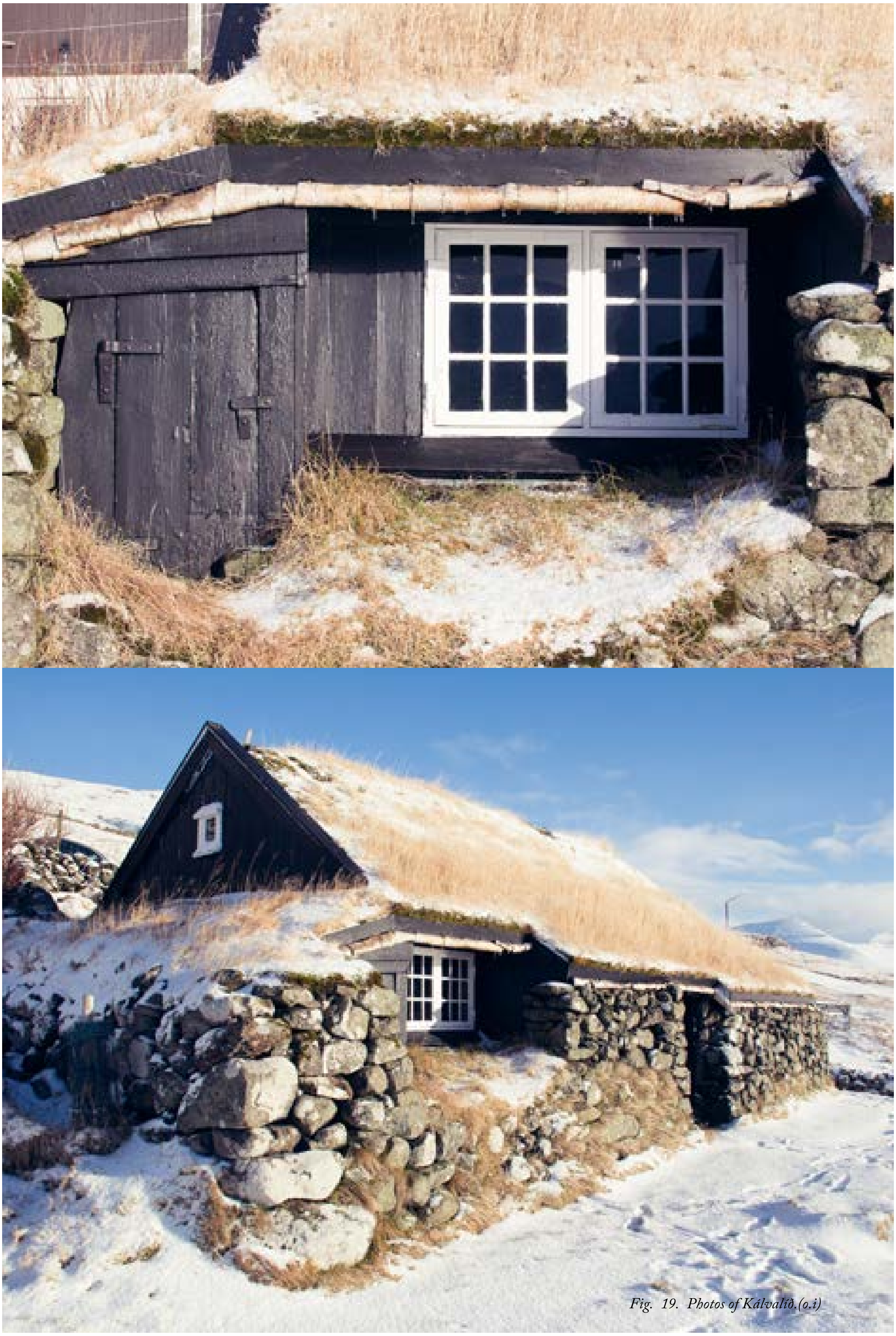
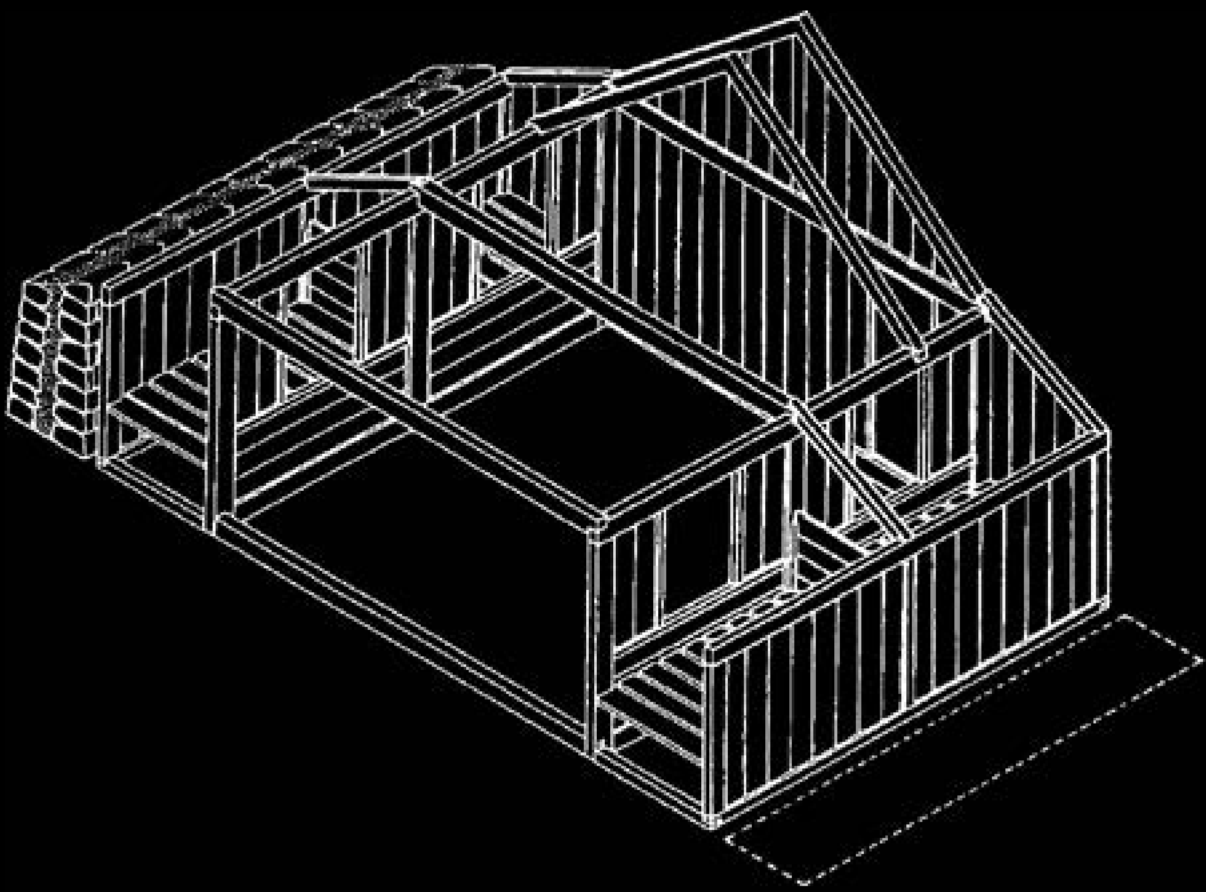


Fig. 19. Photos of Kálvalíð.(o.i)



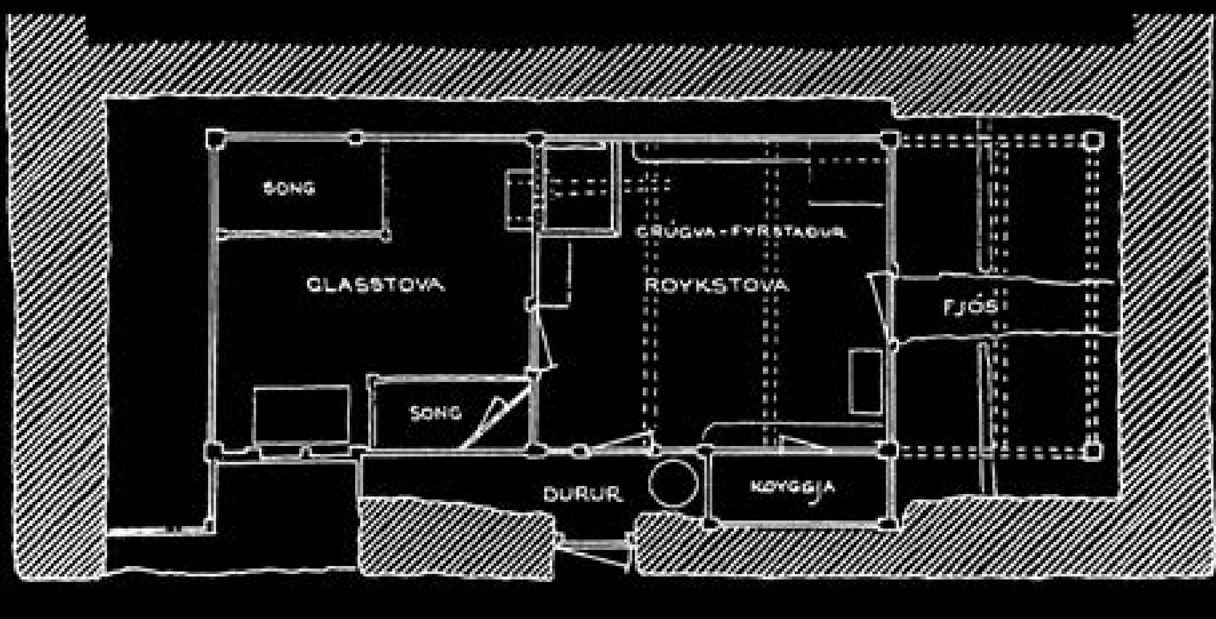

SONG
GLASSTOVA
SONG
GRUGVA - FYRSTADUR
ROYKSTOVA
FJÓS
DURUR
KOYGGJA

Fig. 20. Axonometric view showing the construction of a traditional Faroese house. Drawing by Bo Giersaa.

Roykstova

(gl.) [front room (smoke room) without a board ceiling, where the hearth (grúgva) was situated and with a smoke hole (ljóari) in the roof ridge. The roykstova served as kitchen, workroom, living room, and as sleeping quarters]

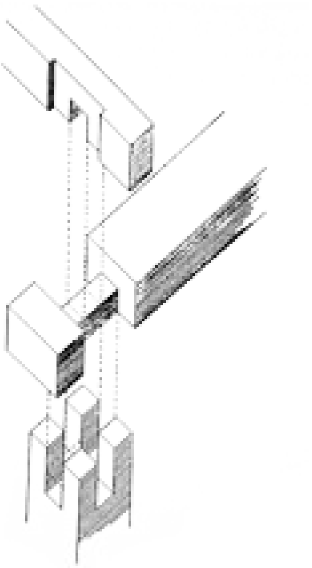


Fig. 21. Axonometric detail of the corner column joint in Kálvalíð. Drawing by Lars Davidsen.

Fig. 22. Plan of Kálvalíð. Drawing by Curt V. Jessen after measurements by K. Kristoffersen

Kálvalíð

In the case of Kálvalíð, the earthwork was done in such a way that the lowest point on the roof facing the slope was touching the ground, this creates a house that very much blends into its surroundings almost becoming one with its terrain. After the earthwork is done, large stones(syllusteinar) are placed on the plot, these form the foundation of the framework that will be built on the site. The construction is based around the timber framework as discussed, with corner columns and a circuit of beams both over and under these(Fig. 20), in the case of Kálvalíð, there are also placed columns along the wall for added strength(Fig. 22). Across this circuit are placed beams going through the upper circuit of beams, joined with a mortise and tenon joint. Between the two circuits of beams are wood panels placed into groves in the beams, both to create space creating walls, and for added stability for the construction. The roof is added to this framework with rafters, with no collar-beam, though in the case of Kálvalíð some windbraces out of timber are placed diagonally between the rafters.

This entire timber construction gets enclosed with a dry masonry wall, the dry masonry wall is, in reality, comprised of two walls(Tvílaða) constructed parallel to each other with earth, peat, and gravel between them.

The plan of Kálvalíð clearly shows the importance of the Roykstova, with the hearth placed in the corner, this room became the main living space for the family that lived there, With rammed earth flooring and rustic decoration the roykstova is clearly as much workspace as it is living. The roykstova was used for all indoor activities, be it knitting, singing, storytelling, butchery, eating, cooking, and a host of other activities. The roykstova has no natural light except for the ljóðari, the light created from the ljóðari is almost ethereal and surprisingly effective. To the east of the roykstova is fjósið, the shelter of the family milking cow, a symbiotic relationship where the cow brings heat into the house. To the west of the roykstova is the Glassstova, the only room in the house with a window, hence the name. This room has wood flooring and generally a much higher level of finish both in construction and furnishing. This is where the master of the house and his wife would sleep and entertain the finer company. Another aspect of Kálvalíð that can also be seen in most traditional Faroese houses is the usage of the space between enclosure and framework, in the case of Kálvalíð a ventilated storage space is placed to the west of the Glassstova, accessed from the outside. Additionally, there are is a single alcove in connection to the roykstova, this created a private space, in this case, believed to be a sleeping space for the children. This type of alcove is very common in most Faroese houses, creating secondary or even tertiary spaces connected to the hearth room.

While the very precise use of different construction elements and how they would best be utilized, were closely considered and easily readable to this day, one must also acknowledge that the spaces themselves connect are in a way tectonic. The hearth is the programmatic and compositional center of the work and the joinery and relation between other spaces are perhaps as important as the system of joinery in the construction itself.

Acoustics

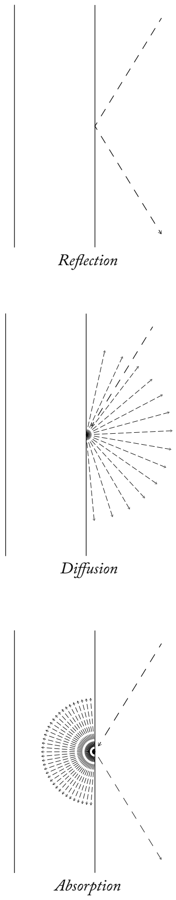


Fig. 23. Diagram showing the way surfaces can interact with sound energy.

EDT:

Reverberation time measured over the first 10 decibels of the decay. (s)

D50:

Early to total sound energy ratio (%)

C50:

Early to late sound energy ratio (dB)

Experiencing space through sound

"Sight isolates, whereas sound incorporates; vision is directional, whereas sound is omnidirectional. The sense of sight implies exteriority, but sound creates an experience of interiority. I regard an object, but sound approaches me; the eye reaches, but the ear receives." (Pallasmaa, 1996)

The acoustic, compared to the visual, is too often considered as an afterthought of the creative design process. Though it is not easily expressed, our bodies have an innate sense of the sonic space surrounding us. Hearing the structure creates an understanding of the space on a more intimate level than merely visual. The ear can pick nuances not only in the shape and size of a room but also the tactility and materiality of the room. This is clear even in everyday life when entering the bathroom of one's home and feeling the reflectivity and reverberation of the hard tile walls(Rasmussen:1966).

Architects have been fascinated with room acoustics since the dawn of architecture, yet the first scientific study and the dawn of the field of architectural acoustics came as late as the 19th century. Wallace Clement Sabine, a young physics professor at Harvard University, was tasked with studying the acoustic issues in Harvard Universities newest lecture hall, the Fogg Art Museum. Through careful experimentation and thousands of measurements, Sabine formally defined reverberation time as the number of seconds before the intensity of sound drops by 60 dB from a specified intensity(Long, 2005:300). Reverberation time is still in use to this day as one of the primary measurements with which acoustic are still judged. Further Sabine discovered the Sabine Formula, a formula describing the relationship between the volume of a space and it's material absorption area and the effect this relationship has on the reverberation time. This allowed architects and engineers alike to create architectural spaces with specific acoustic goals in mind, and have a reasonable expectation of meeting those goals.
Additionally to reverberation, there have been, since Sabine's founding of the field of acoustics, formulated multiple numerical parameters that can give an insight into the acoustic quality of space. Notable mentions are those of Early Decay Time (EDT), Definition (D50), and Clarity (C50). Though placing numerical values on difficult problems can help create an understanding of space, the actual numerical values considered optimal, are under heavy debate (Long, 2005) (Northwood, 1977). Though this mathematization gives the ability to set specific demands for room acoustics, one has to question whether or not something gets lost in translation? A reduction of the architectural search space to that of the mathematically determined to be within bounds of correct might leave rooms with exciting or new acoustic properties unexplored. For just as instruments can be tuned, so can the rooms we inhabit, creating co-stars in a music performance(Rasmussen,1966:240). Examples of architecture as an additional instrument can be seen throughout history, Steen Eiler Rasmussen gives multiple examples in his chapter "Hearing Acoustics" in his book "Om at

opleve arkitektur"(Rasmussen:1966), he mentions how each church had its own particular voice, and how this voice was heavily involved in the music making process of that place. The possibility for creating such spaces, with any tunings particular to music genres or even particular songs, are within reach with the advent of new advances in acoustic simulation software and optimization.

EMRT-System

As mentioned previously, part of this thesis will be the continued development of the EMRT-system. The EMRT-system is a GPU-accelerated geometric acoustic stochastic raytracing engine. The system was implemented by Erik Molin using the Nvidia raytracer Optix(NVIDIA Developer, 2016). It is implemented as a library to facilitate integration with other software packages(Parigi. et al,2017). The main focus of further development will be creating a plugin allowing full integration of the EMRT-system within Grasshopper, a graphical algorithm editor tightly integrated with Rhino's 3-D modeling tools(Grasshopper3d). Creating a plugin within the ecosystem of Grasshopper allows one not only to integrate architectural acoustics in a highly effective environment but also allows access to a variety of other libraries, such as an extremely capable parametric package, evolutionary solvers, various algorithms for optimization and a variety of other tools. Another great advantage is the utilization of the GPU for processing, this has shown to drastically improve simulation times, with preliminary results showing a reduction in speed from 360 seconds to a mere 4 seconds, when compared to Pachyderm and CATT, two comparable stochastic raytracing acoustic engines with running on solely CPU(Parigi. et al,2017).

GPU:

Graphics Processing Unit, a component capable of a much higher level of parallel tasks being completed at once.

CPU:

Central Processing Unit. Sometimes referred to simply as the central processor

Aurelization:

"Auralization is the process of rendering audible, by physical or mathematical modeling, the sound field of a source in a space, in such a way as to simulate the binaural listening experience at a given position in the modeled space."[Kleiner, 1993]

Within the scope of the development, there is also a high level of interest in adding a level of aurelization within the EMRT package. If successful, the EMRT package will allow the creation of a design space with virtually real-time feedback both in the form of numerical values but also in the form of aurelization. Allowing design to become not only a visual but also auditory experience.

Educational Architecture

The built environment and how it is perceived, has an undeniable effect on how its users live, work and learn. In terms of educational architecture, the good learning environment exists within a complex matrix of functional, physical and functional needs. It is, therefore, necessary to be aware of not only the quality of the physical space but also the environmental factors that have an impact on the space.

Creative Spaces

When examining the spatial qualities, it is important to note that individuals have different ways of learning and thus the physical environment in which learning takes place, must be able to accommodate, facilitate, and perhaps enhance these ways.

In her PhD, “A grammar of creative workplaces” Alison Williams seeks to uncover the properties of a creative space by examining how spaces affect the senses, both traditional Aristotelian (taste,smell, touch, sight, sound), neurological (spaciousness and movement) and Steinerian senses (speech, thinking, life and the Ego) (Williams, 2013:114)

Based on these six categories of spatial parameters that support creativity are created: comfort, sound, sight, spaciousness, movement, aliveness. These are ranged and given values that one can use when designing space. Mentionable parameters in the comfort category include smell, tactility, temperature and air quality. (Williams, 2013:115)

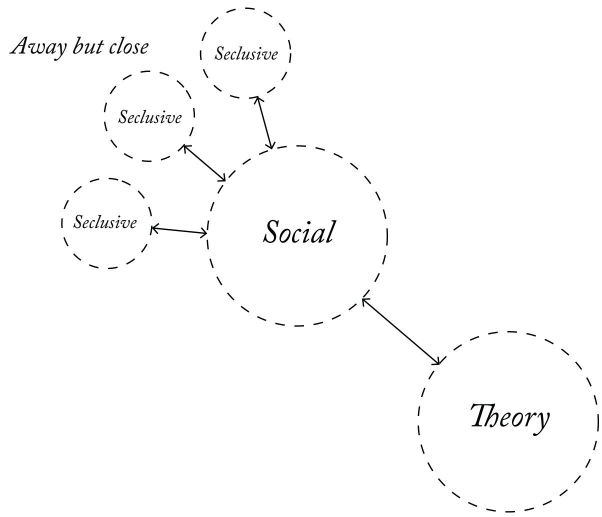
These parameters are closely linked to the notion of indoor environment, that although not a main focus of this thesis, will still be considered, as the quality of the perceived indoor environment is proven to tremendously affect learning. Studies conducted in Danish schools show that every decrease of 1°C under 25°C will increase concentration-demanding assignments by 2-4% (Toftum, Wargocki, and Clausen, 2011:19-20). The same study further adds that if the temperature is kept at 20-21°C, assignments that require logic thinking, concentration and understanding can be improved by up to 20% (Toftum, Wargocki, and Clausen, 2011:20), further stressing the importance of being aware of the built environment when dealing with learning and creative spaces.

The sound and sight categories deal with the use of views from windows and the natural light it gives and states that a quiet, unobtrusive buzz is preferred over complete silence or distracting noise.

Spaciousness details the use of long lines-of-sight, ceiling heights, orderliness, and cleanliness. The last two categories Movement and Aliveness state that ambient movement can create a dynamic environment as long as it is not distracting movement and adds to the feeling of being part of an active environment that encourages collaboration.

While many sensory properties have scientifically proven preferred attributes, the infinite number of ways that these properties can be combined and designed allows for every creative space or building to have its own unique characteristics and personality that directly facilitates the specific users.

Fig. 24. Diagram showing an interpretation of the Engage/Disengage model in an educational setting. (o.i)



Alison Williams further creates the Engage/Disengage model, that supports the notion that different people have different ways of learning and solving problems (Williams, 2013:126). This model claims that that people undertake a finite amount of creative behaviors in the creative process. The two main parts of Engagement are interaction and collaboration of which both are critical to create a space for innovation and creativity. Collaboration can both be through deliberately seeking encounters to discuss ideas or information or through serendipitous encounters. While Teamwork is considered essential in order to create creative success, the need for spaces that accommodate individual thinking is equally recognized in the Disengage part of the model. The main components are concentration and contemplation and both are crucial to problem-solving and thus creativity.

Developing an understanding of these very different settings serves as a foundation to create spaces that support the required behaviors required for creative thinking, creative activity and creative interaction (Groves and Marlow, 2016:130). If students are forced to all their creative processes at their desks, it will inevitably result in poor ideas and weak interactions. Therefore, it is important in a creative space to include different degrees of privateness that facilitate the different creative processes and individual preferences in how people work and learn.

The Faroese Building Regulations
A Sustainable Perspective

As mentioned in the motivation, a lot of inspiration for one theme of the thesis stems from the perhaps involuntary import of a style lacking a level of critical self-consciousness and thus pointing towards the notion of critical regionalism as described by Kenneth Frampton. The issue of not having a building custom that holds true to the specific culture is underlined in the Faroese Building Regulations. These are nearly identical to the building regulations that once were active in Denmark. With some primary examples being:

Energy demands are at 70 kWh/m^2/year along with an additional 2200 kWh/year divided by the heated area. (Landsverk.fo,2017)
Ventilation demands are identical to that of the Danish Building regulations 2007.
For calculation of structural demands, there are cited a slew of Danish Standard literature, though with a particular attention paid to wind loads.

Though one can criticize this blunt replica of the Danish Regulations, the overarching movement is a good one. This is definitely the first step towards a much more ambitious end goal, with the next step in energy demands already arriving in 2020(Landsverk.fo,2017). This has also created a much higher level of attention to the act of building, and all municipalities are in dire need of additional support to go through the now much more detailed building applications. As most of the building industry is educated in Denmark it is, in general, well equipped for this next step, with only the older generation having to reconsider solutions that "now" are considered inefficient or illegal. Though the standard of indoor climate calculation and modeling is low, or few companies want to spend the time, energy and money to do so in a correct manner. It follows then that the standard of building on the Faroe Islands might not live up to its full potential. This might very well be attributed to the very little incentive given by the low demands in the Faroese building regulations. While there have recently been many projects on the archipelago with very high architectural quality it is undeniable that energy efficient and indoor environmentally pleasant buildings is a must in a contemporary building sector and these parameters could have added dramatically increased value to these projects, especially considering the unique premise that building in this location provides.

Scope of sustainability
While sustainability will have a limited scope in this thesis, different parameters will still be evaluated as part of the design. A primary factor in any project in the Faroes is the choice of materials used for construction. With so few local materials, the choice of material will have a massive environmental impact compared to mainland Europe where every material is within grasp, or at least driving distance.

The strong winds of the Faroes will also have a strong impact on the energy efficiency of the building compared to most other environments, with infiltration often being cited as having a larger impact on building energy than transmission loss(landsverk.fo, 2017).

Indoor Environment

One of the primary drivers of design for this project will be, as mentioned previously, acoustics. With a large amount of the focus being on creating good learning and music environments. Further, acoustics will be implemented as a second parameter involved in every design decision. Much like the implementation of 3D tools for both architectural visualization and drafting created a revolution within the building industry, likewise will the functionality of aurelization, creating a deeper understanding of the project.

The Faroese Music Conservatory

As previously mentioned the Faroe Islands have a very active music culture and a conservatory is seen as a way to further support this unique culture, as the Faroe Islands only have primary and secondary music education available and tertiary educations are normally sought after abroad.
Considering the educations that are currently being taught at the faroese music schools and the courses being provided at The Royal Danish Academy Of Music (dkdm.dk, 2018), the Faroese Music Conservatory should provide the following educations in order to both facilitate the local music culture and to stay relevant abroad.

- Popular music and music production
- Singing: solo and choir
- Music teacher
- String instruments: Guitar, electric guitar and electric bass
- String instruments: Violin, cello, double bass
- Keys: Piano and organ
- Percussion
- Brass instruments : Trumpet, horn, euphonium, trombone, tuba
- Woodwinds: Flute, clarinet, saxophone, oboe, fagot
- Theory, ear training and composition

Fig. 25. Local muscians playing a christmas concert at the community house in Skála, Eysturoy. (o.i.)

Because of the unique societal situation on the islands, where most people are familiar to each other, the conservatory should focus on helping each student finding their own identity in order to combat the "sameness" that might be an issue in a community as small as the Faroe Islands. The conservatory should naturally provide these classical music educations but should to an equally high degree be able to facilitate creative minds that does not necessarily find an interest in learning about classical theory.
Therefore the main goal of the conservatory should be to provide the facilities and the sense community and collaboration that is important to many artists. While collaboration is a big part of learning and developing as an artist, making music is also a very personal thing and as such, the conservatory should also celebrate individualism and create introverted spaces .
Designing a music conservatory for the Faroe Islands creates a unique opportunity to embrace the isolated nature of not only the site, but also the Faroe Islands themselves. Where many other music conservatories around the world are placed in large cities, the faroese music conservatory could potentially invite international teachers students as an "educational sabbatical" where the isolated location helps one to delve into the music.


M-AUDIO

Room Programme

	Room	*Size (m²)*	*Amount*	*Total Area*	*Natural light*
Public functions					
	Public arrival	*500*	*1*	*500*	●
	Concert hall	*850*	*1*	*850*	○
	Stage	*200*	*1*	*200*	○
	Black box	*800*	*1*	*800*	○
	Toilets	*5*	*8*	*40*	○

As a big part of the Faroese music culture is centered around live performances, a public venue is closely connected to the Faroese Music Conservatory. This provides a space where the students, as well as established artists, can showcase their skills to the public.

	Room	*Size (m²)*	*Amount*	*Total Area*	*Natural light*
Education					
	Back stage	*300*	*1*	*300*	○
	Cafeteria for students and staff	*400*	*1*	*400*	●
	Theory room / classrooms	*50*	*5*	*250*	●
	Toilets	*5*	*15*	*75*	○
	Hall	*100*	*1*	*100*	●

The educational facilities relate to the daily need for students.
As in any music conservatory, a heavy focus lies on mastering a musical craft, and as such, there is not the same demand for traditional classrooms. However, there still can be situations where traditional classrooms can be beneficial as some courses are of a more theoretical nature.

Acoustic requirements and atmosphere	Comments
Buzz	Contains an area café-area for refreshments
Low to Medium reverberation time. 0.6-1.5	Contains an organ,Has some fashion of acoustic adjustability
Low to Medium reverberation time. 0.6-1.5	Has some fashion of acoustic adjustability
Low to Medium reverberation time. 0.6-1.5	Has some fashion of acoustic adjustability
Quiet buzz	

Acoustic requirements and atmosphere	Comments
Quiet buzz	
Buzz	Contians kitchen and sales counter
Low to Medium reverberation time. 0.6-1.2	Specifically made for teaching larger classes .
Quiet buzz	
Quiet buzz	In informal space, for studying, meetings and sharings ideas and k○wledge.

	Room	Size (m²)	Amount	Total Area	Natural light
Rehearsal					
	Rehearsal rooms	20	10	200	●
	Drum practice	15	2	30	●
	Piano room	15	3	45	●
	Ensemble Rehearsal /classroom	50	2	100	●
	Recording studios	40	5	200	○
	Recording studio/Classroom	80	4	320	○

The rehearsal facilities closely relate and overlap with the educational facilities, as rehearsal rooms are to be considered spaces where practical musical teaching, both individual and in groups can occur, as much as they are considered spaces for practice.

	Room	Size (m²)	Amount	Total Area	Natural light
Staff					
	Teachers lounge	100	1	100	●
	Offices /administration	8	15	120	●
	Meeting room	20	1	20	●
	Library (For sheet music and theory etc)	20	1	20	●
	Secretary office	50	1	50	●
	Toilets	8	1	8	○

Total Area: 4723

The staff area primarily consists of offices where teachers can prepare lessons as well have administrative meetings. Also included in this part of the programme is a common area intended for breaks and informal meetings, as well as a small library where teaching material can be stored.

Acoustic requirements and atmosphere	*Comments*
Low to Medium reverberation time. 0.6-1.2	*Hallways connecting these will have a much more lively acoustic experience.*
Low reverberation time, 0.1-0.4. Acoustically isolated	*Heavily sound insulated and optimized for drum practice.*
Low to Medium reverberation time. 0.6-1.2	*Can also be used as a rehearsal room*
Low to Medium reverberation time. 0.6-1.2	*A bigger rehearsal room that can be used both or big band practice and for larger courses*
None to little reverberation. 0.1-0.3. ○ acoustic interference from outside	*Individual recording studios*
None to little reverberation. 0.1-0.3. ○ acoustic interference from outside	*Recording studios that are also used for the music production education*

Acoustic requirements and atmosphere	*Comments*
Quiet buzz	
Quiet buzz	
Quiet buzz	
Quiet buzz	
Quiet buzz	
Quiet buzz	

Initial Concept - Gesture And Principle

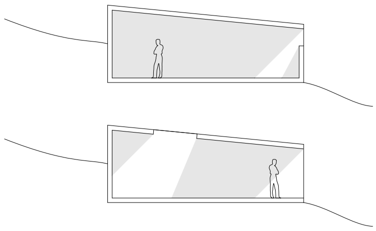


Fig. 26. Light/Dark. (o.i)

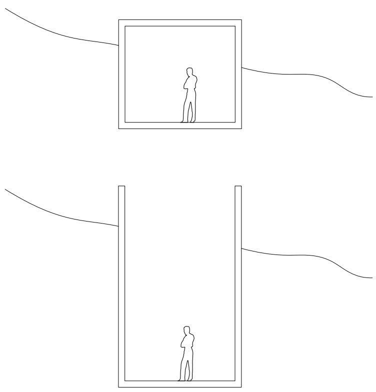


Fig. 27. Enclosed/Open.(o.i)

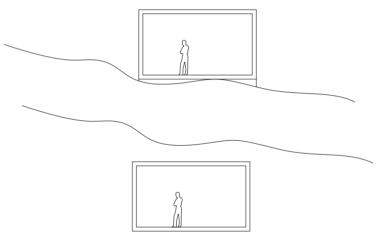


Fig. 28. Above/underground).(o.i)

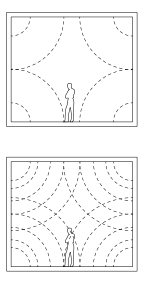


Fig. 29. High/Low Reverberance. (o.i)

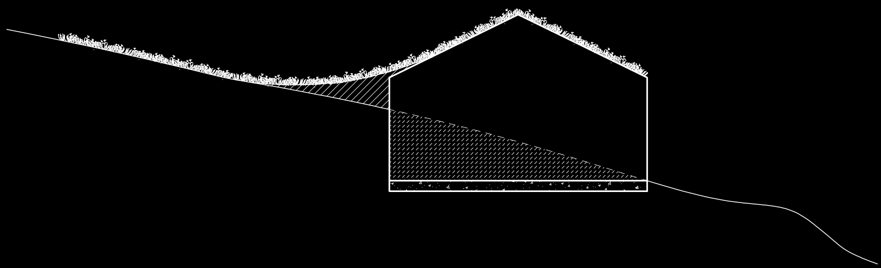
Based both upon the previous analyses and an examination of the characteristics of the site reveals several principles that serve as a point of departure for designing the Faroese music conservatory. These principles are heavily inspired by readings of the natural landscape of the Faroe Islands and the traditional method of building that was present before the emergence of the danish inspired building costum.

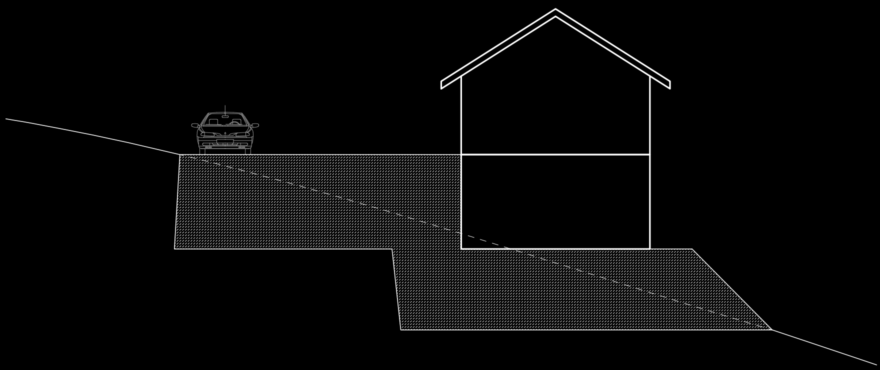
The biggest point of criticism of the danish inspired of style is the insensitive manipulation of the landscape. Whereas the traditional houses actively used the landscape and built into it to create shelter and stability while minimizing the use of material and labour, a lot of contemporary houses flatten vast quantities of rock to create free standing buildings, often completely disregarding the unique opportunities that present themselves within the landscape.

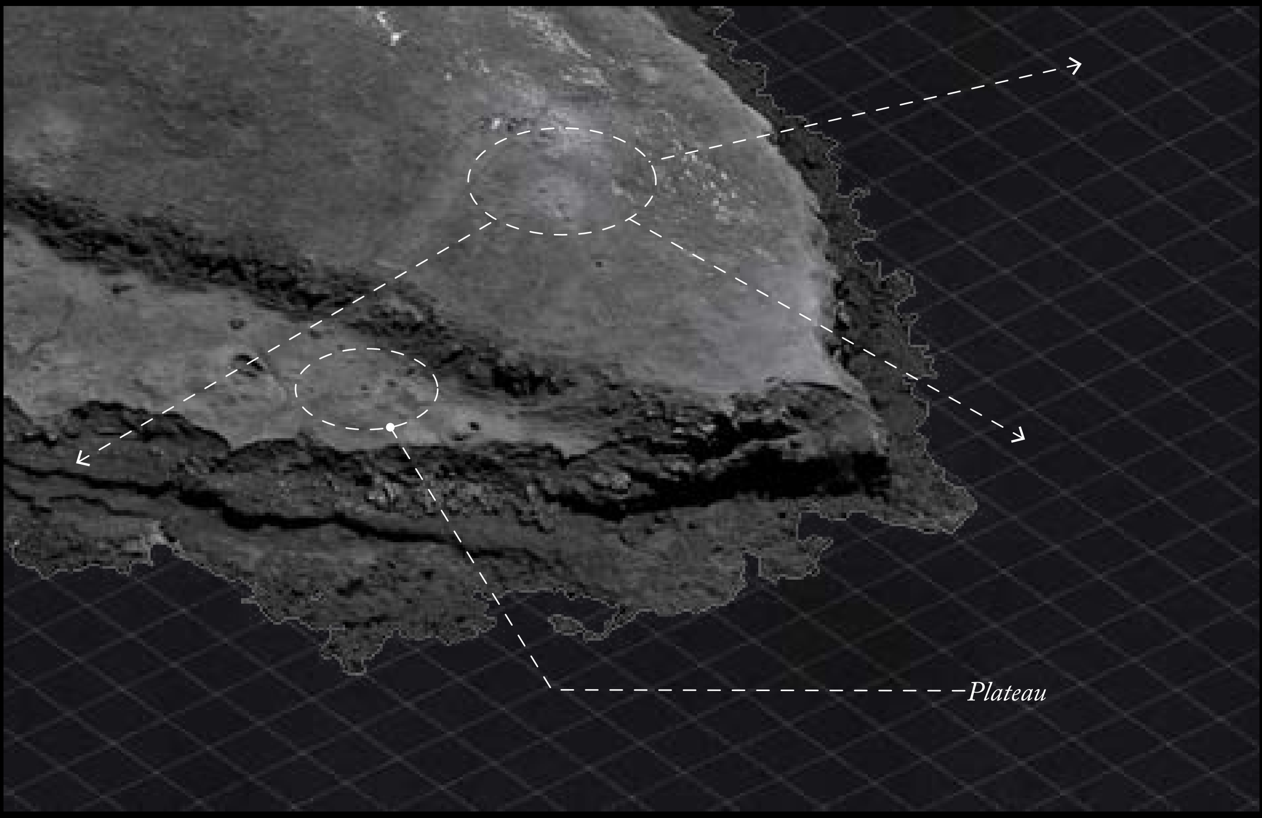
Thus, a big part of the initial thoughts was to follow the natural curves of the landscape to accentuate it while creating shelter and stability. One part of this landscape is the west facing plateau, that naturally draws curious visitors of the site by being surrounded by the small hamar and thus limiting the view to 180 degrees. This plateau is significantly flatter than the rest of the site and is further characterized by its close juxtaposition of the natural elements; grass, basalt and ocean. Combined with the fact that he wind is even more present due to the west facing nature of the area creates a special relation that makes one feel even closer to the forces of nature that are ever present on the Faroe Islands. Due to these factors it is seen as an area that can be activated, but should still retain its unique qualities.
The hamar, is a phenomena where a steep rock face protrudes from a grassy mountainside and is is an image that is seen extensively in the Faroese nature. This image is sought to be interpreted into the building in order for it to accentuate the landscape.

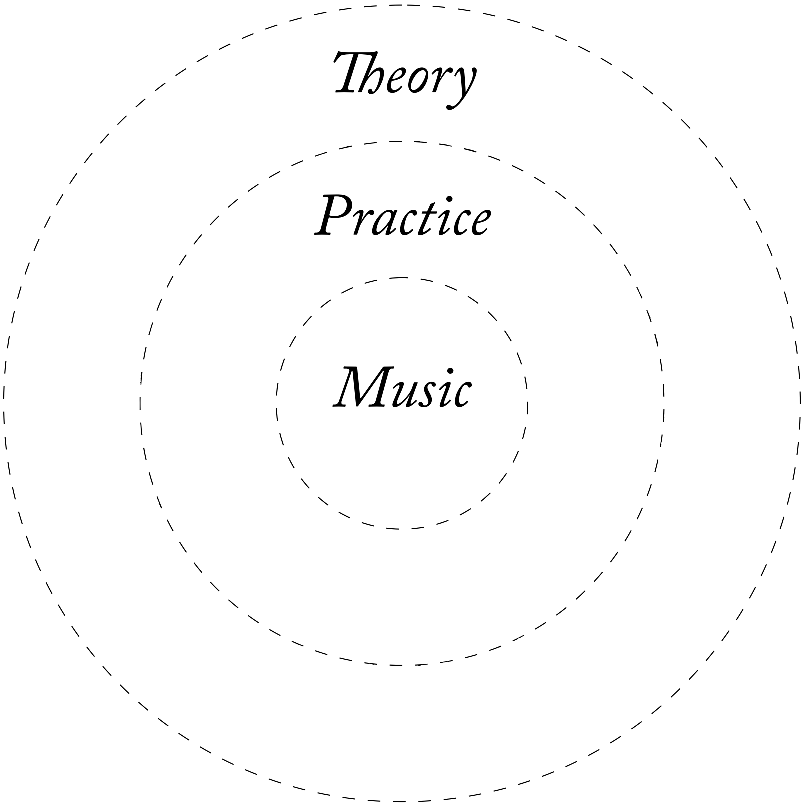
As the majestic views are a hugely important part of the site and the Faroe Islands in general, three specific views from the site should be framed within the project. Firstly, north looking towards Strendur and the rest of the Skálafjørður, south towards the ocean and the island of Nólsoy and lastly west, looking towards Streymoy. As these views are most prominent on the southern top of the site, this warrants an activation of this area as well.

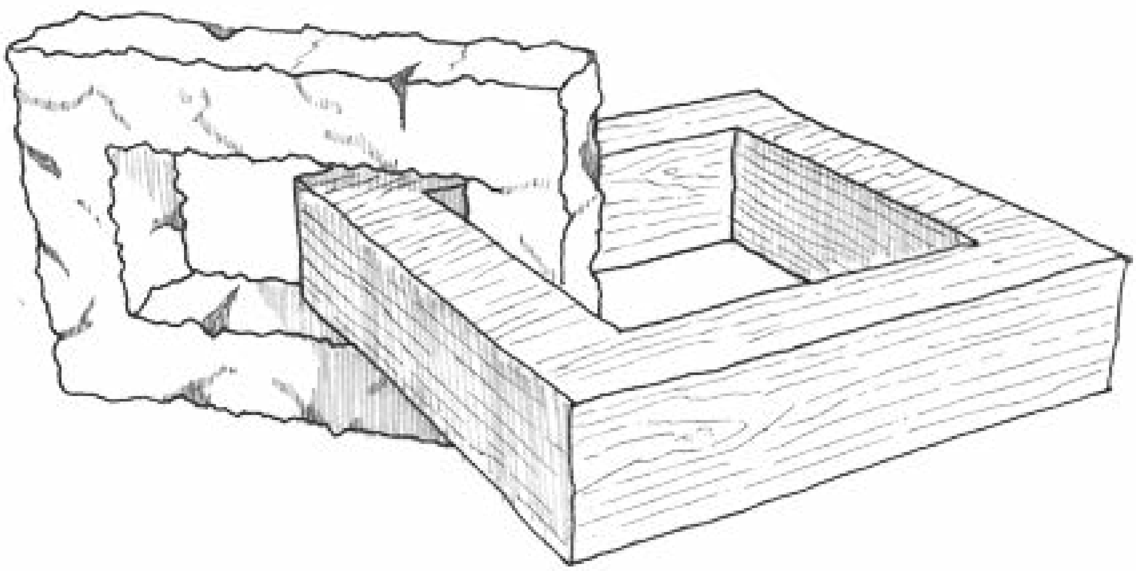
The concept of framing contrasting spatial and sensory configurations as light/dark, warm/cold, enclosed/open, above/ underground, high reverberation/ low reverberation is is sought to be explored. The transition between two contrasting experiences will inevitably highlight and enhance the effect of both, and as the Faroe Islands is, as mentioned in the introduction, a land of great contrasts. Therefore, the framing of contrasting experiences is seen as a way to embed some of the truly unique Faroese sense of place into the design.






Plateau


Theory
Practice
Music



Concept - Musical Education Progression

Fig. 30. The rings of musical progression. (o.i)

The progression between theory, practice, and performing is a key feature in the journey of becoming a musician. One cannot practice an instrument before having at least some knowledge of how it works. And similarly, one cannot perform a moving piece of music before vigorous practice.

The same elements of theoretical teaching, countless hours of practice and formal and informal performance are present in any music conservatory and is, therefore, a big part of the concept for the architecture of the Faroese Music conservatory. This inwards progression becomes a part of the building layout itself, rooms that facilitate these specific elements are laid out in the same circular configuration moving towards the central goal of performing and showcasing the mastery of one's craft.

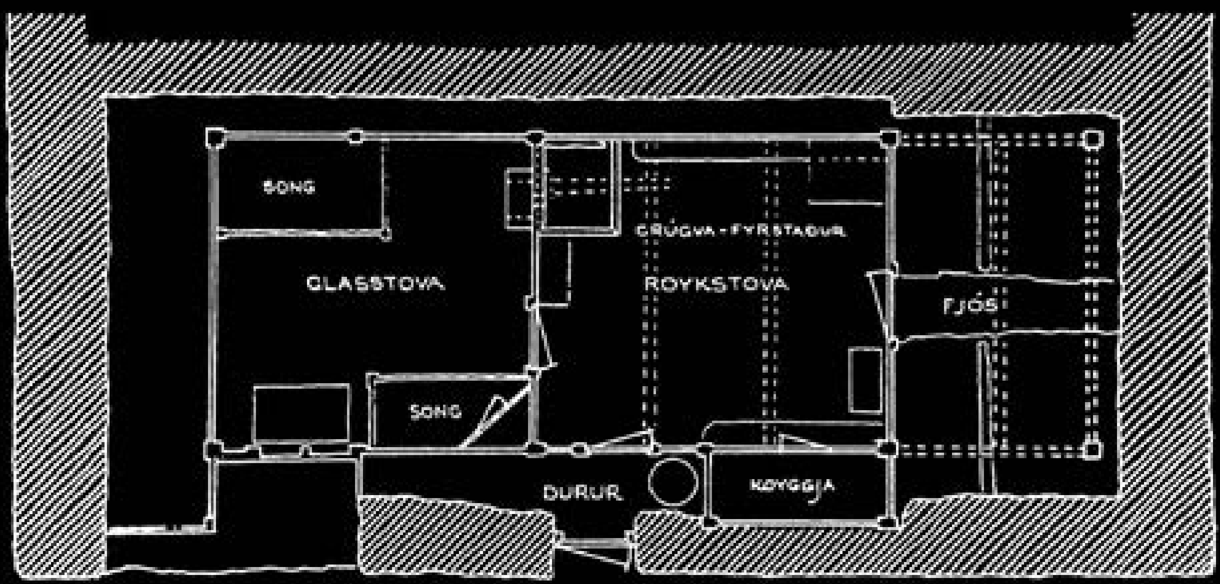
Concept - Interlocked Rings

Fig. 31. Ther interlocking rings.(o.i)

Building upon the concept of the metaphysical progression of the musical education, two interlocked rings tell the story of the physical journey through the building. The wooden ring represents the educational part of the building where the flow is mainly centered around the horizontal axis.

The change of axis and material in the other ring represent the public part of the building and the descent into the rock. The duality and interlocking nature of the two materials further show the importance of the juxtaposition of these two materials in the traditional Faroese building culture.


Framework
Sterotomy
Enclosure
Hearth


SONG
GLASSTOVA
SONG
GRÚGVA-FYRSTADUR
ROYKSTOVA
FJÓS
DURUR
KOYGGJA

Concept - Stereotomy

Fig. 32. Diagram showing a mirroring axis. Highlighting the usage of tectonics. (o.i)

The naturally occurring bedrock is used as an axis that mirrors the built environment and thus takes on different roles within the building complex. In a more traditional sense that bedrock is used as a foundation that supports the framework of the majority of the building. The wooden construction of the conservatory gets mirrored by the rock to form the musical center of the project within the bedrock

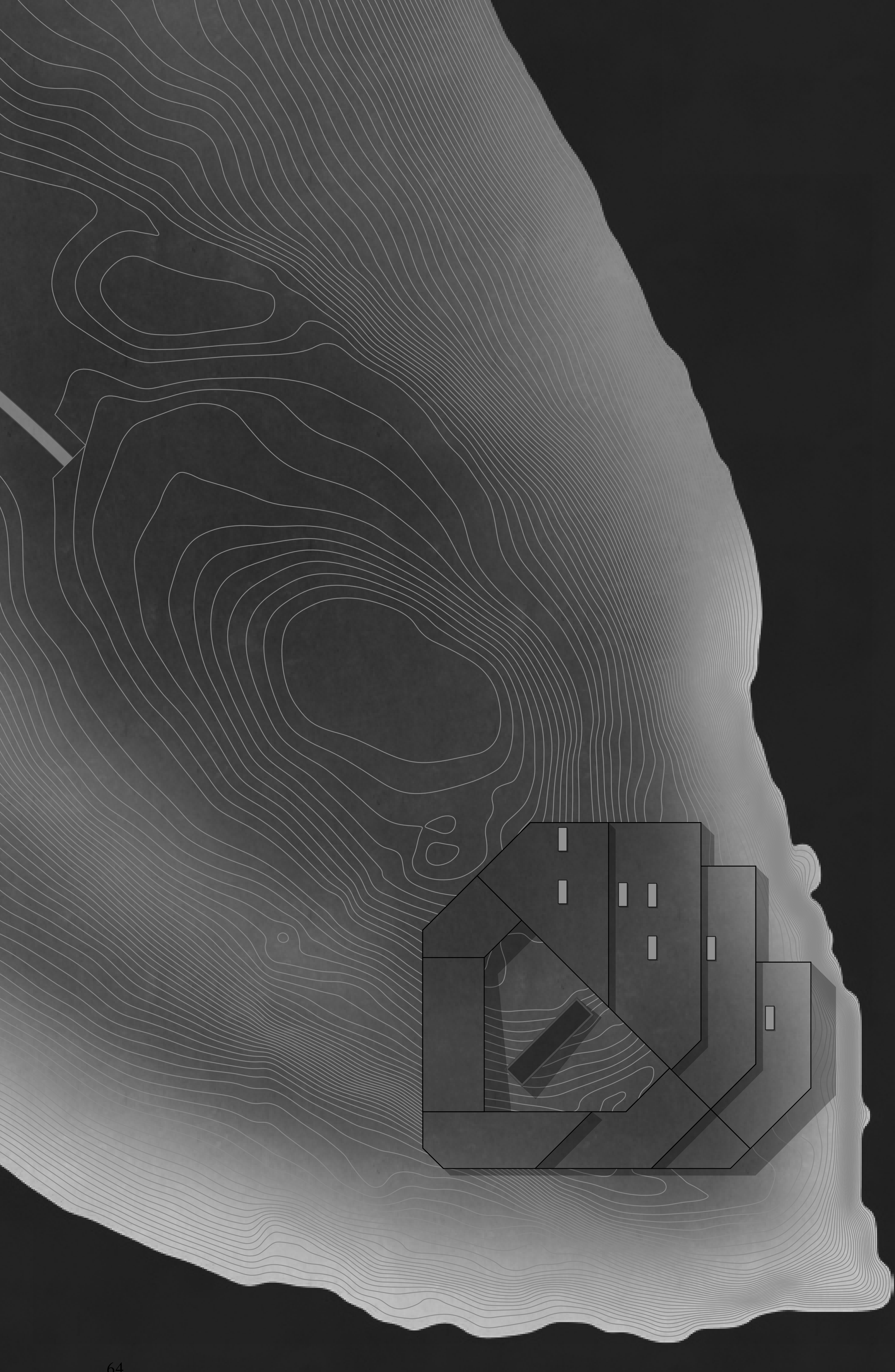
The Semperian understanding of stereotomic in the earthwork details mass and volume being formed through piling heavyweight elements (Frampton, 1995). The musical center can be seen as a reference to the hearth in the seperian theory and as such it's "flame" must be protected against the hostile elements of nature (Frampton, 1995). By flipping the traditional understanding and removing volume from the earthwork the surrounding rock then becomes the enclosure of the musical center of the complex, a reference to the old Faroese building traditions where the rock was not used as a construction material, but rather an enclosure around the actual load carrying wooden construction.

This duality in materiality can clearly be seen in the previously discussed Kálvalíð which is arguably an example of tectonic architecture within the old Faroese vernacular.

Stereotomy

(noun): The art of cutting three-dimensional solids into particular shapes

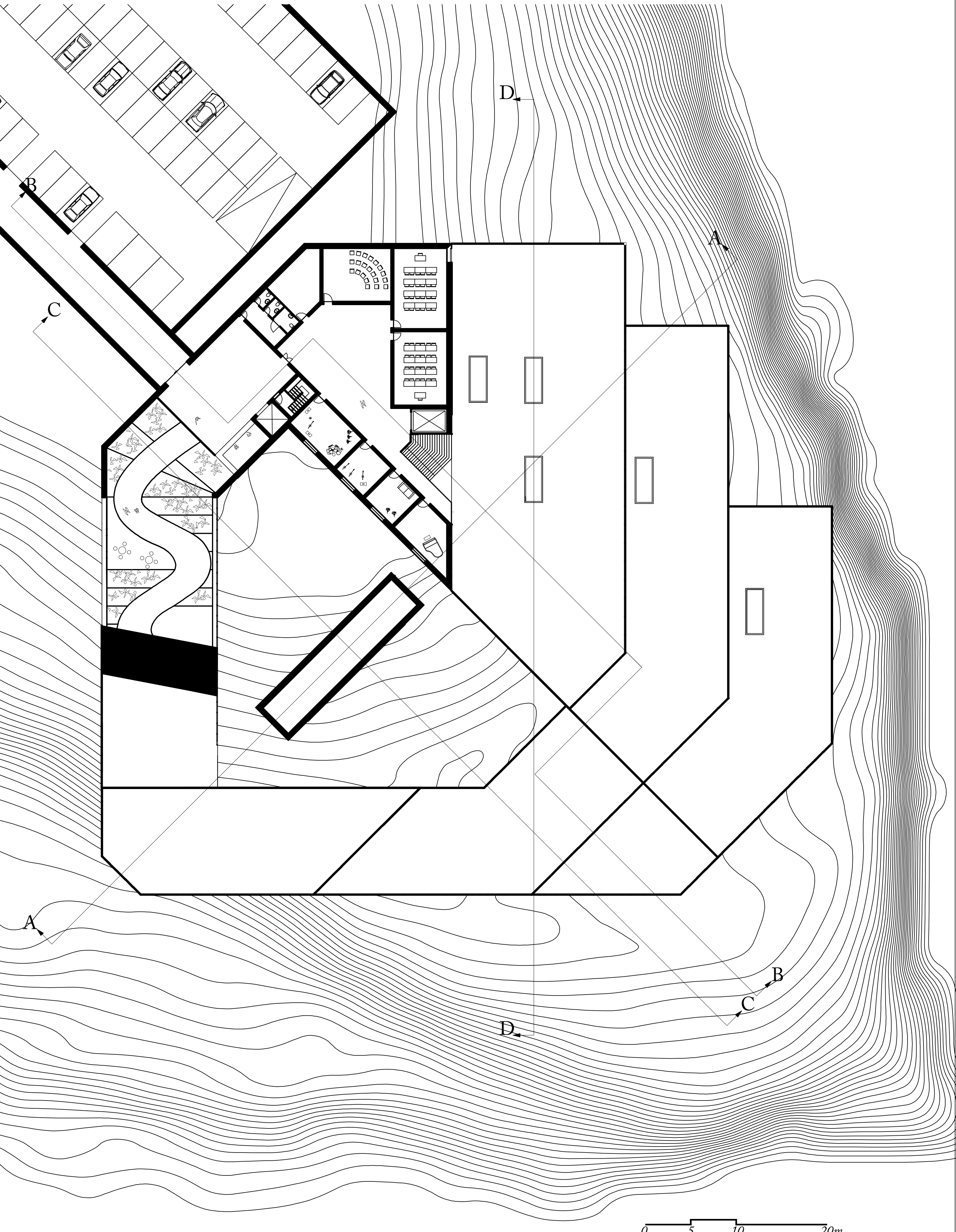
Fig. 33. Plan of Kálvalíð. Drawing by Curt V. Jessen after measurements by K. Kristoffersen



The New Faroese Music Conservatory

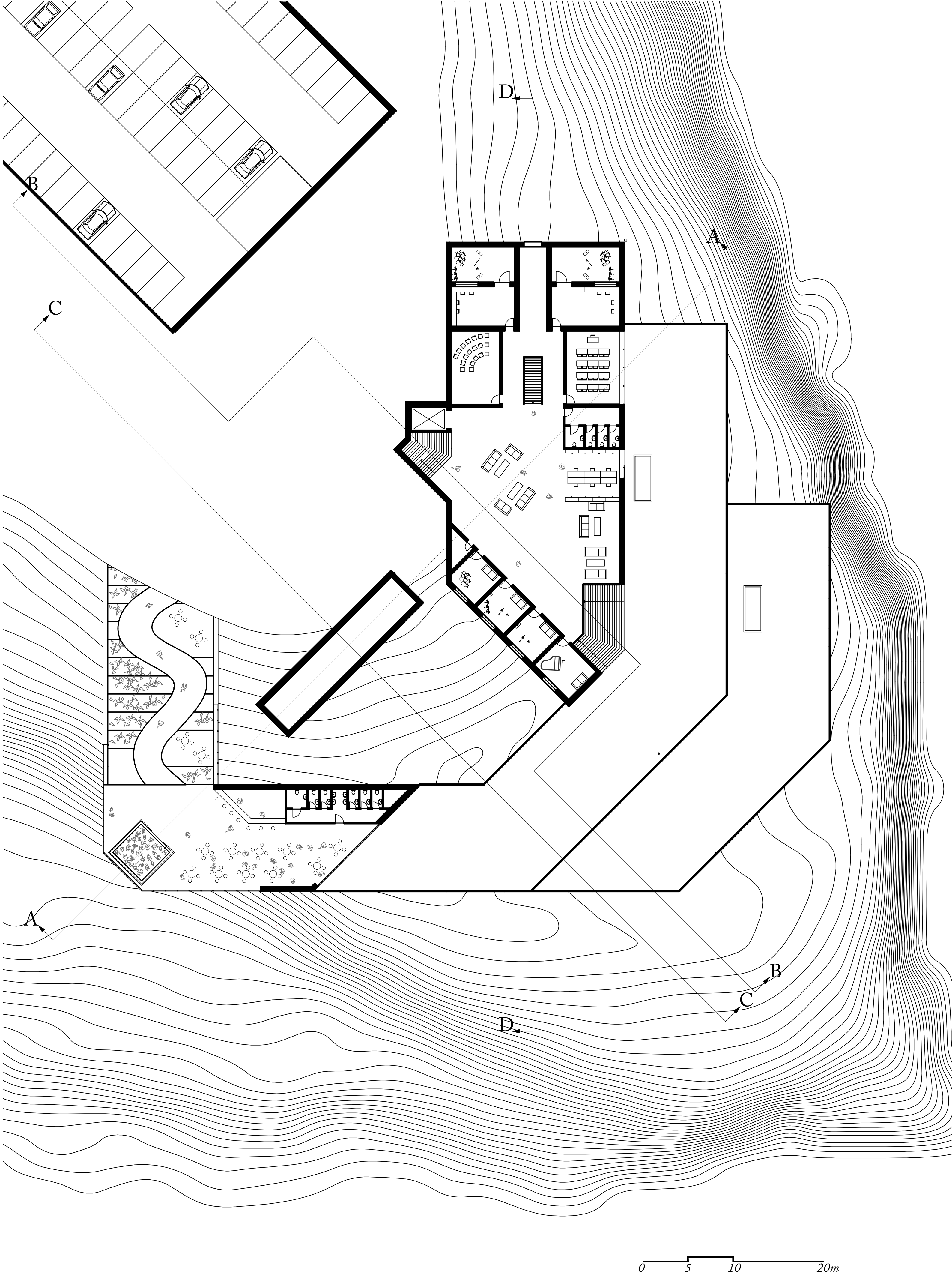
The Faroese Music Conservatory is located on the southern top of Raktangi, surrounded by views of both settlements and magnificent nature. This location creates a feeling of calm solitude within nature, while still being easily reachable by car from most of the country.

The architectural composition is divided into two volumes, parking and conservatory. The parking complex, situated just under the surface of the tongue of land marks the transition between travel and experience, by filtering guest from their cars through a small passageway into the main conservatory building.
The conservatory follows the natural curves of the landscape through a series of stepped levels overlooking the ocean and allowing for dramatic views of the surrounding nature that has otherwise been hidden by the peak of the tongue while approaching the building.


D
B
A
C
A
B
C
D
0 5 10 20m

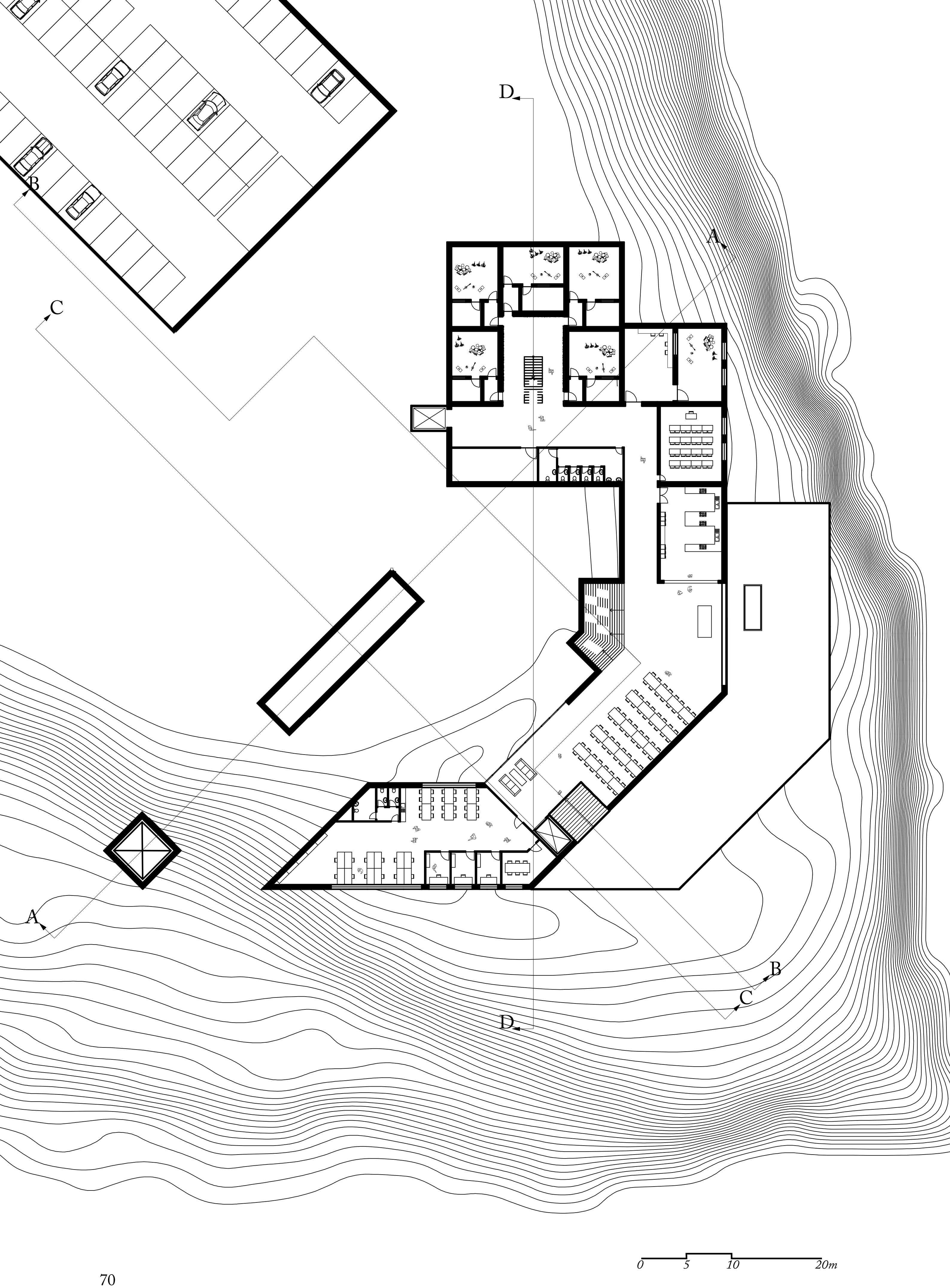
Plan 0

After entering the underground basement all student and guests must filter through the transitional passageway before entering the lobby of the complex. At this point, two opportunities present themselves based on the usage scenario. Students with access to the building can enter the educational part of the building through a door located towards the northeast. Behind this door, students have full access to all theory and rehearsal rooms placed around the central open spaces.
Other guests have the opportunity to buy tickets in the lobby before walking down a slope that seeks to remind the visitors of a pathway going through the inclined Faroese landscape.


D
B
A
C
A
B
C
D
0
5
10
20m

Plan -1

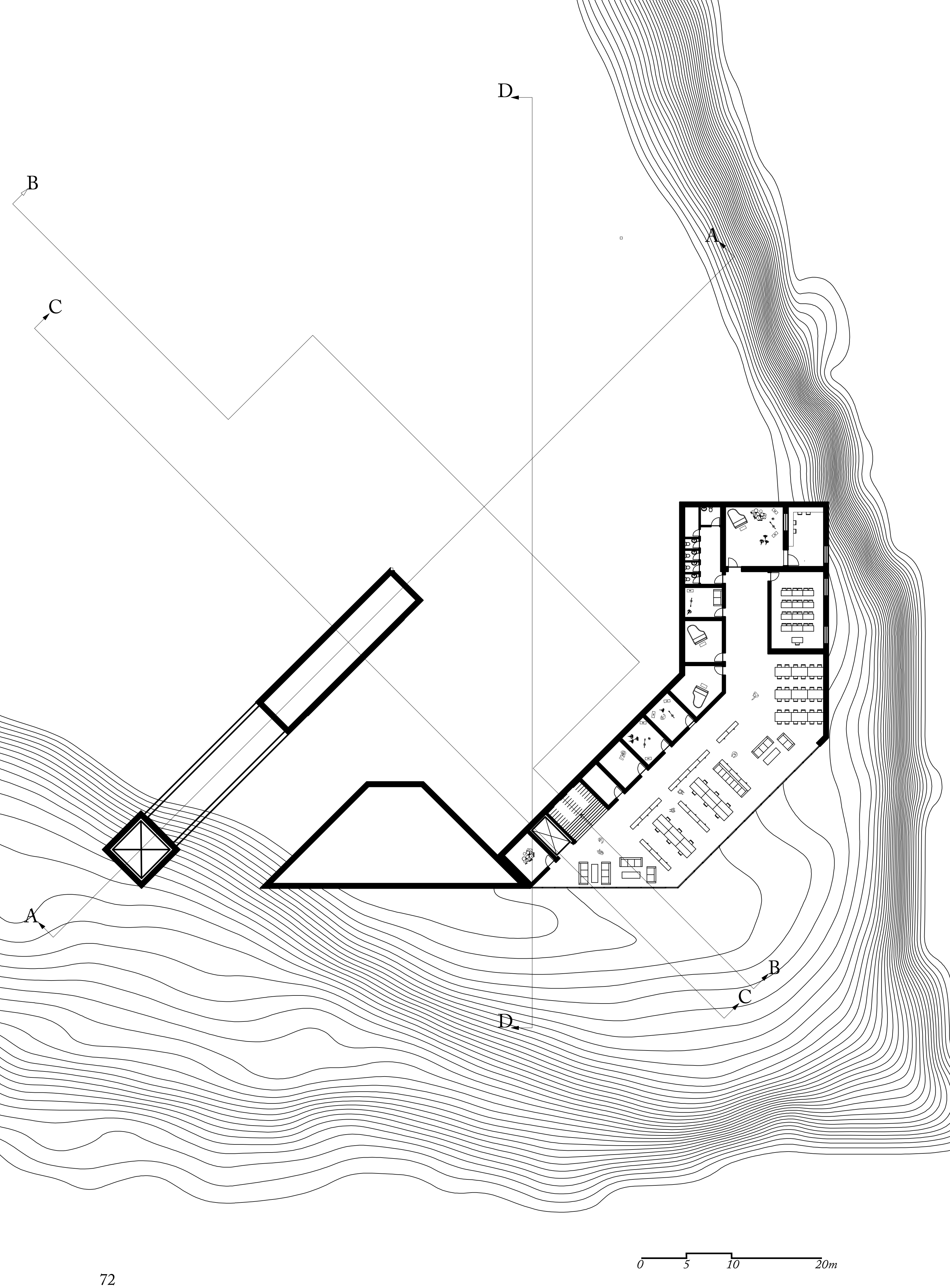
During the walk down the slope, visitors can enjoy views to the central courtyard and the centrally placed skylight within it, hinting at the awaiting experience. At the end of the slope a large wooden box with a glass lid, placed in front of a panoramic view presents itself as a central element within the space. Before a concert guests are welcome to enjoy the views of the surrounding nature while being served refreshments. When the time for a concert approaches a bell will ring and from the wooden box, a hydraulic elevator with a glass ceiling will emerge in order for guests to descend into the bedrock.
Within the educational part of the complex, level - 1 offers a creative open space in close connection to recording studio classes, rehearsal spaces, and theoretical classrooms.



D
B
A
C
A
B
C
D
0
5
10
20m

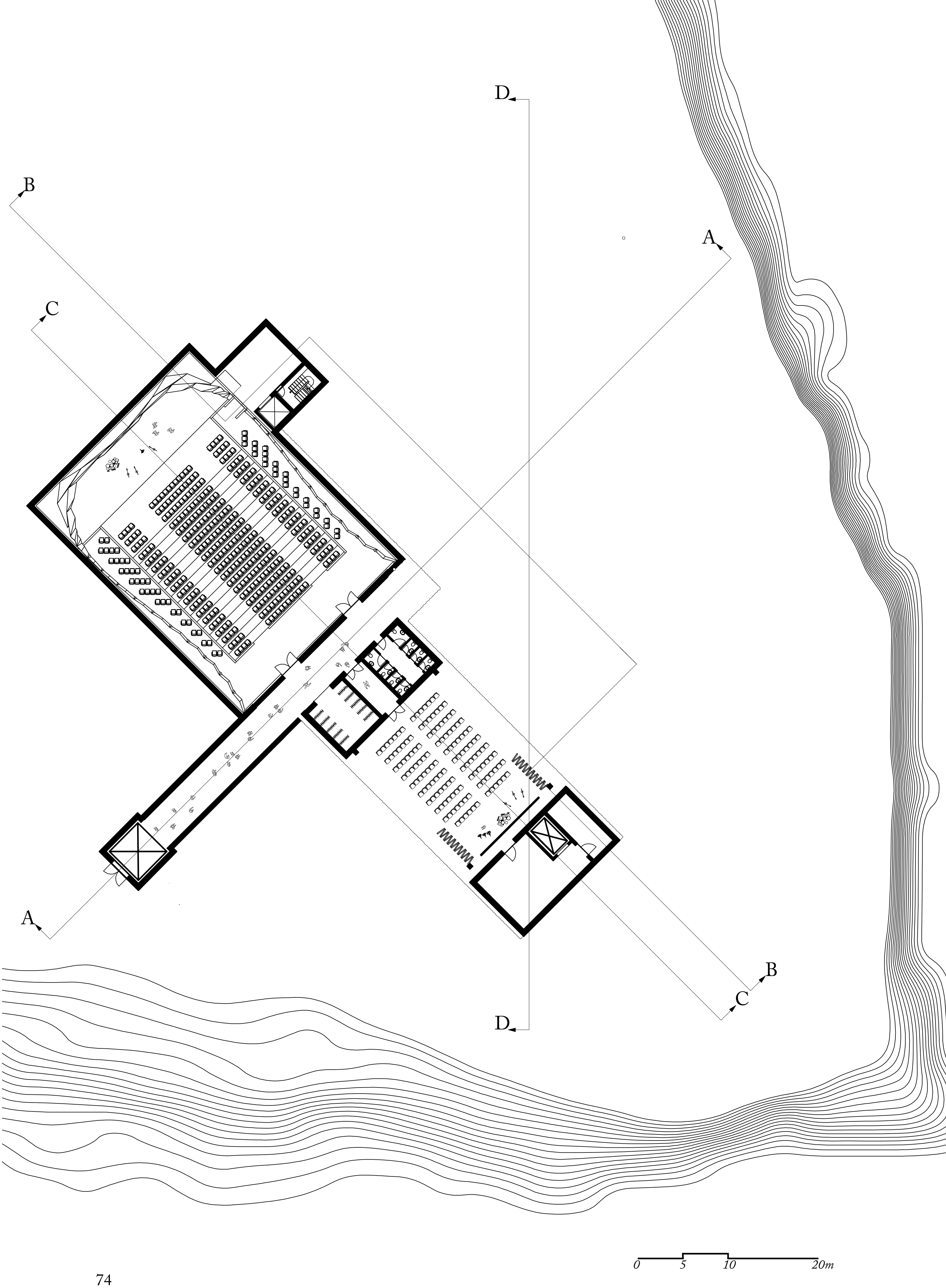
Plan -2

A prominent feature on level -2 is the dimly lit area accessible from centrally placed staircase placed in the creative space on top. This area holds five recording studios available for all students. The outer walls of this area are made of dry masonry in order to create a cave-like feeling of withdrawal when entering the recording studios. On this floor is additionally the naturally lit canteen area that offers partial views towards east and southeast and the teacher lounge located towards the south.


D
B
A
C
A
B
C
D
0
5
10
20m

Plan -3

Level -3 holds the majority of rehearsal spaces, ranging from piano rooms, drum rooms and even a stone room with high reverberation, all located closest to the central performance space to signify the progression from practice to performance. Towards south is an open plan where students can have impromptu jam sessions or informal sharing of ideas. Additionally, this area holds a freight elevator leading down to a backstage area.



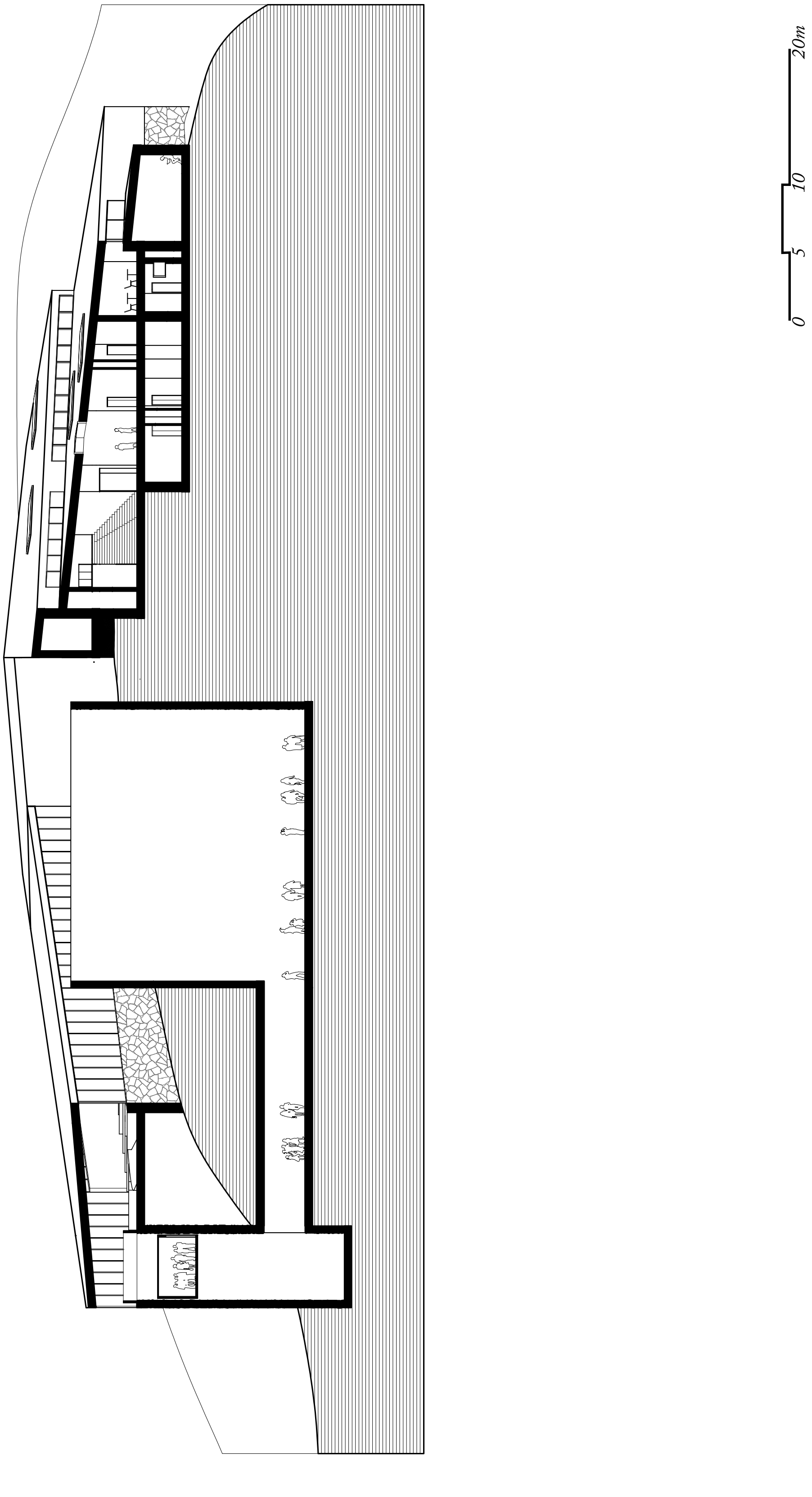
D
B
A
C
A
B
C
D
0
5
10
20m

Plan -4

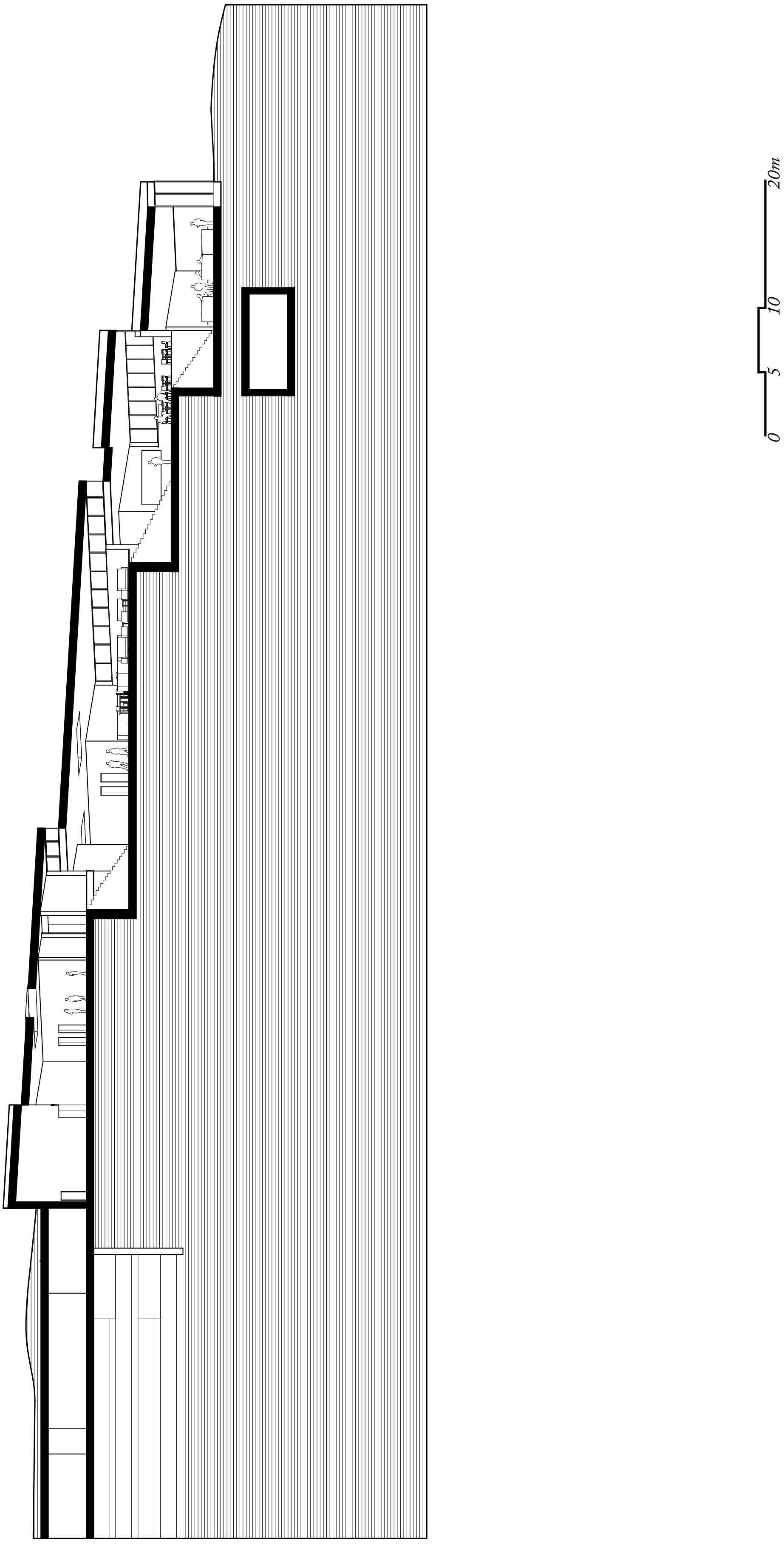
When concert goes exit the large elevator into the dark hallway, a light leads the way towards an open and unheated space between two vastly different concert halls. This space is open to the elements to remind guests of the unique weather conditions on the Faroe Islands. As space is 12 meters below ground, the space will be significantly warmer than on the surface. The largest concert hall holds 400 people and can be utilized by both students and established artists. The smaller concert hall holds approximately 140 seats as seats can be freely arranged. This concert space has untreated stone walls behind an adjustable curtain and rotatable wooden panels on a rail. This allows for a near infinite amount of acoustic variations that enables the students to experiment with their craft.

Fig. 34. Interior Render showing Hallways between classrooms and Recording Studios (o.i)

Section A-A



Section B-B



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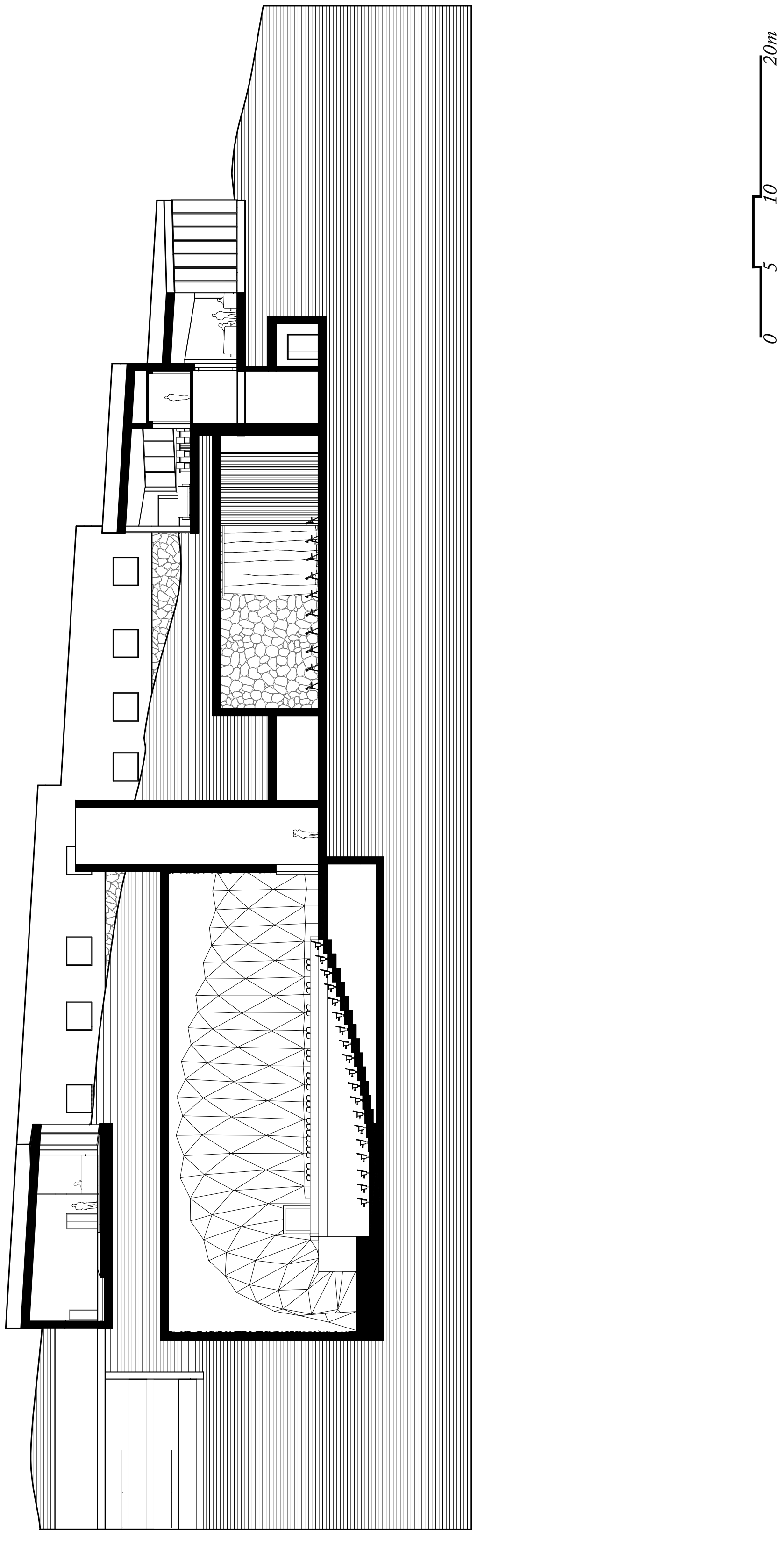

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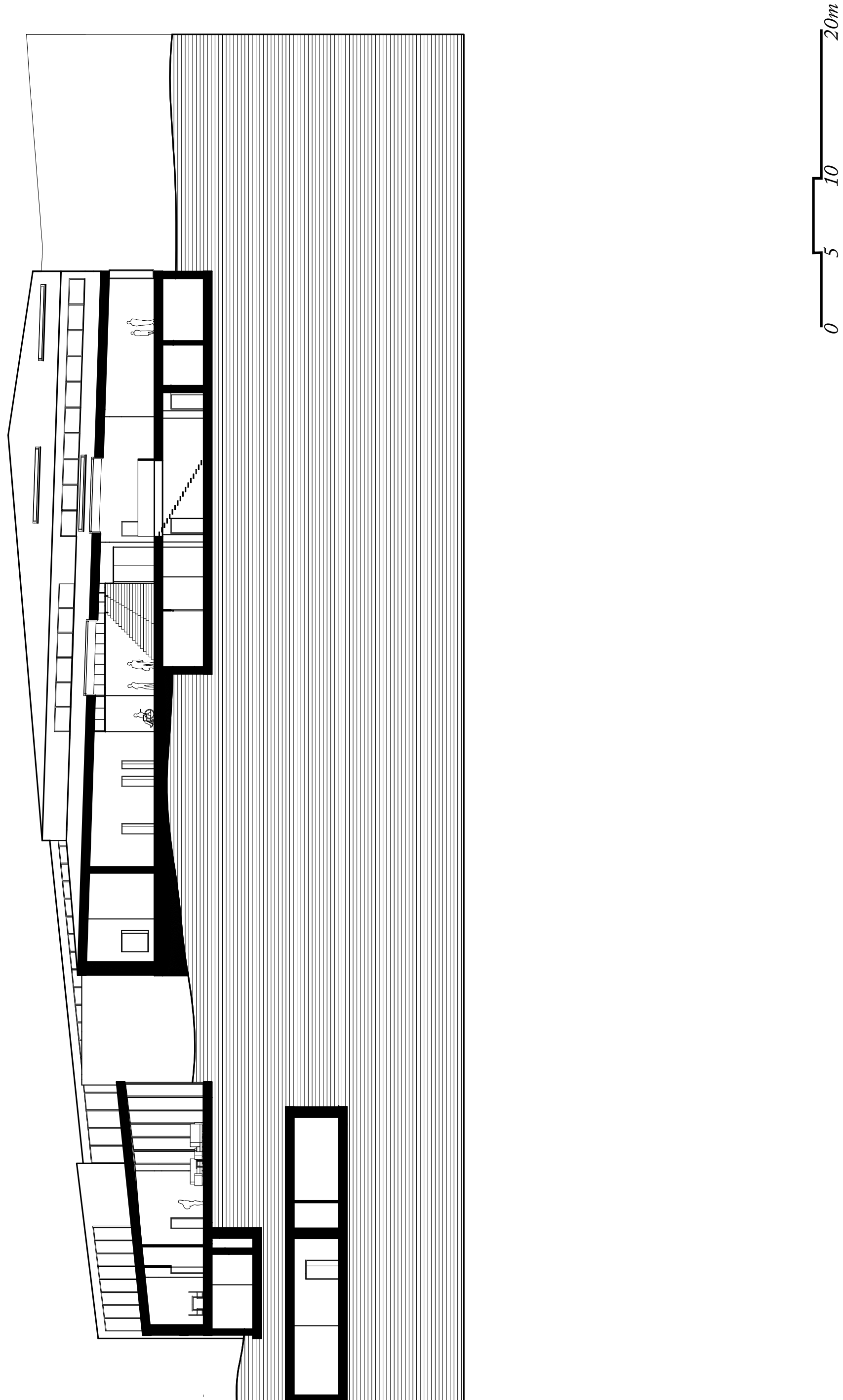
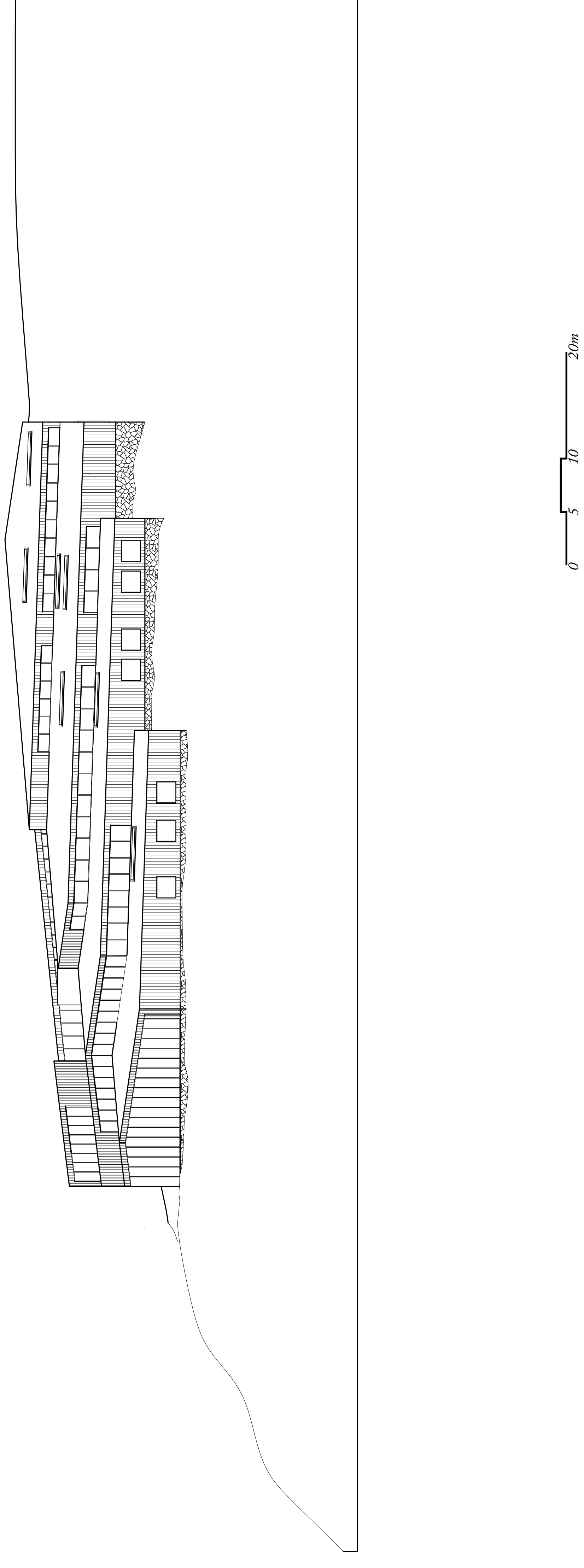
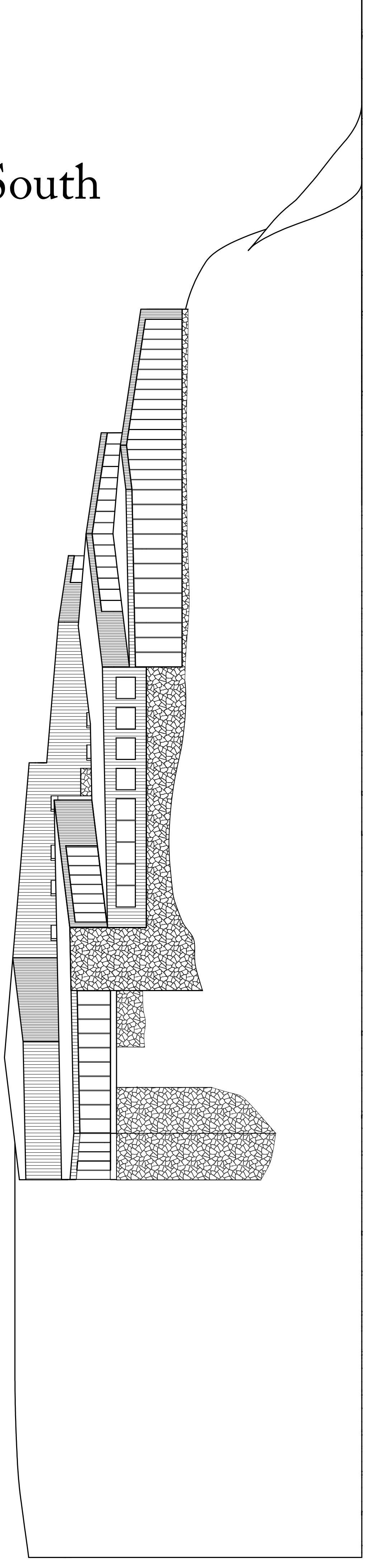


Elevation East



Elevation South



Elevation West

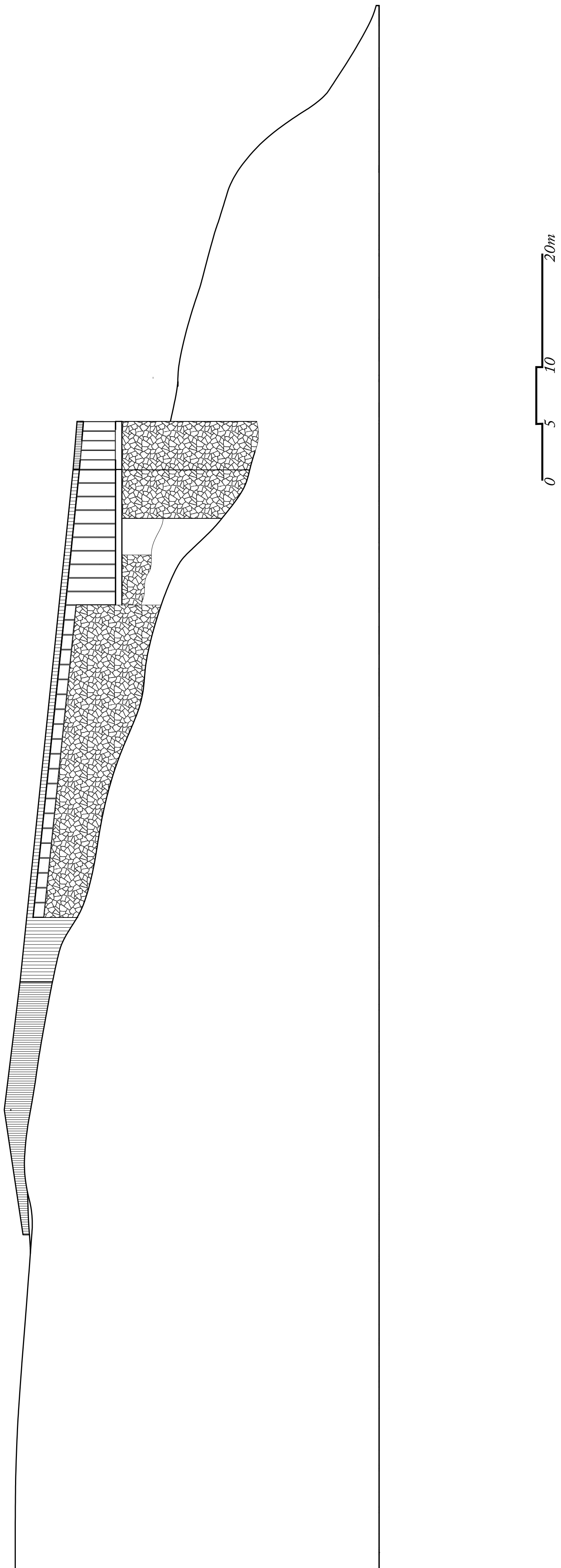
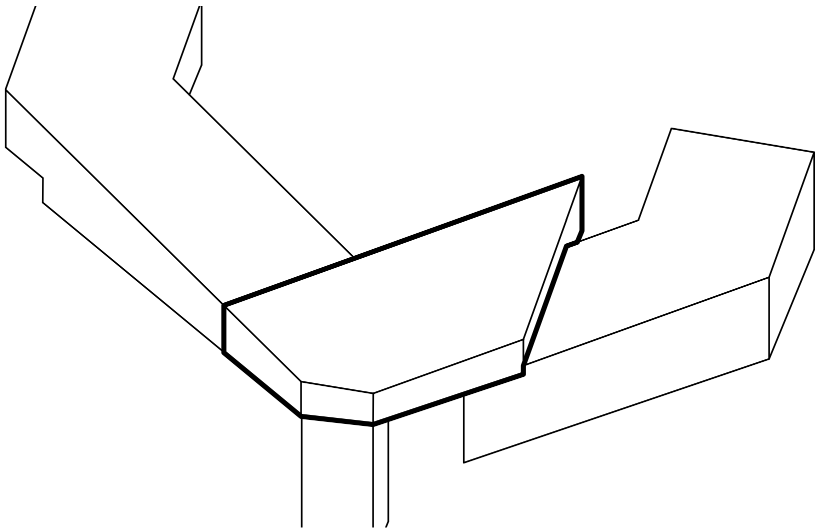


Fig. 35. Interior render showing Concert Hall (o.i)

Structural Considerations
Structural Considerations

Fig. 36. Location of Foyer. (o.i)



The choice of structural system has many implication on architectural quality. As the building is nestled low in the ground there was an ambition to keep the facade free to be able to get as much light into the building as possible while keeping the openings low profile. This lead to an exploration of different structural systems, the system would need to be adaptable to the shape of the roof. The selection of a timber frame structure was seen as optimal for both it's flexibility and it's interaction with the roof structure, making it simple to include acoustic treatment as part of the larger structural system. The roof appears almost floating over the heads of visitors, with only a few columns keeping contact to the flooring. As the building is pushed into the ground there are a multitude of demands put onto the materials with direct contact to the earth. It was therefore seen as appropriate that where the building meets the ground there be concrete. Concrete will act as both protection from moisture and also as a section foundation for the structure to rise from.

To investigate the multitude of variables that are within the structure a parametric system was developed that could control a number of parameters:

- The direction of the frames
- The distance between each frame
- The dimension of each membertype
- Colums
- Beams
- Transversal beams

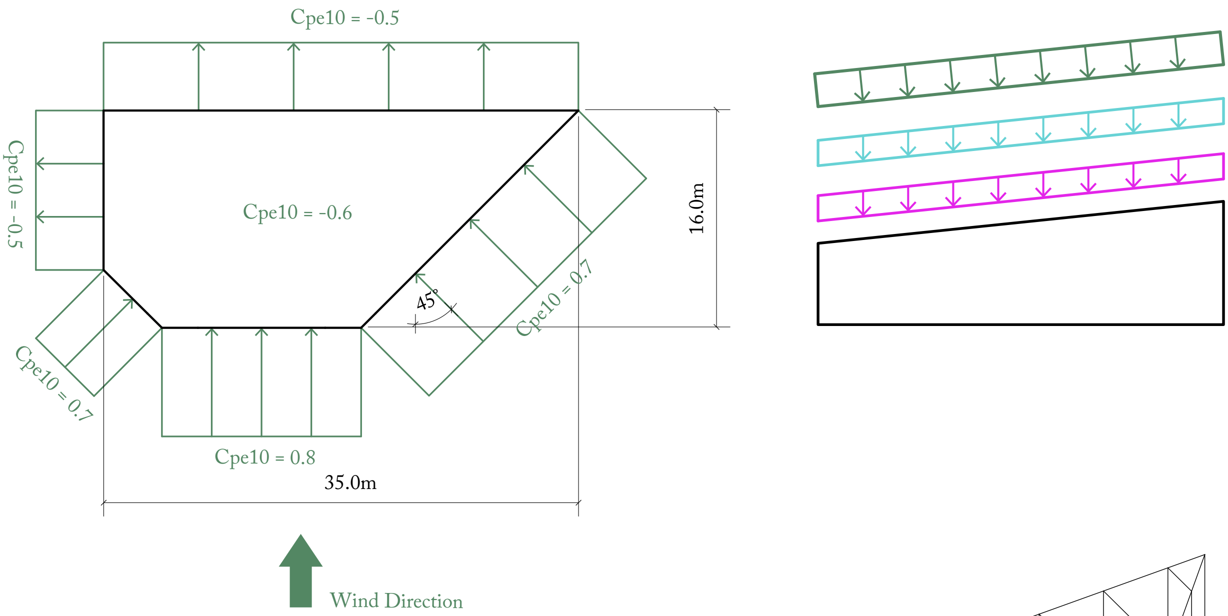


Fig. 37. Diagram showing wind loads and their action. (o.i)

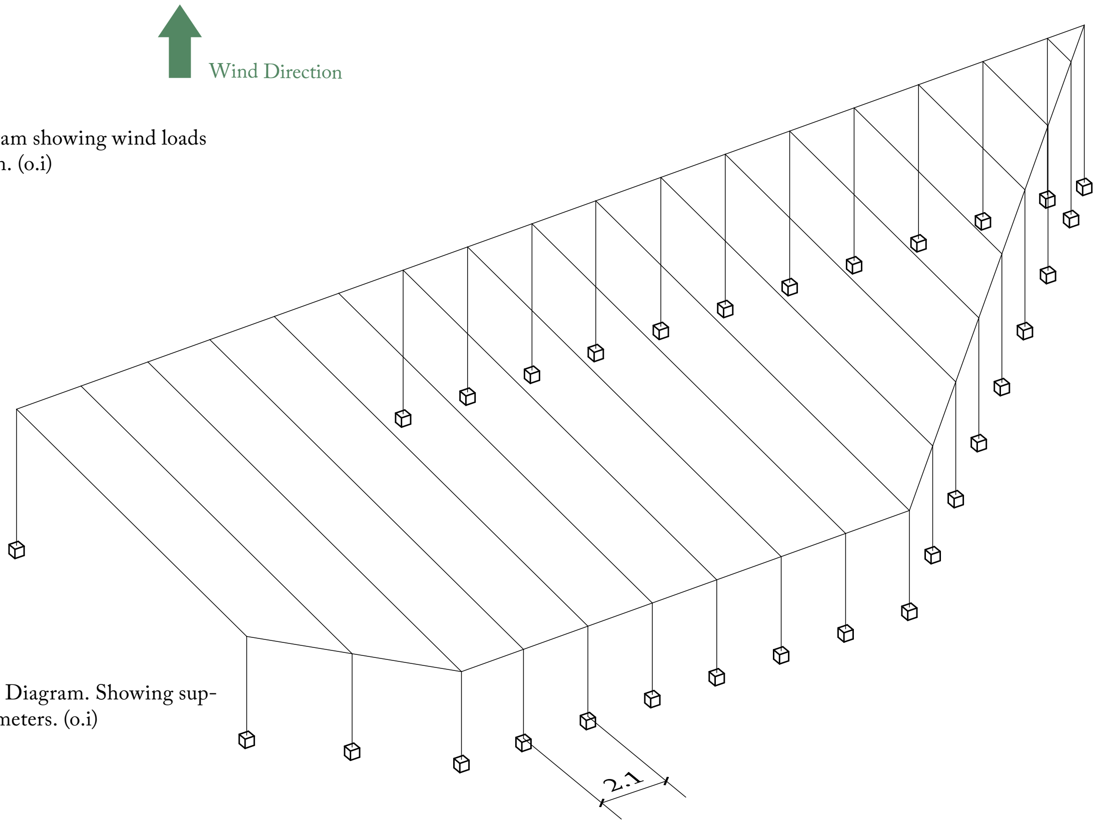


Fig. 38. Static Diagram. Showing supports and parameters. (o.i)

The direction of frames are aligned such that the beams are as short as possible throughout the entire roof surface being constructed. The distance between each frame is chosen based on a balance of visual impact from the surrounding views and the necessary dimension of the beams. This lead to a conclusion where the distance between each frame was 2.1 meters, allowing for a evenly distributed amount of frames, with minimal visual impact

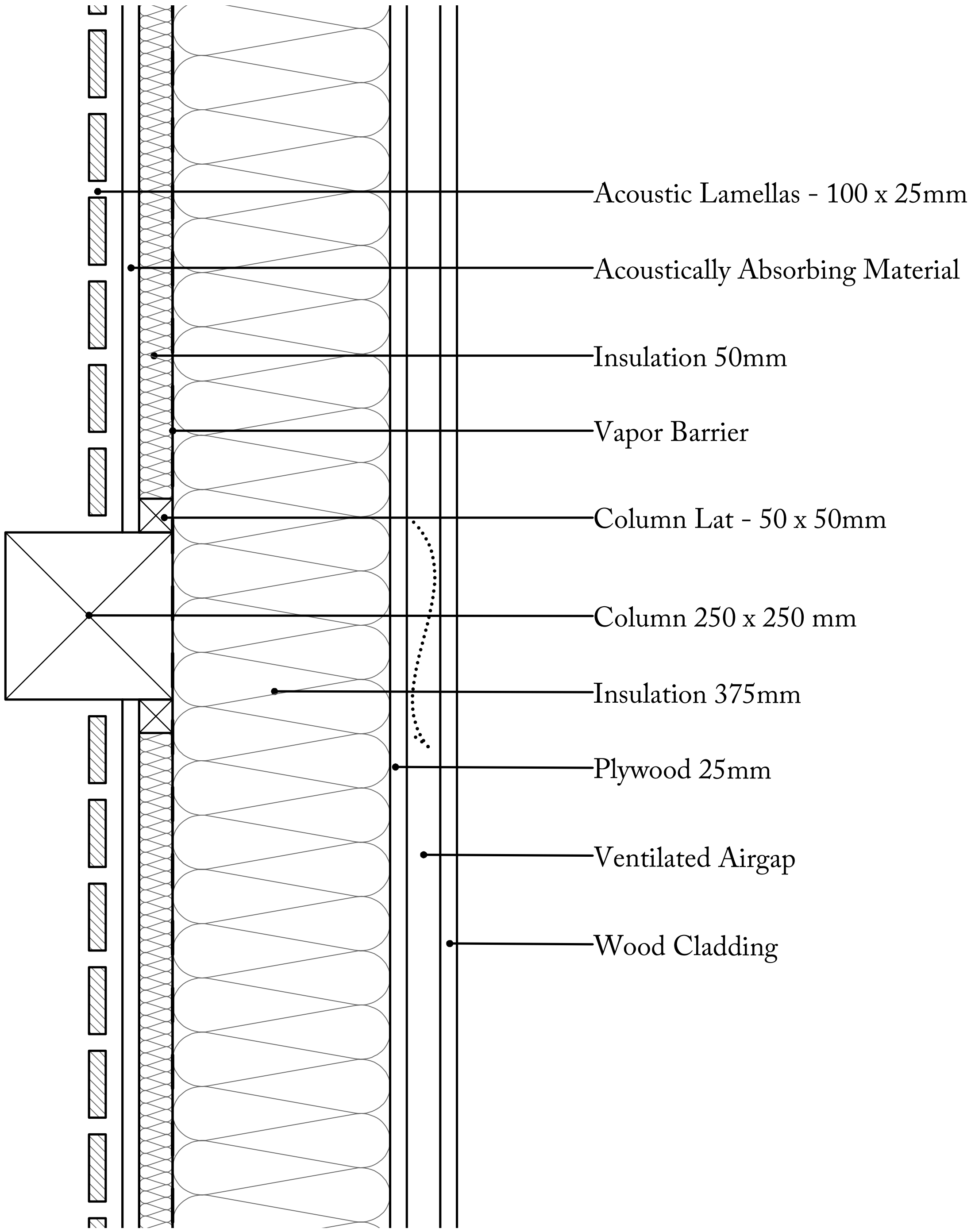
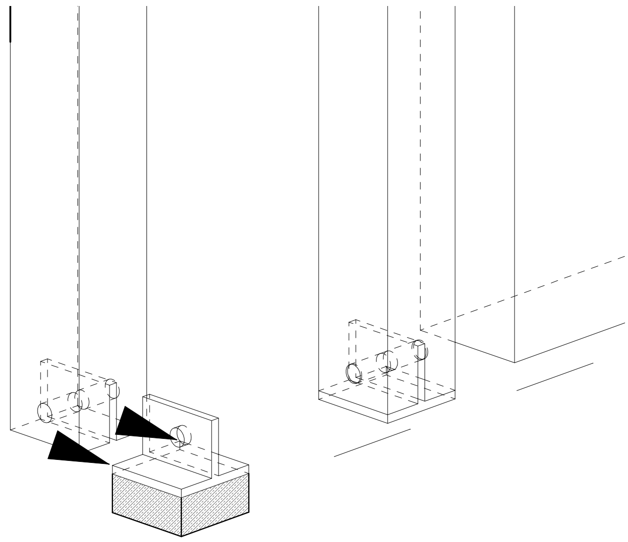

Acoustic Lamellas - 100 x 25mm
Acoustically Absorbing Material
Insulation 50mm
Vapor Barrier
Column Lat - 50 x 50mm
Column 250 x 250 mm
Insulation 375mm
Plywood 25mm
Ventilated Airgap
Wood Cladding

Fig. 39. (left)1:10 Detail of Column-Wall Joint. (o.i)

Fig. 40. (right) Isometric Diagram showing structural joint of column. (o.i)



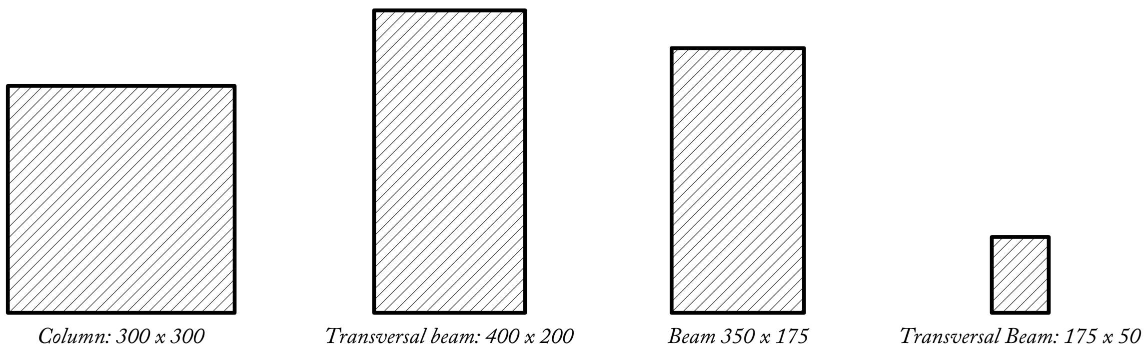


Fig. 41. Cross Sections of construction. (o.i)

The cross section are all at a high utilization ratio, minimizing material waste and increasing ceiling height. The largest transversal beam is dimensioned such that the large opening towards the entrance of the foyer can be left open.

Configuration Principles

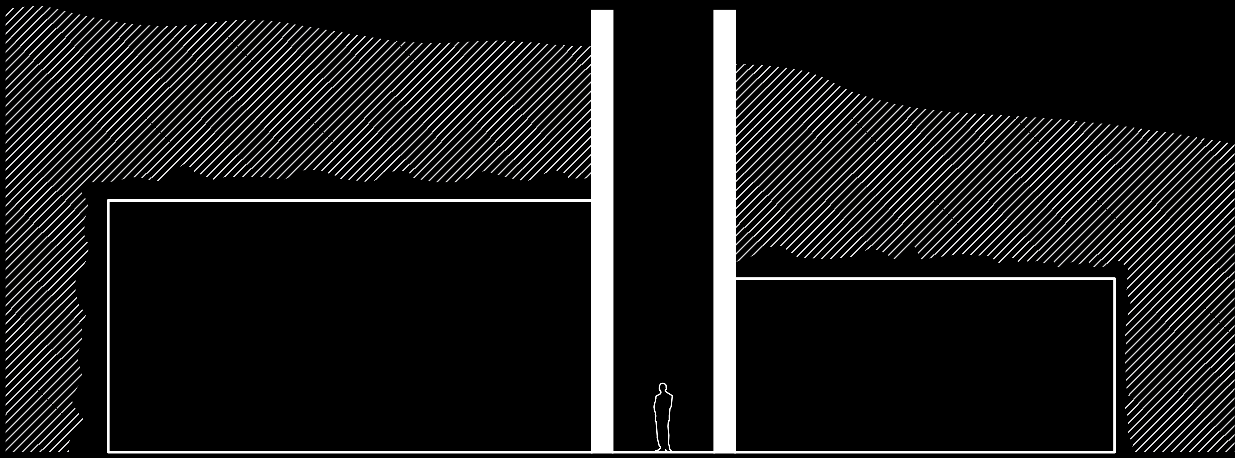
Fig. 42. (Left) Renders showing 3 categories of early concepts. (o.i)

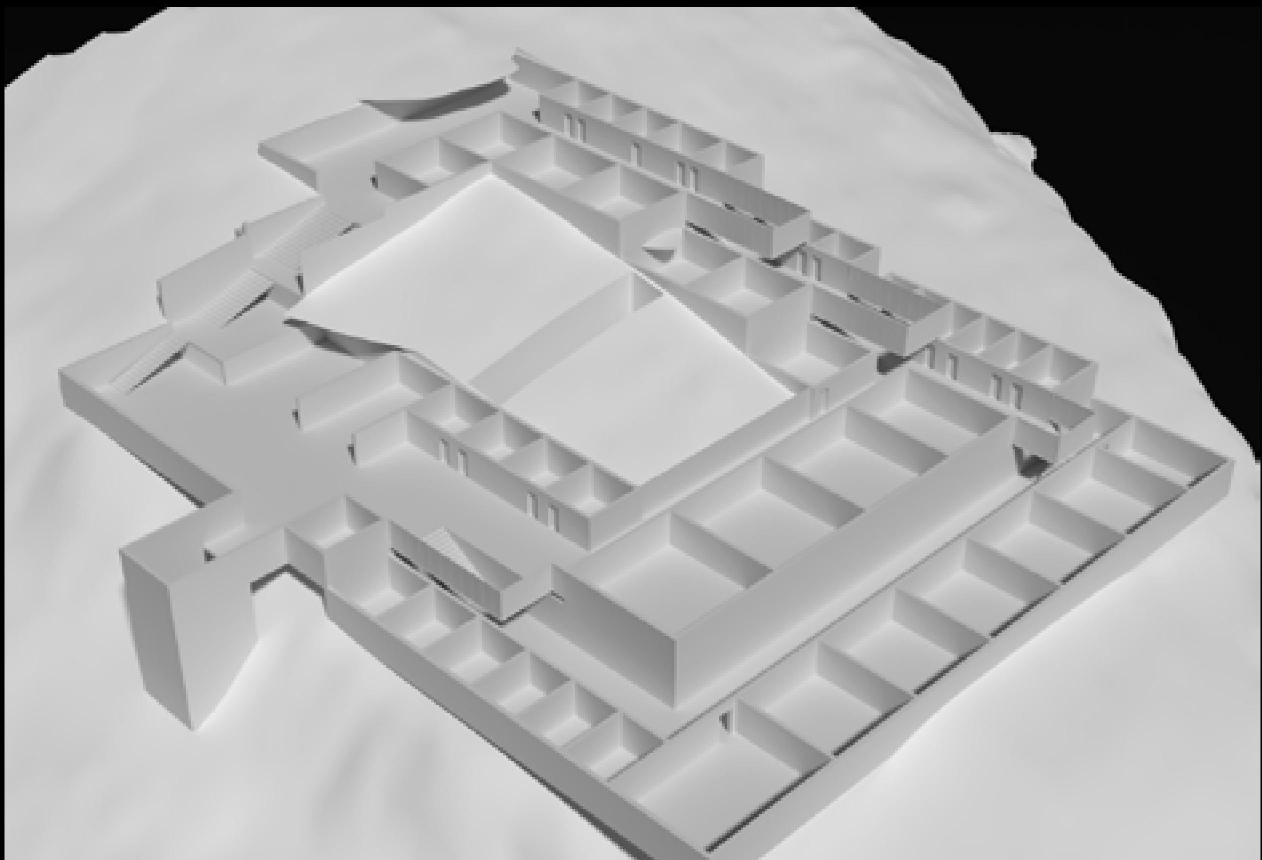
The early process is characterized as being pointing in several different directions. Different elements from the initial program are present, however, no coherent design direction is visible.

Multiple early iterations shared the theme of having many functions buried underground and having masses protruding out of the peninsula from the central functions as means to dramatically frame the views to the surrounding nature. These iterations, however, lacked an understanding and sensitivity to the site that seems central to building on the Faroe Islands.

As previously mentioned, the plateau, was since the programming phase seen as a valuable asset to the site and an investigation was set forth, in order to asses what qualities could be added to the project by placing most of the building mass at this location. While the building volume seems more integrated within the landscape, the long nature of the mass creates unreasonably long transition zones. Nestling the building volume into the landscape at this location additionally would destroy or hide the rock face that is seen as an integral part of the plateau. A conclusion was made that an activation of the plateau should not be at the expense of the rock face

Placing volumes on top of the peninsula became a solution that was closer to the ideology of following the natural topography. However, this stage was lacking a clear concept and the large volumes were seen as visually intrusive in the dramatic landscape.





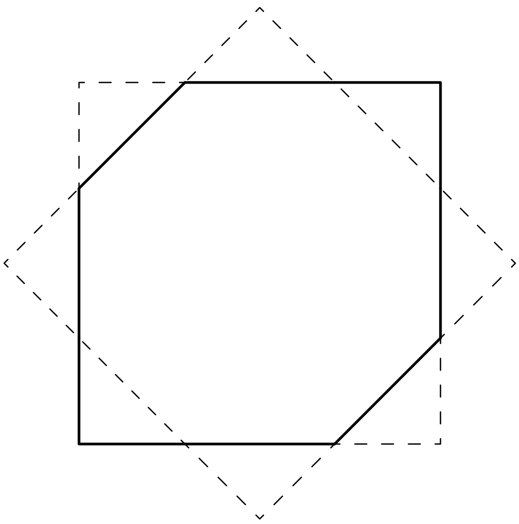
Creative Leap

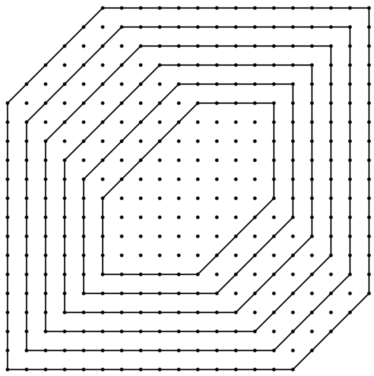
Fig. 43. (Left) Concept of the void between concert halls. (o.i)

As mentioned in the paper Creativity in the design process: co-evolution of problem–solution by (Dorst and Cross, 2001) the “Creative leap” often characterizes a design process when looking at it in retrospect. Looking back, the concept of flipping the traditional understanding of the semperian stereotomy and placing the musical performance space and an open space in between the two halls, became such a strong idea that it became instrumental in the further development of the project.

After the initial idea, many iterations still had to be made in order to arrive at a building that satisfied the many logistical, spatial and technical requirements, in addition to having a central idea behind it.
An early iteration was based on the idea of the interlocking rings and the musical progression mentioned in the presentation. The musical progression was interpreted into a rectangular layout that directly followed the idea of the musical progression without much regard to logistical issues that might arise.
A large amount of area was used for the hallway between the outer theoretical rooms and inner rehearsal rooms, without much variation or architectural intent within the space. Additionally, the large elevator that transports people to the underground performance should have a unique character and central placement seems like an unintegrated addition.

Fig. 44. (Left) Early concept based on musical progression. (o.i)





Development Of Concept

Fig. 45. (Left) Rationalization of concept. (o.i)

In order to solve aforementioned issues, it became apparent that a rectangular layout created large amounts of impractical transit space, especially in corners. The solution was created by superimposing two rectangles and by rotating one 45 degrees, the resulting region opened up large amounts of architectural possibilities. One such advantage was the new facades facing the magnificent surrounding views and more south facing windows making it possible for passive solar gains.

A grid based on this resulting region became an advantage in creating plan solutions, and while the final design is a somewhat changed adaptation of this, the core values of a rationalized approach are readable in the final design.

Facade development

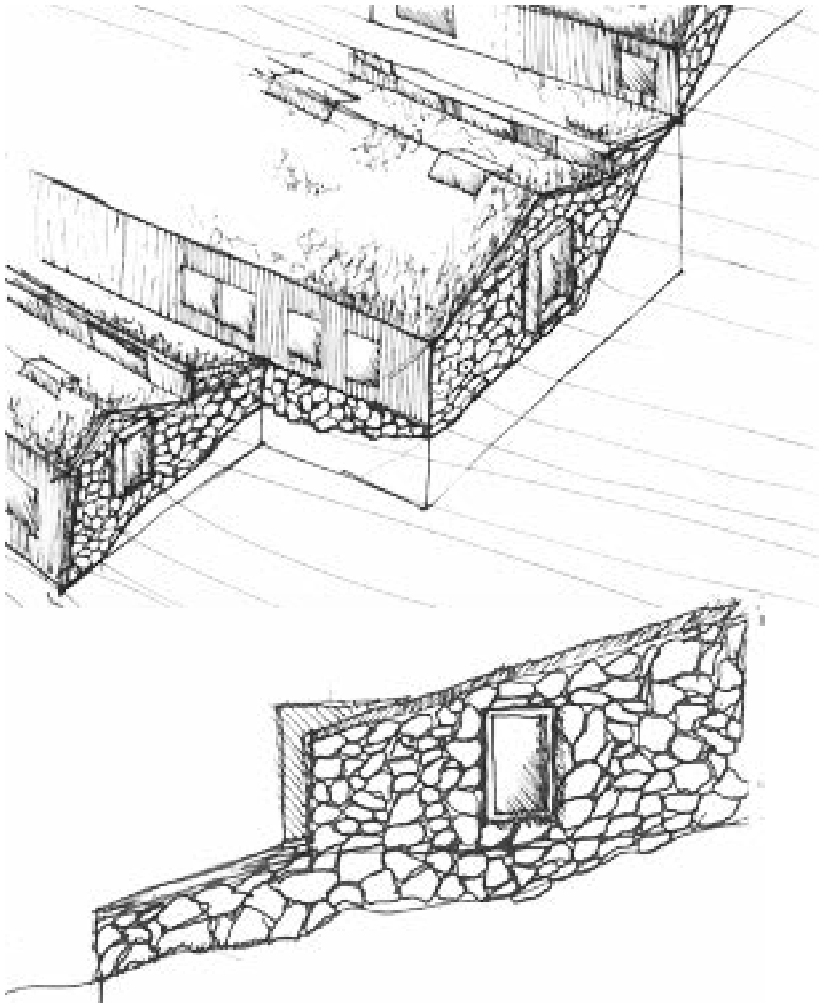
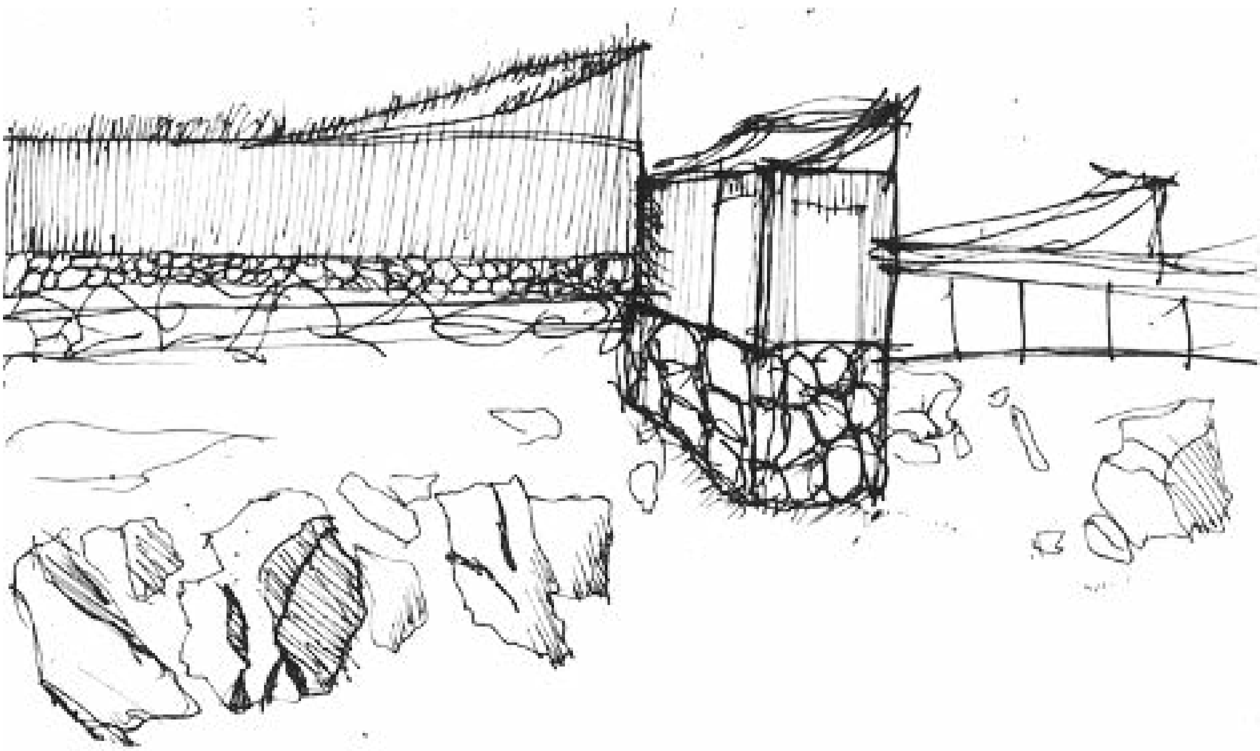
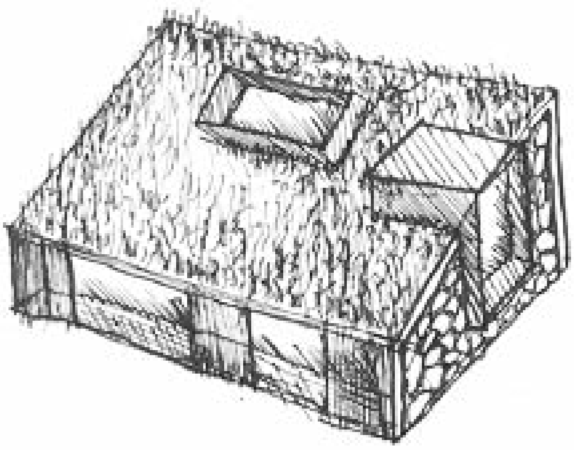
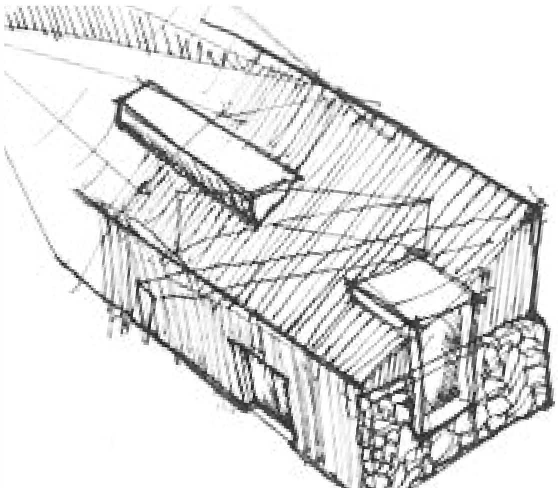


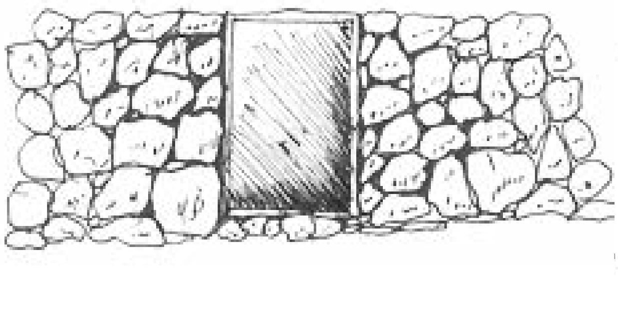
Fig. 46. Various Sketches on facade and topography relation. (o.i)

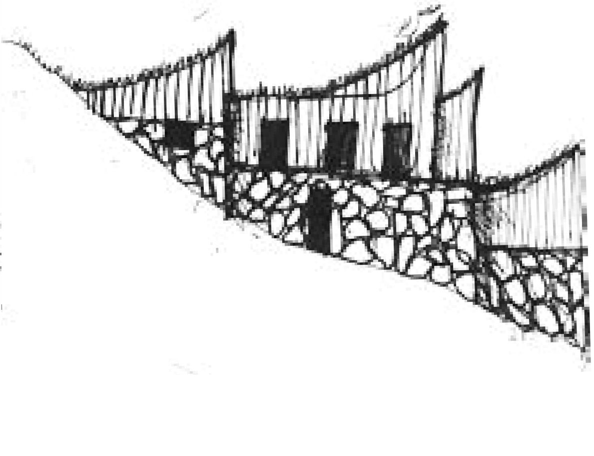
When considering the facade development, this part of the project was done in parallel with the development of the overall building and roof shape. As such, the first and more lose concepts are applied to multiple different scenarios. However, a common trait of them all is the juxtaposition of stone and wood. This is expressed in vertical wooden cladding that is a common trait on most Faroese houses, both old and new. The stone is laid as dry masonry and forms the connection between the natural landscape and the built environment. Further, the idea of having gables entirely of dry masonry is explored. Adding large and protruding window geometry to a wall that uses the naturally occurring and irregular stone is seen as a way to create visual contrast. These window boxes could additionally be used as a space defining element within the interior of the building as these would frame the surrounding view and create niches for solitary contemplation.
Since one of the key concepts of the project is the idea of following and nestling the building into the landscape, this means that several facades will not allow for windows with a view. Thus it became important to actively frame views and additionally to create skylights that allow for sufficient daylight to penetrate the building.

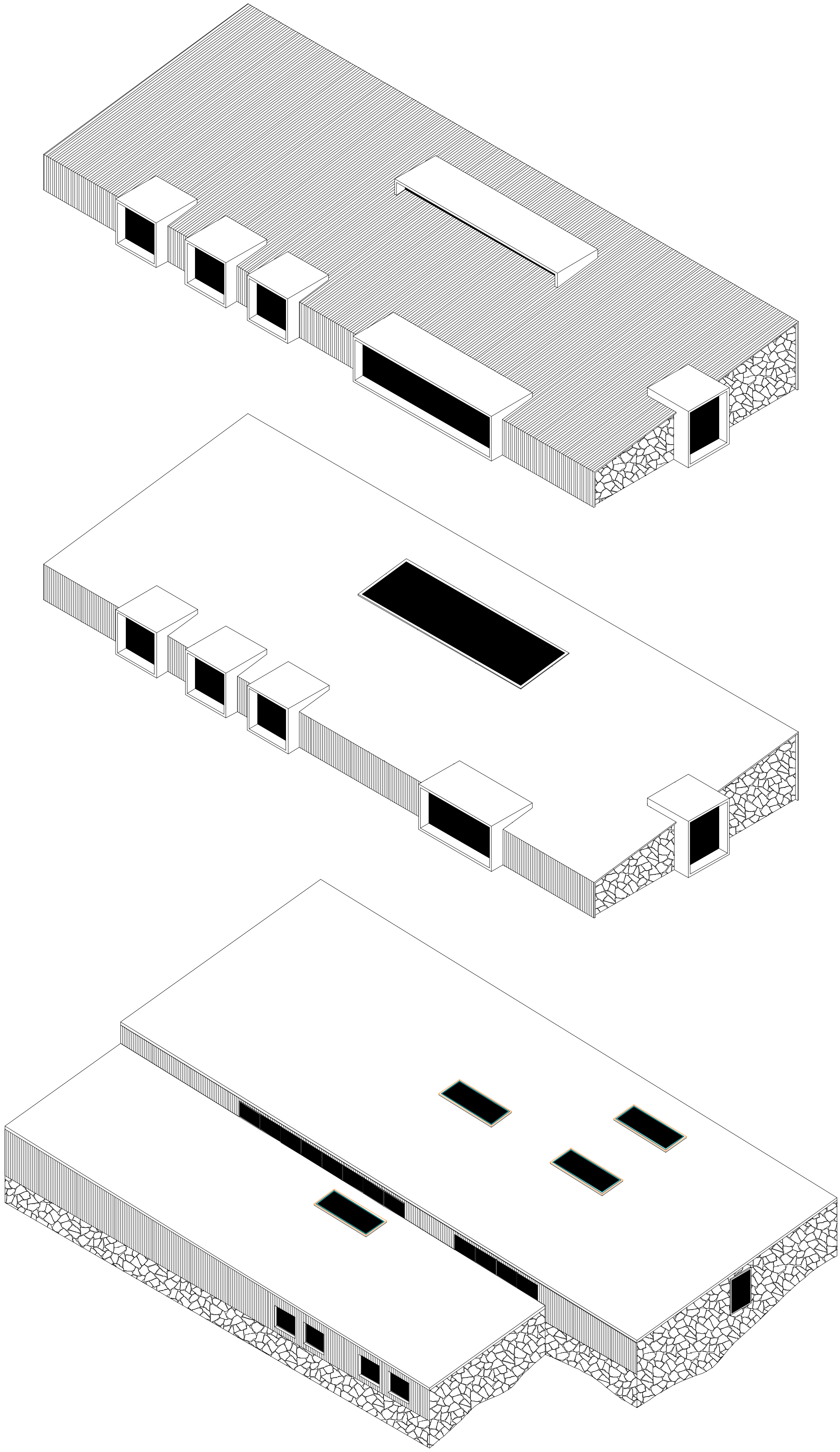












Facade development

Fig. 47. Iteration 1. (o.i)

Fig. 48. Iteration 2. (o.i)

Fig. 49. Iteration 3. (o.i)

After the more loose idea-development of the facade, vignettes showcasing a more in-depth detailing of the facade configuration were made. The examined scenario is considered to be part of the theory based section of the conservatory with a low inclination roof that integrates the building into the surrounding topography. This shape was found to be best fitting as not to compete with the surrounding landscape. Iteration one showcases the idea of having larger window niches to allow for the informal gathering of students. Further, this iteration has wooden cladding on the roof. However, in order for the building to create a dialog with the landscape when seen from afar and additionally adding thermal mass to the building, the use of grass or moss covered roofs is again considered.

Iteration two reinstates the use of moss on the roof and uses large skylight to allow ample light to penetrate into otherwise dark hallways.

The final vignette shows a principle very close to the final design, where a more simple window typology is favored, as the overall building form and layout is relatively complex. The use of intricate window patterns was thus deemed to subtract from the overall building expression rather than add to it. Smaller bands of windows between the stepping roof faces were used as an interpretation of the naturally occurring hamar on the site.

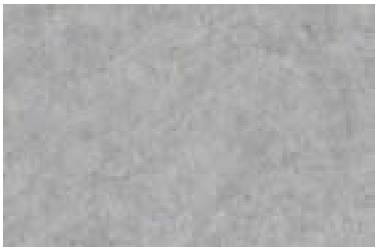
Smaller skylights are used in strategic locations where more light is needed instead of using one big and creating the risk of overheating during summer.

Materials

The materials used in the Faroese Music Conservatory can be grouped into two categories that reference the two most commonly used materials in the traditional Faroese vernacular.

Stone

Concrete
Concrete is used as a constructional element in where moisture might present an issue and is further utilized in one of the most striking architectural elements of the complex. In this area, the smooth concrete walls are contrasted with exposed natural bedrock to highlight the feeling of being underground.



Screed
Scree is used as an enclosure for the rehearsal spaces and an analogy for the rock and how it is used to encapsulate the music within the project. Where rehearsal spaces oppose theory rooms, the screed contrasts the lighter wooden construction and create the feeling of entering into introvert space where personal immersion and concentration is in focus.

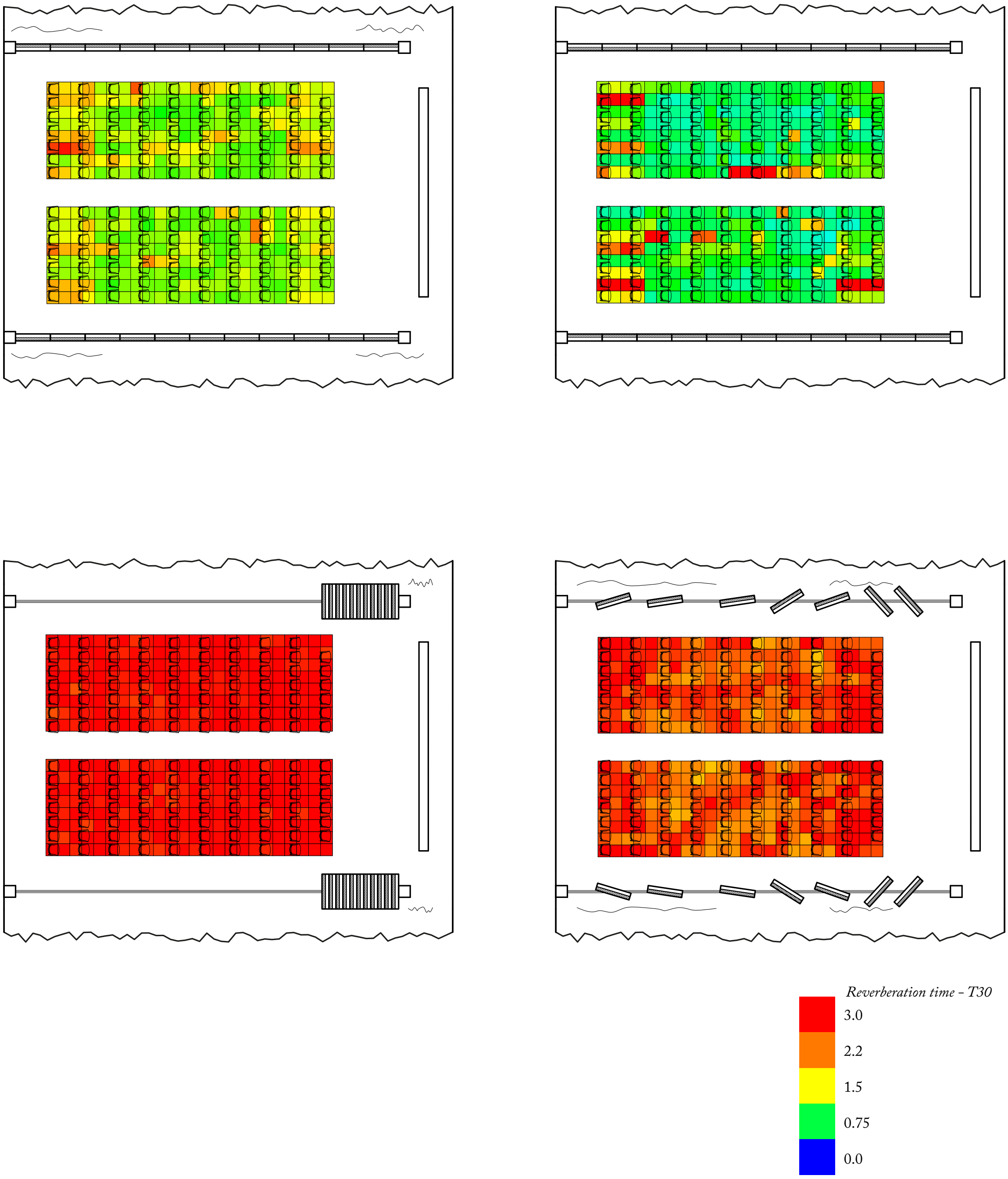
Dry masonry
The traditional craft of Faroese dry masonry is used not only as the connecting medium between the wooden facade and the earthwork but is also used with the interior of the Faroese Music Conservatory. When entering the recording studio area the walls are composed of natural Faroese stone to even further highlight the concept of the stone being closest to the music.
Traditionally, dry masonry was done with carefully selected interlocking stones and without any mortar to bind stones together. Today, however, a layer of cement is often added "behind" the stones used to ensure a watertight construction and to ease the jointing process.

Wood

Glue laminated timber
Like in the old Faroese vernacular, wood is the main load bearing element in the Faroese Music Conservatory. Due to the presence of some larger spans, the use of glue-laminated timber is preferred over traditional construction timber, as individual members can be manufactured in much longer dimensions and with structurally optimized values.

Wooden planks and lamellas
A lightly colored Scandinavian wood is used as the flooring and loft cladding. This has the effect of creating a bright interior in zones where this is wanted while creating an environment of low reverberation.

CLT
The concert hall is constructed of cross-laminated timber panels made from lightly colored spruce. Whereas regular timber is an anisotropic material,-CLT has the same physical properties regardless of the direction of which forces are applied. Because of this property, it is seen as an ideal material to construct the shell of the concert hall.


Reverberation time - T30
3.0
2.2
1.5
0.75
0.0

Acoustic investigations

Fig. 50. Acoustic exploration of different configurations that the black box can have

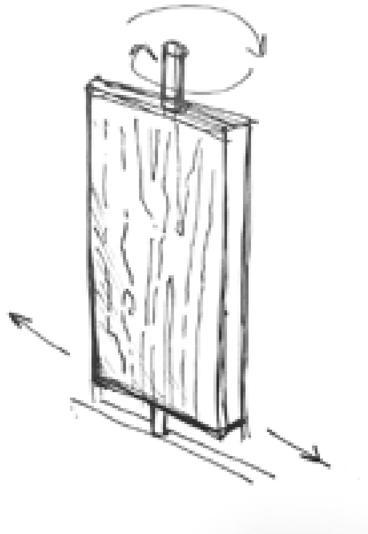


Fig. 51. Sketch of swivel mounted panel, acoustically reflective on one side while acoustically absorbant on the other.

While the concert hall has been optimized for a specific setting and type of music, the ambition with the black box was to create a system that was as flexible as possible, allowing for the largest spans of acoustic character and customizability. The room should become an instrument in and of itself, where a person trained in the instrument can produce any number of sounds and moods. Further, there was an ambition of implementing the beautiful rough cut surface of the stone as a reflector of sound, creating a cave-like experience for the audience. The solution was to create a three-layered envelope structure on the sides of the hall. First a layer of rough stone, a reminder that you are underground, next a heavy curtain, designed to be used as an absorber of higher frequency sound and last a system of wooden panels. The wooden panels are each equipped with one smooth wooden surface and one perforated surface. The panels are mounted on a rail system with a swivel mount, making it possible to slide them from one end of the space to the other. There are just enough panels to cover the sides completely in either absorbing or reflective surfaces. With these three simple elements, two of which are able to be manipulated, it's possible to create an infinite amount of interesting and effective acoustic environments with very different aesthetic qualities. To the left are but a few configurations that were made to explore the extremes of the system. The modular system allows for drastically different acoustic environments, with the highest reverberation times break the scale at 5-6 seconds, while the lowest being around 1.2, with the possibility of going even lower if the stage and back walls were clad in an acoustically absorbing material. A lot of explorations can be made further on the reflective directions that the wooden panels can create, creating completely different acoustic environments on both ends or sides of the hall is a possibility, or even tuning specific panels to specific instruments or sounds. The black box is truly meant to play as an instrument, not just to an audio engineer, but the low-tech solution makes it possible to change the acoustic environment on-the-fly for students exploring and experimenting with sound.

Concert Hall

Story and Layout

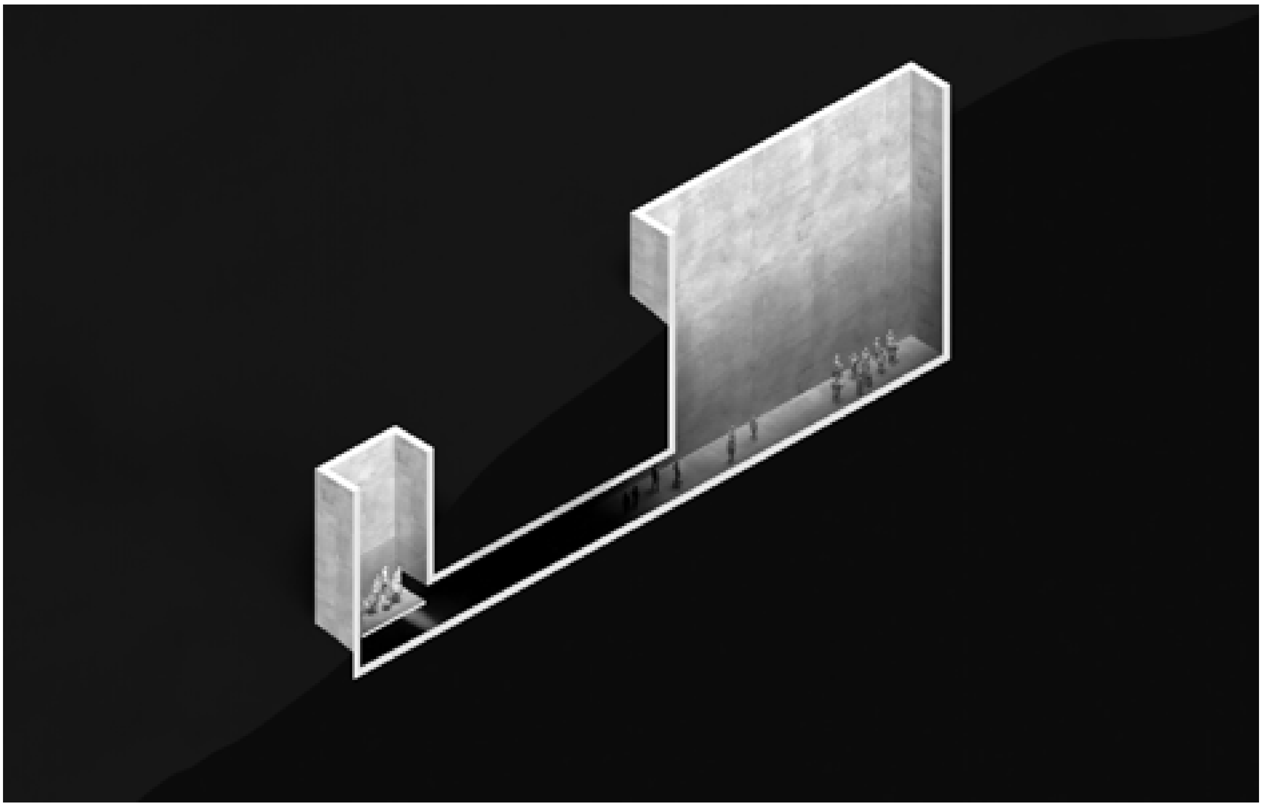


Fig. 52. Conceptual Isometric of journey from Foyer to Concert Hall.(o.i)

Throughout the building, there are references and symbols of what lies beneath the surface. The music within the landscape. As the audience moves closer towards the performance of music so does the intimacy of experience rise. The audience will move from the staggering views from the lounge above towards the music aided by a very large elevator hidden within the floor slab. As the elevator slowly descends into the darkness the audience will also sense a change in temperature, from a comfortable indoor temperature from the lounge above towards a colder zone. When the elevator stops in the darkness the audience will see nothing but a small light at the end of a dark tunnel. Shuffling towards the light the audience will sense the immense size of the upcoming room. outside flooding in from the skylight, the acoustics are lively and loud, echoing the size of the space. From here the audience will shuffle into the concert hall. The warm glow of the room within the concrete box is pouring out of the openings. Once entered, the cocoon can be seen enveloping the audience, swooping up from the floor of the stage all the way over the audience and colliding with the back wall.

Fig. 53. Render showing hallway between the two concert venues. (o.i)

Concert Hall
Designing a concert hall

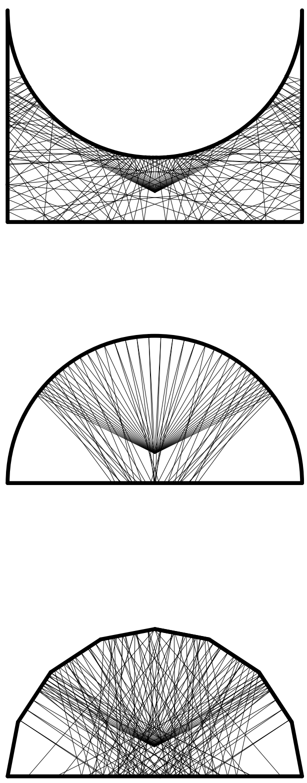
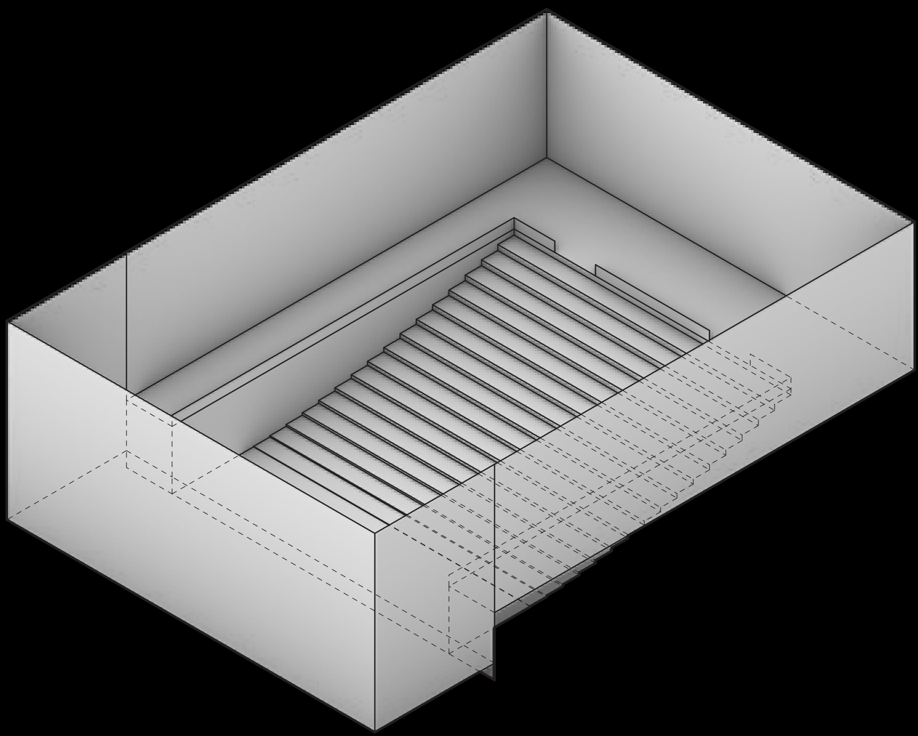
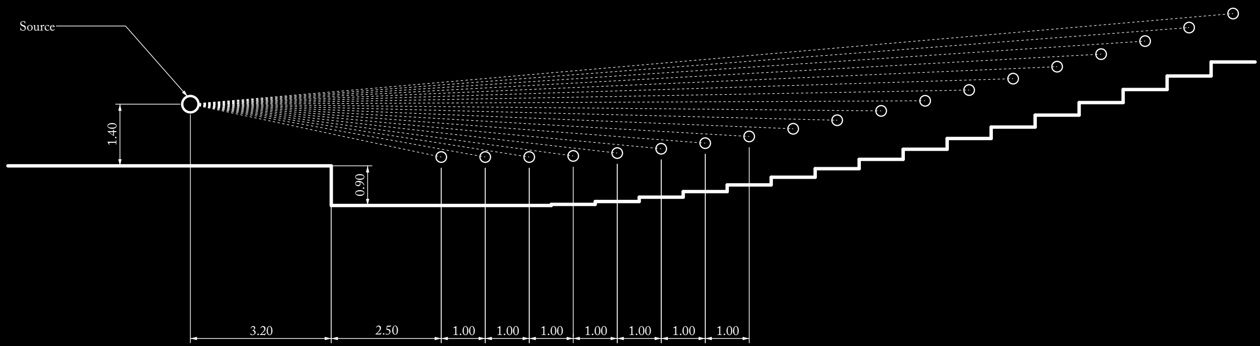


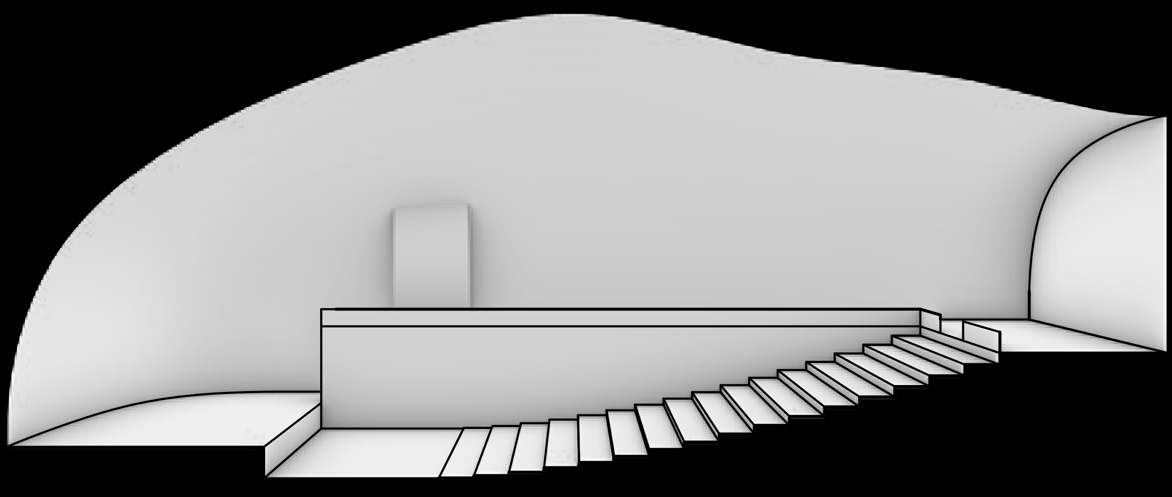
Fig. 54. Shapes showing the contrasting acoustic performance of a concave and a convex shape. While the concave shapes perform admirably structurally, it's acoustic effect is one of focusing the sound to a specific point. The convex however functions as an excellent acoustic diffuser but has very poor structural performance.

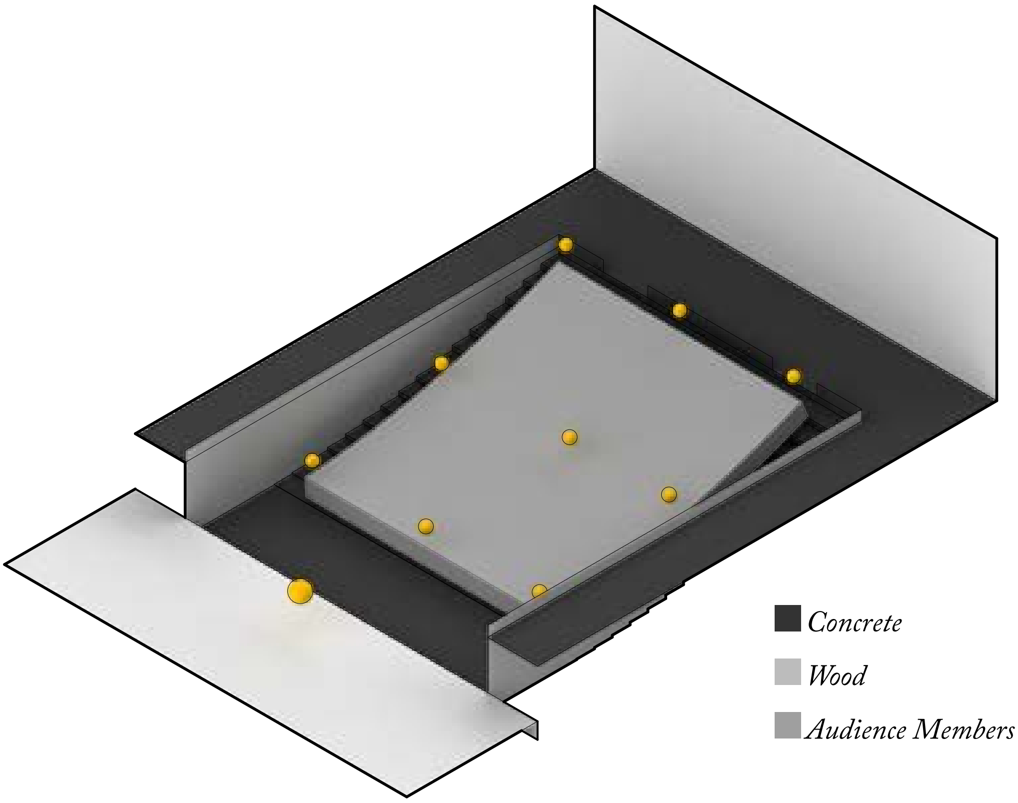
Fig. 55. From top:
1. Isometric diagram of concert hall before receiving
2. Diagram showing sightline principle
3. Perspective section showing freeform shell before adaptation into Folded Timber.

The approach for designing a concert hall is one of compromise. The complex assignment has a multitude of demands for anything from the amount of seating, sightlines, acoustics to the structural performance of the large span, people flows and a multitude of other intricacies. While some of these challenges are fitting to solve within a classical architectural approach, some are difficult to balance. To effectively solve this task, multi-objective optimization has been utilized. Detailed in the coming pages, the methodology seeks to find solutions that, while not the best in any specific area, provide an optimal compromise, one that balances the specific demands of a multitude of objectives. Far too often rooms are created where additional acoustic treatment is needed, hanging expensive and heavy shells from the ceiling or similar(Mendez). These heavy shells can place a heavy toll on the structure surrounding the hall.
The stage is set within a classic shoebox-shaped hall that will be the base of the coming studies. The box is designed to hold approximately 450 people, a size fitting for the venue and location of it. The gradient of the seating is based on a logarithmic arch to ensure appropriate views for all audience members, the addition of a balcony is applied to create intimacy and also to facilitate the location of an elevator, such that even impaired audience members can get the full experience of approaching their seat. The idea of creating a wooden cocoon living within the stone is one based in tectonics. As mentioned previously the Faroese understanding of tectonics blurs the line between stereotomy and topography. Placing it's most valuable resource of music within the stone rather than on top of it. The cocoon's shape is freeform, a shell designed to create an enveloping feeling of being wrapped up in music, it is further a hope and educated guess that this is also a shape that balances structural performance and acoustics. However this shape is not set in stone, rather it's the point of departure for the studies to come. The shape will be reinterpreted with the art of origami, folding will create not only effective reflective surfaces but also add incredible amounts of stiffness to the entire construction. Though the principle of folding is used the final result is not meant to be folded, the approach is rather to rationalize the final folded structure to an array of discrete elements.



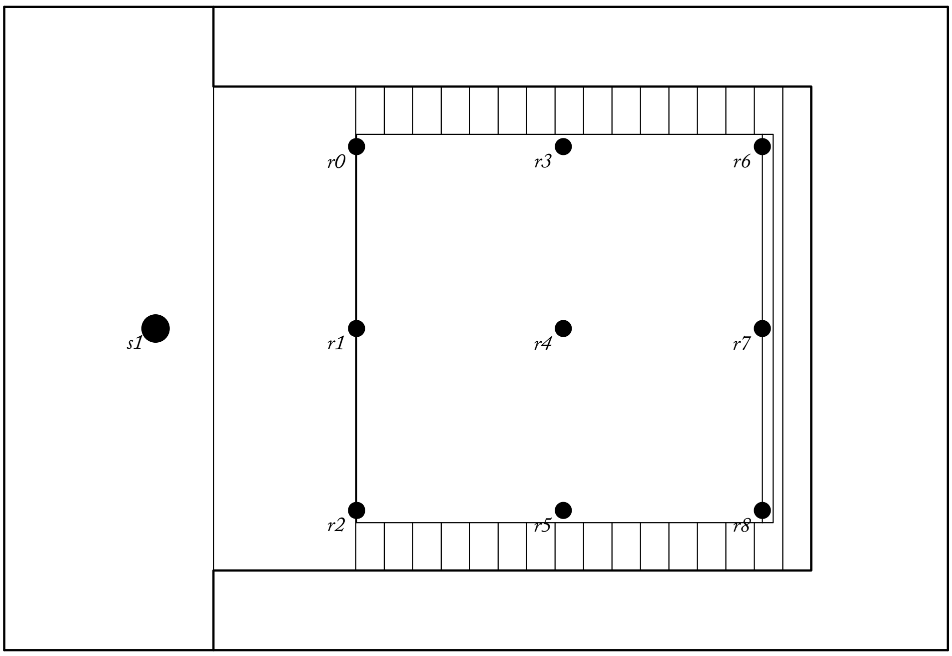

Source
1.40
0.90
3.20
2.50
1.00
1.00
1.00
1.00
1.00
1.00
1.00





Absorbtion Values

Hz	**125**	**250**	**500**	**1000**	**2000**	**4000**
Wood	15%	11%	10%	7%	6%	7%
Concrete	1%	2%	4%	6%	8%	10%
Occupied Seating	45%	50%	60%	70%	70%	65%



Concert Hall
Acoustic Considerations

Fig. 57. Isometric diagram showing model before receiving shell.

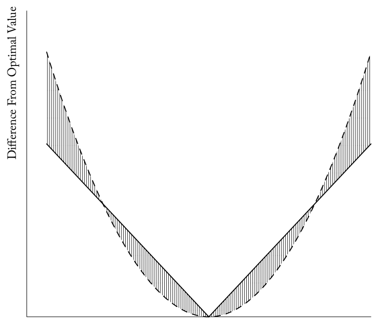


Fig. 56. Graphic representation of the weighting function. As the result approaches the optimal value of 0, the weighting creates a pull towards 0, likewise as the result travels further from zero the function pulls away from 0.

Fig. 58. left :
Plan view showing source and receivers for acoustic simulation. The positioning is such that the results, when weighted give a good understanding of the acoustic properties of the space. (o.i)

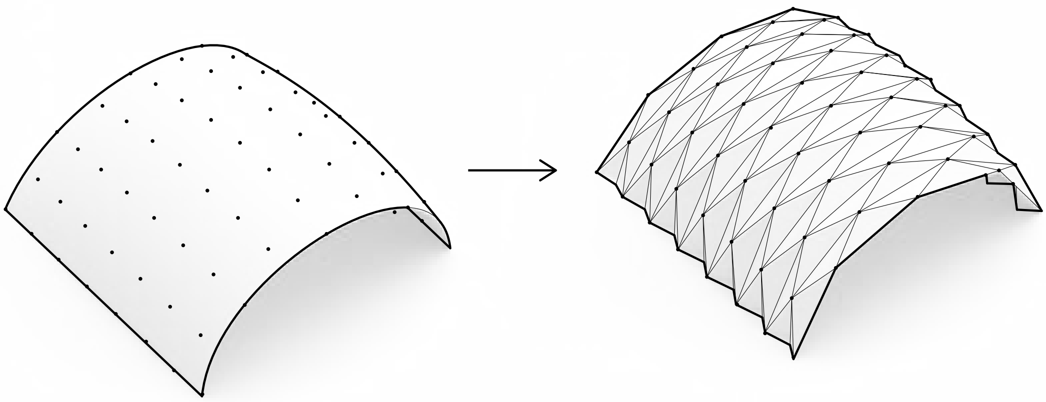
The acoustics of any arena where music is being played is of course of utmost importance. Careful control of sound is demanded, which is why the concert hall must be sculpted to fit the acoustic needs of the space. Sound is a subjective experience, yet there are studies and parameters that we can lean on to discern if the acoustics of a space built or not is good, quantifying subjective experience through objective measures. Detailing of the aforementioned measures and recommended values can be found in the book "Architectural Acoustics" by Marshall Long(Long, 2005). A brief presentation of some of the most crucial follows:
T30 - Reverberation time; the length of time required for sound to decay 60 decibels. This is one of the main factors that plays into our perception of space and scale.
EDT - Early decay time. The time needed for sound to decay between 0 and -10dB. A short EDT value can often indicate good clarity in speech and perception
C50 - Clarity. Describes the ratio between the total energy amount before and after 50ms. The higher this value the more clarity of sound can be perceived.

While some of the more detailed parameters are not within the scope of the study, the ideas will all be implemented.

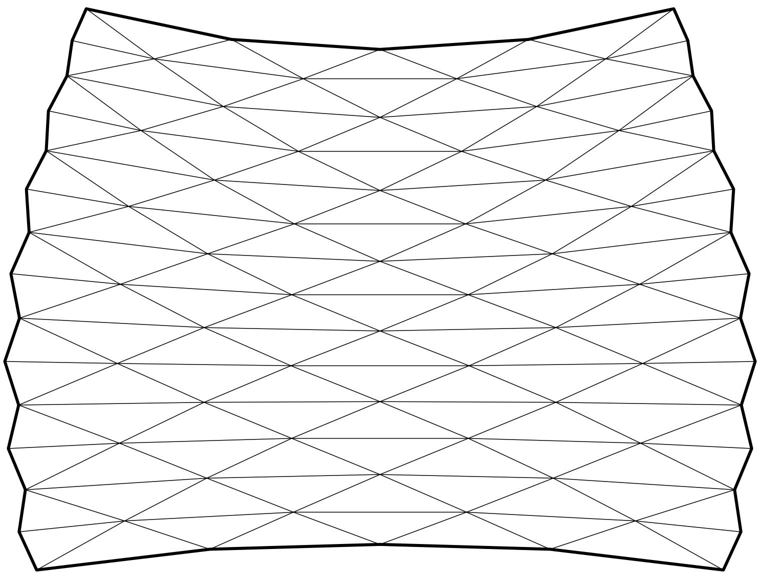
To study the acoustics of the space digitally a computer simulation methodology called raytracing will be used, implemented with the previously mentioned tool EMRT. Ray-Tracing simulates the properties of sound and functions to read the sound energy of the room and to discern objective acoustic parameters from that. The results from EMRT will be the basis of two of the objectives in the Multi-Objective search. The Reverberation time T30 and Clarity C50 are the chosen parameters, that will give a simplified but accurate measurement of space's acoustics. Both of these objectives will be averaged and weighted with a simple weighting function, where the optimal score for any objective is 0. This weighting function "helps" the Multi-Objective algorithm discern good results from bad.

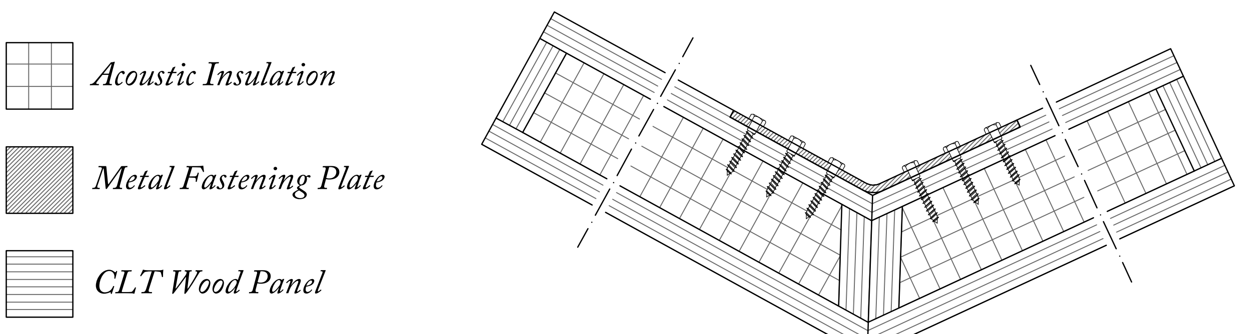
Parameter	*Goal*	*Weighting Method*
C50	*-1 dB*	$\lvert C50 - C50_{opt} \rvert^{3/2}$
T30	*1.8 Seconds*	$\lvert T30 - T30_{opt} \rvert^{3/2}$

When the search is concluded, the final shell will be analyzed and validated within another acoustic ray tracing package - Pachyderm. This package has been previously benchmarked and is, therefore, more suitable for the analysis and presentation of the final results. Further, the results will have more detailed parameters that EMRT does not produce yet.



Split surface into grid *Connect with pattern*





Concert Hall
Structural Considerations

Fig. 59. Miura Ori Folding Pattern

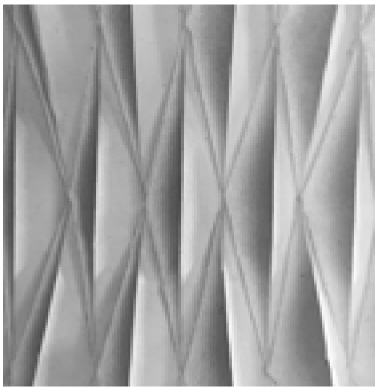


Fig. 60. Yoshimura Folding Pattern

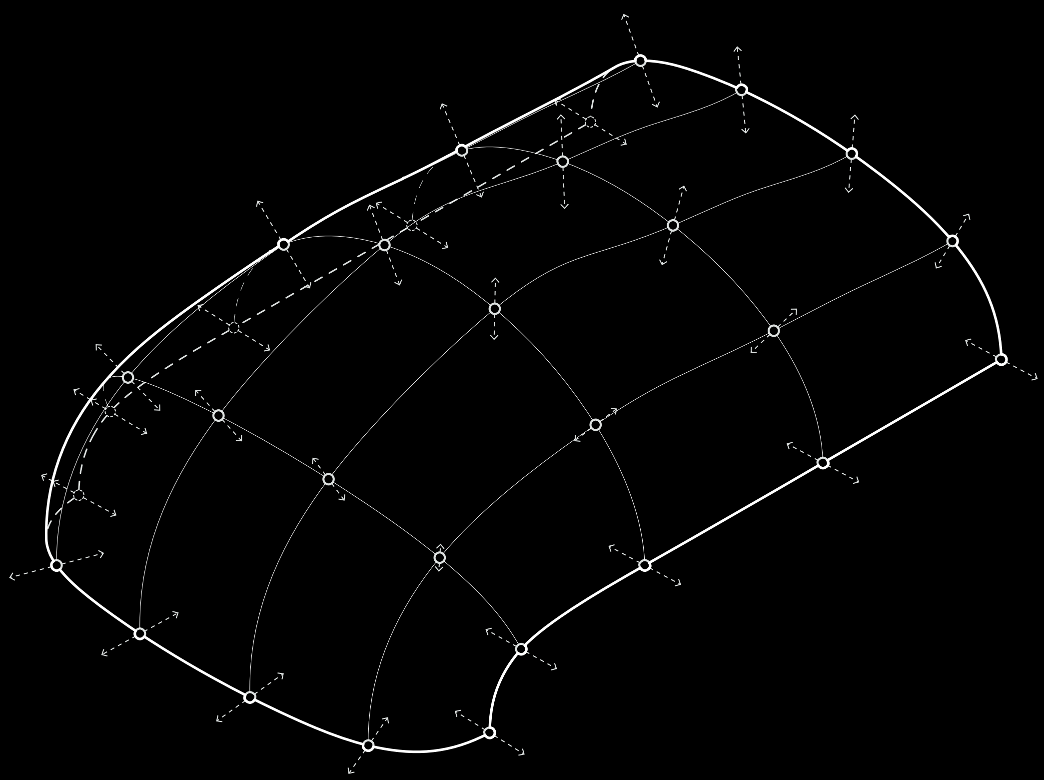
From top:
1. Process of creating folded structure from NURBS surface.
2. Flattened Folded surface.
3. 1:10 Detail showing connection between individual timber panels. (o.i)

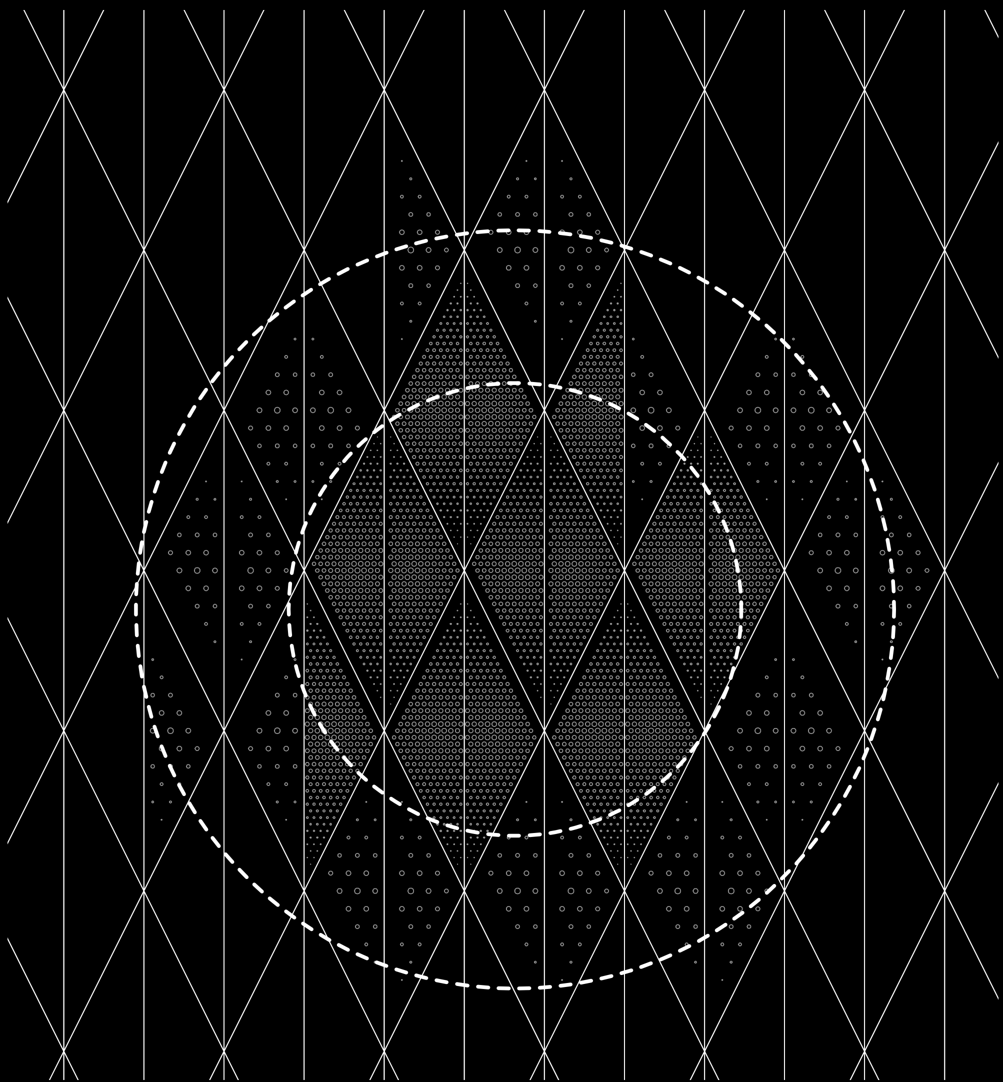
Folded plate systems
Everybody is familiar with the structural benefits of folding. Even with just a simple fold across a piece of paper creates a surprising amount of structural strength in this measly piece of paper. Each folded line represents a line of stiffness added to the system. The same principle can be applied to achieve remarkable spans with very thin elements in architecture, without the complexity of creating a single curved or double curved surface. While historically the folded systems designed were cast as concrete thin-shells, a very expensive and labor-intensive process. Recent research has proved methodologies for creating folded structures with discretized prefabricated timber elements (Robeller, Christopher & Weinand, Yves, 2015). This brings along a multitude of advantages that structural wood has, CO2 storage, excellent weight to strength ratios, and excellent workability.

Folding patterns
There are a multitude of folding patterns to choose from, multiple patterns were considered, but the Yoshimura pattern was chosen. The Yoshimura pattern has numerous advantages, it's triangular in nature creating solely planar faces, an advantage when considering rationalization of the panels. It's triangular nature also adds a considerable amount of stiffness within non-primary fold line directions. The Yoshimura also has the possibility to be very easily produced with the use of a freeform surface, opening the possible search space considerably.

Jointing
One major challenge within prefabricated discrete elements is that of jointing. The joints between each panel have multiple roles, one being structural strength and the other being a locator feature, allowing ease of assembly on site. As the structure only one visible side the solution proposed is to implement bent metal sheet stock within a milled out section of the panels. This would be a simple addition to the CNC pattern already utilized to cut the miters on the panels.

Analysis
To implement structural analysis in the parametric workflow, the Grasshopper plugin Karamba by Clemens Presinger will be utilized. This is a Finite Element analysis plugin capable of receiving mesh inputs. In addition to gravitational self-load, an additional load of 50kN has been implemented, this is to make certain that any equipment loads can be carried by the shell. The cross-section of the shell for analysis has been kept at a constant of 50mm, this is not totally accurate, but is rather an approximation, as the elements are 100mm thick but hollow to allow for acoustic perforations. The plugin simulates the loads on this mesh and returns a number for maximum displacement, which the multiobjective algorithm will try to minimize.





Concert Hall
Parametric Model Creation

To create a parametric model that was flexible, simple, and predictable required a fair bit of development. The following will be a brief description of a linear progression through the parametric system from shell to simulation. The aforementioned shell that was to be the base of the design is loaded and a grid of points (5 x 6) is extracted from it. The point density choice was such that the resolution was high, yet the amount of changable parameters was kept at a reasonable level.

Global shape manipulation

Fig. 61. Isometric showing how surface can be manipulated by dragging points along the surface's normal. (o.i)

The points are moved along the surface's normal with an amount -2 to 2 meters, to keep the shell symmetrical and again to reduce the amount of changable parameters the movement of the points is mirror on the shell's longtitudinal axis, these points are used to create the new manipulated surface, that can vary drastically from the original input surface.

Yoshimura folds

To create the folds the new surface get's split into a parametrically decided grid, this is what decides that amount of fold in the u and v directions of the surface. Any shape manipulation is now over and the folded structure is sent further for simulation.

Structural Analysis

The structural analysis of the folded timber shell is as mentioned previously relatively simple, the borders of the shell are kept fixed and the shell is otherwise free to displace.

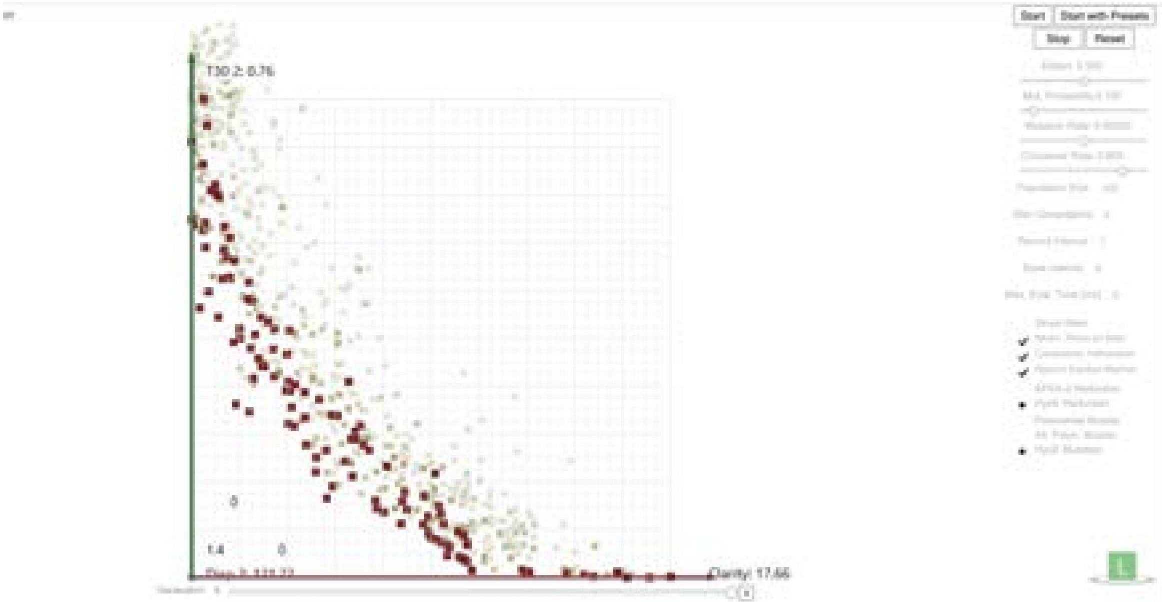
Acoustic Analysis

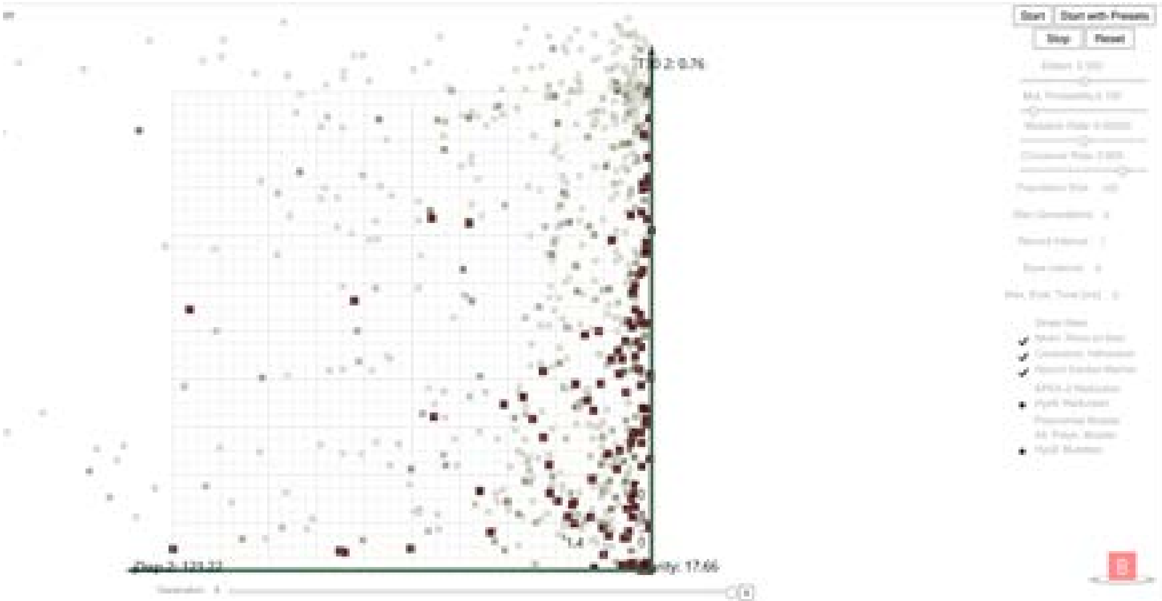
The acoustic analysis demands a few parameters further, by implementing localized perforations, the amount and location of acoustic absorbtion could be included into the shell. Five points are created on the original surface, these points can be moved freely along the u and v value of the surface. The factor of perforation is then decided based on the distance from this point to all the centre points of the panels, if the centre point is within radius x then it will be perforated 25% and the centre point of the panel is within radius x+falloff then the panel gets perforated 5%, if the panel is within neither then there is no perforation. These perforations create three acoustically different values that each individual panel can have (Long, 2014:298).

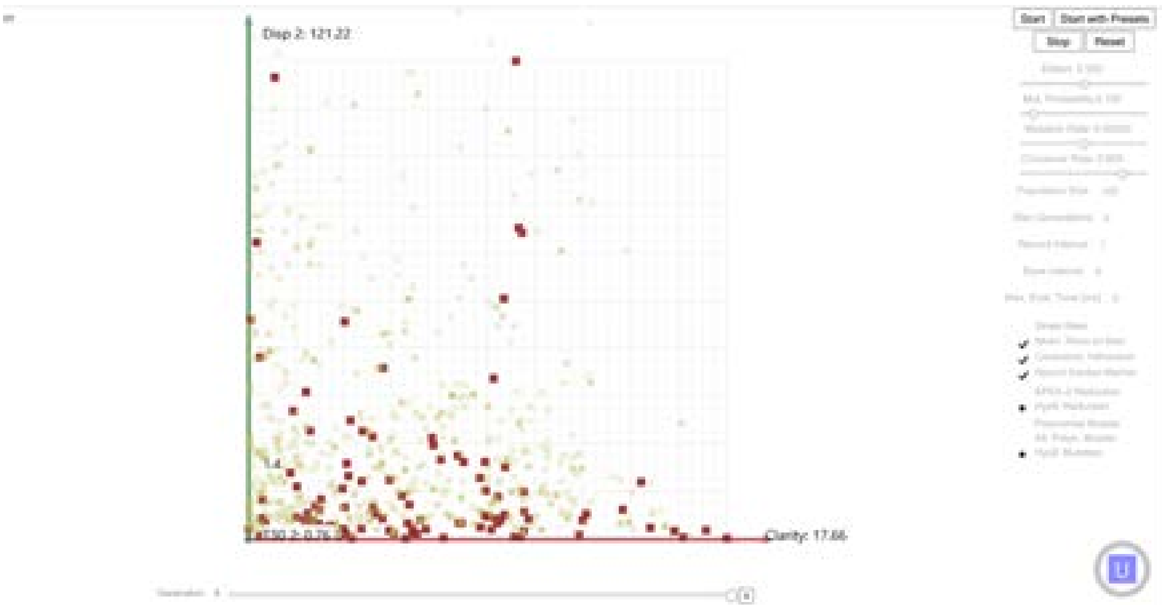
Fig. 62. Process of perforation.(o.i)

Absorbtion Values

Hz	125	250	500	1000	2000	4000
Wood(0% Perf.)	15%	11%	10%	7%	6%	7%
Wood(5% Perf.)	70%	78%	83%	81%	64%	58%
Wood(25% Perf.)	50%	85%	98%	96%	92%	98%

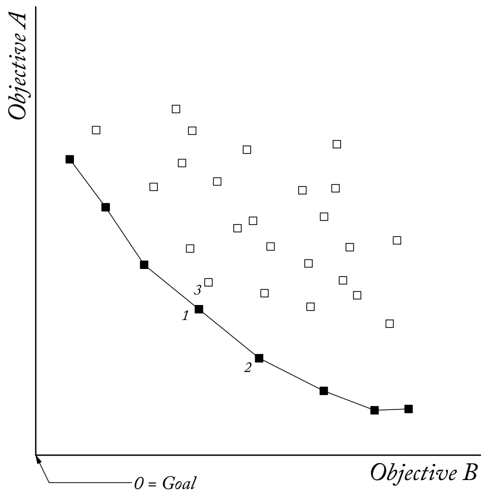

T30 2: 0.76
Clarity: 17.66
Start
Start with Presets
Stop
Reset


T30 2: 0.76
Disp 2: 121.22
Start
Start with Presets
Stop
Reset


Disp 2: 121.22
T30 2: 0.76
Clarity: 17.66
Start
Start with Presets
Stop
Reset

Concert Hall
Multi-Objective Optimization

In contrast to single objective optimization, where parameters are manipulated to reach a single goal, multi objective optimization rather seeks seeks to reduce spectrum of optimal solutions. The concept of Pareto fronts is at the heart of the multi-objective search engine. A pareto front can be described as a set of solutions where no parameter can be changed such that the solution performs better in one objective without performing worse in another. Graphically a 2D pareto front looks like this:



While solution 1 is outperforming solution 2 in objective B and vice versa, meaning that these two solutions are non-dominated, solution 3 is being outperformed by both 1 and 2, meaning that it's being dominated. The result of one such analysis is therefore no single solution that is optimal in all respects, but rather a set(A Pareto set) of solutions, all non-dominated. In architectural applications this is especially useful, consider that often the objectives of design are contrasting.

Fig. 63. Solution map of all solutions, the solutions marked with dark red signify the Pareto Front while yellow are "history" Solutions that have tested and improved.

Implementing a multi-objective search has been made very feasible within Grasshopper, this time in the form of a plugin called Octopus developed by Robert Vierlinger. Within this plugin the HypE algoritm will be used (J. Bader and E. Zitzler, 2011). While an in-depth explanation of this algorithm is outside of the scope of this project, in short terms it uses Monte-Carlo simulation to approximate the shape of the Pareto front. The process of creating a set is still quite computationally taxing, demanding a large amount of simulations to be done to approximate the set. The simulation of acoustics is by far the most computationally expensive, making the other parts of the parametric model almost negliable in comparison. The process of implementing EMRT was therefore seen as vital to the sucess of this analysis, while other comparable simulation software would complete a single analysis within 10-15 minutes for a room this size, it is not difficult to see how this will lead to extreme calculation times when possible hundreds of solutions are needed.

Concert Hall
Partial Conclusion

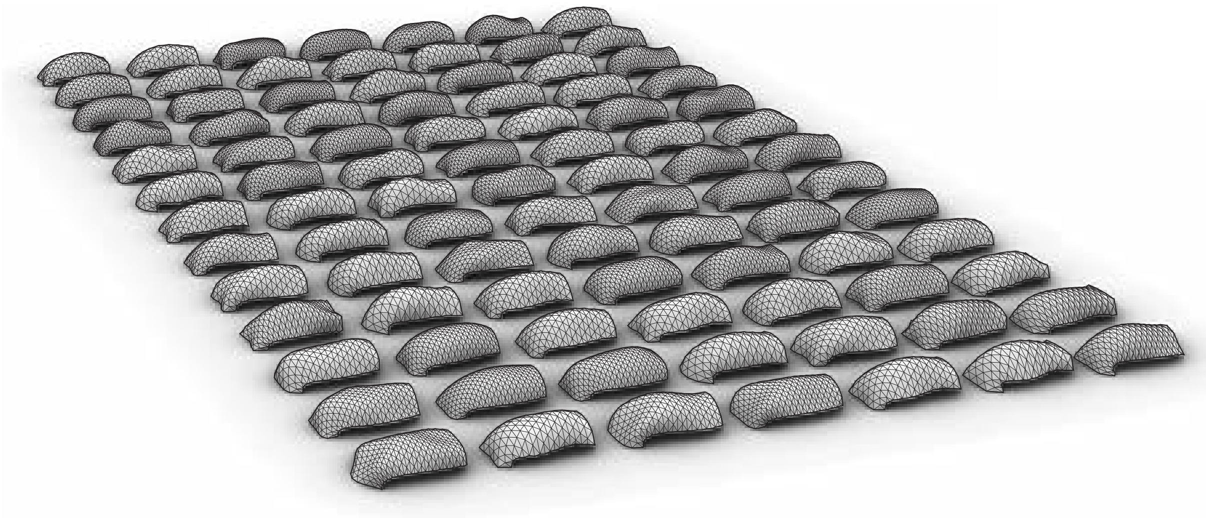
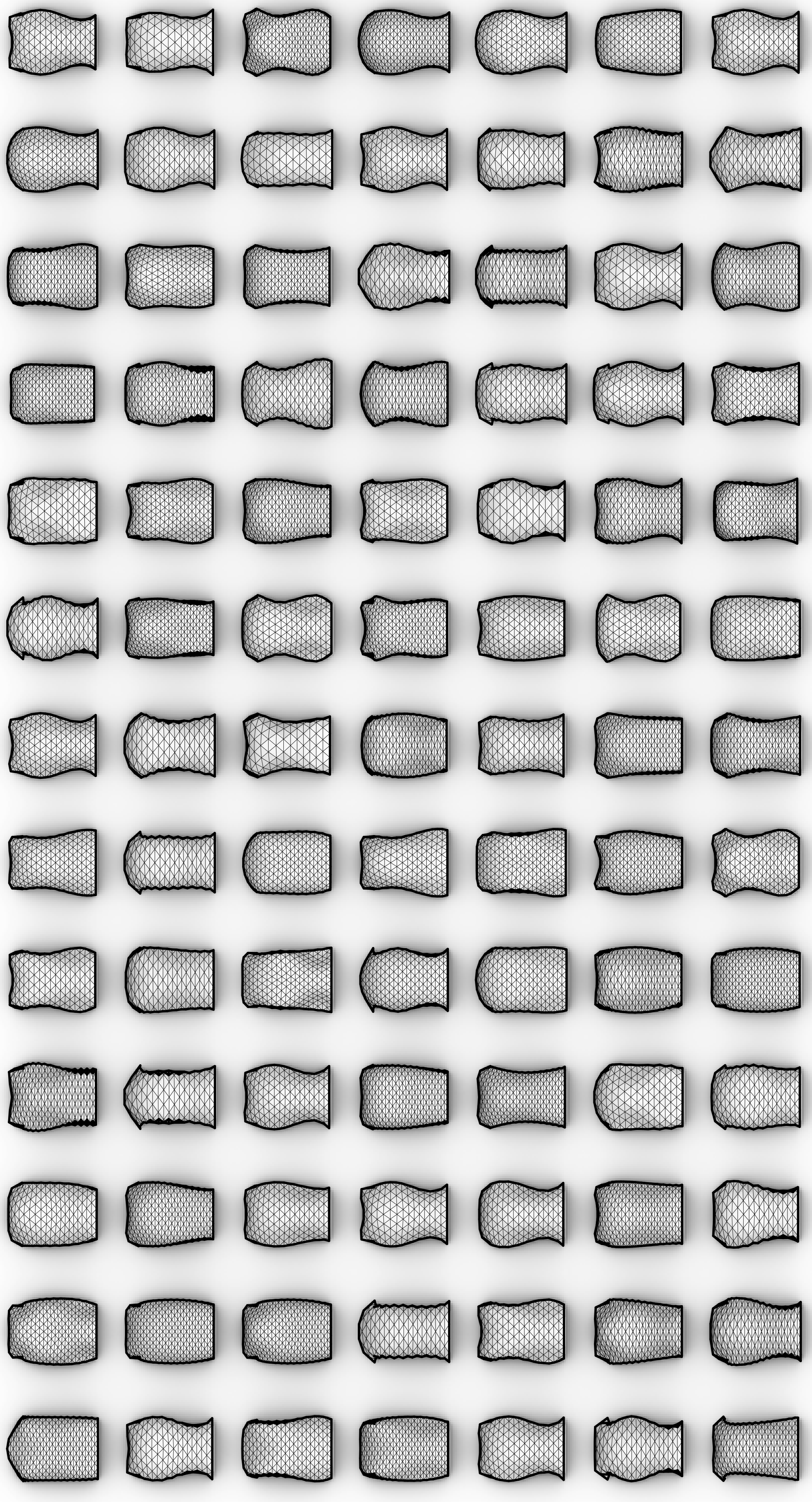


Fig. 64. Isometric showing Pareto Front solutions. All solutions signify a compromise between displacement, C50 and T30 goal values. (o.i)

Fig. 65. Right: Plan view of same Solution set. Clear differences can be seen between the shell, with some becoming convex while other concave. (o.i)

Implementing multi-objective search into the design process of a concert hall was crucial for the architectural, acoustic and structural success of the room. The task of creating a flexible, but predictable parametric system is daunting, and there is a high risk of no reward at the end of the tunnel. But if the parametric system is created such that the end results can be predicted the payoff is tremendous. The set of solutions are not only exciting because of their superior performance, but because of their novel usage of parameters the design didn't think ok, showing solutions not previously imagined. Through the studies it became apparent that the structural performance of the shell would never become an issue, and as such it might seem inconsequential to include it within the search, this is not true, as some outliers showed good acoustic performance but unacceptable structural performance. Further there was a need to include a volume parameter as a hard bolean limit, where if the surface was such that there was less than the allowable amount of volume(7m3 per person) that interation would send a negative value into the search. One of the largest issues seen with this technology is it's lack of reusabilty. Making any change to either the parametric system or to the original shell model demanded a computationally expensive rerun of the simulation, taking up valuable time. Any way of implementing some sort of deeper learning algorithm to the data produced would be extremely beneficial, though we're only on the cusp of such discoveries.

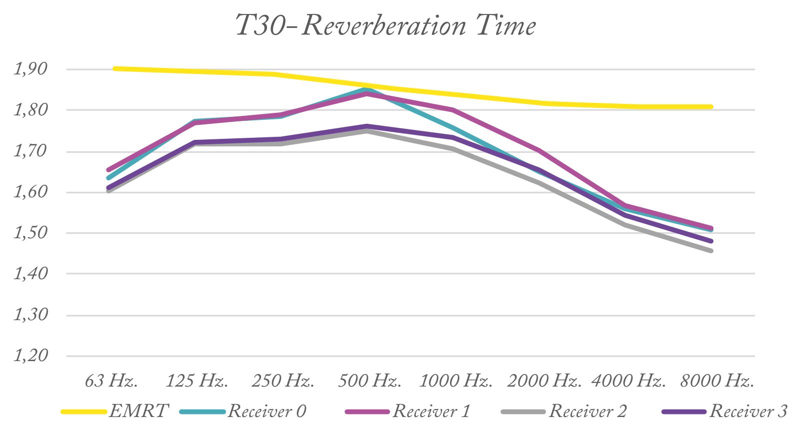


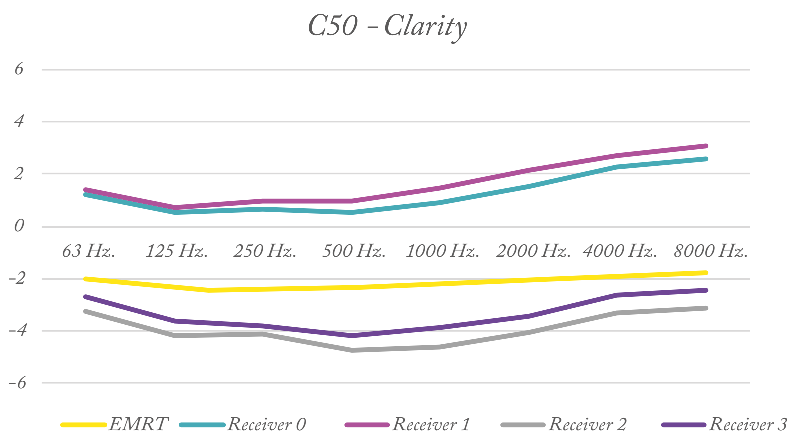
Concert Hall
Selection and Acoustic Validation

Fig. 66. Render from balcony of concert hall. (o.i)

Presented with the set of solutions it soon became apparent that to reach an optimal acoustic performance a compromise between Clarity and Reverberation time was needed, this reduced the amount of viable solutions considerably and the choice between the last few was based on architectural merit. The selected timber shell has a few stark differences to the input shell, perhaps most notable over the stage, where the optimization algorithm created an indentation towards the musicians on stage, this increased the amount of direct energy that the audience received and therefore clarity, further the indendation creates a convex shape in plan, creating excellent diffusion of early sound energy. A novel solution that was previously not thought of.

Within the validation of the shell with pachyderm there was a large descrepancy between the two simulation platforms found, while it may very well be possible that the amount of rays used in the Pachyderm analysis were not enough to properly read the space, this might also point to some larger issues within EMRT. The issues discrepancy can however be relatively easily be solved within surface treatment, where the clarity of the back seats (Receiver 2 and 3) could be lifted up to the goal level of -1.





Conclusion

The aim of this master thesis was to explore how to create the framework for further developing the music culture on the Faroe Islands by creating a music conservatory. As the Faroe Islands is a small nation, many young people venture abroad for education, however, this master thesis argues that much value can be brought forth by adding tertiary education to the country as means to embed the unique culture and sense of place into the craft being taught. By suggesting a rethinking of what it means to build on the Faroe Islands, we set out to investigate the potentials of adding this new institution situated on the dramatic yet unutilized area of Raktangi.

In order to design such a place, a point of departure was to analyze unique aspects of the Faroese culture with tectonic theory in order to uncover the values that the complex should possess.

A tremendous inspiration was the investigation of the specific qualities that can be found in the old Faroese vernacular from a time where materials were scarce and necessity was the main design driver. Not to copy architecture from another time, but to understand where a truly unique Faroese architectural quality can be found. This approach is shared by Frampton's Critical Regionalism that theorizes that holding the international style in such high regard, has caused a lack of identity within building, where a way to combat this global stagnation is to uphold a high level of critical self-consciousness. Further, the theories of Gottfried Semper, especially in regards to his four elements of architecture has laid the tectonic groundwork of the project and was used to further define the qualities of the traditional vernacular and as a result a proposal on what contemporary architecture on the Faroe Islands can look like.

Through these ideas, the programme was developed through an iterative process. The programme of the building should be considered as a current proposal as further development would be needed if such a big and complex project should ever be built. In order to further develop such a programme, huge amounts of work should be put into gathering knowledge on specific needs for a music conservatory, especially regarding the layout and acoustic needs for recording studios as this is a very complex task that is almost a project in itself.

A primary focus of this thesis has been the use of acoustics as a design driver. As mentioned in the methodology chapter, the concept of time in a design process and in simulations has been an area of interest and the integrated use of the new software EMRT has been crucial in the investigation of applying acoustics in a fast iterative process. The software was successfully integrated into a multi-objective optimization search in order to create the shape of the concert hall, based on aesthetic, constructional and acoustic goals.

The overall narrative of this project has been one of progression. This concept emerged from the idea of the journey of a music student. The narrative is transformed into architectural principles through not only the specific layout of functions inspired by the musical progression but also through a progression of contrasting experiences, that together form the project. The layout places the musical performance at the center of the complex followed by rooms for practice and finally having theoretical rooms form the periphery. The experience of contrast is best explained through the journey to the concert hall. After exiting the dimly lit parking, one is greeted with bright views to the central courtyards and hints at what's to come as one progresses to the foyer. Here it is possible to enjoy different views of the surrounding landscape until one enters the dark and unheated hallway within the bedrock. Walking through the hallway one is once again presented with light, this time from above, before once again entering the warm concert hall. Through this progression of events, this master thesis forms an architectural work, that within the context of a music conservatory seeks to remind its users and visitors of the unique conditions of the Faroe Islands.

Perspectives / Reflection

This reflection places the project within a larger context of a student project and seeks to discuss relevant aspects and themes related to the development of the project. In terms of the process, this has largely been dominated by the fact that the so-called “creative leap” happened quite late in the process. This creative leap manifested itself as the concept of placing the performance spaces within the bedrock and having an open space between them. As iterations previous to this were sporadic and pointing in different directions, this means that the time to fully develop the final concept became relatively compressed. Due to this, the final building is perhaps not detailed to the level that could have been hoped for. While the overall needs and logistical functions of a music conservatory are visible in the final project, much more research could have been done, as some functions were found to use more space than intended and more functions were continuously added or removed. This research could have been done through visits to and research of existing music conservatories.

As previously mentioned the effect time in the design process and in simulations was of huge importance as the parallel study of EMRT had the goal of being able to create faster iteration loops. While the integration of EMRT into a Grasshopper Plugin was largely successful there were some issues in its implementation. While the measure for T30 was accurate at a low amount of rays if C50 was to be accurate a very large amount of rays were needed. Even with the higher amount of rays, the simulation times for the larger concert hall were cut from 15 minutes per iteration to 30 seconds, a 30x improvement in simulation time.
The use of Building Information Modelling proved a massively useful tool in order to be able to push the design as late into the process as possible, a parameter considered crucial in the TMIDP method. BIM offers the possibility to create “live” drawings that continuously update and thus minimizing the need to create formal drawings after each iteration. BIM further offers the advantage of linked models, meaning that work on the concert halls could be done in parallel with work on the conservatory complex and the impact that the two had on each other could be continuously assessed. BIM, of course, still have several limitations. Within the context of this thesis, an integration of acoustic simulation would have meant an even faster iteration sequence, as the need to continuously create simplified simulation geometry having two nearly identical models for different purposes would be unnecessary.

Much the tectonic focus was placed within the concert hall, this means that the articulation of the construction in the rest of the construction was somewhat underprioritized. A very simple frame construction was chosen and applied to the entire building and verified where the boundary conditions were considered most unfavorable. However, more focus could have been laid on the joinery and detailing throughout the building in order to further strengthen the narrative of the reinterpreted Faroese vernacular. The notion of the reinterpreted Faroese vernacular is additionally a point of reflection. The thesis criticizes the treatment of topography in the current Faroese building culture and yet somewhat counterintuitively, large excavations are needed in order to construct the building in its current state of development. However where the current building culture oversees or carelessly removes the earthwork, the Faroese Music conservatory actively acknowledges and celebrates its presence by placing the most central element within the landscape in order to celebrate it. This contextual situation of the project proved to be the most fruitful exploration; throughout the project, the relationship between architecture and landscape was explored. Creating a dialogue between the two entities with the hope of creating something larger than the sum of its parts.

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Figure List:

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Fig. 60. Yoshimura Folding Pattern
From top: 1. Process of creating folded structure from NURBS surface. 2. Flattened Folded surface. 3. 1:10 Detail showing connection between individual timber panels. (o.i)
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Fig. 65. Right: Plan view of same Solution set. Clear differences can be seen between the shell, with some becoming convex while other concave. (o.i)
Fig. 66. Render from balcony of concert hall. (o.i)

Appendix 1 – Eurocode calculations

Selfload:

Within the software used (Robot Structural Analysis as well as Karamba) the weight of the construction is included; the load is therefore only the weight of the roof itself (the understructure as well as cladding). The roof is considered a light roof (0.5kN/m²) with a sedum moss (0.5kN/m²) finish:

$$C_k = 0.5 + 0.5 = 1\ kN/m^2$$

Snowload

When calculating snow load for the Faroe Islands the Danish Eurocode standards apply (BK17 – 4.2.1)

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

Where:

μ_i= Formfactor; S_k= Characteristic Terrain Value, C_e=Exposure factor, C_t= Thermal Factor; $S_k = 1kN/m^2$ – EN 1990:2002, 4.1.2(7)

μ_i= Formfactor:

$$\mu_i = 0.8 \text{ when roof angle a: } 0° \leq a \leq 30°$$

Exposure factor is dependent on the topography of the surrounding site as well as the size of the structure:

$$C_e = C_{top} \cdot C_s$$

Where:

C_{top}= Topography = 0.8 for windy environments, C_s=1,0 when the longest side of the structure is less than 50m.

$$s = 0{,}8 \cdot 0{,}8 \cdot 1{,}0 \cdot 1.0 = 0{,}64\ {}^{kN}/_{m^2}$$

Wind load

To calculate the wind pressure:

$$w_e = q_p(Z_e) \cdot c_{pe}$$

$$c_{pe} = external\ \ pressure\ coefficient$$

$$q_p(Z_e) = peak\ speed\ pressure$$
$$q_p(Z_e) = c_e \cdot q_b = [1 + 7 \cdot l_v(z)] \cdot \tfrac{1}{2}\rho \cdot v_b^2$$

$$c_e = exposure\ factor$$

$$\rho = pressure = 1{,}25 kg/m^3$$

$$q_b = basic\ value\ of\ velocity\ pressure$$

$$l_v = turbulence\ intensity$$

$$l_v(z) = \frac{k_l}{C_0(z) \cdot \ln\left(\frac{z}{z_0}\right)} = \frac{1}{1 \cdot \ln\left(\frac{10}{0{,}01}\right)} = 0{,}14$$

$$k_l = turbulence\ factor = 1$$

$$c_0 = oreography\ factor = 1$$

$$z_0 = roughness\ length = 0{,}01\ for\ terrain\ category\ I$$

While the Faroese building regulations do not have an official National Annex of Eurocode, the building regulations demand the usage of a local base windspeed. The measurements from the document "CEM, -Onshore Climate Review for the Faroe Islands, 2002" will be used. The characteristic 10 minutes mean wind velocity at 10 m above ground of a terrain with low vegetation (terrain category II) is used. The station with the most similar exposure and height is station [illegible] giving a fundamental basic wind velocity $v_{b,0} = 42\,{}^{m}/_{s}$.

To calculate the Basic Wind velocity:

$$v_b = v_{b,0} c_{dir} c_{season}$$

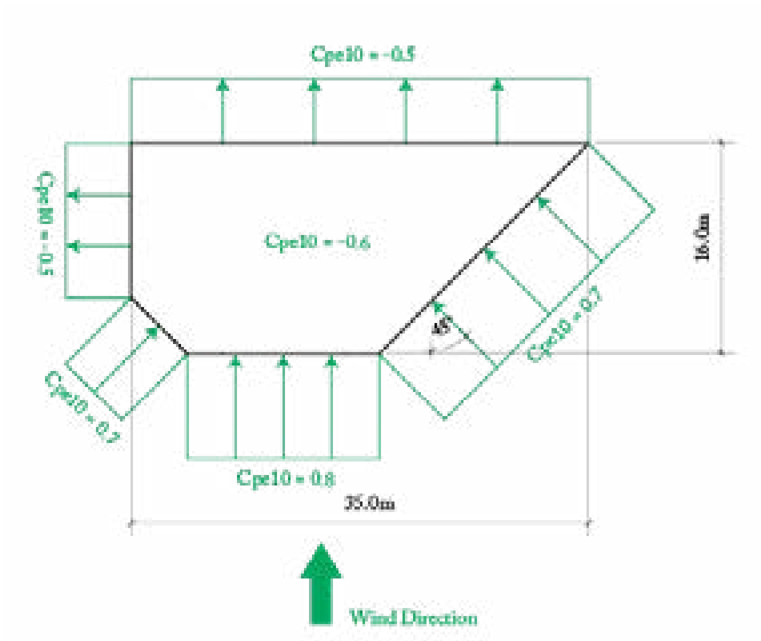
For most cases c_{dir} and c_{season} are equal to 1:

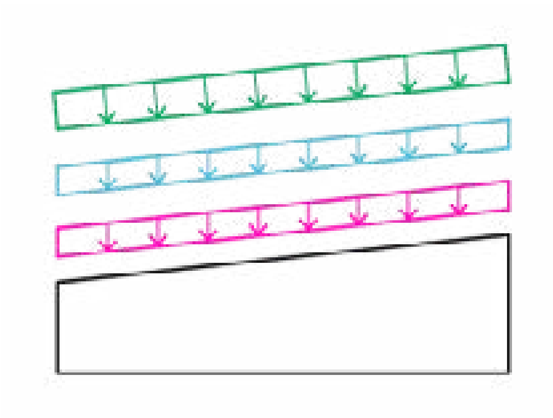
$$v_b = 42.0 \cdot 1.0 \ \cdot 1.0 = 42\,{}^{m}/_{s}$$

The Basic value of velocity pressure can therefore be calculated:

$$q_p(10) = [1 + 7 \cdot 0{,}14] \cdot \frac{1}{2} \cdot 1.25\,{}^{kg}/_{m^3} \cdot 42^2\,{}^{m}/_{s} = 1{,}519\,{}^{kN}/_{m^2}$$

To ascertain the load to be used further, one has to consider all wind direction and chose the one that is least favorable for construction. This proved to be when the wind was coming straight onto the side of the construction. Each face of the construction will have an external pressure coefficient, modifying the basic velocity pressure. The shape of the construction makes is so that the two tilted sides lend themselves to lessen the impact of wind compared to if it was a straight sided face.





Load combination calculation:

$$\sum j \geq 1 \;\; \gamma_{\mathrm{G.j}} G_{k,j} + \gamma_p P + \gamma_{Q,1} Q_{k,1} \text{"} + \text{"} \sum i > 1 \; \gamma_{Q,i} \psi_{0,\mathrm{i}} Q\_(k,i)$$

$\gamma_G = partial\ factor\ for\ permanent\ loading$
$G_k = permanent\ action$
$\gamma_Q = partial\ factor\ for\ variable\ loading$
$\psi_0 = factor\ that\ convert\ its\ variable\ action\ into\ it's\ combination\ value$
$Q_{k,1} = leading\ variable\ action$
$Q_{k,i} = accompanying\ variable\ action$

Through analysis within Robot Structural Analysis it was shown that dominant wind was the worst loadcase:

ULS – Dominant Wind load

$$\sum_{j\geq 1} \gamma_{G,j}\, G_{k,j} + \gamma_p P + \gamma_{Q,1} Q_{k,1} \text{"} + \text{"} \sum_{i>1} \gamma_{Q,i} \psi_{0,i} Q_{k,i}$$

$$\sum_{j\geq 1} 1{,}35 \cdot 1{,}0 \cdot 0{,}5 \frac{kN}{m^2} + 1{,}5 \cdot 0{,}64 \frac{kN}{m^2} + \text{"} \sum_{i>1} 1{,}5 \cdot 0{,}5 \cdot (0{,}91 + (-1{,}21) + 0{,}75 + (-1{,}06) + (-1{,}06) + 0{,}75) \frac{kN}{m^2}$$

$$= 5{,}94 \frac{kN}{m^2}$$

SLS – Dominant Wind load

$$\sum_{j\geq 1} G_{k,j} + Q_{k,1} \sum_{i>1} \gamma_{Q,i} Q_{k,i}$$

$$\sum_{j\geq 1} 0{,}5 \frac{kn}{m2} + (0{,}91 + (-1{,}21) + 0{,}75 + (-1{,}06) + (-1{,}06) + 0{,}75) \frac{kN}{m^2} + \sum_{i>1} 0{,}5 \cdot 0{,}64 \frac{kN}{m^2}$$

$$= 6{,}56 \frac{kN}{m^2}$$

This however may be very misleading when considering an entire structure, as some windloads might have loads that can benefit the structure. The structural analysis includes both windload directions and correct load combination factors, to see any local effects that might influence the structure.

Appendix 2 – Estimation of elevator size

According to Elevator producer Schindler, a standard elevator of the type Schindler 5500 can fit up to 33 persons and carry a weight of up to 2500kg with outer shaft dimensions 2550mm x 3100mm. While a custom solution would be needed to fit 60 persons at a time, it can assumed that such and elevator would need double carrying capacity and area.

$$2{,}5m \cdot 3{,}1m = 7{,}75m^2$$
$$7{,}75m^2 \cdot 2 = 15{,}5m^2$$
$$\sqrt{15{,}5m^2} = 3{,}94m$$

It can therefore be assumed that an elevator capable of carrying 60 persons would need to be minimum 4m x 4m. In order to account for stronger lifting mechanisms, the elevator is assumed to be 5m x 5m

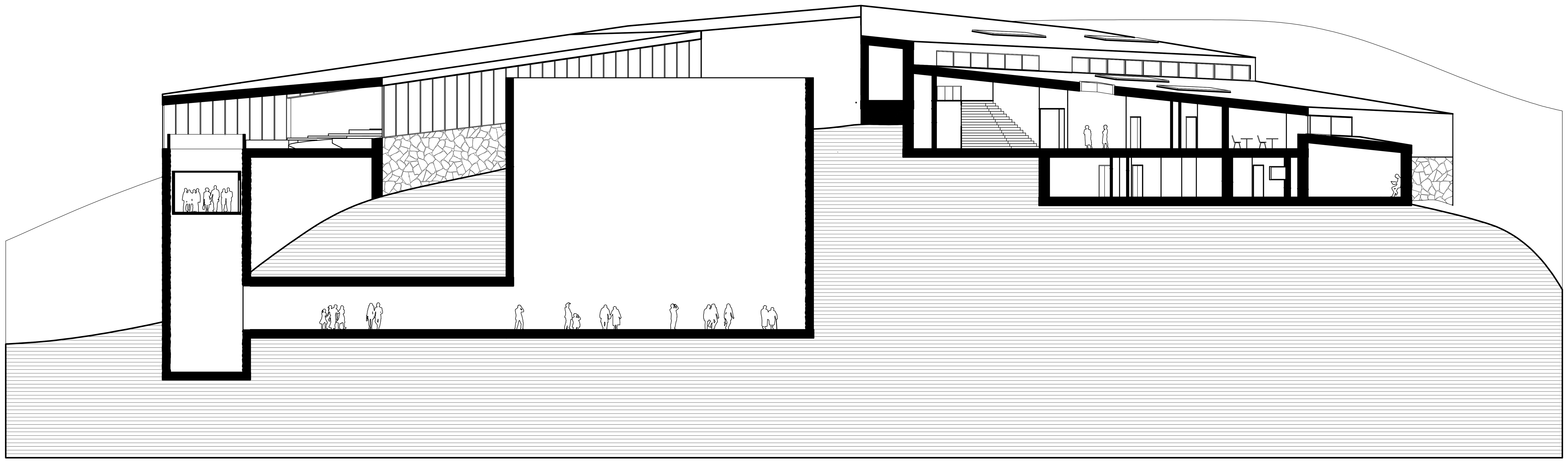
Appendix 3 – Estimation of Parking

Per Aalborg municipality standards:

Bebyggelsens anvendelse	P-norm for Aalborg Midtby	Standard P-norm
Kulturelle formål, herunder teatre, biografer og lign.	1 P-plads pr. 16 siddepladser	1 P-plads pr. 8 siddepladser
Skoler	1 P-plads pr. 2 ansatte samt 1 P-plads pr. 8 elever over 18 år	1 P-plads pr. 2 ansatte samt 1 P-plads pr. 4 elever over 18 år

(Aalborgkommuneplan.dk, n.d.)

Meaning roughly 70 for the concert halls, and 40 for the school when estimating 30 staff and 100 pupils, totalling at 110 parking spots.



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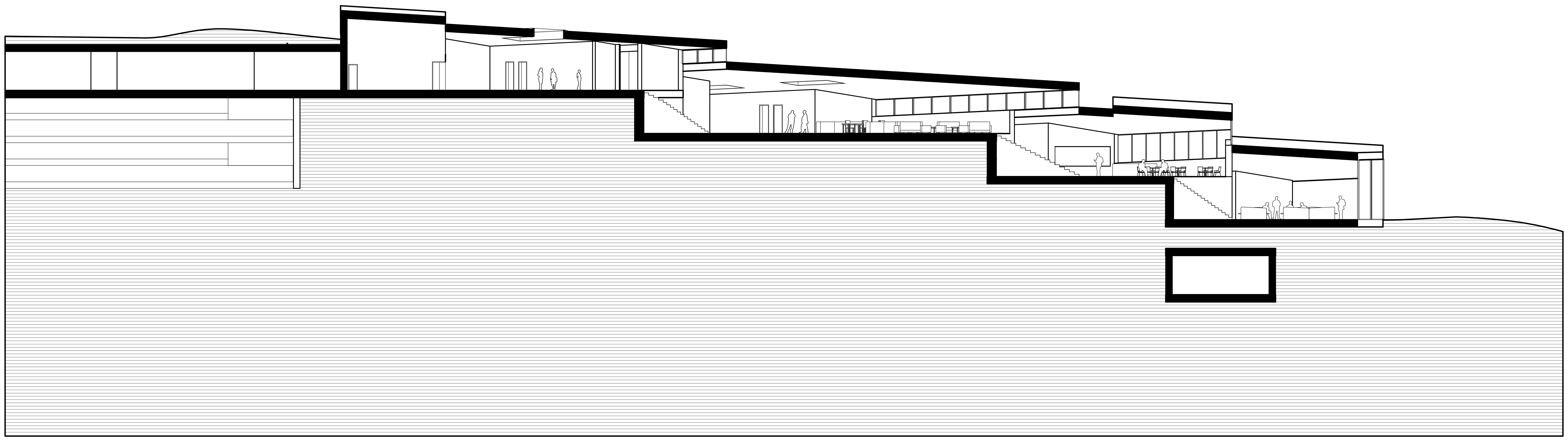

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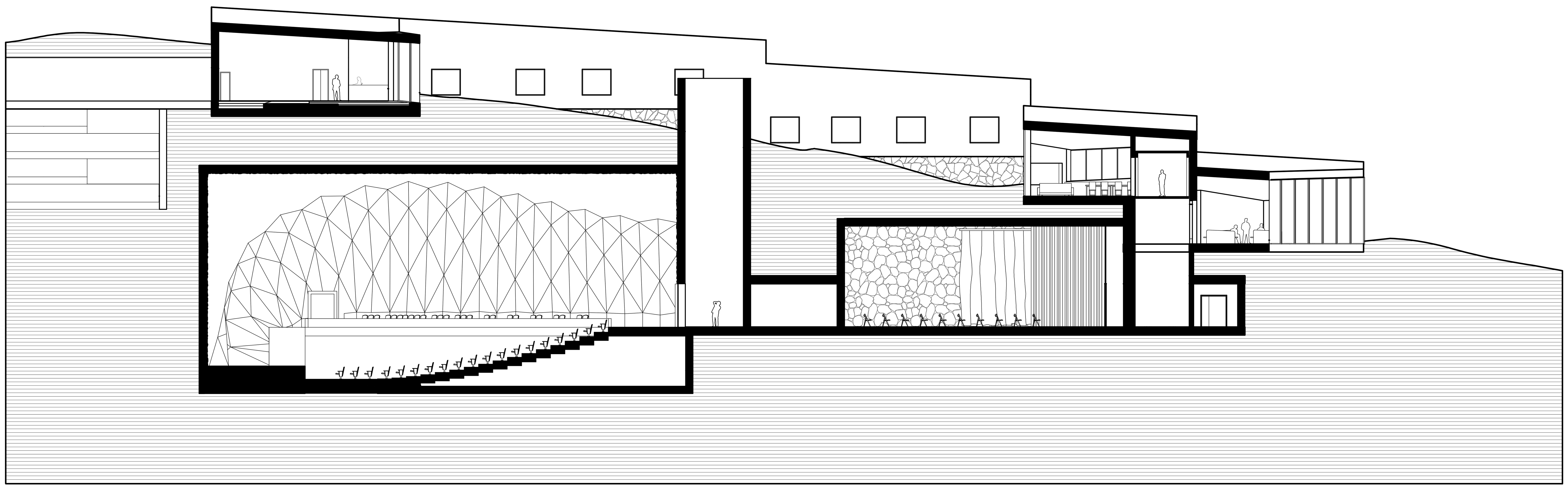

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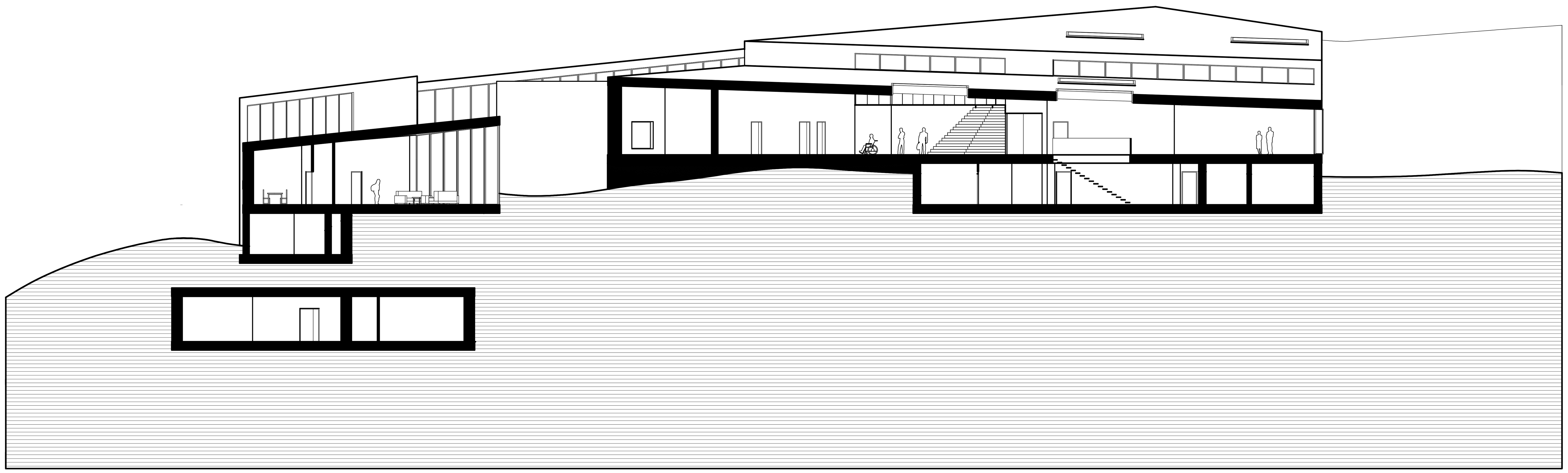

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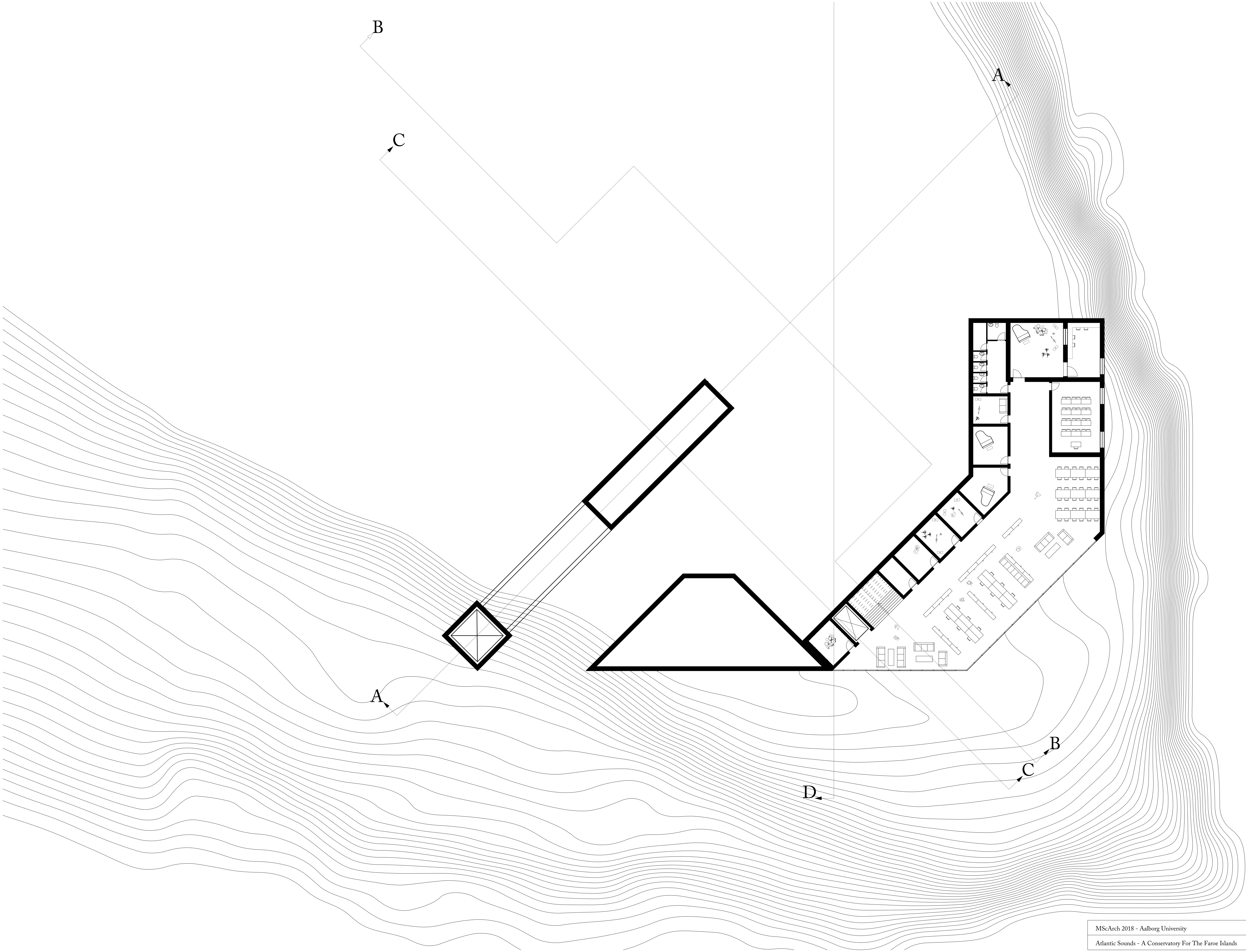
Atlantic Sounds - A Conservatory For The Faroe Islands	Section D-D Drawing	18 Group

MScArch 2018 - Aalborg University	Date 23.05.2018	Scale 1:200
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing Plan 0	Group 18

MScArch 2018 - Aalborg University	Date	23.05.2018	Scale	1:200
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing	Plan -1	Group	18

MScArch 2018 - Aalborg University	Date 23.05.2018	Scale 1:200
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing Plan -2	Group 18



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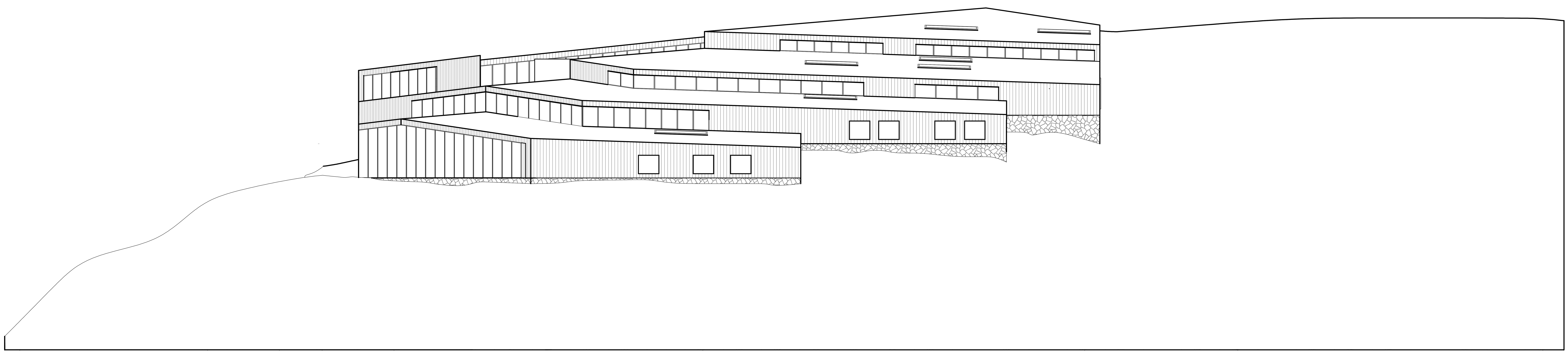
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing Plan -3	Group 18

MScArch 2018 - Aalborg University	Date	23.05.2018	Scale	1:200
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing	Plan -4	Group	18



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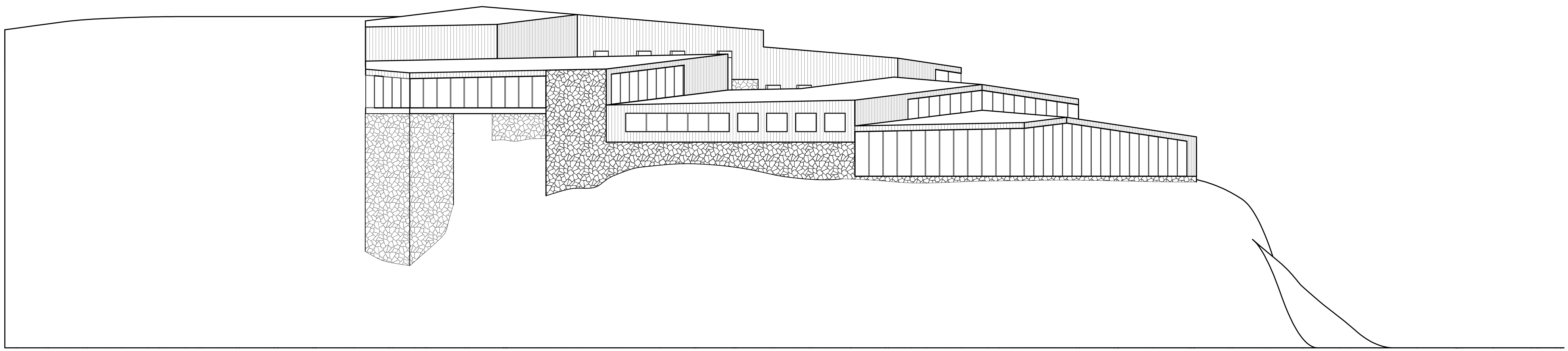

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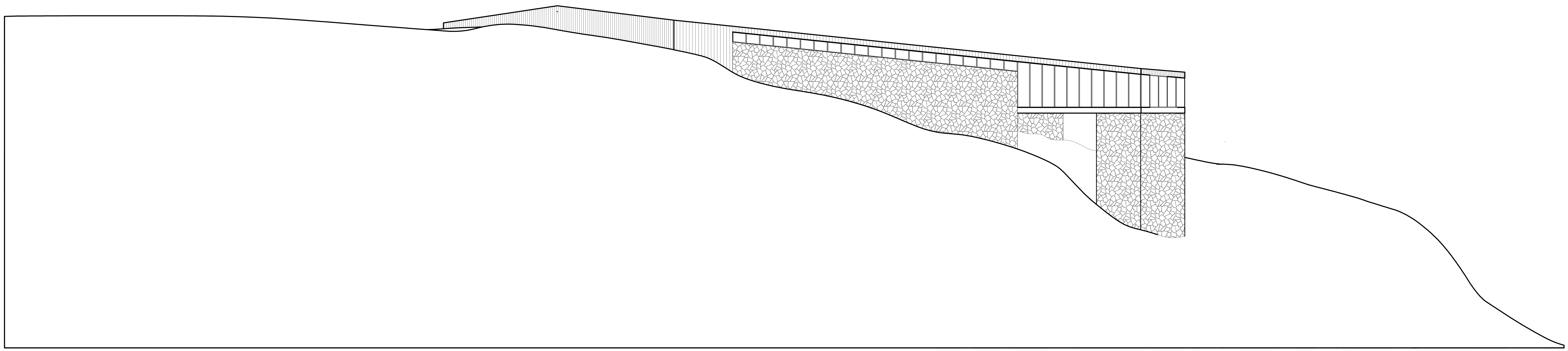

MScArch 2018 - Aalborg University	Date 23.05.2018	Scale 1:200
Atlantic Sounds - A Conservatory For The Faroe Islands	Drawing Elevation - West	Group 18