NORDIC JAPANESE HARMONY

Preface

This project has been completed by Caroline Grandjean-Thomsen and Mette Bebe Juel, 4th semester, MSc Civil Engineering (Architecture) at Aalborg University, Architecture and Design. The project was created in the period between 3rd February and 3rd June 2009.

Images are listed starting at [1] and continue chronologically through the entire report. Image references are included at the end of the report.

The last page of the report contains a fold out page of the Design Criteria developed in the Program, which can be referred to when reading the Design Process.

Attached is a Technical Supplement and a CD with a digital version of the report and Acoustic calculations.

Caroline Grandjean-Thomsen

Mette Bebe Juel

Acknowledgements

We wish to express our warmest thanks to Dr Gerd Bloxham Zettersten, our volunteer external supervisor, for sharing her time and generosity with us, and for contributing her specialised knowledge of Nordic and Japanese Architecture throughout the course of the project.

We would also like to thank the following for their voluntary contribution to this project:

Kristin Gustavsen	Director, Urban Sjøfront
Simon Ewings	Sen. Architect, Snøhetta
Marion Pflugfelder	Architect, G Arkitekter
Nadine Engberding	Architect, Helen & Hard
Daniela Arriado	Marketing, Tou Scene
Niels Henrik	Art Director, Tou Scene
Henning Bredal	Stavanger Konserthus
Arngrim Utskarpen	Stavanger Kommune

Abstract

A Music house is designed in the context of the Norwegian city, Stavanger. It relates to a site with dramatic height changes, overlooking the fjord and the distant mountains covering the horizon. The cultural area of Stavanger East has a vivid music and art environment, which, however, lacks a scene for non-amplified music - a place for people to learn, teach, perform and enjoy every aspect of music.

Architects from the Nordic countries and Japan have in the past and present been influenced by elements in one another's architecture. This project studies the fusion of the Nordic and Japanese traditions by creating a Music House. Nordic elements such as human scale, the appreciation of light and a relationship to the context, establish the foundations of the design together with the Japanese feeling of tranquility and harmony - to seek boundarylessness.

In the frame of the Nordic and Japanese tradition, music evolves by being shared, taught and played. This calls for a venue activities can be of a two-way communicative form. Forms and materials have been chosen with careful consideration of both aesthetics and acoustic expression. Rehearsal rooms and a performance hall have integrated acoustics in the design process. CATT Acoustic, a 3D acoustic modelling program is used to help determine an acoustic form and materiality. The outcome results in an integrated expression of Nordic, Japanese and Acoustic architecture - thus a Nordic Japanese Harmony.

Aalborg University
Institute of Architecture and Design
4th semester, Thesis Project

MSc Engineering (Architecture) 2009

Title: Nordic Japanese Harmony

Themes: Nordic Architecture, Japanese Architecture, Integrated Acoustic Design

Period: 3rd February - 3rd June 2009

Group: AD10-ARK28

Main Supervisor: Peter Lind Bonderup

Technical Supervisor: Poul Henning Kirkegaard

External Supervisor: Dr Gerd Bloxham Zettersten

Pages: 103

Attachments: Technical Supplement, CD

Caroline Grandjean-Thomsen

Mette Bebe Juel

Program

CONTENTS

Design Process

Concept 54

Presentation

INTRODUCTION
Nordic Japanese Harmony

The traditional music concert hall is a formal building typology where performances occur in a 'one-way' communicative form. That is, a professional musician or orchestra performs for the anonymous 'passive' spectator, who is only able to visit the concert hall to attend a performance, and nothing more.

In this project, a 'Music House' will instead be designed. This is place giving the opportunity for anyone visiting the building to become involved in music. In addition to being a performance venue, the Music House aims to generate interaction between users - where people can meet other musically-minded people, play music together, learn to play an instrument or learn about music in general. The focus of the Music House is about celebrating music - through its creation and practice between different people of different backgrounds.

The Music House aims to strengthen society's use, education and awareness of music. It addresses a wide group of users, welcoming anyone in society interested in music of any sort, and of any level. This includes, for instance, people wanting to learning to play an instrument, amateur musicians wanting to practice or jam, upcoming bands wanting to rehearse or perform, the passer-by wanting to find out about a music event, and those who simply want to come and relax to hear music or read books about music.

Most functions in the Music House will be open to the general public. Visits will be encouraged by providing social meeting venues such cafés, relax areas, a music listening 'lounge' and an area notifying of music related

events. These are available for general access and are open throughout the day.

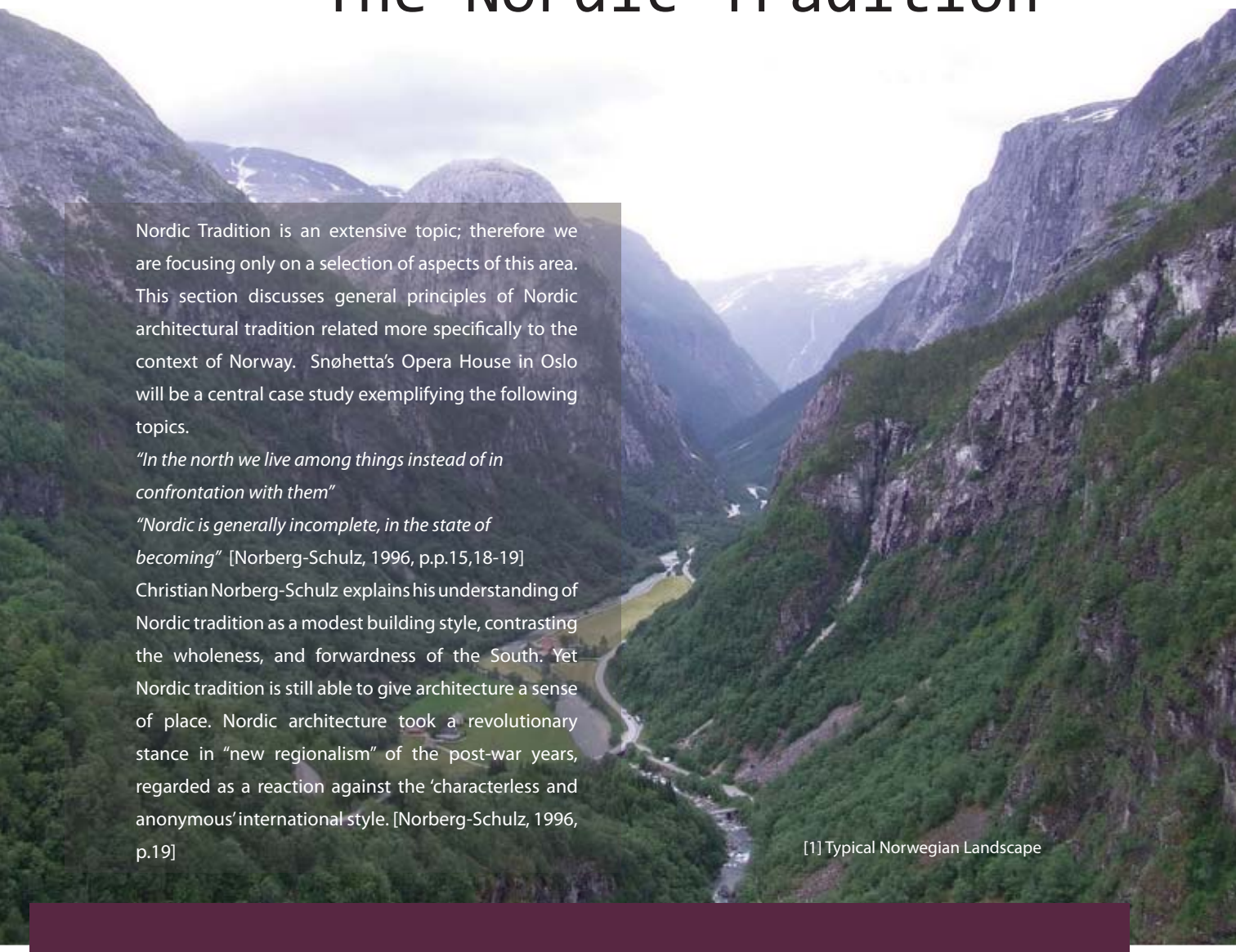
Music is the keyword for the use of the centre, and with all the different people using it. Importance is placed on having flexible rooms which give both the opportunity to study, jam, rehearse, have fun and perform. Furthermore there should also be a variety of rooms, to make it possible to use the centre for wider music-related purposes.

The Music House is an expressive piece of architecture, standing out but still considering the local context.

It is a recreational destination for visitors, where the ambience is peaceful and relaxed. Users should feel comfortable so as to prepare their mind either to listen to music, learn or perform. Of course, sound quality is of utmost importance in the Music House.

The Music House will therefore be designed according to Nordic tradition, Japanese tradition and Acoustics. Nordic and Japanese traditions are chosen since they share common principles and values, solved according to their own cultures. Nordic tradition will focus on the relation to the local context and landscape, while Japanese tradition will focus on generating a feeling of peace of mind in the Music House. Acoustics will be incorporated as an integrated aesthetic design, expressing the Music House's acoustic qualities visually both from an interior and exterior point of view.

TRADITIONS
The Nordic Tradition



Nordic Tradition is an extensive topic; therefore we are focusing only on a selection of aspects of this area. This section discusses general principles of Nordic architectural tradition related more specifically to the context of Norway. Snøhetta's Opera House in Oslo will be a central case study exemplifying the following topics.

"In the north we live among things instead of in confrontation with them"

"Nordic is generally incomplete, in the state of becoming" [Norberg-Schulz, 1996, p.p.15,18-19]

Christian Norberg-Schulz explains his understanding of Nordic tradition as a modest building style, contrasting the wholeness, and forwardness of the South. Yet Nordic tradition is still able to give architecture a sense of place. Nordic architecture took a revolutionary stance in "new regionalism" of the post-war years, regarded as a reaction against the 'characterless and anonymous' international style. [Norberg-Schulz, 1996, p.19]

[1] Typical Norwegian Landscape

Norwegian Means of Thinking

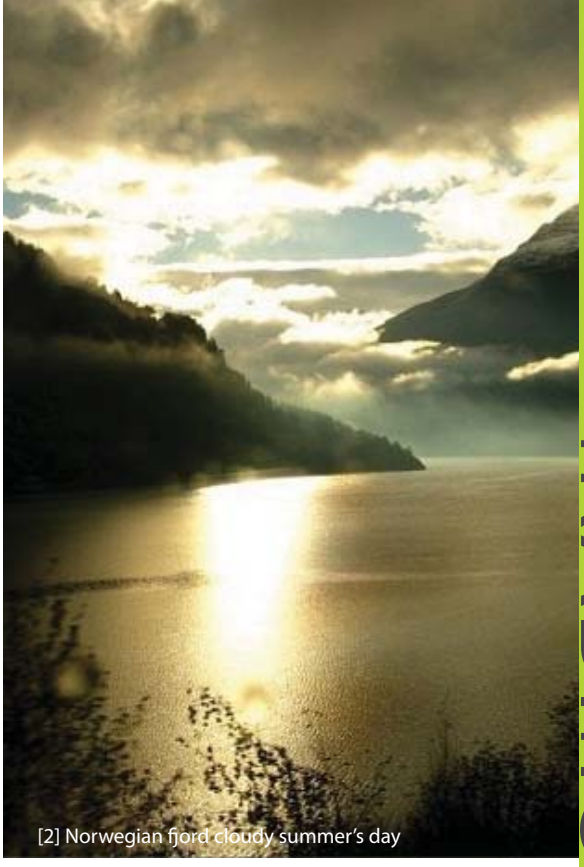
It is relevant to note that, while all the Scandinavian countries follow the general principles of Nordic tradition, each country has developed its own regional style. This is due to not only vast variation in topographies of the different countries, but, according to Gerd Bloxham Zettersten, could also be due to geographic and topographical isolation of regions– in turn leading to some specific characteristics and idiosyncrasies in each nation's ways of thinking. Norway is a land whose landscape is highly rugged and mountainous, with a long coastline, steep cliffs and deep valleys leading to fjords and a welter of islands and islets [1]. The lack of modern transport technologies in the past made it very difficult to overcome these natural physical barriers. The isolation between regions in Norway resulted in individual societies with expressive modes of behaviour, self sufficiency and self assertiveness - who served their own community. As a result, Norwegians today are much more open-minded in their means of thinking than say, of their conservative and cautious Swedish neighbours– this is reflected, amongst other aspects, in their methodology of Nordic building design.

The 'Nordic' Light

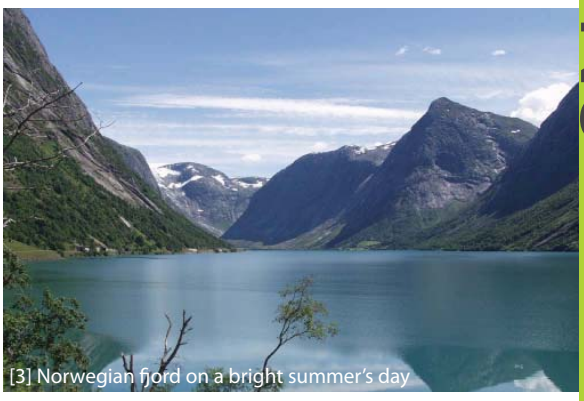
Nordic light has always been an integral part of Nordic tradition. It is highly appreciated by people of Nordic countries because of the scarcity of light during the long winter months. According to Norberg-Schulz, Nordic character is rendered primarily by light, defining the Nordic world and infusing all things with mood. He states: Nordic light "gives presence to an environment, where the web and the thicket emerge in contrast to the south's self-evident sun-space where things stand forth as such." [Norberg-Schulz, 1996, p.197]

High variations in the sun's azimuth and altitude throughout the year create varying and dramatic atmospheres. It is common that a typical day in the north is overcast, so the sparse presence of warm light is embraced. An overcast day with mist lying between the mountains has a diffuse light characteristic, underlining materials with soft shadows and creating immateriality. The mist blurs contours and creates a boundaryless atmosphere [5]. Nordic light accentuates elements of the landscape. The water's surface of Norwegian fjord, partly hidden in a cloud cover, catalyses the mood created by Nordic light [2,3]. The soft, low-angled afternoon sunlight both on a summer and winter day in the north creates a mood through a forest of trees in northern Norway, or a mountain silhouetted by a dimly lit background. [4] The long days and diffuse half-lit nights of summer are acknowledged and celebrated, before the contrasting "dark light" of Northern winter takes over [5]. While days are short and generally grey and overcast, it is only in the North that winter night skies become "whole, large and unified saturated with a peculiar 'dark light'" [Norberg-Schulz, 1996, pp. 6, 36]. Light in the North gives a degree of quality that cannot be found in the generally stark and homogeneous light of southern countries.

Architecturally, it is important to integrate these qualities of natural light in expressing our building's materiality and placement in the landscape.



[2] Norwegian fjord cloudy summer's day



[3] Norwegian fjord on a bright summer's day

[4] Typical Norwegian landscape

[5]"Light" Overcast winter afternoon

Nature and Landscape

Norberg-Schulz discusses the significance of relating built architecture to the spirit of a place, genius loci: "the settlement and buildings that compose it do not exist in isolation but as elements of a context that they represent and complement." [Norberg-Schulz, 1996, p.25] Nordic architecture emphasises the surrounding nature itself, for instance by the way a building sits on the landscape, or how a strong visual connection is made to the sky or nature. The architecture lightly touches the landscape and appreciates the abundance of nature around it, retaining a building's sense of origins and regional character. Whether or not a building is the main element of a context, it is built modestly, and in a way that emphasises its surrounding landscape. Norberg-Schulz exemplifies this idea by contrasting a small, simple wooden church of 1780 at Flakstad in Lofoten [7], with its vast Norwegian landscape: "It mimics no mountain; it stands as a simple volume in complement to the surrounding savage nature. Its onion spire is the only element rising in space thus the church becomes a focus that gathers nature as place." [Norberg-Schulz, 1996, p.38]

A suggestion by Gerd Bloxham Zettersten is that the natural landscape is constantly being recreated by the Nordic architect, whether intuitively or consciously [Zettersten, 2003, p. 39]. That is, the line dividing the "natural" from the "man-made" becomes less distinct. Figure [6] shows Bjørn Simmonæs' Brekkestranda Hotel in Sogn, 1970. Its grass roof is a typical Norwegian feature, where the house underneath it becomes discreet in expression, read as an additional hill of the landscape and complementing the mountains in the distance.

[6] Bjørn Simmonæs' Brekkestranda Hotel , Sogn

[7]Church in Flakstad, Lofoten 1780

Materiality

Simplicity and honesty in the expression of materials and structure are significant aspects of Nordic tradition. Although domestic building traditions from the four Nordic lands differ, a common Nordic feature lies on the dependence of wood [8]. The extensive use of Log and Stave construction characterises in particular Norway's traditional Folk architecture. Norwegian pioneers of architecture, Arne Kormso and Knut Knutsen both appreciated the characteristic natural finish of wood in their works, despite the differences in their building principles.

Sverre Fehn's Hedemark Museum in Hamar, 1979, [9] expresses honesty in materiality and structure through wood. The exposed timber structural system of posts and beams is arranged very logically. The joinery detailing is similarly exposed and expresses the load transfer between elements. This gives an honest expression of the building, making it easily understood. The interplay between the described wooden elements with concrete demonstrates an integration of a traditional building material with a modern one, where "the old and the new mutually explain each other." [Norberg-Schulz, 1996, p.188]. This creates a sense of time through space and form.

Human Scale

"The word "home" is a key to the Nordic. Life does not ensue on the piazza but in the home, this entails that intimacy and warmth are more important than representative grandeur". [Norberg-Schulz, 1996, p.22] This statement could explain why Nordic tradition aims to retain human dimension within its architecture. Nordic architecture relates to human scale and proportions, so as to generate a sense of belonging, of being in place, even of being at 'home'.

Knut Knutsen's own summer house in Portør, Sørlandet built in 1949 [10], has been set in on a sloped landscape, making the building appear much smaller than it actually is upon approaching it. The roof is constructed of exposed and untreated wood, now after weathering similar in colour to the adjacent rock landscape, mimicking an extension of the rock landscape, while expressing homeliness and character.

[8] Wooden houses in Stavanger

[9] Hedemark Museum Hamar, Sverre Fehn 1979

[10] Knut Knutsen's own summer house, Portør

Oslo Opera House

[11] Oslo Opera House

The Opera house is the result of an architectural competition won by Norwegian architects Snøhetta, and was completed in 2008. Located in Bjørvika Bay, Oslo, the 'Opera' (as is it commonly called) rises from the fjord and blends in with the surrounding city. Its careful selection of materials and its modest amalgamation with the surrounding landscape gives it the Opera its memorable yet discreet silhouette as Norway's newest landmark. [Arkitektur N, 2008, p.9] The Opera stand as an icy rock, a fjeld, an element of the Norwegian landscape. The Opera provides rooms for staging areas, workshops, rehearsal halls, ballet academy, and administrative offices. It exemplifies the aspects of Nordic tradition relevant to this project, and it has therefore been necessary to visit the building to get the understanding of modern Nordic architecture. This case study focuses on the element described in the previous pages to exemplify how architecture is influenced by Nordic tradition.

Nature and landscape

The building is situated on a peninsula on the edge of the city, approached from the north across a narrow foot bridge. The gentle lines of water and mountainous curves pointing towards the sky, contrasts with the rigid blocks of the surrounding horizontal city. The Opera is the transition between these two landscapes. Its sloping horizontal platform connects land and sea, breaking through the water and stretching out horizontally to express its modest monumentality [11], [Arkitektur N, 2008, p.9]. A walking platform literally emerges from the waterfront, creating an enjoyable public space where citizens can sit to appreciate the coastline [11]. The platform transitions into the Opera's roof, where one can appreciate the view of the city and waterfront [12]. A part of the platform gently breaks away from the slope, rising up towards the sky and discreetly exposing its interior to the world [15]. In winter, the Opera hides under a blanket of snow, imitating the surrounding hills in the landscape [15]. The natural exterior finish gives the Opera its modest approach in the landscape, allowing it to 'glow' and stand out in the landscape [14].

Light & Materiality

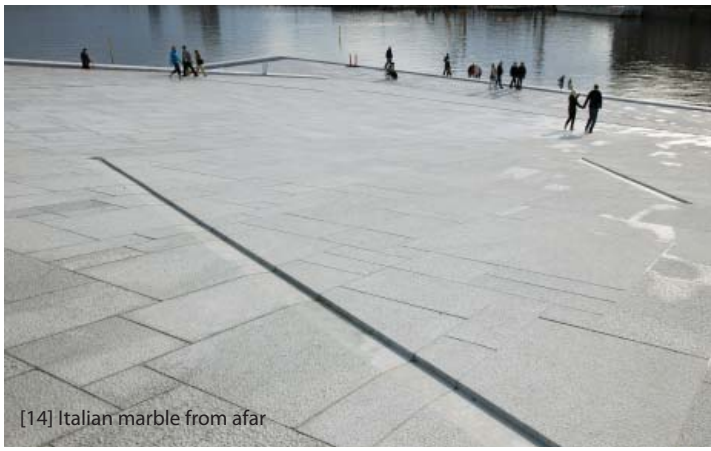
The Opera complements the landscape and stands out through careful treatment of 'natural' materials. The roughness of white marble stone floors and shiny clean aluminium creates a 'hard' exterior, while the warm oak on the foyer walls expresses a 'soft' interior [Arkitektur N, 2008, p.9]. The inner materiality reaches out to the context through large glass facades.

The expression of materiality is catalysed by natural light. This gives the Opera a varying Nordic expression, which is starkest on days with lots of sunlight. It is appreciated by people of the Nordic countries, since direct light is not an everyday occurrence.

The Opera's architectural expression using light on a sunny day creates an excitement in materiality. Direct light expresses the rough finish of the platform's natural Italian white marble. The marble's rough texture and irregular outline pattern are distinct both close up [13] and from afar [14]. Shadows accentuate the subtle protrusions of the marble ground plane [14].

[12] The view from the roof

[13] Marble detailing



[14] Italian marble from afar

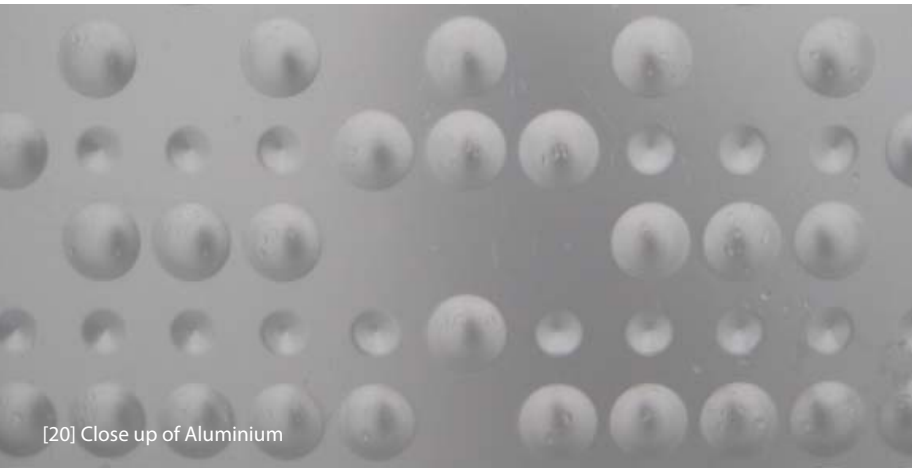
[15] Opera as a hill in the landscape

[16] Complementing landscape

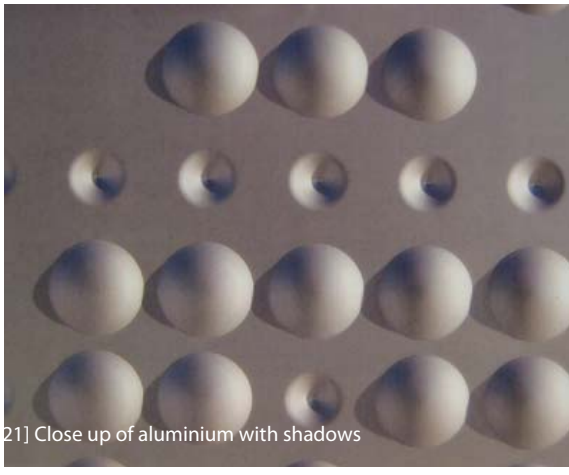
[17] Defining landscape

[18] Aluminium from afar

[19] Aluminium approaching



[20] Close up of Aluminium



21] Close up of aluminium with shadows

[22] Foyer relief wave wall


[23] Direct light


[24] Diffuse light

The materiality complements the harbour and the natural landscape on a clear day [16]. This creates contentment and relaxation when strolling on the roof and savouring the city view.

At the top of the building is a stage tower clad in artistically patterned aluminium panels, designed to shimmer under sunlight. It is a subtle yet stark expression, and is treated with a high level of detailing. From a distance it appears as a uniform surface at first appearing to be the same material as the marble platform [18]. Gradually a subtle pattern is detected [19], but it is only up close when the pattern of convex and concave bubbles really steps forward [20]. On sunny days, the light accentuates the pattern with soft shadows. [21]

On a snowy, overcast day, light is much more diffuse, and the Opera expresses a completely different feeling. The building's materials are much more subdued, yet still giving the context definition. [15, 17]

The interplay of material and natural light is also sensed form the west-facing foyer. On a sunny afternoon, a warm, coloured, low-angled light enhances the space [23]. The light emphasises the thousands of wooden pieces making up the outer wall of the main concert hall. The coloured light creates delicate shadows of each piece, expressing the irregularity of their positioning and form. [22] This interplay of material and light brings the mind at peace to create the foundation of an extraordinary experience with music. On an overcast day, the light in the foyer is soft, diffuse, clean and white, reflected from the excessively white sky. [24]. It is a very subtle but 'fresh' in expression due to the lack of direct light.

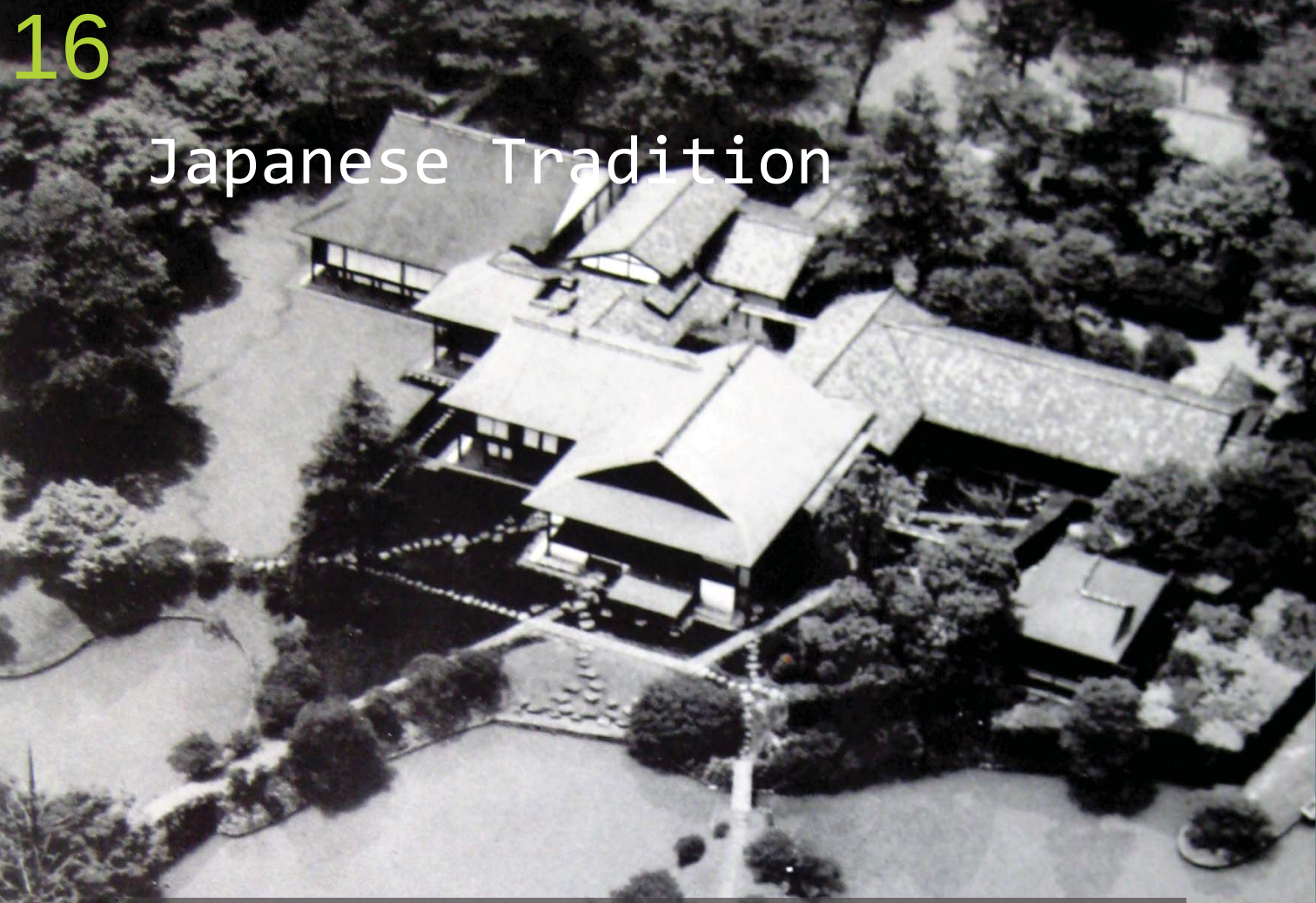
Human Scale

The Opera makes its mark through the horizontal monumenality of the sloped platform, which rises out of the water and becomes the roof. This transition gives the building a hill-like character, where it becomes a small added piece of landscape in the middle of the city. [15] People become part of the Opera by walking on it [11], thus bringing the building closer to the human dimension.

Design Criteria

- Light
- Nature and Landscape
- Honesty in material & Detailing
- Human Scale

Japanese Tradition



This section will be used to define the intended ambience of our Music House - to help musicians achieve an optimal state-of-mind for performance, as well as being an attractive destination recreation and relaxation.

Japanese tradition was chosen because of its close connection to the spirit of its culture, where emphasis is placed on generating a feeling peace, tranquillity and harmony through architecture. Aspects of the traditional Japanese house best exemplify this very essence, so therefore we refer to Japanese houses, not specifically music building typologies, in this section. Our readings are based on [Buck, 2000, pp. 6-51], [De Mente, 2006, p.p. xiii - 77], [Gropius, 1960, p.p. 1-36], the film [Wachtmeister, "Kochuu", 2004] and discussions with Dr Gerd Bloxham Zettersten.

The native religion in Japan, Shinto, reaches back to 712, and with its strong belief in spirits, it makes up the foundation of Japanese culture. The fundamental belief in Shinto is that all things and places have a spirit and their own appropriate role in nature, and therefore deserve respect. The human, in this regard, has a spiritual, intellectual, physical and emotional connection to nature. Therefore, the closer a design gets to the aspects of the nature, the more attractive it is to people.

Katsura Villa in Kyoto [25] will be a central case study, since it is a clear epitome of the spirit, tranquillity, and harmony expressed in Japanese architecture. Katsura's composition - the main building, tea houses, and a strolling garden with water, shifting materials, plants and surfaces - merge together to create a sensuous journey [26]. The aspects chosen in this section are the most important in Japanese tradition. They demonstrate the philosophical notions of 'Sabi', 'Wabi' and 'Shibui' – fundamental elements of Shinto, Zen-Buddhism and thus Japanese culture.

[25] The Japanese garden

Sabi / The rust of age - the process of life is appreciated in elements. Admiring nature, its seasonal changes, weathering, aging, and passing away. Focusing on naturalness and simplicity in materials. Asymmetry and austerity focuses on the unbalanced, apparent randomness of elements, aiming to surprise and delight. This "incompleteness" allows the viewer to complete the image themselves.

Wabi / Spiritual enlightenment and contentment – a mind-set of all Japanese. Focus is placed on the feeling of rustic and natural beauty - both in nature and man-made elements, utilizing and enhancing imperfection. The Japanese have often used wood and other natural materials obtain the Wabi sense.

Wabi-Sabi / Combining the two heightens elements on an emotional, spiritual and intellectual level. It is to live in harmony with nature and obtain a positive and graceful attitude. The values and qualities became a part of the Japanese mind-set.

Shibui / Eliminating the unessential, reducing elements to their simplest -conservativeness, roughness, elegance. Beauty in perfect harmony with nature, balancing elements and arranging to give a tranquil and transcendental effect. Having a soothing, elegant, sensual surface colour and texture. [De Mente, 2006, pp. xiii – xviii, 31-37]

Tranquility and Harmony

A significant element added by the Zen monks is keeping a peaceful mind by seeking tranquillity and harmony. Everything that is not essential should be eliminated to obtain a humble life in harmony with nature – 'Shibui'.

Katsura Villa was built with a tactile and sensual approach, focused on touching feelings and emotions by using natural textures and patterns. This is expressed a close relationship with the nature, where the outer walls are moveable and can be dragged to the side [27]. This gives peace to the mind, being so close to nature and appreciating its beauty. Natural light is also a major contributor. Strong outdoor light is diffused, by outdoor terraces that screen openings, and translucent screens. This results in a more delicate light. Katsura Villa affects a visitor's personal emotions and feelings by emphasising beauty and aesthetics according to 'Shibui' - reducing to only the essential and emphasising surface, tactility and materiality. This is seen in contrast of dark/light, rough/smooth and a delicate use of square, rectangle and stripes plus seeking the elegant and unaffected [27]. Beauty is in perfect harmony with nature and has a tranquil effect on the viewer. In the film Kochuu, Kisho Kurokawa explains: "What the eye does not see is richer than what the eye does see – it is the opposite of materialism, used very much in the west". The Japanese are interested in the invisible– that is, to see what is not shown. This absence of materiality can be referred to as 'immateriality', which evokes a sense of 'Boundarylessness', or no limits. That is, the viewer's mind is not restricted in any way, and is free to use their imagination, suggesting infinity [De Mente, 2006, p35]. This boundarylessness reflects the idea of 'Wabi'.

[26] Katsura Villa and garden

[27] Tranquillity and harmony in relation to nature and daylight

Indoor / Outdoor Relationship

The Garden / The Japanese garden is an "Urban hillscape ambience" – an peaceful escape from the hustle and bustle of everyday life. Even in the mid city, a small naturalistic garden can achieve this [Kochuu, 2004]. "A culture which seeks spiritual richness rejects that which is of size" The Garden need not be sizeable – it is an image of one's own universe. When related to the house, the garden is a sequence of visual elements, shifting textures, patterns and spaces. The materiality of elements expresses this – organic textures such as rocks, moss and trees form patterns without losing their natural appearance. Through the garden, paths are created with irregular, naturally shaped stepping stones of different sizes. Natural elements have been arranged with care by man, catching the eye in delight – another example of 'Wabi'. The path winds through more 'man-made reproductions of nature', offering surprise glimpses of the building. It is not revealed all at once, but rather left to one's imagination [28].

Ryoanji Rock garden, Kyoto, 1480 [29] exemplifies the replacement of one natural element with another. Regular rocks are surrounded by patterned white gravel, acting as water. This detail emphasises the rocks, which otherwise would not have been noticed. This is an expression of 'Wabi-sabi'.

[28] Man-made reproductions of nature

[29] Ryoanji Rock Garden

[30] Engawa Katsura Villa

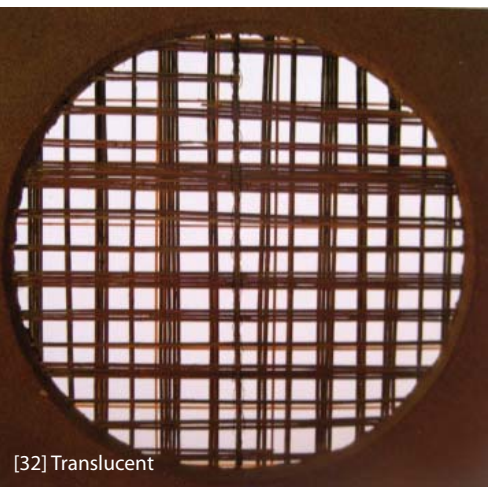
[31] Katsura Villa' garden view from Shokintei room

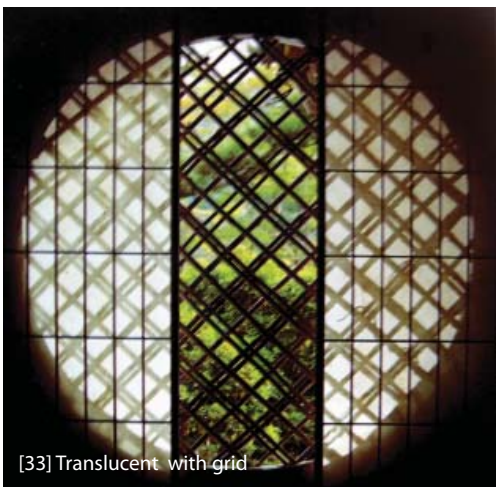
Merging of Indoor and Outdoor / Merging is possible due to the closeness of the garden to the openness of the facades. The garden provides views from outside and inside as one goes through the house. The Engawa (similar to a veranda) is a space neither outdoors nor indoors – its function changes from a place used in good weather, to a protector from the rain not used in bad weather – blurring the boundary [30]. Most Japanese gardens are looked at from the inside, rather than having an outdoor function. Thus the outside becomes an important visual element from inside the building [31].

Merging is also determined according to light. This is exemplified in openings of teahouses, through the penetration of different layers. Translucent openings filter the light, a discrete indoor/outdoor relation is sensed by silhouettes on the other side of the surface [32]. Transparent openings framed with a wooden grid, identify the wall plane, making it seem closed though it is open. The view is filtered lightly [33]. A totally unobstructed opening has no filter – the wall is pushed aside and the nature appears to come inside the building [34].

In Katsura Villa, the man-made and nature merge together; the materials on windows, doors and walls, are natural wood, while the translucency and transparency of openings amalgamate outdoor and indoor. Light penetrating a large part of the wall and the surrounding vegetation further enhances this union of house and nature, generating a feeling of tranquillity [31].

A spiritual 'boundarylessness' merging outside and inside is sensed by a non-direct approach into a building. A visitor forget the boundary dividing 'exterior' and 'interior' , evoking 'endlessness'. By lengthening the journey, the visitor is made conscious of the transition itself, having time to reflect. In the film "Kochuu", Tadao Ando discusses that "a place and time for preparation are also part of architectural space just by visiting one can feel spiritual enrichment".


[32] Translucent


[33] Translucent with grid


[34] Transparent

[35] Detailing Komyo-ji Temple, Tadao Ando

[36] Flexible planning Katsura Villa

Expressing Structure

The immersion of the nature arises the need for architectural order. This is seen in the construction, based on a post-and-beam structure. The concept for balance in the Japanese houses and in Katsura Villa is achieved by using a modular system and sequences of patterns, which form the volume and fill the site given by the nature. The exposed load-carrying structure is reduced to only essential elements, creating an atmosphere of order and harmony through 'Shibui' [10]. Joinery connecting posts and beams can also be treated in detail, particularly in the Japanese temple, emphasising the load transfer between elements [35]. Katsura Villa's expressive heavy wooden structure also defines rooms by removing the light walls between [36]. Katsura's contrasting ceiling construction is an exposed bamboo and wood system, expressing the structure but the texture and detailing gives the roof a lighter feeling [37].

Planning

Asymmetry / Asymmetry in architecture plays a major role by being the fundamental in the culture and Shinto. It is one of the primary elements in ornamentation and is used in the teahouse [38]. A conscious effort is made to ensure windows do not match, since underlying the irregular is typical of Japanese tradition. Only the incomplete was considered to be a tranquil part of the fluid process of life – symmetry, the symbol of perfection, was reserved for the temple [Gropius, 1960, p.8]. Katsura Villa and its immediate surroundings are one homogenous, integrated space composition – there is no symmetry or any central focus in the plan [25]. Natural irregularity and asymmetry in terraces are enhanced by leaving them raw or unfinished – expressing 'Wabi' [39]. This gives a fresh, surprising, and extraordinary calming expression.

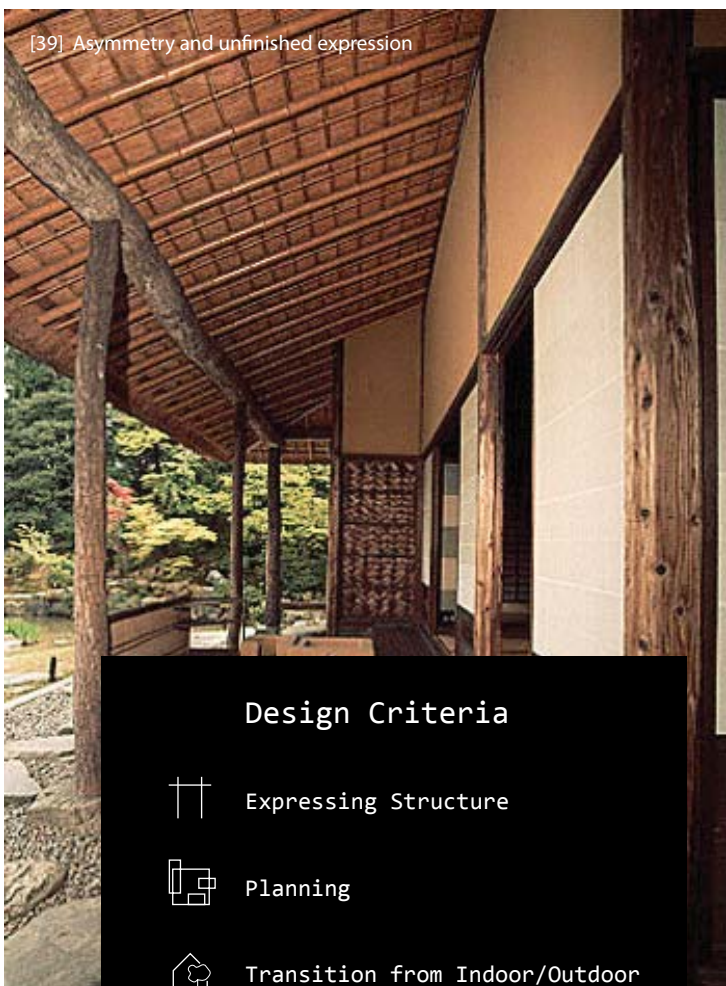
[37] Light expression of roof structure Katsura Villa

[38] Asymmetry in windows of Katsura Villa

Flexible Planning / The floor plays an important role, since all activities such as sleeping and sitting are based directly on it. The floor plane is acknowledged and shown respect by raising it up from the ground and by the removal of shoes when treading on it. The smooth wooden terraces around the building are also lifted up off the ground to avoid dampness when raining [30]. The floor protrudes outside the walls and becomes a terrace, covered by a heavy roof protecting the house from rain and sun. These two strong, horizontal elements stand out from the thin, transparent and open walls, which are withdrawn under the roof.

Katsura Villa is designed with the floor and roof as the basic elements. Thick wooden posts hold up the roof, and are clearly distinguished from the light, non-structural walls in between. The walls are flexible, and room sizes vary according to their position [36].

The Japanese use the same rooms for various functions. A room is used for sleeping at night, using thin mats directly on the floor, and during the day the bed mats are stored away. The room is replaced with a low table, transformed into a day-room where users sit on the floor to eat, drink and relax.



[39] Asymmetry and unfinished expression

Design Criteria

- Expressing Structure
- Planning
- Transition from Indoor/Outdoor
- Sensuous Journey

ACOUSTICS
Quality & Expression

Architectural acoustics is of crucial importance for any music performance building, so that music can be experienced at its best by providing high quality listening conditions. This applies for not only the audience, but for performers to hear themselves to provide good music. We aim to express this acoustic importance aesthetically, underlining the typology of the Music House. We will include technical acoustic considerations from the first design phase, to achieve an integrated architectural expression developed through its technical requirements. Focus will be placed on the main performance hall, seating approximately 300-400 guests. The target performers play non-amplified music only. The performer size will range from soloists to groups of approximately 20 [see 'User'].

Acoustics will be expressed through the following:

External Acoustic Expression / A representation of "Acoustics" should emerge on the building's exterior, and have a relationship to the interior acoustic expression.

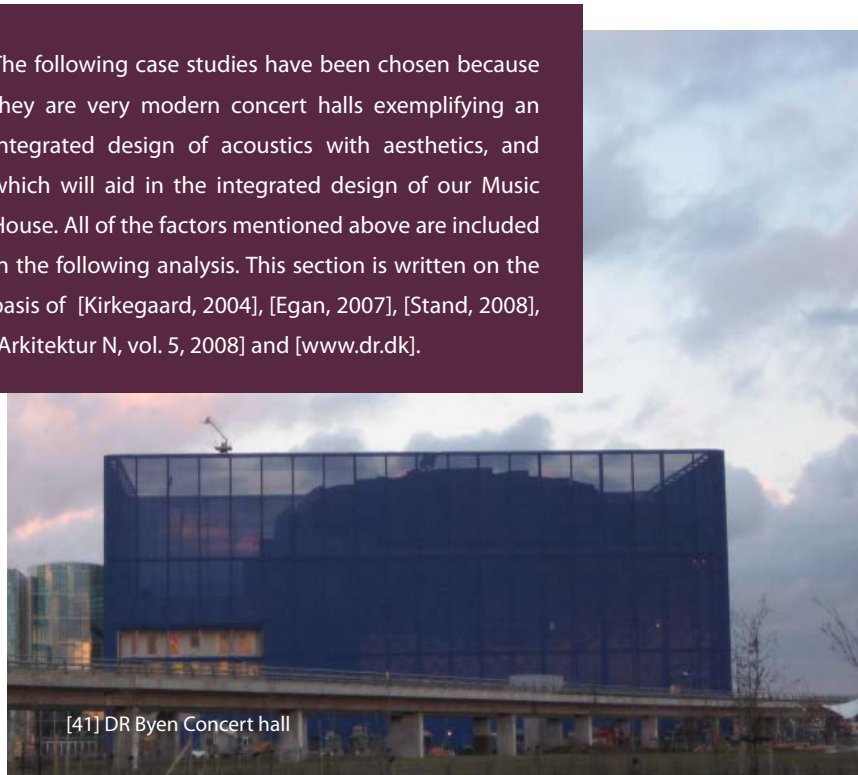
Interior Performance Spaces / The aim is for the visitor to immediately envisage beautiful and high quality music through the interior architecture, before actually hearing a performance itself - that is, to experience acoustics visually.

Facades, Materials and Forms / Facades of varying depths and angles, express a careful consideration of sound distribution in a room. Materials of different textures and surfaces express a careful consideration of the required level of sound absorption and reflection in a room.

Adjustability / Expresses the room's capability to achieve the different optimal acoustical conditions through adjustable facades and volumes, required for music groups of various sizes and genres.

The following case studies have been chosen because they are very modern concert halls exemplifying an integrated design of acoustics with aesthetics, and which will aid in the integrated design of our Music House. All of the factors mentioned above are included in the following analysis. This section is written on the basis of [Kirkegaard, 2004], [Egan, 2007], [Stand, 2008], [Arkitektur N, vol. 5, 2008] and [www.dr.dk].

[40] Outer side of Studio 1



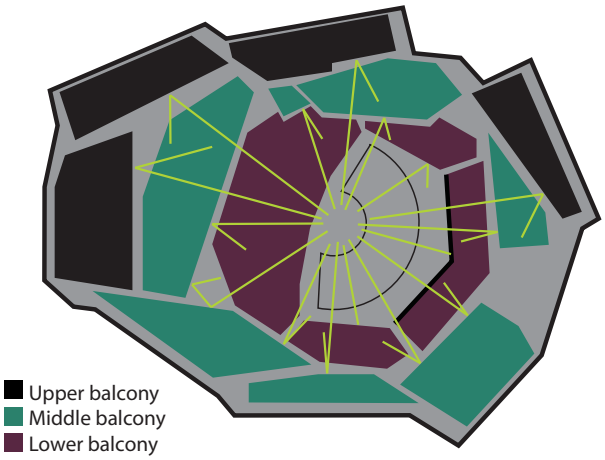
[41] DR Byen Concert hall

DR Byen Concert Hall

Studio 1 / Concert Hall

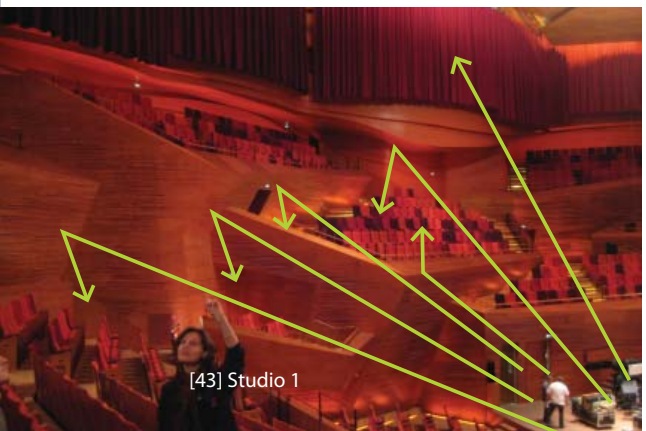
The main concert hall has been developed in a spherical form, which is enclosed by large overlapping panels. This form is seen from the foyer directly outside the hall [41], as well as from a distance in the context, protected by a large blue screen box [41]. This expresses the acoustic connection on a contextual level.

The interior amphitheatre layout is inspired by Berlinerfilharmonien, famous for its acoustics and its layout expression. A circular configuration of terraces surrounds the stage, expressing a closer intimacy to the musicians. The idea works in the same way people gather around music in a circle on the street - people prefer to be close to the music in a circle than to be on axis line further away. In this way, 1800 guests can come as close as possible to the performers, also reducing the overall massive volume [42]. The acoustics are optimised for symphonic music, with a reverberation time of 2.8 seconds (empty hall), 2.4 seconds (full hall at 500 Hz). Acoustic adjustments can reduce the reverberation time to 1.8 seconds [www.dr.dk, 11 March 09].

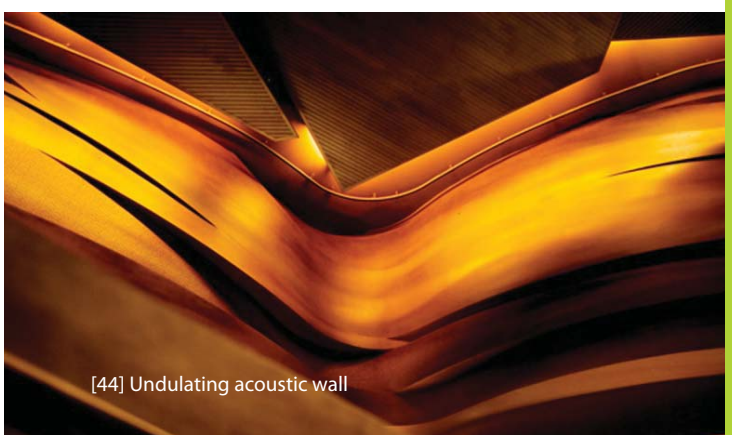


[42] Plan of Studio 1

Expression of walls / The warm golden glow of the walls is made of timber, a good sound reflector, but also is preferred material for the mental performance of the musician [Egan, 2004, p.159]. None of the walls are parallel, to produce strong lateral deflections over the entire hall. Sound deflecting walls near the performers aid in achieving tonal texture by reflecting some sound back to them, providing the essential sensation of responsiveness of the hall [Egan, 2004, p.158]. The angle of balcony fronts and walls are made non-parallel to diffuse sound around the hall [43]. The upper walls are waves of undulating laminated timber, carefully designed to create a strong artistic effect while the convex curvatures diffuse sound further around the room, so listeners perceive music coming from many directions [44]. For amplified performances requiring lower reverberation times, red curtains are drawn over the wave walls, fully covering them and absorbing more sound due to the material's higher absorption coefficient [43] [www.dr.dk, 11 March 09].



[43] Studio 1



[44] Undulating acoustic wall

Seating / Sound absorption by human in large numbers can affect sound quality and alter the reverberation time. This issue has been solved by upholstering each seat with wool and linen with the same level of sound absorption as a human. Therefore reverberation time will not be affected according to an audience size since and empty seat and an occupied seat absorb the same amount of sound energy.

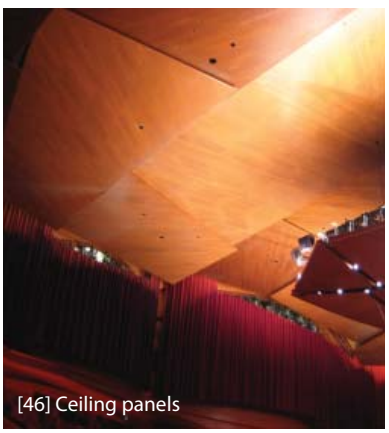
Wall surfaces / The walls of the perimeter of the hall are perforated with small holes with increasing density as one moves away from the stage. This is because sound at the front needs to be reflected to the back, but once at the back it can be absorbed
The walls are also given an aesthetic detail by scraping line patterns in the wall. This also works as acoustic deflectors for the wall [45].

Ceiling / The ceiling is made with timber panels overlapping each other and angled always away from the performance area, distributing sound out to the audience to avoid focus and echoing in the centre [46]. The expression of the ceiling is similar to the outside, and links the interior and exterior elements [40,41].

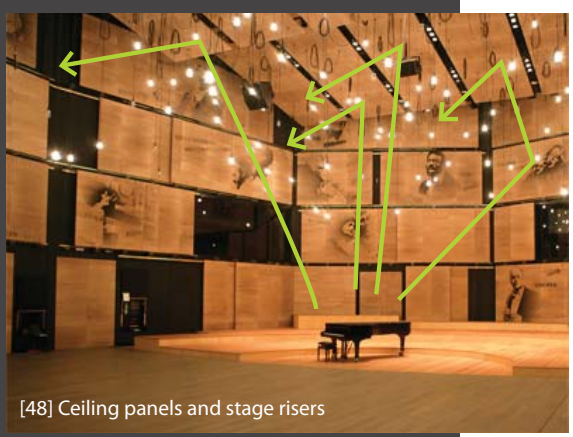
Studio 2 / Orchestra Hall

This room is similar in scale to the main performance space, to be designed for the Music House. Seating 540, it functions both as a performance and rehearsal space. Reverberation time varies from 1.1 to 1.7 seconds [www.dr.dk, 11 March 09]. The room's walls are non-parallel to prevent flutter echo and standing waves [48]. The walls are acoustically adjustable, and this makes an obvious architectural expression in the room. The sliding beech panels reflect sound almost totally when drawn [47], but when open, they overlap each other, revealing another material with a different absorption coefficient [48]. This alters the overall reverberation time in the room. The panels can be opened and closed according to the required reverberation time needed for various music groups [Egan, 2004, p.134]. The ceiling is covered by adjustable sound reflecting timber panels, to provide shorter initial-time-delay-gaps (ITDG). The panels are perforated to allow some of the sound energy to absorb through the ceiling, controlling the amount of sound deflected. The panels are angled to face away from the stage in order to reflect the sound from the stage towards the back of the room. Stage risers aid in bringing the direct sound of the orchestra further away [48], [Egan,2004,p.156].


[45] Scraped wall


[46] Ceiling panels


[47] Wall panels

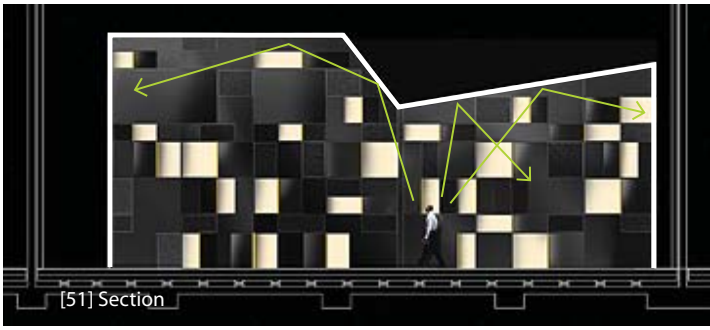

[48] Ceiling panels and stage risers

Studio 3 / Big Band Hall

This small hall seats 170 and is primarily a rehearsal and performance space for DR's Big Band. It stands out because of its grand piano inspired colours and shininess, and its irregular dimensions. The ceiling undulates rigidly, made up of black horizontal slats reflecting some sound while allowing some sound to be absorbed between them [51]. The walls are also varying in their angles. Sound absorbing materials are installed inside sound-reflecting panels [49,50], which open and close to vary conditions from hard to soft, thus changing the amount of sound reflection and the reverberation time in the room. These openable panels integrate into the façade expression of varying black squares and rectangular lights, which reflect off the hard shiny black panel surfaces. This again exemplifies an interesting integration of acoustic and aesthetic design.


[49] Studio 3

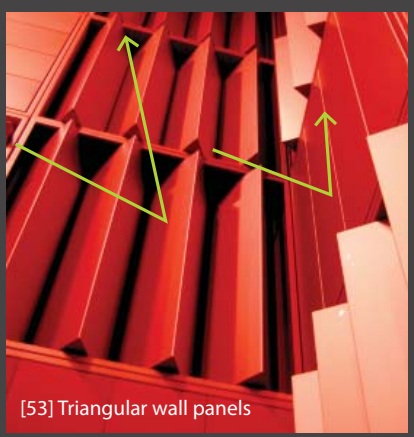

[50] Absorption panels

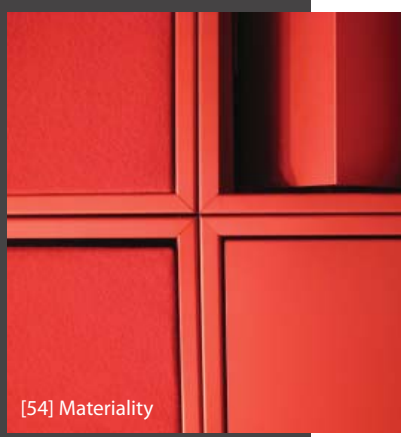

[51] Section

Studio 4 / Choir Hall

This room exemplifies a very stark but successful integration of acoustic design with architectural aesthetics. Seating 200, the walls and ceiling are a module of panels made of triangular sections [53]. The sides consist of three different materials [54], and can be rotated to either reflect, absorb or diffuse approaching sound energy. This can be altered in many hundreds of combination to achieve optimal acoustics for a range of situations. The variation in the panels' orientation, the exposed side and the surface texture of the materials, along with the choice of colour, generates an interesting and effective architectural pattern [52].


[52] Studio 4


[53] Triangular wall panels


[54] Materiality

Oslo Opera House

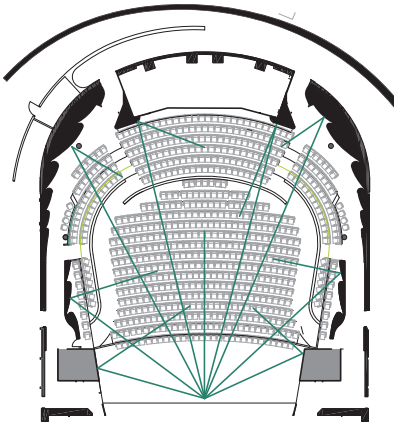
Main Concert Hall

Oslo Opera House gives a subtle acoustic expression to its context by lifting the roof plane, where the 'soft' interior wooden lamella facades are exposed beside the contrasting 'hard' marble exterior [55]. This façade defines the shape of the main performance hall behind it, being an acoustically designed façade itself.

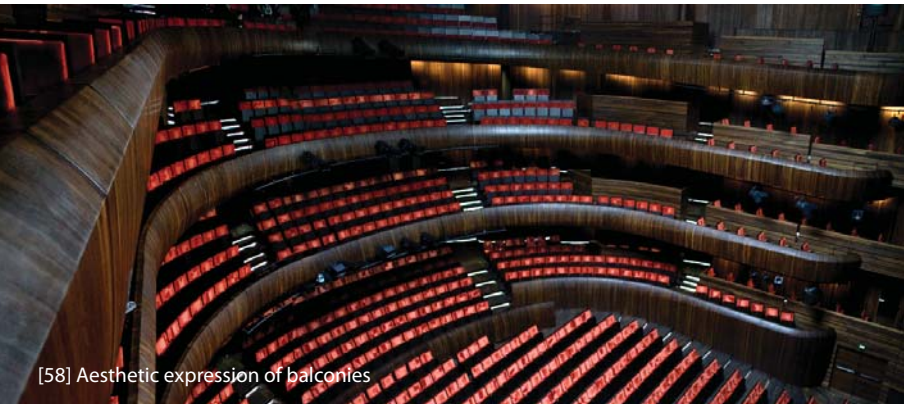
Room Dimension / The main concert hall focuses on Opera acoustics, therefore a balance between clarity in vocals and sonority in tones is required - a reverberation time of at least 1.7 seconds at 500Hz [Stand, 2008, p.180]. The classic horseshoe-shaped room is chosen [56], since it is the most optimal shape based on the short distance between a large audience and performers, good sight lines and optimal acoustics [Arkitektur N, 2008, p.25], [Stand, 2008, p.182].

"Acoustic ear" / Larger volumes are required for achieving a higher reverberation time, so the hall's walls on the upper levels are placed further away from each other. The wider space at the top sharpens reverberation time, while the narrower space at the ground level ensures sound clarity and intimacy [57]. The required floor-to ceiling height of over 20 metres is achieved by exposing the structure and technical spaces above the concert hall. They are hidden above an oak sound reflection ring and a monumental chandelier. These elements take the attention and a smaller volume is interpreted, create a more intimate and proportional space [57, 59].

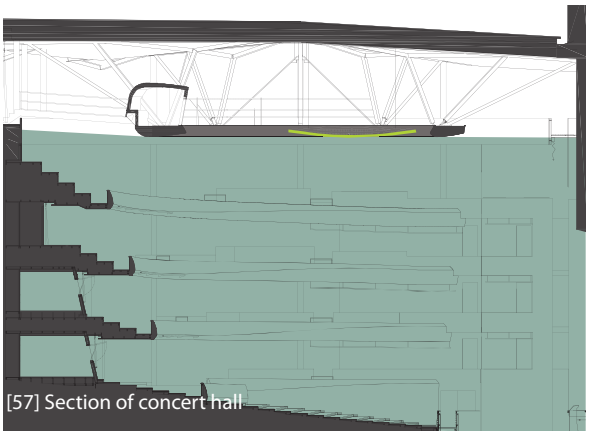
[55] Oslo Opera, Exterior acoustic expression



[56] Plan of concert hall



[58] Aesthetic expression of balconies



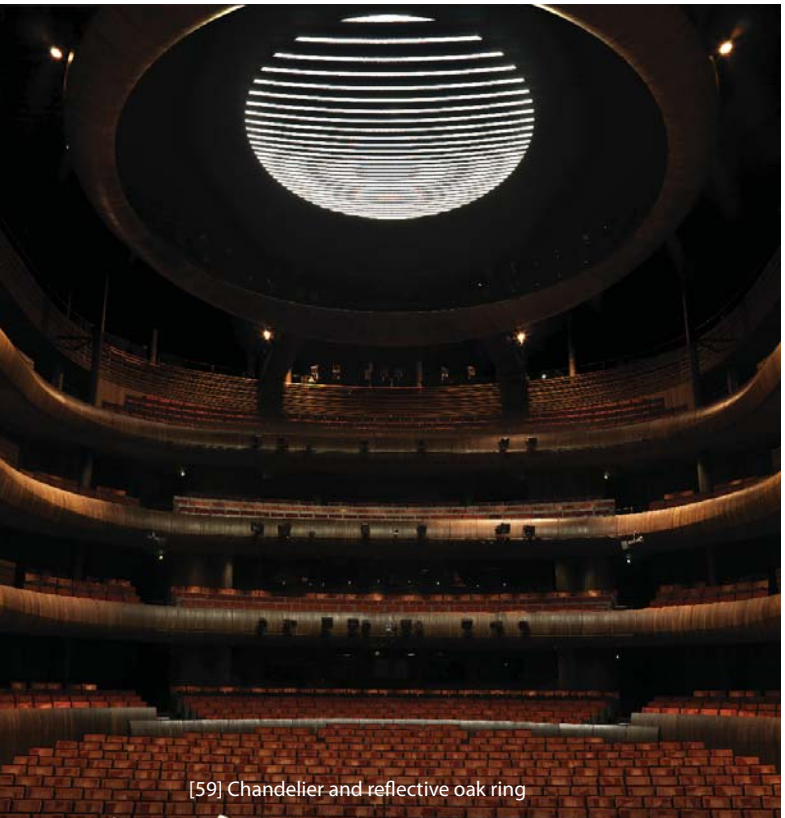
[57] Section of concert hall

Timber

A principle aesthetic expression of the concert hall is timber, working well acoustically. To ensure a good bass sound by adding resonance to the lower frequencies, the walls and ceiling are heavy and thick. The wave walls [60] are 100mm thick medium density fibreboard plates (MDF) clad with oak. The double-curved balcony fronts and oval ceiling ring are also made of prefabricated oak [59].

Wave walls / The oak walls are shaped as 'waves' where the convex curvature diffuses sound evenly across the hall, so that listeners perceive reflected sound from many directions [56, 60]. The form, introduced in the initial design phase purely for acoustics, evolved as central aesthetic element of the hall [Stand, 2008, p.182]. Curtains with a higher absorption coefficient can be drawn over the walls, increasing sound absorption (thus decreasing reverberation times) for amplified music, and to control sound intensity.

Balcony forms / The changing geometry of the balconies functions partly as acoustic reflectors, again diffusing sound and avoiding focus sound. On the side walls closest to the stage, the surface is angled downwards to reflect sound to the audience [62]. The surface at the back evolves to a convex surface, diffusing the approaching sound and avoiding sound focus [61], [Arkitektur N, 2008, p.30]. These two acoustic methods are integrated aesthetically as a continuous line emerging over the entire balcony front [58].



[59] Chandelier and reflective oak ring

[60] Wave wall

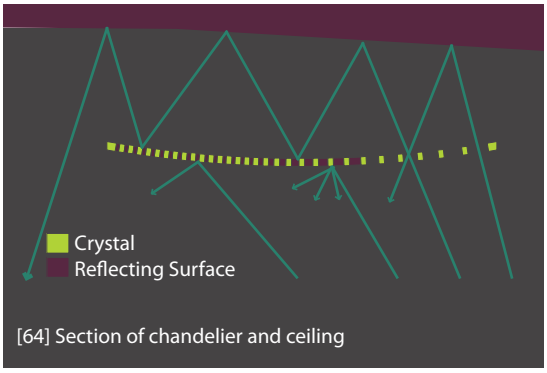
[61] Back balcony

[62] Front balcony

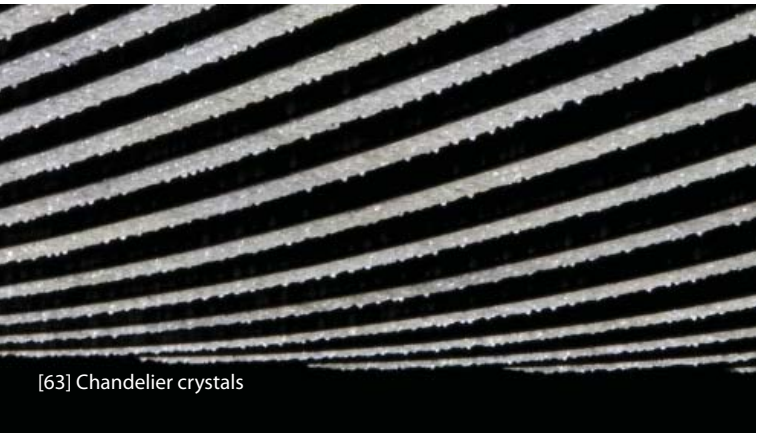
Chandelier / Acoustic data analyses showed a need for sound reflections around the hall and to the balconies, since the direct sound alone from the stage was too weak [Stand, 2008, p.183]. The Chandelier evolved from a square aesthetic design to its current integrated design, functioning as a sound reflector, a main source of illumination and a visual ceiling hiding technical spaces and structure above it [59]. It consists of strips of 8000 LEDs behind 5800 hand cast crystals [63], [Arkitektur N, 2008, p.26]. The irregular surface of each crystal creates a random scattering and diffusion of sound, distributing sound more evenly throughout the hall, preventing flutter echoes and focuses. The spaces between the light strips allow sound to travel through the chandelier. It makes use of the high ceiling space above it and maximise the 'wholeness' sound quality by increasing reverberation time, instead of all the sound being reflected and absorbed by the audience and seating [64], [Stand, 2008, p.181.] The spacing between the light strips diminishes towards the back of the hall, where eventually the very last 'spacings' are solid. This is because more surface is needed to reflect sound to the very back of the hall. The chandelier can also adjusts in height according to the performance, varying the sound path distances to prevent echo from occurring by maintaining an initial time delay gap of <50ms.

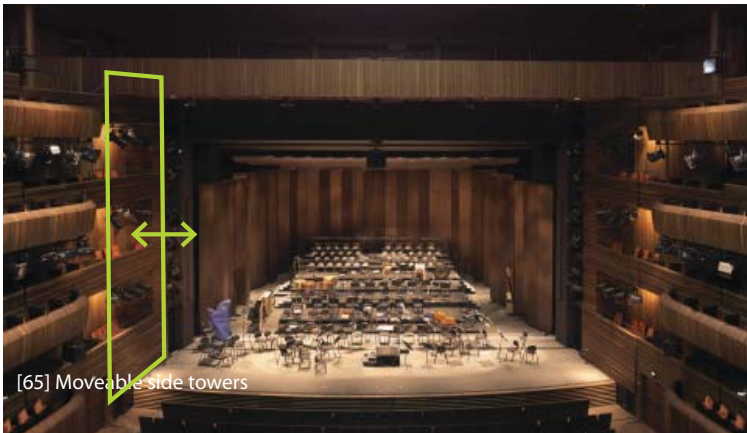
Sound Isolation / Because of the massive program of active musical functions, all rooms are sound isolated so as to neither disturb nor be disturbed by neighbouring functions. The 'box in box' method is used, where a concrete box surrounds the inner walls of the concert hall, while neither box touch to keep sound isolated.

Adjustable elements / The two towers on either end of the stage can be moved 2 metres into the stage, depending on the performance. For performances where vision to the stage is vital, the towers can be drawn back. For more musically-oriented events, the towers are drawn closer to allow sound to be reflected into the centre of the hall [65].



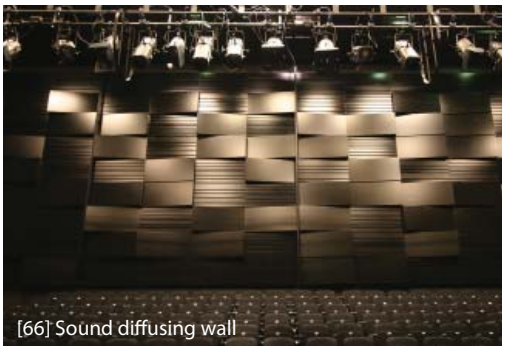
[64] Section of chandelier and ceiling

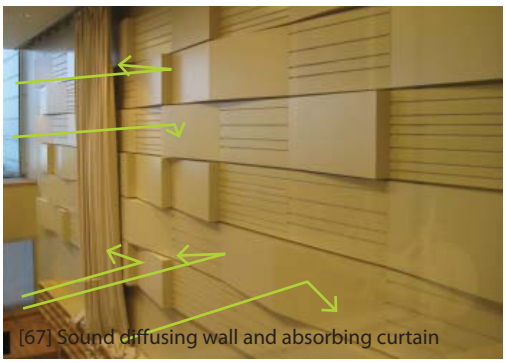

[63] Chandelier crystals

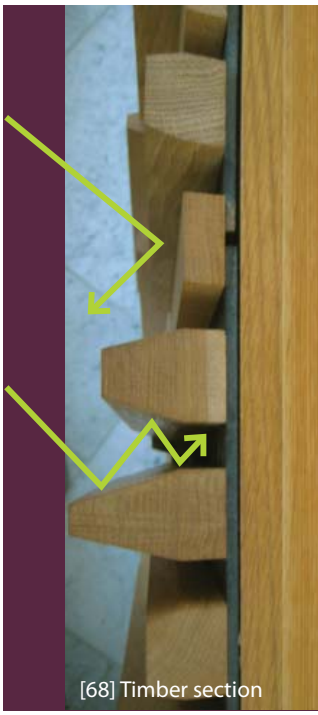

[65] Moveable side towers

Rehearsal Rooms

These rooms are relatively resonant, yet designed with non-parallel walls to prevent flutter echoes and standing waves. The wall cladding consists of absorbent, reflecting and diffusing panels of different materials applied in a modular system. This gives the façade a particular aesthetic expression [66].The panels are oriented at different angles for sound dispersion and avoiding focus sound. The retractable full-length curtains, more porous with a higher absorption coefficient, have a better sound absorbance and thus decreases reverberation time when fully drawn [67].


[66] Sound diffusing wall


[67] Sound diffusing wall and absorbing curtain

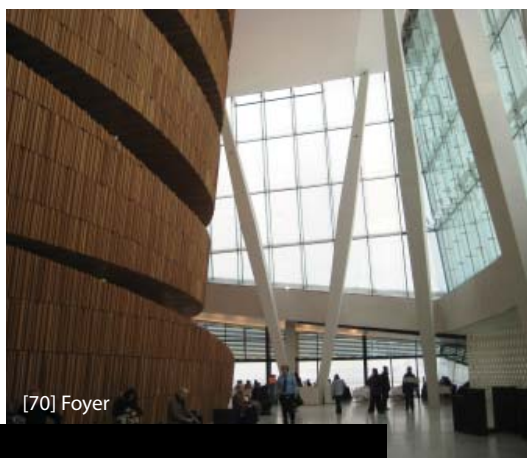

[68] Timber section

Foyer

It is imperative for the foyer to have sufficient sound absorbers, to keep a comfortable sound environment even when over 1000 people gather here during intermissions [70]. The curved wall facade is made up of spaced out wooden slats at varying angle sections to redirect sound. The material behind the facade is perforated, exposed between the wooden slats to absorb some of the sound [68, 69].

The ceiling is clad with micro-perforated foil, dimensions 10 x 10 metres and hung up using aluminium frames. Over the foil is a layer of mineral wool plates to give an extra level of sound dampening. [Stand, 2008, p.182] [70]


[69] Perforation


[70] Foyer

Design Criteria

- External Acoustic Expression
- Interior Performance Spaces
- Materials, Forms & Facades
- Adjustability

SUMMARY
Traditions & Acoustics

NORDIC TRADITION

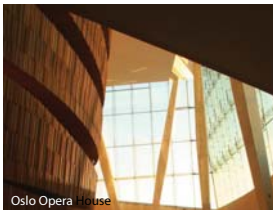
LIGHT

Utilising diffuse soft light quality


Copenhagen Airport


Norway


Stavanger East


Oslo Opera House

CONSIDERATION OF ENVIRONMENT

Adding to Landscape


Oslo Opera House

Human Scale


Knutson's Summer House


Brekkestranda Hotel

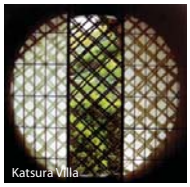
JAPANESE TRADITION

Filtering light to create diffuse quality


S house, Japan


Church of light


Komyo-ji Temple


Katsura Villa

Garden /Courtyard


Katsura Villa


Ryoanji Rock Garden

Sensuous Journey
Merging of Indoor and Outdoor


Office of Riyue Nishizawa

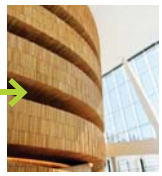

Katsura Villa


Katsura Villa

ACOUSTICS

External Acoustic Expression


Oslo Opera House




DR Byen

ELEMENT EXPRESSION

Detail


Oslo Opera House


Vikin Church, Finland

Honesty in Materiality & Detailing


Stavanger


Aaltos Summer house, Finland


Hedemark Museum, Hamar

Express Structure


Komyo-ji Temple, Sajio

Reduce to Essential Flexible Planning
Enhance imperfection Asymmetry

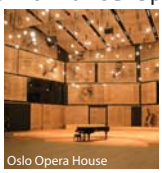

Katsura Villa


Katsura Villa

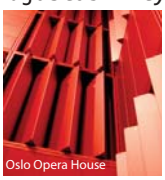

Katsura Villa

Interior Performance Spaces


Oslo Opera House


Oslo Opera House

Adjustability


Oslo Opera House


Oslo Opera House

Materials,Forms & Facades


Oslo Opera House


Oslo Opera House


Oslo Opera House

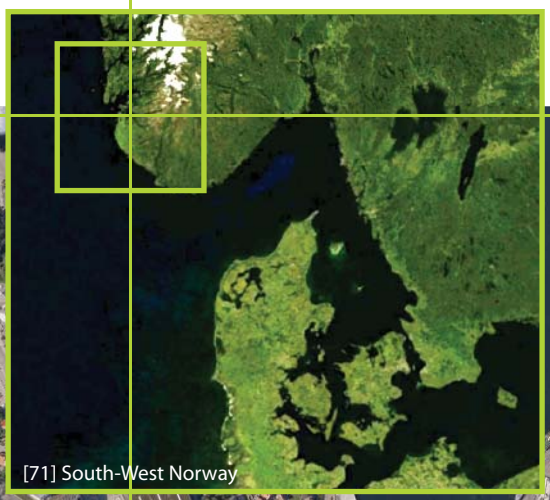
DESIGN AIMS

MODEST BUT SIGNIFICANT CONTEXTUAL EXPRESSION

TRANQUILITY & HARMONY

RELATE INTERNAL & EXTERNAL ACOUSTIC EXPRESSION

SITE
Stavanger/Norway


[71] South-West Norway


[72] Stavanger

It is important as Danish-educated architects to have a solid understanding of our own surrounding Nordic tradition, and for this project, the architectural tradition arises in the rocked, rugged and mountainous landscape of Norway. This chapter will focus on the Nordic and characteristic features of Norway, in particular Stavanger, the site for our Music House The Music House will fit into a city with an actively developing music environment.

Norway has a 20 000 km coastline with steep fjords and a welter of islands and islets [72]. It is a country whose climate changes vastly from north to south. Norway follows the North Atlantic Ocean, starting north of the polar circle with subarctic conditions, the midnight-sun in summer and total darkness in the winter. Norway generally experiences a harsh climate, except along the rocky, rugged and mountainous coastline, which is temperate because of the Gulf Stream [www.netleksikon.dk].

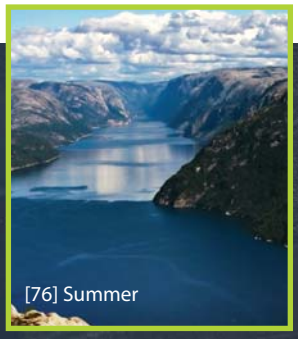
Stavanger is situated in the south-west part of Norway [71,72]. It is close to Denmark and easy to reach, which gives the opportunity to visit the city on a study trip. With an area of 71 km^2 and a population of 121 956, Stavanger is similar in size to Aalborg. This medium-sized city is populated enough to create our Music House, being neither too much for the city to handle nor too small to be noticed. Furthermore, Stavanger is a central driving force in the development of cultural life, and was awarded status as the European Culture Capital in 2008.

Stavanger has a close connection music and art culture. This takes place in different places around the city and ranges in character. The traditional music scene, the Concert Hall along with the adjoining Music Conservatory specialising in classical music, is situated in the western part of the city. There are performances all year around, and in 2012 a competition-winning Concert Hall will replace the existing one [www.medplan.no, 6 Feb 09]. This will give students and musicians the opportunity to perform under even better acoustical conditions in the future.

In the east part of the city is undergoing a cultural transformation. What used to be the unattractive and empty part of the city is now becoming a trendy, alternative cultural area. Less mainstream music genres and art forms mix together in a modern symbiosis.

[72] Stavanger


[75] Winter

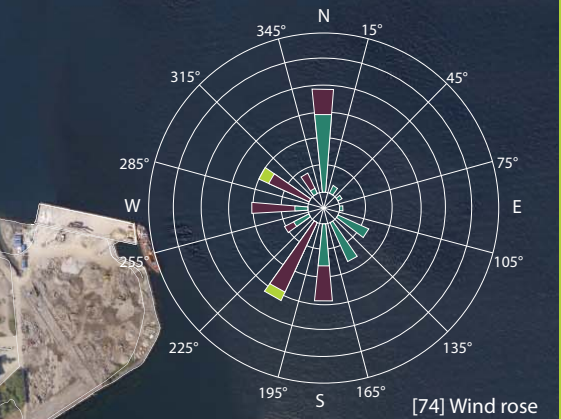

[76] Summer

Atmosphere / Stavanger has a climate close to the conditions in the north part of Jutland. There are, however, features in the landscape and weather conditions which give a slightly different mood in and around the city. The overcast days convert the city to a boundaryless world where mist rests in the streets, giving an anonymous appearance [75]. At the same time the light is still strong and underlines the feature of the city in a shadowless diffuse way which buildings a uniform expression.

On a sunny day on the other hand the atmosphere is the opposite. The clouds and mist hiding the mountains in the horizon rise and draws the eye to the rugged landscape in the distance [76]. The city is defined and the clean air and blurred shadows play together with the white houses, which strengthen the light and reflect it into the living rooms.

The wind is strongest from North and south-west [74] and the sunrise and set has, like the rest of the Nordic countries, a significant time difference [73].

[73] Solar path



[74] Wind rose

Stavanger East

East Stavanger is an interesting developing district. It is undergoing a major urban renewal, where private investors and the municipality are collaborating to create an attractive area with dwellings, work places, cultural initiatives, parks, and education institutions. Stavanger East has served as the dirty backyard of Stavanger but is evolving from industrial buildings mismatched with run-down traditional family houses, to new modern buildings, renewed traditional wooden houses and alluring parks.

In 1999, the organisation 'Urban Sjøfront' was established by 21 land owners in East Stavanger. The purpose of Urban Sjøfront is to convert 601 000 m^2 lifeless area into a vibrant part of town where people would want to live. This is still developing, and involves the challenge of changing local citizens' attitudes toward Stavanger East. Urban Sjøfront made a vision to establish a common line for rebuilding, to ensure private investors and the municipality work toward the same goal. They parted the area in six zones, oriented east – west and connected them with the Blue Promenade, a walkway following the waterfront from the west of the city to the east [83].

The vision contained several parks which among other is the culture park with different pieces of art [88]. The Culture Park is in the Cultural Zone and bind several public buildings together e.g. Ostehuset [79] which is a cafe and bakery, Orangeriet [87] which is a yoga centre and architectural offices, Borgen just next to Ostehuset which houses different artists and last the Tou Scene [86] which is a music scene and centre for contemporary art. Next to the Cultural area are different dwelling projects arranged as competitions concerning sustainable living, European 8 [80], building in a Nordic context, Norwegian Wood [84] and focus on qualities like daylight, room height and flexible plan, INBO [78]. All these different new initiatives have to appeal both to the people living in and around the area, but also allure new people to move to the area.


[77] Traditional houses


[78] INBO Housing project


[79] Ostehuset - Cafe

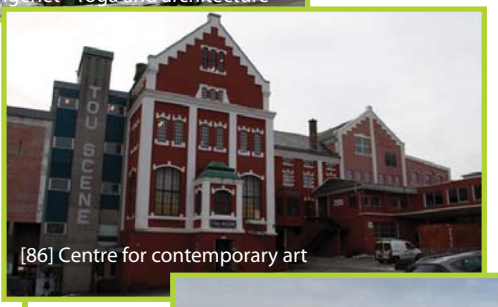

[79] Ostehuset - Cafe


[80] European 8 - Sustainable housing


[81] The surrounding city

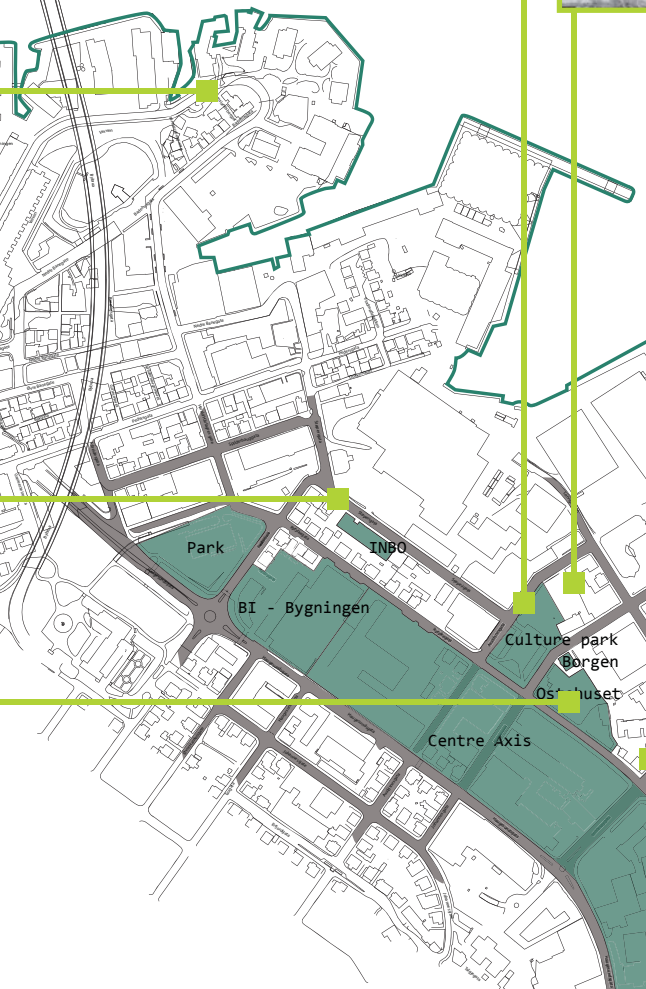

[88] The future Culture park


[87] Orangeriet - Yoga and architecture



[86] Centre for contemporary art


[85] The Site

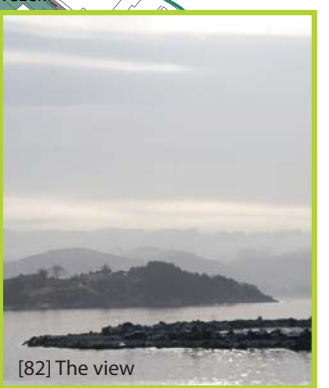



[84] Norwegian Wood

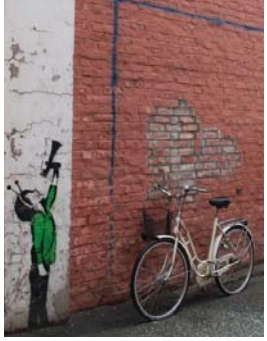
[83] The Blue Promenade


[77] Traditional buildings


[80] European 8 - Sustainable housing


[82] The view

Tou Scene



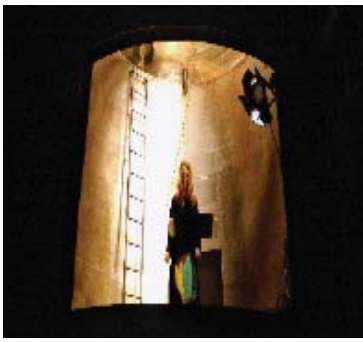
[89] Art on Tou Scene walls

A major part of the east area will be a cultural mecca with music, art, cafes, and parks. The main building in the area is Tou- scene: a centre for contemporary art and culture, owned by the municipality [92,93]. The building, built in1895 functioned as a brewery until it closed down in1980. The building was left deserted until a group of artists moved in and began using the buildings to create various kinds of art. The construction of Tou Scene and its official inauguration started in 2001 where the municipality bought the brewery [www.touscene.com].

[90] Tou Scene and surrounding parks

The aim for Tou Scene is to provide a venue for all sorts of art - music, film, stage art, architecture, lyric, new forms of media, hybrid art and art which do not have traditional definitions. Throughout the year a variety of exhibitions and concerts are performed, putting Tou Scene on the map as the most dynamic music-arena in Norway focusing on the future art forms. Furthermore the building works as a rendez-vous for creative artists arranging workshops and performing their art. They meet up or use the place on a daily basis and have access to residential accommodation there, making the place a living organism for new and interesting things to grow and evolve. [92] shows the back of Tou Scene containing the artist's workshops, small sleeping rooms and exhibition rooms; the basic functions for creating art. When walking around the building it is obvious that it is used by creative people. It is seen in the wall paintings which are present all the way around the building [89] [www.touscene.com].

[91] Performance on the main stage



[92] Art galleries and art work shops, Tou Scene

[93] Tou Scene

Tou Scene has a major influence on the area because it attracts people to Stavanger east to party, listening to music, or to enjoy a variety of art forms.

The place undergoing a rapid development. Together with the architectural company Helen & Hard new plans have been made for 'Tou Park'. This will connect Tou Scene with a surrounding housing complex, green areas and a planned Culture Park [90]. The park will start in front of the Tou Scene and end in the Culture Park. By demolishing some of the existing brewery, the park will be placed over two levels and contain an open-air stage.

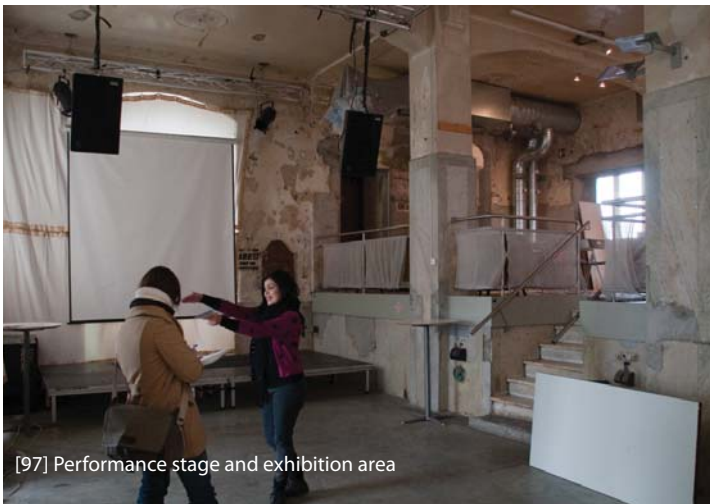
A variety of rooms serve the different activities going on in the building. The Loft is a room used for small concerts, meetings and other weekly arrangements [94]. The exposed trusses give character and intimacy to the room. On the first floor is the main stage [91] where all kinds of performance take place. A smaller stage is located adjacent to the café where events and exhibitions take place [97]. The Cafe serves food and drinks, and contains a relax area and an area for dining [96].

The Tou Scene offers numerous contemporary art and music events, a 'raw' place attracting many people particularly from the alternative scene. However, Tou Scene offers only spaces for amplified music. They lack facilities offering optimal acoustics for non-amplified music. Placing our Music House near Tou Scene will strengthen the culture of the area, by providing the function rooms that Tou Scene does not have. Therefore the Music house will not compete with the events at Tou Scene, but rather will enhance the cultural 'hub' of the area. The Music House will provide harmonious surroundings, intending to reach a wider audience welcoming all walks of life.

[94] Performance stage and exhibition area

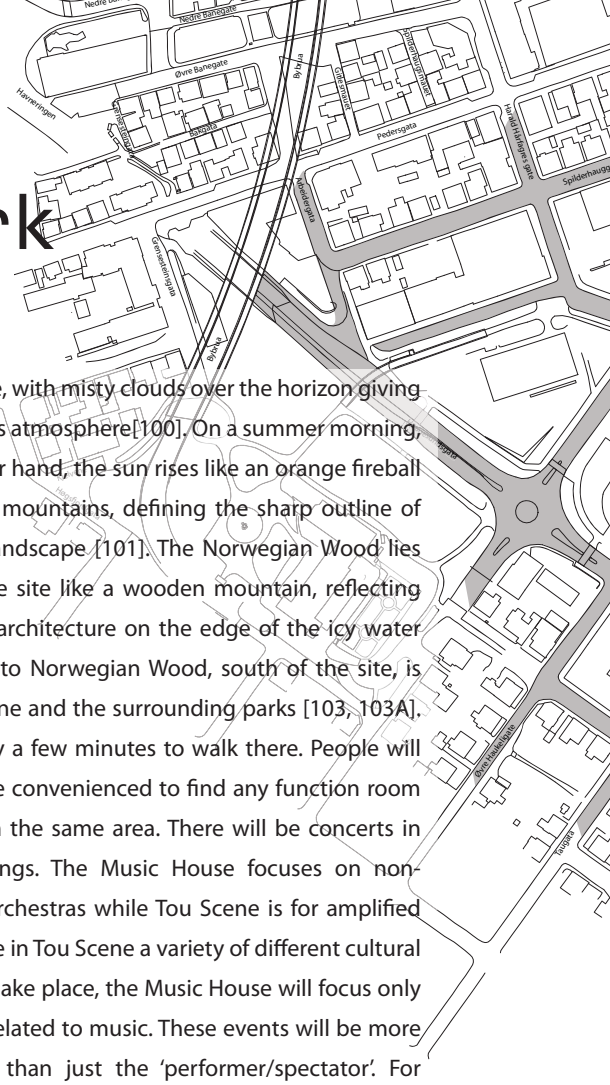
[95] Cafe and relax area

[96] Cafe and relax area



[97] Performance stage and exhibition area

Merging / Tou Park

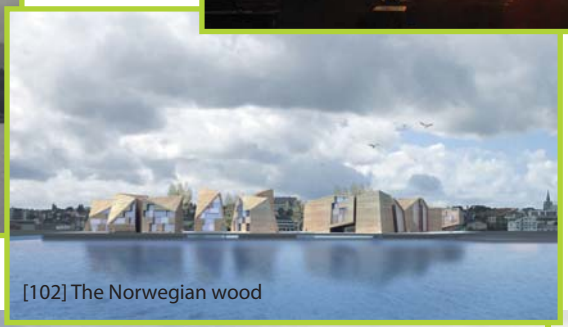


So far the municipality has planned the area between Tou Scene and the waterfront with housing and parks; the Norwegian wood and Aliancen [98]. To create a close connection with Tou Scene as well as strengthening the cultural significance of the area, the Music House should be in close proximity to Tou Scene. North of Tou Scene across the road is an area with a warehouse and steel factory, dashed on image [98]. The municipality has no plans for the area, but are eager to connect it with the Tou Scene, Ostehuset, Borgen, Norwegian Wood and the other functions nearby [Urban Sjøfront, Feb 09]. Therefore the Music House will be placed in the southern part of this site. For this project, we will make a general design proposal for the adjacent warehouse area of the site. The site merges with Tou Park and the Cultural Park. The park will aid in binding the Music House and Tou Scene together. By arranging different events, the atmosphere of culture in general will be strengthened in East Stavanger, attracting people in all ages to the area.

Picture [99] show a 360° view from the site. To the east is a magnificent view over the fjord with mountains in the distance, with misty clouds over the horizon giving a mysterious atmosphere[100]. On a summer morning, on the other hand, the sun rises like an orange fireball behind the mountains, defining the sharp outline of the rocky landscape [101]. The Norwegian Wood lies south of the site like a wooden mountain, reflecting the Nordic architecture on the edge of the icy water [102]. Next to Norwegian Wood, south of the site, is the Tou Scene and the surrounding parks [103, 103A]. It takes only a few minutes to walk there. People will therefore be convenienced to find any function room for music in the same area. There will be concerts in both buildings. The Music House focuses on non-amplified orchestras while Tou Scene is for amplified music. While in Tou Scene a variety of different cultural events will take place, the Music House will focus only on events related to music. These events will be more 'interactive' than just the 'performer/spectator'. For instance, the local music school can visit to going to


[101] The sunrise seen from the site


[100] The view from the site on a overcast day


[102] The Norwegian wood


[99] A 360 ° view, seen from the site

make instrument workshops, rooms will be available for relaxing and jamming, and in summer it could be possible to use the surrounding parks for music festivals.

To the west of the site is a cliff of 6 metres high, separating the site from the neighbour [104, 104A].

The municipality has planned a promenade to run from the centre of the city to end up in the east. It is on the edge of the site just next to the coast line, leading pedestrians into the area during summer. It could be an integrated part of the planning of the surroundings which also have to involve a proposal design for the north of the site which is not yet planned by the municipality.

[98] Site and neighbouring buildings

Design Criteria

- Climate
- Local Context
- View

[103] Tou Park, Culture Park

[103 A] Tou Scene

[104] Cliff

[104 A] Site and the view over the water

USER

The Music House will be used for a variety of activities related to music. Therefore a stark variety of users will use the building both on a daily basic and occasionally. Their common interest is that their passion for non-amplified music, or playing non-amplified instruments. They are people from all backgrounds of all ages, with different musical interests and with a musical knowledge of different levels.
Following is a short description of the user groups, which will be used to develop the required functions according to their needs.

The Musician:

The Musician [105] is ambitious with his music. He is either a professional or an amateur and treats the Music House as a working environment - he is a daily user of the building.
As an amateur, the Musician rehearses alone or practices in a group, either in preparation for admission into the local music conservatory, or to pursue a profession in music. He is an upcoming musician or already performs concerts. The Musician therefore utilises the performance stage - both to work and to create a name and reputation for himself. He enjoys listening to music and reading books for inspiration and enjoys jamming and having a social drink with his friends or colleagues.
As a professional, the Musician performs on the performance stage and uses the Music House for music events, courses or workshops. The musician works either alone as a soloist, or in larger orchestras. The Musician has very specific acoustic demands to maintain a high level of music quality and performance - both in rehearsals and concerts. He expects a calm and stress-free environment for ease in concentration, and to achieve a state of mind before and during performances.

[105] The Musician

The Enthusiast:

The Enthusiast [106] plays his instrument for fun in his spare time and uses the centre occasionally. He could be a student in a school band visiting from the local area, or a member of a casual band. He needs a place to play with others , and maybe attend the local music school to take private lessons. The Enthusiast may want to participate in regular music lessons once or twice per week for a longer period of time, to learn to play an acoustical instrument. He can be of any age, but with an inclination to learn more about music and sharing his interest for music with others. The Enthusiast attends concerts and events in the Music House and enjoys learning more about music by attending different courses, workshops and festivals. Like the Musician, the Enthusiast could also play alone or in any kind of larger acoustic bands.

[106] The Enthusiast

The Appreciator:

The Appreciator [107] visits the building to discover the music, enjoy the atmosphere and participate in music-related activities. He attends concerts and meets friends to have a cup of coffee in the café, or to look up new music in the music shop, or read books about music. The Appreciator is not himself a performer, but enjoys music and appreciates listening to good quality acoustics. The Appreciator sees the Music House as a relaxing recreational destination, so for him it is important for the ambience to be peaceful and pleasant, to relax people before a concert.

[107] The appreciator

Design Criteria

- The Musician
- The Enthusiast
- The Appreciator

SPACE PROGRAM

Music is the keyword for the use of the Music House. As described in "User" a wide spectra of people will be using the building to study, practice, perform, listen to and appreciate the sensation that music provides. Because the centre provides for a variety of users, some facilities should be flexible to be used for more than one purpose. There will be naturally be distinct divisions between spaces for the professional performers and the general public and it will still be possible to appreciate and discuss music together under one roof.

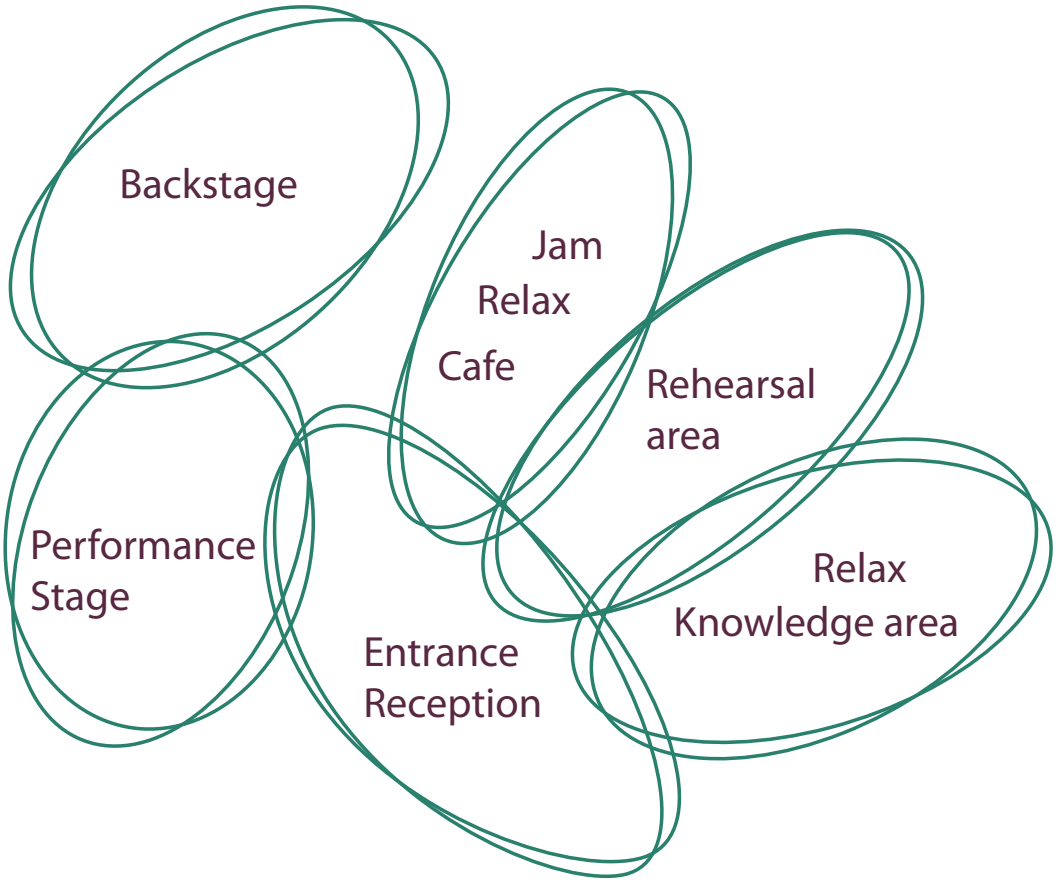
The functions required are deduced from the description of the user. Basic functions such as toilets and cloak room have been considered, but there is also a requirement for storage space and kitchen plus the more specific functions directed to the specific user. The Music House is not going to function as a traditional place for performance. In a traditional place everything is a one-way communication, where only the performer 'talks', while the listener is passive - the atmosphere becomes formal. The Music House contains both a formal and informal atmosphere. It encourages an interactive two-way communication where people can play and jam casually together, teach each other music and give each other advice. For this interaction to work, it is essential to generate the right kind of room size, organisation and casual feeling. The functions will be designed with the purpose to make the user feel free and relaxed, as well as providing a place for spontaneity in get-togethers for jamming.

Diagram [108] compare the importance of different functions according to the three users. Some functions are equally important for some or all of the users, e.g. both the Musician and the Enthusiast will use a rehearse room.

- Rehearse rooms
- Jam sessions
- Relax area
- Cafe, bar
-Listen and reading area
- Info about activities
- Performance scene
- Backstage area
-Storage

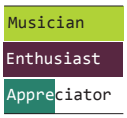
- Rehearse rooms
- Jam sessions
- Relax area
- Cafe, bar
-Listen and reading area
- Info about activities
- Info about the music school
- Info about concerts
- Tickets sales

- Cafe, bar
-Listen and reading area
- Info about concerts
- Tickets sales



Least interest → Most interest

Reception
Info - events
Info - teaching
Info - Concerts
Tickets

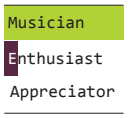


Cafe-Bar
Food
Drink

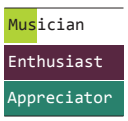
Rehearsal area
Individual
Group
Relax, jam area

[108] Functions of interest to user

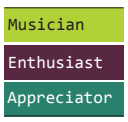
Least interest → Most interest



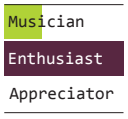
Performance stage
Band room
Relax area



Concerts
Attending



Knowledge area
Books
CDs



Relax Area
Jam area

Entrance

Functions / Reception for obtaining information - 30 m²
Area for arrival/ performance intermission - 200 m²
Cloak room - 30 m², 4 m/100 person
6 Toilets -12 m², 1 Handicap toilet - 5 m²
Storage - 60 m²

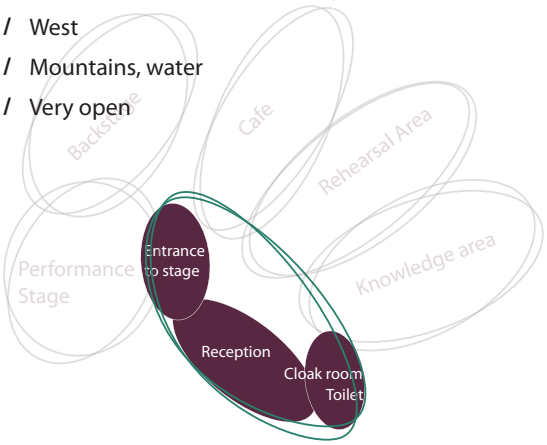
Size / 337 m²

Feeling / Open and welcoming, human scale
Clear to find functions and easy to reach them

Light / West

View / Mountains, water

Accessibility / Very open



Knowledge Area

Functions / Reading/relax area - 100 m²
Listening to music/relax area - 100 m²
Entrance/meeting area -30 m²
Storage - 50 m²
4 Toilets - 8 m², 1 Handicap toilet - 5 m²

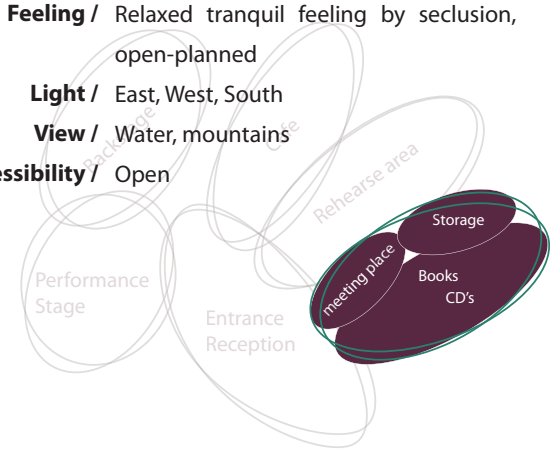
Size / 290 m²

Feeling / Relaxed tranquil feeling by seclusion, open-planned

Light / East, West, South

View / Water, mountains

Accessibility / Open



Rehearsal Area

Functions / Medium rehearsal room, 10 persons - 100 m²
Large rehearsal room, 20 persons - 150 m²
5 x 40 m² Large Group rooms, <10 persons - 200 m²
5 x 30 m² Small Group rooms, <5 persons - 150 m²
5 x 15 m² Teaching rooms, < 3 persons - 75 m²
4 Toilets - 8 m², 1 Handicap toilet - 5 m²
Storage - 50 m²
Jam and waiting area - 100 m²

Size / 780 m²

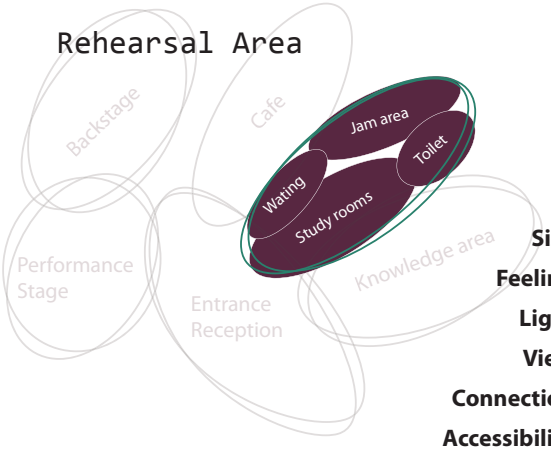
Feeling / Focused, concentrated, basic acoustics elements

Light / North

View / Garden

Connection / Water, garden,

Accessibility / Less open



Cafe

Functions/ Kitchen - 50 m²
Storage - 20 m²
Jam and relax area - 300 m²
4 Toilets - 8 m², 1 Handicap toilet - 5 m²

Size/ 380 m²

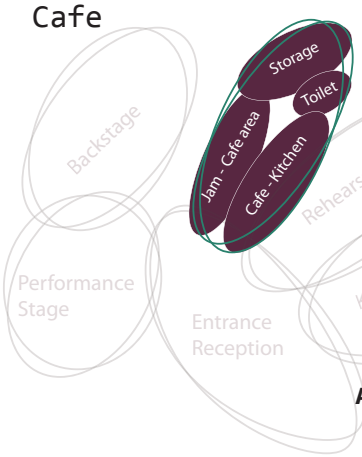
Feeling / Relaxed, transperent, easy to see and access

Light / South, east, west

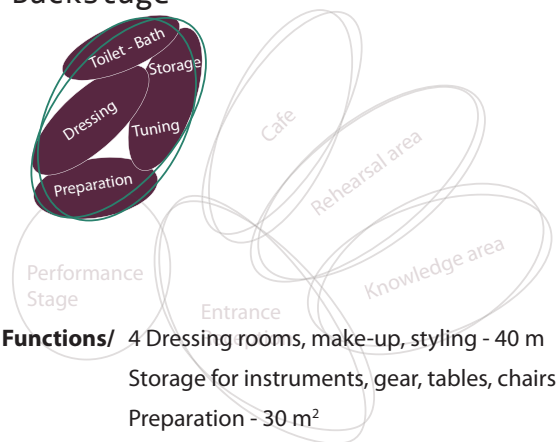
View / Water, mountains, populated area

Connection / Water, park, garten, promenade

Accessibility / Very open



Backstage



Functions/ 4 Dressing rooms, make-up, styling - 40 m
Storage for instruments, gear, tables, chairs - 80 m^2
Preparation - 30 m^2
4 Toilets - 8 m^2, 1 Handicap toilet - 5 m^2, 2 Bath - 12 m^2

Size/ 185 m^2

Feeling / Focused, concentrated

Light / North

Connection / Garden, calm areas (eg. roof/privet area)

Accessibility / Closed

General

Delivery of goods / equipment
Garbage removal
Drop-off zone
Delivery of food (Cafe)

Performance Hall

Functions/ Stage - 150 m^2
Audience - 300 m^2
Technical room - 25 m^2
Sound Separation 35 m^2

Size/ 550 m^2
400 people

Feeling / Acoustics, earnestness, stimulating, impressive
non-amplified music (brass, woodwind, strings, piano, percussion, acoustic instruments)

Connection / Cliff [possible acoustic element]

Accessibility / Open

To sketch on the space program later in the project it is important to determine the relation between functions, their sizes and the main focus for the rooms. When the bulbs overlap it means there is a clear and strong relation between the functions. Their arrangement is entirely to show the relation between each other, and later in the project the detailed plan will be made. The estimated area in the Music House is 3000 m^2, but is subject to increase or decrease.

Administration

Functions/ 5 Offices - 100 m^2
1 Print room - 20 m^2
Storage - 50 m^2
4 Toilets - 8 m^2, 1 Handicap toilet - 5 m^2

Size/ 184 m^2

Feeling / Welcoming

Light / North

Accessibility / Less open

Approximate Size / 3000m^2

VISION.
Nordic Japanese Harmony

Nordic Tradition


Light


Nature and Landscape


Honesty in Material & Detailing


Human Scale

Japanese Tradition


Expressing Structure


Planning


Transition from Indoor/Outdoor


Sensuous Journey

Acoustics


External Acoustic Expression


Interior Performance Spaces


Materials, Forms & Facades


Adjustability

User


The Musician


The Enthusiast


The Appreciator

Site


Climate


Local Context


View

VISION

The project aims to design a Music House in Stavanger, Norway. The Music House will be designed to attract people interested in music on all levels, encouraging them to play together in a 'two way' interactive environment with a wide variety of genres and events. The Music House will work in close connection to the local area to strengthen the cultural atmosphere in Stavanger East. The Music House will be designed in a Nordic context expressed in the architecture, and create a unity with elements from Japanese design, aiming for a tranquil and harmonic mood. Integrated acoustic design will be a keyword for the project, where the aesthetic expression of acoustics is made visually through architecture - indicating that the building provides good music. Finally, the requirements by the users demand a high standard of acoustics.

DESIGN PROCESS
Site Parameters

This section of the report refers frequently to the Design Criteria developed in the Program. A summary of these Criteria is listed on the last page of the report, which can be unfolded for reference while reading.

Challenges on the site

Changing heights / The site consists of three different heights [110], making the building interesting but challenging in terms of connecting them.

Light and shadows / the cliff overshadows the south part of the site [111].

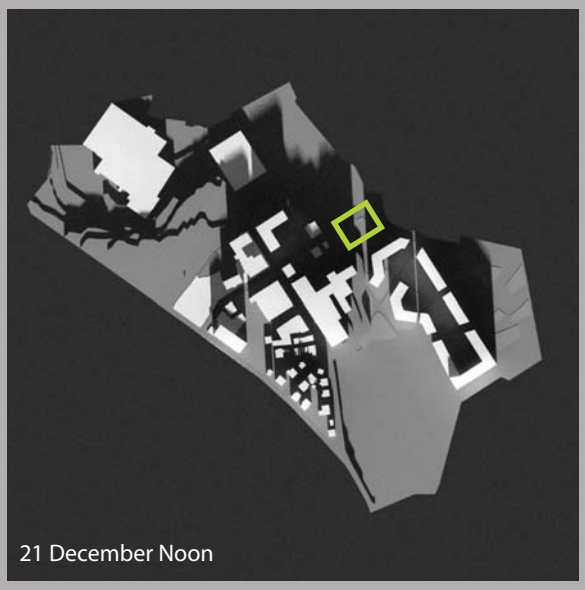
Connection to context / Culture Park and its sloping plane, the waterside promenade, road axis, neighbouring site are all important connections to be addressed.

Connection to Tou Scene / A strong connection must be made, also to strengthen the higher level of land.

Assumptions for neighbouring site / It is assumed that the North-West neighbours of the site will become residential or office blocks. The house on the cliff edge (Dashed on [109]) will be removed and given as part of our site.

[109] Site and context

[110] Section across site



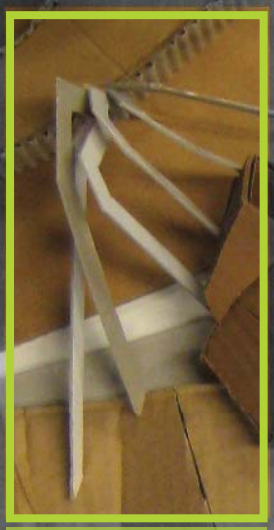
= The site

NB / 21 December 4pm has as no light

[111] Shadow studies for the site

Ideas 1

Folding and framing



Many journeys from one point

Designing began with general form-giving models to brainstorm ideas. Four models were chosen which gave potential for expressing Nordic and Japanese traditions.

Transition through elements

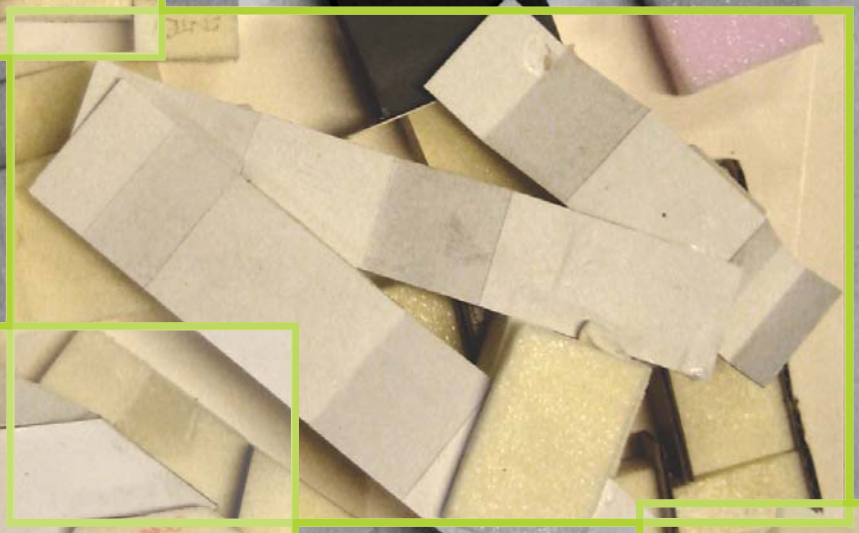
Lifting of plans to utilise roof

Ideas 2

Splitting journey from one point

Exploring facade planes

A new brainstorm of models was made according to the previously selected models, and five ideas were chosen.



3 journeys to ground

Journey on building, connect to ground and view

Central entry point to connect different heights

Ideas 3

A site model and space program models at 1:500 were made where three ideas were developed.

LAYERING

- Layered floors following context ground
- Scaled to human dimension
- Performance Hall expressed alone

TRANSITION

- Central entrance path connects differing heights
  Path through the building from cliff to the water
- Central journey path connects functions
- Public functions exposed to the waterside promenade and directed towards view

JOURNEY

- Simplified geometry
  One landscape path crossing a more simple geometry
- Urban path connects different heights
- Performance hall placed irregularly to emphasise externally

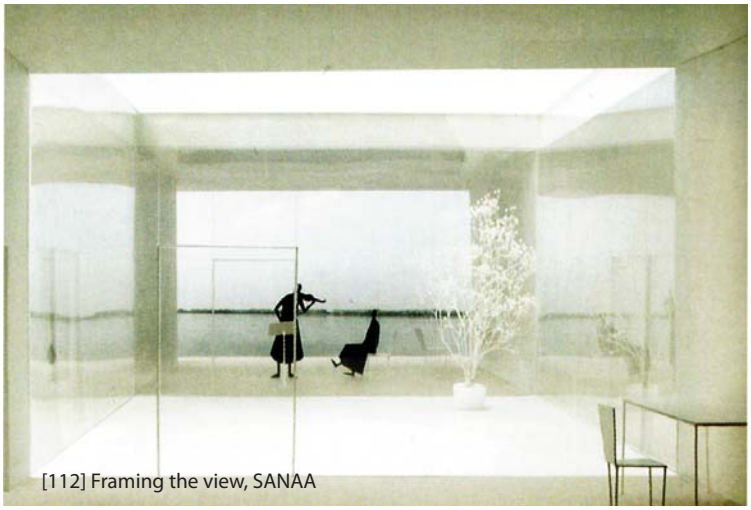
Relation to Nature

Images by Japanese architects SANAA inspired ideas about creating framed views into green areas, acting as an extra layer to filter the view outside. This lead to our own concepts of different "filtering" methods of outdoor areas [115].

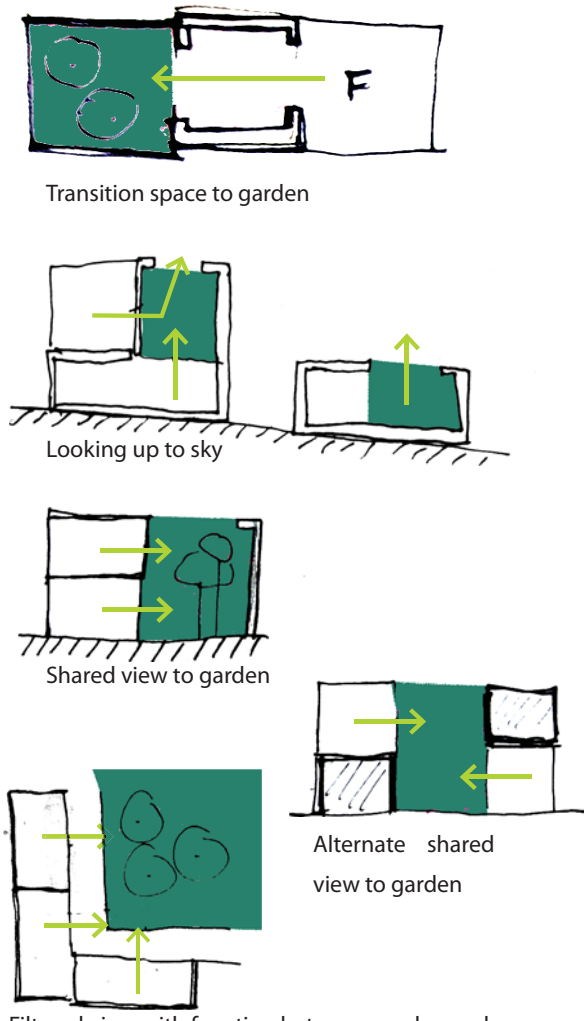
Framing the view [112]

Layering & filtering [113]

Journey [114]

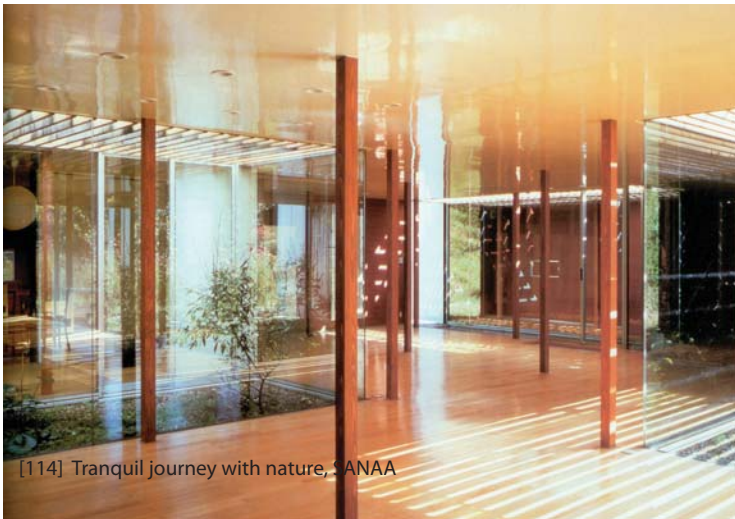


[112] Framing the view, SANAA



[115] Filtering concept methods

[113] Layering and Filtering transition from out to in, SANAA



[114] Tranquil journey with nature, SANAA

Concept

From the three idea phases, inspiration pictures and an impressive image of the surrounding mountainous landscape over the site, an underlying concept arose.

View / Inspiration by the horizontal coastline stretching across the fjord adjacent to the site

Framing / A small part of this breathtaking is highlighted and framed

Journey / The idea that a sensuous path weaves around these layers of mountains

Layering & Filtering / The layering of mountains behind one another is enhanced, which filters the distinction between foreground and background. Light is also filtered through the layering, thus emphasising its quality.

Planning

The initial space program models were looked at internally according to the new concept. A plan and section emerged [116] [117].

Retaining the view to water from foyer

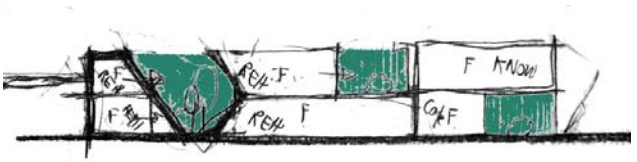
Well-rounded access point from promenade, Culture Park, the Kvitsøygata street axis

Rehearsal using cliff as acoustic and insulating walls

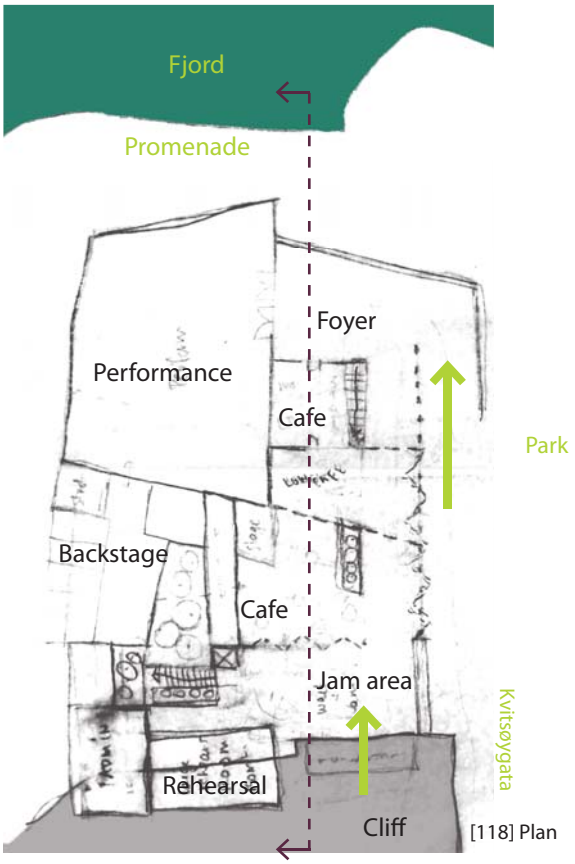
A Transition zone created into the main entrance, merging indoor and outdoor
Framed views made into shared courtyards

The cafe however had no direct view or access to the culture park and the connection to the cliff could have been be stronger as a Nordic element.

[116] Plan



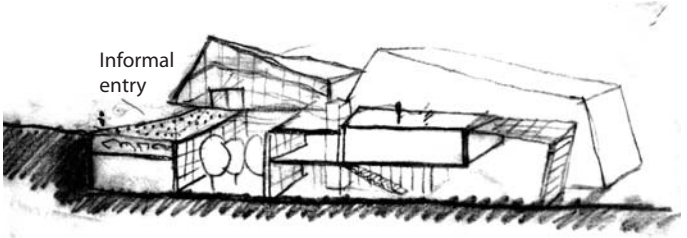
[117] Section



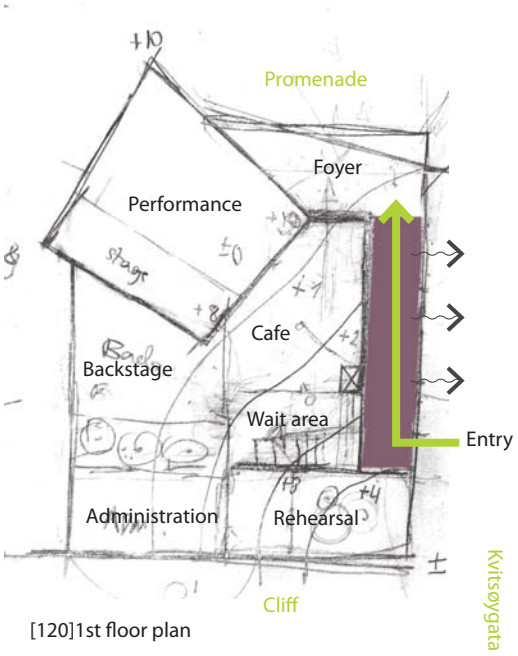
[118] Plan

[118] marked the formal entry from the corner promenade, being the most central and equal access point to all directions

The connection to Tou Scene was weak, so a less formal entrance was placed for regular at the cliff top [119]. However this weakened the strength of the journey and different users would never get an opportunity to interact.

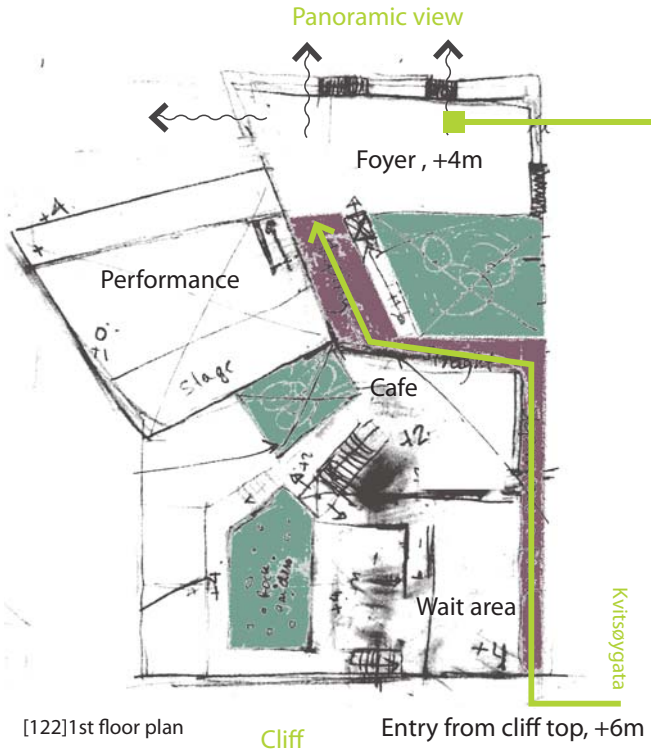


[119] Section



[120]1st floor plan

However the journey around the rest of the building and the relationship to the cliff height was not clear. There was still no exterior form and the Performance Hall needed to be designed.



[122]1st floor plan

The connection to the cliff was retained by creating one common entry point at the top of the culture park, with a visual connection out over the culture park [120].

Ramp created a larger transition journey to the Foyer and Performance Hall. The visitor had more time to be aware of surroundings. Outdoor/ indoor merges - view made visitor feel like they were outside when walking down the ramp

Mind-set through the view / The glimpse of mountain view at the end of the ramp opened out to a panoramic view in the foyer - creating a peaceful and relaxed atmosphere before a show

Closer physical connection to Tou Scene and to main traffic/pedestrian flow from Kvitsøygata. Closer visual connection to Culture park

[121]Utzon Centre Auditorium view

The Utzon center in Aalborg has a room overlooking the fjord. The room, protruding out 2m on either side with openings, created a panoramic view over the water. The distance from the water edge and elevated height gave the feeling of being on top of the water, and making the view more exclusive [121]. This idea was integrated into the next sketch [122].

Foyer developed a 180° view over fjord, to create an impressive and elegant atmosphere while waiting to enter the performance hall. The elevated height and wider view angle brought the viewer close to nature, blurring the boundary between inside and outside.

The ramp looked out to Culture park and wound around large courtyards, for an interesting journey and various framed views.

Height Changes

The form of the building was still unclear, because of the many split levels now emerging. The journey needed to be simplified and have only one focus instead of many simultaneously. This was explored by gathering all the stairs for level changes around a single courtyard. The connection of the entry to the culture park was still unresolved because of the height changes. Therefore the cliff connection needed to be resolved.
Planning became troublesome in terms of fitting in functions while receiving adequate light (see shadow diagram on page 49) and allowing the three different heights (0m of site, 4m sloping culture park, 6m cliff) to relate to each other. This was solved by setting the entire building 9m away from the cliff, to avoid being in shadows in the times of year where there is more light across most of the site. Thus the cliff changed in its definition:

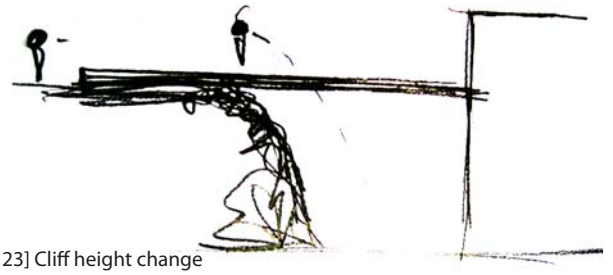
Cliff used as a viewing element with a garden placed between it and the building. This generated a small tranquil garden view.

Light able to enter the entire facade facing the cliff, even if indirect when overshadowed.

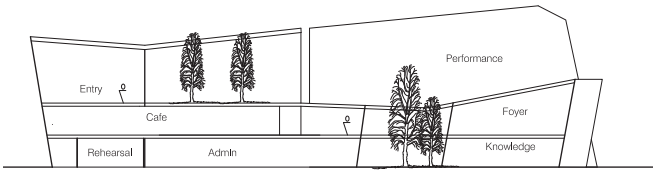
Connection created to the cliff top (6m) and the ground (0m) by a bridge starting at the cliff and crossing the garden space. The cliff suddenly dropped, making the visitor aware of the height change [124]. The culture park slope created the perpendicular boundary wall for the garden space [123].

[124] Model of cliff

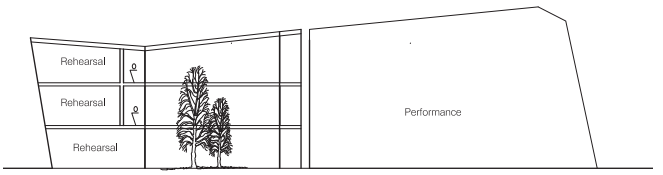
[125] Form model from neighbour building



[123] Cliff height change



Section HH



[126 Sections showing layered courtyards and form

[127] Facade walls relating to human scale

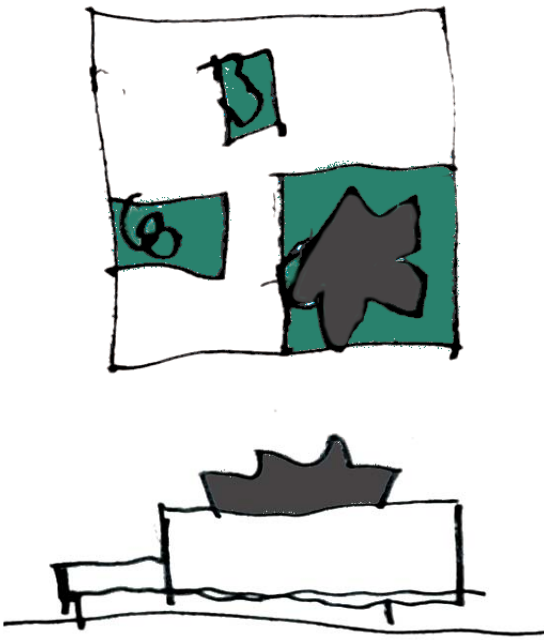
Form Finding

A model was built integrating a combination of the discussed aspects, to try an integrate a form from early sketches relating to human scale [127]. A building was made with a "Gap" separating the Performance Hall from the rest of the functions, to be able to express its acoustic quality independently. A roof shape was made to be able to identify the Performance Hall as part of the functions [125], [126].

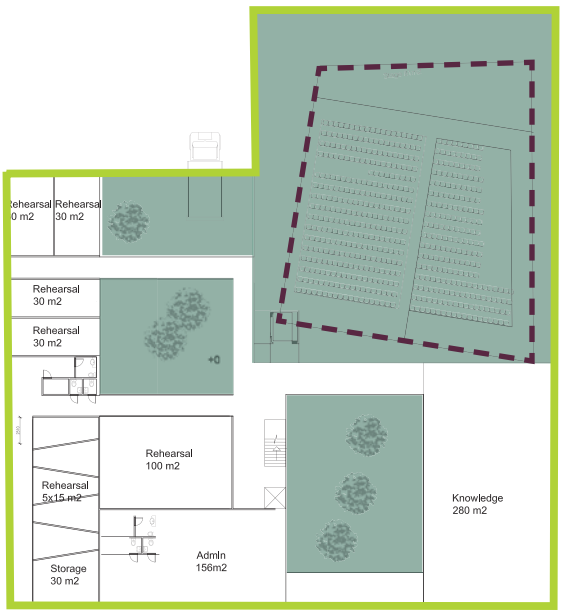
However the form was confusing - it was not clear whether the Performance Hall was trying to be its own form, or part of the rest of the form.

The problem was that the Performance Hall needed to be distinguished from the rest of the building because of its acoustic design and expression. At the same time, it was of equal importance with the rest of the functions and so should have been be read as a part of them. A new way express the definition between the Performance Hall and the other functions was explored. Instead of the "Gap", the Performance Hall became own expression, but placed within a space belonging to the rest of the building.

This idea was solved by expressing the form as a simple squared form with large courtyards, where the Performance Hall became read as enclosed by a large courtyard [128], [129]. The Performance Hall protruded out from the courtyard walls [128]. This defined the Performance Hall as a free standing expression, but as still belonging to rest of the Music House because of its enclosure.



[128] Expression of form in plan and section



[129] Realised version of Form expression

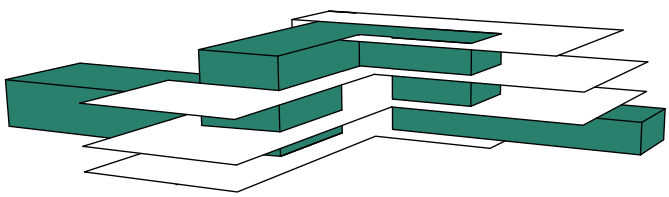
Green Flow Path

The positioning of the courtyards within the building gave the opportunity to enhance views. Here the Green Flow Path emerged. The courtyards were interconnected visually in plan and section.

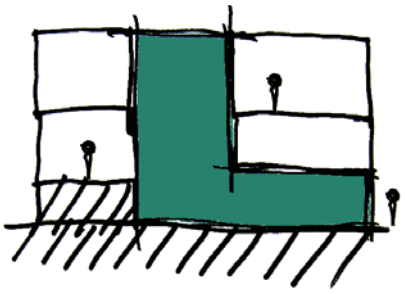
The view strengthened the connection to culture park and the opposite neighbouring site [130], [131]

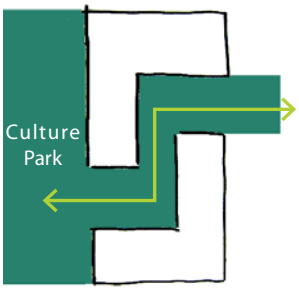
Filtration of views / the courtyard now acted as a layer filtering the view further out in the distance to either another courtyard or to a view in the context [132].

Variations of this idea were made according to the height positioning of courtyards. This enhances the journey.

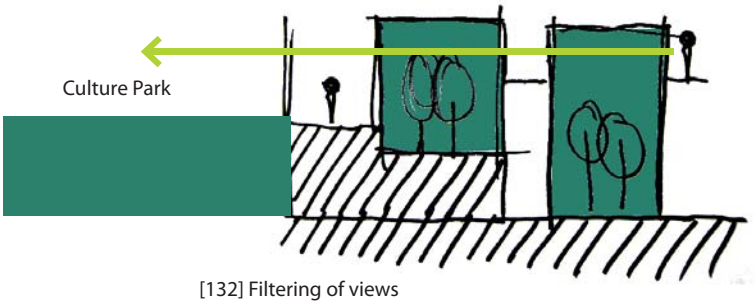


[130] Green Flow Path concept





[131] Green path connecting to context



[132] Filtering of views

Structure & Materiality

Inspiration images were taken to define the structural expression. Sverre Fehn's double beams express a subtle detail on a simple construction. They complement elements around it without taking all the attention [133]. Talo Arunikokello's exposed column and double beams express the load path clearly and gives the walls a feeling of lightness [134].

A grid was placed over the plans, simplifying the form further and strengthening the form concept [135].

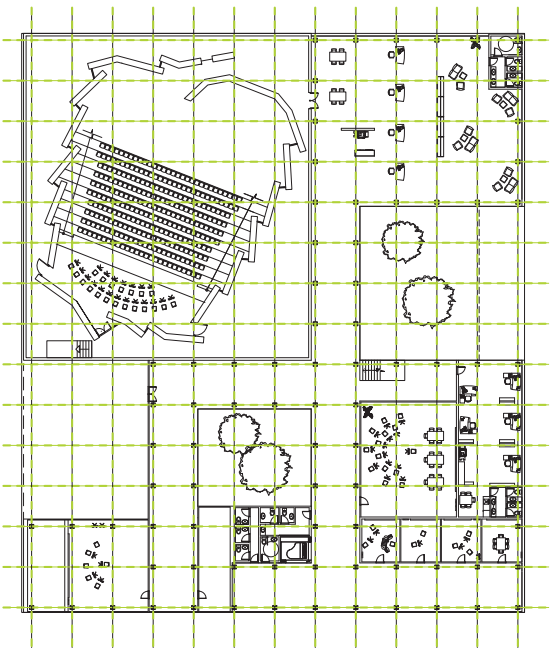
[133] Double beam expression Sverre Fehn

[134] Exposed beam and set back column, Talo Arunikokello

A simple, regulated exposed system reflected a calm form.

A post and beam wooden structure was chosen since its naturalness and honest in materiality and could help in maintaining calmness through regularity.

The structure aimed to express calmness through regularity, to maintain a sense of tranquility and contribute to a sensuous journey.



[135] Grid overlay on plans

A physical model was made to test variations in beam and column properties, to determine the expression of the construction.

Exposed double beam / Column against wall
Too defining and dividing

Exposed double beam / Column offset
Walls appeared lighter but still too defining & dividing

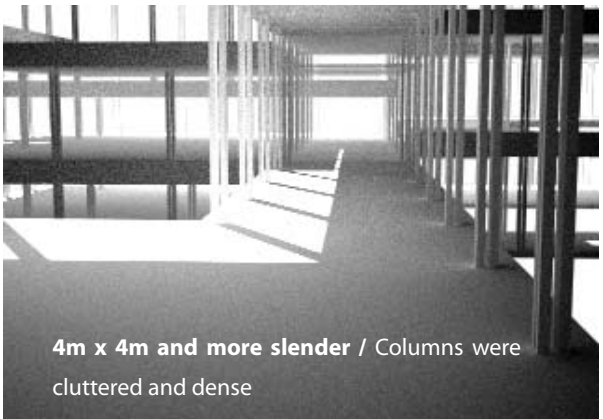
Underside of beam / Column against wall
Too dividing - split up room into grid spaces

Underside of beam / Column offset
More subtle expression
Walls appeared lighter

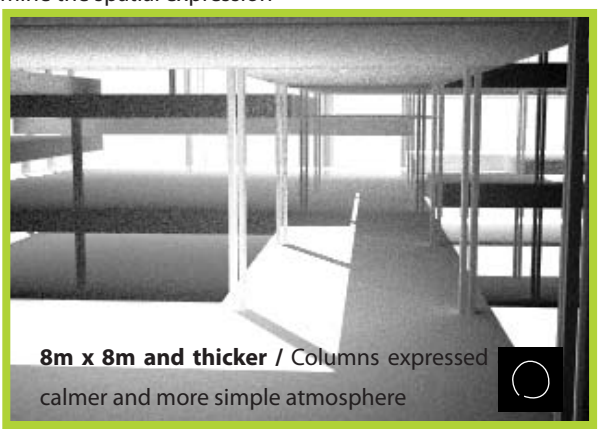
Underside of beam / One column
Column thickness seemed heavy

Underside of beam / four slender columns
Gave a much lighter expression

A 4m x 4m and 8m x 8m grid system were tested in 3D to determine the spatial expression



4m x 4m and more slender / Columns were cluttered and dense



8m x 8m and thicker / Columns expressed calmer and more simple atmosphere

Facade Expression

The idea arose to use a horizontal form to relate to a modest expression. This is how Oslo Opera House expressed its monumentality.

Inspiration was taken from Baumschlager and Eberle's Häusler Haus [136]. A perforated wall allowed in light while defining spaces behind the wall plane. It gave opportunities to create layered facades, but the wall was read as a single plane.

A combination of transparent, translucent and solid facades were explored, exposing the interior of the building at different rates [139]. It gave a discrete intricacy and horizontal expression.

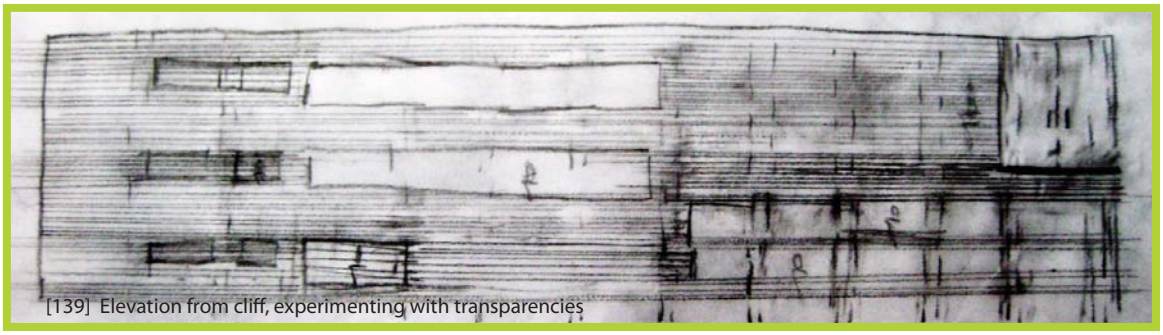
The filtered glimpses of the view and light, instead of a solid wall, brought the exterior closer into the building [137].

Making openings for views versus heat control was considered. Thus, some floor-to ceiling translucent or glass walls were reduced in glass area but this created better defined framed views [138].

[136] Translucent facade, Baumschlager and Eberle

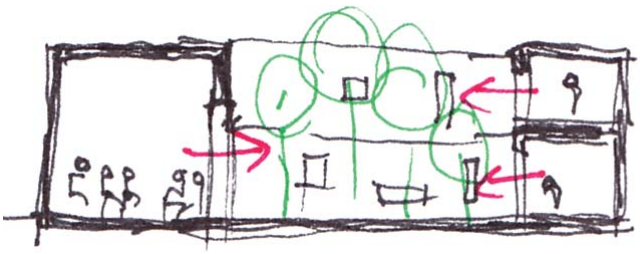
[137] Translucent wall giving glimpses of exterior

[138] Reducing glass area made stronger framed views

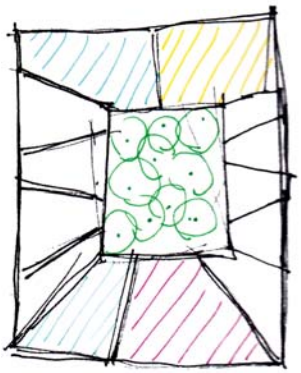


[139] Elevation from cliff, experimenting with transparencies

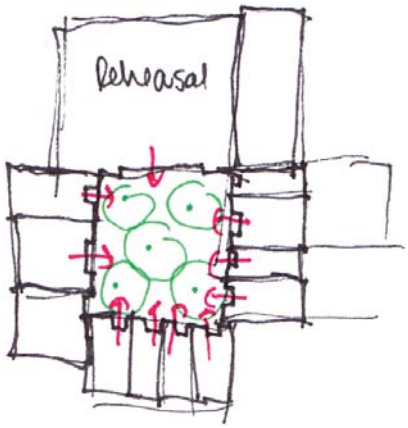
Rehearsal Rooms



[140] Framed views into a courtyard / section



[142] Non parallel walls



[141] Framed views into a courtyard / plan

[143] Wood sound absorption ceiling panels

Aesthetic principles /

The rehearsal rooms were developed according to visual connections to a private courtyard, to keep mental focus and tranquility. This created framed views and a connection to the outside [140], [141].

The interior facades were tested in a combination of normal glass, acoustic glass and different hardnesses of woods. This was done in order to provide adequate acoustic conditions while still keeping the aesthetic aims.

Acoustic principles /

The room shapes began with non-parallel walls [142], but changed into a shoebox shape instead. This is because it fit much better in the squared plan and grid. The aim for reverberation time was 1.6 to 1.8 seconds. There was a need to use acoustic glass in order to maintain the framed views to the outside. This glass was combined with normal glass, wood and sound absorbent ceiling panels [143], [see Technical Supplement for more details on materiality]. The combination of these materials were adjusted according to the CATT results for different room volumes.

Performance Hall

Creating an optimal music perception is based on a satisfactory level of sound or loudness (Dynamic range). For the Music House's performance hall, with non-amplified instrumental performances ranging from soloists to groups if 20, optimal music perception was designed according to the following:

Evenly distributed Sound Pressure Level, *SPL*

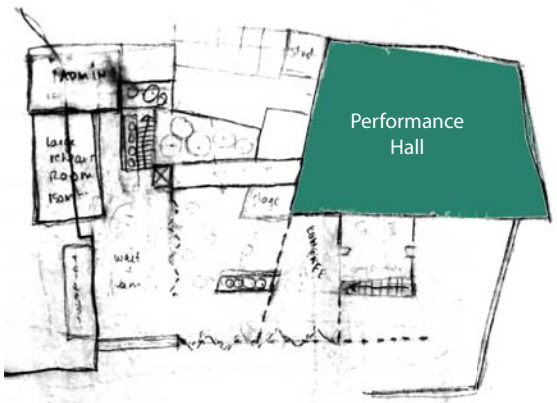
An even spread of sound intensity over the room at 20<t<50 ms (approximate time when sound is most audible before dying off), with a sound pressure level difference of under 10 dB.

Deutlichkeit *D50>40% , preferably >50%*

Clarity related to speech, related to the % of sound occurring within the first 50ms. The measures give a ratio of the quantity of early and late arrived sound energy.

Reverberation time, *T30 = minimum 1.6 seconds at 1kHz*

The amount of time taken for a sound to die off 60dB below its original sound level [Egan, 2007, p.64]**.**

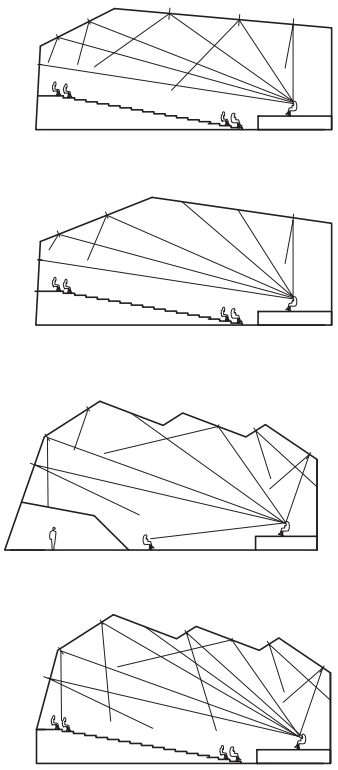


[144] Initial form

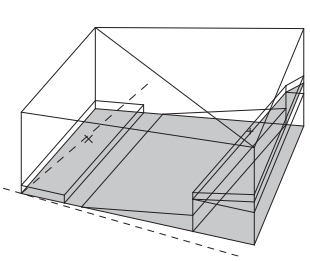
The Performance Hall was designed in stages. It began as a rough shape for initial ideas, based on simple acoustic principles such as non-parallel walls and different length/breadth/height dimensions.

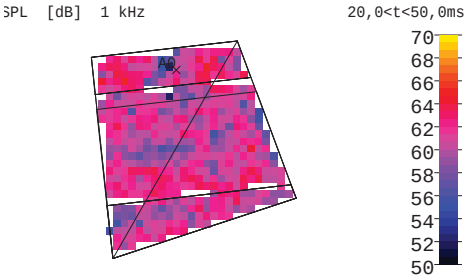
The basic shape was designed along side with the plans for the rest of the building, but once the form concept in plan was distinguished, the Performance Hall could be designed much more freely.

Early Forms / The first shapes of the hall [144] were tested with non-parallel walls and different roof sections [145]. After making Ray Diagrams to get a general idea of the sound deflection in the room, the forms were tested in CATT Acoustic, a 3D acoustic modelling program. Default material settings were used.



[145] Ceiling ray diagrams

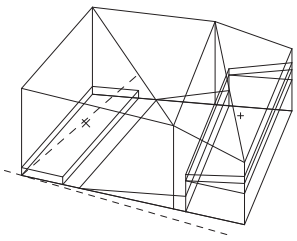


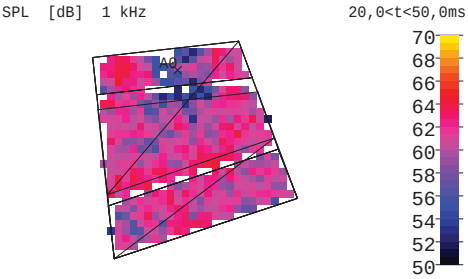


T30 = 1.43 secs

D50 = 45.4 %

Flat sloped roof / The results of the initial forms showed a very low T30 (Reverberation time) and a good D50 (sound clarity). Sound distribution was not very good.

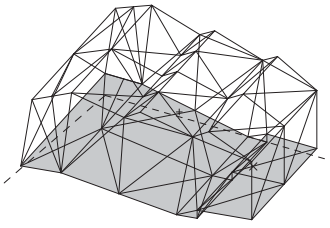


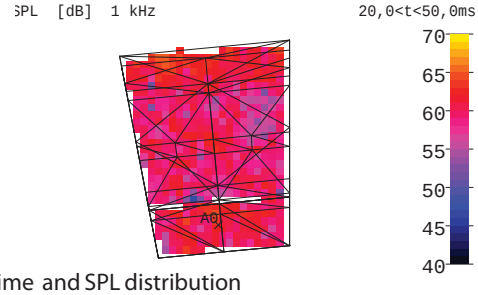


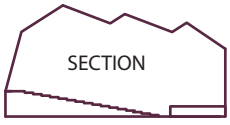
T30 = 1.48 secs

D50 = 57.7%

Pitched ceiling / The roof shape improved both reverberation time and clarity, but SPL distribution became worse.



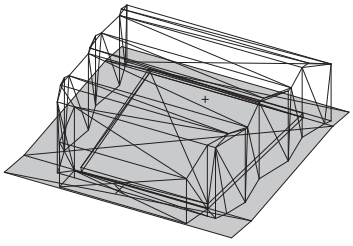


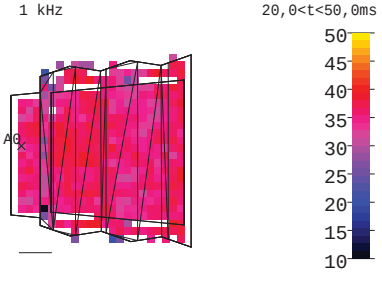


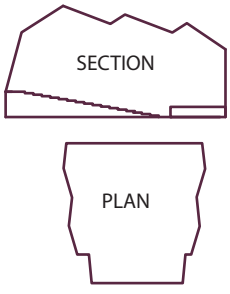
T30 = 1.9 secs

D50 = 30.1 %

Jagged ceiling / Reverberation time and SPL distribution radically improved but clarity worsened.







Jagged ceiling and walls / Clarity improved and SPL distribution was still very good. Reverberation time needed to be increased.

T30 = 1.49 secs

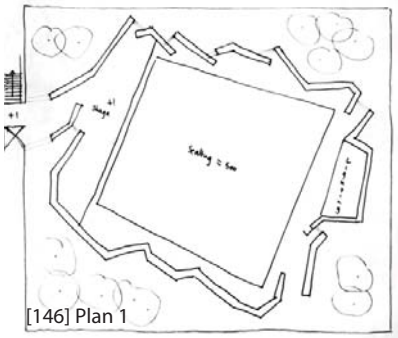
D50 = 45.7 %

Nordic & Japanese expression / The CATT model with jagged ceiling and roof gave the most well-rounded results, so from here plans for the Performance Hall were designed to integrate Nordic and Japanese aesthetic expressions.

Plan 1/ Creating contrasting form of apparent 'randomness'

Continued the journey from the foyer into the Performance Hall by creating views

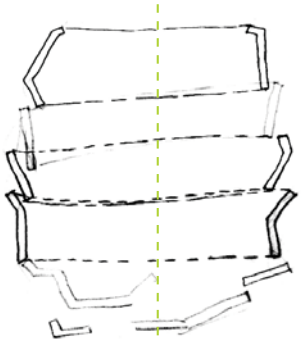
Began to incorporate light to define walls



[146] Plan 1

[147] Kavela Church, Reima / Raili Pietilä

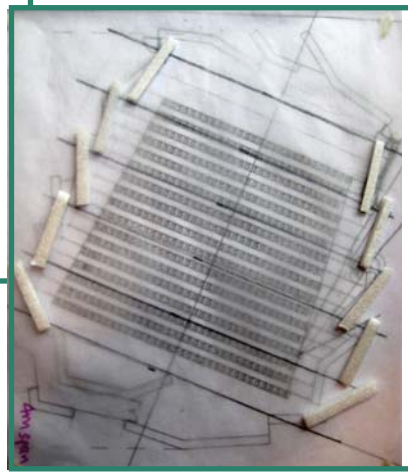
The plan lacked order, so a 'hidden order' was developed to express calmness. Inspiration was taken from Kavela church in Finland, whose walls were vertically very expressive but still very calming [147]. It is here where the idea came of expressing the Performance Hall as a vertical element. It was to be the symbol for its acoustic design, while the rest of the building expressed itself horizontally.



Plan 2 / Planning in symmetry

The symmetrical wall panels were able to have a ceiling placed across to the its corresponding panel, creating a more even and calming expression for the ceiling.

However to strengthen the expression of the plan, it needed a hidden order or repetition of elements.

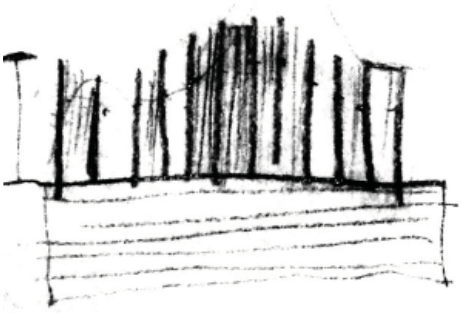


Plan 3 / Prefabricated elements

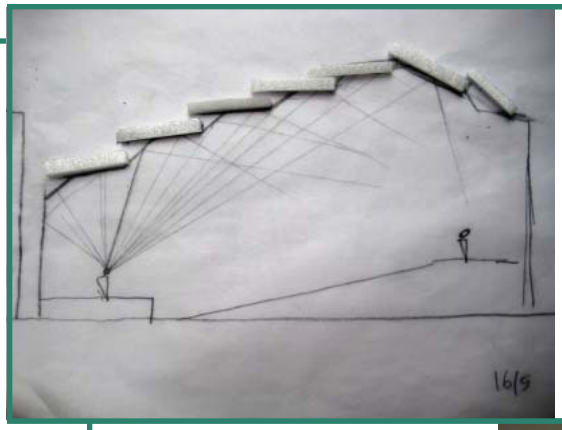
Identical wall lengths used in the 'additive' principle - A typical Nordic principle.

Expression was more regulated and calming, yet still expressive from the rest of the square Music House.

Expressing verticality / The section of the Performance Hall needed to be developed according to the plans, in a way that expressed verticality. The top of the wall panels were made to follow the ceiling but offset higher so only the vertical wall elements could be seen. This also gave a musical expression [148].



[148] Concept of vertical vs horizontal



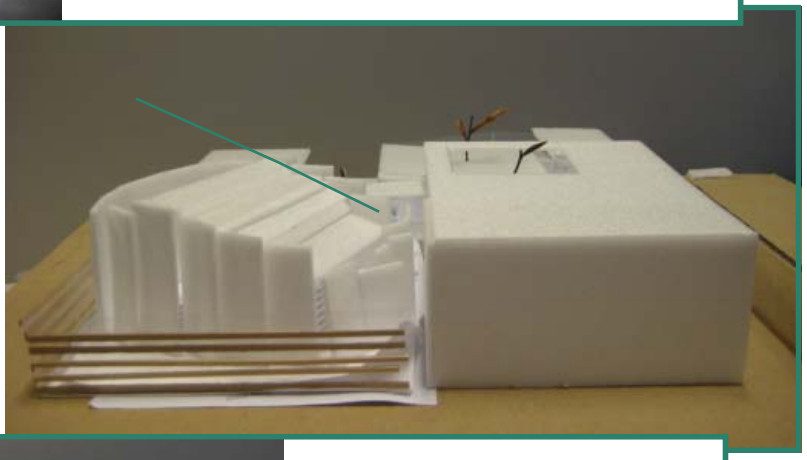
Designing according to sound deflections / Ray diagrams

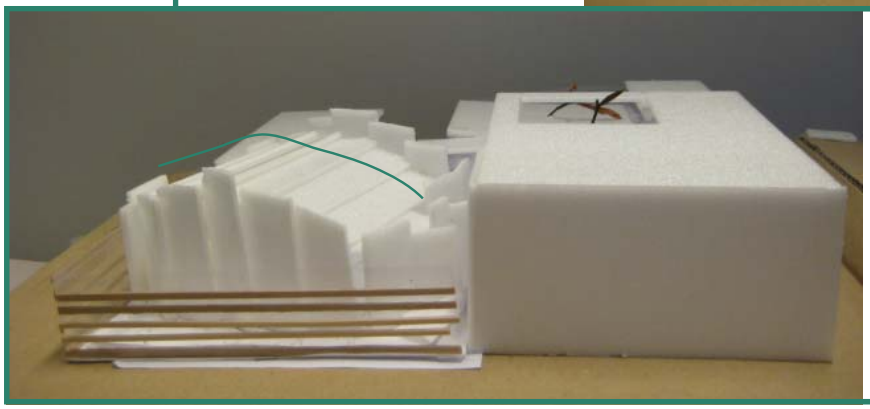
Built in the additive elements principle

Expressing inside and outside in relation to each other

A regulating rise and fall of the ceiling to keep feeling of calmness and tranquility

Test model 1 / the contrasting of vertical and horizontal was evident, but the height of the Performance hall according to the context could be refined, where the form could lower closest to the water.

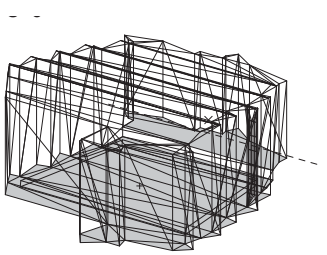


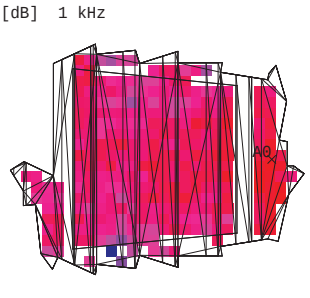


Test model 2 /

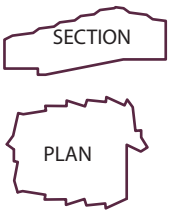
The height of the hall along the water was lowered, responding to human scale and context heights

The aesthetically designed hall was tested in CATT, this time with more focus on materiality. Acoustic glass was put in for the long horizontal windows, and different wood combinations are tested.



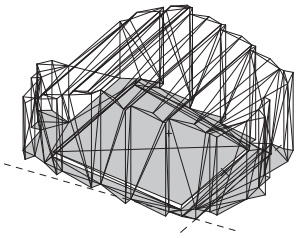


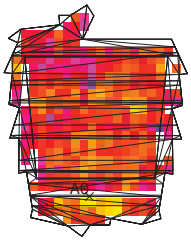
Materials /
5mm Plywood
Acoustic Glass



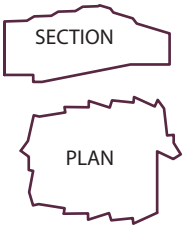
Nordic Elements / Reverberation time increased slightly, clarity decreased but SPL distribution was very good. However Reverberation time could have been higher. This was tested by increasing the height of the ceiling.

T30 = 1.51 secs
D50 = 41.6 %





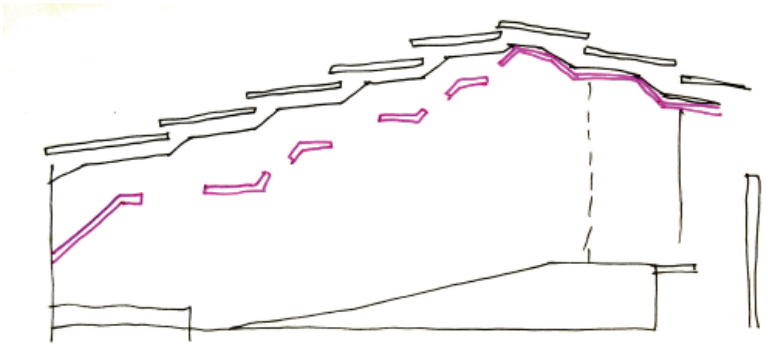
Materials /
19mm Ply Floor
19mm Ply Ceiling
3mm Ply Walls
Acoustic Glass



Nordic Elements raised ceiling / Reverberation time greatly improved, clarity increased slightly but SPL distribution worsened. Testing progressed by integrating panels, but these needed to be aesthetically integrated.

T30 = 1.71 secs
D50 = 41.8 %

Section with panels 1/



Designing according to acoustics - adding panels to improve clarity

Expressing acoustic design through the facades and materiality

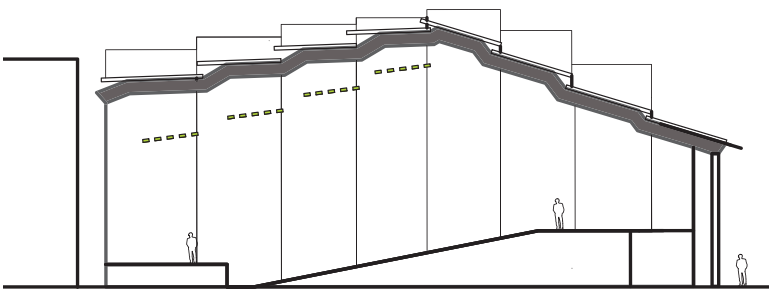
Making panels would reduce the height of the roof, so the height more proportional to human perception. Acts as a layer of the ceiling being peeled back

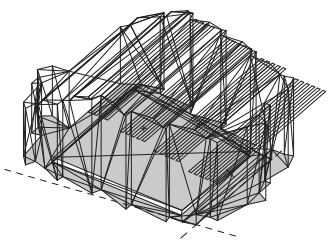
However, the panels lacked the regularity of the original ceiling, could be too complex spatially / thus needed to be simplified

Section with Panels 2/ A more regulated repetition of panels was developed, spaced out at small increments

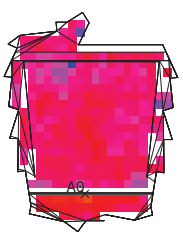
The panels added detail to the subtle expression of the Performance Hall through materiality

The panels expressed acoustic design Gave a more regulated expression, thus calming and tranquil

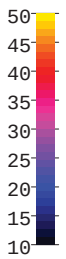




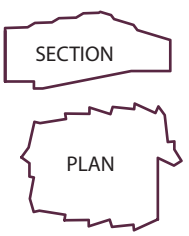
SPL [dB] 1kHz



20<t<50ms



Materials /
3mm Ply Floor
3mm Ply side/front walls
3mm Ply Panels
19mm Ply Ceiling
19mm Ply Back wall
Acoustic Glass



Added horizontal ceiling panels / A highly absorptive back wall was tested here to improve clarity. The Reverberation time reduced slightly, but clarity improved, and SPL distribution became excellent. This became the chosen model.

T30 = 1.69 secs

D50 = 45.3 %

PRESENTATION
Nordic Japanese Harmony

Concept / The underlying concept of the Music House is inspired by the horizontal coastline stretching across the fjord adjacent to the site. A small part of this breathtaking View is highlighted and Framed, enhancing the Layering of the mountains behind one another. These layers Filter the distinction between foreground and background. A sensuous Journey is generated that weaves around these layers of mountains.

Architecturally, this concept is translated as experiencing arriving and walking around the Music House as a Journey, made interesting by varieties of Framed Views through the building and to the surrounding context. The views are expressed through materiality, translucency and transparency in facades, creating Layers that Filter the light and the view. This blurs the boundary defining indoor from outdoor [149].

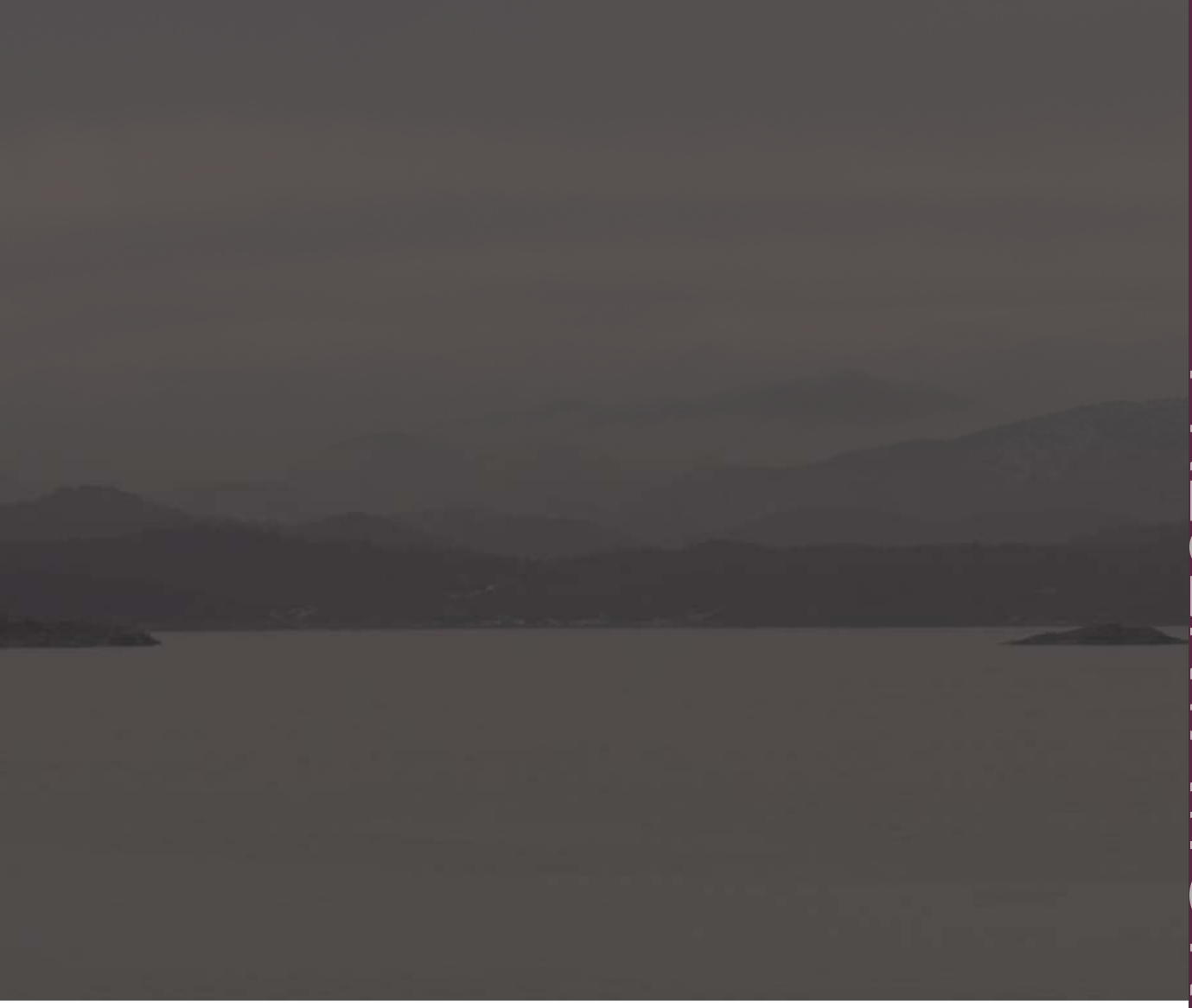
[149] Concept

Expression of Form / To express the equal importance of all the functions within the building, the Music House is read as one simple square volume. Courtyards are placed at various heights and positions. In one of the gardens, the Performance Hall acts as the 'nature' in the garden, protruding out over the walls [150][151].

Horizontality and verticality are used to distinguish the functions according to the way the Music House expresses Nordic, Japanese and Acoustic design.

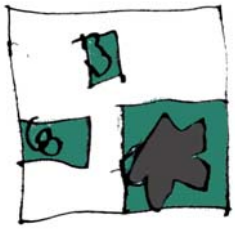
The Music House expresses Nordic and Japanese traditions through a modest horizontal expression. The building outline is a simple square form, wrapped together by a horizontal wooden envelope. The building envelope brings all the functions together to be read as an ordered, calm and modest building.

The Performance Hall underlines the Music House's Acoustic expression, as well as Nordic and Japanese traditions. Its higher level of formality and interior acoustic influence expresses a form with a different interpretation of calmness and tranquility. This contrast is enhanced as a vertical expression, distinguishing it from the rest of the building form. It gives the Music House its external acoustic expression. Meanwhile, the horizontal wooden building envelope wraps around the Performance Hall so that its expressive form is still as part of the Music House [151]. The building is thus still read as one enclosing volume, expressing the equal hierarchy of all the functions.



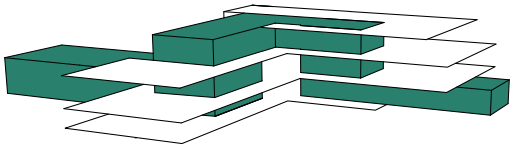
Green Flow Path / The courtyards interconnect as a visual path flowing through building [152]. This not only expresses a connection between the two sides of the Music House, but is also an important visual contributor to experiencing filtration and layering of views across the building's interior. The Green Flow Path will be described throughout the presentation.

The order of Floor Plan drawings in this section is presented according to how the journey through the building begins, which starts on the Second Floor and skips some mid-floors. Therefore the plans are *not* presented in typical chronological order. Following the plans are Elevations with their corresponding Sections. In between drawings, both aesthetic and technical solutions to the building are described.



[150] Concept of form / plan

[151] Concept of form / elevation



[152] Green Flow Path

SITE & CONTEXT

Arrival area / The entry is placed at the top of the cliff, being the most direct way to access the building from the main flow of traffic and pedestrians. Visitors arriving from the promenade will experience seeing the building at various angles, walking through the culture park before actually arriving inside the building. This gives them a better awareness of the external architecture and extends their 'journey' into the building.

Cliff / The cliff is left naturally untreated, the building set back 9m from it to avoid being in shadow when relevant. A garden space is created between the cliff and the building. It is used as a view for functions facing the cliff. The cliff plays an important role in giving an awareness of heights when entering the building.

Connection to Tou Scene / The building's main arrival position on the higher ground of the site is located in the same zone as that of Tou Scene. This creates a common 'arrival zone' for both buildings, mutually strengthening both buildings' cultural stance within the area.

Connection to Culture park / Kvitsøygata road, originally ending perpendicular to the waterside promenade, has been shortened to end at the Music House and Tou Scene's shared entry zone, because there are no functions using this road from here. This space is given back to the Culture park, now extending right to the edge of the Music House. This blurs the boundary between the two sites and creates a much stronger connection between them. There are no traffic routes running along any of the Music House's facades. Visitors now arrive to the Culture park and the waterfront by walking through a park. This makes a much more pleasant, calm and people-oriented building.

Delivery zone / a road starting at the building's west corner is joined to , which slopes up to the raised level North-West of the site and is fully accessible for deliveries for food catering and performances.

No car park / A car drop-off zone is located at the entry zone at the top of the cliff next to the entrance. No parking is provided, because there is no urgent need for it. Users living in the city centre have no use for a car. A reliable public bus service runs frequently to and from the city, taking only 10 minutes. Users living in East Stavanger live very close to the site and can walk.

[154[View of entry bridge and distant mountains

[153] Exterior view

Lervigsveien

Kvitsøygata

Drop-off zone

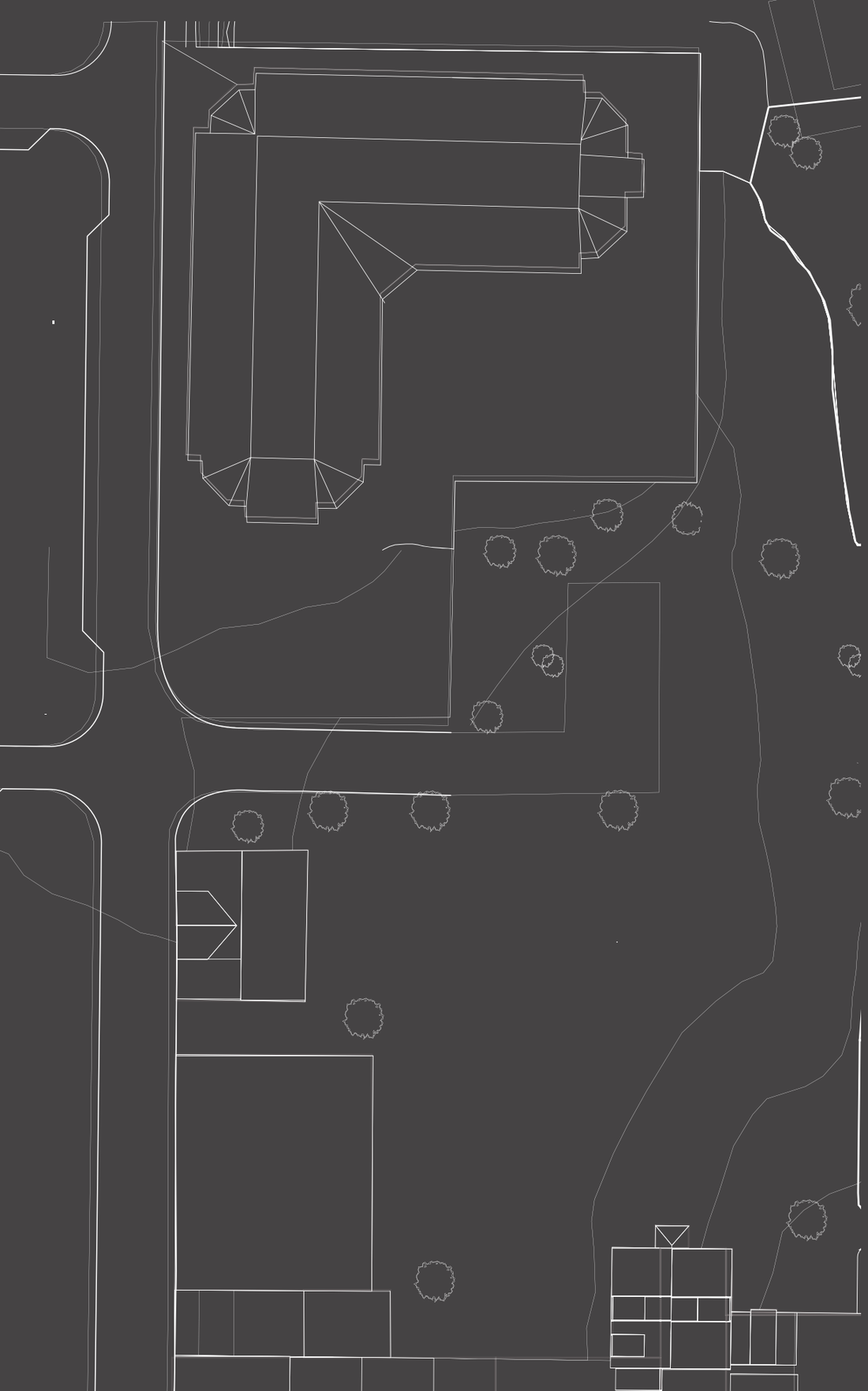
Arrival Area

Delivery Access

N

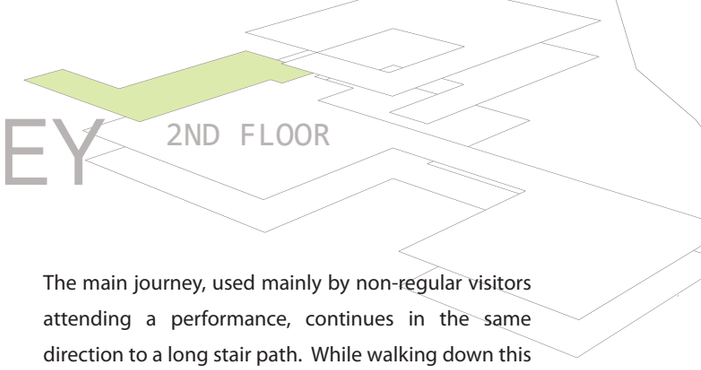
Tou Scene Entrance

Culture Park



SITE PLAN 1:500

THE JOURNEY



The entry for all the functions has been gathered at one common point, to give more opportunities for different users to meet and interact.

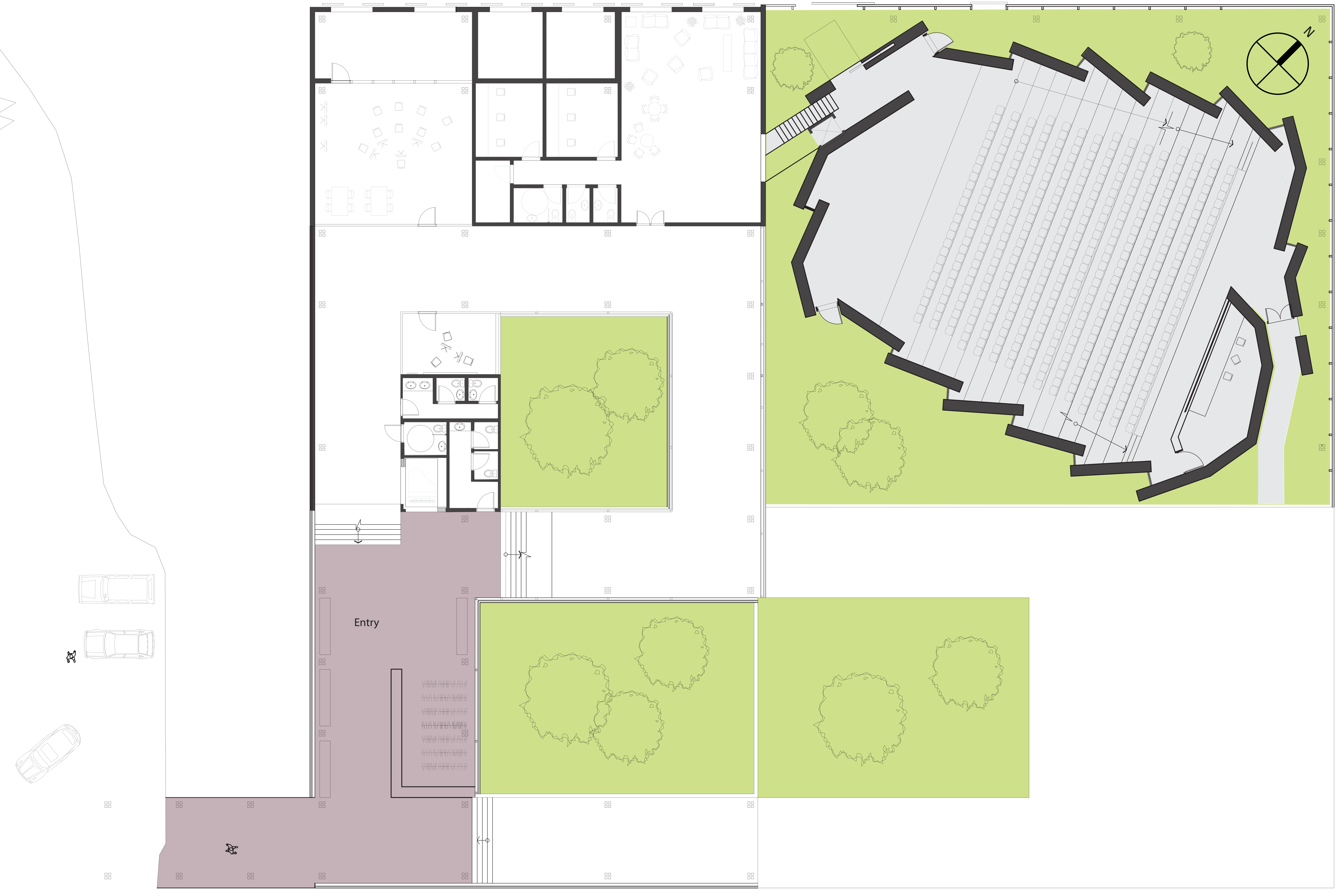
The journey starts at the Second Floor - where the main entry is located. The raised arrival zone allows a visitor to become aware of height changes across the site. When crossing the entrance bridge, the ground suddenly drops underneath and becomes the cliff. Between the cliff and the building facade is a leafy garden. A visitor looking down into the site also gets a subtle glimpse of what is happening in the building, the view filtered by the garden. [155]

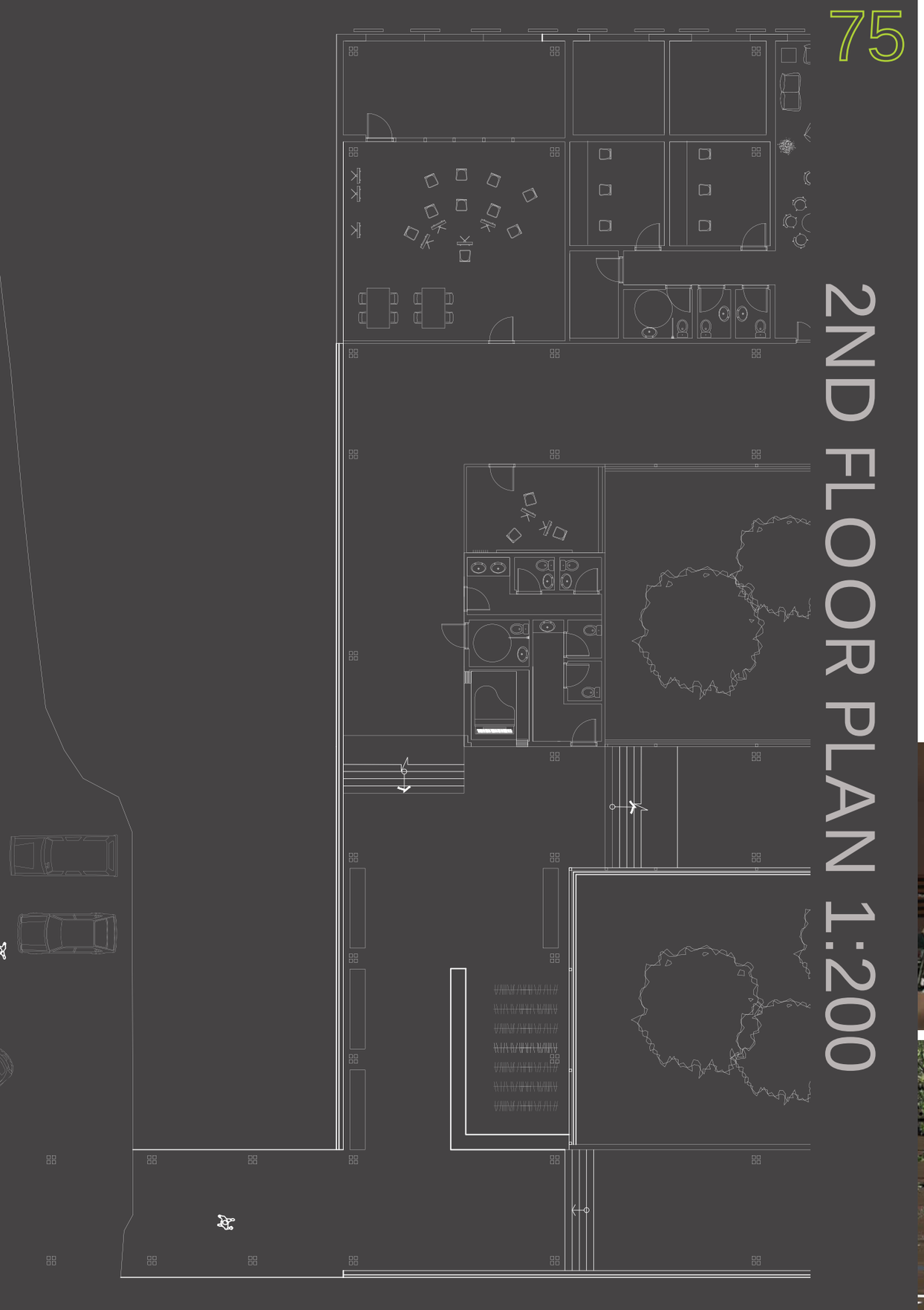
The entrance bridge begins as outdoor, but transitions to become an indoor arrival space. This expression is catalysed by the interior structure that frames the entry zone, blurring the definition of outside from in. From here the visitor can walk two directions, depending on which user they are.

The main journey, used mainly by non-regular visitors attending a performance, continues in the same direction to a long stair path. While walking down this long path, a view towards to Culture park is seen on the right side, varying in exposure. Parts of the view are filtered through the translucent wooden panel facade, allowing only small glimpses of the park, while other parts are large transparent horizontal openings that frame the surrounding view. This continuous but varying view allows the visitor to maintain a sense of connection to the context, even though they are no longer outside. The definition between indoor and outdoor is thus blurred.

The long stair path is marked by a rhythmic regulated exposed column structure, which complements the framed and filtered views. In the distance at the end of the stair path, the visitor gets a glimpse of the mountains and water ahead [154].

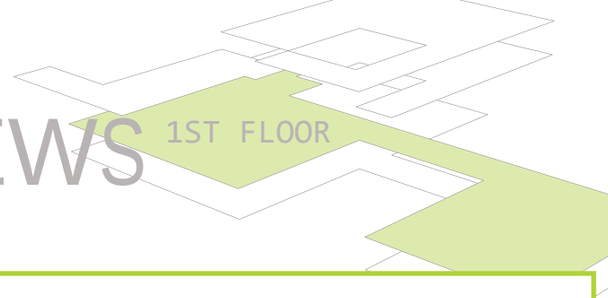
[155] Arrival area seen from cliff


N
Entry



2ND FLOOR PLAN 1:200

FRAMING VIEWS



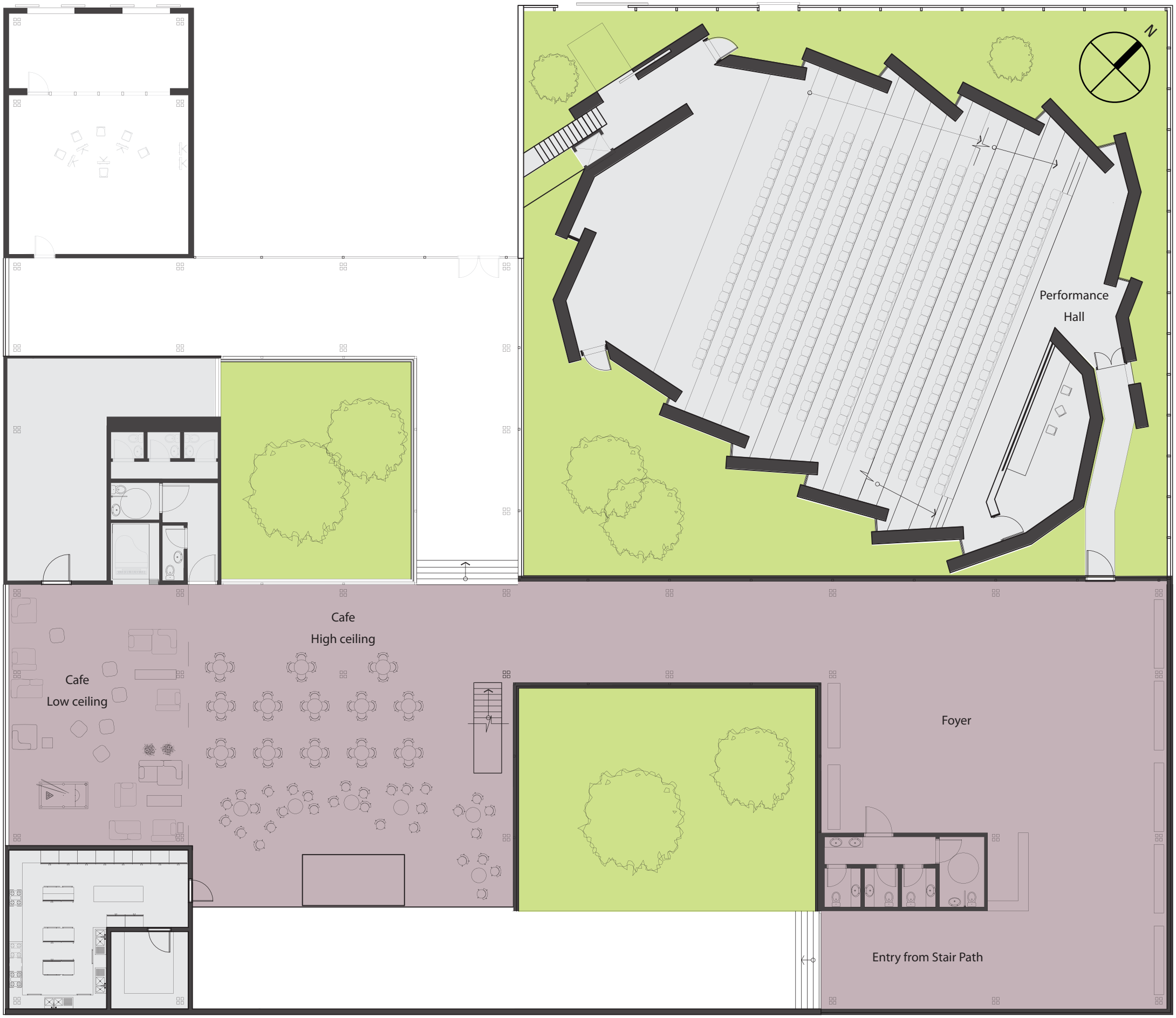
Foyer/ The view from the foyer sets the visitor's mind to be relaxed and at ease for the performance they are about to attend. The small framed glimpse of water and mountain at the end of the long stair path [154] suddenly opens up upon arrival to the foyer, transforming into to an uninterrupted view of a mountain range sitting on an almost endless stretch of the fjord. This contrast welcomes the visitor in a much more impressive manner and heightens their appreciation for the view.
The opening is stretched lengthways across the entire foyer, positioned to frame the view of the mountains [156]. The view is made more dramatic because the adjacent sides of the foyer are also transparent, thus giving a wider visual angle. The raised height of the foyer (3m) increases visibility over the area, creating an even more impressive panoramic experience.

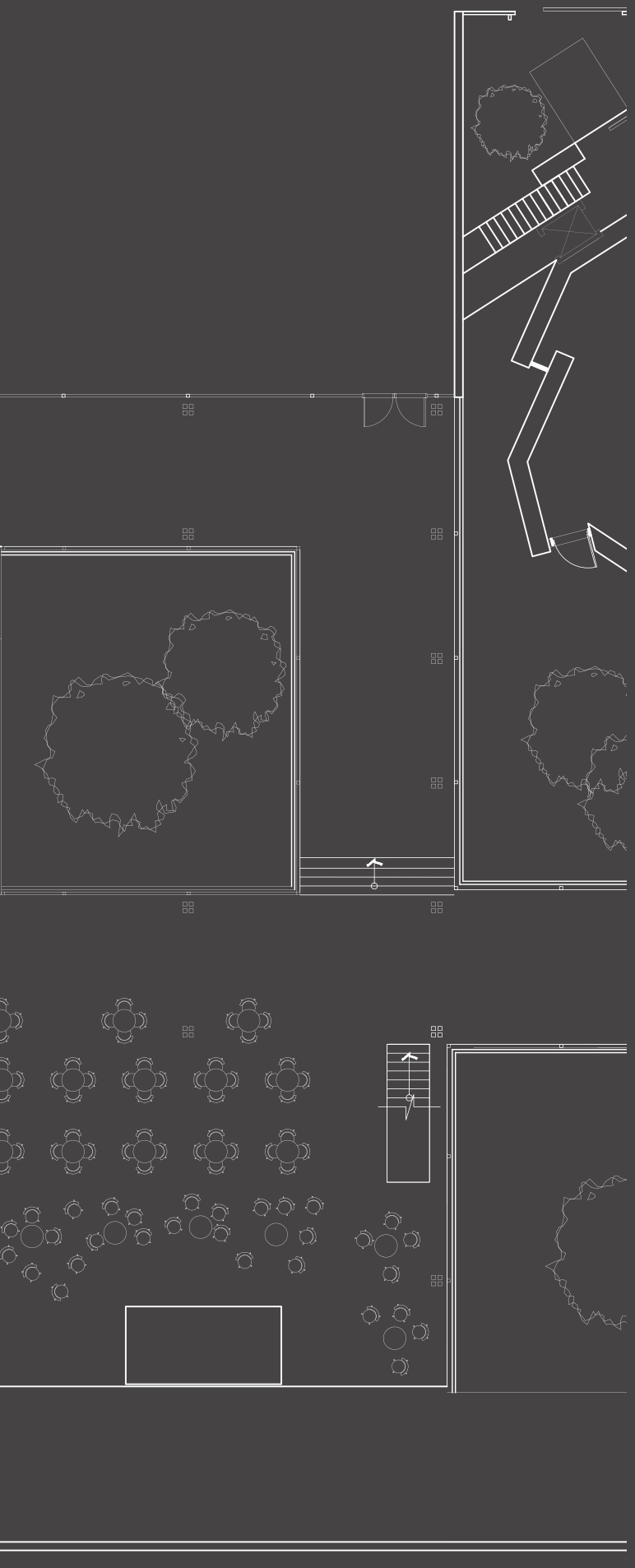
Cafe / Relaxed and spontaneous in character, it is the casual alternative to the Performance Hall. The cafe is used for eating, but also for informal shows on a small stage and impromptu jamming. Different atmospheres are created with contrasting ceiling heights of the cafe. The visitor can therefore always find a comfortable place to sit, eat, or enjoy music.
Parts of the cafe boundary are defined by adjacent courtyard walls. When looking in the direction towards the water, the view into these courtyards are framed by horizontal openings. This view itself acts as a filter to the view of the mountains and water further in the distance (seen through the foyer) [157]. This experience is part of the Green Flow Path.

Sound Absorption in 'Spill out' areas / The increased noise levels in the Cafe and Foyer before, during intermission and after performances in the Performance Hall have been considered. It is important to have highly absorptive wall materials to absorb sound created by over 400 visitors.

[156] View from Foyer

[157] View from Cafe


N
Performance
Hall
Cafe
High ceiling
Cafe
Low ceiling
Foyer
Entry from Stair Path



1ST FLOOR PLAN 1:200

INTEGRATED DESIGN
Performance Hall

The Performance Hall expresses itself on a different level to the rest of the functions in the building, to highlight its integration of acoustic design with Nordic and Japanese tradition. This is expressed through a stark contrast in form and materiality. Its placement however is still within the square enclosure of the horizontal wooden envelope. Therefore the Performance Hall is still read to be of equal (and not higher) importance with the other functions, and as a part of the entire building volume [158].

Journey and transition space / The journey into the Performance Hall is important, where the visitor walks through a transition zone to arrive in the hall. The transition path runs through the garden surrounding the performance hall, closely along its outer facade [see 1st floor plan]. This transition allows the visitor time to prepare to enter the hall. Arrival is on the upper floor, looking down the hall. Gaps between each wall element frame views of the garden and the horizontal wooden facade outside, which filters the distant view out to the fjord and mountains. This view is reminiscent of the view previously experienced in the foyer, allowing the visitor to be aware of their context. These views can be seen when walking down the aisles towards one's seat.

[158] Performance Hall's vertical expression

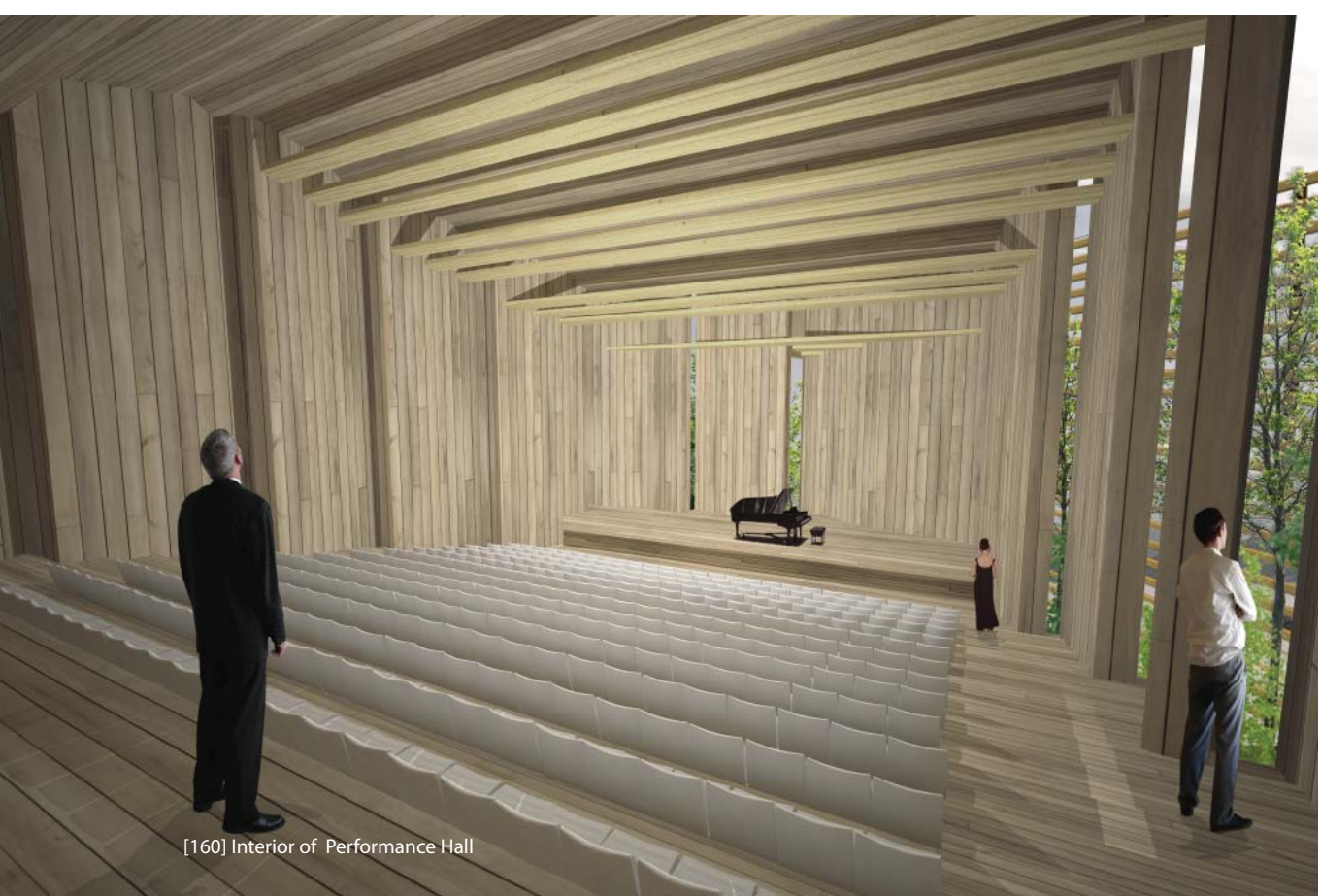
[159]External materiality

Form & acoustics / The Performance Hall evokes a sense of 'calmness and tranquility' through acoustic expression, as opposed to a regulated structure like in the rest of the building (described later).

The form expresses verticality by use of concrete prefabricated elements of identical size [159]. The concrete elements are 600mm thick and extruded vertically, contrasting from the delicate horizontal wooden expression of the rest of the building.

The exterior form is a reflection of the acoustically designed interior - the vertical concrete elements are arranged according to the best acoustic shape for lateral sound deflection, while also maintaining small glimpses of the surrounding garden around the hall. The heights of each panel change according to the height of the acoustically designed ceiling.

Interior / Aesthetically, the hall expresses a calm spatial grandeur through symmetry, vertical continuity of the walls and openings, and a gradual lifting of the ceiling height towards the back of the hall. Ceiling height changes occur according to each wall panel width [160]. Wood is used for the floor, ceiling and walls [161], European oak for the panels [162]. The natural, honest finish of wood gives a warmer atmosphere to the hall, characteristic of Nordic tradition, and gives a better relation with nature, characteristic of Japanese tradition. Transparent openings frame the views to the surrounding transition garden. This allows a soft indirect light into the hall, and blurs the boundary between inside and outside.



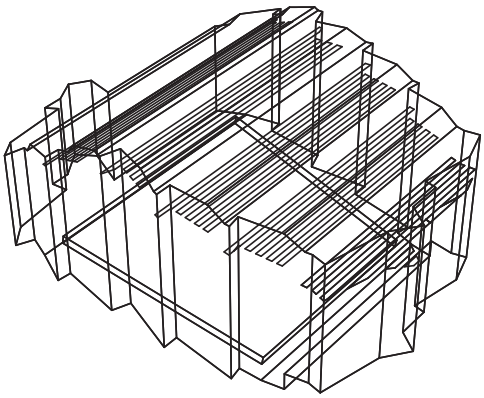
[160] Interior of Performance Hall

[161] Internal materiality

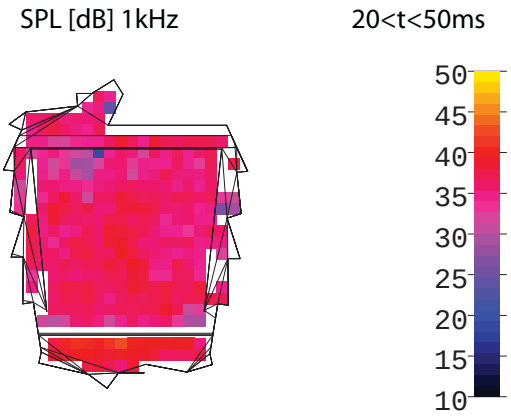
[162] Internal panels

The long vertical windows are able to be integrated using Acoustic glass, since it has a much higher absorption than regular glass (equivalent to softwood). Seating in the Performance is upholstered with a material with the same absorption coefficient as a human, so that the overall sound absorption by the audience is constant, regardless of the audience size. The added layer of long, thin wooden acoustic panels stretching along the entire ceiling width causes the perceived ceiling height to be lower and better in spatial proportion. The hall's form [163] and materiality [166] combined give a satisfactory Reverberation time (T30) of 1.69 seconds at 1 kHz. Satisfactory sound clarity (D50) is provided at 45.5%, and an even Sound Pressure Level distribution [164] [see Technical supplement for complete results].

Sound transmission reduction / The Performance Hall's walls are made up of concrete panels 600mm thick. This gives a sound reduction of much higher than 55 dB, since 250 mm concrete has sound reduction of 55dB [Teknisk Stabi, 2007, p81], meeting the Norwegian standard.

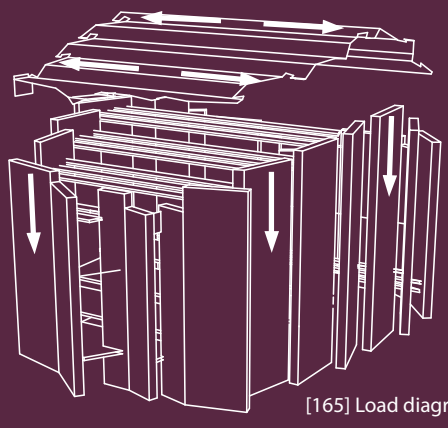


[163] Interior form

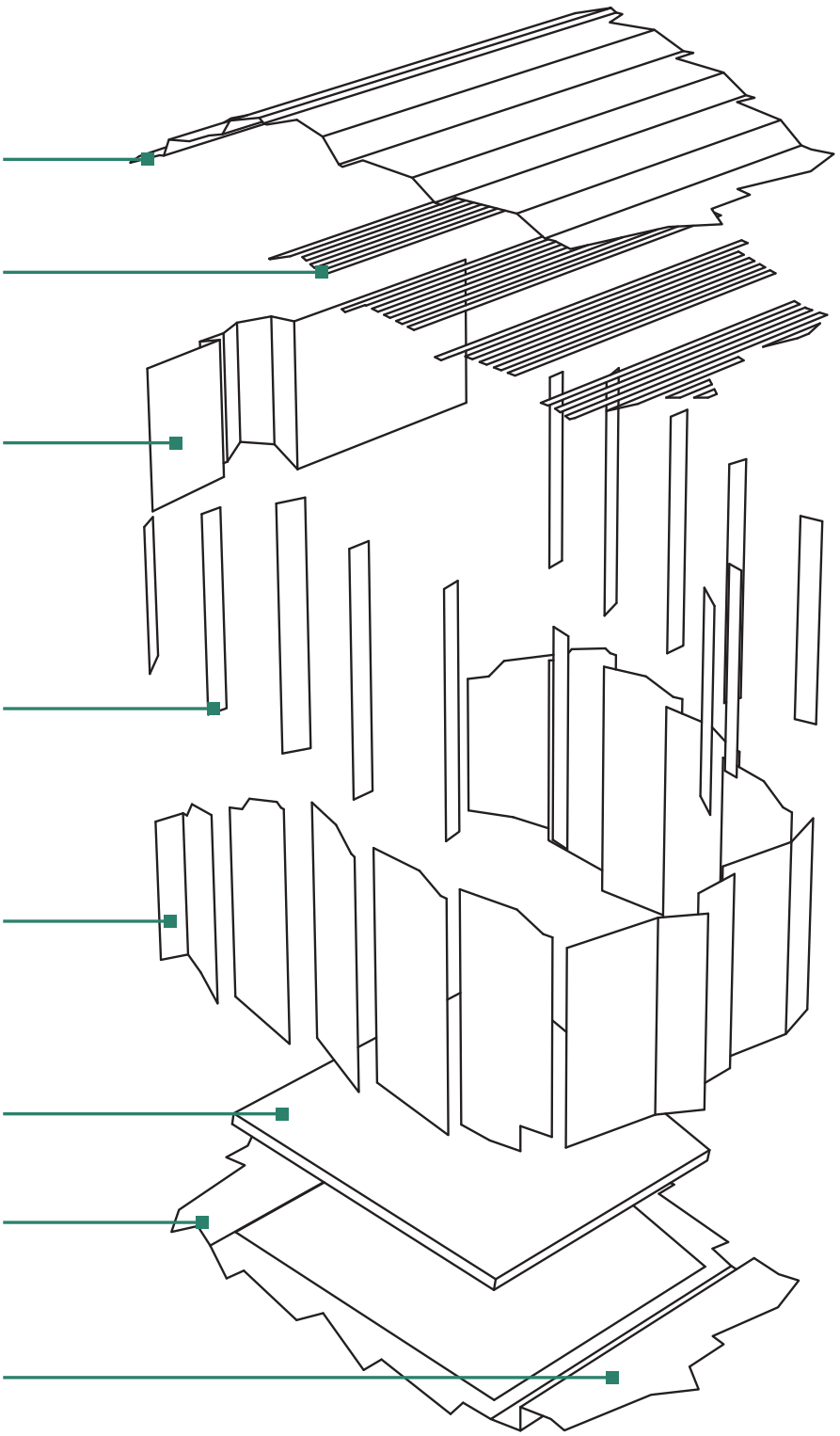


[164] SPL distribution

Loads & lateral stability / The Performance Hall's roof is made of a steel space frame truss 900mm deep. This sits on the concrete panels which transfer loads down to the earth. The roof works like a plate that connects the adjacent walls together, providing lateral stability and transferring the torque caused by wind. [165]



[165] Load diagram



[166] Materials of interior

FILTERING / LAYERING

Knowledge area / Relaxed, quiet and secluded because of its position in the journey, the Knowledge area's translucent wooden facade reduces its exposure out to the promenade, while users can still enjoy the view to the fjord and the mountain landscape.

Courtyard & transition spaces / Particular areas of the building have been designed to experience a layering of views, done through the placement of courtyards at different levels. Layers of green areas are created (highlighted in green on the Ground floor plan). Divided up by building functions, these green areas have varying qualities.

The garden surrounding the Performance Hall is gravel covered, with sparse trees. It acts as a transition zone between functions. It is experienced upon entering the performance hall, and glimpses of the garden are seen when walking around the performance hall [A].

The courtyard adjacent to the Knowledge area is leafy and green with deciduous trees so that the atmosphere changes across the seasons. It is seen from the Knowledge area and the culture park. It also makes an extra layer of view when looking out to the water from the cafe [B].

The courtyard surrounded by hallways is also green and leafy. It acts as an element bringing together the journey paths between levels [C].

These gardens' surrounding walls are very transparent so as to view the adjacent layers of gardens contributing to the Green Flow Path described earlier.

Next to the Performance hall is a sheltered rock garden, more man-made in expression, with lighting installed. This space frames the view out to the surrounding context [D].

An elevated courtyard, placed on the roof of the cafe, is seen from the entry along with other courtyards on different levels. This creates an interesting play of layering through vertical positioning of outdoor areas [167].

[167] Layered views at the entrance

D

C

A

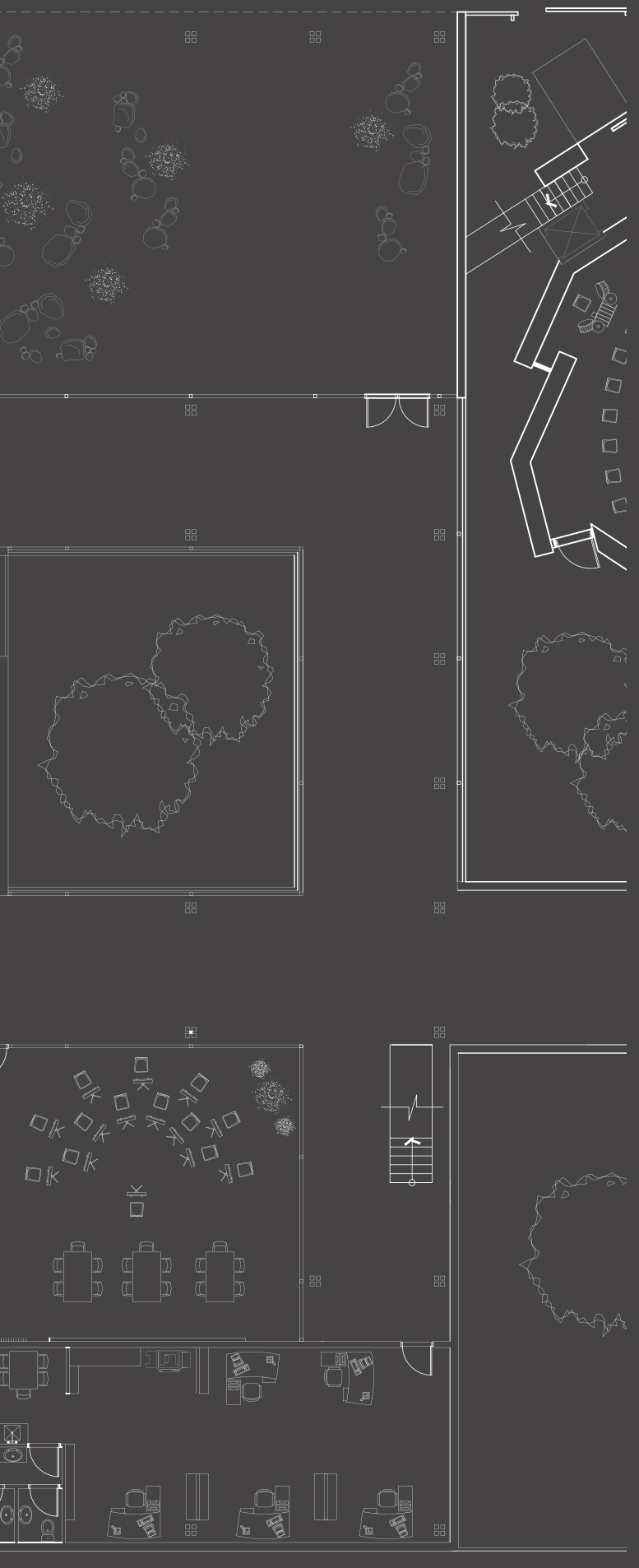
B

Storage

Knowledge Area

Rehearsal Room 100m²

Administration



BOUNDARYLESSNESS

1.A FLOOR

The journey of the regular users of the Music House starts at the same common entry point - but extends mainly to the upper floors of the building.

Backstage / located in the same zone as the Rehearsal areas, whose rooms also double in function as tuning and warm up rooms for performers . This increases the level of interaction between the performer and the enthusiast, thereby decreasing the hierarchy between different users. This contributes to a stronger two-way communication expression in the Music House. The journey from Backstage into the Performance Hall works like the audience entry, where the performer experiences a transition through the garden space to prepare mentally for a performance.

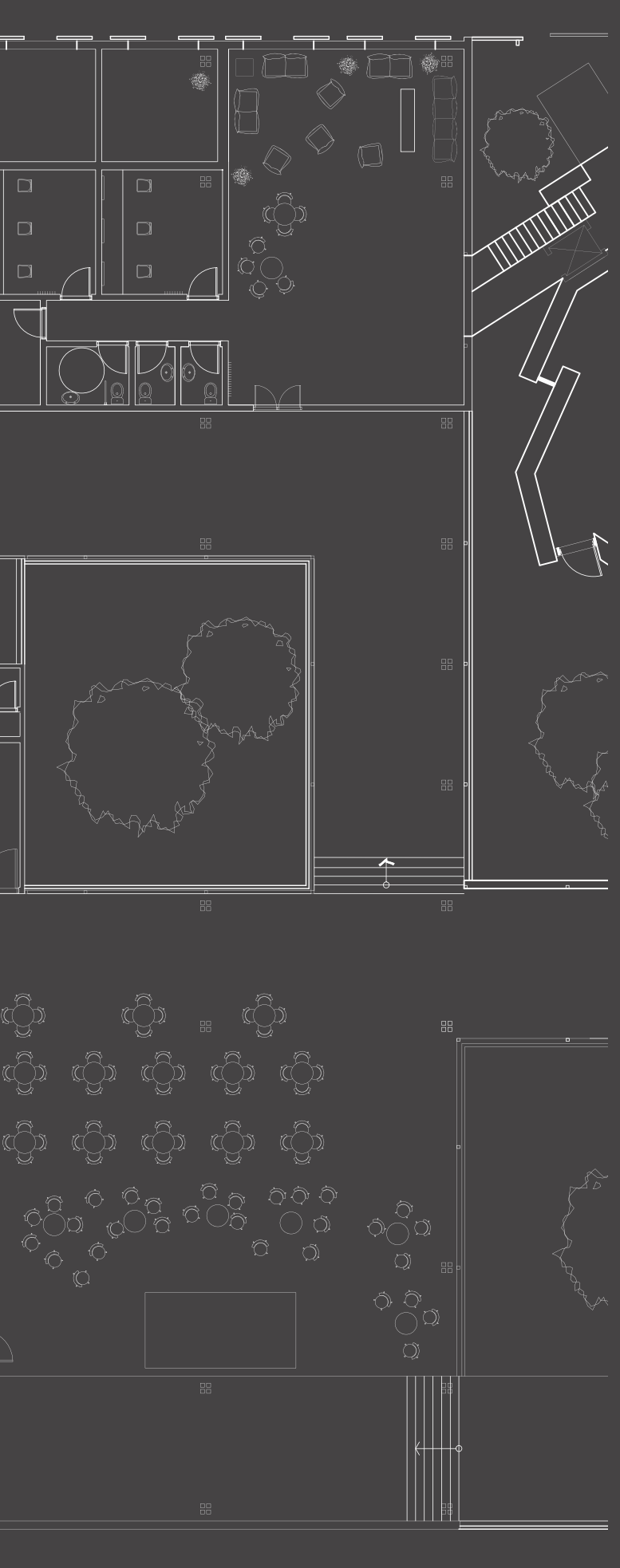
Rehearsal Areas / There are a variety of rehearsal rooms designed acoustically and aesthetically for different group sizes [see following page and Technical Supplement].

Boundaryless Space / Both backstage and the rehearsal rooms incorporate a Boundaryless garden space. This is a space that is not inside but not quite outside, creating two levels of 'outdoor' and thereby blurring the transition from inside to outside. This space also gives a sense of tranquility due to the higher level of privacy [168].

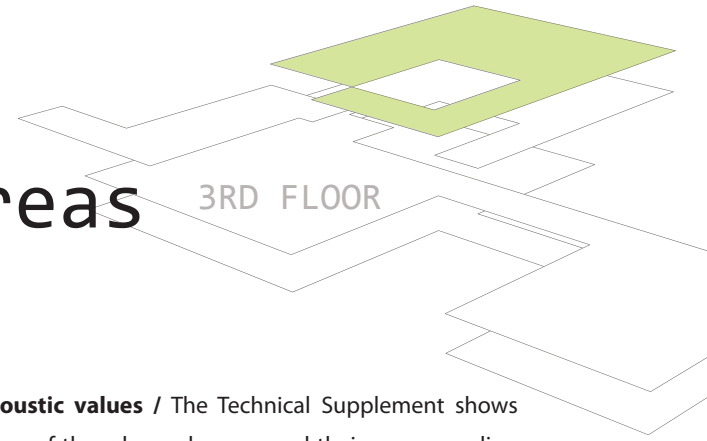
The Green Flow Path also creates a feeling of boundarylessness - the filtration of the garden views by layering generates a blurring of the perception between outdoor and indoor.

[168] Rehearsal room transition space


Backstage
N



ACOUSTICS
Rehearsal Areas

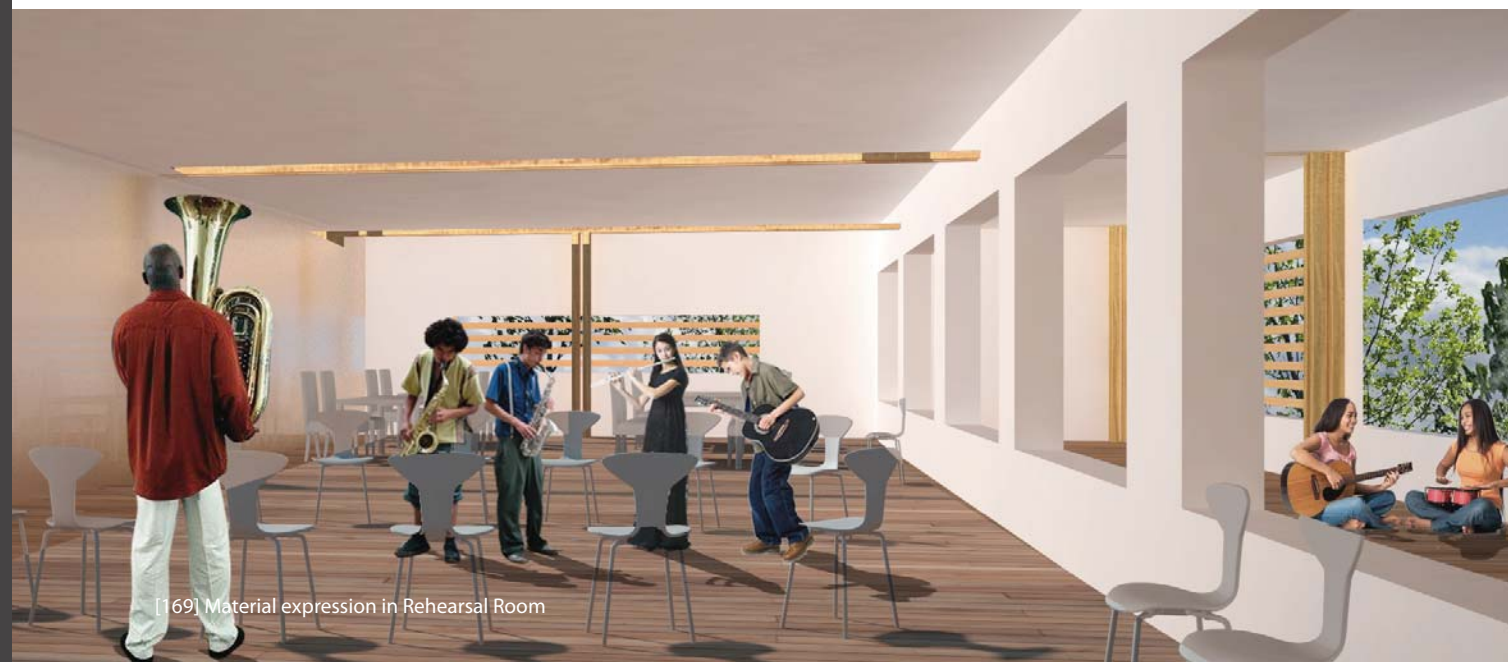


Materials / A combination of the translucent glass, timber ceiling panels, floorboards of hard and softwood, plasterboard and acoustic glass, along with the given room dimensions, gives an acceptable reverberation time and even sound pressure level distribution. Aesthetically they create a calm atmosphere complementing the interior structure. The combination of solid walls with acoustic transparent and translucent glass contributes to the filtration and layering of views, while also allowing light into the room. Passers by in the walkways are able to see silhouettes of users in the room, but privacy is maintained - this blurs the boundary from outside to in [169].

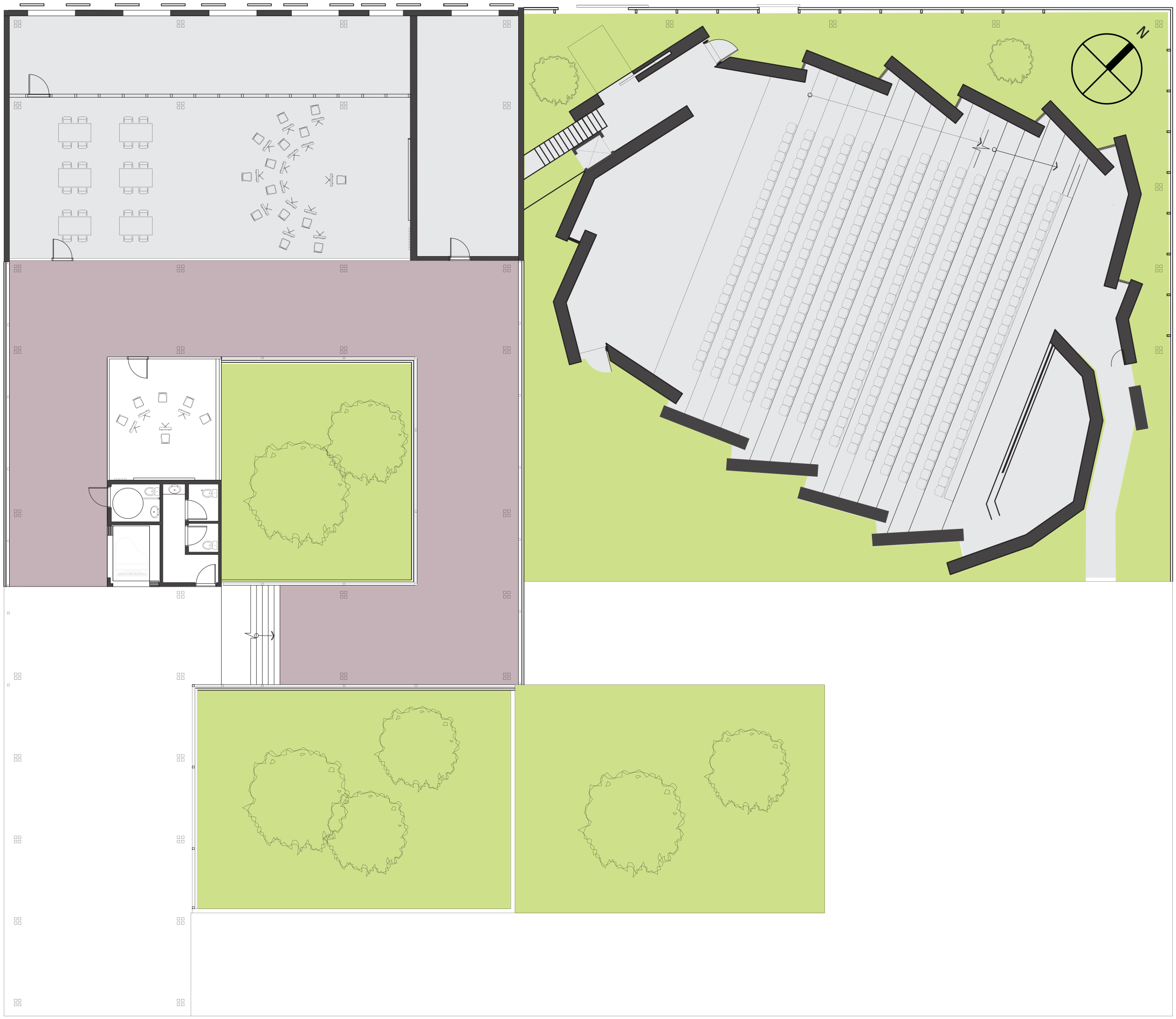
Acoustic values / The Technical Supplement shows plans of the rehearsal rooms and their corresponding Reverberation times (T30), Clarity (D50) and SPL levels.

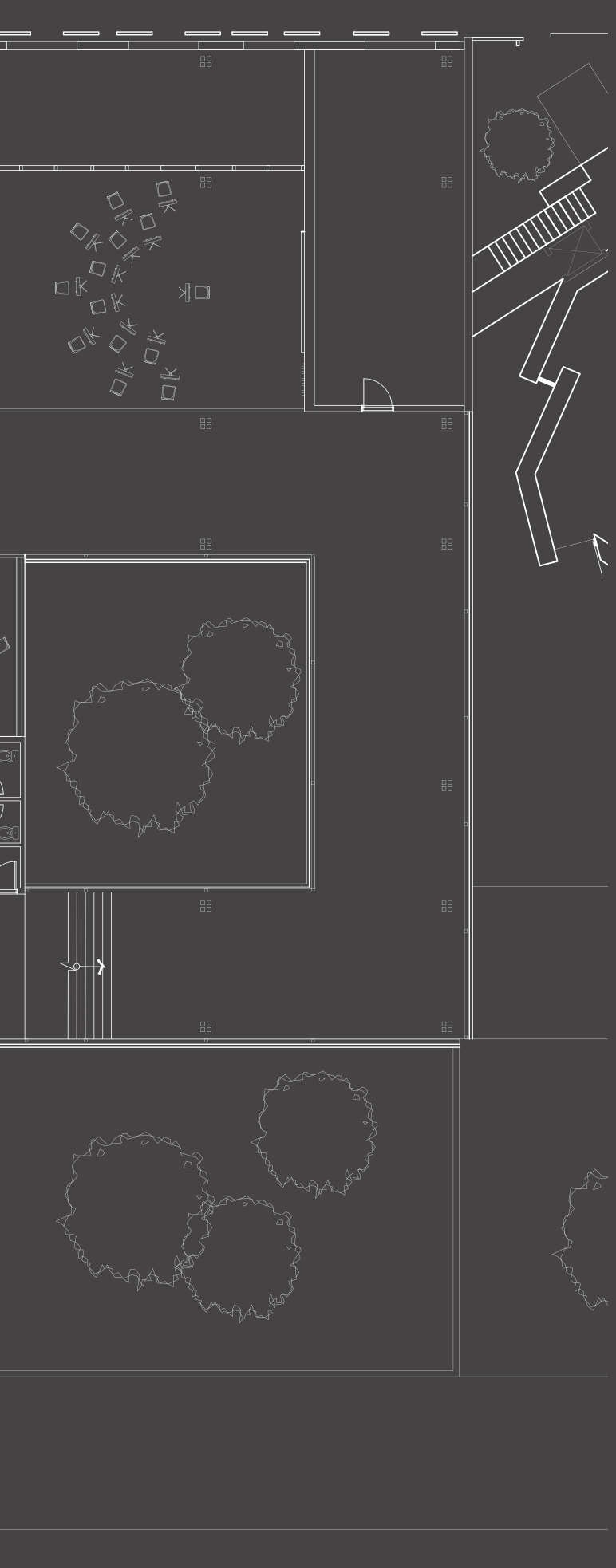
Sound transmission reduction & impact sound / The rehearsal walls and floors are made up of particular sound insulating elements, giving an acceptable overall sound reduction of 68dB and impact sound reduction of 39dB, meeting the Norwegian standard [see Technical Supplement 1:50 section].

Ventilation / Because of the large floor deck thickness, it is possible to install ventilation pipes within these spaces across the floor of the building.



[169] Material expression in Rehearsal Room


N

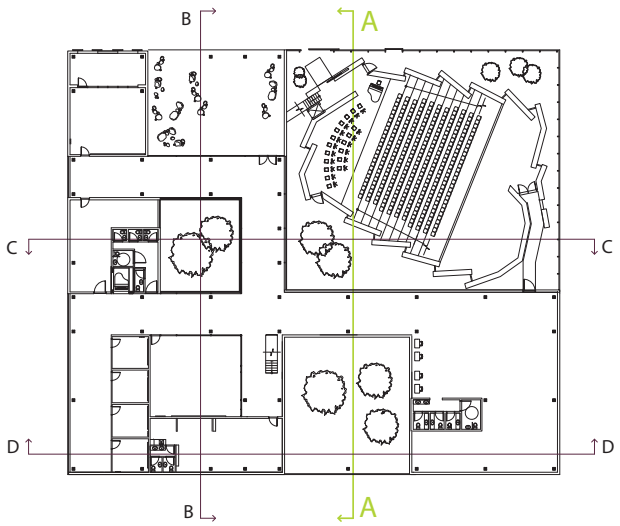


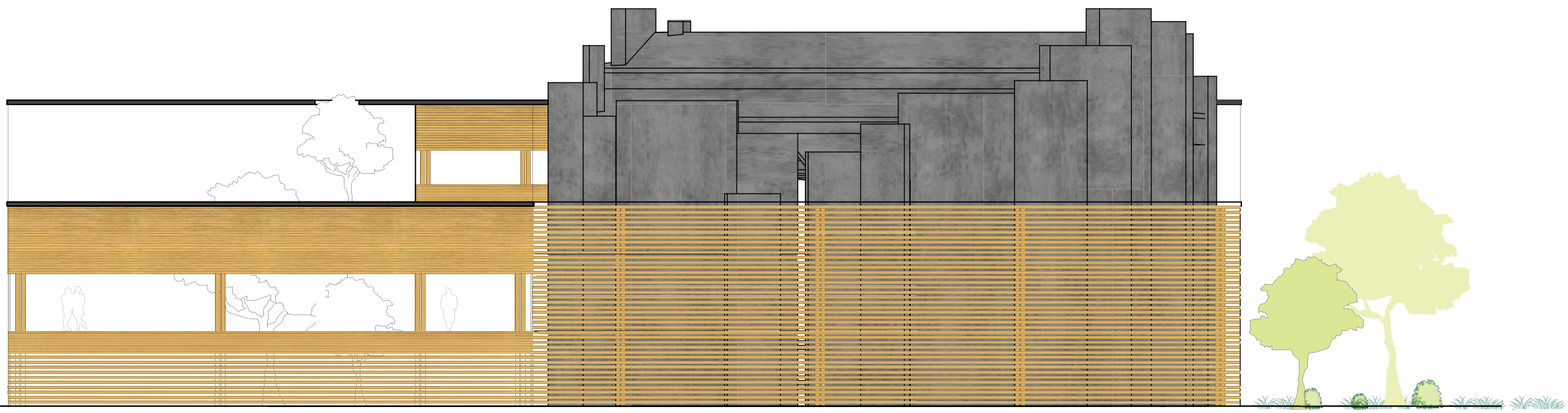
3RD FLOOR PLAN 1:200

EXPRESSION
Materiality

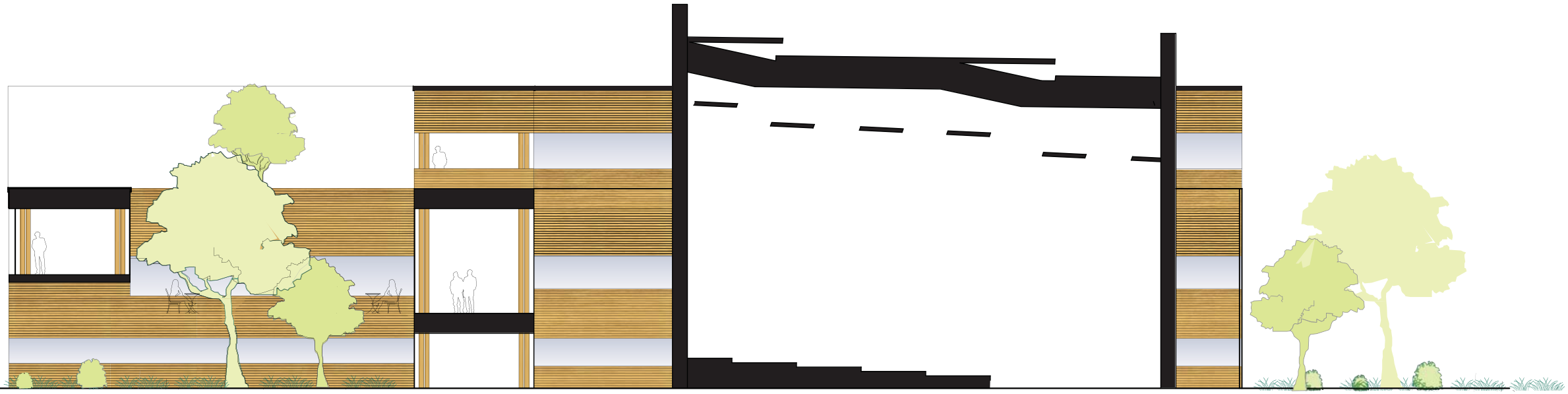
The materiality of the Music House, as discussed earlier, along with the building form, expresses the building as a single volume containing all the functions within it.
The external cladding consists of 100 mm high horizontal cedar panels wrapping around the entire building. The horizontal direction of the panels expresses the wrapping of the material as an enclosing form.

As discussed earlier, the Performance Hall uses materiality and a vertical form to express it acoustically. Its dark concrete vertical elements protrude over the horizontal wooden walls, giving an external acoustic expression that still belongs to the enclosing horizontal volume.

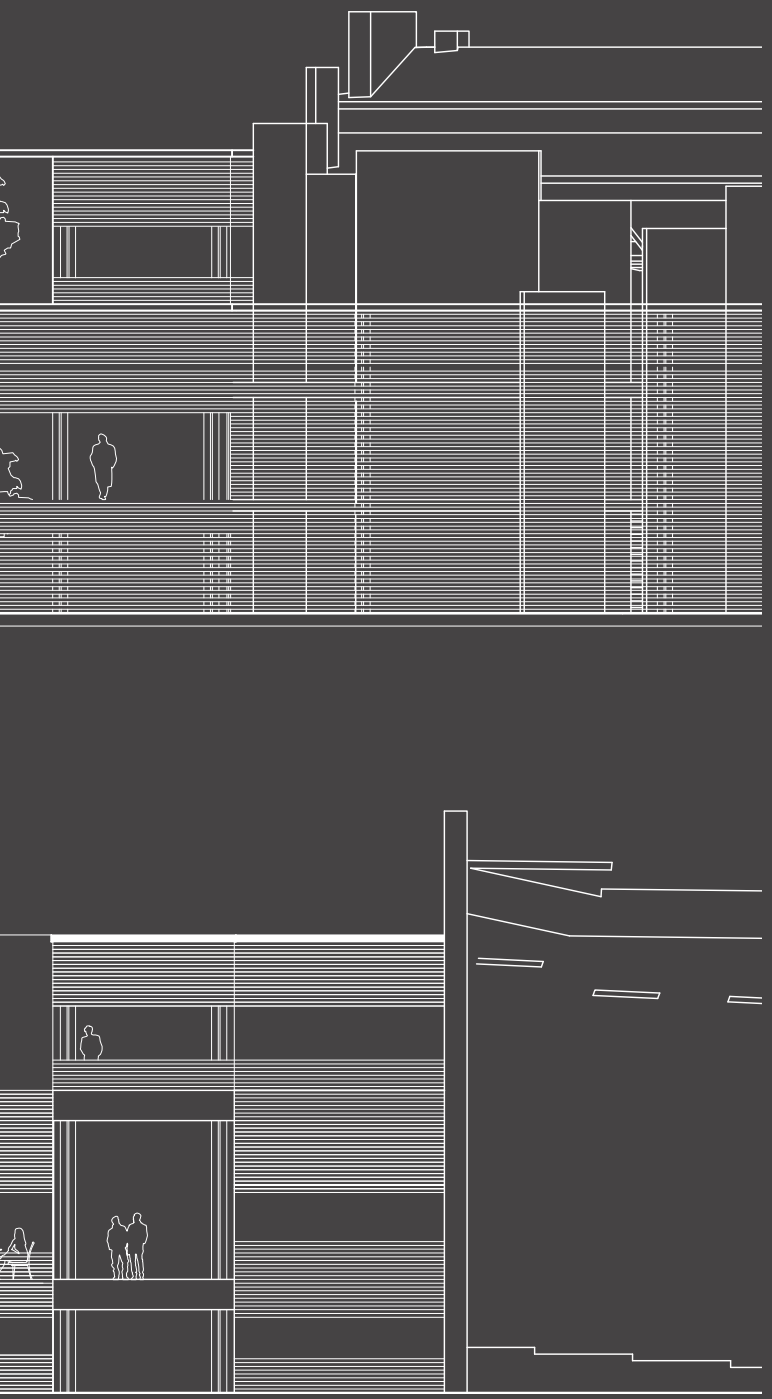




NORTH EAST ELEVATION



SECTION AA



ELEVATION N-E 1:200

STAVANGER Cultural City ‘08

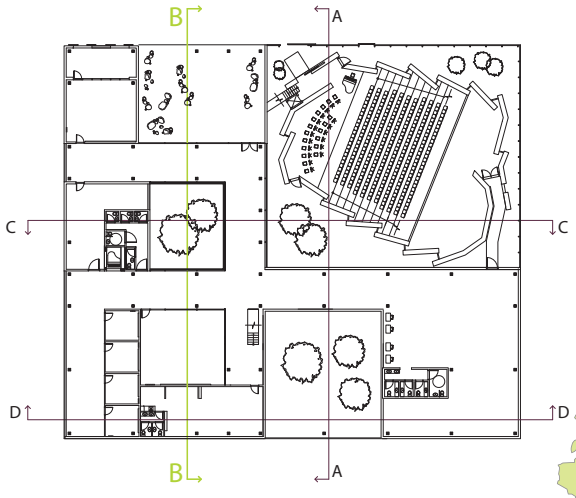
Exterior Cladding

Cedar has been chosen because of its pale colour, its ageing grey colour and character over time, as well as its high resistance to the effects of seawater [170]. The panels are positioned at three levels of transparency. These control the level of privacy inside the building.

Solid / No spacing between panels. Solid walls with defined transparent openings frame views around the building.

Translucent / Every second panel is removed, with translucent or transparent glass behind. Translucent walls create a filtration of views, blurring the boundary between indoor and outdoor.

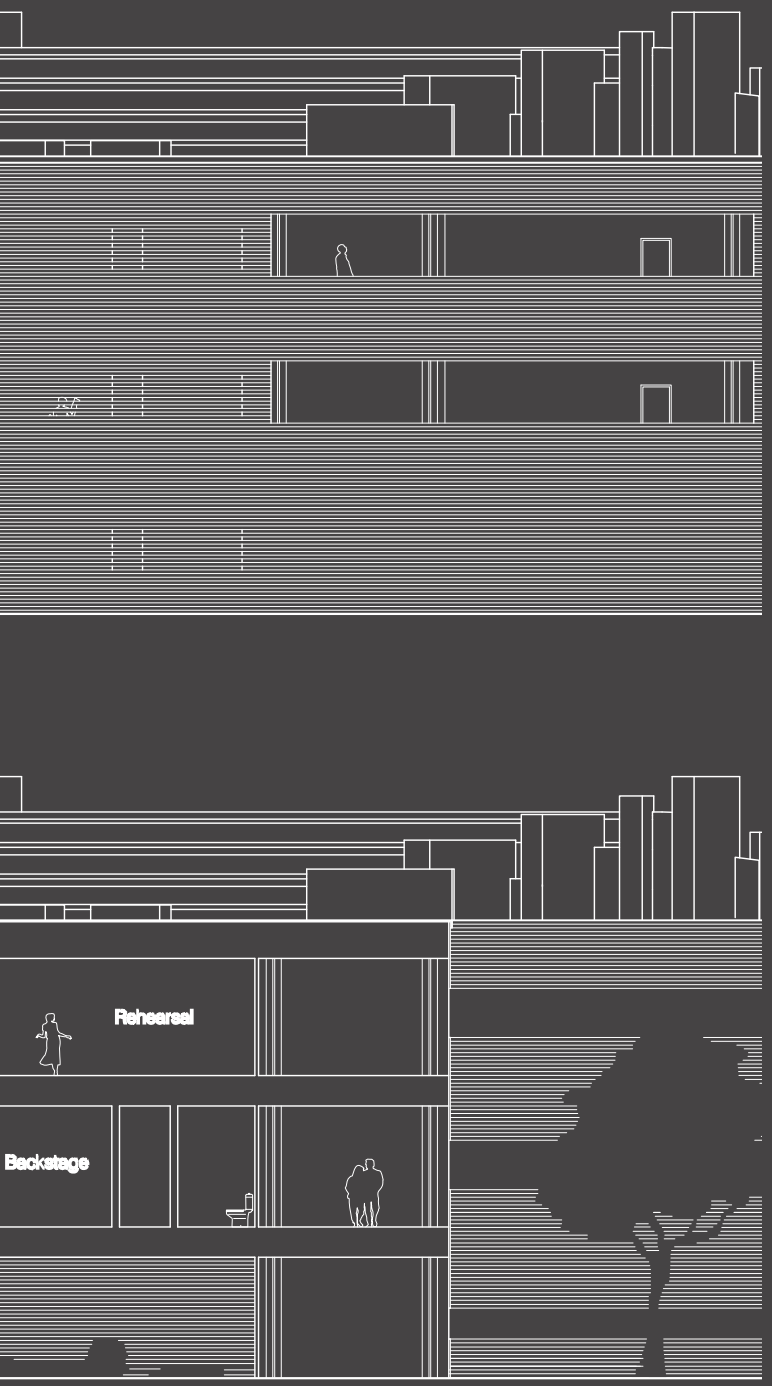
Transparent / All panels removed - double glazed surface. Transparent views allow filtration of views to occur from other positions in the building, so that layers of views are possible.



[170] External timber cladding panels

SOUTH WEST ELEVATION

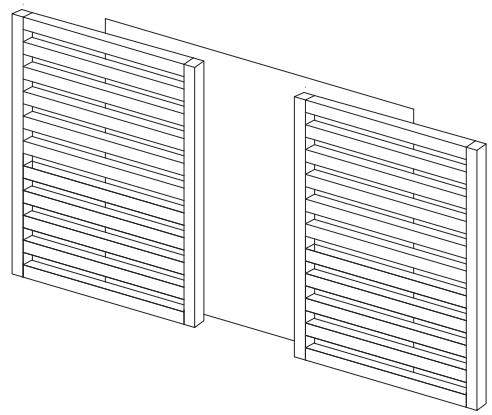
SECTION BB



STAVANGER Cultural City ‘08

Screens

Translucent screens are present over window openings, giving an opportunity to filter the view out from them. The screens consist of cedar panels spaced identically to the translucent walls, which can be opened and closed according to the user’s requirements.

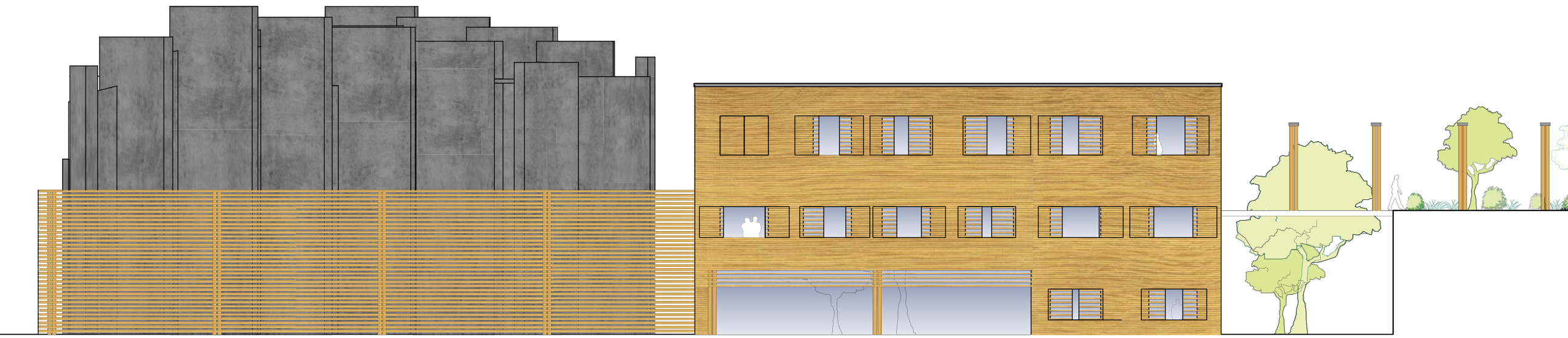


[171] Translucent screening

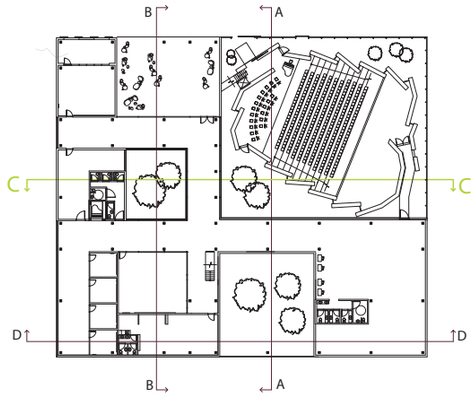
Heat Control / Because the transparent and translucent areas of the building have very limited insulation properties, the amount of these facade are limited to smaller areas, in consideration of avoiding overheating in summer and particularly heat loss in winter.

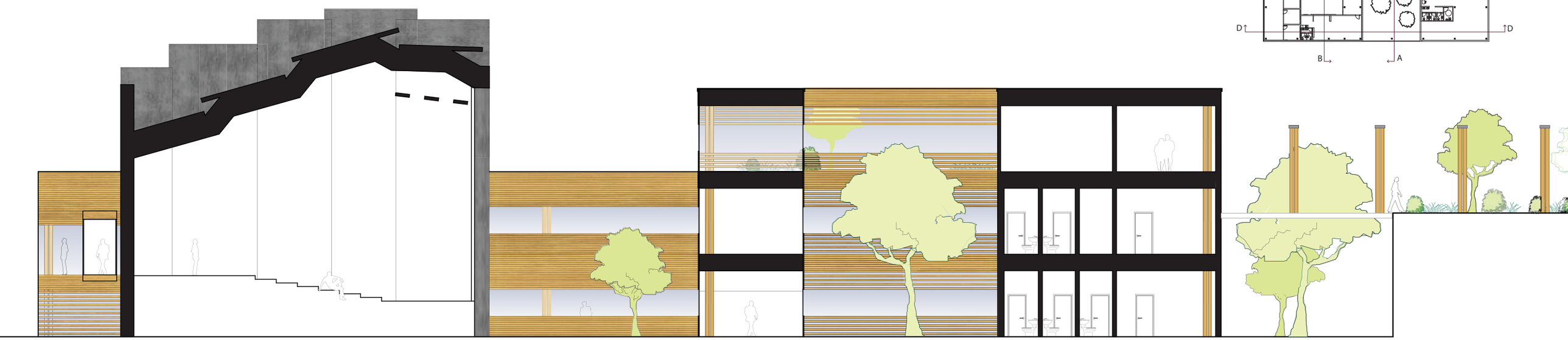
Roof Cladding / The roof is a discrete line defining the top edges of the building. It is covered in zinc and wraps over the edges of the facades 100 mm down, the same width as the wooden cladding panels.

[172] Translucent screening

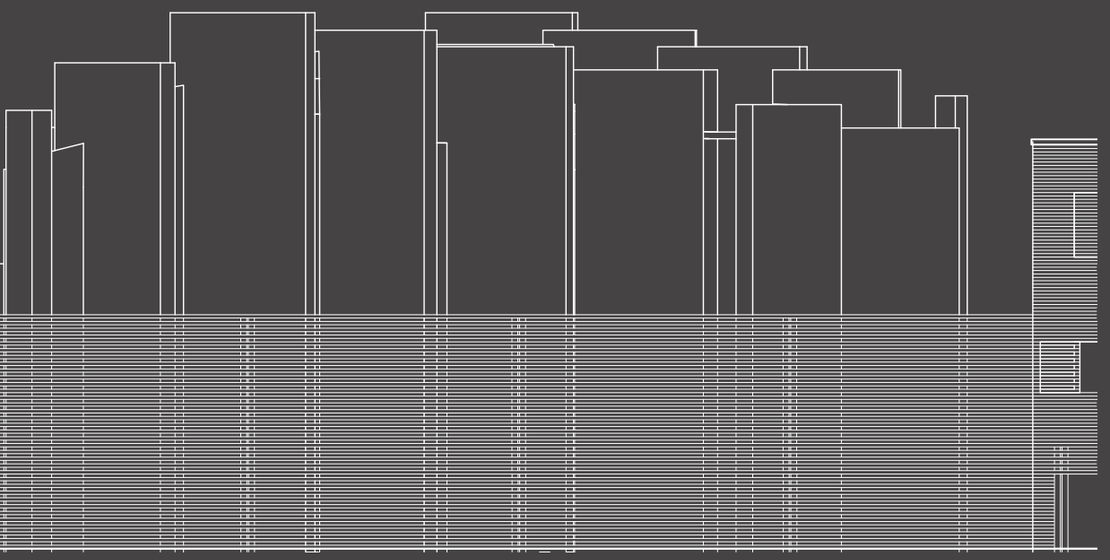


NORTH WEST ELEVATION

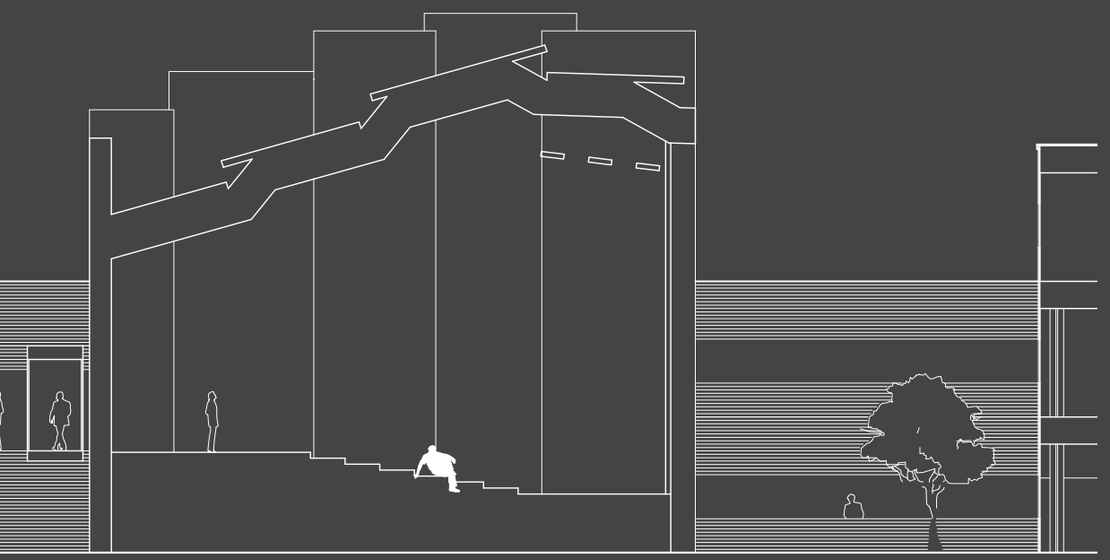




SECTION CC



ELEVATION



N N-W 1:200

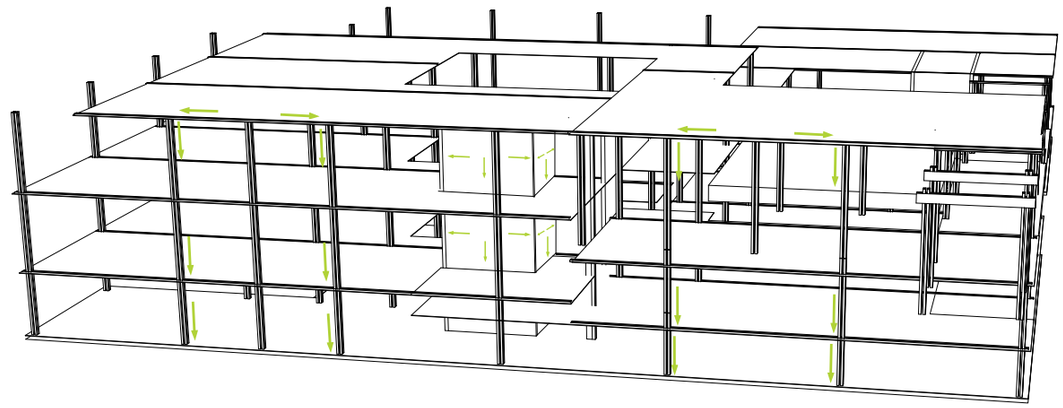
Structure

The composition, dimensioning, spacing and exposure of the structure has been determined to give a light, regulated expression which contributes to a calming feeling. The structure complements the framing of views throughout the building. It begins outside at the entrance bridge and continues into the building, blurring the transition form outdoor to indoor.

Grid / The structural system is a one-way post and beam system based on an 8m x 8m grid. Most walls are placed outside this grid and are non-load bearing. This spacing between the wall and column enhances a light expression. There is a core lift and stacked toilets, whose walls are load bearing and provide lateral stability [3].

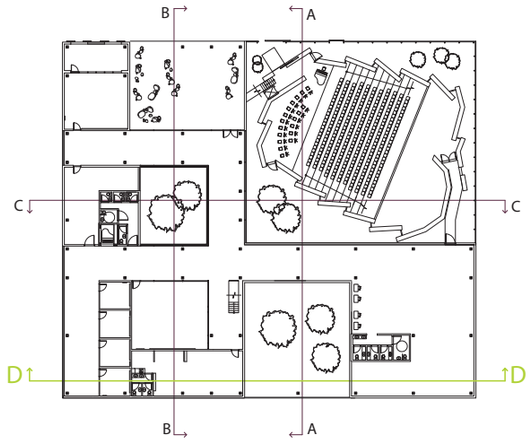
Columns / Dimensions are based on the 8m grid span. All columns have a corresponding dimension throughout the building to maintain a regulated rhythm throughout the building. Along the hallways non-load bearing columns are placed so the grid is 4m x 8m, in order to express the structure evenly when passing these spaces. Therefore there are some over dimensioned columns. Columns at the entrance zone is 4m x 4m because of the higher ceiling height - to keep the dimensions of the column the same. The column has been split into 4 for a more slender and lighter expression. They are dimensioned 115 x 115mm and each acts independently [see appendix for calculations].

Beams / The beams are composed in a one way system, to keep a regulated order and direction. The 2 beams over the columns are placed in line with the ceiling plane to keep the expression and framing of the surrounding views subtle and to avoid defining the room into sections.

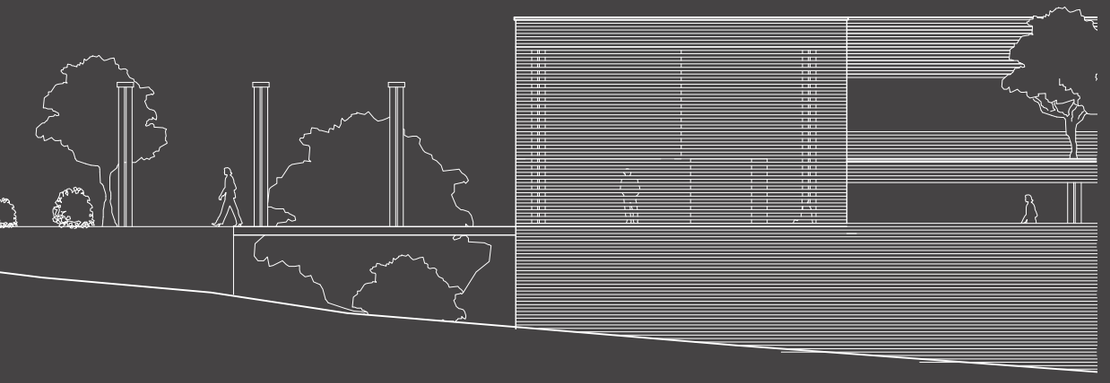


[173] Load Diagram

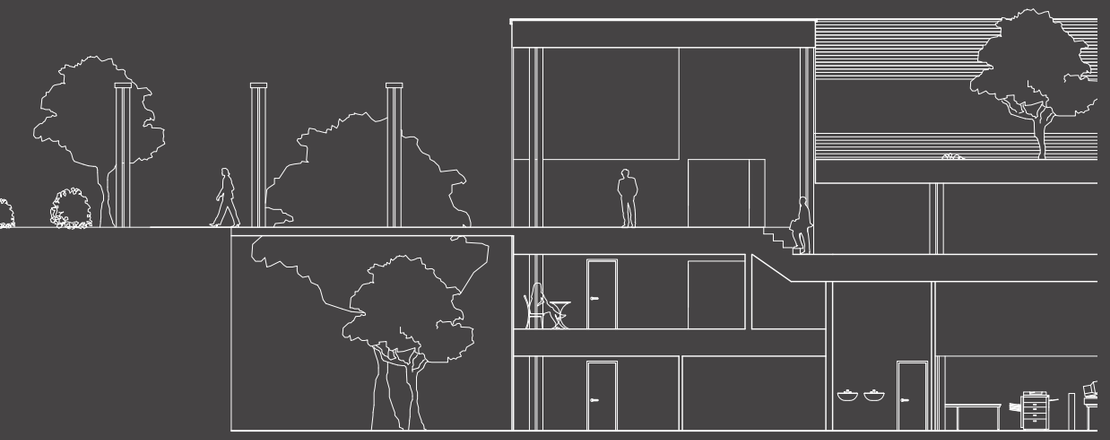
SOUTH EAST ELEVATION



SECTION DD



ELEVATION S-E 1:200



REFLECTION

The main aim of the project has been to design a Music House in relation to Nordic tradition, Japanese tradition as well as acoustic integration. These design factors were tied together by a concept of a journey incorporating framed views and filtration through layering.

User / The journey concept with framed and filtered views allows the user to be better aware of their surroundings and of the presence of others in the music house, giving more opportunities to cross paths and interact. The idea of a 'two way' interaction is fulfilled by providing facilities not requiring knowledge of music but allowing exposure and encouraging learning. This also gives social opportunities to create contacts. A common entry point and a circulation through the building encourage interaction between the three different users. The Music House attracts people of all musical levels by making an 'open' building, whose functions are available for use by all. This is expressed through the translucent facades. The building is appealing as a place to relax, with functions that relate to more than just music.

Site / The concept of the journey is extended outside according to the entry placement. Visitors arriving from the water are made better aware of the surroundings of the site and can appreciate the architecture of the building. It is an external extension of the inner journey. The three heights surrounding the site generated a building form in many split levels, in order to be able to relate the heights to one another. A close relationship to Tou Scene is created by placing the arrival area in the same zone as the entry to Tou Scene. This mutually strengthens the buildings' cultural stance in the area.

A connection with the Culture park is made through framed and filtered views out to it in both transition spaces and in functions. The Green flow path of courtyards throughout the building aid in creating visual connections throughout the building, and more conceptually this flow connects the culture park and the opposite neighbouring site. The building was set back from the cliff, allowing light into this façade and removing it from shadowing by the cliff. The cliff is thus expressed independently from the building, its height serving as an element that expresses the change in ground level when approaching the building. Its natural façade also served as a viewing element, filtered by a garden in the space between it and the building.

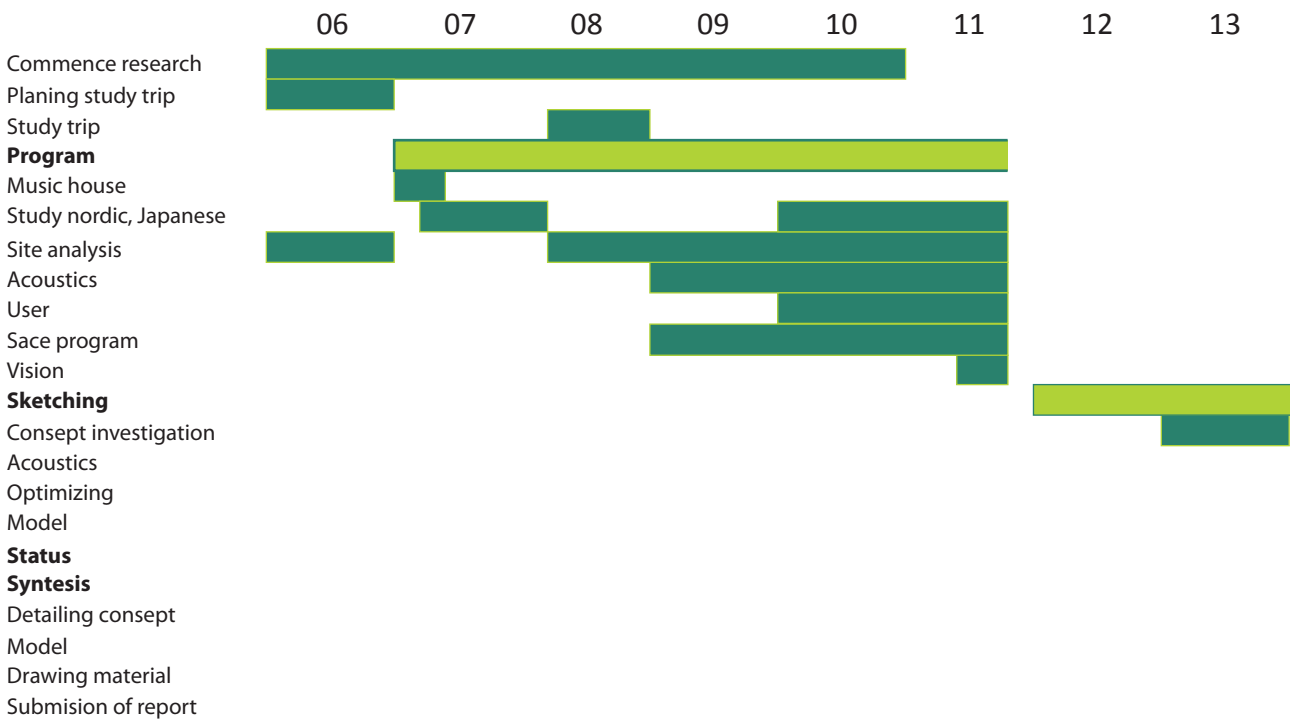
Nordic Tradition / The journey, with its framed views to the surroundings, gives a sense of orientation, connection to and appreciation of the landscape. Light is enhanced in the building through filtering and layering. When views are framed with translucent materials, or layered with subsequent transition spaces, it creates a filtering of light into the building, giving an extra dimension of detail. The building is read as one simple square volume, expressed by a horizontal emphasis through the façade cladding. This gives a more modest expression. The building height is much higher along the cliff and decreases when approaching the water. This relates to the movement of the surrounding landscape while also creating a better relation to the human scale. Wood is the choice of material throughout the building. The play of light into the building through translucent facades highlights the detailing of the wood's regulated expression. The exterior cladding will remain untreated to celebrate the natural ageing process of this natural material. The building expression over time will thus also change.

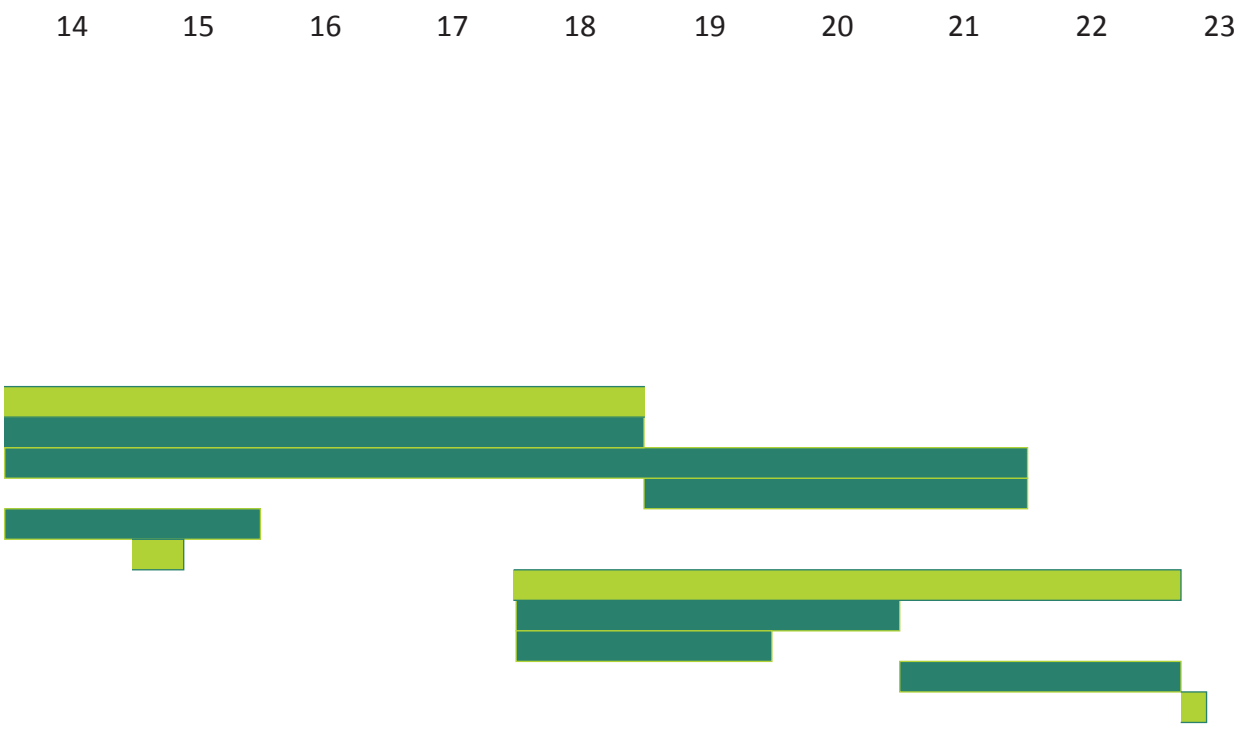
Japanese Tradition / A feeling of calmness, harmony and tranquillity is achieved by the sensuous journey throughout the building. This is enhanced by a regulated, calm post and beam structure which is exposed throughout the building. The spacing and construction of the posts and beams complement and frame the surrounding views. Framing, layering and filtering of views to nature strengthen the connection between outdoor and indoor, also blurring its transition. The building form and layout is asymmetrical in expression. An aspect that could be further worked on is the integration of flexible planning – where rooms could be subdivided or combined for different uses when needed.

Acoustics / Acoustic design is integrated aesthetically into the architecture primarily in the Performance Hall, with a design process that varied between sketching and calculating. The final form is influenced by acoustic calculations to give good acoustic results, but the expression still relates to the simplicity, calmness and tranquillity of Nordic and Japanese traditions. The hall's interior acoustic shape is reflected externally, giving it a special aesthetic expression but still distinguishable as part of the entire Music House. Both the Performance hall and rehearsal rooms use materials, forms and facades to express their acoustic element aesthetically. An aspect that could be worked on is integrating adjustable elements to facades. This would change acoustic conditions of a room, fine tune sound quality according to the performer, as well as create an interesting variety of aesthetic expressions.

The Music House in Stavanger has been designed not just as a regular concert hall, but as a place for use in the daily life of the local community. It is a place providing optimal acoustic conditions for professional and amateur musician, but also a place with a tranquil atmosphere to relax with music or celebrate music. The Music House is expressed qualitatively through Nordic and Japanese traditions, refined with the added integration of Acoustics. This has resulted in a mentally sensuous inner experience while reaching out to people from all walks of life interested in music, perhaps making way for a new musical culture for the future.

SCHEDULE


06
07
08
09
10
11
12
13
Commence research
Planing study trip
Study trip
Program
Music house
Study nordic, Japanese
Site analysis
Acoustics
User
Sace program
Vision
Sketching
Consept investigation
Acoustics
Optimizing
Model
Status
Syntesis
Detailing consept
Model
Drawing material
Submision of report


14
15
16
17
18
19
20
21
22
23

LITERATURE / IMAGES

Image Reference List

Pictures not in this list are taken by the authors.

[1] cruises.about.com/od/jeweloftheseas/tp/Jewel_of_the_Seas_Cruise_Log.htm (13.02.09)

[2] www.earth-photography.com/photos/Countries/Norway/Norway_Fjords_Sunset.jpg by Peter Visontay (1302.09)

[3] www.billig-reiser.com/bilder-fra-norge-reise/ (05.03.09)

[4] blog.thomaslaupstad.com/2008/03/16/picture-of-sunset-within-a-winter-forest-in-northern-norway/ (13.02.09)

[6] kobieta.gazeta.pl/wysokie-obcasy/51,96856,3845452.html?i=5 (05.03.09)

[7] Norberg-Schulz, Christian (1996), "Nightlands- Nordic Building", MIT Press: Cambridge p22

[9] www.flickr.com/photos/67035552@N00/sets/518200/ (15.02.09)

[10] Ole-Lund, Niels (2008) "Nordisk Arkitektur", Arkitektens Forlag p p47

[11] Simon Ewings, Snøhetta

[13] Simon Ewings, Snøhetta

[14] Simon Ewings, Snøhetta

[16] Simon Ewings, Snøhetta

[18] www.archdaily.com/440/oslo-opera-house-snohetta/May 2008 (12.03.09)

[19] www.archdaily.com/440/oslo-opera-house-snohetta/May 2008 (12.03.09)

[21] Arkitektur N, 2008, p.17

[23] www.archdaily.com/440/oslo-opera-house-snohetta/May 2008 (12.03.09)

[24] Simon Ewings, Snøhetta

[25] Gropius, Tange, Ishimoto (1960) "Katsura : Tradition and Creation in Japanese Architecture", New Haven: Yale University Press

[27] www.japanese-architecture.info/ (12.03.09)

[28] grzegorz.aksamit.org/usa/01japan/019_16a-511169.jpg (04.03.09)

[29] japan-wallpaper.japanican.com/images/0804_kyoto_ryoanji_1440x900.jpg (02.03.09)

[30] Gropius, Walter et al (1960) "Katsura: Tradition and Creation in Japanese Architecture", New Haven: Yale University Press p 13

[31] Naito, Akira (1977), "Katsura - A princely retreat", Tokyo: Kodansha

[32] Hibi, Sadao (1989), "Japanese Detail: Architecture" ,San Francisco: Chronicle Books p. 56

[33] Hibi, Sadao (1989), "Japanese Detail: Architecture" ,San Francisco: Chronicle Books p. 56

[34] Hibi, Sadao (1989), "Japanese Detail: Architecture" ,San Francisco: Chronicle Books p. 56

[35] www.outsidersdesign.blogspot.com/2007_11_11_archive.html (12.03.09)

[36] pro.corbis.com/search/Enlargement.aspx?CID=isg&mediauid={6592A25D-AD73-4275-A6B5-6845ACC1994B} (12.03.09)

[37] Naito, Akira (1977), "Katsura - A princely retreat", Tokyo: Kodansha

[38] Gropius, Tange, Ishimoto (1960) "Katsura : Tradition and Creation in Japanese Architecture", New Haven: Yale University Press

[39] pro.corbis.com/search/Enlargement.aspx?CID=isg&mediauid={CCDED625-F1EB-44D9-A8F4-99F77DFB5D9E} (12.03.09)

[43] plus.politiken.dk/Uploaded/2489/DR_20000_550.jpg (07.03.09)

[44] www.dr.dk/Koncerthuset/Om-koncerthuset/ (11.03.2009)

[48] www.dr.dk
[55] www.archdaily.com/440/oslo-opera-house-snohetta/May 2008 (12.03.09)
[59] Simon Ewings, Snøhetta
[60] Simon Ewings, Snøhetta
[65] Simon Ewings, Snøhetta
[66] Simon Ewings, Snøhetta
[67] Simon Ewings, Snøhetta
[71] www.live.maps.com (11.03.09)
[72] www.live.maps.com (11.03.09)
[75] cs.klikk.no/CS2008/forums/t/410.aspx?PageIndex=4 (10.03.09)
[80] Nadine Engberding, Helen & Hard
[81] Nadine Engberding, Helen & Hard
[84] www.dac.dk/visArtikel.asp?artikelID=4433 (10.03.09)
[95] Nadine Engberding, Helen & Hard
[96] Nadine Engberding, Helen & Hard
[101] Nadine Engberding, Helen & Hard
[102] www.aart.dk/projects/?cat=1&id=47 (10.03.09)
[106] Nadine Engberding, Helen & Hard
[107] www.flickr.com/photos/ndesh/14463353/ (09.03.09)
[112] Hasegawa, Yuko, "Kazuyo Sejima + Ryue Nishizawa - SANAA" 2005: Electa, Milan p.74
[113] Hasegawa, Yuko, "Kazuyo Sejima + Ryue Nishizawa - SANAA" 2005: Electa, Milan p.201
[114] Hasegawa, Yuko, "Kazuyo Sejima + Ryue Nishizawa - SANAA" 2005: Electa, Milan p.216
[134] MaRIANNE yVENES arkitekt sverre fehn intuisjon refleksjon konstruksjon Nasjonalmuseet for Kunst Ark og Design 2008 Oslo p122
[135] Timber construction in Finland Rakenettu Puusta 1996 Finnish Timber Council p124
[136] Cerver, Francisco, Atlas of Modern Architecture, 2003,Konemann, Berlin p963
[137] Puusta, Rakennettu. Timber Construction in Finland, 1996, Finnish Timber Council, Helsinki p 124
[143] www.moeleven.dk 16.06.09
[159] www.vrey-materials.de
[161] www.vrey-materials.de
[162] www.vrey-materials.de
[170] www.moelven.dk
[172] www.moelven.dk
PUU Wood Holzbols, 4/20.08, Aksomatric OY, Helsinki

Literature List

Books /

"Arkitekt Sverre Fehn, intuisjon – refleksjon – konstruksjon" (2008), Utstilling Nasjonalmuseet - Arkitektur

Buck, David (2000) "Responding to Chaos", New York: Spon Press

De Mente, Boyé Lafayette (2006) "Elements of Japanese Design", North Clarendon: Tuttle Publishing

ECO Architecture (2008), "natural flair – Maisons De Champagne, Ländliche Häuser", Evergreen, pp 186-189

Egan, M. David, "Architectural Acoustics", New York: J. Ross Publishing, 2007

Gropius, Tange, Ishimoto (1960) "Katsura : Tradition and Creation in Japanese Architecture", New Haven: Yale University Press

HFB Byggecentrum "HFB31" 2008: Ballerup

Hugues, Theodor (2004), "DETAILPraxis, Timber Construction-detail, Products, Case Studies" Birkhäuser, p. 7

International Utzon Symposium, Aalborg, August 28th-30th 2003 : proceedings, Aalborg : University of Aalborg

Neufert, Ernst and Peter, "Architects' Data - Third Edition" 2000 : Blackwell Science, Oxford

Norberg-Schultz, Christian (1996) "Nightlands - Nordic Building", Cambridge: MIT Press

Zettersten G (2003) "Is there a nordic Janus-Face?" in Mullins, M et al(2003) Utzon Symposium : Nature vision and place : the First

Articles /

Bies & Hansen, "Engineering Noise Control" 1988 p.p. 172-174

Jones, Peter Blundell and Kang, Jian "Acoustics Form in the Modern Movement " in Arq, Vol. 7, No.1, 2003 p.p 75-85

"PUU-WoodHolzbois", nr.1 2008, pp. 8-9

"PUU-WoodHolzbois", nr.4 2008, pp. 28-31

"PUU-WoodHolzbois", nr.4 2007, p. 35

Puusta, Rakennettu (1996), "Timber Construction in Finland", Suomen Rakennustaiteen Museo, p. 124

Strand, Lars (2008): 'Det Akustike Håndverket' in "Operaen", Oslo: Opera Forlag

Websites /

www.acoustics.salford.ac.uk/acoustics_info/concert_hall_acoustics/?content=shape (21.04.09)

www.archdaily.com/440/oslo-opera-house-snohetta/May 2008 Site Maps (05.02.09)

www.arkitekturbilleder.dk/billedbasen/popup2.php?id=459 (16.05.09)

www.cben.net (16.05.09)

www.dr.dk/Koncerthuset/Om-koncerthuset/ (11.03.09)

eklima.met.no (07.03.09)

en.wikipedia.org/wiki/Shinto (12.02.09)

http://finsarch.wordpress.com/category/hawaii-architect/ (26.04.09)

www.flickr.com/photos/94852245@N00/1221184511 (26.04.09)

www.flickr.com/photos/pg/2695576692/ (26.04.09)

www.live.maps.com

www.medplan.no/engelsk_prosj.html (06.02.09)
www.moelven.com/dk/ (16.05.09)
www.moelven.com/dk/Produkter-og-tjenester/Produkter/Udvendig-bekladning-/Overfladebehandling-/#BMTW (16.05.09)
www.moelven.com/dk/Referencer/Udvendig-bekladning-/Thermowood-/Bronsholm-Eng-/ (16.05.09)
www.netleksikon.dk/n/no/norges_geografi.shtml (11.03.09)
www.nzlive.com/blog/2008/07/30/a-double-honour-for-new-zealand-architect/ (26.04.09)
http://oscar-acoustics.co.uk/sonacoustic.html (06.05.09)
www.realoakfloors.co.uk/junkers_sport_portable_wood_flooring_system.php (06.05.09)
www.saecollege.de/reference_material/pages/Coefficient%20Chart.htm (06.05.09)
www.snohetta.com (12.02.09)
www.sso.no (05.02.09)
Stavanger Concert Hall Competition (06.02.09)
www.stavanger-guide.no/maps/pages/geographical.html (11.02.09)
Stavanger Interactive Map (10.02.09)
www.stavanger.kommune.no (03.02.09)
www.stavanger.kommune.no/bjergsted/konserthuset.nsf/startenglishv3?openform
www.stavanger.kommune.no/publikum/divsvg.nsf/SVGkart/kart?opendocument&referer=Kart
www.stavanger-konserthus.no (07 .02.09)
www.timeanddate.com/worldclock/astronomy.html?n=289&month=6&year=2008&obj=sun&afl=-11&day=1 (11.03.09)
www.touscene.com (10.02.09)
www.trada.co.uk (15.04.09)
www.urbansjofront.com (05.02.09)
www.sbi.dk/br08/5/2 (17.05.09)
www.thelondonglass.co.uk/acoustic_glass.asp (12.05.09)

Films /

Wachtmeister, Jesper (2004) "Kochuu – Japanese Architecture, Influence and Origin", Stockholm: Solaris

DESIGN CRITERIA

Nordic Japanese Harmony

Nordic Tradition

- Light
- Nature and Landscape
- Honesty in Material & Detailing
- Human Scale

Japanese Tradition

- Expressing Structure
- Planning
- Merging Indoor/Outdoor
- Sensuous Journey

Acoustics

- External Acoustic Expression
- Interior Performance Spaces
- Materials, Forms & Facades
- Adjustability

User

- The Musician
- The Enthusiast
- The Appreciator

Site

- Climate
- Local Context
- View

DESIGN CRITERIA