AMoMA - THE NEW GUGGENHEIM MUSEUM is a master thesis project made by Admir Cerimagic and Alessandro Ronga. The project has a sustainable approach which has followed the process and influenced the design throughout the full duration of the semester. This report contains a visual and textual explanation of the thoughts behind the final design and gives an insight in our work progress. The museum has been thought with the purpose of creating architectural experiences and a strive for a creative atmosphere.

TITLE OF THE PROJECT

AMOMA - THE NEW GUGGENHEIM MUSEUM

THEME OF THE PROJECT

SUSTAINABLE DESIGN

SEMESTER

MASTER THESIS - MSc04

FIELD OF STUDY

ARCHITECTURE & DESIGN

PERIOD

JANUARY - MAY 2016

DESIGN, CALCULATION & EDITING

ADMIR CERIMAGIC & ALESSANDRO RONGA

IN COLLABORATION WITH

MAIN SUPERVISOR

CLAUS BONDERUP

TECHNICAL SUPERVISOR

CLAUS TOPP

THANKS TO...

A special thanks to our families and friends, that have supported us during this long and uproarious walk in the architectural field.
Thanks to Samir and Semira for always being there in rough times, when moslty needed and a big thanks to Alija and Alma for always being in the good ones.
Thanks to Mamma & Papa´, that had given me the strengh and the possibility to fully live my dreams, and a warm thanks to my brother Mario, that taught me the importance of pushing myself to reach my goals.

A GUGGENHEIM IN THE NORTH

The Guggenheim in Helsinki is from a competition briefing conducted by the Guggenheim Helsinki Supporting Foundation, Guggenheim Helsinkiin Association, Loiuse och Gôran Ehmrooth Foundation, Svenska Kulturfonden and private and individuals who wish to be anonymous.
The purpose of the project is to create an innovative multidisciplinary museum of art and design and should be well integrated on the South Harbor of Helsinki.
The museum is intended to be a long term investment with cultural, educational and economical benefits for Finland.
The destination of Helsinki is getting more popular as a tourist attraction, the project should enhance Finland´s international profile. [Competition Conditions LR]
The museum should be able to house various exhibitions involving both international and local art.
As Finland already has a proud heritage of architectural design, the new museum should live up to the expectations of it being a unique piece of architectural art.

Contents

AMoMA - The New Guggenheim Museum is composed of five feature sections, each of which will showcase five perspectives - *Problem*, *Analysis*, *Sketching*, *Synthesis* and *Presentation. Problem* addresses the project brief and presents the overall mission for the project while *Analysis* introduces and analyses the site area. *Sketching* features the beginning of the design process. *Syntesis* connects all of the pieces together and, finally, the *Presentation* will showcase the design and the results.

METHODOLOGY

The approach of the design of the Guggenheim museum has been worked through with the tool of the Integrated Design Process (IDP). The methodology has been developed by Mary-Ann Knudstrup from the book, Pandoras boks [Knudstrup,2005].

This process contains five phases: problem, analysis, sketching, synthesis, presentation. The Integrated Design Process begins with the introduction of the problem, which is in the form of a former competition brief for the Guggenheim Museum in Helsinki. Hereafter comes the analysis phase, where various analysis of the site, theme and climate are investigated. In the sketching phase ideas are generated by sketches, physical models and through 3D software and in the same time a sustainable approach should be integrated. An iterative process is hereafter initiated with a focus on improving the design and making sure that everything works. The final stage is the presentation, where the final design has to be shown as clear as possible.

FEATURE ONE

A NEW GUGGENHEIM

The Guggenheim competition, which had one of the largest amount of entries ever, represent a good opportunity to achieve a perfect balance between aesthetic and functional architecture. In the following chapter you will be presented and walked through the project brief and introduced to some of the necessary studies for making pleasant museum architecture.

Necessary information like the site, room program, light, scale etc. are discussed and investigated. Case studies have been made in order to achieve a better understanding of how different museums are set up and work in practice.

PHOTOGRAPHY **WHITE FOREST**

Guggenheim Helsinki Design Competition

FOR THE PROGRAM, AN EARLIER COMPETITION BRIEF MADE IN 214 HAVE BEEN USED AND FURTHER DEVELOPED UPON. THE COMPETITION PROGRAM HAVE BEEN ANAYZED ACCORDING TO FUNCTION AND TYPOGRAPHY AND ADJUSTED HEREAFTER ON BASIS OF INVESTIGATED STUDIES.

IMAGE **FROM PALACE HOTEL**

The competition program have been made to make a museum on the harbor of Helsinki that aimed to be an exemplary museum and an internationally recognized building. Helsinki is a relatively new city that is still under development and have been since it became the capital two hundred years ago. It should be an addition to an already very cultural city that would contain some internationally significant exhibitions and draw artists, new audiences and tourists to the city. [Competition Conditions, 2014]

The museum will have have international exhibitions, generate their own exhibitions and put an emphasis on Nordic heritage, Finnish design and artistic inquiry. The museum will strive to have a synergetic relationship between the experts at the museum and Helsinki's already well developed artistic community. The centre that will have a focus on modern and Nordic art must also work as a place where conferences and different cultural events needs to be hosted. The museum must also have a café and kiosk that needs to be integrated in the design of the building. [Competition Conditions, 2014]

The museum wants to initiate a dynamic program for educations, engaging students, families, teachers and scholars that would be able to arrange lectures and events. The building should work as a platform where artists and local organizations can meet, discuss and collaborate with each other. Therefore it needs to show off the work of Finnish artists and designers that could help raising the profile. It needs to be appealing for people in all ages and be a must-see destination for tourists. The location at the waterfront could function as a welcome center for those arriving to the city by faery. The estimated visitor count annually is 550,000. [Competition Conditions, 2014]

The quality of the architecture should be worthy of the site. Since it is in a high profile location it is important that the building should become a symbol for the city. The construction needs to live up to the ethical and ecological values that is characterized Finnish tradition. There should be an awareness of environmental consciousness in the construction and operations of the building [Competition Conditions, 2014]

The room program, provided by the competition, shows in detail the areas that have to be assigned to the different functions. The total area of the site is 18.520 mq and 12.100 mq are reserved for the realization of the museum.

Friends With The Site

SITE AND MASSING GUIDLINES FOR THE MUSEUM ARE AS FOLLOWING

According to the guidelines written in the competition condition of the "Guggenheim Helsinki design competition", the museum areas have to be divided into two categories: assignment areas, which include spaces related to a specific museum use or activity, and unassigned areas, which include lobbies, circulation spaces, restroom, mechanical space and so on. The assignment area is approximately 7000 m2, whilst unassigned area is 5100 m2. Outdoor space for exhibitions or dining should be included in the design.

VISITOR SERVICES

RETAIL: it should be included in the design a museum store which sells items from Finnish designers as well as museum-related books. Being an unusual catalogue of items, the shop can be an attraction in itself.

DINING: include café/bar on ground floor open until late during summer, with outdoor spaces which has to be provided during hot seasons. The capacity should be around 120 indoor covers. Also a restaurant can be included in the design, with a capacity of 55 covers.

COAT CHECK: should include self-service lockers as well as staffed coat and bag-check counter.

MANAGEMENT

OFFICES: for staff it should be designed an open office spaces with shared conference room, while for department head and director private offices should be thought.

EXTERNAL FUNCTION

MAKESIINI PORT TERMINAL: required a passenger facility of 1000 square meters to replace the port terminal which has to be demolished. It can be integrated with the museum as well as can be a stand-alone building.

The overall site area is 18520 m2 where the new museum building should approximately have 12100 m^2 gross area with 42% Unassigned areas. An additional 1000 m2 gross area may be provided for the new port terminal. This could either be a completely stand-alone structure or integrated into the new museum building.

The building should be designed so as to fit into its surroundings. In cityscape and landscape impact, the design should be located so as not to obscure views from Tähtitornin vuori park past and over the building. City guidelines recommend a building ground level of +3.1 meters, with any levels below having waterproof construction.

At lower level, a 10-meter width by 5.5-meter clear height zone should be retained adjacent to Laivasillankatu for vehicular access in and out of the port (this could be shared for service access to the museum). This allows for one lane of traffic in each direction, catering for heavy goods vehicles with a pedestrian buffer zone on either side.

At higher level, a 5-meter-wide zone should also be retained adjacent to Laivasillankatu to widen the pedestrian and cycle route.

The City of Helsinki considers it an important goal that the museum should enjoy a close relation ship to the water. It is accepted that this objective will necessitate a reduction in the service zone setback to the quayside, but not overhanging or projecting into the water. No reshaping of the quay is permitted (nor creation of new basins). A revised vehicular access for heavy goods vehicles (servicing the museum and accessing the port) is to be created at the junction of Eteläranta and Eteläinen Makasiinikatu.

A drop-off area to the museum building is to be included.

Limited VIP and disabled visitor and staff parking provision is to be provided on-site.

A pedestrian link to the new building may be considered from Tähtitornin vuori park in the proximity of Bernhardinkatu at high level across Laivasillankatu.

TIMBER AND BIO-ECONOMY: Due to the fact that Finland is a leading proponent of the sustainable bio-economy, the Guggenheim foundation is looking for inspiring and innovative use of timber. It can be incorporated into the building's internal and external finishes.

ENVIRONMENTAL

The design should meet or exceed the LEED Gold standard using different strategies:
Minimizing the energy demand for cooling, heating, and lighting;
Maximizing efficiency, use of renewables, and use of alternative forms of energy;
Saving water for indoor use and irrigation;
Careful use of materials;
Preventing light and noise pollution;
Pmploying passive solutions where possible (e.g., solar shading,stack-effect cooling, etc.).

A Place To Learn and Experience:

MUSEM ARCHITECTURE, LIGHTING & SPACIAL EXPERIENCE

IMAGE **BRASILIAN NATIONAL MUSEUM**

Museums are made for collecting materials, which is a universal phenomenon as ancient as the mankind. It can collect natural objects or art objects which are out of the economic circulation, either temporarily or permanently. The museum aim is to protect them from damages and show them in the best possible way, in order to catch the attention of the visitors. The term museum comes from the Greek "mouseion", which means place of the muses and of their mother Mnemosyne, the Greek goddess of memory.
At the initial stage, the term museum was associated only to an academic of scholars and secondly to a place which houses collections. Only in the 19th century, the museum gained the meaning of a place to safe-keeping and presentation of collections.

The aim of a museum should be the one of re-call the love of knowledge through a physical path, giving the possibility to the visitors to fully live different experiences and to view themselves as learners across the rich array of available formal and informal learning experiences. Experience the space is one of the primordial instinct of the mankind, and we usually do it through the body. We put ourselves in relation with the size of the building and its dimensions form. This spatial quality is shown by means of geometric abstraction. In this way, the presentation of objects represent a fundamental and crucial task to be done. The context and all its own characteristics plays a crucial role for the visibility of an object. If the special conditions are changing, the perception of the object changes too. In other cases, it is the object itself which change completely the space.

"The person-object-space constellation may occur in accordance with a variety of design principles: as correspondence or harmonious connection, as contrast or conscious antithesis, or as adaptation or association, in which the imaginative aura of the object finds a more or less adequate correspondence in the building." [A design manual, Museum Buildings. 2004, pg.42]

Is it important to mark that the interrelationship between objects and space and observer and object lies also on the use of both artificial and natural light. Every room has its own spatial quality and the light plays an important role to make it suggestive and unique for every single use.
There must be an attempt to convert the museum experience "into a holistic experience that triggers a process of conversion from the receptive to the creative in the conscious – as well as in the subconscious." [Manfred Lehmbruck,Freirarum Museumsbau" p.13]

Our museum will exhibit pieces of modern art. The aim of the envelope will be to valorise the objects and pieces of art displayed and at the same time to express and interpret them through the aesthetic expression of the building itself, trying to find the perfect balance between these two aspects. For this purpose, not only the envelope plays a very important role to embrace suggestive atmospheres, but also the environment plays a crucial role. The building should moreover be as flexible as possible, in order to interpret the different needs of the exposed pieces. In some cases should in fact interpret specific aspects of the displayed art. This will be the case of the permanent exhibitions. In other occasions, the building should have the quality of being adaptable to different possible exhibitions.

IMAGE **LIGHT BULB**

Natural and artificial light in a museum play a fundamental role for the achievement of an optimal and comfortable result of the indoor environment. Planning the lighting design requires to take in consideration several number of factors. Indeed, not only an exhibit has to be enlightened in order to show its contents as much as clear and comfortable for the human eye, but also it has to be protected by light, avoiding possible damages. The architectural aspects of general lighting, special orientation and view of the outside are indispensable components.

VISIBILITY: A good visibility requires a minimum level of illumination, good contrasts without shadows and good colour renderings, avoiding at the same time the glare effect.
All those requirements vary consistently according with the type of exhibit. For example, paintings need different co nditions compared to sculptures which have to be observed from all sides. Moreover, objects made of light or videos should be located in dark areas.

PROTECTION OF OBJECTS: The energy intensity of radiation increase as the wavelength diminishes, the ultraviolet or blue spectrum is more damaging that the red or infrared spectrum.

The damage depends on the degree of absorption or reflection of the material and its spectral classification. For example, a dark surface is more prone to damage rather than a light surface, or a reddish surface than a blue one. Sensitivity to radiation depends on the type of material. For example, artworks on paper are more sensitive than ceramic or metal.

Damage is also depending on the duration of the radiation exposure. Maximum illuminance intensities are frequently set for objects of a specific light sensitivity. For example. 50 lux for paper and textile, 150 lux for painting on canvas. Unfortunately, nothing can be considered as scientifically proved, due to the fact that is not considered the spectral composition of light and the radiation energy.
For this reason, different museums are adopting some requirements that can be taken in consideration:
- determination of different maximum values of luminous intensity in dependence on the source of light
- limitation of the maximum duration of exposure
- complete ultraviolet protection and dimming of light outside visiting hours
- classification of the individual artworks according to categories of light-sensitivity.

ROOM LIGHTING, ORIENTATION & VIEW:
General light is very important according with orientation, perception of the space and also to enlighten objects.
Also in this case, the amount of general light as to be adjusted in order to preserve the integrity of the exhibits. For this reason, can be reasonable to design different rooms which implement diverse illuminance and darkening possibilities.
For a pleasant and comfortable sojourn inside the museum, it might be useful to arrange a satisfactory number of windows which provide a view of the exterior surroundings including the horizon.

DAYLIGHT: As a key factor for a good result of the indoor conditions, the daylight presents a very important and crucial characteristic regarding its spectral composition for colour rendering of the objects.

EXTERNAL CONDITIONS: The external conditions as well as the climate aspects of a site have to be taken in consideration during the design of the rooms.
In general, it is possible to establish that with a clear and limpid sky there are 100.000 lux while when it is overcast, it reaches 18.000 lux.
Even the colour composition changes with the different weather situation.
Although, daylight can be introduced not only for general light, but also for object lighting.

DISTRIBUTION OF DAYLIGHT: Important to avoid is the glare effect, which can appear through reflection of direct sunlight.
Moreover, the protection of objects can lead to a reduction of the light intensity in a room to a maximum of 50 lux up to 200 lux. Basically, it is very important to keep out the ultraviolet spectrum of the daylight using

different strategies, among which the use of windows with ultraviolet filtering.
The illumination of a room is easier to achieve using skylights rather than side windows. Direct sunlight should be avoided and, instead, the diffuse light from the sky plays a decisive role.
If the design of the room provide the use of side windows, it is better to locate them in a high position in order to avoid the objects to be cast in the shadows.

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DAYLIGHT OPENINGS: Unless the museum has thought to be built with one storey, when it is easy to use skylight openings, to allow the right amount of daylight it is necessary to adopt different solutions, for example with a realization of an atrium.
Lateral lighting via openings is also successful, although it has a limitation as far as lighting deep rooms goes. One role as to be followed: room depth to be lighted naturally = window height x 2.5.
Also very helpful is the use of light-deflecting devices, but it is important to take in consideration the material in which they are made. Indeed, it has to transmit a large amount of light (>50%).

CONTROL OF DAYLIGHT: As a rule, the daylight factor requires devices to attenuate the light near the windows. Immovable devices are not so successful, while adjustable system can be used also as a thermal solar protection. Movable system as a roller blinds, sun blinds are located outside, which means they are exposed to wind and dirt. For external areas, is recommended robust and large-format lamella.

ROOM SURFACE: Light quality depends also to the design of the room surface. The lighter is the surface, better will be the light distribution.
Important to underline that there should not be too much deviation in the illumimance values between dark objects and background, in order to avoid glare generated by contrast.

ARTIFICIAL LIGHT: Museum light varies as much as museums themselves do. The light becomes a crucial component of the presentation. The interaction between the exhibition design, the exhibits and their lighting requires a coherent conception. Also in this case, there are not general rules which guide the design.

ROOM LIGHTING: Illuminance describe the measurable incidence of light on a surface. Luminance reflects the perceived impression of lightness.
For the complexity of human perception and its interaction with psychological effects of special perception it is not possible to describe a “good lighting”.

LEVEL OF LIGHTING: To move safety through the museum the light should be between 20 lux to 50 lux. In addition to this, room lighting has the task to make the visitor comfortable. The necessary luminous intensity for lighting objects depends on the minimum luminous intensity for perceptibility.
For comfortable perception, it can be assumed an illuminance of 200 lux for most exhibits.

LIMITATION OF GLARE: Glare arises when high light densities from light sources overlap the exhibits in the viewer visitor’s field. Lighting is not completely free of plan until no sources of light are visible in the direct field. This is possible with lamps with low light intensity. Direct view into a light source does not lie in an observer field of vision and reflection is not so bright. Several low-powered spotlights are better for three-dimensional illumination than fewer high-powered ones.

DISTRIBUTION: good distribution of light ensures balance relations of light intensities. Is it possible to assume that the best conditions are when the paintings and the wall have a similar luminance. On the other hand, an inefficient distribution of light may occur when the room, especially for the large ones, has indirect light via skylight or illuminated ceiling. The exhibits appear in contrast to be dark, and usually the pupil is contracted when entering in the room. This leads to force the observer to be close to the exhibits itself and even in this case the eyes can have some difficulties to adjust to the lightness. In this case, is it possible to resort to the use of some additional spotlighting which can raise the level of lightness of the exhibits.

COLOUR OF LAMPS: Usually, for lighting exhibition objects, white light is the most used one. Its rage goes from 2000 Kelvin to more than 6000 Kelvin. According to Kruithof's curve, at low illuminance only warm tones or neutral-toned light sources are found comfortable, while at higher illuminances light sources with higher colour temperature are found comfortable.
Also in this case, the light's colour is to take in consideration according with the daylight.

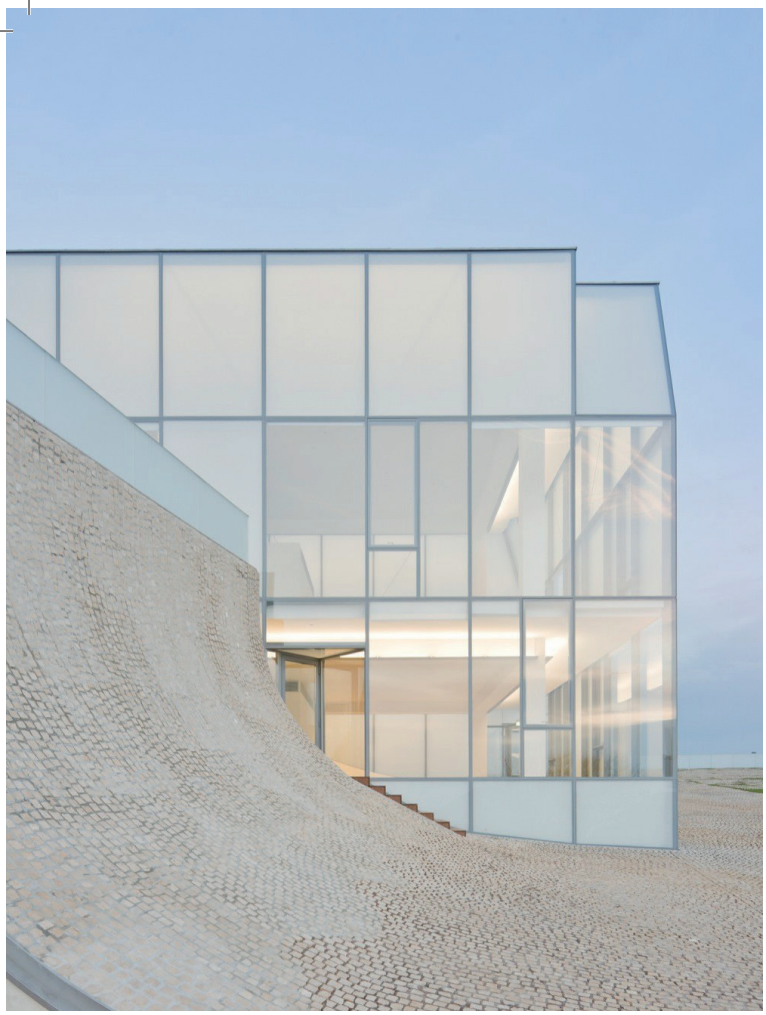
COLOUR RENDERING: For a good colour rendering, it has to take in consideration that in the spectral distribution of the light sources should be continuous progression. This can be the case with the use of daylight and light-bulb light with a colour rendering index Ra=100. For a normal lighting task, uneven colour rendering is not critical, but for paintings a bad colour index (<90 Ra) makes substantial changes in the perception of the colours. For this reason, fluorescent lamps with improved colour rendering have been developed even if are very expensive.

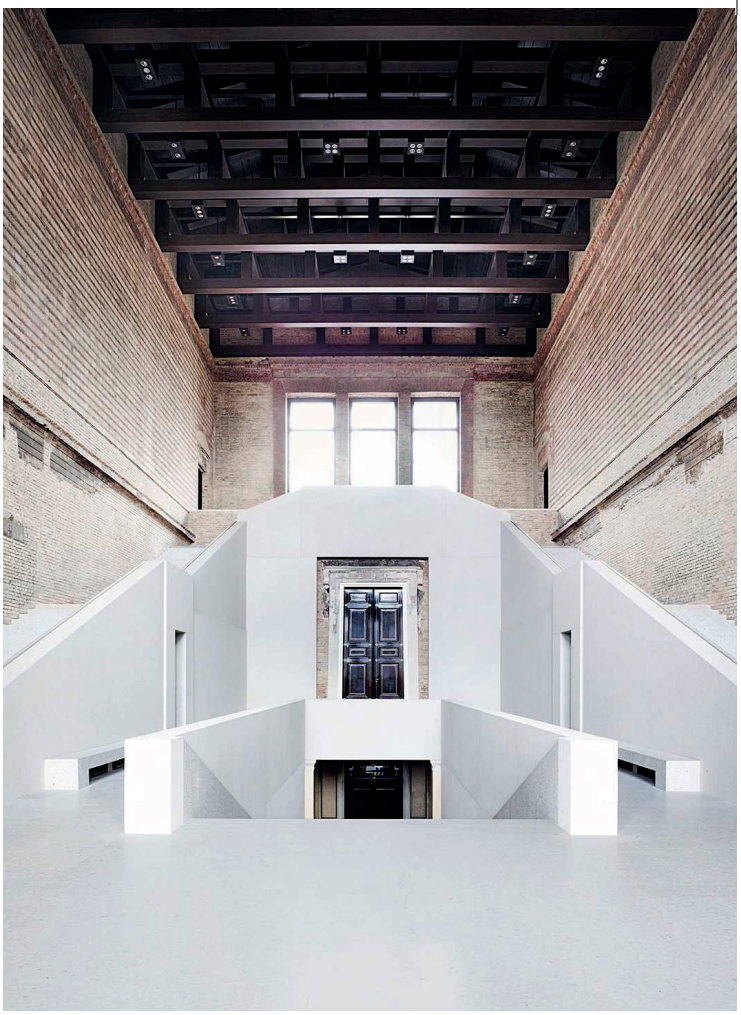
LIGHT DIRECTION AND SHADOW FORMATION:
The light direction is crucial to regulate how an exhibits appears to the observer. Using directional light, the attention should be placed to avoid observers casting shadows on the objects. A combination of diffuse light and direct is ideal for the exposure of three-dimensional objects. The proportion of diffuse light can also result from the reflection of direct light on the surfaces in the room.
Deep shadows have to be avoided as much as possible, there is the possibility to make them more moderate by diffuse light.

LIGHTS AND LUMINARES: Exist different kind of lamps that can be used for the lighting in a museum. As always, the type of room lighting determines the category of light methods.
-Light bulbs: spot-shaped light sources, directional lighting possible, good colour rendering, warm light colour, small models available, wide performance spectrum.
-Discharge lamps: spot-shaped or linear, limited coloyr rendering, high performance, models more suitable for general lighting.
-Special case: fibre-optics, very small models available, especially suitable for accent lighting, low proportion of ultraviolet and infrared minimizes the damage potential.
-LED: very low illuminating power and limited wavelength spectrum with correspondingly bad colour rendering limits the use in museum lighting to special cases.
Luminaries can be designed for special requirements according to the particular case.

LIGHT AND ENERGY: The consumption of expensive electrical energy for artificial light can amount to a significant proportion of the operating costs of a museum. Moreover, there are also cost related to the maintenance and the changing of light bulbs o the luminaries. For this reason is very important to optimize the lighting requirements and choose the optimum illumination source in order to not burdening on the ecological and economic factor.

Note: All the information of the texts related to Museum architecture, Spatial experience and light have been found in the book "A design manual, Museum buildings, Paul von Naredi-Rainer, 2004 Birkhauser"





INSPIRATION

WORKS FROM AROUND THE WORLD ARE USED AS CASESTUDIES

TOP LEFT CITÉ DE L'OCEAN ET DU SURF MUSEUM BY STEVEN HOLL. THE SURF MUSEUM IS A GOOD EXAMPLE OF A MUSEUM THAT PRESENTS AND EXPRESSES THE CONTENT. THE BUILDING HAVE A FOCUS ON CREATING VIEWS TO THE OCEAN BY LETTING THE WAVE-LOOKING WALLS DIRECT THE SIGHT. THE FACT THAT THE SITE IS VISIBLE FROM THE OCEAN LED THE DESIGNERS TO CREATE TWO BOULDERS CONTAINING THE RESTAURANT AND KIOSK WITH AN ALMOST 'LIGHTHOUSE' EFFECT BY USING TRANSPARENT MATERIALS. THE MUSEUM HAVE ALSO INCORPORATED SOME SUSTAINABLE METHODS WITH A FOCUS ON RESPECTING THE SITE. THIS WERE DONE BY USING MATERIALS MADE OF AGGREGATES FROM FRANCE AND COBBLESTONE THAT CAN ALLOW RAINWATER TO PERMEATE INTO THE GROUND. [WWW.INHABITAT.COM]

BOTTOM LEFT JEONGOK PREHISTORIC MUSEUM BY X-TU ARCHITECTS. THE FUTURISTIC LOOKING MUSEUM IS LOCATED IN EAST ASIA. THE MUSEUM IS TAKING THE CONTEXT IN CONSIDERATION AND LIKE A SNAKE MOVES AROUND THE NATURAL TOPOGRAPHY. THE BUILDING IS VERY INTERESTING SINCE IT HAS DOUBLE WALL FOR PROTECTING THE GALLERIES FROM THE HEAT AND IS A VERY BIG CONTRAST TO THE CONTENT. THE METAL FACADE IS DEDICATED TO BLEND THE MUSEUM INTO THE SURROUNDINGS BY REFLECTING THE NATURE AROUND. [WWW.INHABITAT.COM]

TOP RIGHT NEUES MUSEUM BY DAVID CHIPPERFIELD & JULIAN HARRAP. THE MUSEUM LOCATED IN BERLIN IS A REFURBISHMENT OF AN OLD BUILDING. HERE, IT SHOULD BE NOTICED HOW CHIPPERFIELD EXPLOITS THE SPACE AND HOW HIS SENSE OF SCALE IS CREATING A RATHER INTERESTING EXPERIENCE. THE PROPORTIONS BETWEEN THE ELEMENTS CREATES AN EXPERIENCE FOR THE VISITORS AND CREATES A FOCUS ON THE EXHIBITIONS AND THE GALLERIES. THE BUILDING TRANSFORMS INTO SOMETHING COMPLETELY DIFFERENT WHEN WALKED INTO AND SHOWS AN ASPECT TO IT THAT WERE NOT EXPECTED WHEN STANDING OUTSIDE. [WWW.ARCHDAILY.COM]

BOTTOM RIGHT SOLOMON R. GUGGENHEIM MUSEM BY FRANK LLOYD WRIGHT. UNDOUBTEDLY ONE OF THE MOST FAMOUS MUSEUMS IN THE WORLD. THE GUGGENHEIM MUSEUM HAVE SOME SPECTACULAR SPACIAL QUALITIES. THE WAY ONE WALKS THROUGH THE BUILDING AND EXPERIENCES THE ART EXHIBITIONS IS TRULY AN EXPERIENCE. ONE THING TO NOTICE IS THAT MANY ARTISTS HAVE COMPLAINED ABOUT THE WAY THE CURVY WALLS ARE MAKING IT A HARD TASK TO EXHIBIT SOME PAINTINGS. THIS IS SOMETHING THAT REQUIRES SOME THOUGHT DURING THE PROCESS OF DESIGNING WHERE FLEXIBILITY NEEDS TO BE AN IMPORTANT FACTOR. [WWW.ARCHDAILY.COM]

ASSIGNED AREAS

	Net Square Meters	Net Area	Gross Area	Notes
Exhibition	**4,335**	**61%**	**35%**	
Exhibition galleries	3920			Flexible spaces, fully wired
Art storage	100			Short term storage only
Shipping/recieving	50			
Crate storage	50			
Uncrating/Staging	50			
Shared art prep/Conservation studio and equipment storrage	70			Including 7 staff
Registrar, conservation, exhib. design & tech offices	30			Refrigirated
Multifunctional classroom/laboratory	65			
Multi purpose zones	**920**	**14%**	**8%**	
Coat check/lockers	60			Queuing area in unassigned space
Ticketing and information desk	20			Queuing area in unassigned space
Storage	10			
Project space/atrium	300			
Museum and design store	250			Museum-related, design merch.
Stock room and offices	50			Incl area for 3 staff
Security office/Control room	20			1 staff
Custodial office	20			1 staff
IT Server, workroom and staff offices	35			3 staff
Supply, equipment and seasonal furniture storage	40			
Landscape and grounds maintenance equipment	25			assume outside contractor & off-site
Staff lunch room/Lounge	65			storrage
Locker rooms	25			
Dining	**700**	**10%**	**6%**	
Cafe/bar	200			120 seats (1.7 square meters/seat)
Formal restaurant	130			
Kitchen	370			
Catering prep/staging area	incl			
Recieving	incl			
Offices	incl			Assume 1 office, 2 workstations
Trash room	incl			Refrigerated
Storage	incl			
Offices	**1,000**	**15%**	**9%**	
Flexible performance/conference hall	500			275 seats
Green room	incl			
Control room,/Projection booth	incl			
Simultaneus, translation booth	incl			
Seating, stage and equipment storage	incl			
Technician office	incl			2 staff
Dressing rooms	incl			
Administative offices	130			10 staff
Curatorial exhibition design, publications, archivist offices	110			9 staff, 3 temp
Education offices	30			6 staff
Marketing and development offices	100			8 staff
Conference rooms	75			1 room 20 seats; 1 room 10 seats
Shared work room/Copy room/File storage	55			
Total Assigned Areas	**6,955**			

UNASSIGNED AREAS

Total	**5,045**			**42% of gross building area**
Lobbies	incl			Assumes generous social/circulation spaces
Circulation	incl			
Restrooms	incl			
Art loading dock	incl			
General loading dock	incl			
Mechanical/Electrical/Plumbing	incl			
Partitions, structure, shafts, stairs, elevators	incl			
Total Gross Museum Area	**12,001**			

The room program, provided by the competition, shows in detail the areas that have to be assigned to the different functions. The total area of the site is 18.520 mq and 12.100 mq are reserved for the realization of the museum.

THE TASK

IMAGE **IN THE WOODS**

The location of the site makes it seem natural that the museum will have to be a symbol and a landmark of Helsinki. It should be a place that would gather artist, art enthusiasts and tourist from around the world. This, combined with the fact that it has to include international art, Nordic exhibitions and educational facilities will help gather people in all ages. The museum will have to communicate with the rest of Helsinki and be a part of the overall style of the city. The room program has been optimized to include all the facilities of good museum planning. There is a focus on drawing people to the museum and it should function as an impressive piece of architecture.

FEATURE TWO

THE PLACE IN BETWEEN

To get a better understanding of the area, some analysis have been made in order to use the surroundings and the climate as a benefit for the project.

In this feature section, *The Place in Between*, we head out into a little colder climate with our cameras and sketch books to explore the South Harbor of Helsinki. We step out in different creases of Helsinki to experience the architectural heritage, atmospheres and cultural uses and customs.

Climatic analysis has been performed to achieve an overview of the conditions of the site in order to use it later to shape our ideas. Various sustainable approach have been discussed and left open for further investigations.

PHOTOGRAPHY **SNOWY ROAD**

Learning From The Past

ANALYZING THE SURROUNDINGS AND THE HERITAGE

IMAGES TOP **HATJE CANTZ** BOTTOM **SAUNALAHTI**

FINNISH ARCHITECTURE

Alvar Aalto is one of the most celebrated architects in Finland. He is seen as one of the key figures in international modernism. Finnish architecture has its roots deep down in Nordic traditions and Byzantine architecture. This is easiest seen in the capital where architecture from many different movements is present.
Finnish architecture is constantly changing and architects are often introducing new aspects to include a certain topic. Contemporary Finnish architecture has; similarly to Scandinavian, a lot of focus on honesty and tectonic theory. The Temple Church in Helsinki is a good example of architecture made with a tectonic approach.
Wood is something that is becoming more and more popular to use in Finnish architecture. [www.finland.fi]

NORDIC IDENTITY

Louisiana Museum of Modern Art opened a new exhibition back in 2012 where multiple Nordic studios have been invited to build a house that would express architecture from their own regions respectively.
The Nordic architects chosen were from Denmark, Finland, Iceland, Sweden and Norway. The exhibitions purpose was to explore Nordic architecture in relation to culture, materials, identity and in general what makes architecture 'Nordic'. [www.archdaily.com]

CULTURE AND TRADITIONS

While the northern countries in Europe have their clear differences, they have similarities when it comes to art and design. The Scandinavian countries and Finland have often had a similar point of view when it comes to architecture. The Swiss architect Peter Zumthor and the Finnish Juhani Pallasmaa discusses the Nordic values and how the culture have had a meaning in way of designing. [www.archdaily.com]
Nordic architects have come a long way when analyzing the surroundings of a certain place. There are a lot of different landscapes in the North which have had influences on how a designer approaches a certain project. The initial stages are seen as a critical period, where strong relations between the surroundings and the building is being interpreted. It's almost like a tradition. [www.en.louisiana.dk]

SOCIETY AND COMMUNITY

The welfare system that is commonly associated within the Nordic countries has had an influence on buildings to the public. People here have their own sense of what a community should be like. This translates to almost like a dialogue between the people and the architects. The building is intended for the community to use, therefore a prediction in how the social behavior is necessary to form what is known as a Nordic community. [www.archdaily.com]

IDENTITY

Nordic identity can be said is a synergy of multiple factors. Adaptation has been a key factor for processing the idealogical beliefs within the Nordic countries. By adapting to the culture, traditions and the environment there is a possibility to create a hospitable place no matter the conditions. Nordic design can therefore be said to have a special attention to the surroundings. Clean lines with materiality in mind that uses nature as inspiration and as an ally. [www.archdaily.com]


A Sustainable Approach

THE INDOOR QUALITY, ENERGY CONSUMPTION & MATERIALS

IMAGE **KIMBELL ART MUSEUM**

The world is changing in a lot of ways. Because of the carelessness; that have ruled for many years a new problem have risen. Global warming is an issue that describes the increase in temperature of the earths atmosphere and is said to be caused/expedited because of human behavior and the fact that we as people pollute like never before. Many people from different professions have been working on minimizing the CO_2 levels in their respected area of expertise. Architecture is a vital part of a strategy for a greener future.

RESPECTING THE SITE

Materials from the area should be investigated for their properties and construction abilities. This would mean that transport would be minimal. If other materials would have better properties and a higher sustainable value these should be used instead.

INDOOR CLIMATE

The museum should include operational management that have to make sure that the indoor climate is on satisfying levels. Following requirements must be met to achieve a satisfying thermal/atmospheric comfort:

Temperature: 22 C° +/- 2,5 C°
Relative Humidity: 51% +/- 5%
Lux levels:
150-250 for gallery walls
50 for paper
No direct sunlight on gallery walls

These parameters should be met and incorporated in the overall design and logistics of the museum. Already at this point it is important to notice that no direct sunlight can hit any walls within the gallery space. Here it is important to work with indirect sunlight as well as artificial light. Well functioning strategies should be investigated to use passive and active strategies for maintaining a good indoor environment with a low energy consumption. Software for analyzing energy consumption and the indoor quality should be used to achieve the most sustainable outcome that lives up to the requirements.

PASSIVE STRATEGIES

Using the climatic studies, there should be investigated passive strategies that could possibly minimize the overall consumption. It is important that this step is incorporated in the design during the early phases of the design process and be used as a form factor.

ACTIVE STRATEGIES

Active strategies could be used to make a more comfortable indoor environment. These could include electric light, heat pumps etc.

SUSTAINABLE ARCHITECTURE

Nordic architecture should be the key focus when approaching the project. Within this broad topic there should be integrated a sustainable idea that guides the designing of the building and leaves a museum that is designated for the city, the people and the surroundings.
Honesty, simplicity and light are vital elements of Nordic architecture which combine, in a unique and distinctive way, all the characters that are involved in the architectural design.
Local materials should be investigated to find their optimal properties which could benefit the sustainable purpose whilst making a connection between nature and artifact. The indoor climate of the building should be a pleasant environment in which art can be preserved and people sojourn. Achieving good indirect sunlight should be a main element in accomplishing a good atmosphere without damaging the exhibited art.

Exploring The Site

AN IN DEBTH ANALYSIS OF THE SITE, THE SURROUNDINGS AND THE SPIRIT OF THE PLACE

IMAGE **SOUTH HARBOR BACK IN THE DAY**

The site is located in Helsinki, Finland. The city plays an important role in the region known as the Gulf of Finland Growth Triangle, which is a zone extended from Tallinn in Estonia and up to Saint Petersburg in Russia. Nowadays, Helsinki is going through a significant urban change since it has been chosen as capital two hundred years ago. Thanks to its privileged situation, it is a city which has enormous possibilities regarding urban development due to the freedom about the plan of the future growth of the city. As reported in the "Helsinki City Plan", the vision for 2050 is based on the concept of a human scale city, well connected through tram networks and new bicycle routes. Furthermore, the plan is also focused on the requalification of Helsinki's proximity to the sea and of its green spaces.

Helsinki is going through a completely renovation of some industrial and harbour areas in order to convert them into new residential and commercial districts, with the purpose of drawing the attention both local residents and tourists.

For what concerns the cultural field, the city is seeking to develop the concentrations of arts and sciences with the realization of different and specialized districts.

From an architectural point of view, Helsinki is gradually growing, housing new public buildings like the new Central Library.

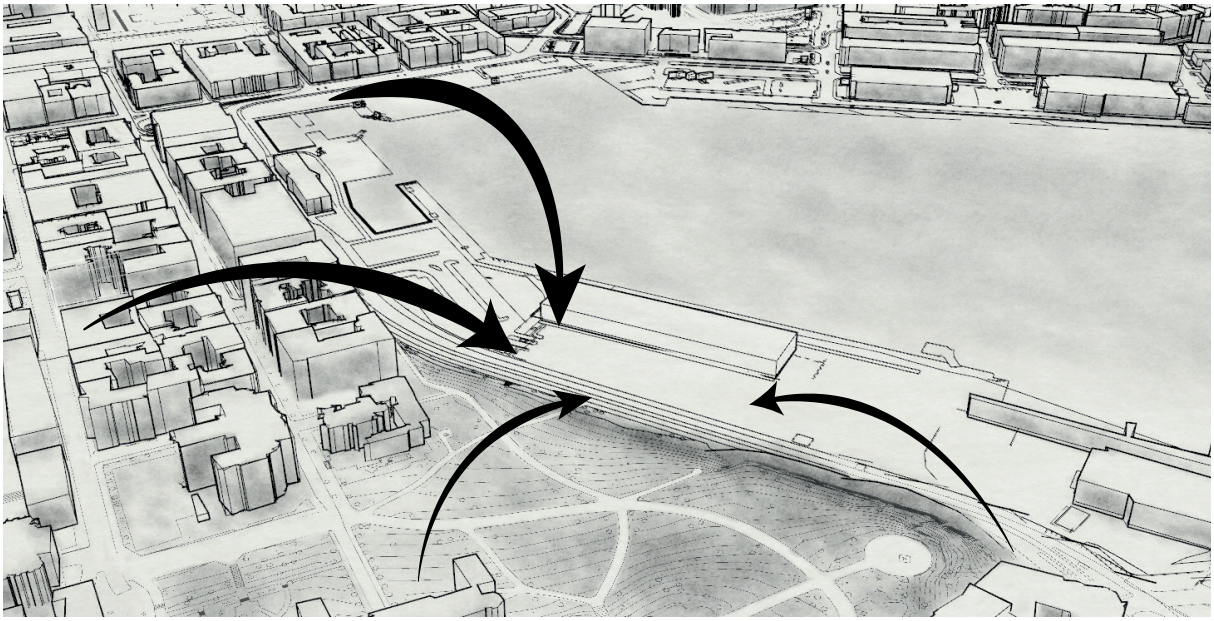
ON THE SOUTH HARBOR

The site is located exactly in the Helsinki's South Harbor, a vast area highly fragmented with a limited-access to the water's edge, turning out to be an unpleasant and unattractive public place both for inhabitants and tourist. Nevertheless, it results to be a place rich of potentiality, with a significant number of cultural areas which could reveal interesting when it wants to create a network between them and the museum.
The project area it is surrounded by the Eteläranta's water, respectively on North and East side, by the Kaivopuisto Park on South side and by the Observatoriebergets Park on top of the hill situated on West side.
Right next to the site, stands out the "Observatory Park", which it results to be a predominant green space in the middle of the city.
Moreover, very close to the site, there is a characteristic and unique building which is the "Old Market Hall". It was the first indoor market in Helsinki built in 1888 and nowadays it is possible to find traditional Finnish food. Furthermore, there is the Market square nearby the indoor market, a cosy and pleasant place with several stands which sell handmade objects.
One of the most important cathedral of Helsinki is situated 800 meters north from the site. Called "Carl Ludvig Engel", this monumental neoclassical cathedral stands majestically on the top of an impressive staircase, surrounded by other neoclassical buildings.
Nearby, there is another cathedral, "Uspenski Cathedral"where, on top of a hill, stands out from the rest with its green domes.

HISTORY OF THE SITE

During the 17th century, the bay called "Kaupunginlahti" (Stadsviken) was used mainly from the inhabitants for their own boats, due to the fact that the shores were very low. In the 18th century, have been made some changes and among which the bay's name, which became Eteläinen kaupunginsatama (Södra Stadshamnen). For a long period of time, it was used and considered only as a secondary harbour but when the traffic increased, it was necessary to build fastening places for ships and some harbour warehouses for storage.

Once Helsinki became the capital of Finland, the bay's shores were filled with piers with the aim of turn this bay from a secondary harbour into a first one. At the beginning of the 19th century, was built the Market Square. The connections to the harbour were improved thanks to the construction of a railway in the 1894. In 1922, the first icebreaker, called Hercules, docked at the south harbour of Helsinki. For heavy cargo, the harbour was equipped with cranes, counting 14 at the end of the 1939. In the early 1960s, started the era of the ferries between Finland and Sweden. Cargo traffic in Katajanokka was discontinued and the railway there was dismantled in the early 1980s. Since that time, Eteläsatama has been used by passenger ships and car ferries. [www.wikipedia.com]



ACCESSIBILITY

The museum site has a very prominent location and is one of the first sights you will get to experience when arriving by faery. How most people will approach the site will be from the north where a lot of tourist tend to gather - from the Helsinki Cathedral. Kaivopuisto; which is located south and west of the site and is one of the best known parts of the city will also be accessing the site but in smaller numbers. Since there are a park on the west there is no immediate possibilities to reach the site from this point. However, smaller roads around the park will be possible access ways for the residents living in Kaivopusto, Viiskulma and other smaller district west of the site.

INFRASTRUCTURES

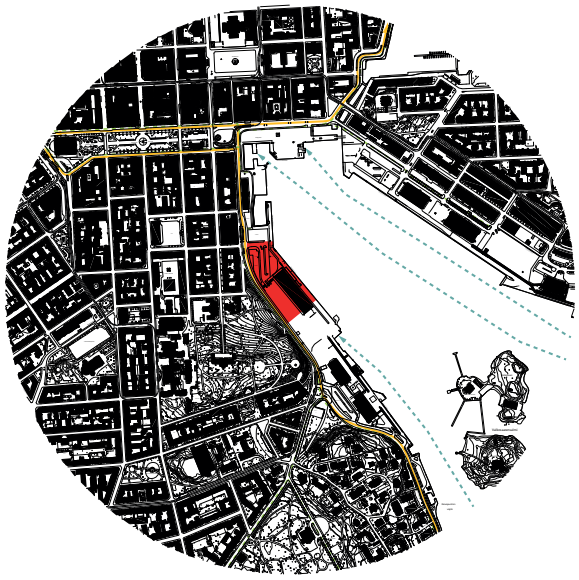
The site is directly adjoined to one of the most important street of the city, Laivasillankatu, which serves many users during the day and links the city from North to South. It is one of the few roads of the city which is well furnished of cycling lanes. Being a cruise terminal, the Harbour presents different connections by sea, which link Helsinki to Mariehamn, the capital of Åland Island, to Tallin and to the nearest islands in front of the harbour.
Taking in consideration the public transports, are counted six stops between bus and tram which allow to the inhabitants of Helsinki to easily reach this area.
Mostly of the project area is currently used as a parking lot, manly for the near terminals. We can assume that part of the parking lots demand will be reduced once in the site will replaced the museum at the terminal.

SURROUNDINGS BUILDINGS

The project site is well located inside the urban contest. Several interesting buildings are spread around the area, the three small museums about military, architecture and design of the Finnish tradition, which are very close to the site. The two cathedral, located 650 meters north to the interested area, give an example of the different artistic trends presents in the City, the "Uspenski Cathedral" it is the main Eastern Orthodox church in the City, with a distinctive Russian outcome while the "Carl Ludvig Engel Cathedral", which overlooks the "Senate Square", is a distinctive landmark of Helsinki in a unmistakable neoclassical style. All around the square, are place other neoclassical buildings like the "National Library" and the "University Museum".

URBAN GREENS

The Helsinki's South Harbour is characterized by a great amount of public green areas and mostly of them, indeed, are ample parks in which is possible to carry out different activities. To the North, the closest green area accessible from the site is the one located in between two roads (Etalaesplanadi and Pohjoisesplanadi) and it is called "Esplanadi Park", whereas to the South there is the "Kaivopuisto Park", an extended area which runs along the entire extremity of the South Harbour. The closest one to the site is the "Observatory Park" which, situated on its West side, displays a spectacular panorama towards the harbour and the several small islands which characterized the Helsinki Gulf.
Moreover, there are two interesting squares, one at 450 meters from the site called "Market Square", thought to be a commercial area full of stands which sell handmade objects and traditional food, and one at 650 meters called "Senate Square", which is located at the foot of the Carl Ludvig Engel's cathedral staircase and surrounded by neoclassical buildings.



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The Climate Conditions

IT IS VERY IMPORTANT TO BE AWARE OF THE WEATHER CONDITIONS OF THE SITE. THE CLIMATE CAN AFFECT THE DESIGN IN MANY DIFFERENT WAYS AND HAS TO BE INCLUDED FROM THE BEGINNING TO ACHIEVE THE BEST POSSIBLE OUTCOME. THE DIFFERENT GRAPHS AND ILLUSTRATIONS GIVES AN IDEA OF HOW THE AVERAGE WEATHER CONDITIONS ARE DURING A YEAR.

TOP LEFT The temperature in Helsinki is very humid due to the influence of the Baltic Sea and the North Atlantic Current. Temperatures rarely exceeds to an extreme where temperatures lowest average temperature falls to about -5 degrees celsius in the winter. Helsinki is the one of the most southern places in Finland which means that they experience temperatures milder than most of the other cities. [www.Meteoblue.com]

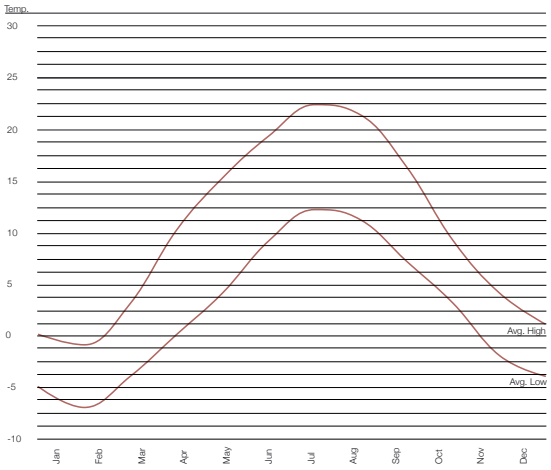
TOP RIGHT The precipitation is almost the same throughout a whole year where the second half of a year often have an increase up to about 60 mm on an average. It will rain almost the same amount of days each month, where the intensity will increase during the summer months. Since there is a good amount of precipitation in Helsinki, it should be included as a climate factor. [www.Meteoblue.com]

MID LEFT Helsinki like most of the Finnish cities experiences a good amount of days with moderate snowing. Especially during the winter season it could snow on an average of 10 days. It is varying between days with a lot of snowing to only a couple of hours a day. The sea around Helsinki tend to be frozen during February, March and April. Snow and the ice around the site should be defined as a considerable climate factor when designing. [www.Meteoblue.com]

MID RIGHT There will be a lot less cloudy days during the summer where most months during the winter season can experience a lot of cloudy weather. Foggy days is also a common thing occurring during the winter in Helsinki where visibility would drastically decrease. [www.Meteoblue.com]

BOTTOM LEFT Like many other places in the Nordic countries there is a higher contrast between summer and winter. Helsinki has short amount of daylight during the winter, where the sun is low on the sky. The residents will only experience less than 6 hours of daylight during the Winter Solstice and up to almost 20 hours during the summer. [www.timeanddate.com] [www.sunearchtools.com]

BOTTOM RIGHT On the wind rose it is seen that the strongest wind will come from South-West. From June to October it is mostly calm winds where strong winds will occur from December to April. The location and orientations of the site makes it mostly vulnerable to the winds coming from South to South-East. The wind should be an important factor for the landscape of the project and to create attractive outdoor spaces. [www.Meteoblue.com]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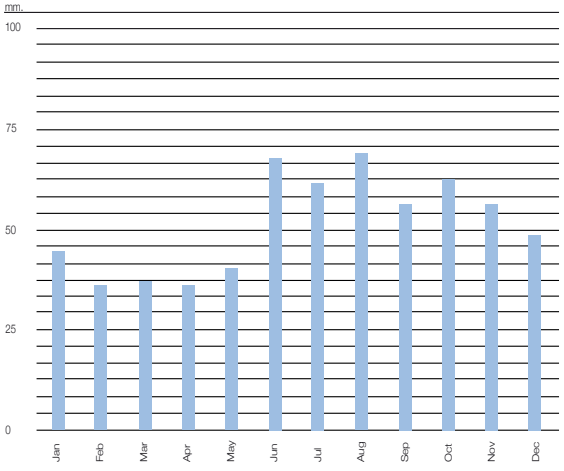
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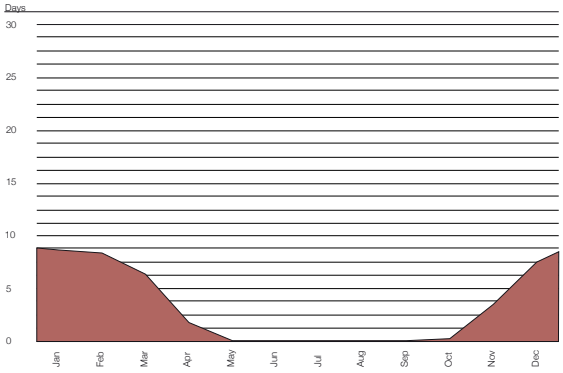
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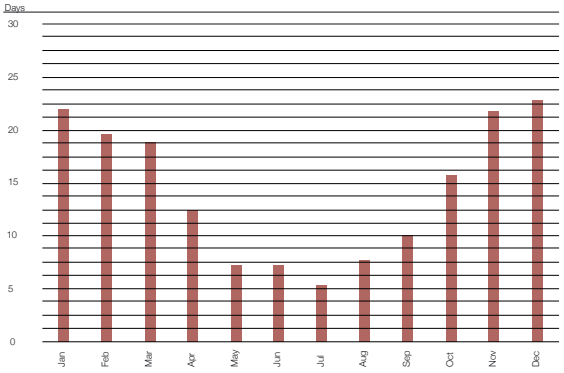
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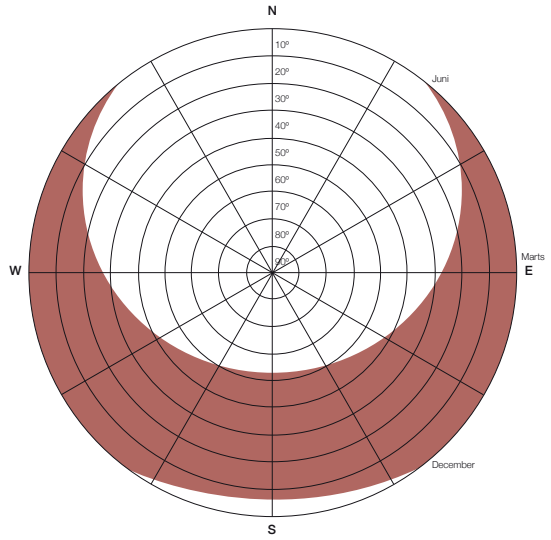
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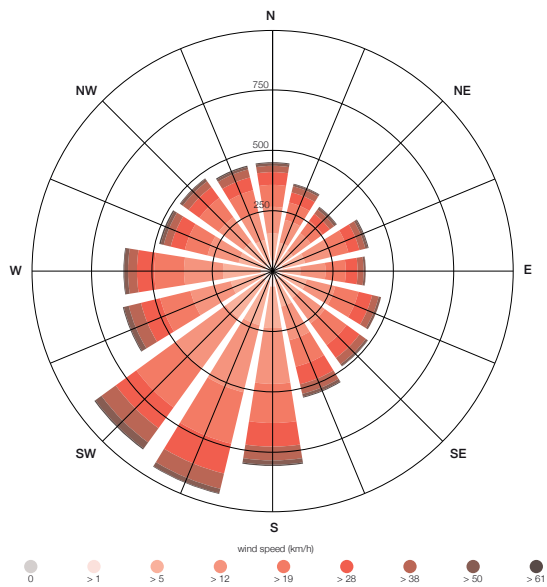
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Our Journey

OUR INSPIRATIONAL WALK THROUGH THE FINNISH CAPITAL

IMAGE **HELSINKI UNIVERISTY MAIN LIBRARY**

Helsinki, since the first moment, appears to our eyes as a harmonious city. People walk serene anywhere smiling at the first eye contact, dressed with their own personal style. Everyone is very kind and friendly, trying to help you in every possible way, de-mystifying the upper countries behaviour.

Looking up, Helsinki shows itself as a city rich of the Russian influence, dominated by several neoclassical buildings and at the same time by new and unusual shapes sons of a traditional Finnish culture.

The city itself is not so extended, but it is possible to perceive that it is growing fast and it is constantly changing. For this reason, people are attracted and stimulated and lot of events are spread all over the capital.

Not so many bike routes are present, but it is still very comfortable and easy to move around with the light train (tram), which gives to the city a characteristic rètro touch and throws the visitor back in time.

There are different ways to approach the project site: from north-west along the seafront where, passing through the outdoor market, it is noticeable in the distance an empty spot occupied, nowadays, by a parking for the port terminal next to it, from south, with the main street called "Laivasillankatu", which skits entirely the site.

From the top of the "Observatory Park", which provide a breath-taking view of the whole harbour, sliding down towards the main street, the visitor can immediately perceive the different heights and, metaphorically speaking, the characteristic scenario of the Finnish landscape, dominated by mountains and water.

The site presents itself as a quiet and unspoken space, with a lack of attractions and with the inability to reach the waterfront due to the fences placed all over the borders.

It is surrounded by residential and commercial buildings which present different styles, mostly neoclassical and modern architecture.

IMAGES TOP **HELSINKI SOUTH HARBOR** CENTRE **TAHTITORNINMAKI OBSERVATORY** BOTTOM **VANHA KAUPPAHALLI**

THE SEA

Calm, peaceful and majestic, the Sea dominates the scene as a main character in the stage show. It embraces Helsinki and the other small strips of land with its warm and soft touch, heartening the soul of the observer. The sound of the waves crashing on the shoreline, the call of the seagulls in the distance and its endless magnificence, make the bystander lose its gaze beyond the horizon, let it stop and build its own castles in the air.
When the snow falls from the sky and the water becomes ice, the two elements which generate life merge each other. The Sea and the Land weave together in a magnificent union sealing, even for a short period, their affinity.

THE PARK

Soft grass, viewpoints and a quiet atmosphere are dominant within the park. Walk through the narrow paths, surrounded by trees is an experience by itself, discovering step by step different perspectives of the city as well as of the landscape thanks to the many panoramic viewpoints.
The observatory stands on the top of the highest hill, silent and mysterious, and its small dome seems like an eye oriented towards the azure.

MARKET HALL

Standing along the sea front of the South Harbour, The Old Market Hall is a unique and symbolic landmark of Helsinki. Built in 1889, it represents the first indoor market of the City design by the architect Gustaf Nyström, characterized by a style which involves both Gothic Revival style and a so-called neo-Renaissance style of classicism.
Once entered in the Hall, the visitor can experience a warm and ancient atmosphere, make him feel back in the past. Walking through the stalls, the smell of the traditional food invades all the senses, stimulating a pleasant stomach grumble.

SOME THEMES HAVE BEEN CHOSEN TO BE A PART OF THE MUSEUMS EXHIBITIONS. THESE THEMES SHALL INCLUDE NORDIC ART AND IN GENERAL MODERN ART FROM AROUND THE WORLD AS WELL AS AN PERMANENT ART COLLECTION THAT HAS SHOULD BE A PART FOR ITSELF.


SILJA LINE


Bar & Cafe
NIKOLAI II

IMAGES TOP **THE WHARF** CENTRE **THE PARK** BOTTOM **THE SITE**

MARITIME PRESENCE

Docked to the wharfs, giant iron monsters are motionless annoying the gaze towards the horizon. They are waiting for a signal to raise anchor, and crowds of people are excited to be their inhabitants, to experience, even if for a short time, the life in a movable city, something extraordinary.
Hidden by this mutable skyline, another harbour hosts the traditional Finnish ships, the "Ice breakers". Against the nature, they cut through the iced water of the sea, making the mankind, once again, the ownership of the blue.

LANDSCAPE

Down to the hill of the "Observatory Park", the site presents itself as an aseptic and empty plain. Beyond the border, the sea predominates the scene and the distant small islands describe perfectly the characteristic scenario of the Nordic coasts.
Standing in the middle of the project site, is it possible to immediately perceive the change in altitude and the different elements which the area is made of. Earth and Water, the elements of life, live in a perfect synergy sealed with a warm and fond embrace.
Buildings have been raised following the main street, leaving the gaze free towards the sea.

ATMOSPHERE

Full of high potentialities to become one of the most alluring place of Helsinki, the south harbour shows itself to the visitor's eyes as an unspoken and unattractive space, placid and dull. The green high hill on west, the traditional market hall on north and the sea which flows the shoreline of the harbour and the small unreachable island on the distance, raises a quiver of enthusiasms in the visitor but at the same time it feels a sense of lack. The site is missing the Art, the harmony between nature and human. When the nature is not properly enhanced, the context loses its value to the visitor's gaze, inasmuch decades the primordial instinct which connects the mankind to the Mother Earth.

THE VARIETY OF EXHIBITIONS

SOME THEMES HAVE BEEN CHOSEN TO BE A PART OF THE MUSEUMS EXHIBITIONS. THESE THEMES SHALL INCLUDE NORDIC ART AND IN GENERAL MODERN ART FROM AROUND THE WORLD AS WELL AS AN PERMANENT ART COLLECTION THAT HAS SHOULD BE A PART FOR ITSELF.

IMAGES LEFT **MUSEUM OF TOLERANCE** RIGHT **LIMINAL IRISH DESIGN**

NORDIC ART

The Nordic countries have their own style in both architecture and art. Some of this art should be exhibited by local artists which is a good way of showcasing Finnish art to the world.

MODERN ART

Modern art should be the main focus in the museum. Flexible spaces should be present in the museum for various of types of exhibitions; both big and small. These kind of exhibitions could generally fill out a good amount of the space at the museum, so this should be as functioning as possible.

PERMANENT COLLECTION

The permanent collection should include various types of exhibitions that should be a permanent part of the museum. This collection includes paintings, sculptures and other types of art pieces from famous international and local artists.

OUTDOOR EXHIBITIONS

Sculptures are desired around the museum. These could be integrated with some exhibitions on the inside of the museum. The quality of the outdoor spaces would as well benefit from this.

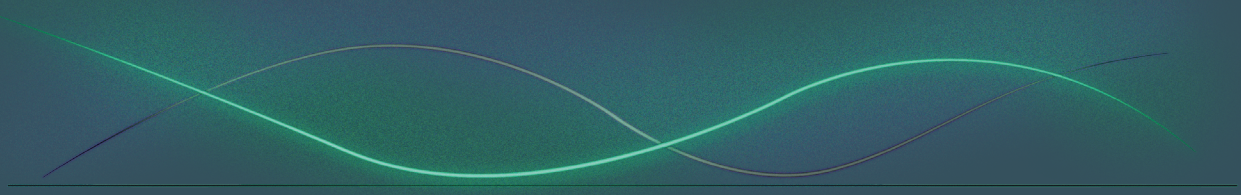
THE VISION

The new museum of Helsinki shall be able to gather both local and international visitors in an unique and pleasant environment. Flexibility shall play an important role of the internal design since the building would have to host diverse types of exhibitions. The rooms shall embrace the art with their warm and extraordinary atmosphere, while the visitor can transcend into a different world of art and architecture. The spaces of the museum should be able to evoke different senses and a play of spacial quality, materials, daylight and artificial light should be present to further emphasize the art which plays the main character in this simple and clean proscenium.

The museum shall be designed as a piece of architecture which incorporates various theories of sustainable approach. The design of the museum shall embody passive and active strategies in order to achieve good atmospheric and thermal comfort and minimizing the footprint of the environment. The museum should be a prominent piece of architecture on the South Harbor of Helsinki and function as a symbol of the City. Although being an iconic building, it should still function well and communicate with the surroundings. Principles of nordic architecture and tectonic have to be integrated in the structural process which can help to create an honest and clear expression.

Concept

The building should emerge from the ground and be an appendix of the site but with its own life, giving character to the whole area. It should be spectacular and impressive whilst being humble and modest. Simplicity and fluency should play a crucial role in order to link the sea, the park and the sky.



FEATURE THREE

THE CREATIVE JOURNEY

Designing a museum for the first time required insight and understanding. This needed to be well integrated in the designing of the project and throughout the rest of the phases. Shapes and scales have been investigated by using various tools.

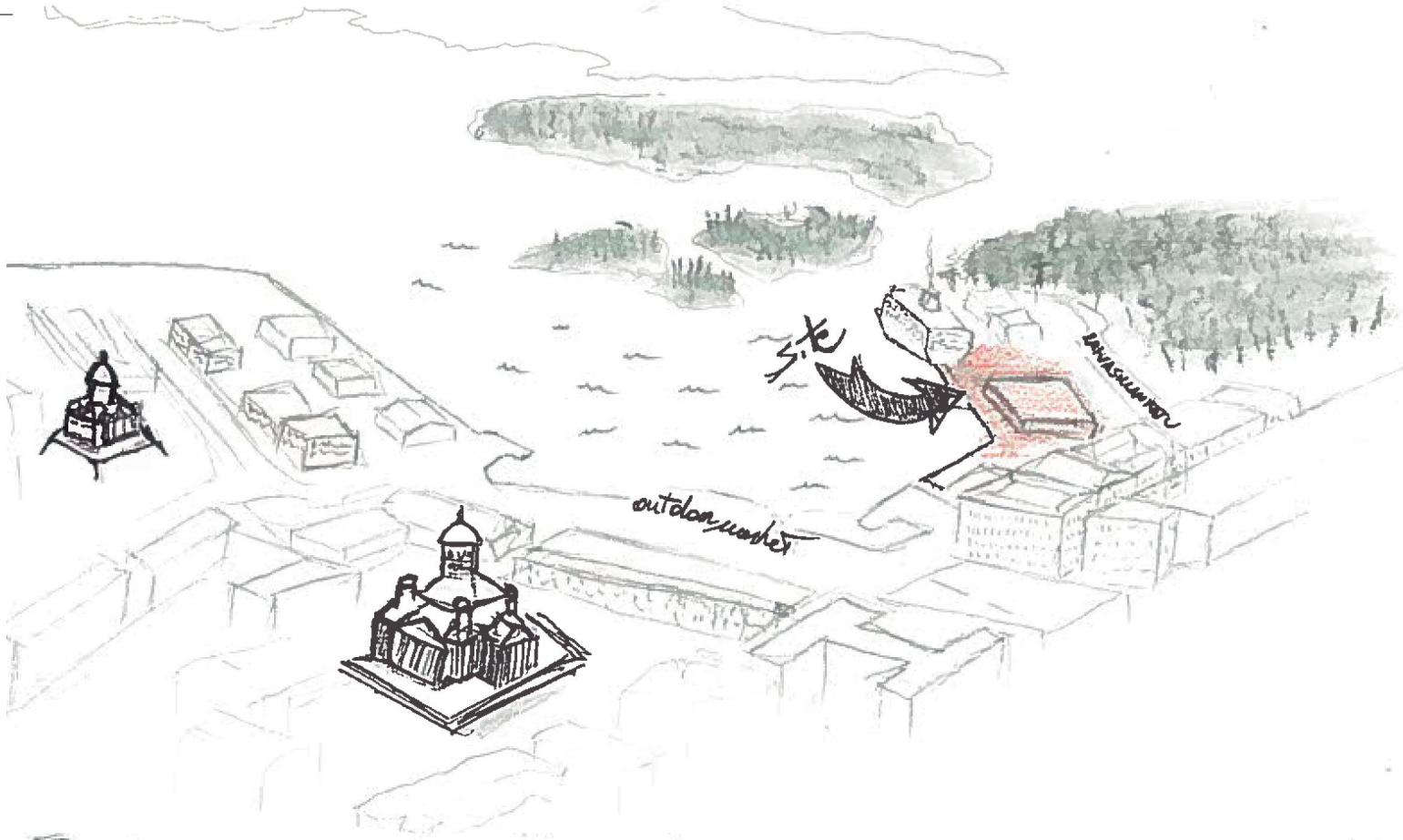
In this feature section, The Creative Journey, we are exploring shapes and approaches for designing with the soul purpose of using our concept and vision as a 'north star' to reach the most satisfying result. A visual experience in form of pictures and illustrations is laid out to explain some of the methods used .

PHOTOGRAPHY **LEAFS**

Shaped With Soul

DESNING A MUSEUM CAN HAVE MANY APPROACHES. OURS CAME FROM A DESIRE TO MAKE A MUSEUM WITH BEAUTIFUL SPACES AND EXPERIENCES BEHIND EVERY 'CORNER'.

The initial stage was to roughly sketch different forms and shapes which worked as the first brainstorming. Here, the overall picture of the area was the main focus where fluent shapes kept on appearing on the paper. The shape of the site invited us to create long and dynamic forms that would follow the lines of the streets, park and the wharf. In this initial stage we also thought of a use of ramps as the main way to move around in the building. This were already established early in the phase to exploit the length of the site. Curved lines were mostly used to form the building in order to fulfill our expectations which made it seem natural and organic. Flows were also considered which helped us orient certain functions already in the beginning. Initially perspective sketches were made to get an understanding of the atmosphere and get a sense of the scale. Later, both rough plans and elevations were made to more in depth understand the functionality and the views from different angles on the ground. Important decisions were made already at this stage, like connecting the building with the observatory park, which is a very interesting and appealing area within the city. Thoughts of using the site as a canvas, gave us the idea to cut through the ground and pull up the slices like it was a sheet of fabric. Basic climate parameters were taken in consideration when positioning the buildings and some of its functions. This were later further investigated with the help of modern tools and parametric design.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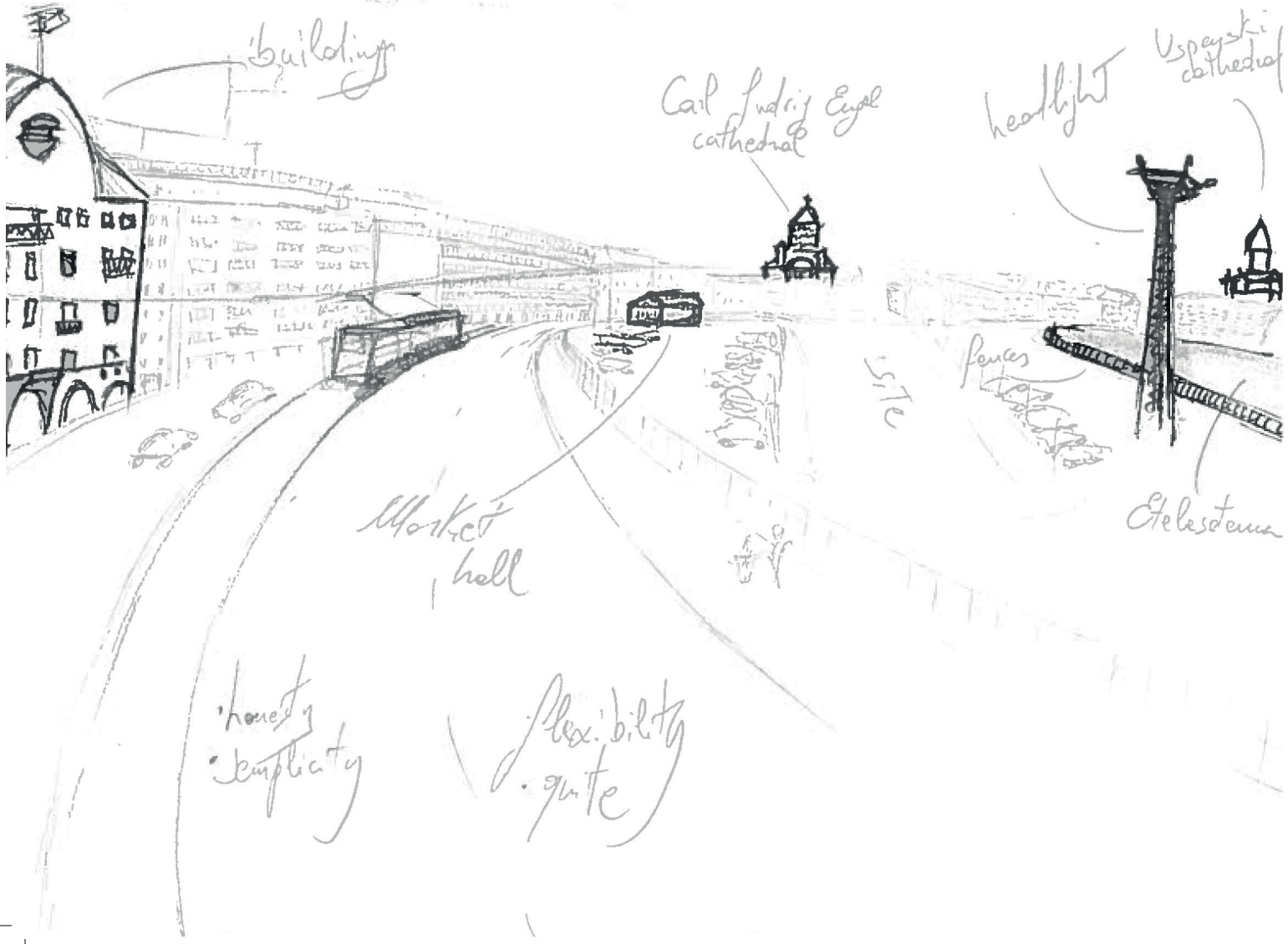
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Market hall
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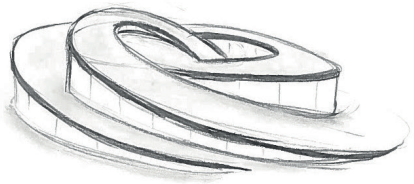
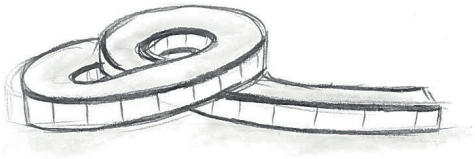
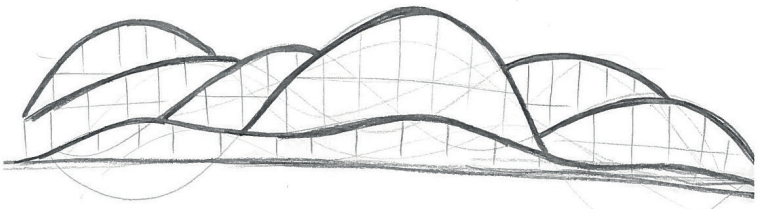
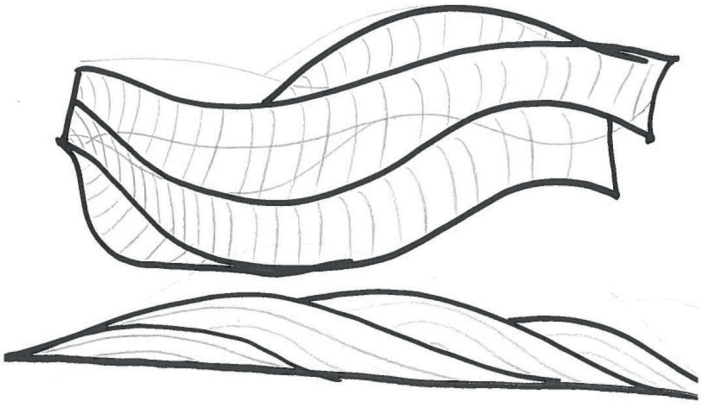
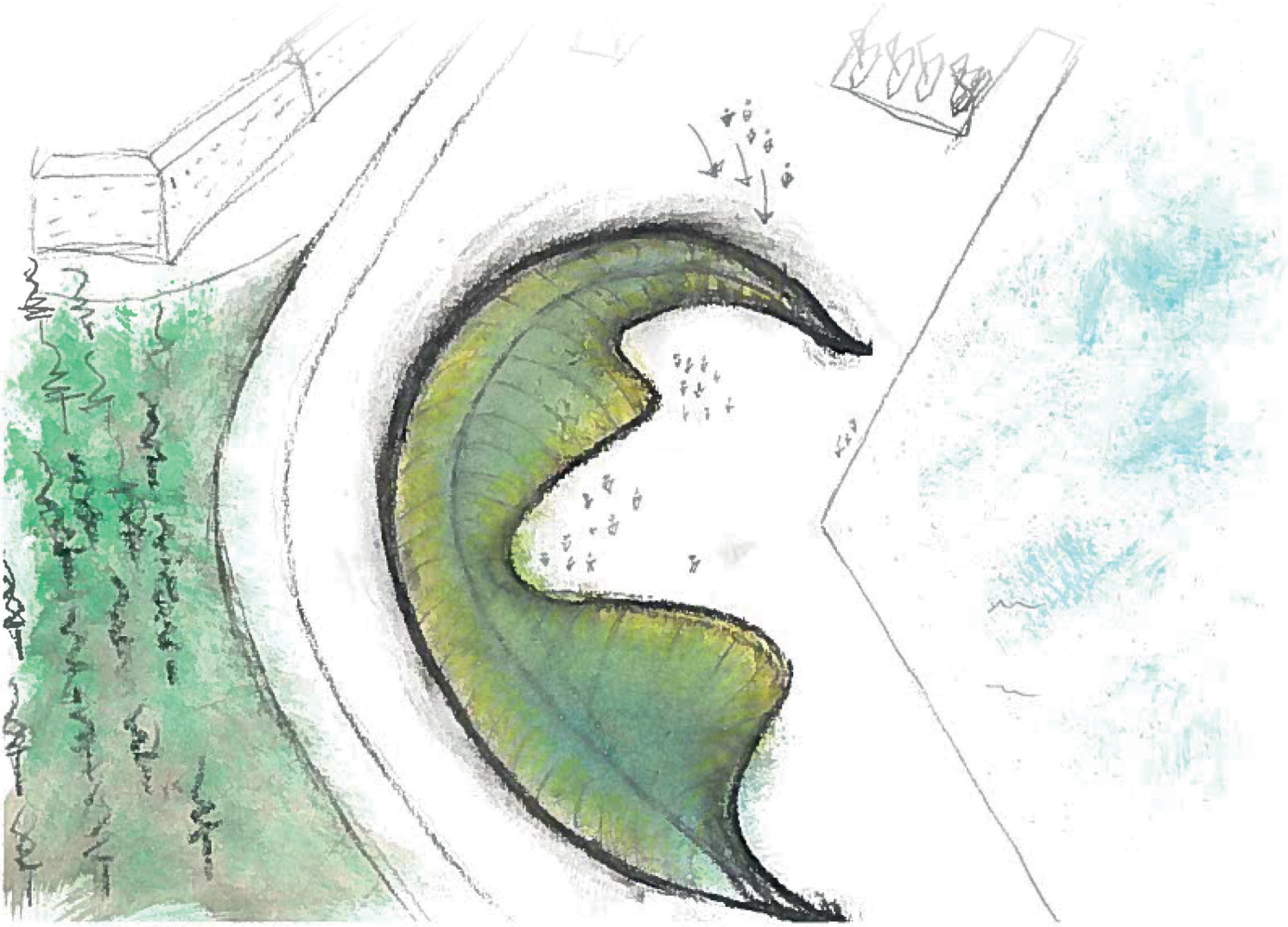






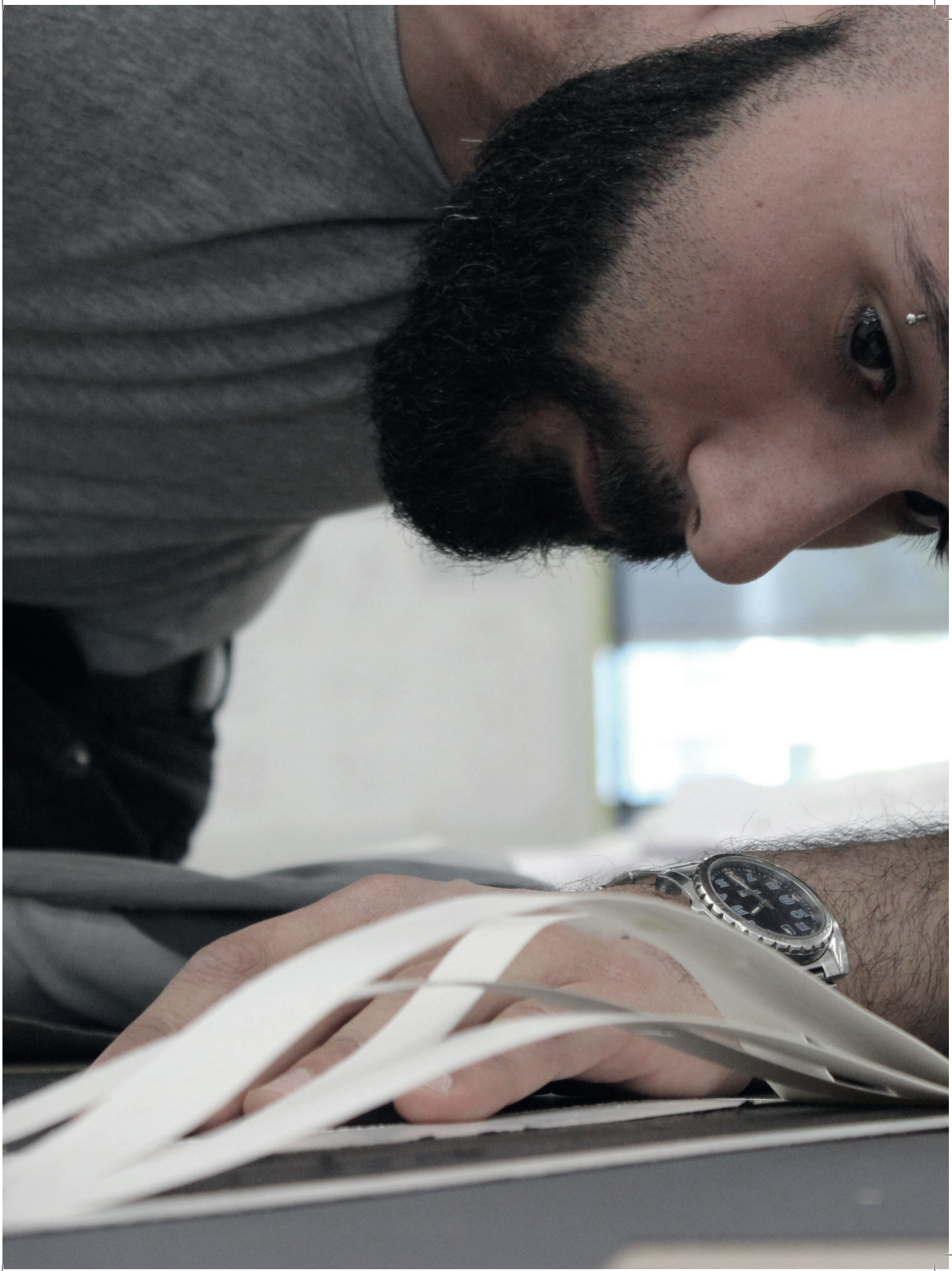


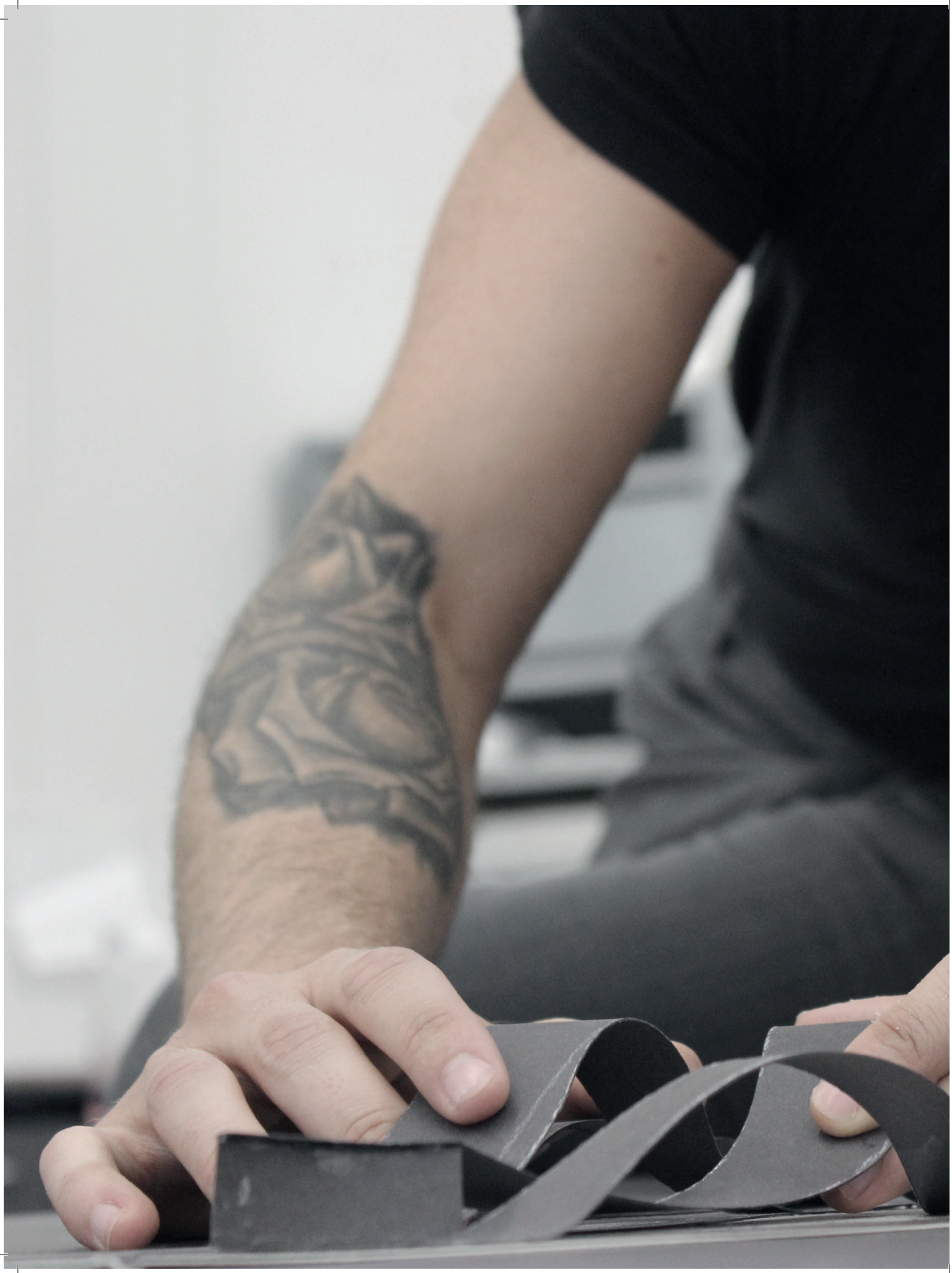


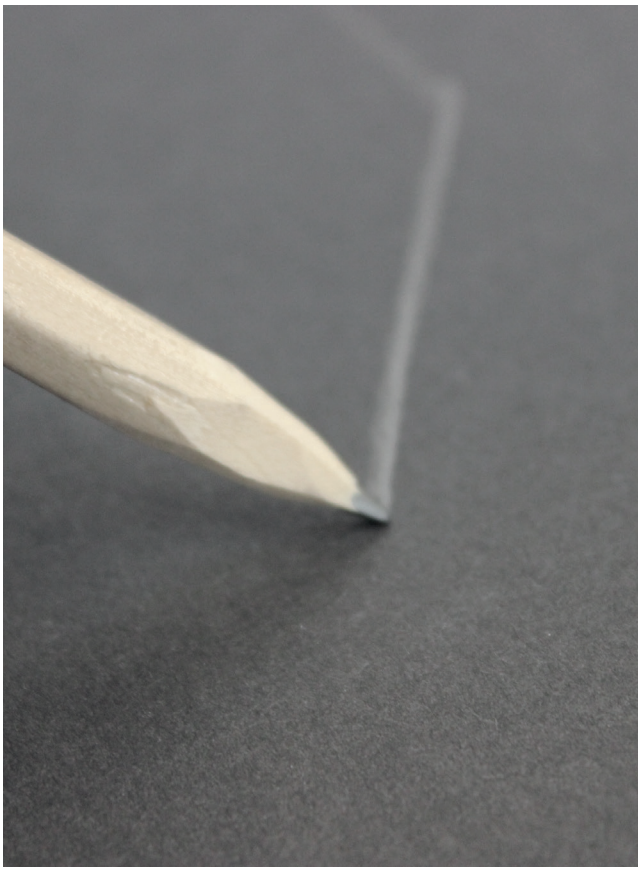
From Sketching to Modeling

GETTING A BETTER UNDERSTANDING OF SPACIAL QUALITY

The second phase in our design process was to make our drawings more concrete. The way of working was to have different workshops with a duration of 2 weeks where following where investigated: Scale, Shape, Functions, Sun and light. The strategy was to shape the building starting from the external to the internal form factor.
For this purpose we chose to work with physical models which gave us a more flexible way of working with curved forms and hereby adjust the scale to the site. To get a better understanding of the surroundings a context model was made that would be used as a scale compass and for putting our model footprint onto.
Shaping the building was an interesting venture that required us to play with the advantages of the paper. By cutting through these thin white sheets it made it possible for us to be creative and experiment with endless possibilities of organic shapes. To have some boundaries we chose to incorporate the functions. By adding the important spaces to the design at this point the building started to develop. Four sections were thought to house all of the functions of the museum. The result of this step was an initial stage of the final product.
The orientation and placement of the functions in the building has been controlled by the sun. Since some rooms require more daylight that others, it was important to adjust the necessary dimensions accordingly. The offices and cafe were places on the outer part of the building while the main museum functions were placed in the central part. This would give us the flexibility to later adjust according to glazing areas.





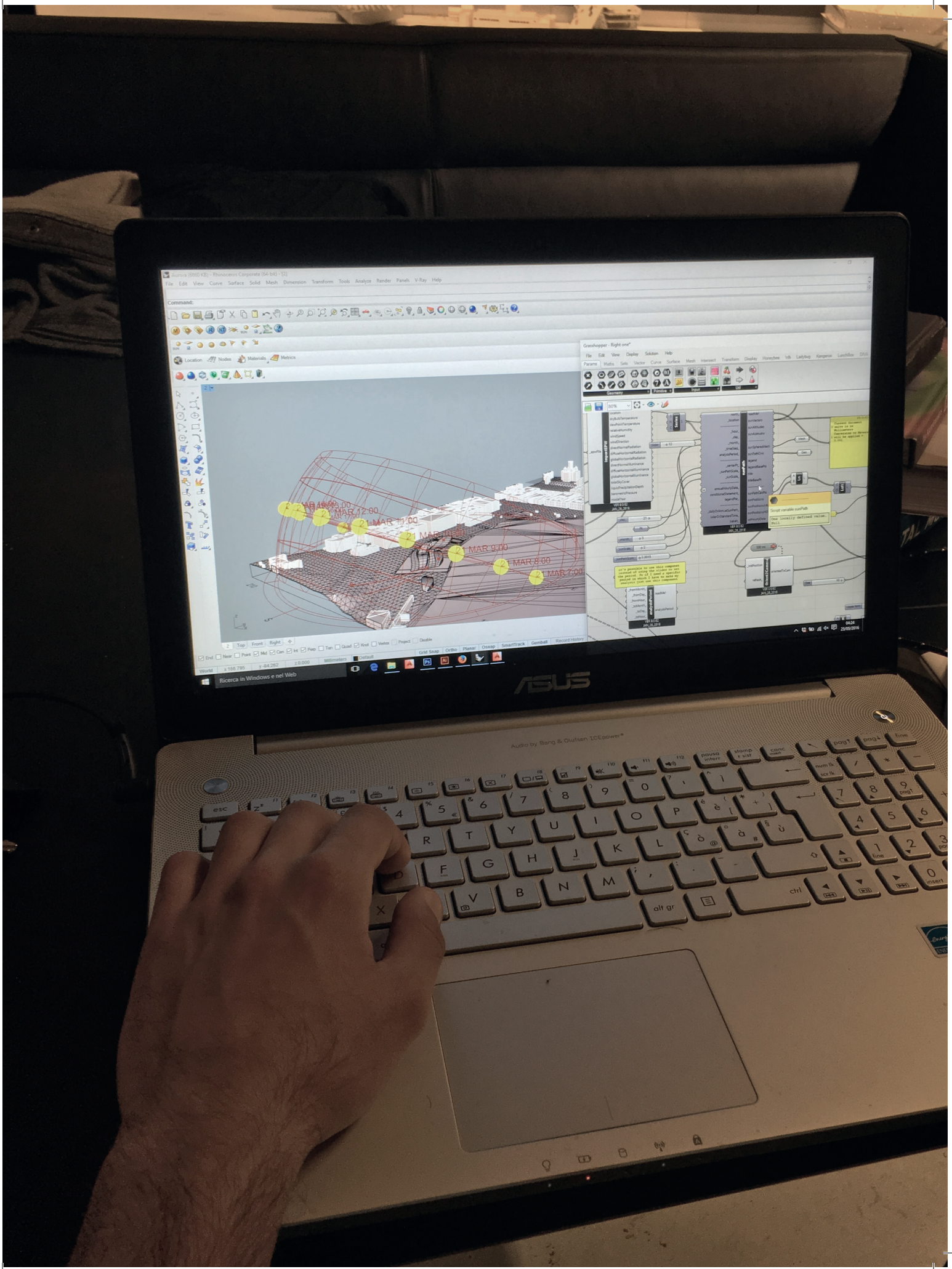


Performance Aided Design

BY USING PAD SOFTWARE WE CAN ADJUST THE DESIGN ACCORDING TO SUNLIGHT, WIND SHADOWS AND MORE.

The following step was necessary to adjust the design with the aim of reaching the most optimal position, shape and orientation for the building and its functions. This strategy was adopted to make the building more sustainable and minimize the energy consumption.
A plugin tool to the software Rhinoceros, Grasshopper, were used to reproduce the shape which has been made during the previous stage. Grasshopper made it possible for us to change some parts of the building according to our key parameters which are: sun path, wind, daylight, orientation and the dimension requirements provided by the competition brief.
After some analysis we figured out that the building in general had good conditions. The cafe had some undesired spacial qualities and position on the site, where we wanted a more Northern orientation. Therefore a swap between the offices and the cafe had been made, which gave the desired qualities to both areas.
Since the offices had a very organic roof, it made it hard to make a functional design, we therefore simplified the roof in that area to ensure a more pleasant work environment and a more flexible space.

The different analysis made can be found in the Annex.


Grasshopper - Right one*
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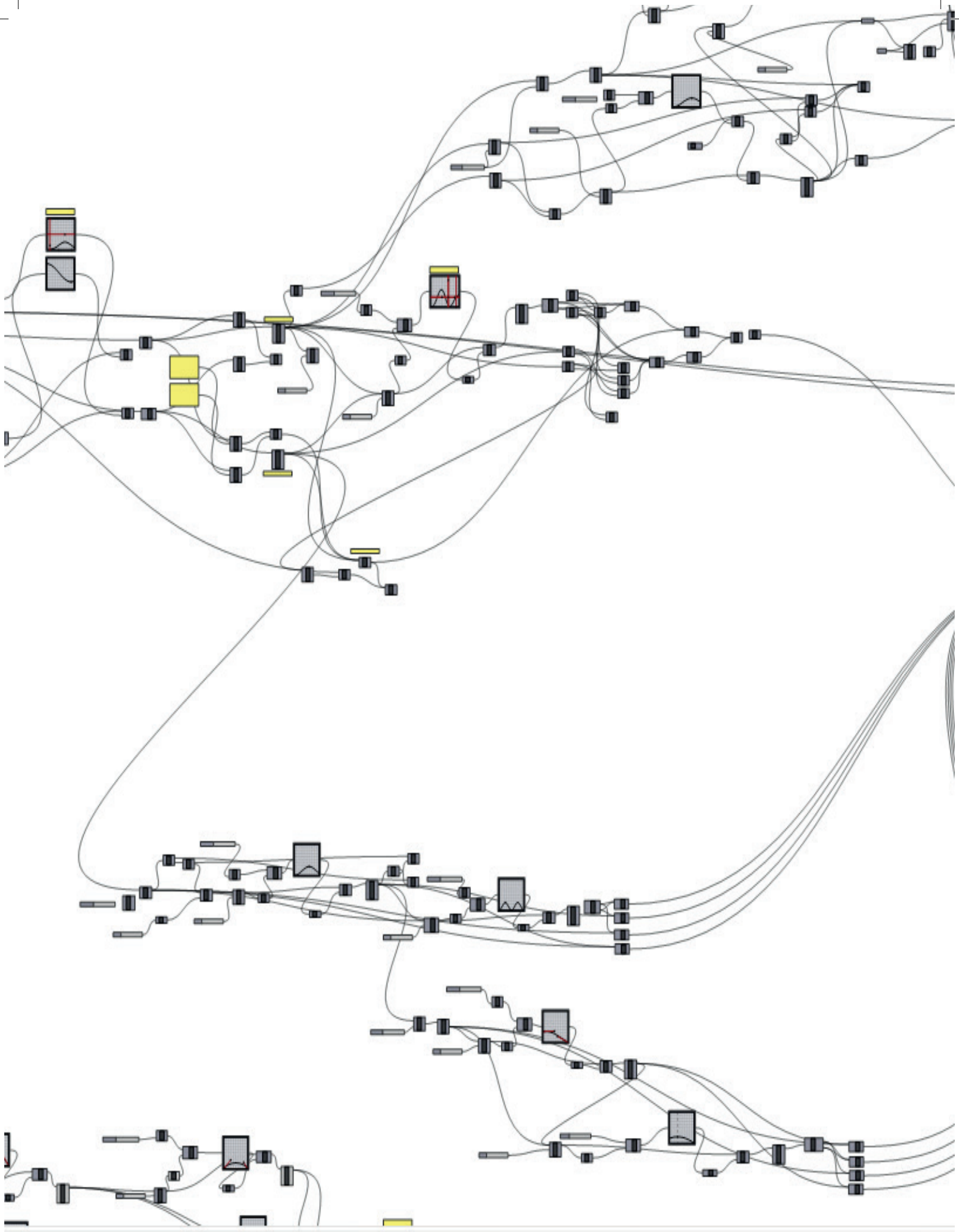
ASUS
Audio by Bang & Olufsen ICEpower*



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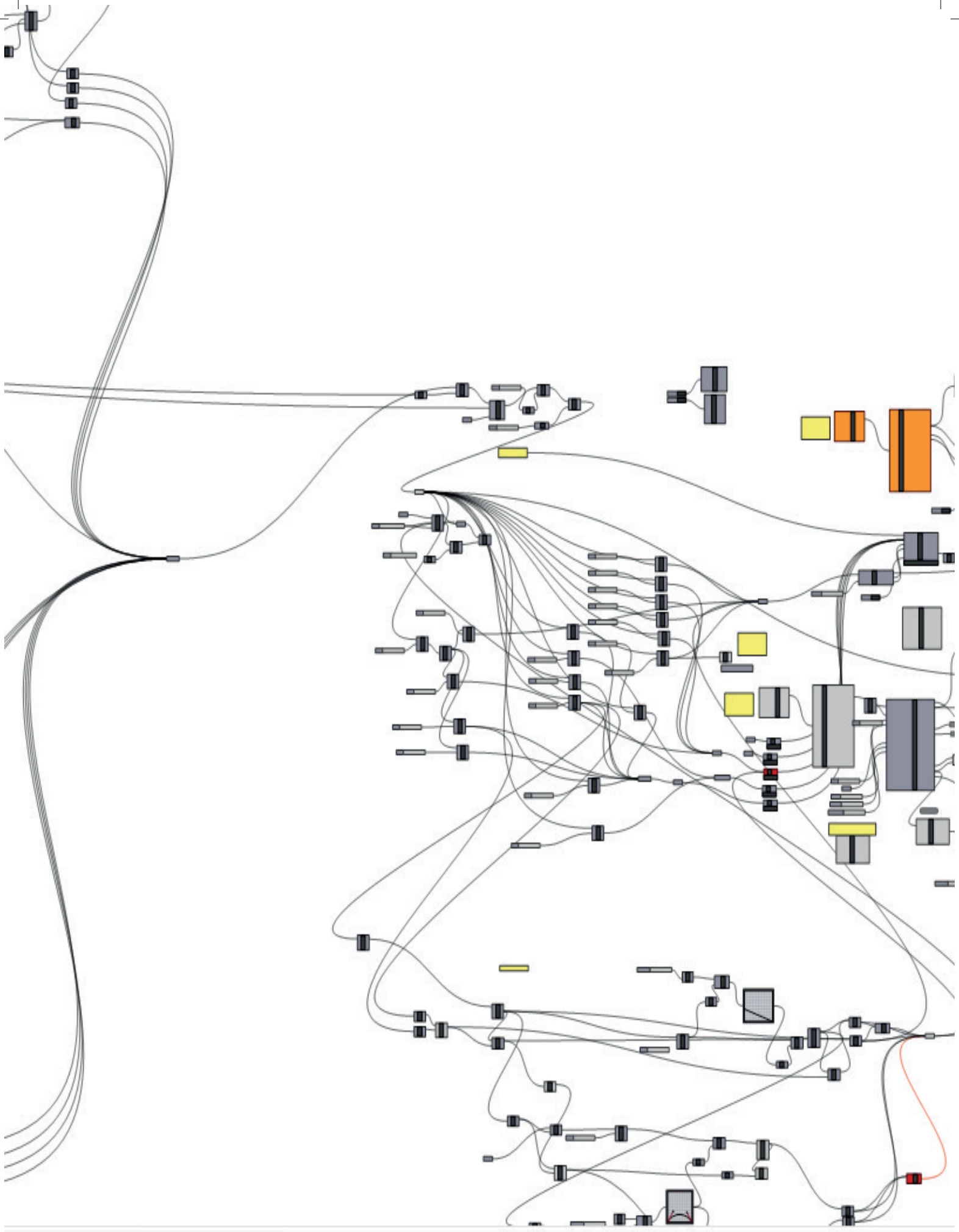
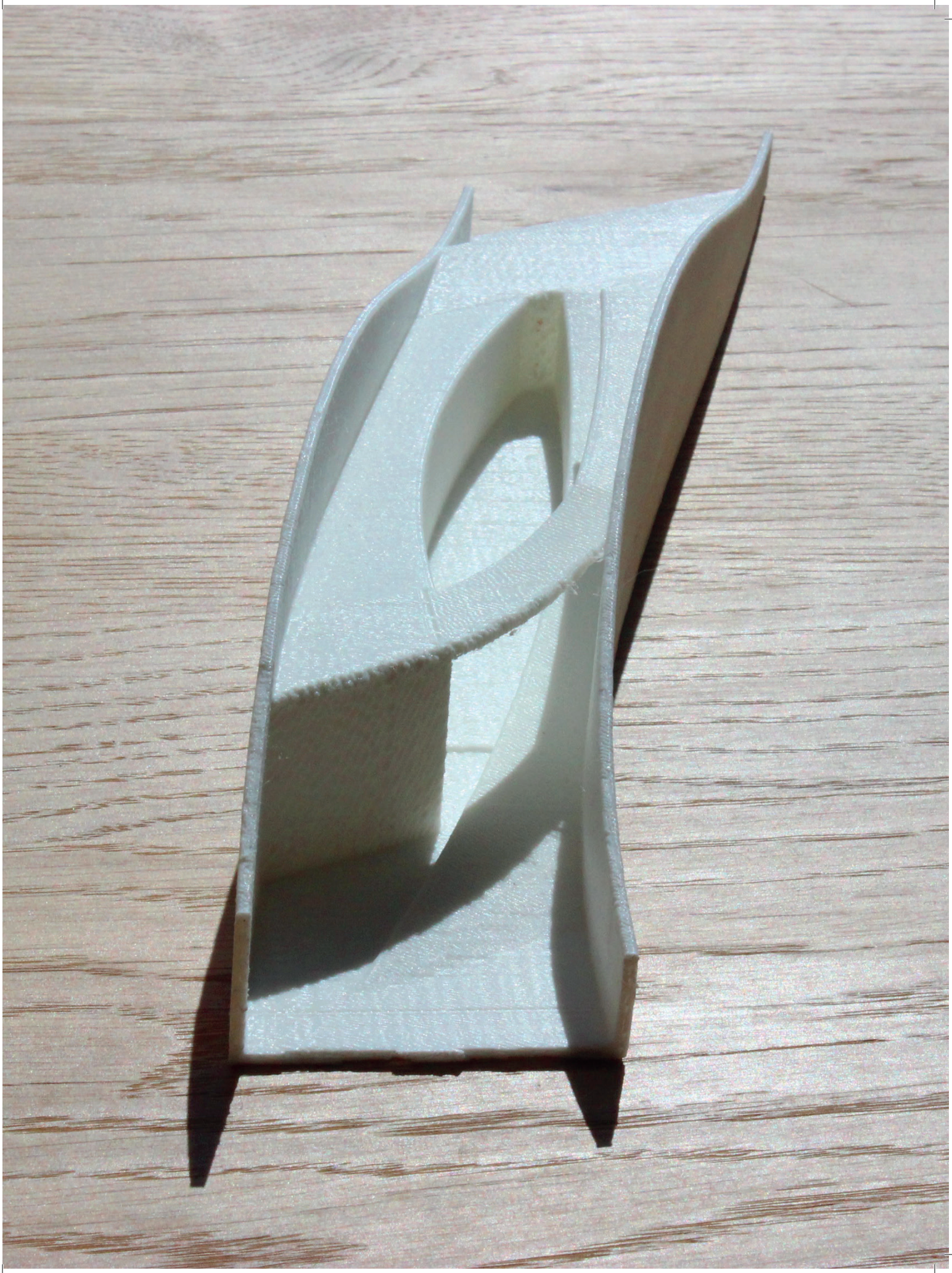
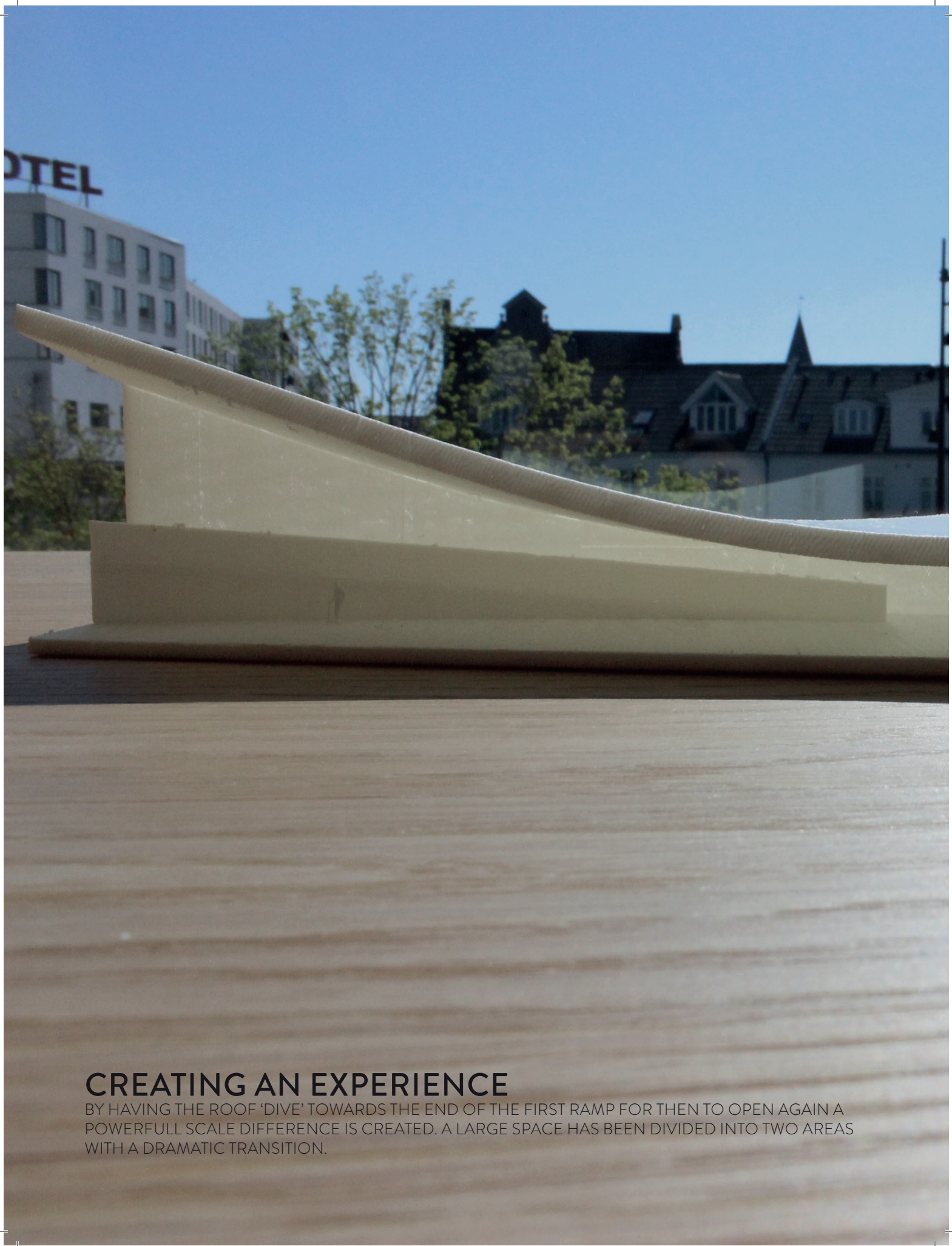


Sensing The Scale

3D PRINTING HAVE MADE IT EASIER TO GET AN UNDERSTANDING OF THE DIFFERNT SCALES WE ARE WORKING WITH.

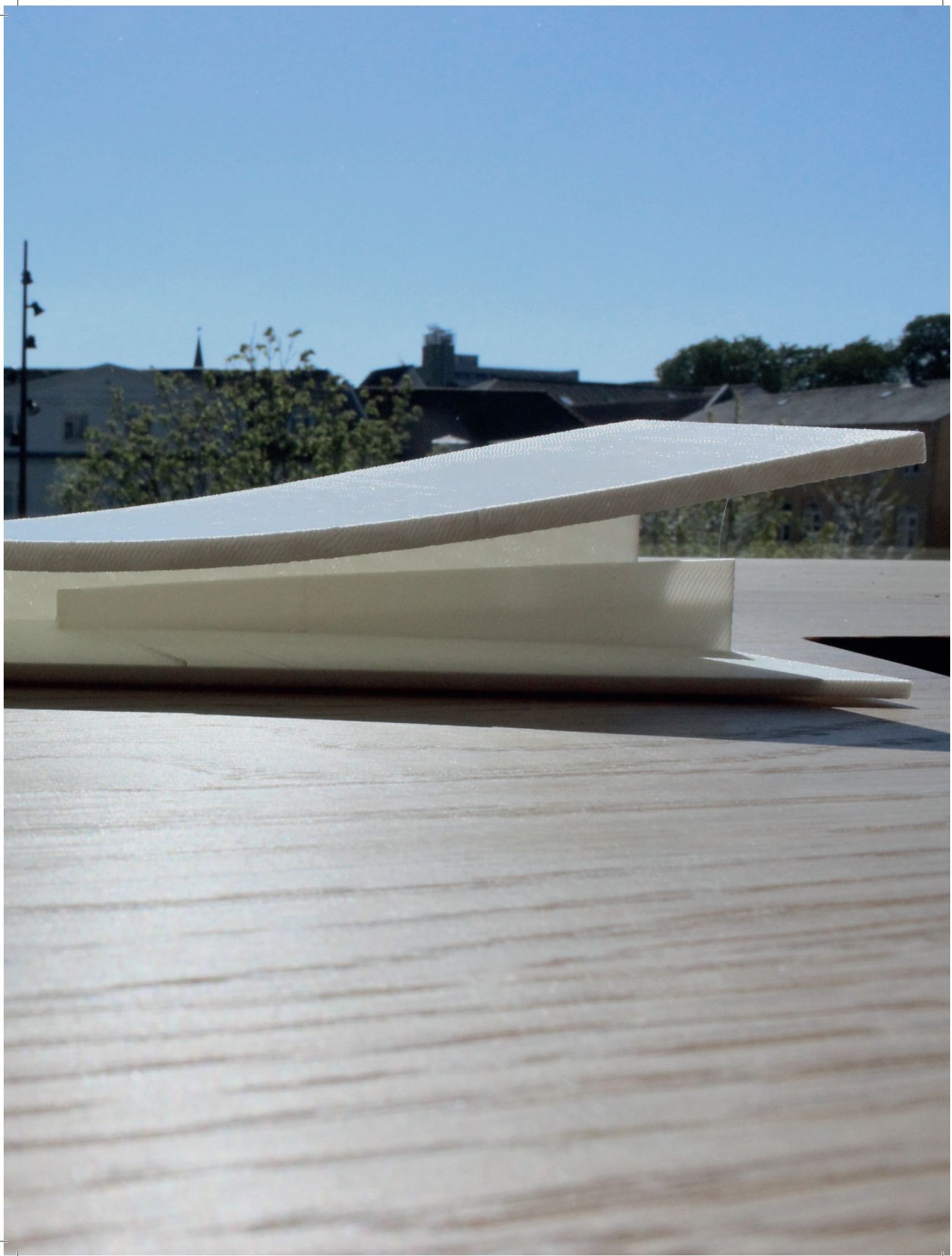
After the workshops which gave us the possibility to optimize our building it felt necessary to sense the atmospheres and spacial qualities to ensure that we are living up to our design parameters from the concept and the vision.
Making models by hand can be difficult, especially when having an organic model. 3D printing has made it possible for us to take the models made from grasshopper and make a real life model out of plastic, which can be physically investigated. By doing this, we have gotten a feeling of the individual spaces and the scale. This was a very important factor for us to understand since the scales had to vary throughout the museum.



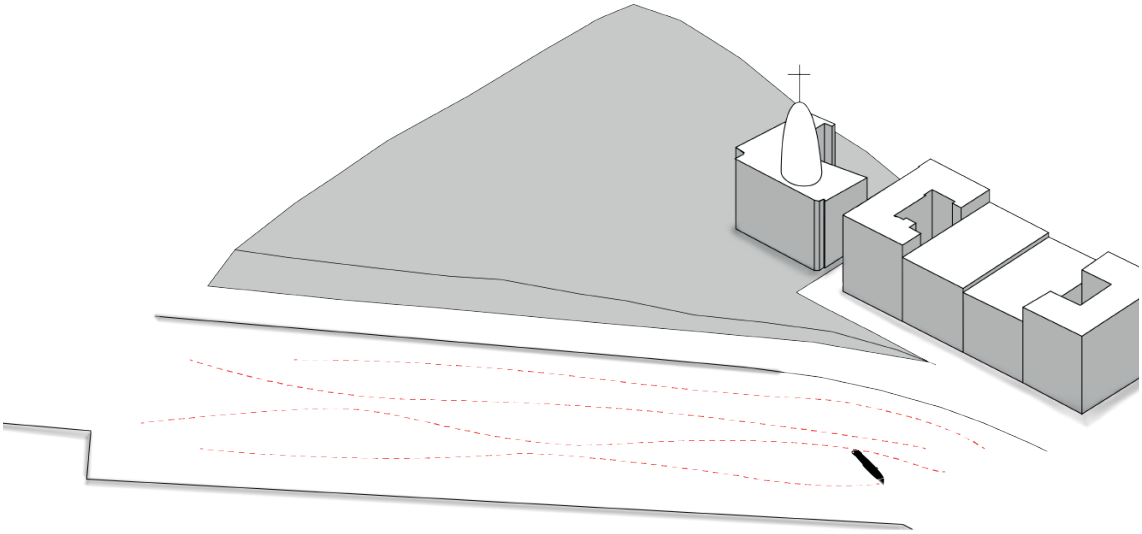


CREATING AN EXPERIENCE

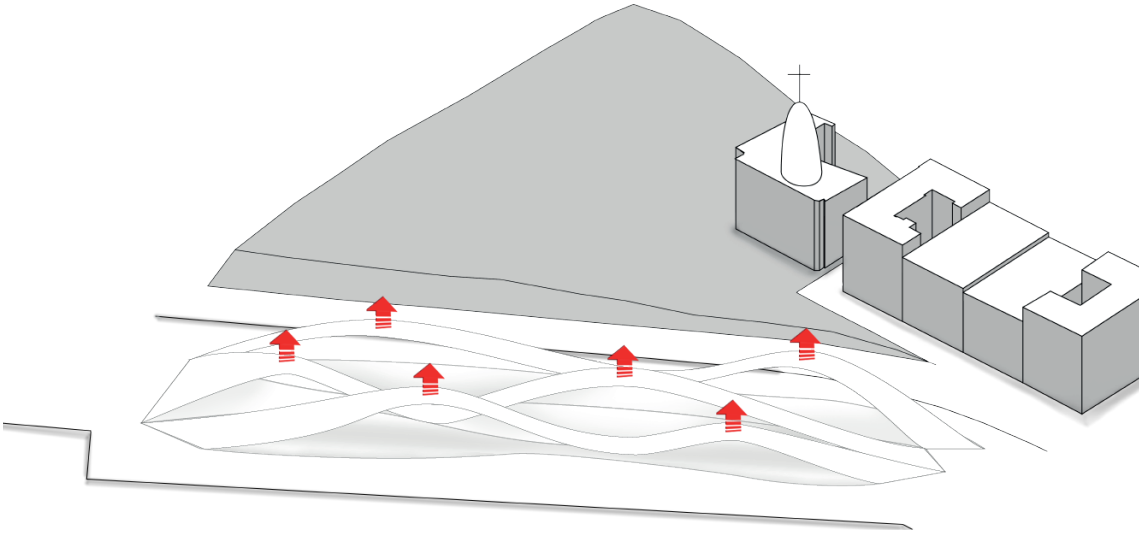
BY HAVING THE ROOF ‘DIVE’ TOWARDS THE END OF THE FIRST RAMP FOR THEN TO OPEN AGAIN A POWERFULL SCALE DIFFERENCE IS CREATED. A LARGE SPACE HAS BEEN DIVIDED INTO TWO AREAS WITH A DRAMATIC TRANSITION.



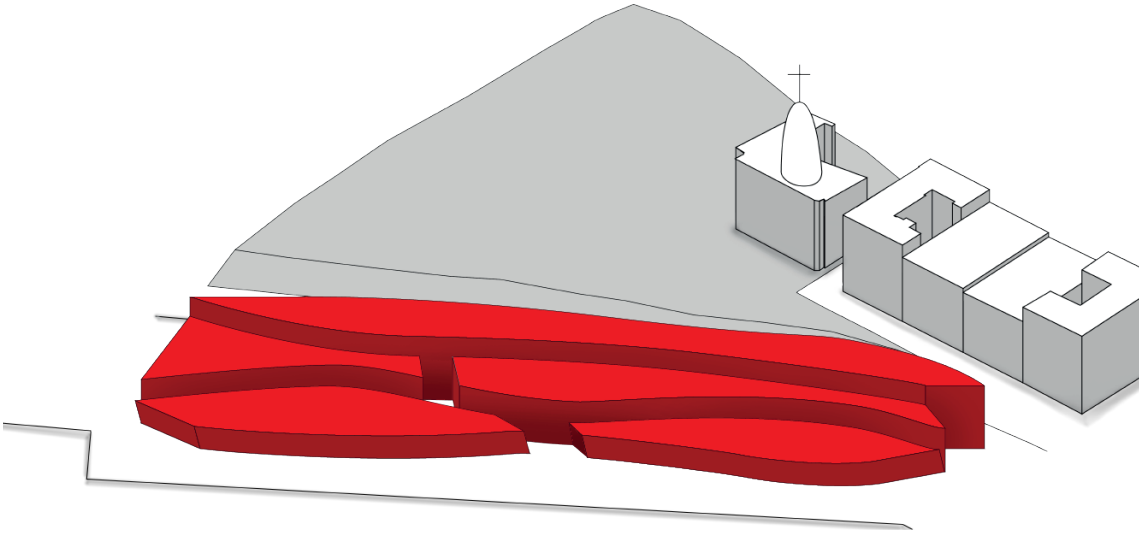
DIAGRAMATIC OVERVIEW



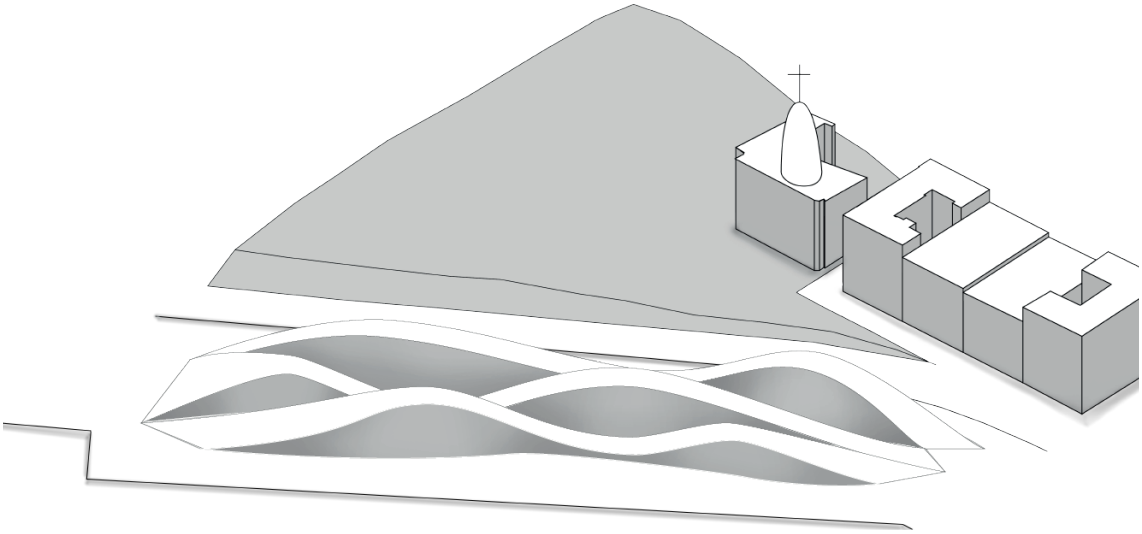
Incision is made in the site to simulate the natural lines of the surrounding streets, wharf and flows. This will ensure the possibilty of hollowing out the areas underneath. The urban tissue will later be repared.



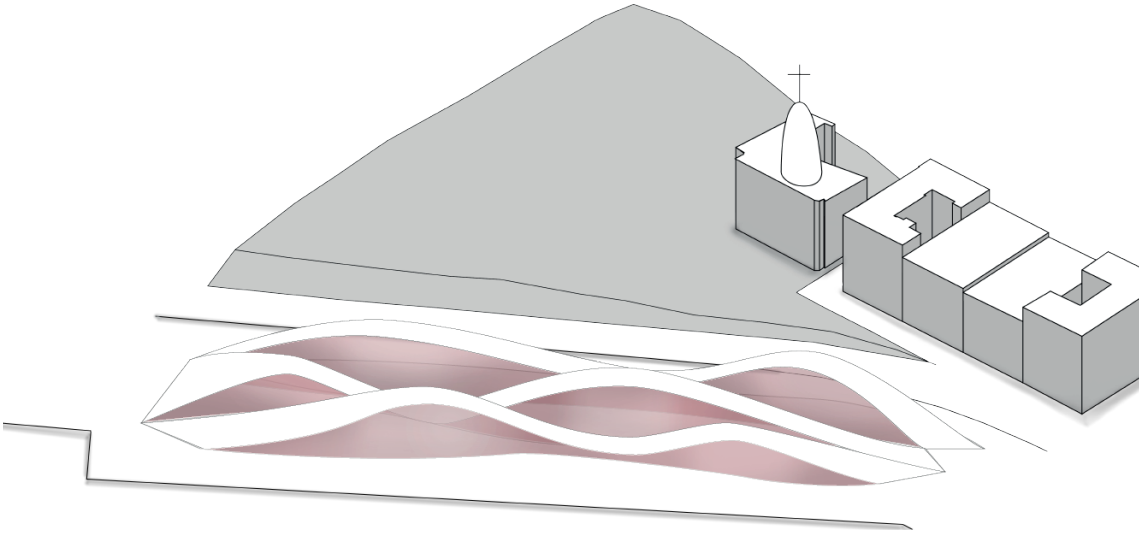
The earth is lifted up to create spaces underneath. Functions can be placed.



The important functions are inserted to investigate. There would be further development according to sun and light analysis.



The funtions is incorprated in the design and entrances are placed along the facades.



The model has gone through some daylight and direct sunlight investigations.

FEATURE FOUR

DEVELOPING THE PURE

To further develop the project necessary topics have to be covered. Necessary discussion have been made to make sure that the building will end up as intended. The details of having to choose a material that fits to the building, a good indoor environment and a structure that will support the light design and allow us to make a unique building is some of the key topics discussed in this chapter.

In this feature section, *Developing the Pure*, it is explained how and why certain decisions were made. Having a design that is this simple by idea is not necessary simple to realize which is why certain studies have been made to ensure that it is possible to achieve the final result. Furthermore specific products have been chosen to ensure that the quality can live up to the expectations for the many parts of the museum.

PHOTOGRAPHY **REFLECTIONS**

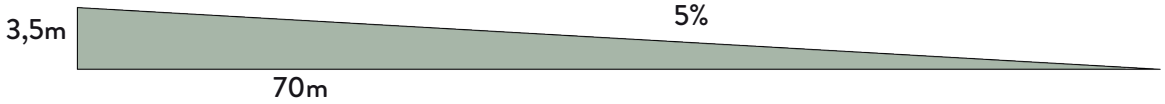
Connecting the Levels

RAMPS ARE MADE TO AVOID BOTH STAIRS AND ELEVATORS IN THE PUBLIC AREAS

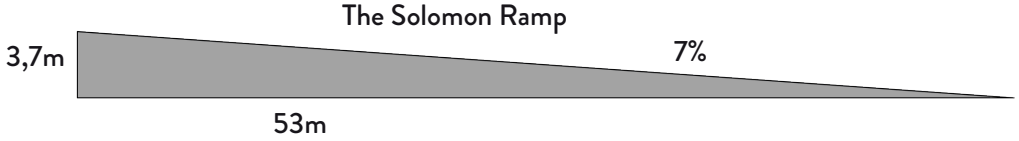
To avoid having stairs and elevators in the museum, we decided to use ramps as the main connector and an element that makes the building stand out. The ramps were made based on the rules of the Finnish Regulations. We decided to use the same material as the floors in order to have a continuous flow inside the building so the same expression as the exterior can be achieved. The walls containing the handrail are extruded up to 1,60m with the purpose of controling the gaze of the people walking on the ramps.
The different inclinations and the length can be seen on the following diagrams. The Solomon Ramp is an exception which has a steeper inclination than the other ramps. This is due to the fact that it should be a part of the exhibition and function as art itself.

Entrance Ramp

Exhibition Ramps

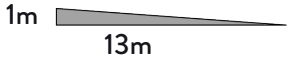


The Solomon Ramp



The Solomon Ramp

The Solomon Ramp

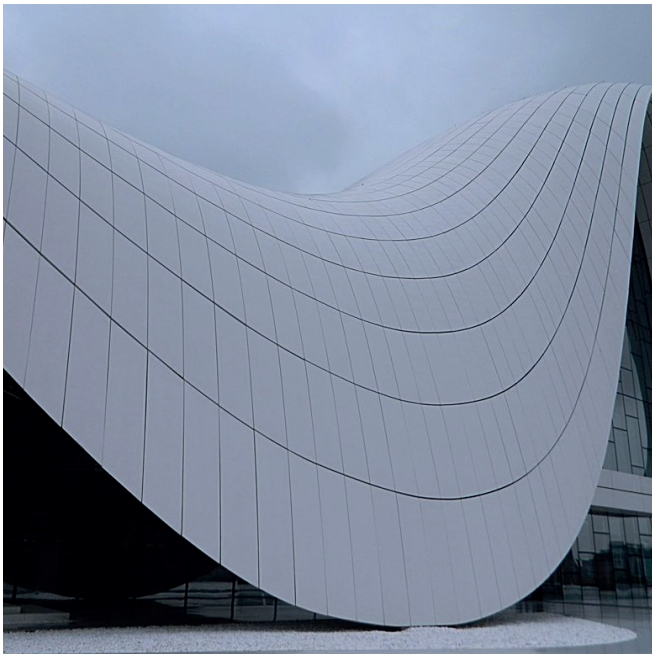


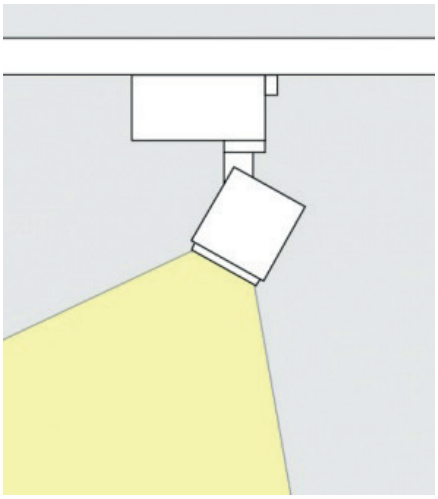
Materiality and Texture

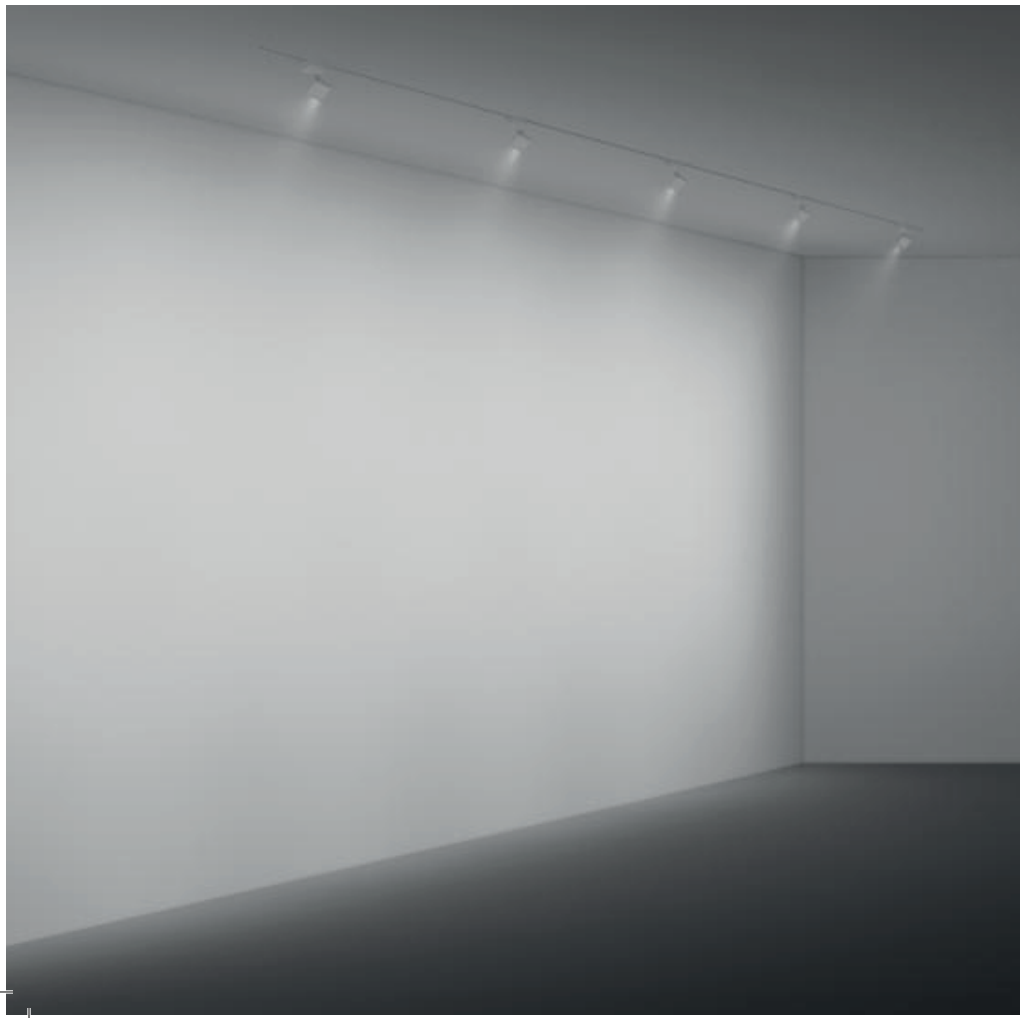
USING MATERIALS FOR EMPHASIZING THE SHAPE AND TEXTURE OF THE BUILDING IS A VITAL PARAMETER TO ACHIEVE A COMPLETE DESIGN.

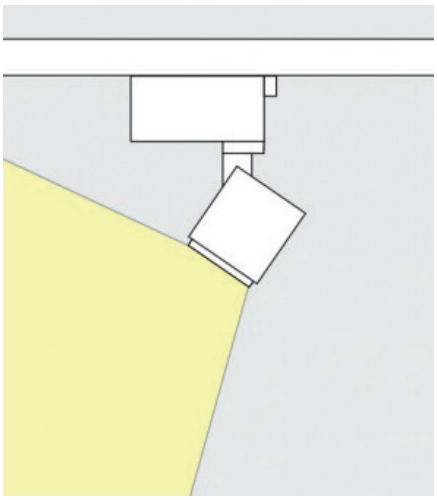
IMAGE TOP **HAMILTON** BOTTOM LEFT **HEYDAR** BOTTOM RIGHT **OAK**

As we want the building to be an extension of the site the materials for the external pavement and the material for the roof have to be similar. We strive to achieve a homogeneous surface to embody the fluidity of the waves of the aurora. For this reason our choise was to use Glass Fiber Reinforced Polyester (GFRB) which is, in our case, the ideal material for the cladding due to the fact that has optimal plastic characteristics.
For the interior cladding on the ceiling regular plastic panels are chosen to continue the same expression, while glossy concrete are used for the floors. This is to achieve a wet effect which can simulate a water-like look that emphasizes the fact that the building is on the same level as the sea.
Wood materials are used in the cafe, the office and the auditorium. Oak has been chosen as the main wood material.
Curtain walls are installed in the offices, café and for the entrance while Channel Glass are used on all the other external walls.
Furthermore the tiles used for the ourdoor pavement are regular concrete tiles that matches the texture on the roof to ensure a continuous expression.









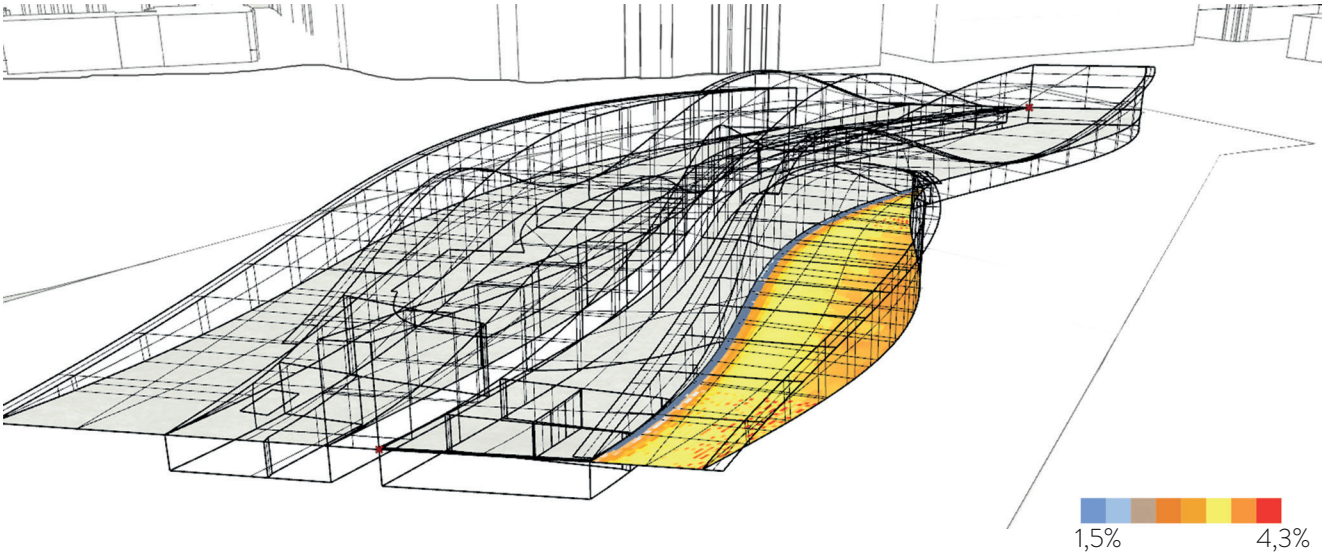
Lighting It Up

ARTIFICIAL LIGHT IS AN IMPORTANT PARAMETER TO TAKE INTO ACCOUNT WHEN MAKING A MUSEUM BUT ARTIFICIAL LIGHT COMES IN MANY VARIANCES.

ILLUSTRATIONS **ERCO**

Lighting is an important part to investigate and use in a museum. Not only for the visual quality but also for the overall experience and flexibility of possible setups. To make sure that the whole building is fully flexible regarding light an Erco System has been adopted. Erco offers great possibility to adjust, remove and add lighting in various areas. This is possible due to the fact that it has a railing system which will be separately installed where many different lighting systems can be installed hereby.

In our case it was important to know that there are many different kind of light casting, which each has their main purpose. We are mainly using wall-washers, Spotlights and floodlights which gives the possibility to have the right light on basically any given type of art. The optimal angle for these light are 30 degrees which has also been thought into the design and the placement of the rails. [Erco,2016]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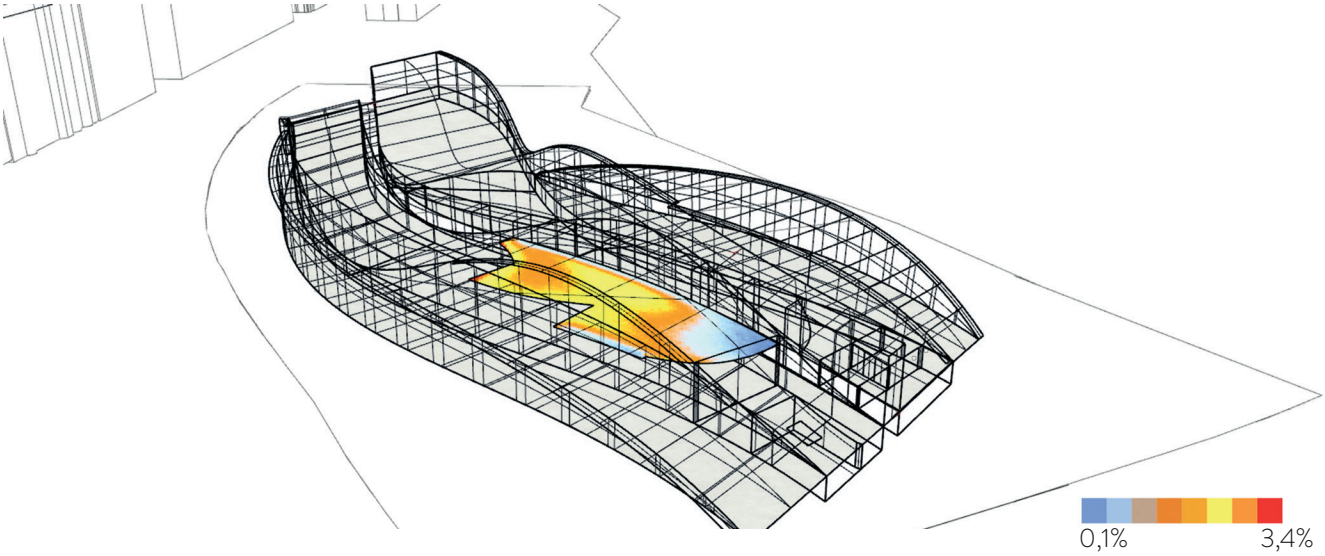
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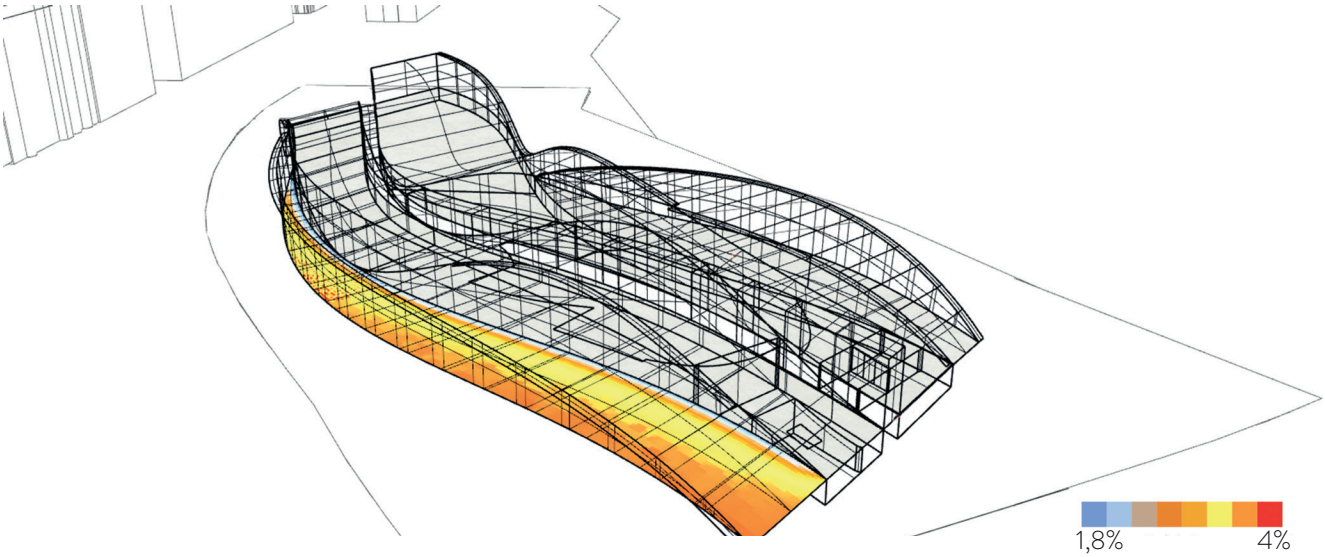
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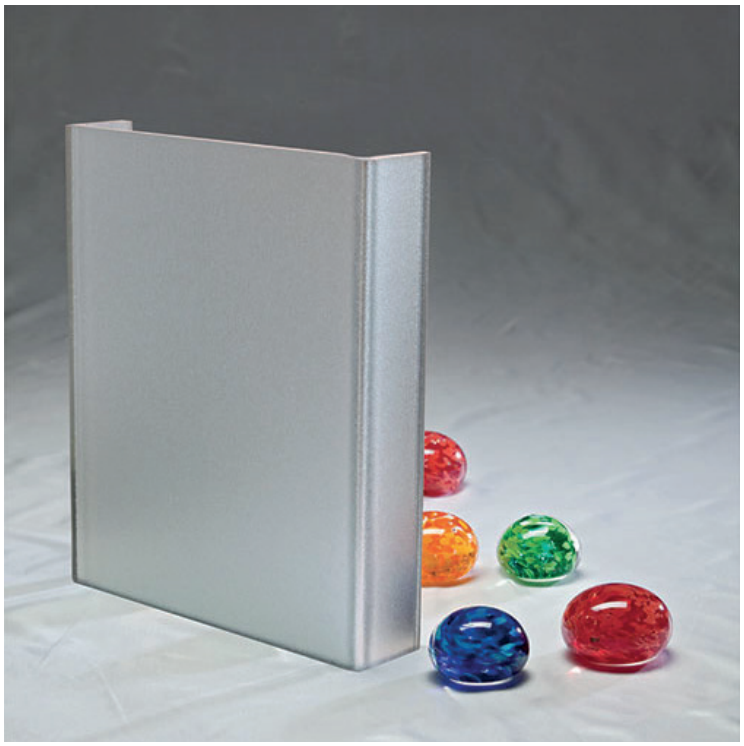
Let There Be Light

NATURAL LIGHT; ALTHOUGH UNWANTED IN MANY CASES CERTAIN AREAS IN A MUSEUM, CAN BE A WONDERFULL ADDITION FOR MANY SPACES.

The daylight factor is the percentage of the internal light in relation to the external light level, measured in Lux. The outdoor daylight is measured based upon the Standard CIE overcast sky. According to Danish regulations, a sufficient indoor daylight is reached when the calculation can demonstrate that in workrooms, kitchens or habitable rooms the factor is at least 2% in the work zone, meaning toilets and closets are not included. Moreover, another statement assumes that the daylight level in workrooms can usually be taken to be sufficient if the glazed area corresponds to a minimum of 10% of the room floor area. The diagrams show three different daylight analysis of the principal rooms in the museum: the upper exhibition room, the offices and the café.
Other than having an aesthetical reason, the roof extension of 2 meters over some of the glazed façades of the museum, like the offices and café ones, has the purpose of reducing the amount of direct sunlight throughout the windows. Moreover, in all the curtain walls a shading system is installed.



Channel Glass

GETTING NATURAL LIGHT INTO THE MUSEUM IS EQUALLY IMPORTANT AS PROTECTING THE ART INSIDE. WITH A LOW LIGHT AND SOLAR TRANSMITTTANCE CHANNEL GLASS IS THE PERFECT CHOICE.

IMAGE TOP **SAMPLE OF GLASS** IMAGE BOTTOM **CHANNEL GLASS**

Along the perimeter of the exhibition rooms, it has been decided to place a particular glass which has extraordinary characteristic. This particular product, called Channel Glass, consists of self-supporting glass channels, which obstacles the vision but allow the light to pass through. We chose this material for different reasons: to avoid direct sunlight (in order to do not damage the art exhibited but at the same time to achieve a good indoor daylight) and to keep the purity of the interior space without any external distractions made from the landscape. For this reason, in the highest part of the museum, where the Solomon R. Room is located, we designed a view point from which the visitors can enjoy the landscape.
In particular, the channel glass that has been chosen is the "Lumira aerogel", a product which present a gel (described as a lattice work of glass strands with very small pores) in between the glass as insulation. It is recyclable and environmentally friendly. [TGPAmerica.com]
Some key factor and cons can be pointed out:

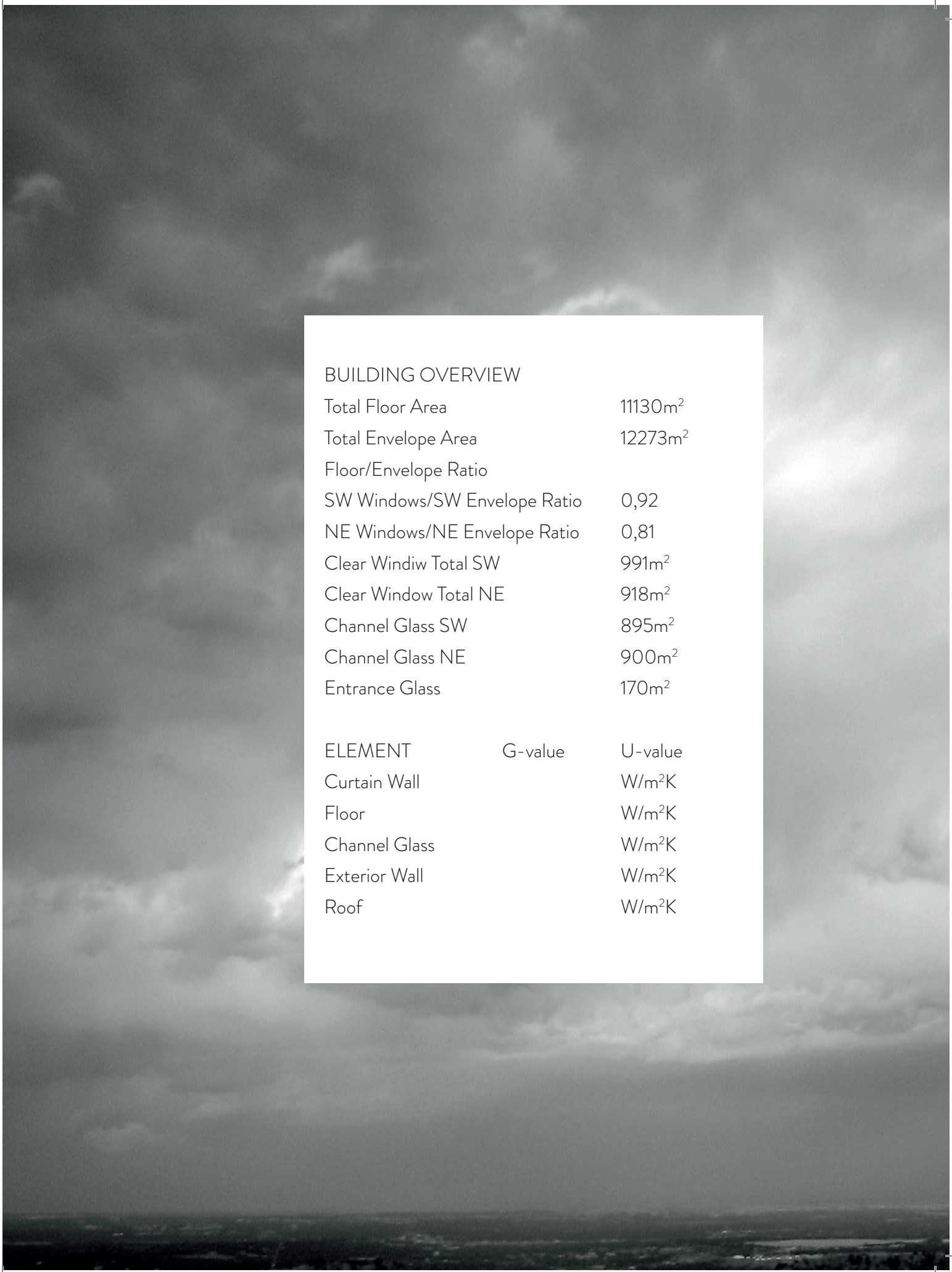
- Reduction of energy consumption
- Enhances daylight design
- Simplifies installation
- High cost of the product

Indoor Quality and Energy Consumption

BSIM AND BE15 CALCULATIONS HAVE BEEN MADE TO ENSURE A SUSTANABLE PROJECT

To ensure that the different functions have good indoor quality BSim has been used. Three different functions have been chosen to test out the quality of the interior climate. These includes the café, a large exhibition space and part of the office area. The simulation have been actively used to give the best results as possible and not force us to compromise on the design of the building.

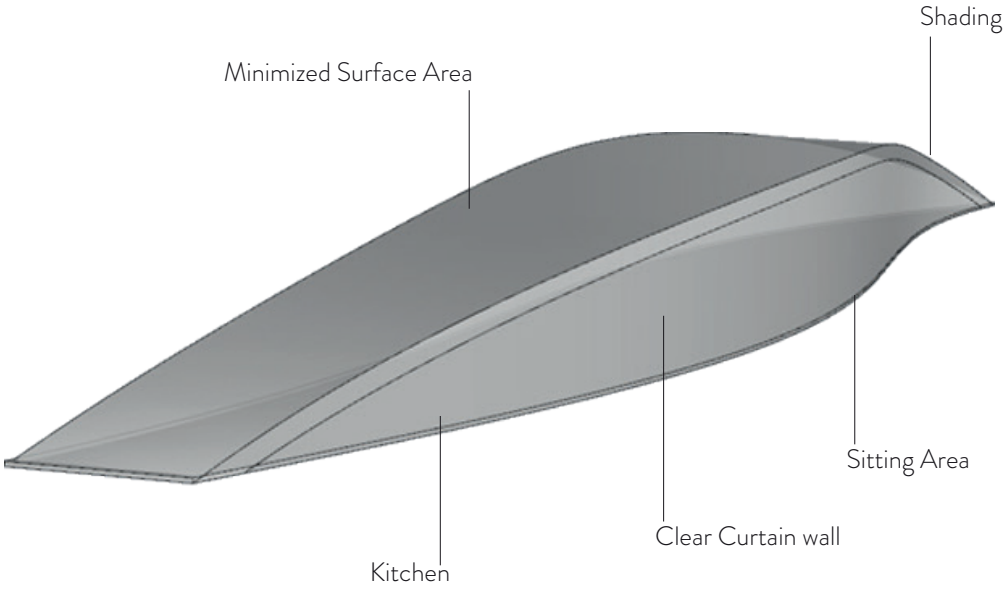
Be15 has been used to make sure that the energy consumption of the building is held as low as possible. Alternative methods for lowering the energy consumption has also been made and taken in consideration of, if needed.
Be15 is a tool that measures the energy consumption in a building and checks if it lives up to the demands in the Danish Building Regulations. Finland is using a different kind of conversion of the energy consumption which means that it is not possible to compare the two, but since Denmark has one of the highest standards in the world, it is safe to assume that fulfilling the The Danish Building Regulations will ensure that we are not exceeding the Finnish.



BUILDING OVERVIEW

Total Floor Area	11130m^2
Total Envelope Area	12273m^2
Floor/Envelope Ratio	
SW Windows/SW Envelope Ratio	0,92
NE Windows/NE Envelope Ratio	0,81
Clear Windiw Total SW	991m^2
Clear Window Total NE	918m^2
Channel Glass SW	895m^2
Channel Glass NE	900m^2
Entrance Glass	170m^2

ELEMENT	G-value	U-value
Curtain Wall		W/m^2K
Floor		W/m^2K
Channel Glass		W/m^2K
Exterior Wall		W/m^2K
Roof		W/m^2K



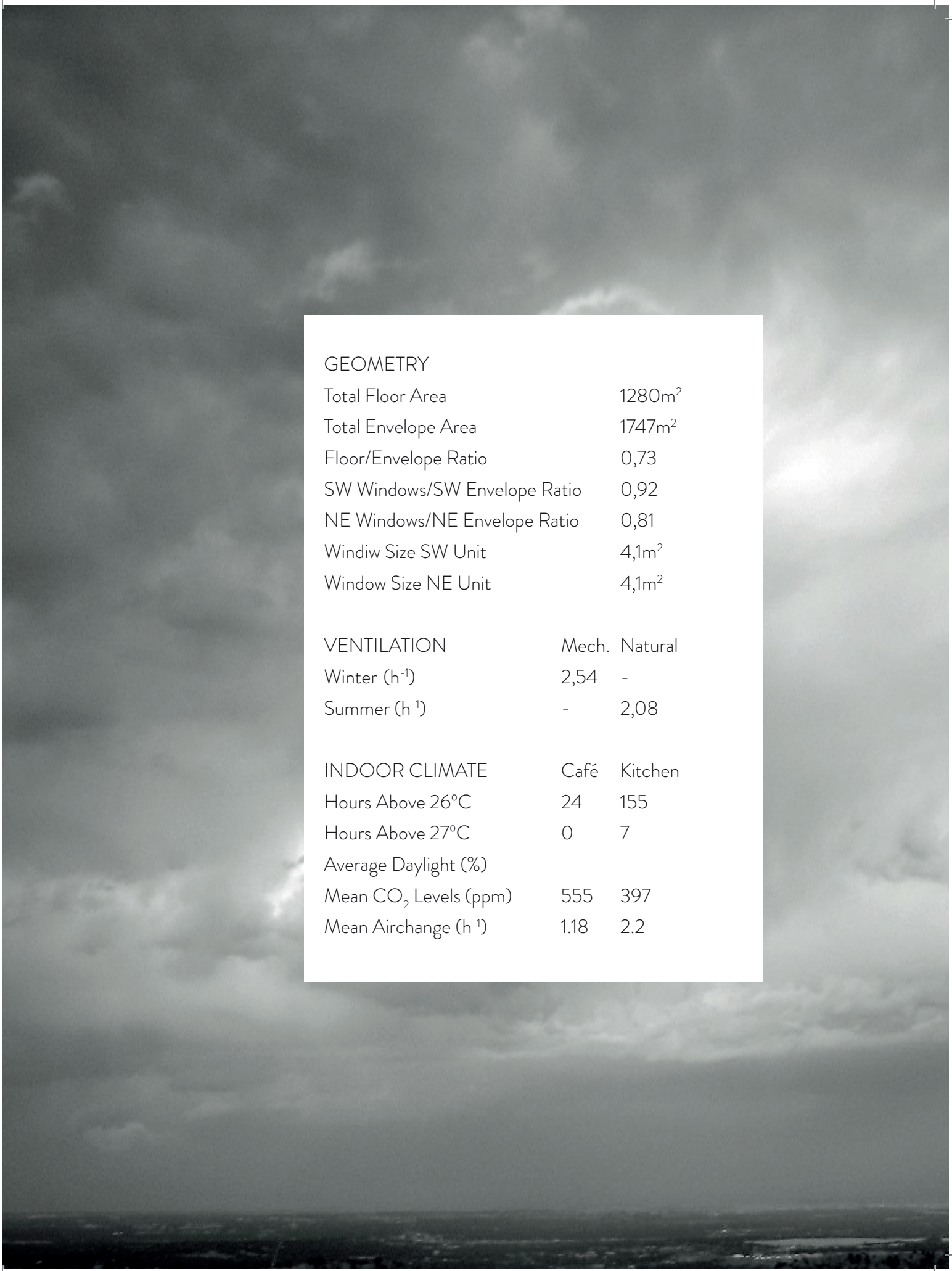
THE CAFE & KITCHEN are strategically placed in the strip closest to the harbor. This would ensure that visitors have the best view over the water. The orientation is important, since the aim is to have the sun in the morning and avoid it during the evening. A simpler model have been made to make a simulation in BSim.

THE BASIC FORM: A Simple form has been tested with minimal modifications or installations added to the building. It was expected that the indoor quality was quite poor and the simulation in BSim showed exactly the predicted. The most critical room being the kitchen was overheated and the CO_2 levels were too high.

ENVELOPE: By improving the buildings envelope and the windows it is possible to minimize the heat loss during the winter. To further improve the indoor quality in the building a hybrid ventilation strategy have been used, where the kitchen and cafe will be ventilated my the mechanical ventilation during the winter and the exclusively by the natural ventilation during the summer.

VENTILATION: Natural ventilation will be integrated in the curtain wall system, so that the inlet air can come in trough the lower part of the glazing area and have an outlet system on the top. Cross ventilation will also be possible witch will improve the natural ventilation.
The rest of the year a mechanical ventilation strategy with heat recovery will be used. The mechanical ventilation will also be used a couple of times during the summer to avoid high levels of CO_2.

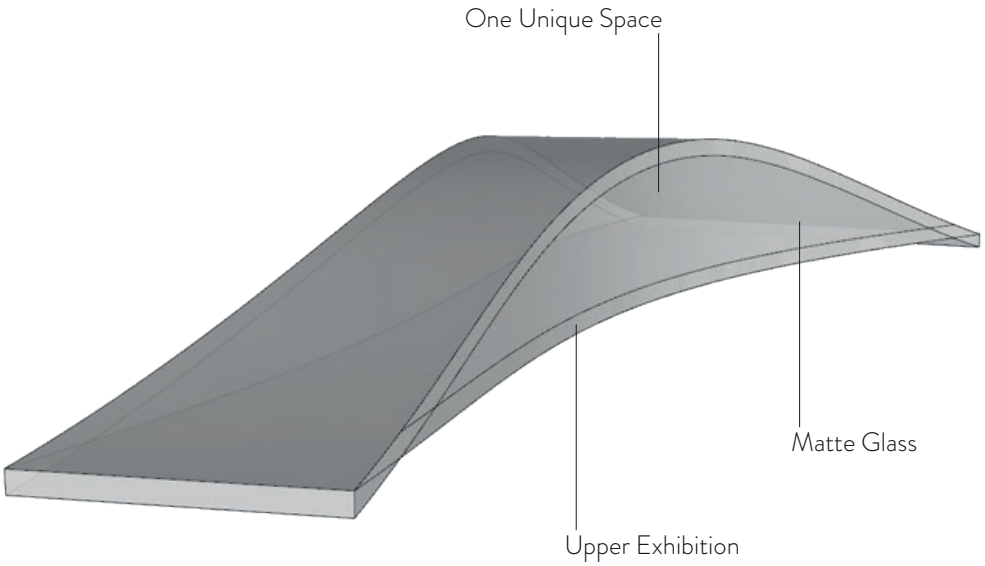
SHADING: Another passive strategy is to have shading. This was achieved by extending the roof and create a small cantilever. There will also be an automatic curtain system that can be used when needed.



GEOMETRY	
Total Floor Area	1280m^2
Total Envelope Area	1747m^2
Floor/Envelope Ratio	0,73
SW Windows/SW Envelope Ratio	0,92
NE Windows/NE Envelope Ratio	0,81
Windiw Size SW Unit	4,1m^2
Window Size NE Unit	4,1m^2

VENTILATION	Mech.	Natural
Winter (h^{-1})	2,54	-
Summer (h^{-1})	-	2,08

INDOOR CLIMATE	Café	Kitchen
Hours Above 26°C	24	155
Hours Above 27°C	0	7
Average Daylight (%)		
Mean CO_2 Levels (ppm)	555	397
Mean Airchange (h^{-1})	1.18	2.2



THE UPPER EXHIBITION is in the central strip closest to the cafe. The space should have a pleasant amount of daylight with no direct sunlight. This space should have a focus on experience and immerse the visitors, which means that the the passive strategies used should be subtle.

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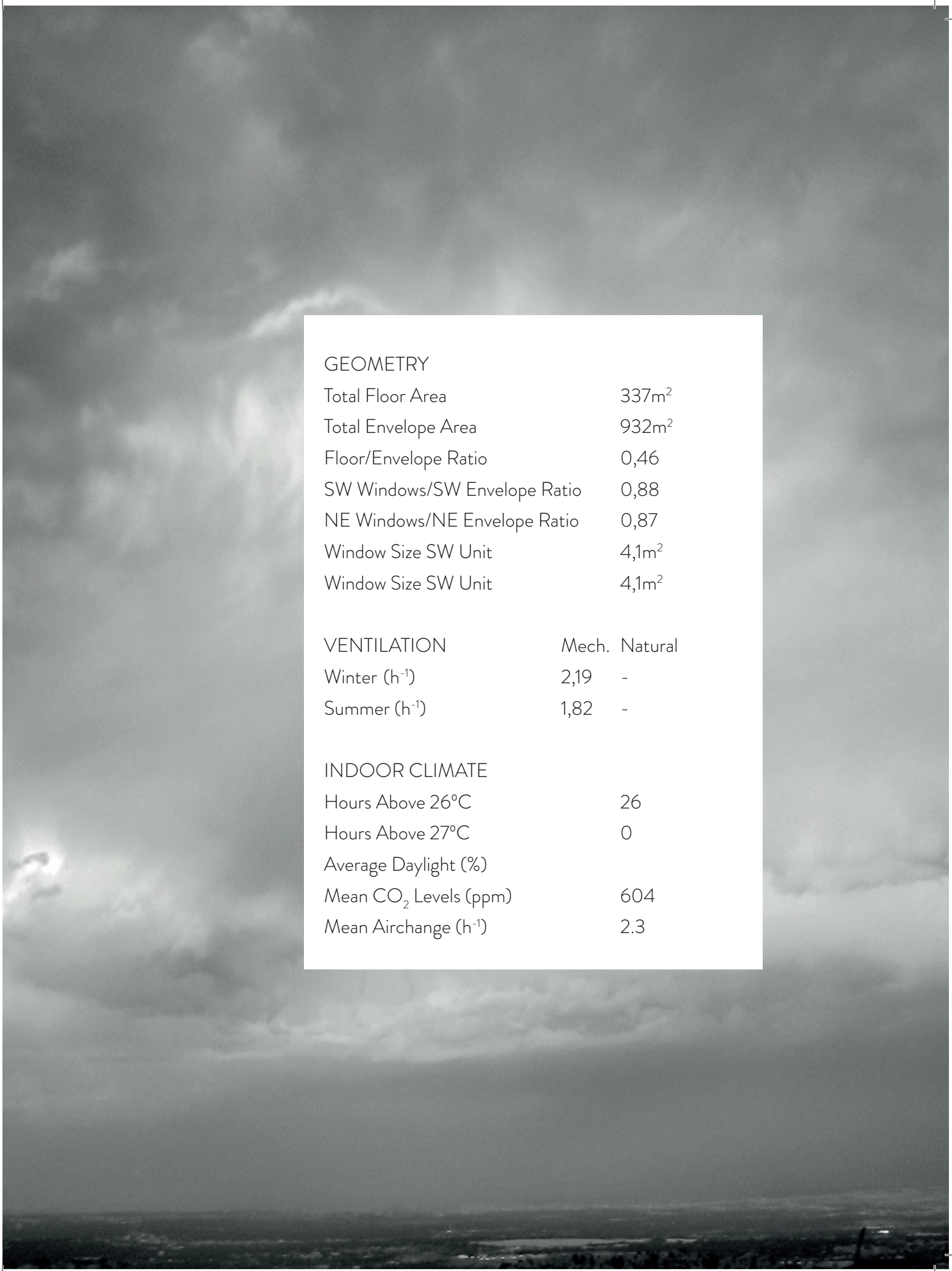
THE BASIC FORM: A simple form with the same envelope and window properties as the basic form of the cafe. A model has been made in BSim to test out the indoor quality. It showed a large amount of overheating and the CO2 levels were too high.

ENVELOPE: The envelope has been optimized so it has a more airtight construction with a lower U-value. Special windows called the channel glass which have special properties that could benefit the experience of the space.

CHANEL GLASS: Chanel Glass have been chosen for it's unique properties. The windows are made of polycarbonate and comes with a translucent rubber in the center that gives the window a low U-value. The panels used will have a matte finish which will have result in a lower light transmittance. This will mean that direct sunlight would be avoided and that the heat gains will be lower as well since the G-value is noticably lower than other windows.

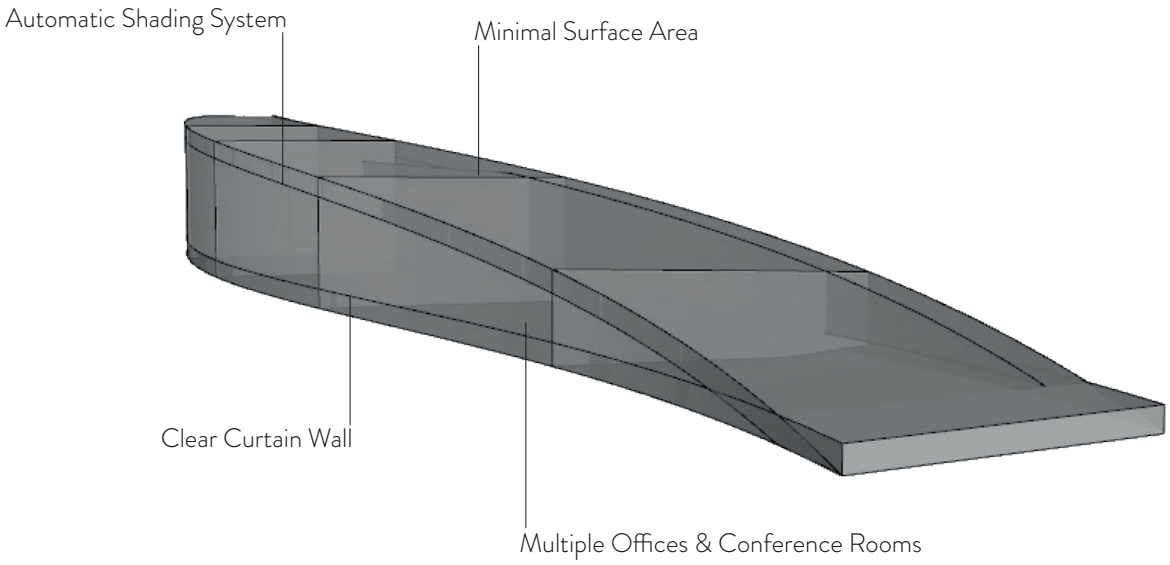
VENTILATION: Natural ventilation have been avoided in the exhibition rooms to keep the windows closed and have a simple expression in the interior walls. Therefore a mechanical ventilation strategy have been used all year.



GEOMETRY		
Total Floor Area		337m^2
Total Envelope Area		932m^2
Floor/Envelope Ratio		0,46
SW Windows/SW Envelope Ratio		0,88
NE Windows/NE Envelope Ratio		0,87
Window Size SW Unit		4,1m^2
Window Size SW Unit		4,1m^2

VENTILATION	Mech.	Natural
Winter (h^{-1})	2,19	-
Summer (h^{-1})	1,82	-

INDOOR CLIMATE	
Hours Above 26°C	26
Hours Above 27°C	0
Average Daylight (%)	
Mean CO_2 Levels (ppm)	604
Mean Airchange (h^{-1})	2.3



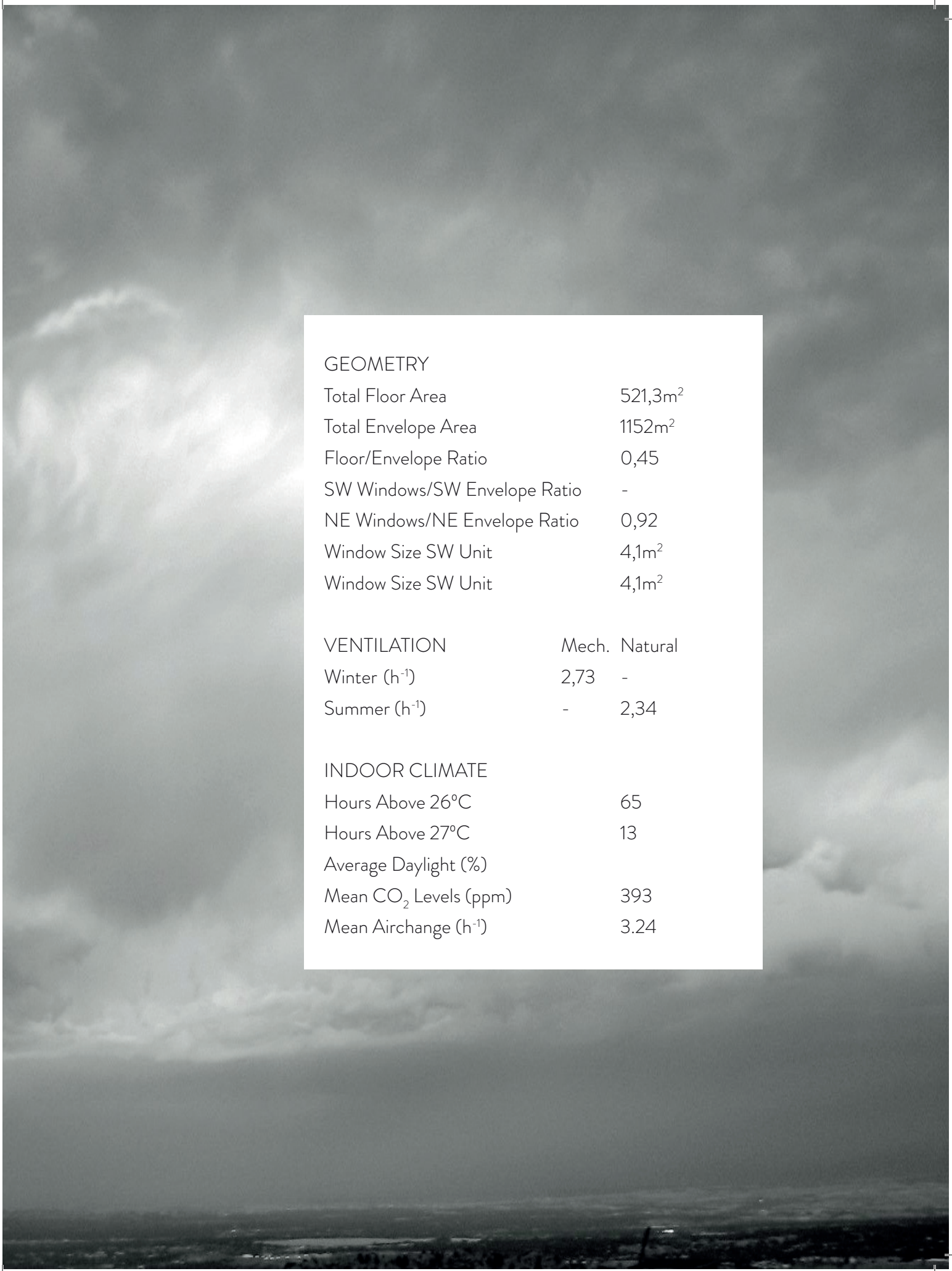
THE OFFICES are in the outer strip having a curtain wall towards North-West. The orientation of the windows helps avoid direct sunlight during the usage time. The focus for this area is to have it as functional as possible and show passerbyers how the museum is being maintained. The offices are strategically placed with an access to the windows, where the corridor are towards the inner wall.

THE BASIC FORM: To get a good idea of how the indoor quality will be in the offices a BSim model were created. Again, simple wall constructions were made and regular windows with only natural ventilation on. The simulation showed that the temperature were irregular.

ENVELOPE: An improved wall construction gave a lot better results and made the indoor temperature more stable, which means that the building have an improved heat loss. The windows used are triple glazed windows with an automatic shading system that helps avoid direct sunlight during long hours at work.

VENTILATION: The offices will use natural ventilation during the summer and mechanical ventilation if necessary and the CO_2 levels becomes too high. During the winter only the mechanical ventilation with heat recovery will be used to reduce energy loss.

SHADING: The roof is extended outwards to function as shading. Also automatic blinders are installed and are available to use in case of direct sunlight.



GEOMETRY		
Total Floor Area		521,3m^2
Total Envelope Area		1152m^2
Floor/Envelope Ratio		0,45
SW Windows/SW Envelope Ratio		-
NE Windows/NE Envelope Ratio		0,92
Window Size SW Unit		4,1m^2
Window Size SW Unit		4,1m^2

VENTILATION	Mech.	Natural
Winter (h^{-1})	2,73	-
Summer (h^{-1})	-	2,34

INDOOR CLIMATE	
Hours Above 26°C	65
Hours Above 27°C	13
Average Daylight (%)	
Mean CO_2 Levels (ppm)	393
Mean Airchange (h^{-1})	3.24

THE ENERGY CONSUMPTION has been an important task to optimize so it fulfills the energy frame for new building in Finland. Compared to the Danish energy requirements for new building found in the Danish Building Regulations, the Finnish have have The National Building Code.

FINNISH REGULATIONS: The Finnish regulations are formulated in a different way compared to the danish standards. It is therefore not easy to compare the results from Be15 to the requirements from Finland. Since Denmark have on of the strictest demands for energy consumption it is safe to assume that if the building can live up to the Danish Building Regulation it will also be able to live up to the Finnish standards.

2020 BUILDING CLASS REQUIREMENTS: To create an idea of how the energy consumption is for the building the software Be15 has been used. The weather file in the program have been changed to give more realistic results.

FIRST RESULTS: When initially inserting the numbers required in Be15 the building would have an energy consumption of about 50-60 kWh/m2 year. It was therefore needed for the building to be optimized. This was being done while the BSim model was being made, which required improved wall constructions and the rest of the building elements.

OPTIMIZING: The results eventually got better when inserting the shading and the improved building elements. It was very important that the right values were inserted such as the lighting, witch should have certain properties all depending on the placement in the building. By optimizing the building according to the ventilation strategies good results was achieved in the end.

FINAL RESULTS: For the final results a satisfying energy consumption has been achieved. Even though it doesn't fully reach the 2020 requirements from the Danish Building Regulations it is safe to assume that the building is living up to the Finnish standards. It is possible to use active strategies later if required to reach the 2020 goal.

FURTHER DEVELOPMENT: To further improve the energy consumption of the building active strategies can be provided. If necessary photovoltaics can be installed on the roof on the building or a space close to the site can be used for this purpose. The photovoltaics can be helpful for providing the energy for the ventilation system and the lighting which has the largest electricity consumption.

GEOMETRY	
Heated Floor Area	11130m^2
ENERGY	
2020 Requirements	25 kWh/m^2 year
Results	32,9 kWh/m^2 year
Heat Requirement	33 kWh/m^2 year
Electricity Requirement	6,6 kWh/m^2 yea
Energy From PV Cells	6,6 kWh/m^2 year
Area Needed for PV Cells	370 m^2
Result w/ PV Cells	25 kWh/m^2 year
PHOTOVOLTAICS	
Peak Power (PV Cells)	0,17 kW/m^2
System efficiency	0,75
Orientation	SE

FEATURE FIVE

A NEW MUSEUM IS BORN

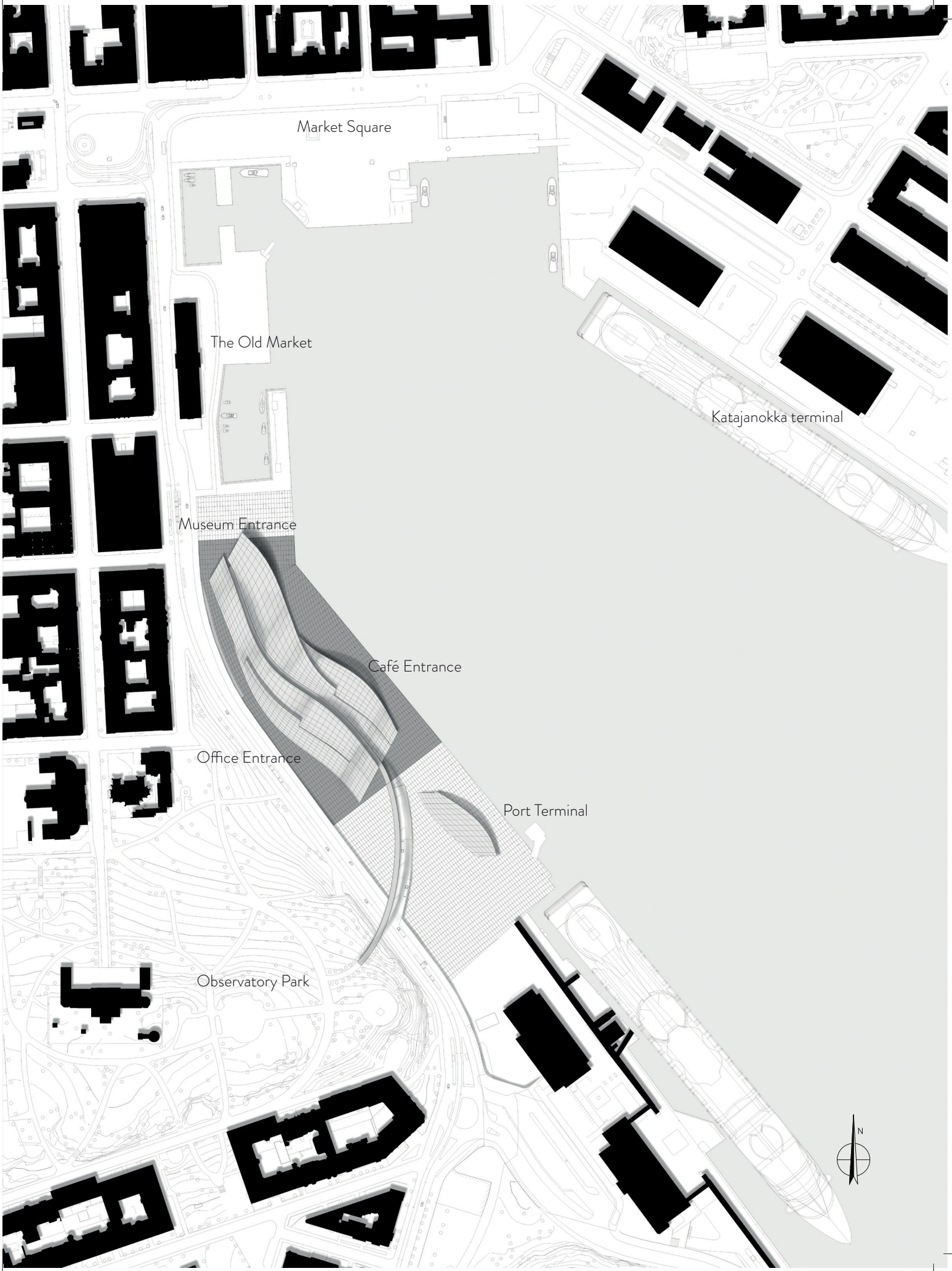
Walking around and throughout the museum is an experience in itself. New sights are to be seen from different perspectives. Whether one comes from the park, the old marked or by ferry the view will always be breathtaking. A sense of belonging is present. Lights bouncing off of the glossy facade in the night creates a sense of brightness, almost like an aurora!

In this feature section, A New Museum is Born, it is possible to enjoy the museum from various points of view. In this chapter the pictures and the illustrations are the narrator.

PHOTOGRAPHY **THE SEA**

ARCHITECTURE MEETS LANDSCAPE

The design of the museum makes a mutual relationship between the site and the building itself. The same principle has been applied to the interior in order to follow the continuity of the outside gesture. In this way we achieved a complete fusion between the architectural quality and the urban landscape.

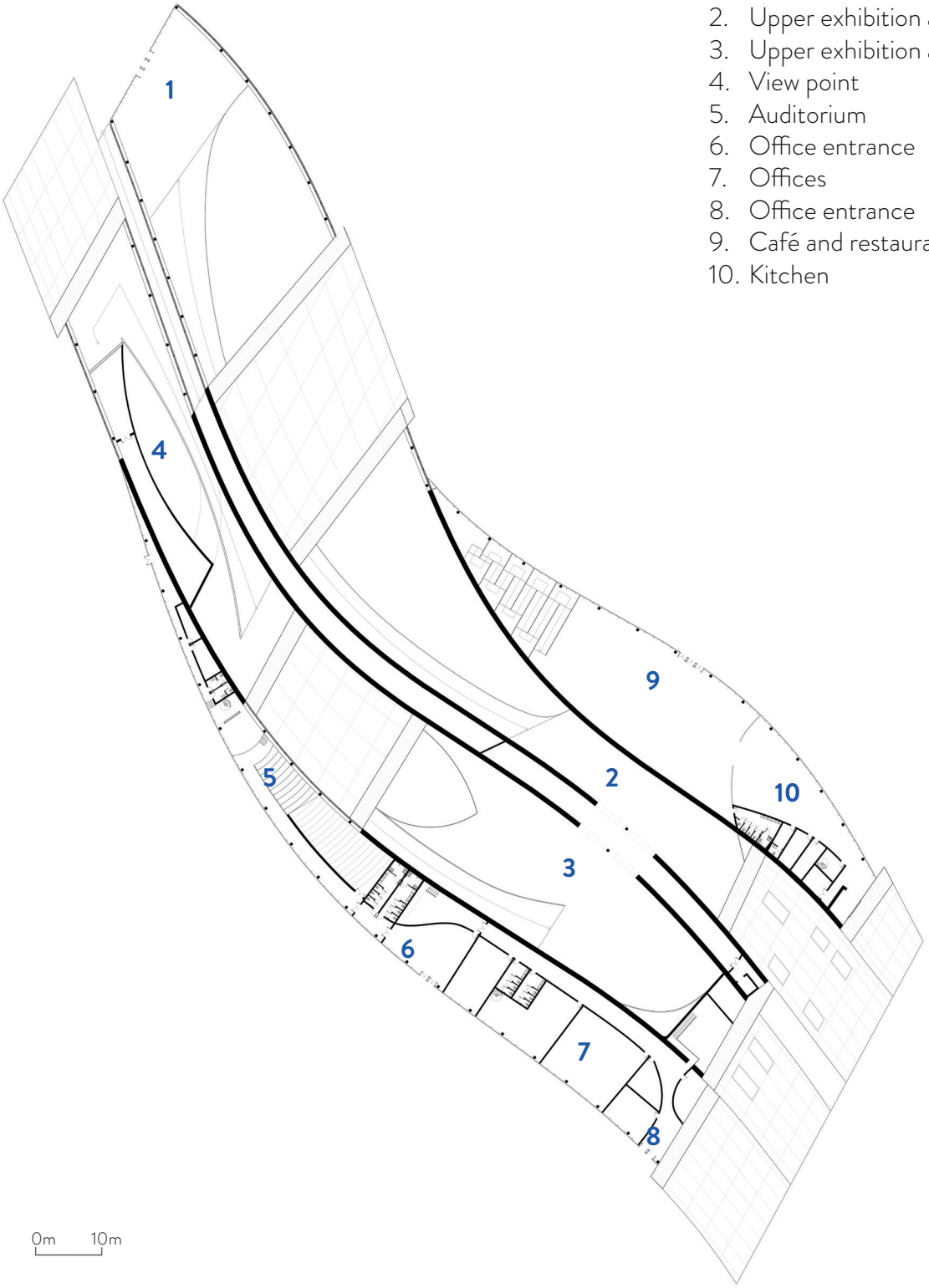

Market Square
The Old Market
Katajanokka terminal
Museum Entrance
Café Entrance
Office Entrance
Port Terminal
Observatory Park
N

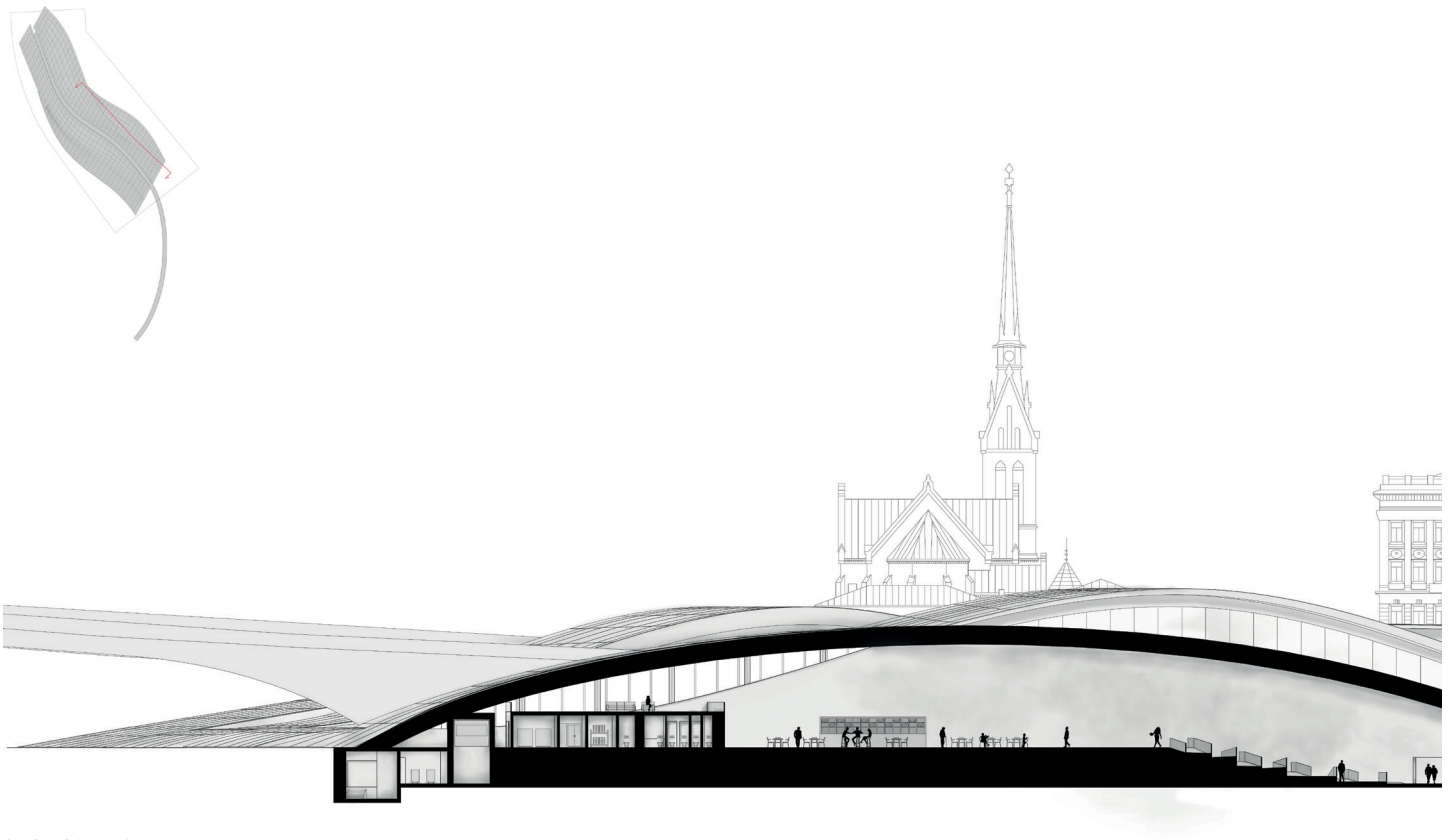
FIRST NIVEAU PLAN

1. Lobby
2. Museum and design store
3. Project Area
4. Dark exhibition 4
5. Dark exhibition 3
6. Dark exhibition 3
7. Dark exhibition 2
8. Project area
9. Solomon ramp
10. Children exhibition area
11. Visitor lockers
12. Shipping and recieving

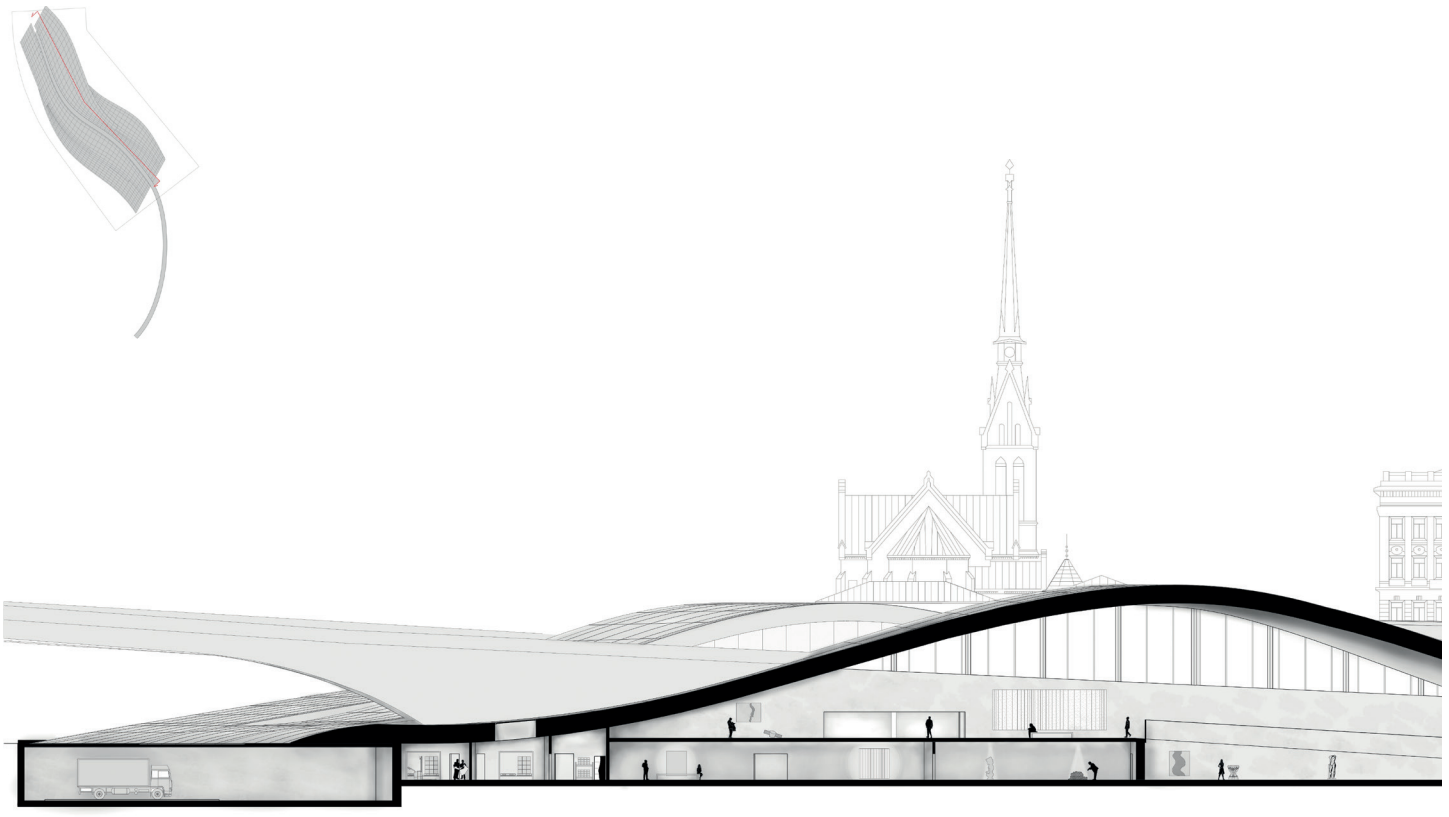
SECOND NIVEAU PLAN

1. Entrance and reception
2. Upper exhibition area 1
3. Upper exhibition area 2
4. View point
5. Auditorium
6. Office entrance
7. Offices
8. Office entrance
9. Café and restaurant
10. Kitchen



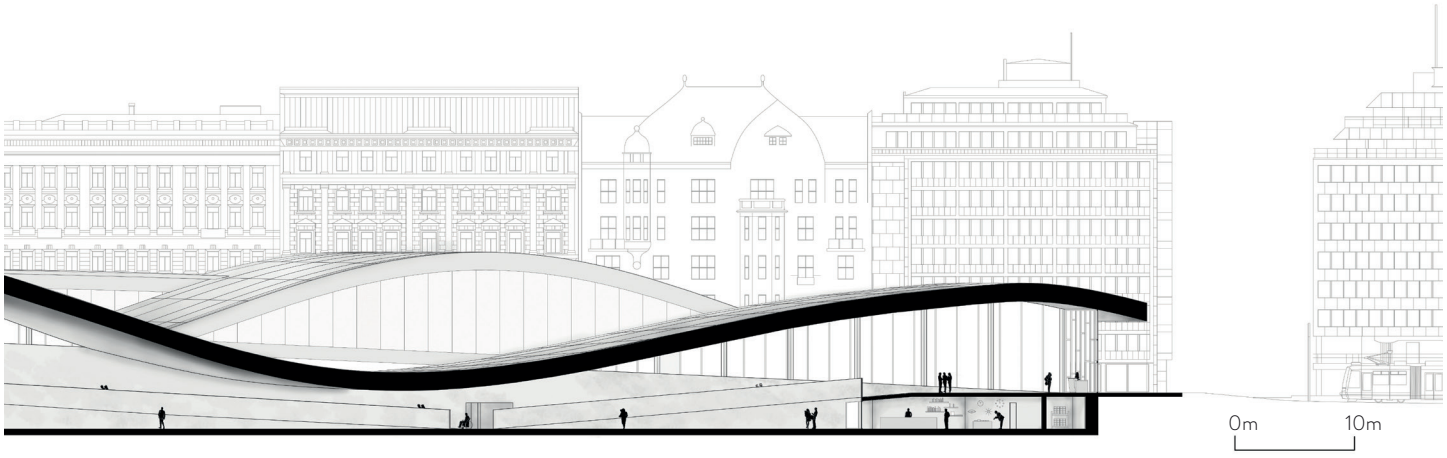


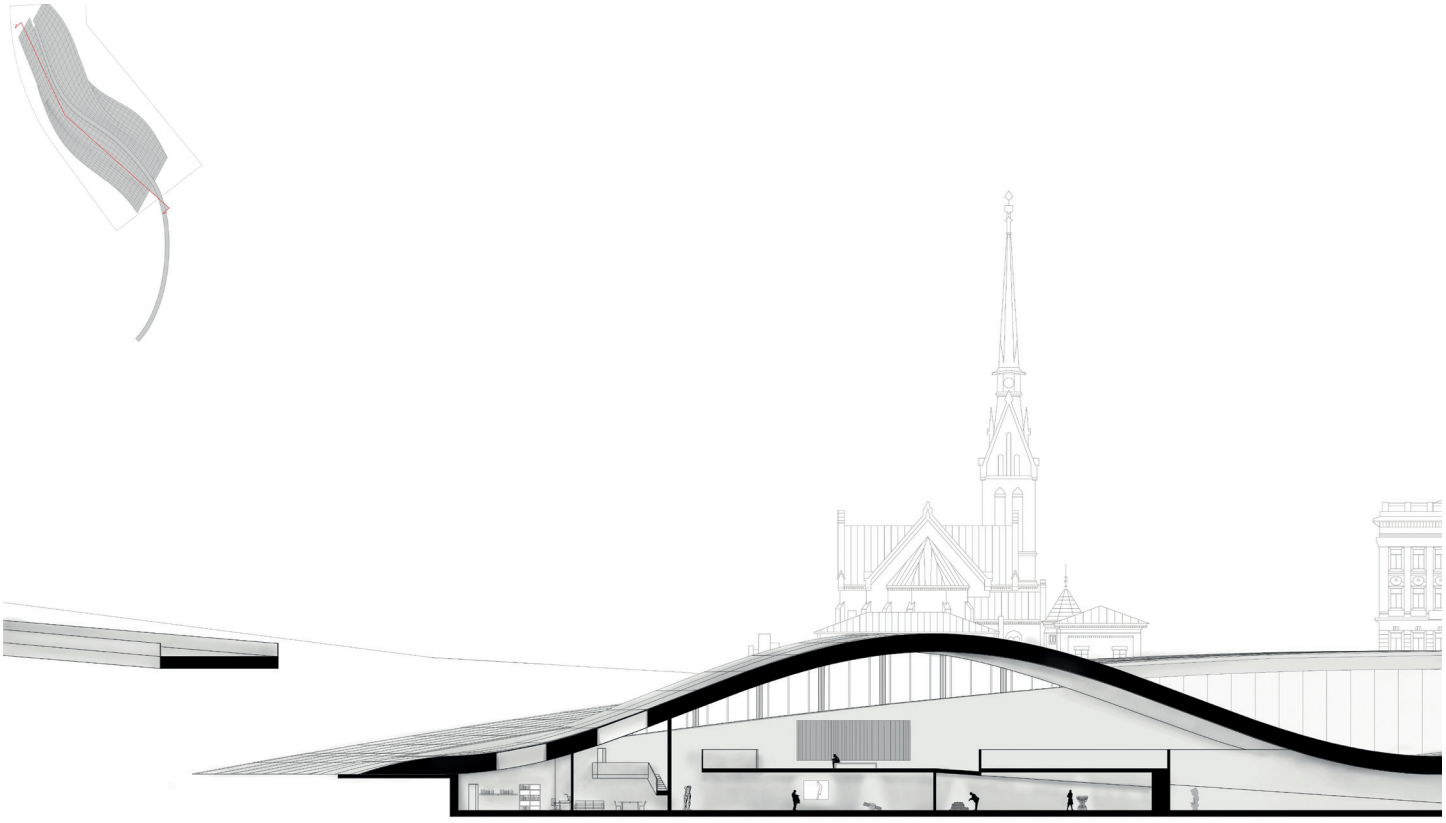
SECTION A-A



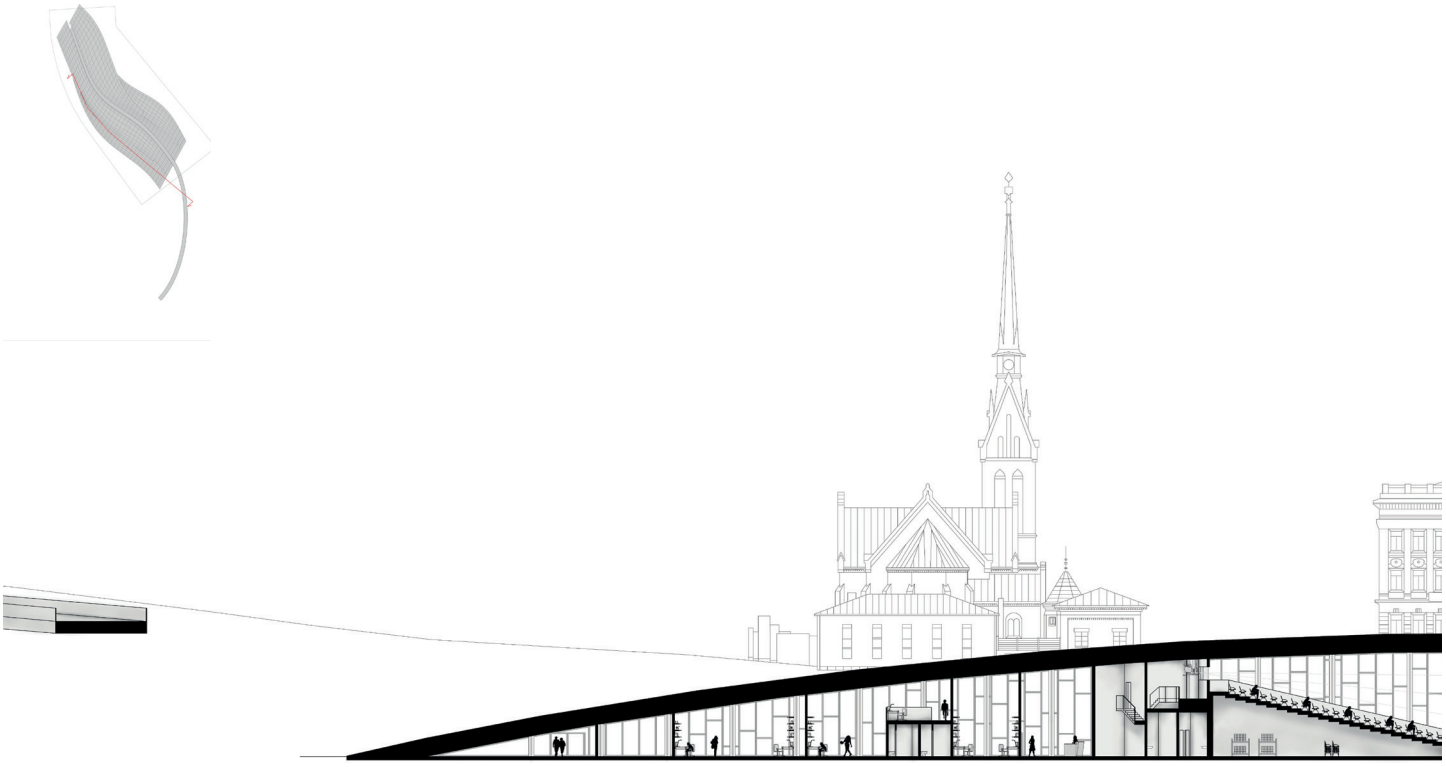
SECTION B-B


0m
10m

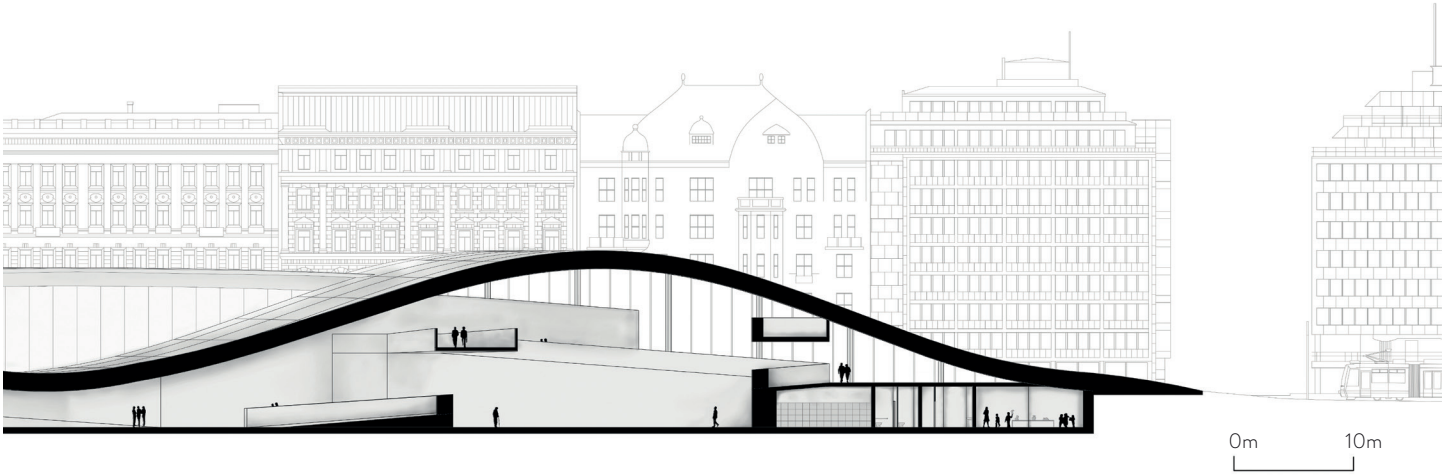

0m
10m



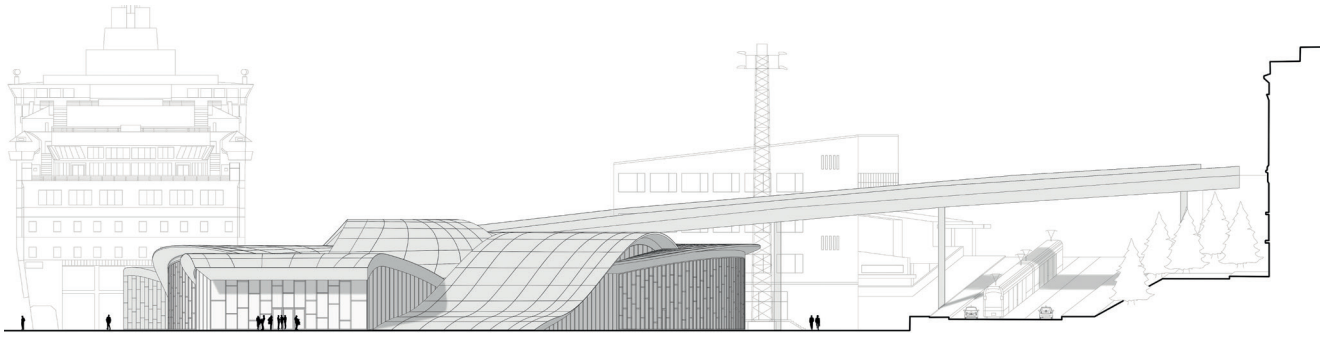
SECTION C-C



SECTION D-D

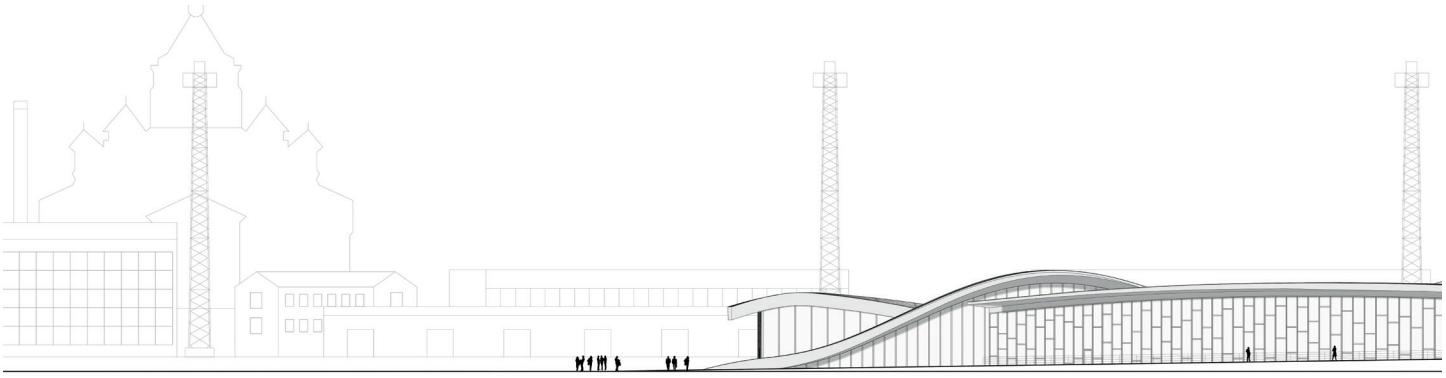

0m
10m


0m
10m

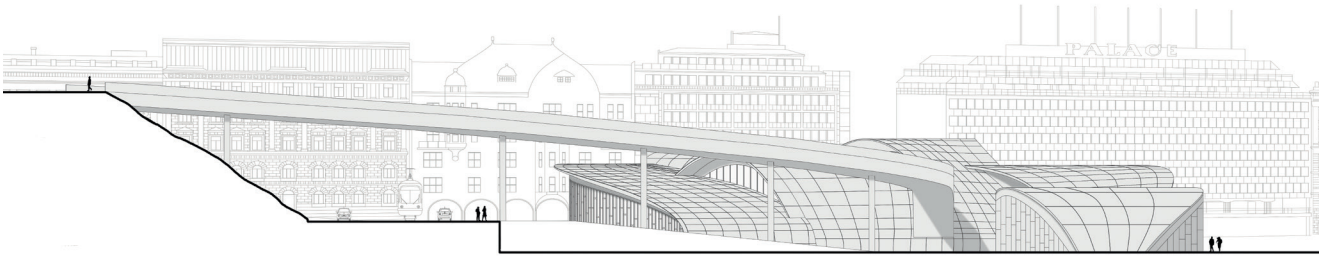


NORTH WEST ELEVATION

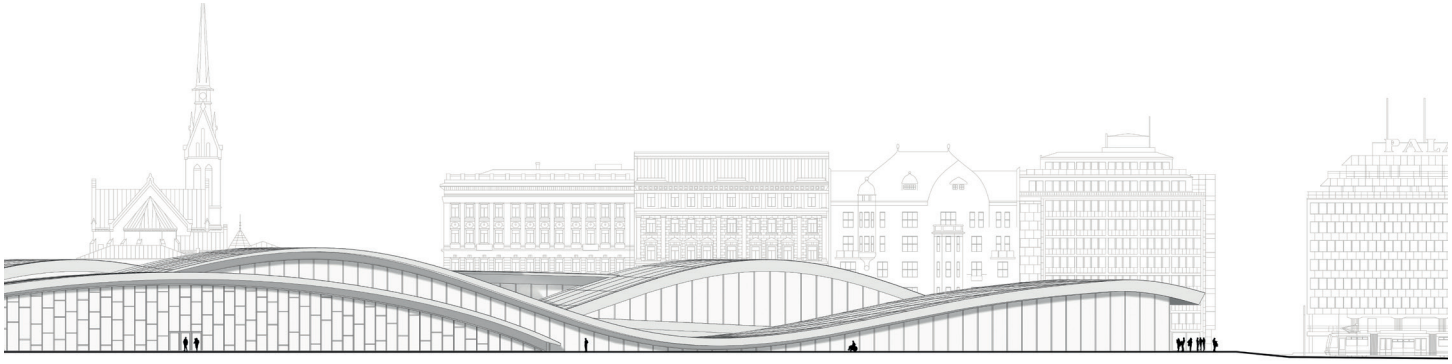
NORTH EAST ELEVATION

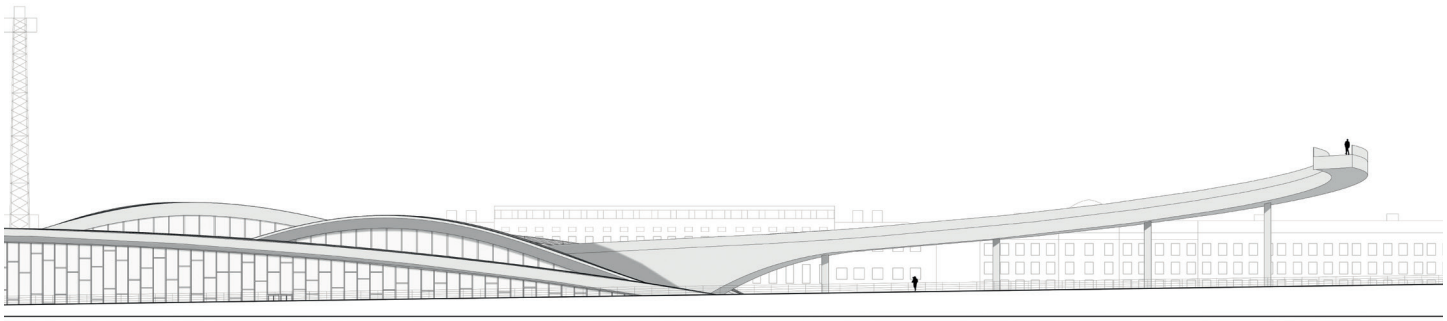


SOUTH WEST ELEVATION



SOUTH EAST ELEVATION

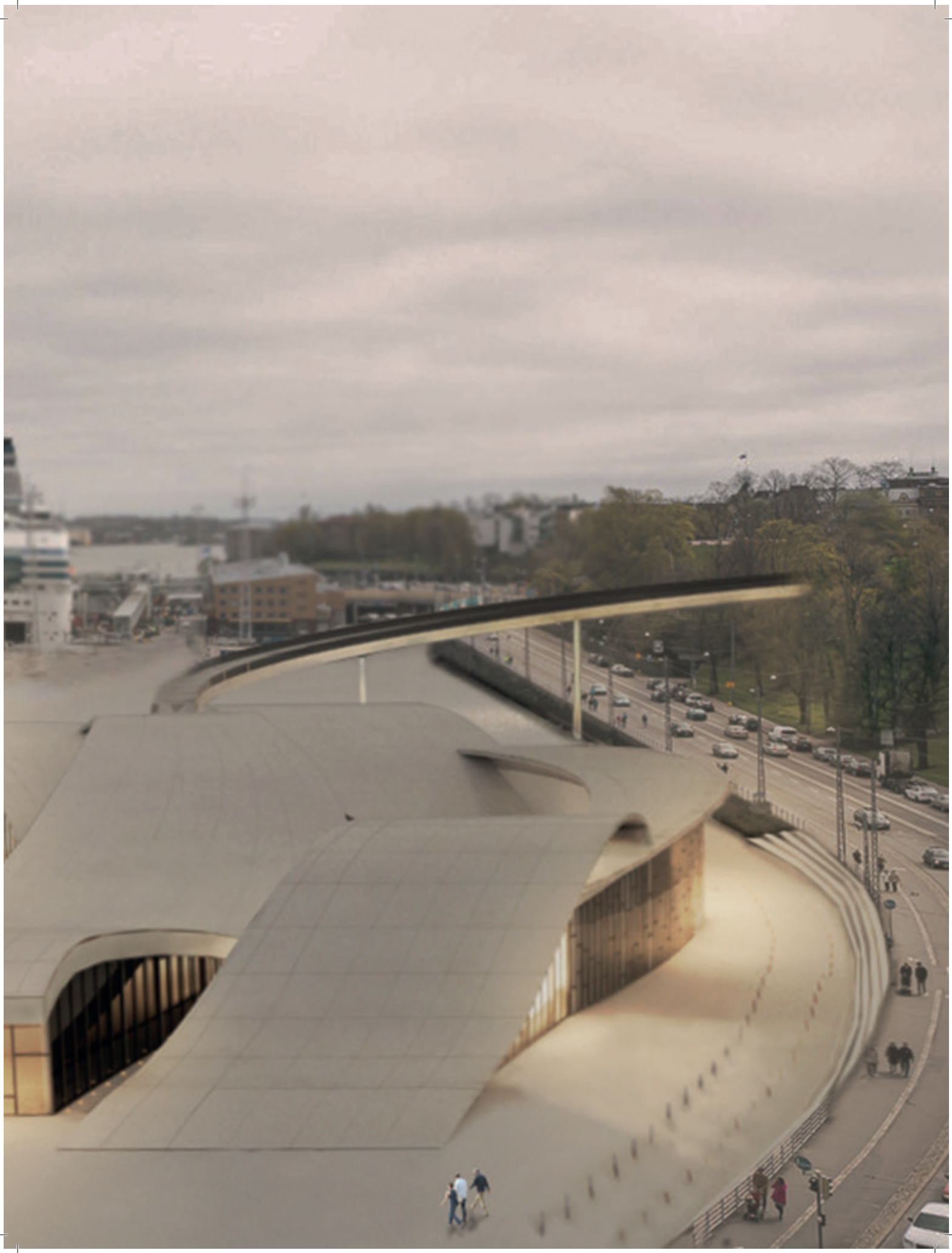




VIEW FROM KATAJANOKKA TERMINAL

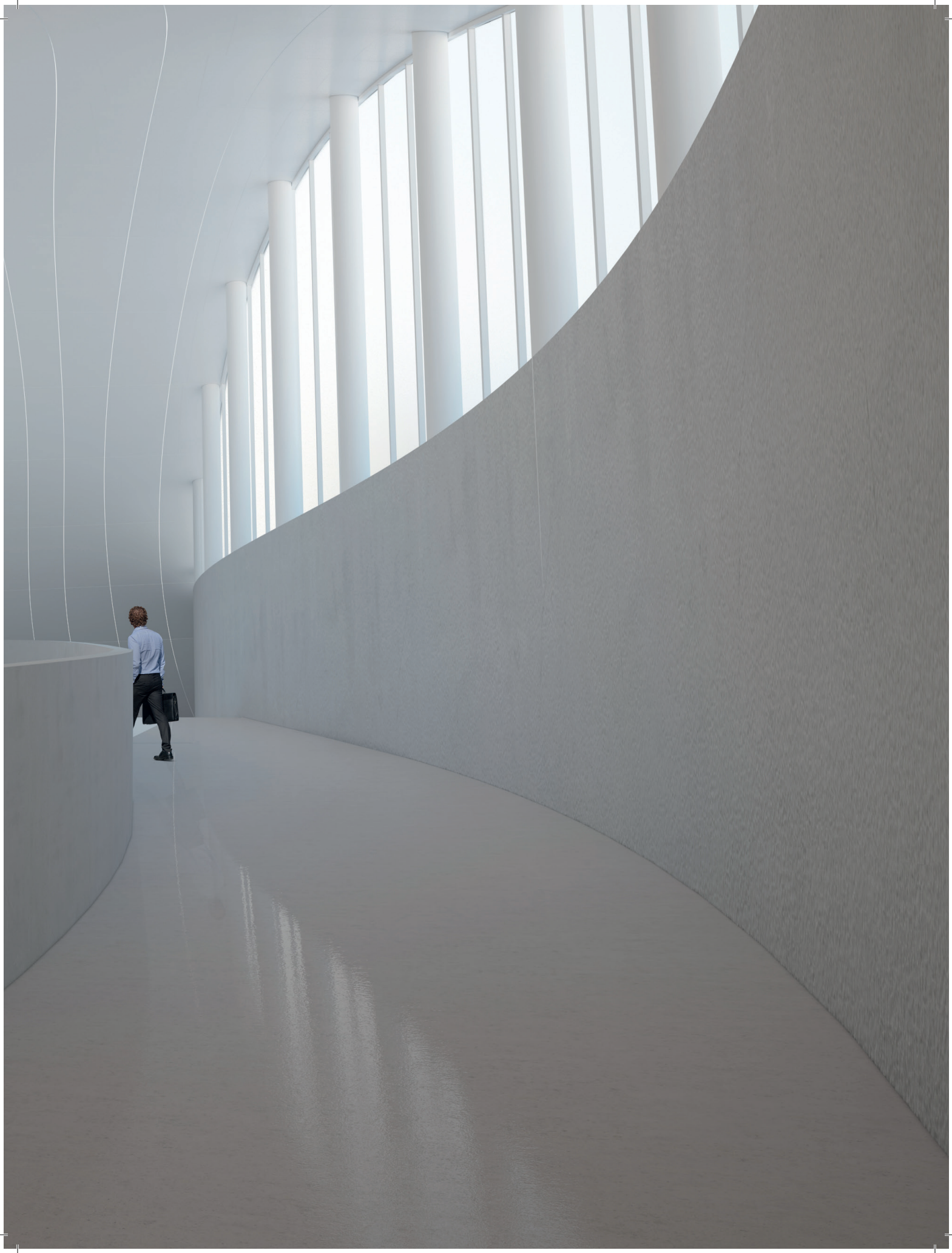

PALACE

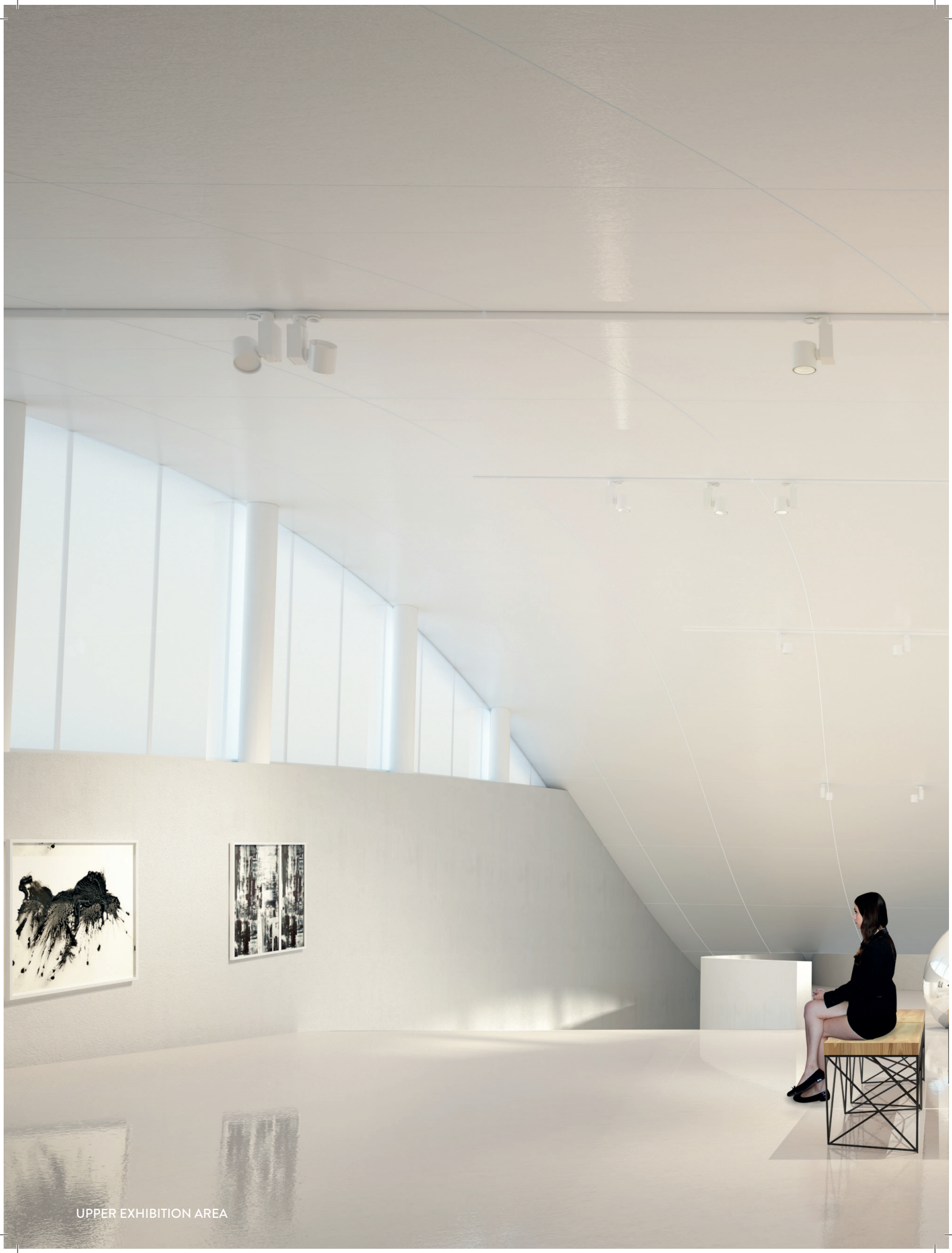
VIEW FROM THE PALACE HOTEL



VIEW FROM THE EXTERNAL RAMP

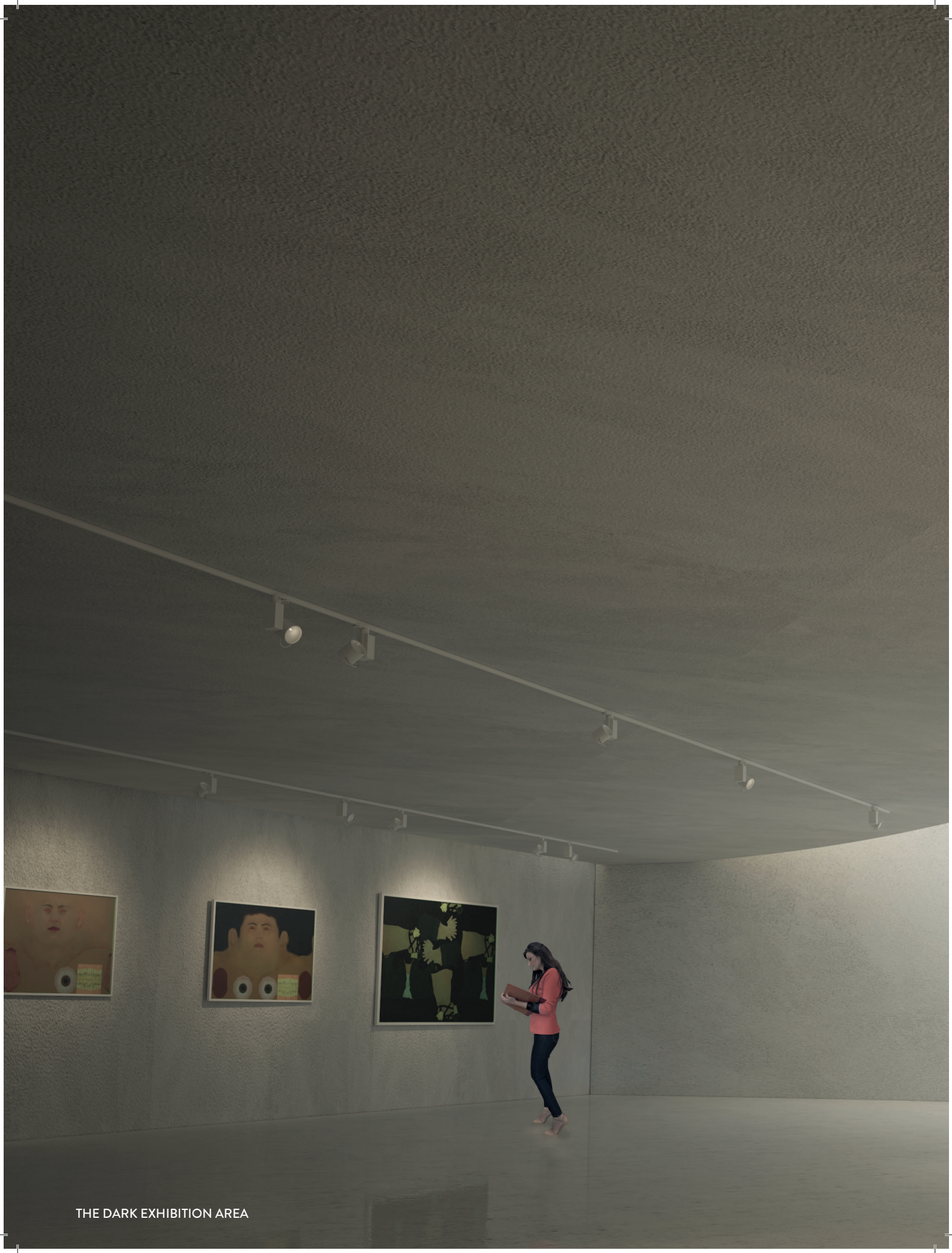
MAIN HALL



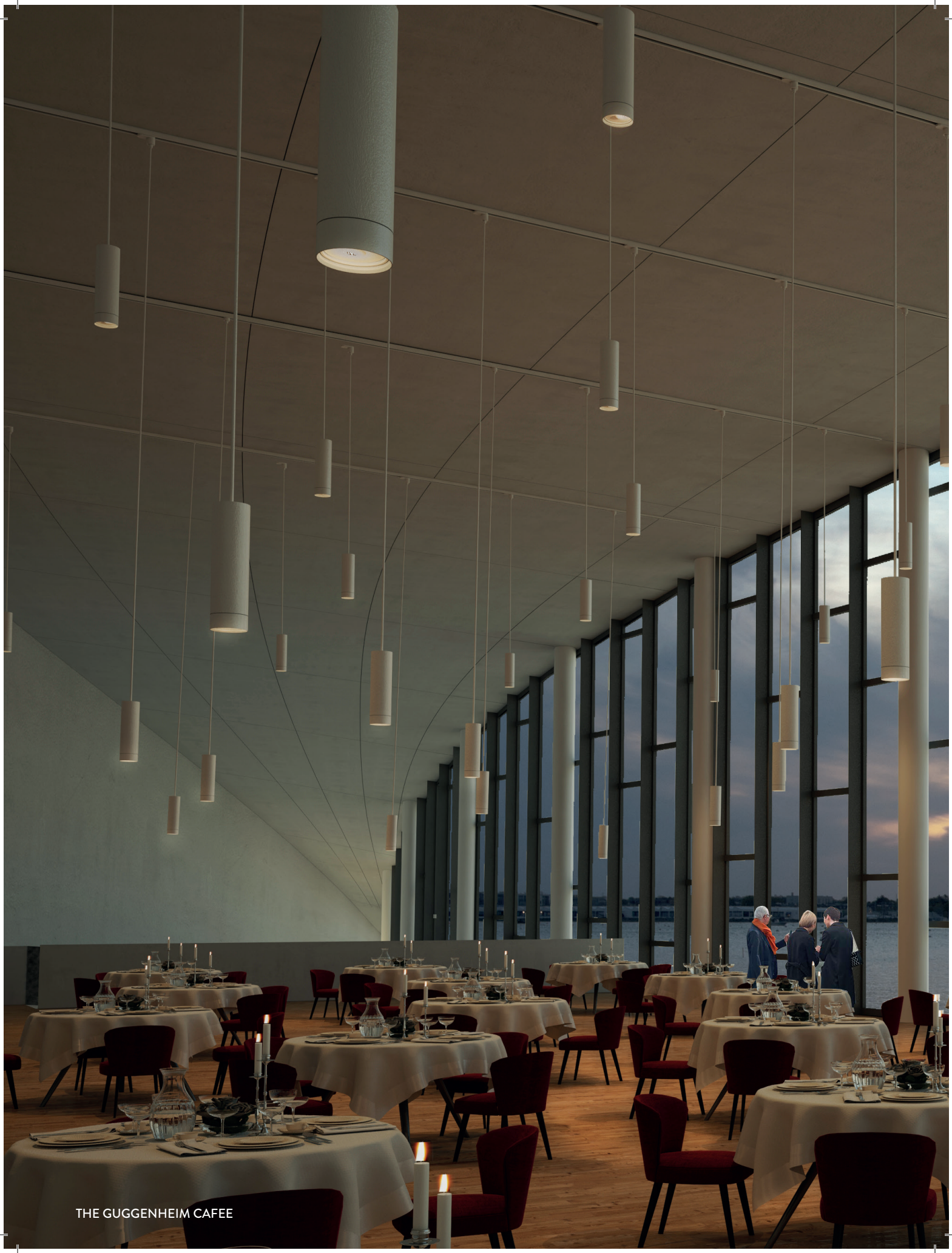


UPPER EXHIBITION AREA

THE SOLOMON RAMP



THE DARK EXHIBITION AREA



THE GUGGENHEIM CAFEE

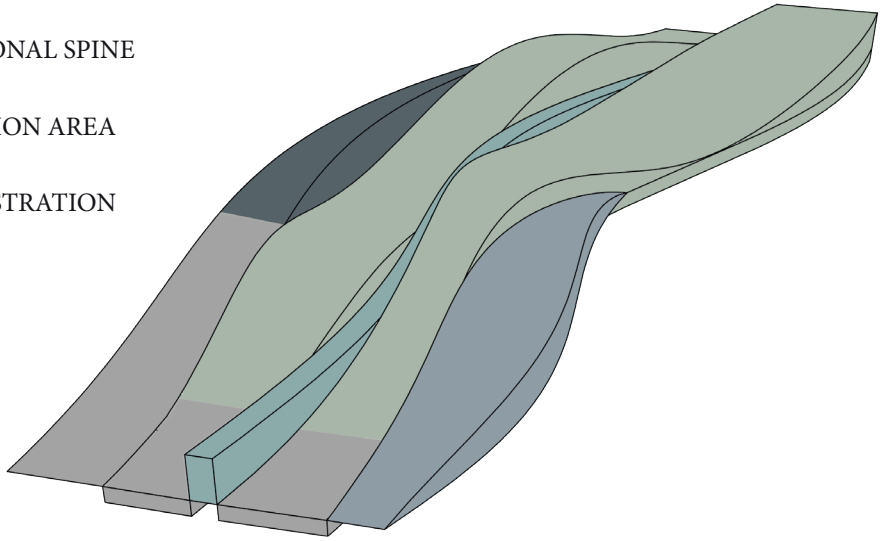
CAFE

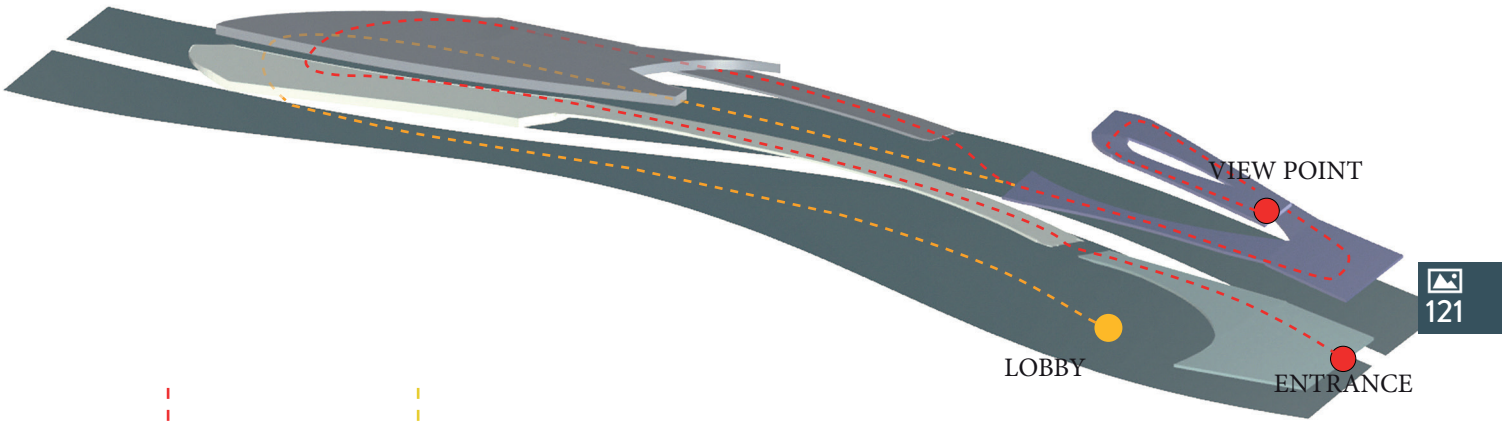
AUDITORIUM

FUNCTIONAL SPINE

EXHIBITION AREA

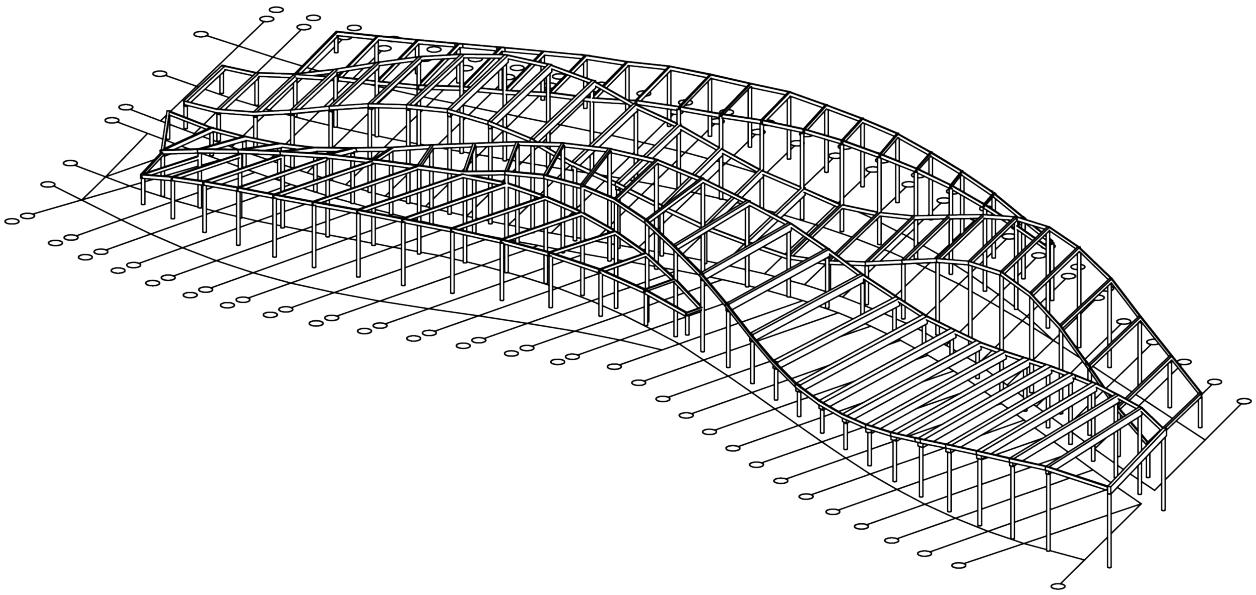
ADMINISTRATION





UPPER ROUTE

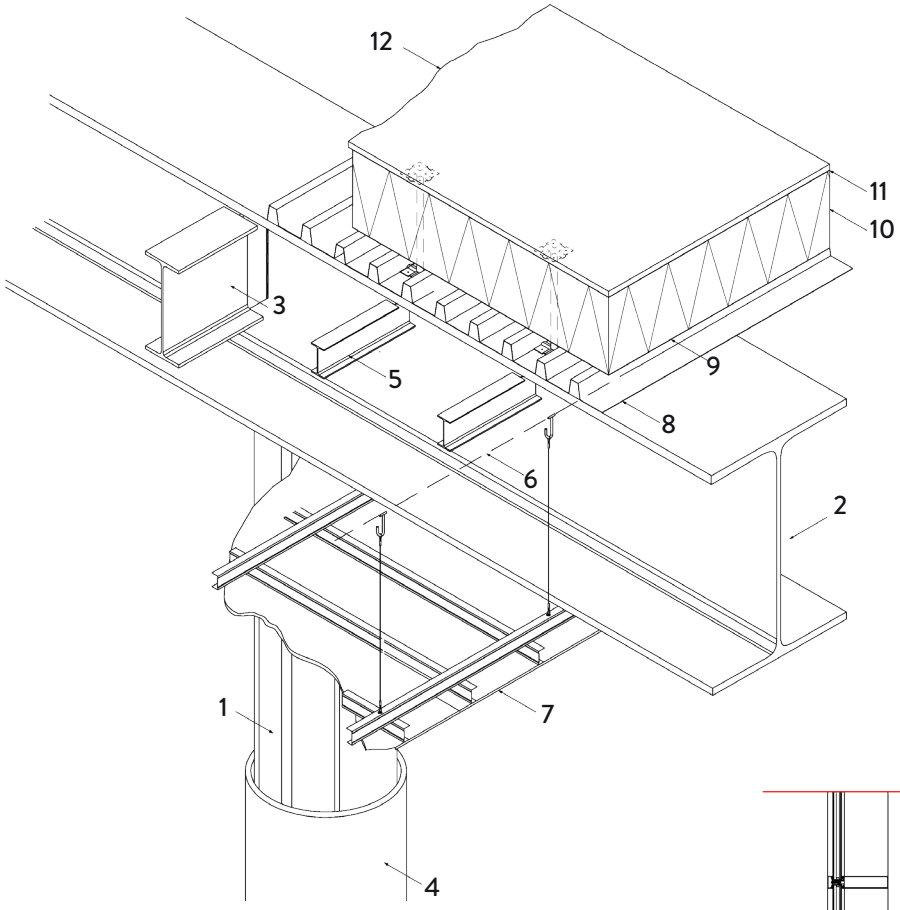
LOWER ROUTE



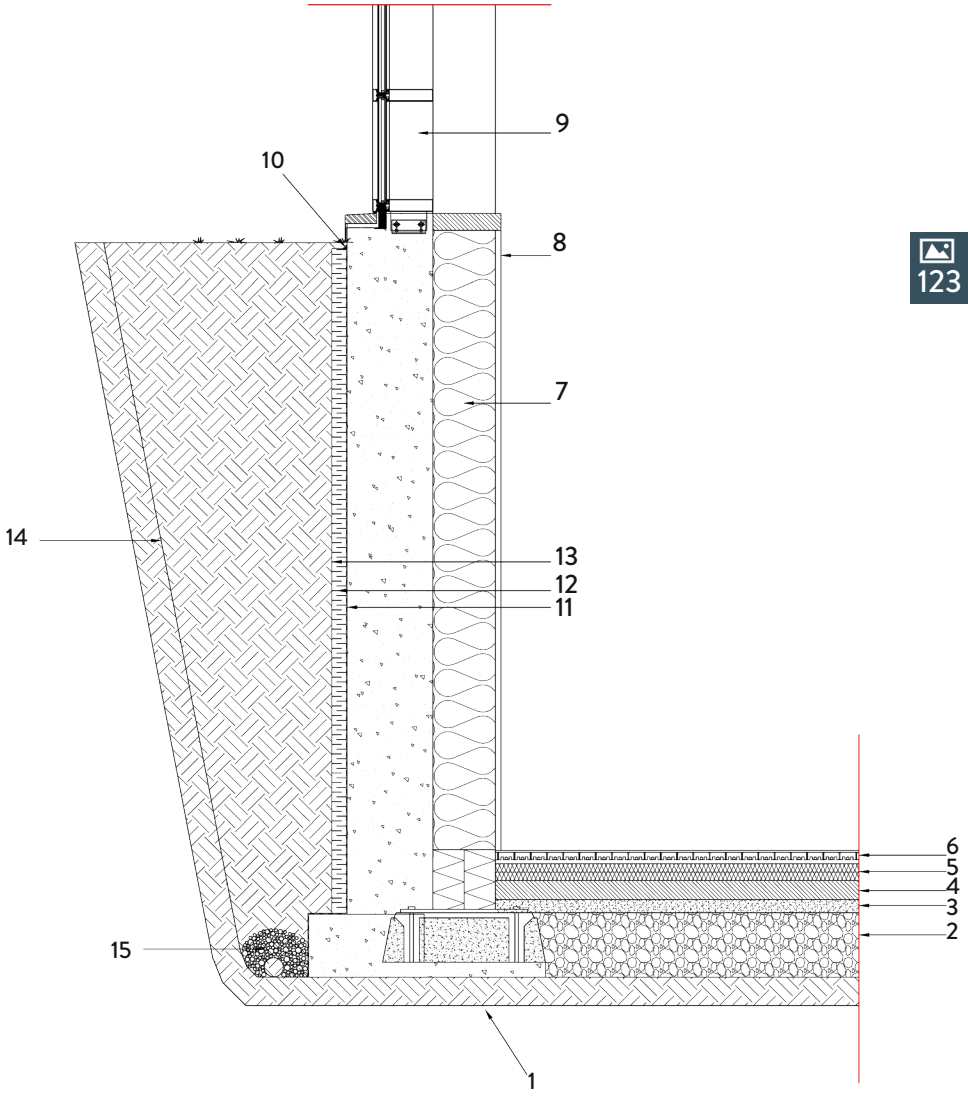
The Structural System

THE STRUCTURAL SYSTEM IS IMPORTANT IN ORDER TO DOCUMENT A REALISTIC RESULT

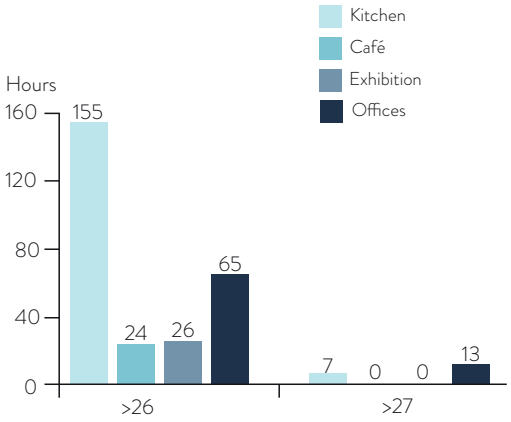
The structural system of the museum principally consists of a simple steel frame structure. We chose this method in order to minimize the cost which would have been high if a space frame system had been chosen instead. To get a sense of fluidity and free space within the building, vertical structural columns are placed between the envelope and the curtain wall system. Particular beams are required in order to hold the structure according to a rough structural calculation which is located in the annex. The maximum span present in the building is 27 meters and the maximum size of the steel beam is 1000x882 mm. For a more accurate example, some drawings are placed in the following page which show the roof and the wall system.

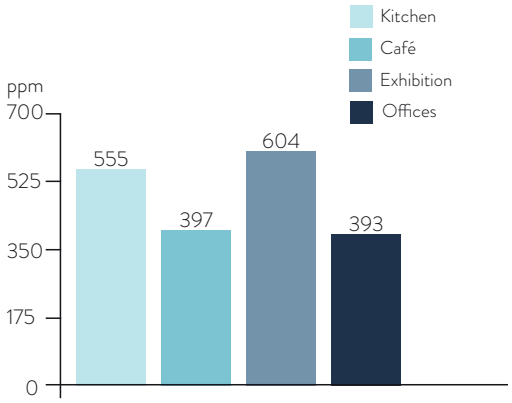


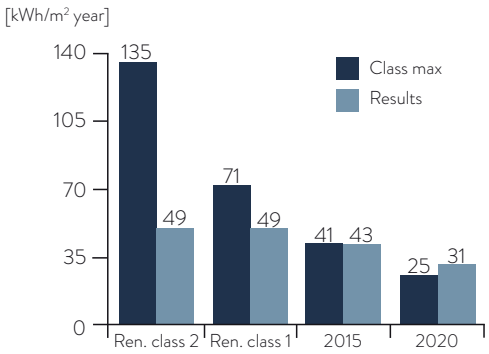
1 Pillar HEA 340
2 Main beam HL 1000M
3 Secondary beam IPE 500
4 Pillar cladding
5 Rafters
6 Scaffolding
7 Lowered ceiling
8 HTL 90/600
9 Vapor barrier
10 Hard insulation
11 Waterproof membrane
12 GFRP

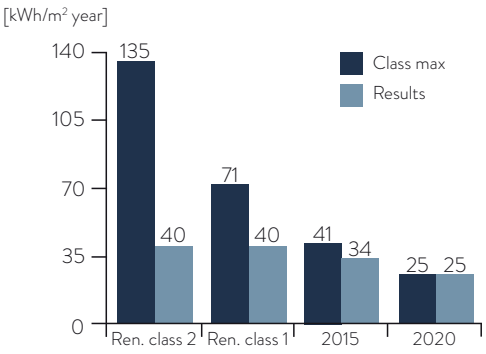


1 Ground
2 Gravel
3 Sand
4 Screed
5 Insulation
6 Radiant heating
7 Rockwool
8 Plaster
9 Curtain wall
10 Sealant
11 Waterproof membrane
12 Styrofoam perimate
13 Line of drainage slots
14 Line of excavasion
15 Washed river rock







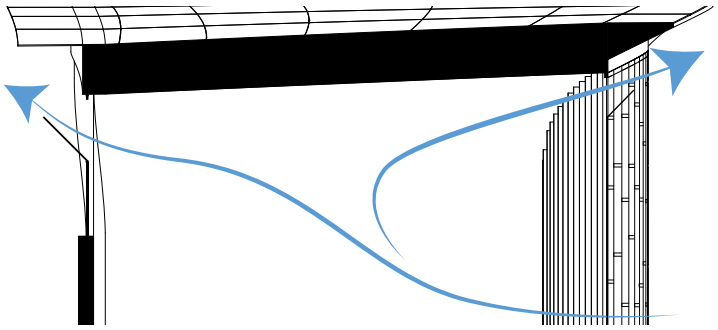


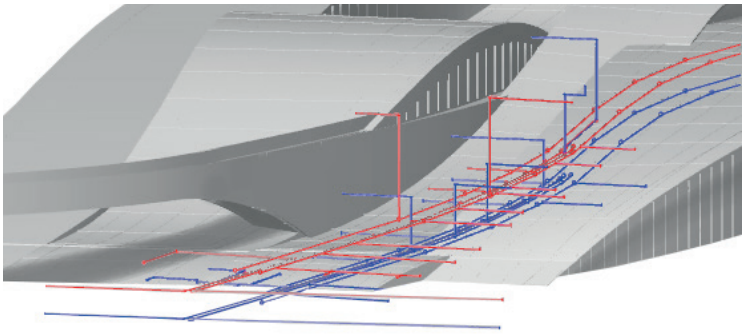
Building Performance

THE FINAL RESULTS FOR THE INDOOR QUALITY AND THE ENERGY CONSUMPTION HAVE BEEN REACHED

The overall building performance is satisfying. The indoor climate in the various functions are all living up the regulations, where the kitchen will have more hours above 26 degrees celsius which higher than the others, but very understandable since it is more prone to heat from the different equipment. The overall CO_2 levels are acceptable as well.

Be15 showed that even though we have a building with a relatively low energy consumption it is not living up to the Danish Building Regulation, but would presumably be within the Finnish Standard. If not, then photovoltaics could be a solution for this problem, which could ensure a lower energy consumption. The PV's could be installed on the roof of the museum or on the neighbor buildings.





Inlet: Blue
Outlet: Red

Ventilation

MECHANICAL AND NATURAL VENTILATION STRATEGIES

The natural ventilation strategy used for the cafe and offices are cross and thermal ventilation. This will ensure a good climate during the majority of the summers with no use of mechanical ventilation except for the kitchen. Natural ventilation is avoided in the central part of the museum.

The mechanical ventilation are spread out to all of the functions in the museum. Having the inlet air come from the ground and the outlet in the ceiling of the different functions. The illustration is showing how the ducts are placed through the center of the building for then to be distributed to the different area of the building. Each exhibition spave have the possibilty of controlling the temperature, to ensure maximum flexibility according to the needs.

Conclusion

The result of the thesis is a building which has both spacial qualities and sustainable background. Although we did not reach the 2020 requirements we managed to reduce the energy consumption in a significant way which can further be lowered to the 2020 goal by adding the PV's. Our aim was to design a building able to evoke the Guggenheim spirit as a landmark and at the same time incorporate the fundamentals of sustainable theories.
The idea of the fluidity and the free spaces are also reflected in the use of ramps, which gives to all types of visitors the same experience and leaves a clean and homogeneous result, free from elevators and stairs in the public areas. All the ramps are fulfilling the Finnish regulation according to inclination. The spaces inside the museum are thought out to be as flexible as possible with their own separate character. This includes large and low spaces, dark and light rooms, straight and organic areas. This results in a great play of different scales and lights. The roof itself plays an important role in creating dramatic transitions between the museum areas. It is also emphasizing the scale and fluidity throughout the building. The internal flow is kept as simple as possible with one continuous route that leads the visitors through the museum and back.
The café and restaurant is thought out to be a pleasant and interesting space where visitors can enjoy the landscape after the visit at the museum and adds another dimension to the experience. The materials here are different from the rest of the public areas inside the museum, since it has wood flooring, to create a more warm and intimate space.
Even though the norm in Helsinki is to keep indoor at the cafés due to the climate conditions, there are possibilities of extending to the area outside in the warmer seasons.
The offices area is made as flexible and pleasant to work in, with hight ceiling heights and a good daylight factor. Moreover, it has its own separate access in the south-western facade. The auditorium which is located in the administration area is thought to have a good acoustical performance and being an interesting addition to the museum.
We decided to keep the urban area around the building as clear as possible to keep the illusion of the ground becoming alive. The urban flows have been taken in consideration in our design in order to attract visitors coming from the main street which moves around the South Harbor and the pedestrians from the park. The bridge is a visual and physical connection between the site and the observatory park which is one of the highest and most populated parks in the area. Moreover the bridge works as a spine of the museum where it connects the functions on one side of the building to the other whilst also distributing technical appliances like veins in a body.
The aim of the competition brief has been fulfilled where all of the guidelines and parameters have been followed. The port terminal which was not a fundamental part of the competition, has also been designed to achieve a more complete project.

Reflection

There are countless ways of approaching a design process following an initial concept and vision. Furthermore, it is subjective which is the optimal one to choose. Although we feel that our design process was the right approach to this project brief, other methods could have been used. Our way was to take a simple shape and form it according to all the parameters we have gotten. This, however, made sure that we did not explore many other shapes which could have resulted in a more dynamic design process. Our approach was to make a Guggenheim, which involves great and new architecture, impressive and suggestive atmospheres. This led us to be more attentive towards the sustainable theme where a balance between aesthetic and sustainability was challenging to achieve. We felt that it was necessary to prioritize aesthetics and not compromise the whole building with the common strategies used for sustainable design. This could have been done differently by allowing more sustainable strategies in the project to achieve a lower energy consumption.
Even though the museum has good functional conditions, some changes can be adopted in order to improve the mobility for the staff.
Although the shape of the building was made as intended, some factors could be looked into in the future. This involves the access to the roof, as the main issue.
Moreover, the use of steel, concrete and large glass facades may not be an optimal environmental strategy due to its high carbohydrate emissions produced during the fabrication.

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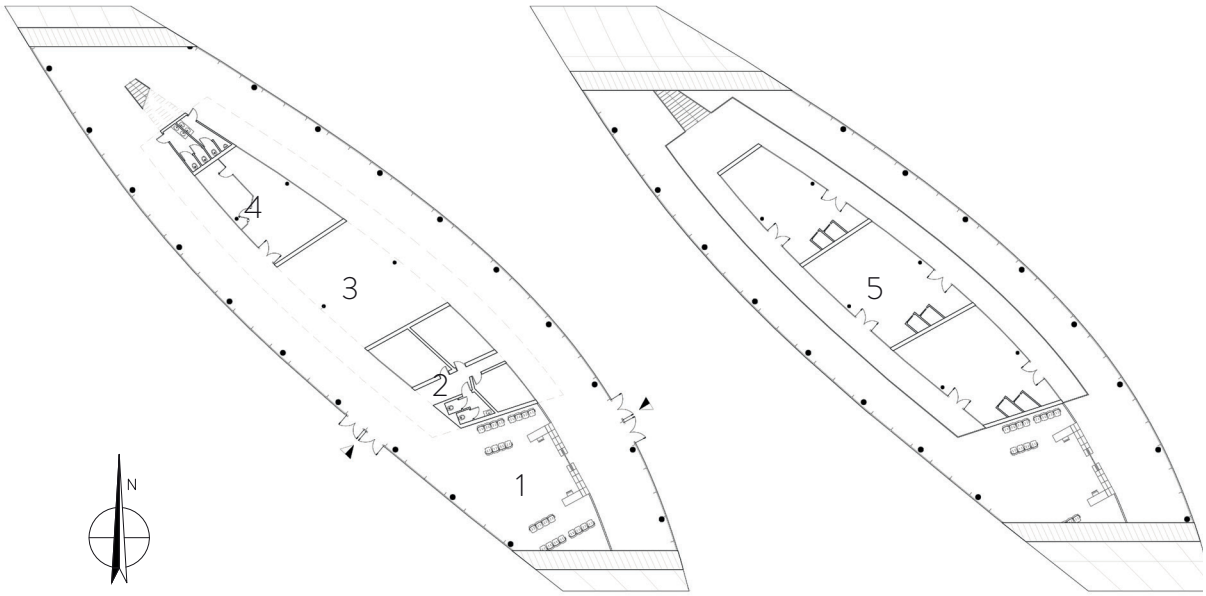
The Sea: Photo by https://commons.wikimedia.org/wiki/File:Bandon_State_Nature_Area_%28Bandon,_Oregon%29.jpg

ANNEX

PORT TERMINAL



1 Port terminal
2 Offices
3 Information Point
4 Travel Agency
5 Shop area

STRUCTURAL ANALYSIS

MAIN STRIP

	Span (m)	q_s (KN/m^2)	q_p (KN/m^2)	q_a (KN/m^2)	q_u (KN/m)	luce (m)	M_{max} (KN*m)	$f_{y,k}$ (N/mm^2)	f_d (N/mm^2)	$W_{x,min}$ (cm^3)	W_x (cm^3)	TYPE	SIZE
A	6,00	4,60	2,03	2,49	76,56	19,58	3668,91	275,00	261,90	14008,57	14070,00	**HL 1000 A**	**990x440**
B	6,00	5,40	2,03	2,49	82,80	21,60	4828,90	275,00	261,90	18437,60	20200,00	**HL 1000 M**	**1000x443**
C	6,00	6,30	2,03	2,49	89,82	23,30	6095,30	275,00	261,90	23272,95	23350,00	**HL 1000 M**	**1000x539**
D	6,00	7,90	2,03	2,49	102,30	24,50	7675,70	275,00	261,90	29307,21	32430,00	**HL 1000 M**	**1000x748**
E	6,00	7,90	2,03	2,49	102,30	25,50	8315,07	275,00	261,90	31748,46	32430,00	**HL 1000 M**	**1000x748**
F	6,00	8,60	2,03	2,49	107,76	26,00	9105,72	275,00	261,90	34767,29	38389,00	**HL 1000 M**	**1000X882**
G	6,00	8,60	2,03	2,49	107,76	26,60	9530,83	275,00	261,90	36390,45	38389,00	**HL 1000 M**	**1000X882**
H	6,00	8,60	2,03	2,49	107,76	27,30	10039,06	275,00	261,90	38330,94	38390,00	**HL 1000 M**	**1000X883**
I	6,00	8,60	2,03	2,49	107,76	27,00	9819,63	275,00	261,90	37493,13	38391,00	**HL 1000 M**	**1000X884**
J	6,00	8,60	2,03	2,49	107,76	26,60	9530,83	275,00	261,90	36390,45	38392,00	**HL 1000 M**	**1000X885**
K	6,00	7,90	2,03	2,49	102,30	25,50	8315,07	275,00	261,90	31748,46	32430,00	**HL 1000 M**	**1000x748**
L	6,00	7,90	2,03	2,49	102,30	24,40	7613,17	275,00	261,90	29068,45	32430,00	**HL 1000 M**	**1000x748**
M	6,00	6,50	2,03	2,49	91,38	23,10	6095,16	275,00	261,90	23272,43	23880,00	**HL 1000 M**	**1000x554**
N	6,00	4,60	2,03	2,49	76,56	21,40	4382,68	275,00	261,90	16733,86	18330,00	**HL 1000 B**	**1000x400**
O	6,00	4,20	2,03	2,49	73,44	19,40	3454,98	275,00	261,90	13191,76	14220,00	**HL 1000 AA**	**982x400**
P	6,00	5,00	2,03	2,49	79,68	17,20	2946,57	275,00	261,90	11250,53	11650,00	**HE 650x407**	**650x407**
Q	6,00	3,74	2,03	2,49	69,85	14,90	1938,48	275,00	261,90	7401,47	7933,00	**HE 550 M**	**572x306**
R	6,00	3,70	2,03	2,49	69,54	12,70	1402,01	275,00	261,90	5353,14	5501,00	**HE 450 M**	**478x307**
S	6,00	3,40	2,03	2,49	67,20	10,90	998,00	275,00	261,90	3810,56	4052,00	**HE 340 M**	**377x309**
T	6,00	3,30	2,03	2,49	66,42	9,60	765,16	275,00	261,90	2921,51	3482,00	**HE 300 M**	**340x310**
U	6,00	2,70	2,03	2,49	61,74	9,00	625,12	275,00	261,90	2386,81	2551,00	**HE 280 M**	**310x288**
V	6,00	3,30	2,03	2,49	66,42	9,70	781,18	275,00	261,90	2982,70	3482,00	**HE 300 M**	**340x310**
W	6,00	3,40	2,03	2,49	67,20	10,70	961,72	275,00	261,90	3672,01	4052,00	**HE 340 M**	**377x309**
Y	6,00	3,70	2,03	2,49	69,54	12,70	1402,01	275,00	261,90	5353,14	5501,00	**HE 450 M**	**478x307**
Z	6,00	3,90	2,03	2,49	71,10	13,40	1595,84	275,00	261,90	6093,21	6180,00	**HE 500 M**	**572x306**
A'	6,00	4,10	2,03	2,49	72,66	13,70	1704,69	275,00	261,90	6508,83	7933,00	**HE 550 M**	**572x306**
B'	6,00	4,10	2,03	2,49	72,66	13,70	1704,69	275,00	261,90	6508,83	7933,00	**HE 550 M**	**572x306**
C'	3,00	3,90	2,03	2,49	35,55	19,00	1604,19	275,00	261,90	6125,10	6180,00	**HE 500 M**	**572x306**
1	13,00	1,20	2,03	2,49	108,42	6,00	487,89	275,00	261,90	1862,85	1928,00	**IPE 500**	**500x200**
2	13,00	1,20	2,03	2,49	108,42	6,00	487,89	275,00	261,90	1862,85	1928,00	**IPE 500**	**500x200**

OFFICES

	Span (m)	q_s (KN/m^2)	q_p (KN/m^2)	q_a (KN/m^2)	q_u (KN/m)	luce (m)	M_{max} (KN*m)	$f_{y,k}$ (N/mm^2)	f_d (N/mm^2)	$W_{x,min}$ (cm^3)	W_x (cm^3)	TYPE	SIZE
a	6,00	1,12	2,03	2,49	49,42	1,62	16,21	275,00	261,90	61,90	77,32	**IPE 140**	**140x73**
b	6,00	1,22	2,03	2,49	50,20	2,70	45,74	275,00	261,90	174,65	194,00	**IPE 200**	**200x100**
c	6,00	1,36	2,03	2,49	51,29	3,80	92,57	275,00	261,90	353,47	428,00	**IPE 270**	**270x135**
d	6,00	1,49	2,03	2,49	52,30	4,86	154,42	275,00	261,90	589,60	713,00	**IPE 330**	**300x160**
e	6,00	1,57	2,03	2,49	52,93	5,90	230,29	275,00	261,90	879,31	903,00	**IPE 360**	**360x170**
f	6,00	1,77	2,03	2,49	54,49	6,90	324,26	275,00	261,90	1238,08	1500,00	**IPE 450**	**450x190**
g	6,00	1,90	2,03	2,49	55,50	7,90	432,97	275,00	261,90	1653,16	1928,00	**IPE 500**	**500x200**
h	6,00	2,05	2,03	2,49	56,67	8,90	561,10	275,00	261,90	2142,40	2441,00	**IPE 550**	**550x210**
i	6,00	2,20	2,03	2,49	57,84	9,80	694,37	275,00	261,90	2651,23	3069,00	**IPE 600**	**600x220**
j	6,00	3,40	2,03	2,49	67,20	10,60	943,82	275,00	261,90	3603,69	3769,00	**HE 320 M**	**359x309**
k	6,00	3,50	2,03	2,49	67,98	11,30	1085,05	275,00	261,90	4142,90	4820,00	**HE 400 M**	**432x307**
l	6,00	2,96	2,03	2,49	63,77	12,00	1147,82	275,00	261,90	4382,60	4971,00	**HE 550 B**	**550x300**
m	6,00	2,96	2,03	2,49	63,77	12,60	1265,48	275,00	261,90	4831,82	4971,00	**HE 550 B**	**550x300**
n	6,00	4,10	2,03	2,49	72,66	13,10	1558,65	275,00	261,90	5951,20	7933,00	**HE 550 M**	**572x306**
o	6,00	4,10	2,03	2,49	72,66	13,50	1655,29	275,00	261,90	6320,18	7933,00	**HE 550 M**	**572x306**
p	6,00	4,10	2,03	2,49	72,66	13,80	1729,67	275,00	261,90	6604,20	7933,00	**HE 550 M**	**572x306**
q	6,00	4,10	2,03	2,49	72,66	14,10	1805,69	275,00	261,90	6894,46	7933,00	**HE 550 M**	**572x306**
r	6,00	4,10	2,03	2,49	72,66	14,30	1857,28	275,00	261,90	7091,43	7933,00	**HE 550 M**	**572x306**
s	6,00	4,10	2,03	2,49	72,66	14,40	1883,35	275,00	261,90	7190,96	7933,00	**HE 550 M**	**572x306**
t	6,00	4,10	2,03	2,49	72,66	14,50	1909,60	275,00	261,90	7291,18	7933,00	**HE 550 M**	**572x306**
u	6,00	4,10	2,03	2,49	72,66	14,56	1925,43	275,00	261,90	7351,65	7933,00	**HE 550 M**	**572x306**
v	3,00	2,20	2,03	2,49	28,92	14,50	760,05	275,00	261,90	2902,02	3069,00	**IPE 600**	**600x220**
w	3,00	2,20	2,03	2,49	28,92	14,50	760,05	275,00	261,90	2902,02	3069,00	**IPE 600**	**600x220**
1	16,60	2,20	2,03	2,49	160,02	6,00	720,11	275,00	261,90	2749,50	3069,00	**IPE 600**	600x220

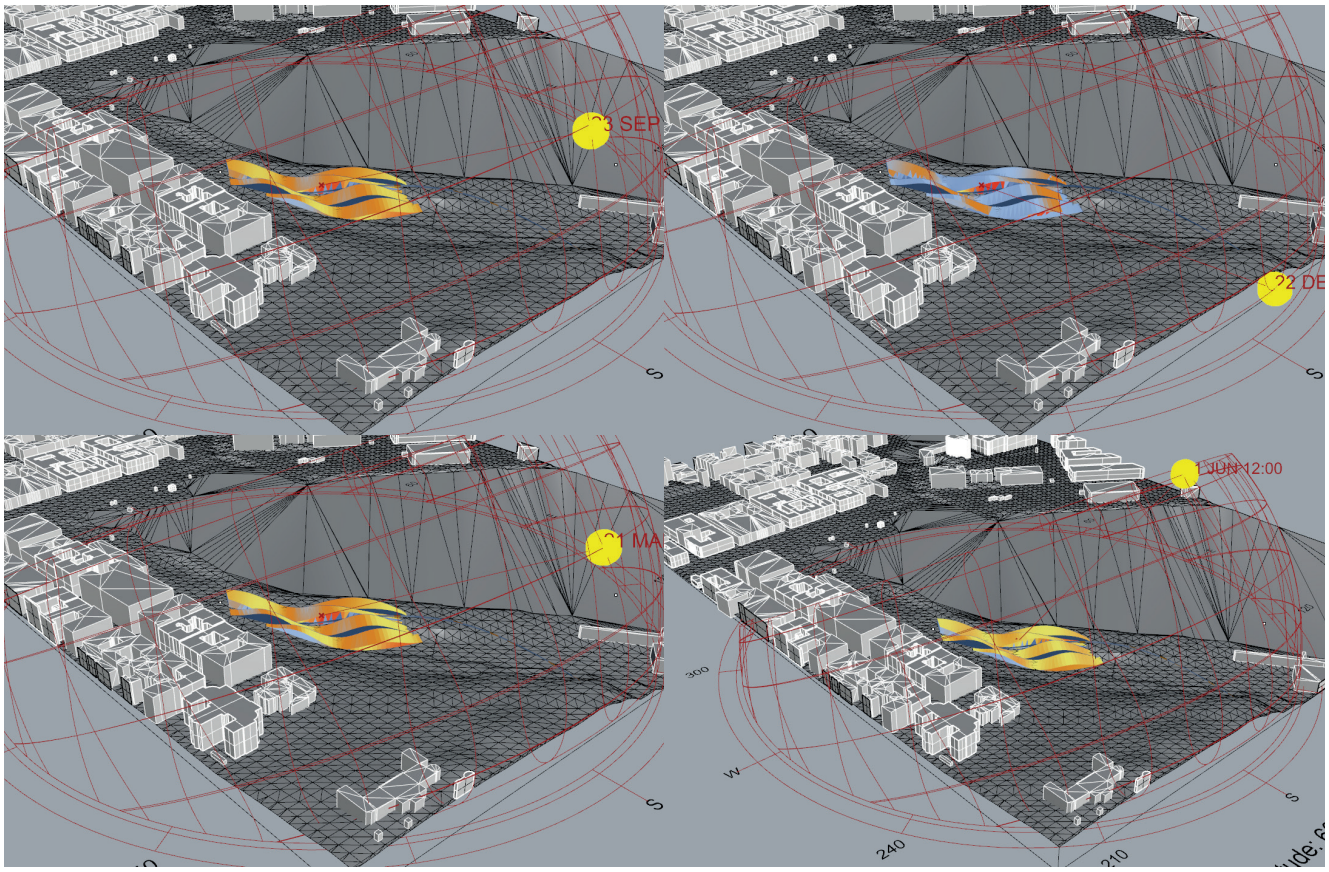
CAFE

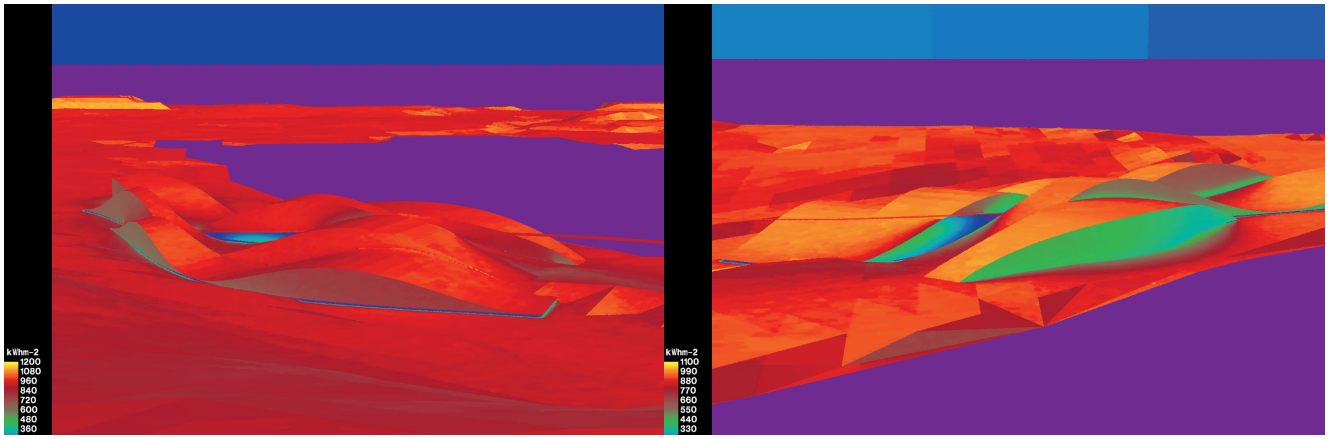
	Span (m)	q_s (KN/m^2)	q_p (KN/m^2)	q_a (KN/m^2)	q_u (KN/m)	luce (m)	M_{max} (KN*m)	$f_{y,k}$ (N/mm^2)	f_d (N/mm^2)	$W_{x,min}$ (cm^3)	W_x (cm^3)	TYPE	SIZE
a	6,00	1,15	2,03	2,49	49,65	1,90	22,40	275,00	261,90	85,54	108,00	**IPE 160**	**160x82**
b	6,00	1,49	2,03	2,49	52,30	4,44	128,88	275,00	261,90	492,10	713,00	**IPE 330**	**300x160**
c	6,00	1,77	2,03	2,49	54,49	7,10	343,33	275,00	261,90	1310,90	1500,00	**IPE 450**	**450x190**
d	6,00	3,40	2,03	2,49	67,20	10,00	840,00	275,00	261,90	3207,27	3769,00	**HE 320 M**	**359x309**
e	6,00	2,96	2,03	2,49	63,77	12,70	1285,64	275,00	261,90	4908,82	4971,00	**HE 550 B**	**550x300**
f	6,00	4,10	2,03	2,49	72,66	15,00	2043,56	275,00	261,90	7802,69	7933,00	**HE 550 M**	**572x306**
g	6,00	4,90	2,03	2,49	78,90	16,50	2685,07	275,00	261,90	10252,07	10640,00	**HE 600x399**	**648x315**
h	6,00	4,60	2,03	2,49	76,56	17,50	2930,81	275,00	261,90	11190,38	14070,00	**HL 1000 A**	**990x440**
i	6,00	4,80	2,03	2,49	78,12	17,00	2822,09	275,00	261,90	10775,23	11650,00	**HE 650x407**	**650x407**
j	6,00	4,90	2,03	2,49	78,90	16,10	2556,46	275,00	261,90	9761,02	10640,00	**HE 600x399**	**648x315**
k	6,00	4,20	2,03	2,49	73,44	14,50	1930,10	275,00	261,90	7369,45	8961,00	**HE 600x337**	**632X310**
l	6,00	2,96	2,03	2,49	63,77	12,60	1265,48	275,00	261,90	4831,82	4971,00	**HE 550 B**	**550x300**
m	6,00	2,96	2,03	2,49	63,77	10,70	912,60	275,00	261,90	3484,47	4971,00	**HE 550 B**	**550x300**
n	6,00	2,05	2,03	2,49	56,67	9,00	573,78	275,00	261,90	2190,81	2441,00	**IPE 550**	**550x210**
o	6,00	1,77	2,03	2,49	54,49	7,50	383,10	275,00	261,90	1462,76	1500,00	**IPE 450**	**450x190**
2	13,55	2,05	2,03	2,49	127,98	6,00	575,91	275,00	261,90	2198,92	2441,00	**IPE 550**	550x210
3	8,70	1,57	2,03	2,49	76,74	6,00	345,34	275,00	261,90	1318,58	1500,00	**IPE 450**	**450x190**

SECOND STRIP

	Span (m)	q_s (KN/m^2)	q_p (KN/m^2)	q_a (KN/m^2)	q_u (KN/m)	luce (m)	M_{max} (KN*m)	$f_{y,k}$ (N/mm^2)	f_d (N/mm^2)	$W_{x,min}$ (cm^3)	W_x (cm^3)	TYPE	SIZE
A	3,00	4,10	2,03	2,49	36,33	17,70	1422,73	275,00	261,90	5432,23	6180,00	**HE 500 M**	**572x306**
B	6,00	4,60	2,03	2,49	76,56	17,50	2930,81	275,00	261,90	11190,38	14070,00	**HL 1000 A**	**990x440**
C	6,00	4,80	2,03	2,49	78,12	17,10	2855,38	275,00	261,90	10902,37	11650,00	**HE 650x407**	**650x407**
D	6,00	4,90	2,03	2,49	78,90	16,30	2620,37	275,00	261,90	10005,04	10640,00	**HE 600x399**	**648x315**
E	6,00	4,90	2,03	2,49	78,90	16,20	2588,31	275,00	261,90	9882,66	10640,00	**HE 600x399**	**648x315**
F	6,00	4,90	2,03	2,49	78,90	15,80	2462,07	275,00	261,90	9400,65	10640,00	**HE 600x399**	**648x315**
G	6,00	4,20	2,03	2,49	73,44	15,40	2177,13	275,00	261,90	8312,67	8961,00	**HE 600x337**	**632X310**
H	6,00	4,20	2,03	2,49	73,44	15,20	2120,95	275,00	261,90	8098,16	8961,00	**HE 600x337**	**632X310**
I	6,00	4,20	2,03	2,49	73,44	15,20	2120,95	275,00	261,90	8098,16	8961,00	**HE 600x337**	**632X310**
J	6,00	4,20	2,03	2,49	73,44	15,30	2148,95	275,00	261,90	8205,07	8961,00	**HE 600x337**	**632X310**
K	6,00	4,90	2,03	2,49	78,90	15,80	2462,07	275,00	261,90	9400,65	10640,00	**HE 600x399**	**648x315**
L	6,00	4,90	2,03	2,49	78,90	16,40	2652,62	275,00	261,90	10128,18	10640,00	**HE 600x399**	**648x315**
M	6,00	4,80	2,03	2,49	78,12	17,20	2888,88	275,00	261,90	11030,26	11650,00	**HE 650x407**	**650x407**
N	6,00	4,60	2,03	2,49	76,56	18,00	3100,68	275,00	261,90	11838,96	14070,00	**HL 1000 A**	**990x440**
O	6,00	4,60	2,03	2,49	76,56	18,80	3382,42	275,00	261,90	12914,70	14070,00	**HL 1000 A**	**990x440**
P	6,00	4,60	2,03	2,49	76,56	19,48	3631,53	275,00	261,90	13865,85	14070,00	**HL 1000 A**	**990x440**
Q	6,00	4,80	2,03	2,49	78,12	19,80	3828,27	275,00	261,90	14617,03	14630,00	**HE 900x391**	**922x307**
R	6,00	5,40	2,03	2,49	82,80	20,00	4140,00	275,00	261,90	15807,27	20200,00	**HL 1000 M**	**1000x443**
S	6,00	4,60	2,03	2,49	76,56	19,60	3676,41	275,00	261,90	14037,21	14070,00	**HL 1000 A**	**990x440**
T	6,00	4,60	2,03	2,49	76,56	19,10	3491,23	275,00	261,90	13330,16	14070,00	**HL 1000 A**	**990x440**
U	6,00	4,60	2,03	2,49	76,56	18,30	3204,90	275,00	261,90	12236,88	14070,00	**HL 1000 A**	**990x440**
V	6,00	4,80	2,03	2,49	78,12	17,30	2922,57	275,00	261,90	11158,89	11650,00	**HE 650x407**	**650x407**
W	6,00	4,90	2,03	2,49	78,90	16,10	2556,46	275,00	261,90	9761,02	10640,00	**HE 600x399**	**648x315**
Y	6,00	4,20	2,03	2,49	73,44	15,00	2065,50	275,00	261,90	7886,45	8961,00	**HE 600x337**	**632X310**
X	6,00	3,80	2,03	2,49	70,32	13,90	1698,32	275,00	261,90	6484,48	7660,00	**HE 600 M**	**620x305**
Z	6,00	4,10	2,03	2,49	72,66	13,00	1534,94	275,00	261,90	5860,69	7933,00	**HE 550 M**	**572x306**
A'	6,00	2,96	2,03	2,49	63,77	12,40	1225,62	275,00	261,90	4679,64	4971,00	**HE 550 B**	**550x300**
B'	3,00	2,05	2,03	2,49	28,34	12,20	527,17	275,00	261,90	2012,84	2441,00	**IPE 550**	**550x210**
1	10,00	1,20	2,03	2,49	83,40	6,00	375,30	275,00	261,90	1432,96	1928,00	IPE 500	500x200
2	10,00	1,20	2,03	2,49	83,40	6,00	375,30	275,00	261,90	1432,96	1928,00	IPE 500	500x200

secondary bea


S
W
240
300
JUN 12:00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960
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720
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kWhm-2
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990
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660
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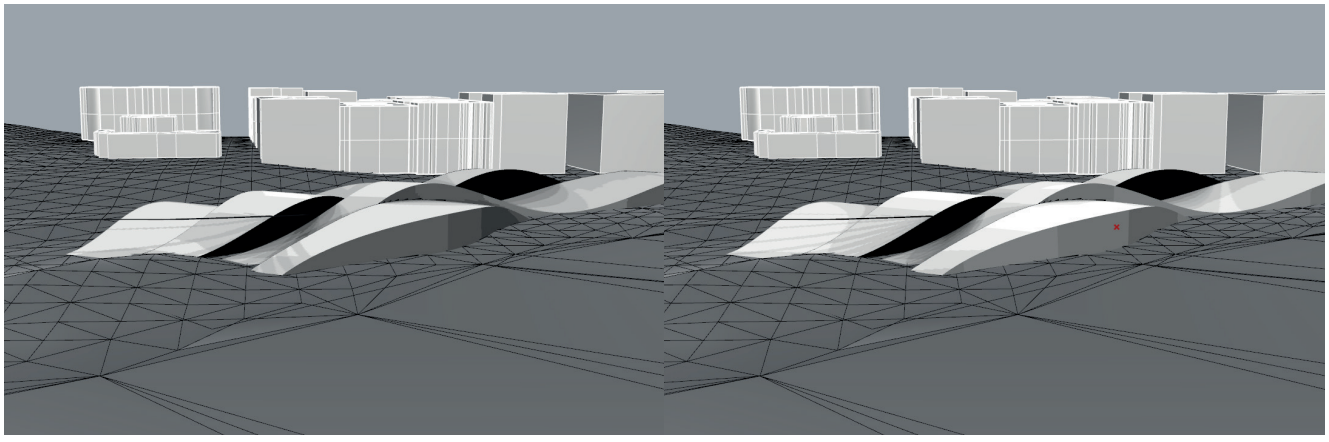
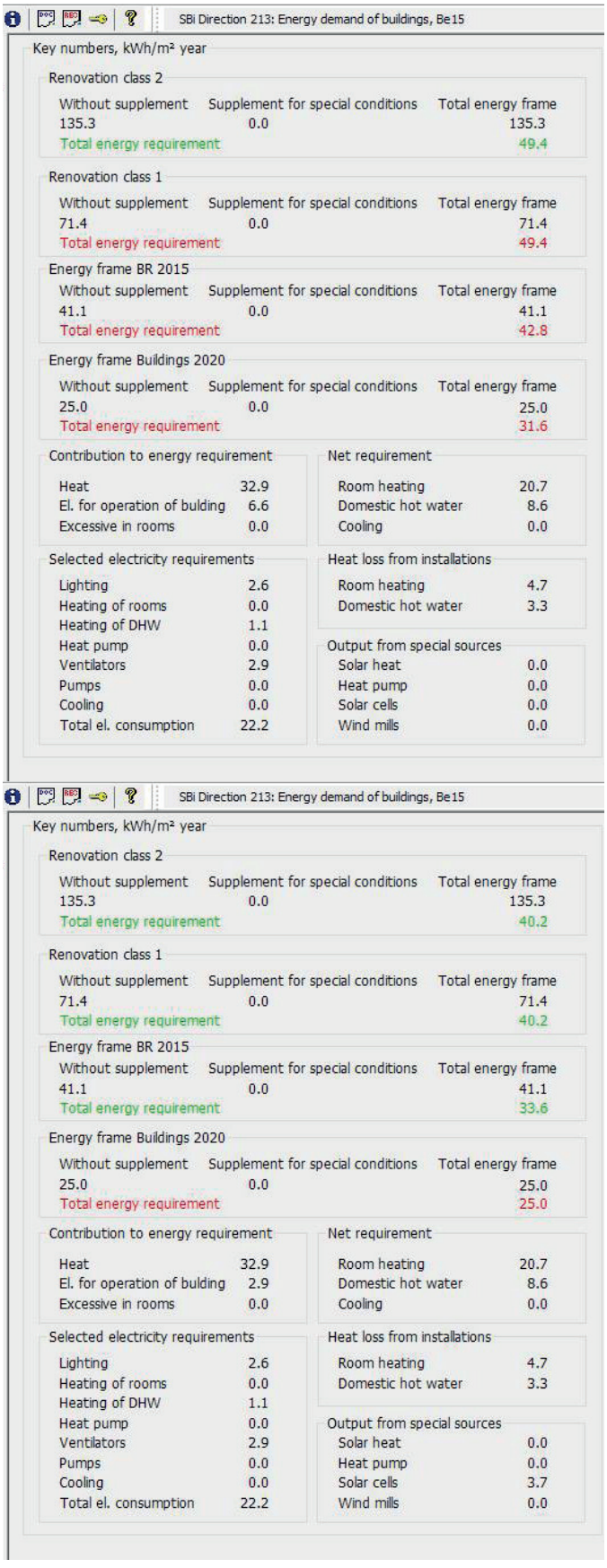
440
330



BE15 WITHOUT AND WITH PV´S



SBi Direction 213: Energy demand of buildings, Be15

Key numbers, kWh/m² year

Renovation class 2

Without supplement	Supplement for special conditions	Total energy frame
135.3	0.0	135.3
Total energy requirement		49.4

Renovation class 1

Without supplement	Supplement for special conditions	Total energy frame
71.4	0.0	71.4
Total energy requirement		49.4

Energy frame BR 2015

Without supplement	Supplement for special conditions	Total energy frame
41.1	0.0	41.1
Total energy requirement		42.8

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
25.0	0.0	25.0
Total energy requirement		31.6

Contribution to energy requirement

Heat	32.9
El. for operation of bulding	6.6
Excessive in rooms	0.0

Net requirement

Room heating	20.7
Domestic hot water	8.6
Cooling	0.0

Selected electricity requirements

Lighting	2.6
Heating of rooms	0.0
Heating of DHW	1.1
Heat pump	0.0
Ventilators	2.9
Pumps	0.0
Cooling	0.0
Total el. consumption	22.2

Heat loss from installations

Room heating	4.7
Domestic hot water	3.3

Output from special sources

Solar heat	0.0
Heat pump	0.0
Solar cells	0.0
Wind mills	0.0

SBi Direction 213: Energy demand of buildings, Be15

Key numbers, kWh/m² year

Renovation class 2

Without supplement	Supplement for special conditions	Total energy frame
135.3	0.0	135.3
Total energy requirement		40.2

Renovation class 1

Without supplement	Supplement for special conditions	Total energy frame
71.4	0.0	71.4
Total energy requirement		40.2

Energy frame BR 2015

Without supplement	Supplement for special conditions	Total energy frame
41.1	0.0	41.1
Total energy requirement		33.6

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
25.0	0.0	25.0
Total energy requirement		25.0

Contribution to energy requirement

Heat	32.9
El. for operation of bulding	2.9
Excessive in rooms	0.0

Net requirement

Room heating	20.7
Domestic hot water	8.6
Cooling	0.0

Selected electricity requirements

Lighting	2.6
Heating of rooms	0.0
Heating of DHW	1.1
Heat pump	0.0
Ventilators	2.9
Pumps	0.0
Cooling	0.0
Total el. consumption	22.2

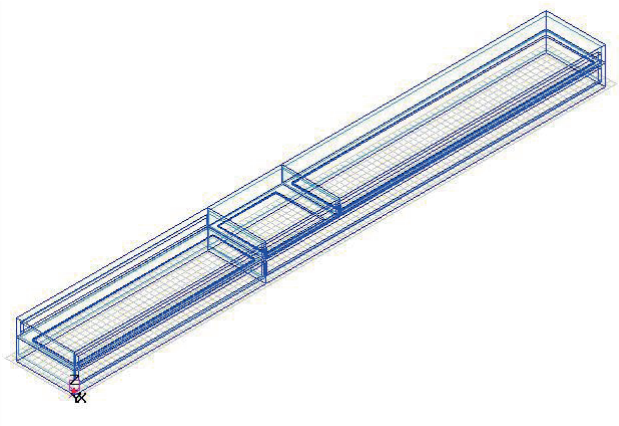
Heat loss from installations

Room heating	4.7
Domestic hot water	3.3

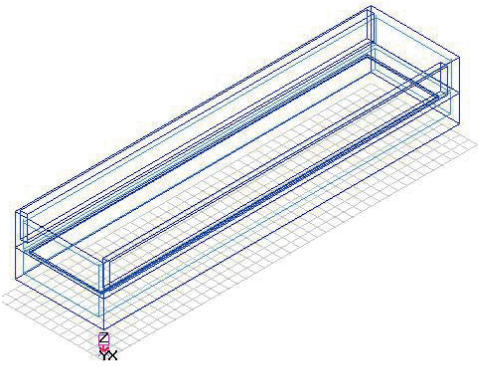
Output from special sources

Solar heat	0.0
Heat pump	0.0
Solar cells	3.7
Wind mills	0.0

BSIM CAFE MODEL



BSIM EXHIBITION MODEL



BSIM OFFICES MODEL