MASTER-/DIPLOMARBEIT

Opera house Tallinn
Opernhaus Tallinn

A new connection to the sea
Eine neue Verbindung zum Meer

ausgeführt zum Zwecke der Erlangung
des akademischen Grades eines
Diplom-Ingenieurs / Diplom-Ingenieurin
unter der Leitung von

Manfred Berthold
Prof Arch DI Dr

und unter der Mitbetreuung von

Christoph Müller
Univ.Lektor DI Dr

E253 - Institut für Architektur und Entwerfen

eingereicht an der Technischen Universität Wien
Fakultät für Architektur und Raumplanung

Emiliya Marinova
Matr. Nr. 01253400

A 1080 Wien
Pfeilgasse 1a

+43 676 6881170
emarinova93@gmail.com

Wien, am _____
Datum

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Unterschrift

Abstrakt

Tallinn ist eine sich sehr rasch entwickelnde Stadt, die großen Wert auf Smart-Ideen und digitale Technologien legt. Deswegen ist Tallinn die passende Stadt für das Aufkommen von neuartigen Konzepten. Die Idee für das Projekt ist durch einen Ideenwettbewerb im Rahmen von einem größeren städtebaulichen Plan entstanden. Im Masterplan 2030 ist die Entwicklung von dem Tallinn Hafen Areal vorgesehen. Als ein neuer kultureller Anziehungspunkt soll ein Opernhaus gebaut werden, welches die Integration von Vorhandenen mit den neu entstehenden Gebäuden schaffen soll.
Inhalt dieser Arbeit ist die Untersuchung und der Entwurf für eine Oper, deren Gestaltung innovative Lösungen erzielt, die auch den Anforderungen für heutige Opernhäuser entsprechen sollen. Im Fokus von diesem Gebäude steht die Gelegenheit für saisonbedingte Aufführungen, um verschiedene Erlebnisse für die Besucher zu schaffen.
Um diese Ziele zu erreichen, beschäftigt sich die vorliegende Arbeit mit der Recherche über anregende Vorbilder, sowie auch mit Analysen über bestehende Anforderungen. Resultat ist ein Entwurf, der eine neuartige Typologie und eine städtebauliche Intervention vorschlägt.

Abstract

Tallinn is a rapidly developing city, well-known for its progressive initiatives and smart technology applications. For this reason it is a very suitable location for the production of new building concepts. The idea for the project emerged from an idea competition as a part of a larger urban renewal plan. Masterplan 2030 foresees the redevelopment of the Old City Harbor and a new Opera House is to be built as a main cultural attraction point. Its design should integrate the existing built form with the newly arising buildings. Methodologically this project comprises a thorough research and a design strategy for an opera house. The result aims to find innovative solutions that also comply with contemporary requirements for this building type. A central element of the opera is the potential for seasonal performances to expose visitors to more diverse experiences throughout the year.
To achieve these objectives, this work introduces emblematic precedents and analyses of modern requirements. The end product results in a design proposing a novel typology and an urban intervention to connect the existing building pattern with the new.

Contents

I. INTRODUKTION

The development of new building technologies and production processes changes people's perceptions towards architecture. Nowadays more than ever the formal language of architecture can be expressed in built projects and should serve the society. However there is always a need for a certain negotiation between form and function. The opera house is a typology that requires a fulfillment of functional standards and it should be planned for the convenience of people. Multiple aspects should be integrated into the building concept such as the spectator capacity, lighting, acoustics, visibility conditions, necessary rooms etc.
Aim of this work is to find an aesthetic expression of function and provide new spatial qualities to the public. For the research of intertwinement of these aspects some inspiring precedents exist such as the Harbin Opera House by MAD Architects and Guangzhou Opera House by Zaha Hadid Architects. Building on these ideas the role of the stage should be reconsidered as a classical fixed element serving only one purpose. It could be an ever-changing element and provide diverse experiences for the audience.
The aim is to create an architectural design that adapts to landscape. The location of the new building provides various opportunities due to its proximity to the sea and to the old cultural heritage Linnahall that used to be a public building. It will be a part of a larger project for the fast-growing port area that will be expanded by 2030. From my perspective, the new opera house should create an atmosphere that liberates from the massive architectural language of the socialist style and establishes an urban connection between the Linnahall and the Old City Marina.

II. SITUATION

Fig.1: Linnahall, Tallinn, Estonia, Competition Opera by the sea, Uni Team

I. Competition Opera by the sea

Task:	A new design for an opera house building
Location:	Tallinn, Estonia
Organizer:	UNI competitions, New Delhi, India <uni.xyz/competitions>
Deadline:	20.10.2020.
Description:	Nowadays opera houses are seen as cultural identity of the modern society. The competition aims to find good solutions for designing a new opera house for the city that will become an icon for the city of Tallinn and will attract more tourist as well locals visitors. (Information and overview of the competition, p. 5, UNIT, 15.02.2020) Its design has to allow a multi functional structure, hosting conferences, auditoriums, museums, eateries. (ibid., p.6) Designing a public space that fits to the context and makes the area more alive. A parking should not be included in the design requirements. (ibid., p.7)

Fig.2: Site, Competition Opera by the sea, provided by Uni Team

The site of the future opera house is located in a key area of the city, direct on the Gulf of Finland and in close proximity to the former multi-functional hall- Linnahall. The location intends to further develop and improve the area and to restore the Linnahall as a cultural heritage. The new opera house should become a symbol of the city as well as a common touristic attraction. (Information and overview of the competition, page 10, UNIT, 15.02.2020)

Fig.3: Site photo, Competition Opera by the sea, provided by Uni Team

Fig.4: Site photo, Competition Opera by the sea, provided by Uni Team

Fig.5: Site photo, Tallinn, Estonia, view from google maps

2. Theoretical knowledge

2.1. Modern examples

Fig.6: Guangzhou Opera house

Fig.7 left: Guangzhou Opera house, Foyer

Fig.8 right: Guangzhou Opera house, Foyer

Guangzhou Opera House, Zaha Hadid Architects

Construction: 2005-2010
Architect: Zaha Hadid architects
Capacity: big auditorium: 1800
Small Auditorium: 400
Cost: $ 211 Million

Guangzhou Opera house was designed by Zaha Hadid Architects, who won the international competition in 2002 in which Rem Koolhaas architects and COOP Himmelblau competed as finalists. The construction started in 2005 and was completed 2012. The building is located on the embankment promenade of the Pearl River in the new business area of the city, surrounded by plenty of skyscrapers.

Shape

The opera is designed as two large pebble shaped structures, which look like two boulders that have naturally obtained their shape from the water washing around them. The big house represents the main auditorium, offering space for 1800 people and the smaller house provide a multipurpose performance hall for 400 guests.
The opera house was a considered as a masterpiece in the digital architecture as it was one of the first parametric designed building to be realized. (Guangzhou Opera house, Detail Magazin, page 184, 03.2011)

Façade and panelizing

The outside shape of the building is divided into a triangulation system structure, which allows the building to be covered by triangular tiles made of glass and white and black granite. T he black granite has been used for the main building, in contrast to it, the small one shines in white color.(ibid., p.3)

Foyer

The foyers are voluminous, column-free public spaces. The lobbies wrap most of the hall so that audiences can circumambulate the theater. The sweeping staircases and sculpted terraces of the foyer in the main building give a direct access to the auditorium. (ibid.)

Auditorium

The small multi-functional hall has a form of a black shiny cube and is contained in the triangulated grid from the outside. It can be easily reconstructed to fit the need of the performers.
In a total contrast of It and of the white, gray and black lobby environment, the main auditorium is shining in gold and red. These colors so not only provide a wormer atmosphere but are likely to be more appreciated by the Chinese culture as a symbol of good fortune. The seats are arranged in a slightly asymmetrical pattern with a split level terraced seating. The ceiling lighting is designed with 4,000 little white LED, so that when the main light is switched off during the performance, it looks like you are sitting under a sky full of starts. (ibid.)

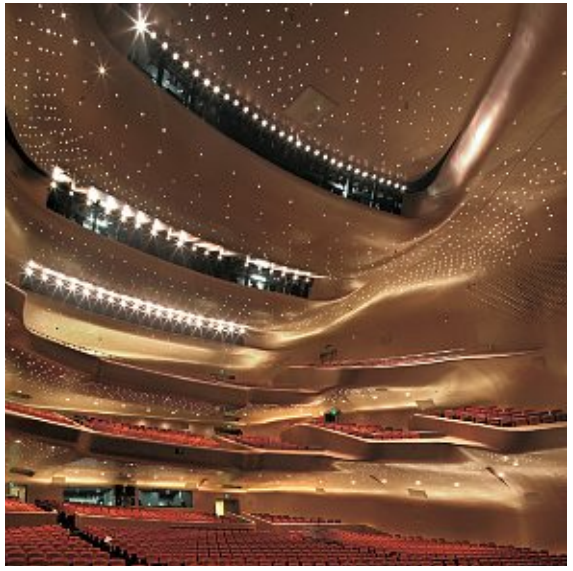
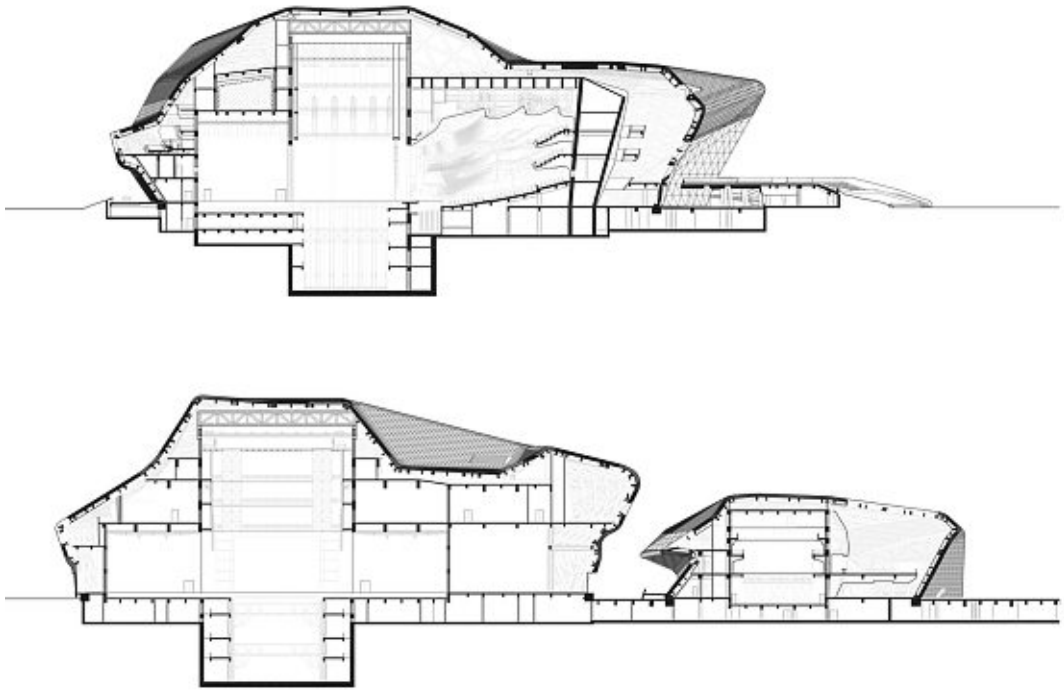


Fig.9. up: Guangzhou Opera house, big Auditorium

Fig.10 down: Guangzhou Opera house, big Auditorium

Fig.11 up: Guangzhou Opera house, Sections

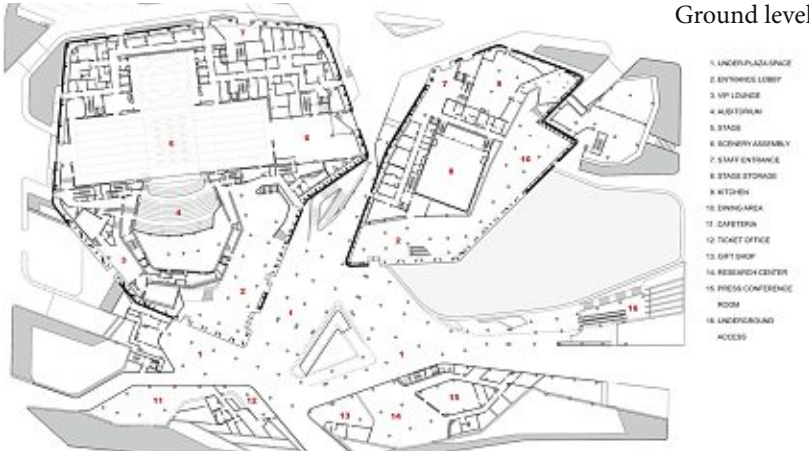


Acoustic concept

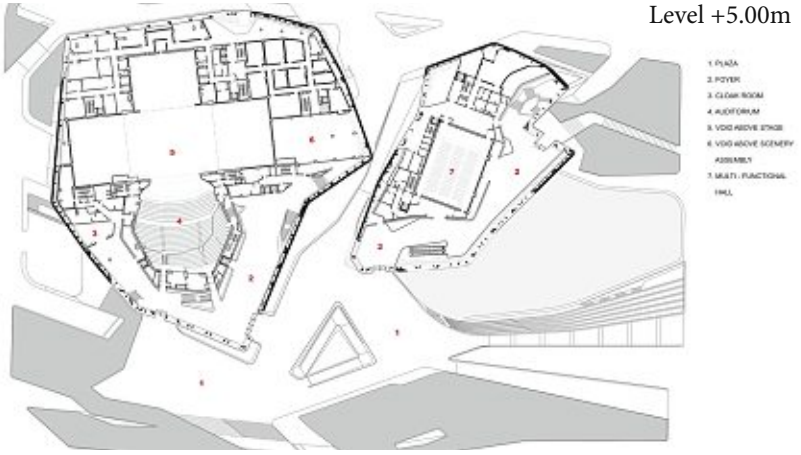
Not only the design is innovative, but also the whole acoustic concept is new. In concert halls the aim of a warm sound has been achieved by a good balance of absorbent and reflecting surfaces. In contrast of that, in an opera house the acoustic clarity is very important so that the lyrics could be understood by the audience. Absorbent surfaces prevent the spreading of the sound energy, which means that they are destroying the sound. As a result of that, the volume in large auditoriums is markedly reduced. For this reason, there are no absorbent surfaces in the Guangzhou opera house except for the upholstered seats. Balustrades, walls and ceilings are lined with a gold-coated, sound-reflecting, fiber-reinforced layer of gypsum plaster. The Control of sound reflections can insure an even distribution of sound energy to every seat. Angled balcony balustrades and the use of parametrically developed fluting to
the walls reduce the sound energy reaching the front seats and reflect it into the depths of the auditorium.(ibid. p.4)

Fig.12. down: Guangzhou Opera house, Floor plans

Ground level

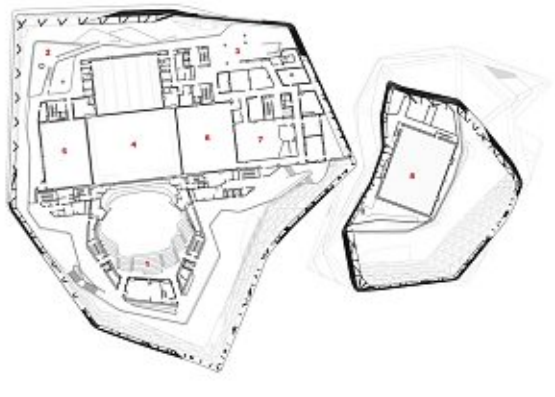


Level +5.00m

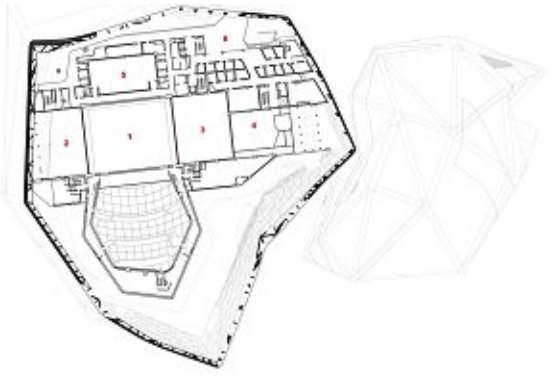


Designing flow and Construction

The complicated building structure required advanced computational technologies. Several different programs have been used. The outer crystalline form was designed and modified with Rhino and the Inner part inside the auditorium was created by more complexed NURB surfaces in Maya. They achieved the organic forms through the work with logarithms, splines, blobs, NURBs and parametric designed codes.
The façade is made by a giant steel lattice, that vaults out of the inner concrete structure and forms a shell with flat facets triangulated with steel members. The facets meet in rounded fillet edges that pivot each facet toward the next. These huge star-shapes joins, 59 of which are used in the facade, are made of cast steel and were formed using an unexpectedly traditional technique. The joins were built from wood, that was embedded in sand to form the molds into which the steel for the final nodes was poured. These joints support the facets of the steel lattice and the whole armature - knots, fillets and lattice together - acts like a rigid surface. The structure was covered in triangular tiles of rough granite (in white and black color).It was a challenge to cover the fillets as it required curved pieces of granite stitched together in tessellated patterns. The structural mesh was indifferent, so it could receive granite and glass. Glass was used in fields that allow you to see the structure and the inside of the lobbies. Working in Maya, the architects sent digital files to the factory where the data was translated and milled into molds into which the final material – glass fiber – reinforced gypsum – could be cast. The forms were put together on site, forming continuous surfaces. (Art, Design and Architecture Collection, Joseph Giovannini, Mai 2011, p.10)
By the time that it was build the Guangzhou opera house was the most ambitious architectural building of its kind in China and it was constructed only by a Chinese company. Several years after the opening, the building received critical comments about the construction quality. The architectural critic Nikolai Ouroussoff in his architectural critic for New York Times, 08.06.2008 describes the construction as poor and mentions that many of the exterior panels has already been replaced. In his opinion the whole constructional work looks clumsy and rough and this is consequence of lock of experience in such area of the construction company and the bad cooperation between the constructors and the architects. Other critics blame the poor construction quality to China`s attempt to save money on the construction and using worse material quality. Nevertheless, The Guangzhou opera house is considered as a very remarkable building that not only has an unique shape, but also provide a high quality performance experience for the audience.



Level +16.00m



Level +20.50m

Fig.12. down: Guangzhou Opera house, Floor plans

2. Theoretical knowledge

2.1. Modern examples

Construction: 2013-2015

Architect: Ma Yansong
(MAD Architects, Beijing)

Big Auditorium: 1600

Small Auditorium: 400

Area: Big auditorium: 3650 m²

Small auditorium: 650m²

Fig. 13: Harbin Opera house

Harbin Opera House,
MAD Architects

The city of Harbin is also known as the Ice city. China`s northernmost province is well known for its hard winter. The average temperature in Harbin during this period is – 18 Degree and temperatures such as -38 have been recorded. Based in Beijing, MAD Architects have developed a design process that can be highly responsive to the site. The design was inspired by very natural geometries in order to present the architecture as part of the landscape. Their goal was not only designing the building itself, but also creating a public space for the residents of Harbin.
The new opera house is located on an island in the river about 5 km away from the city center. The structure, which reminds of a gigantic snow cornice rises 56 m above the flat landscape. The building offers two auditoriums – the large ground theater for the audience of 1,600 and the other for 400 people. These facilities are divided between two building volumes. (Opera house in Harbin, Detail Magazin, 03.2018, p.37)

Construction and Materials

The building is designed to mirror the landscape and to adapt in the extreme weather conditions. To reduce the building time in the cold weather most of the building components were prefabricated and then brought to Harbin for assembling. The roof of the opera house is engineered to hold snowfall. There is also heating installed around downpipes of the drainage system to avoid these becoming frozen.

Both parts of the building have large glazed roofs over the foyers, supported by lattice steel structures. The large glass facade consists of four layers of glazing to reduce heat loss.
The building`s complexity required multiple structural systems and their implementation in building information modeling (BIM). Each of the structural system is different, but fully adaptive with the rest of the building. The parking and base are concrete slabs with columns and beams construction as that was the most efficient system for the typology. The team integrated a steel radial beam system for the back of the house areas and space-frame system for the large distances, where no columns were possible. Each building system was the most efficient for each geometry and purpose and the BIM System was used in order to optimize them individually and to make the connection between them. The design team worked with façade consultants to analyze material, which would be appropriate considering the site's environmental conditions. The materials were chosen in order to fit with city`s extreme temperature differences between summer and winter and meanwhile to maintenance the aesthetic of the shape. Along the river front, the building is covered by white sheet aluminum, in the fold of which public staircases leas up. The metal panels are hold by a steel supporting construction and protect the building from the icy wind. (Sinuous Workflows, Richard Garber, 2017, p.133)

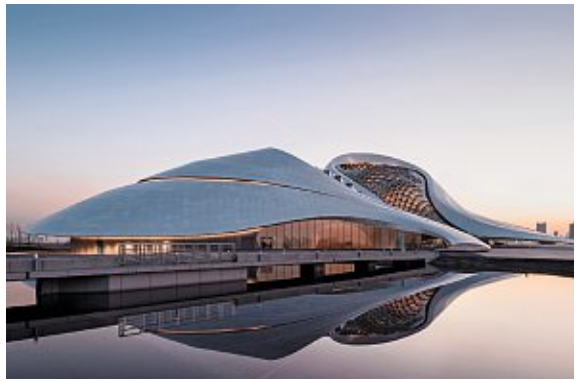


Fig..14 up: Harbin Opera house

Fig.. 15 down: Harbin Opera house,

Fig.16 Harbin Opera house, Foyer

Fig.17 Harbin Opera house, Foyer

Workflows and Building Delivery

Geometric computational analyses developed specially by MAD architects helped optimizing the façade curvature and defining a panelization schema for easier fabrication and assembling methods. The studio on the building design and construction continually through the whole period from the planning until the fully completion and they were involved in all the phases of the project. An architect was stationed on the site for the last two years, working closely with the building company and engineers to update any information and change regarding the project. The completeness of the fully 3D building information model helped achieving a minimal variation from design intent to construction tolerance. (Sinuous Workflows, Richard Garber, 2017, p.134)

Fig.18 up: Harbin Opera house,Section

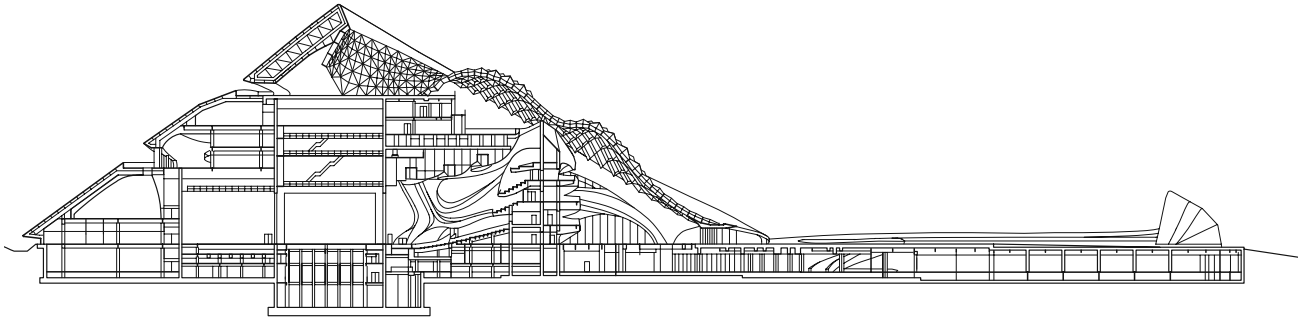


Fig.19 down left: Harbin Opera house,Section

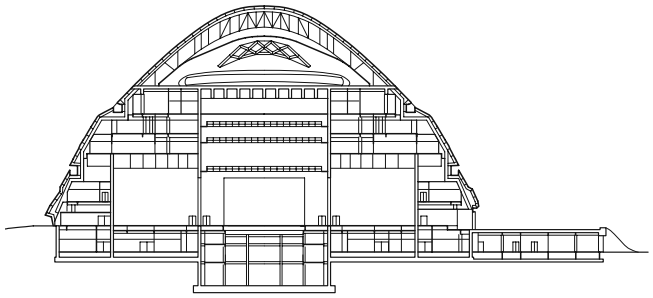
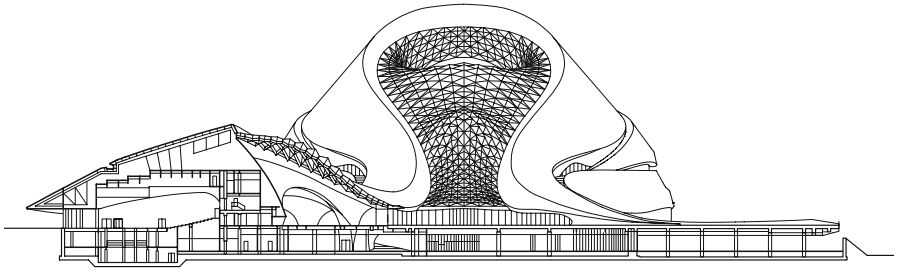


Fig.20 down right: Harbin Opera house,Section



Inside of the Building

The two part of the building have very significant foyers. Daylighted from above and with a polished marble flooring, they look almost completely white. Contrasting with the bright foyer and the white aluminum façade, the grand theatre is lines to timbre to ensure the best performance experience. The auditorium has all the facilities for a classical Opera house such as an orchestra pit, a raised area and two balcony levels with boxes. The edges of the boxes are defined by slender LED strips. The glazed roof at the top of the house allows some daylight to come inside and creates a link between the exterior and interior. Behind the stage of the small auditorium, there is a fully glazed wall with sound-insulating glass, through which one has a view to the external realm. (Opera house in Harbin, Detail Magazin, 03.2018, p.38)

Fig.21 Harbin Opera house, big Auditorium

Fig.22 Harbin Opera house, small Auditorium

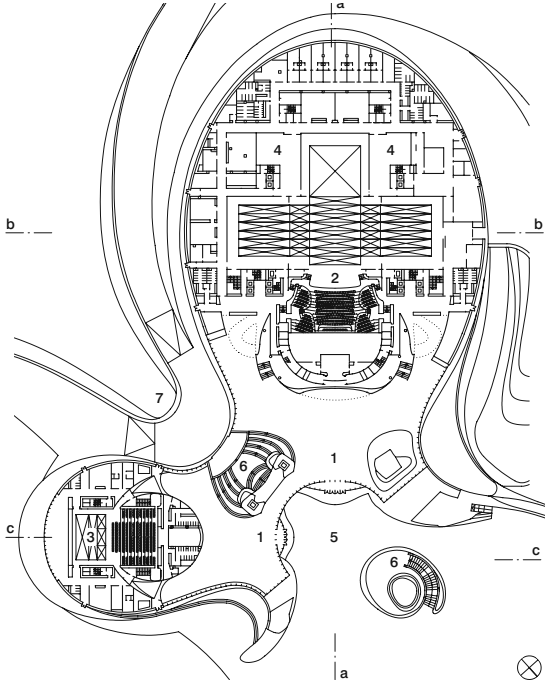


Fig.23. left: Harbin Opera house, floor plan, Ground floor

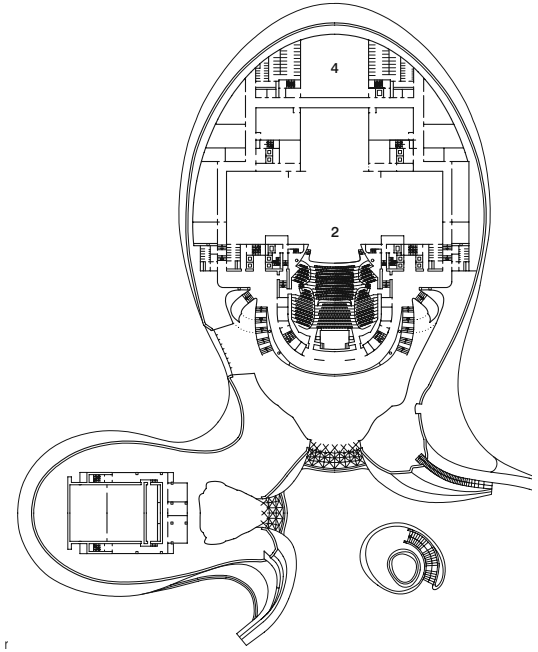


Fig.24 right: Harbin Opera house, floor plan, Upper floor

1. Foyer
2. Large auditorium
3. Small auditorium
4. Rehearsal space
5. Forecourt
6. Stairs to basement garage
7. Garage access

2.2. Building requirements standards and recommendations

An opera house is a place that usually for both opera and ballet performances. Opera houses can host usually between 1,800 and 2,200 viewers. They must provide a well-equipped stage with a large orchestra pit for musicians.
There are three main areas of activity which build a typical opera and they are: Auditorium and stage, Front of house and Backstage.

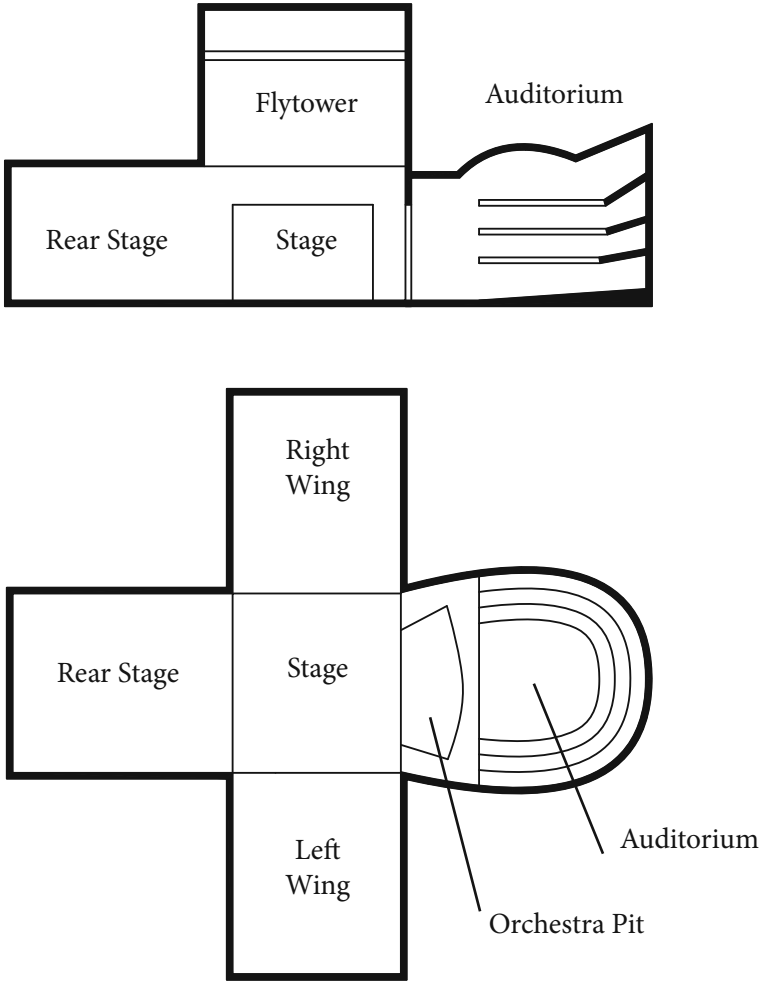


Fig.25. : Typical Opera house

Front of the house

The front of house encompasses all the foyer facilities for the needs of the audience and will
often also be open throughout the day. Unlike most other building types, the main users of a theatre building will all arrive shortly before the performance starts and will move end masses during the intervals and at the close of the show. According to this, the building must be planned to accommodate large numbers of people moving through a sequence of activities as they progress to and from the auditorium.
Many of the audience may be visiting the theatre for the first time and it is essential that the building is clearly laid out and legible, with the facilities arranged in such a way that movement through the foyers is not impeded, particularly when those who arrive at the last-minute want to move fast to their seats.
Foyers are often not only used as a hosting the audience of the theater, but also for presentations, small performances as well as parties during and after performances. For that reason, it is desirably to include a significant quantity of sound absorption. Carpeting the main circulation area is desirable to control noise from footsteps and from the movement of chairs and tables.
The front house facilities can be divided into two main areas: Public area and support facilities. (Theatre buildings - A design guide, Judith Strong, 2010, p. 54)

Public areas and Support Facilities
(Marked with blue)

Arrival and drop-off

Routes from car parks and pedestrian streets need to be planned safety and smart. For larger opera houses it is very helpful to have taxi ranks located near the entrance of the house. As many theaters are reliant on group bookings a pickup point for buses must also be considered. After the show, a large group of people will exit the building at the same time. Considering that a larger open space at the front of the building as well as a big canopy to protect from rain or snow need to be designed. (ibid. p.56)

Foyer free space

Foyers and open-plan circulation paths and stairs
The size of the space is normally defined by the seating capacity of the auditorium. Foyers circulation area excluding stairs and counters must provide a space of 0.6 m² to 1.2 m² per person. Bigger foyers are preferably. (ibid. p.57)

Kiosk sales – confectionery and programs

The kiosk is usually located in the entrance foyer. It must have a noted position, but it must also avoid causing queues where they may interrupt. (ibid. p.62)

Merchandising, program, ice cream and confectionery stores

The merchandise store must be located behind the kiosk or very close. There should be enough space for storage as well as for a freezer, a fridge and a basin. (ibid. p.62)

Box office and ticket collection

Box office services are often served by websites including the option to print your ticket or show it digital. Nevertheless, some customers will still need to buy their ticket in person or collect a per-booked ticket. The box offices are usually located in the entrance of the foyer and are open at time when the rest of the opera house is close. For that reason, it is preferable to plan the box office in a way that it prevents access to the rest of the house. As they work with money, workers need to have a quick access to transfer the money to a secure location. Especially by planning an open style box office, it must be ensured that the staff is secured, that is arrange so that the customers are not able to get behind the staff. Ticket collection prior to the performance can be provided by the box office or in the best case by a separate counter or machine. (ibid. p.60)

Box office manager's and cash offices Telephone, Internet and mail bookings office

These support spaces are best located behind the box office. The office needs to accommodate mail and telephone sales team, ticket storage and post room, the manager`s office as well as a secured safe for the cash from the ticket sales. (ibid. p.60)

Cloakroom

The size of the cloakrooms is much debated. Mostly they have the capacity of one coat peg per seat, although usually only around 30 percent of the audience leave their coats. However, for some gala events or bad weather conditions the cloakroom must be able to provide enough capacity. The needed space for storage is considered as 0.1 m² per coat. (ibid. p.61)

Toilets

Providing enough toilets is significant in planning an opera house. Considering the peaks of the demand they must be able to serve big amounts of people for very short time. They must be easy to access and find as well as easy for the staff to maintain and serve. Toilets must be located away from walls adjoining the auditorium or special measures need to be taken to avoid spreading a noise. They must have a local storage, toilets for disabled people as well as baby changing facilities (Baby changing facilities can either be combined with the toiled for disabled people or to be placed in a separate room). (ibid. p.60)

Bars

The size and the location of the bars depends on the audience number seated in each level. The bars in opera houses work with very high peak in the half an hour pre-show and during the intervals. Guests need to be able to get their drink fast and have time to enjoy it. Considering that, bars need to be quickly accessible and designed in a way that guests can get a drink and move fast to a less crowded space. Long straight bars with multiple cash tills usually produce quicker service compared to multiple separated bars, which encourage people to queue in front of each bar.
Opera and ballet audience will provide higher sales of wines and champagne. Coffee service is also a regular demand. The bars should be divided into 1.5-1.8m modules, which are representing a typical workstation including bottle fridges, a range of spirits, soft drink dispensers, beer pumps and clean glasses. Each station can serve an audience of 100 people during a normal interval. (ibid. p.51)

Bar stores, chilled cellar, spirits and empties stores

Each bar must include a local storage for spare stock and a wash-hand basin. A central storage for all the bar must be easily accessible from all parts of the front house. (ibid. p.65)

Catering and food service

There are several reasons for a food service in opera house:
The house must be able to offer a catering for different events for example gala events. This usually includes a classical table service - plate serve from the kitchen or an assisted service – usually a buffet or counter service.
The opera house may want to provide small meals for peak demands (before the show and during the intervals). This opportunity is usually available in kiosks located in the main foyer.
The house may also find it practical to include a separate restaurant, which will be open during the day to attract non-opera visitors. In this case it needs to be in a place, where it will not disturb the audience, also it should not have a direct access to the bars and allow noise and smell to intrude upon the auditorium. (ibid. p.65)

Kitchens, cold and dry stores

The catering as well as the restaurant must have an appropriate sized back area. This area includes a kitchen, server, wash up, dry stores, cold stores, crockery and cutlery store, drink store, goods delivery, waste disposal and well as staff changing with separate toilets and shower. (ibid. p.66)

Hospitality suites (conference breakout spaces)

Sponsor`s and VIP lounges are very important part of the opera house. In most cases they accommodate only around 5-10 guest at a time, or they could be divided into two or three groups on the same evening. Nevertheless, sometimes they could hold parties for 50 guests and more. For that reason, the suites should have a flexible design that allows the space to be divided into two or three smaller rooms.
The hospitality areas should have:
Kitchen access or a food preparation space, a cleaning area for dirty plates and glasses, separate bar facilities, easy access from the front of the house, accessibility even when the auditorium is not open to the public, direct access to the VIP seats, a large enough furniture storage. Hospitality rooms will be used for different purpose – lectures, conferences, parties etc. This require a frequent change of furniture. (ibid. p.67)

Auditorium entrance doors and lobbies

The entrance doors to the auditorium should be easy to recognize and wide enough to avoid queueing of people but manageable for checking tickets. Between the foyer and auditorium there need to be a lobby to provide fire separation of the area, reduce sound transference and avoid light split into the auditorium. (ibid. p.69)

Informal Performance space

The performance space is considered for small performances during the day, before or after the show. It must be designed as a part of the foyer or to be easily accessible from it. It should provide a raised platform for the performers and a space for spectators. (ibid. p.66)

Education suite

Educational facilities are not a must, but a preferable opportunity. They are usually designed in addition to the hospitality suits. They must be in the foyer or at least to be easily accessible from there. As they are hosting children`s workshops and school group meetings, they need to provide a room for craft art like painting which will include work with dirty materials and must have a water access and a quite storytelling area for around 30 children. (ibid. p.67)

Exhibition area

Theater foyers are often hosting some stage exhibitions, public art installations and galleries. Exhibitions and installation space need sufficient floor and ceiling height and variable lightings. They also must be location in a place, where they do not interfere the escape routes. The foyers may also provide a gallery for more cultural program like for example displaying paintings, photographs or sculpture or work for sale by local craftspeople. To provide this opportunity an integrated hanging and displaying system as well as suitable lighting must be considered in the design of the foyer. The exhibition space also needs an appropriate storage. (ibid. p.68)

Duty manager's office and security office

The office usually needs to accommodate two or three staff members and several activities including pre-show briefing and cashing up of program, ice cream and other sales money. It requires placing a safe, separated from the one used for the box-office. (ibid. p.73)

First aid room

A first aid room has to me located close to the point where an ambulance can arrive. I must be equipped with a bed, a space to store a wheelchair as well as a stretcher, a washbasin and preferably a WC. (ibid. p.73)

Attendants' changing rooms and briefing office

The staff changing area includes large space for changing with locker space, staff toilets and showers and eventually a lounge for taking a break. This area must be close to the briefing area. (ibid. p.73)

Local and central cleaners' stores

There must be a central storage for all the cleaning facilities such as vacuum cleaners, mops, brushes etc. The cleaning staff also needs a locker rooms as well as a cleaners ' room on each floor with sinks and a storage of cleaning appliances. (ibid. p.74)

FOH equipment store

The front house requires a large storage for these facilities:
Tables and chairs that are not in use at the moment
Meeting equipment (projectors, screens, etc.)
VIP equipment (umbrellas, red carpet etc.)
Key safe
Sponsors 'materials
Office supplies
(ibid. p.74)

Refuse store, compacting and recycling space.

The waste of the front house and auditorium need to be operated separately from the stage waste. It must be separated into waste, paper, plastic and glass. A space for crates needs to be planned for collecting a recycling bottle. (ibid. p.74)

Auditorium

The auditorium is the heart of a theatre building. It could be designed as a simple studio space with fewer than 100 seats to a multi-level room with up to 2000 seats. In both cases, audience seating is arranged to view the stage and the stage, and it must provide the best visibility and acoustic to enable the audience to see and hear the performance. Designing an auditorium is a task composed of artistic and technical requirements in terms of visibility, acoustics, safety and comfort. (Theatre buildings - A design guide, Judith Strong, 2010, p. 76)

Technical requirement

- Maximum distance from the stage: 30-32 meter
- Maximum number of seats: 2000 for safety reasons, although there are some examples of opera houses with bigger capacity (London, Sidney)
- Proportion of Auditorium to Stage: 40% to 60%
- Width of a Row: 76-90 cm, preferable width is 90 cm
- Width of seats with arms: 50-55 cm, preferable width is 55 cm
- Width of seats without arms: 45-50 cm
- Distance from seat to gangway: for seat 50cm or more is required 12 seats in a raw for gangway on one side and for gangway on two sides the number of seats in a row is limited by the distance to place of safety by evacuation
- Railing high in the balcony: min. 90 cm, this can be reduced to 80 cm if the top profile has a width of 20 cm or more and to 70 if the top profile is at least 50 cm width. (ibid., p.85)

Seating considerations

The main goal in designing an auditorium is to bring as many people as close as possible to the stage and this must be done in the best way to ensure a good visibility and acoustic. One way of increasing the number of people is to increase the degree of envelopment. Another way is to add additional levels of seating. Designing a multi-level space is a very complex task as it must meet all the sightline requirements and at the same time to ensure a high-quality atmosphere in the auditorium. Several shallower levels a considered to be much more effective than one deeper one. The levels are usually subdivided into several boxes. (ibid., p.85)

Shape

There is a variety of different theater formats, but not all of them are suitable for an opera house. The proscenium theater format emerged in Italy has been dominated since over two centuries. Another popular format are end stage for smaller audience and the wide stage. Sometimes the shape of the auditorium could combine different formats together.

Proscenium format

Examples: Oslo Opera house; Guangzhou opera house

Proscenium is the primary format for the presentation of large-scale performances and opera. It is designed in a way that the stage house and the audience chamber are separated volumes. The audience observe the performance throw a proscenium opening that reminds a picture frame. (ibid., p.78)

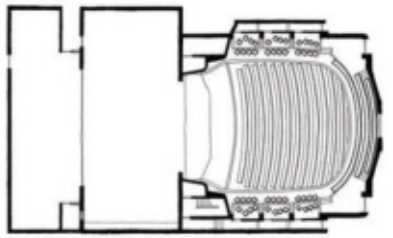


Fig.26: Proscenium stage

End stage

Example: Netherlands Dance Theater, The Hague

In the end stage format, the audience is placed directly in front of the stage without an encirclement. An advantage of this format is that all four corners of the acting area can be visible from the audience. However, this type is not preferable for opera performances as the shape of the auditorium makes it harder for an actor to make a personal contact with the audience. (ibid., p.79)

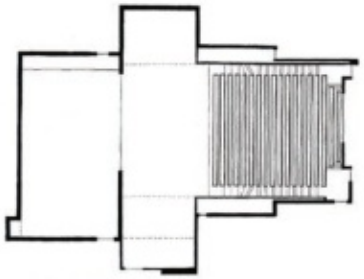


Fig. 27. End stage

The wide fan stage

Example: Bayreuth Opera, Germany.

This type is considered as a very effective way for the performance to interact with the audience. The seating plan is divided into three parts. The middle part is placed straight opposite the stage, while the two parts on the side are is rotated at exactly 135°. This allows the actor to command the attention of the entire audience, without need to turn the head. (ibid., p.80)

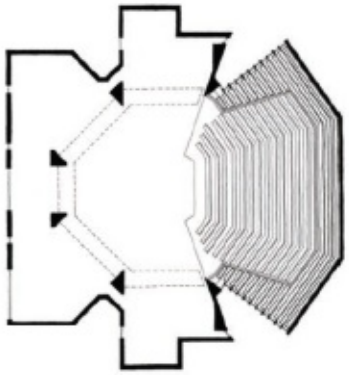
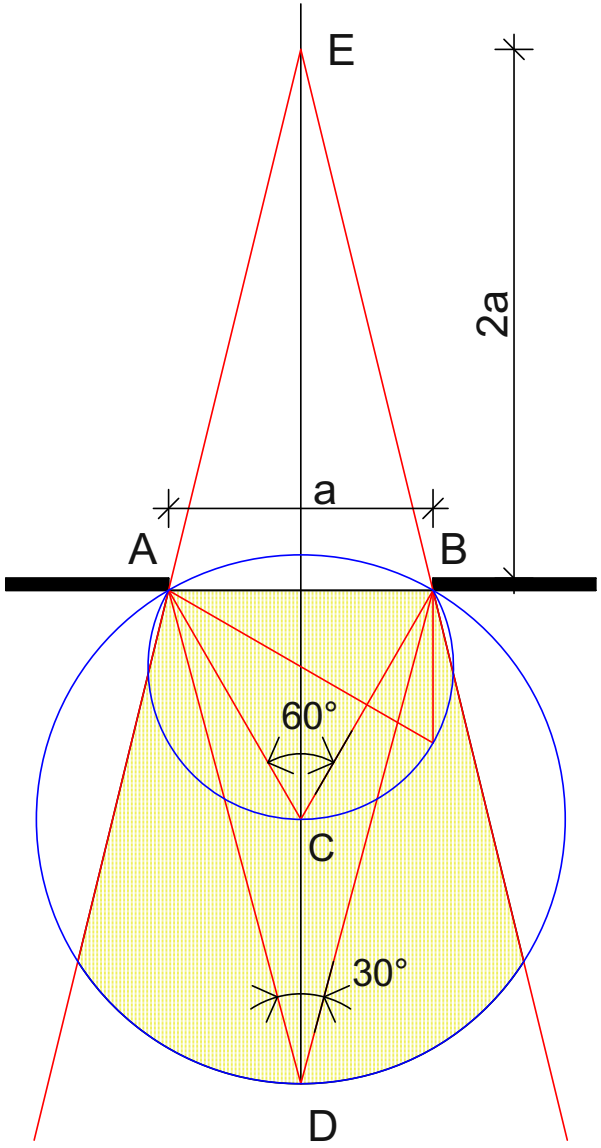


Fig. 28.: Wide fan stage

Fig.29 : Horizontal Sightlines



In order to ensure a high-quality view from every seat of the auditorium several important sightlines and points that need to be considered carefully. These sightlines and points are following some basic geometric criteria. For more complicated shaped the usage of 3D model in order to explore some more complex sightline issues could be needed.

Horizontal Sightlines
(Theatre buildings - A design guide, Judith Strong, 2010, p. 88)

A, B: Boundary points of the stage opening
a: Stage opening width
C: Place on the central axis from which the stage opening width appears at an angle of °; Center of the bigger circle that goes throw points A and B
D: Place on the central axis from which the stage opening width appears at an angle of 30°; It represents the dept of the auditorium.
E: The deepest point on the stage that must be seen from the audience. The distance from the front of the stage to point E is twice bigger than the stage opening.

Vertical Sightlines

(Theatre buildings - A design guide, Judith Strong, 2010, p. 88)

• P1: Point of Sight

This is the lowest point that should be clearly visible on the stage. Its position can vary in both horizontally and vertically. The point can be located on the leading edge or approx. 1 m back from the proscenium. Point P can also be set at the level of the stage or slightly higher. For an opera house it can be raised up with 30 to 40 cm.

• EH: Average eye height

Normally a height of 1,12 m has been taken.

• TH: Top of the head

Distance from the center line of the eyes to the top of the head is normally around 10 to 12,5 cm.

• D: Distance from point P to first row eye position

The closer the distance the steeper the resulting rake will be. A good distance for an opera performance would be at least 6 meters.

• P2: Point of sight for the upper levels

Point P2 is the lowest and nearest point that a balcony audience member needs to be able to see. This could be the same position as for the stall's audience or a bit further in order to see the orchestra pit.

• DP: Depth of the stage

This is the normal acting area of the stage.

• HP: Clear visible height

This is the clear height to be visible at the back wall of the stage. This requirement can vary, but for opera house it can be considered as around 4-5 meters.

• PH: Proscenium Height

This is the height of the proscenium opening. The panel above the proscenium may be used to provide subtitles.

• D: Distance from point P2 to front balcony row

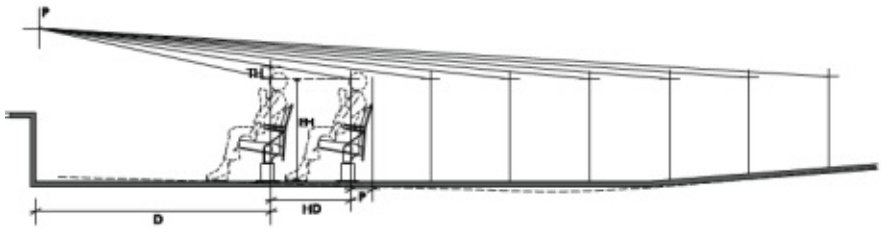


Fig.30: Vertical Sightlines

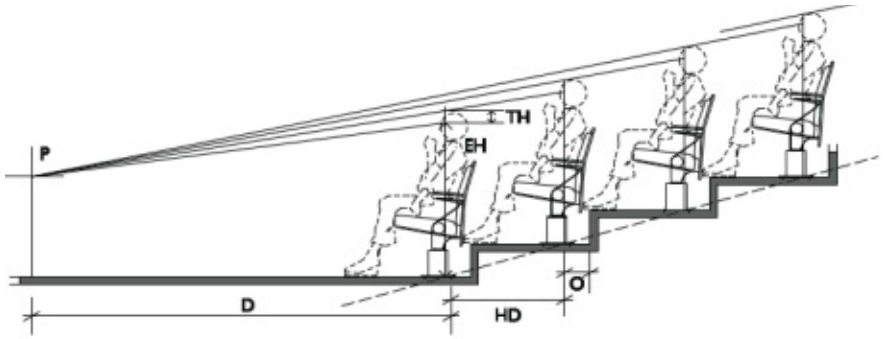


Fig.31: Vertical Sightlines

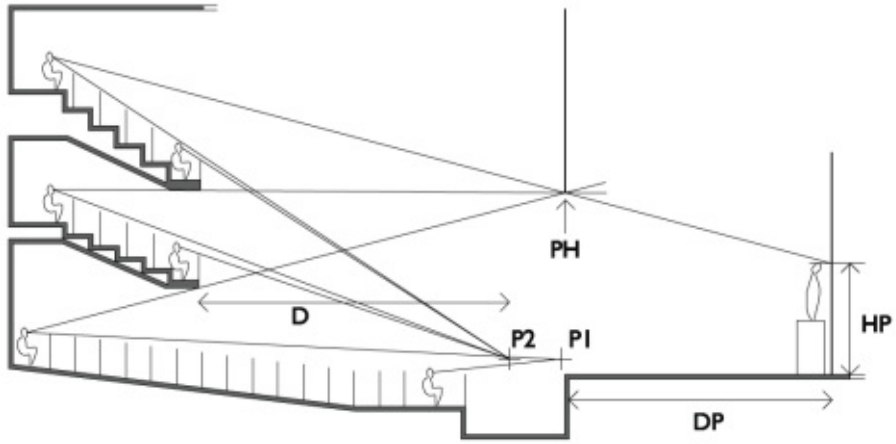


Fig.32: Vertical Sightlines

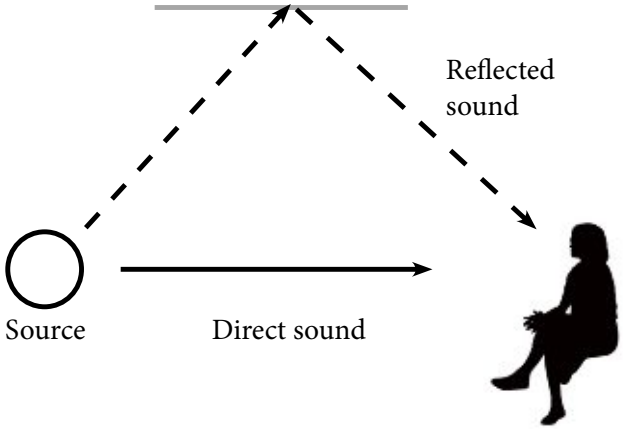


Fig.33 : Direct and reflected sound

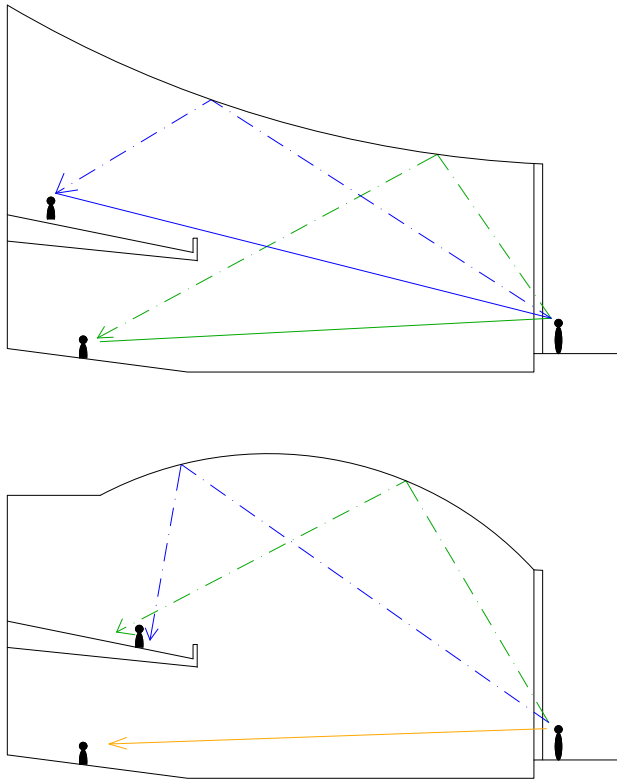


Fig.34 : Differences in the acoustic depending on the geometry

Acoustic

Good acoustic means that every single member of the audience hears the performance clearly and at the same time the performers can hear each other well. The two most important factors that are affecting the acoustic are the geometry of the auditorium and the construction – the materials that has been used. There are two types of sound – a direct sound and a reflected sound. Close to the stage the audience hear only the direct sound, while further from the stage the audience hear a mixture of a direct sound and reflected sound. If they do not arrive in an ordered way this could affect the quality of the sound. For that reason, long delays of the reflected sound should be prevented. In principle the echo effect occurs when the path of the reflected sound is 17 meters longer than the path of the direct sound. The volume of the room directly affects the reverberation time (Theatergebäude, Gussmann, p.37). Therefore, it is important to establish the correct volume for a performance type. For an opera performance the reverberation time should be less or close to 2.0 seconds, which means a volume of around 10m³ per person or more. For achieving a good acoustic, it is recommended that the capacity of the audience do not exceed 1800 seats. Very effective tool that has been used to provide early reflections to the audience and to improve communications between musicians are the overhead reflectors. (Theatre buildings - A design guide, Judith Strong, 2010, p. 91)

Orchestra Pit

Orchestra pit is a necessary feature in an opera house. For a large opera house, it may need to accommodate up to 80 musicians or more. The general requirements for designing the space for the orchestra is 1.1 m^2 for a musician in open space, 1.5 m^2 for those under the overhang, 5.0m^2 for a piano and 6.0 m^2 for the timpani. It is usually around 6-7 meter under the stage. The orchestra pit can be party put under the stage. This would not harm the acoustic, but it helps to balance the orchestral sound with the sound of the vocalists on the stage above. Orchestra pit must be design in a way to adapt easily to different occasions. This could be achieved either manually with panels installed over a demountable framework, which require lots of time and effort, or mechanically using a lift. The elevator could also be helpful in transporting a large item such as pianos between stage and basement/orchestra level. The list could be installed as a single elevator or as several split elevators. (ibid., p.97)

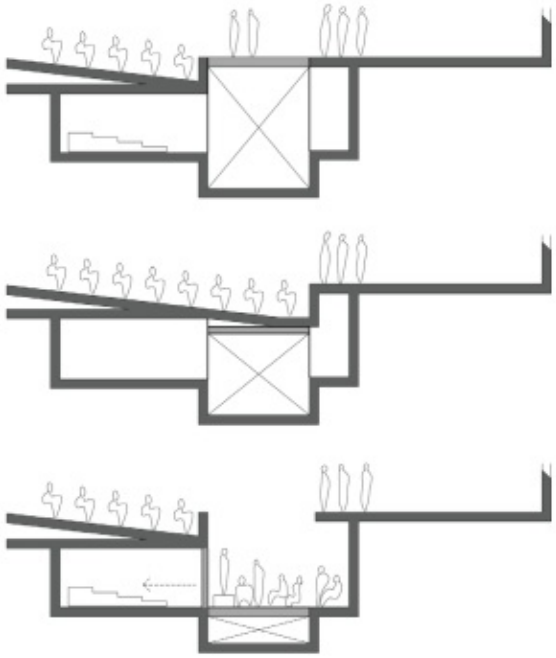
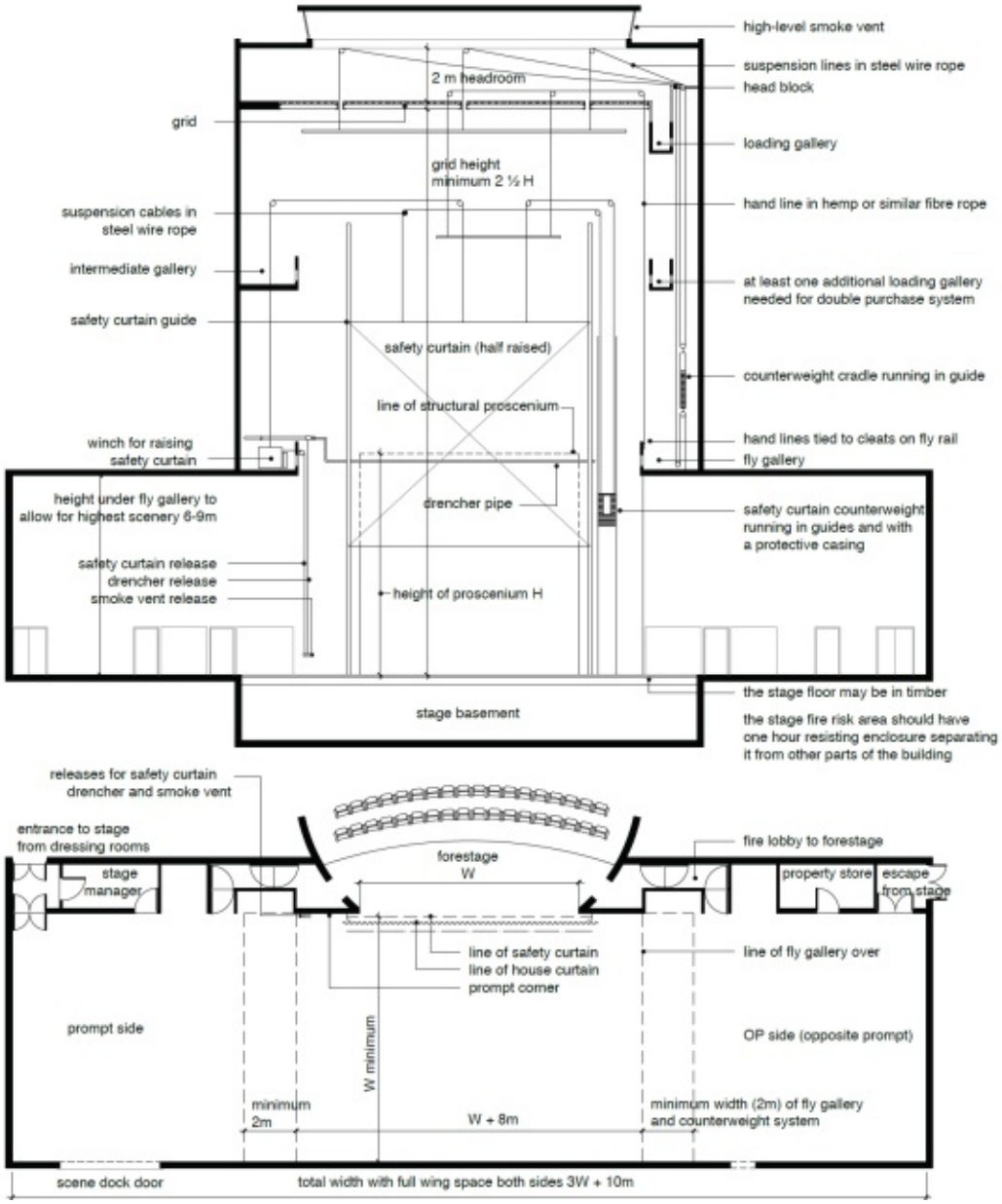


Fig.35 : Orchestra Pit, elevator position

Fig.36 : Stage and flying system



The Stage

The stage house consists of several important elements: proscenium stage wings, fly tower and backstage.

Proscenium and rear stage

The proscenium stage is the place where the performance take place. Its dimensions depend on the proscenium structural openings 'dimensions. It is common to install a vertical safety curtains which can close the proscenium opening if needed. The purpose of the safety curtain is not only to protect in case of fire, but it can be used to provide a sound separation as well as to keep the auditorium clean during stage operations.
The rear stage is located at the back of the stage and it is used as a storage for equipment as well as an extension of the acting area. The width of the rear stage should not be less than the width of the proscenium opening. Extra height over the rear stage should be considered to install hoists used for performance, assembly and storage. (Theatre buildings - A design guide, Judith Strong, 2010, p. 113)

Wings

For every performance, the proscenium stage needs to accommodate scenery. During the performance, the scenery and the light will need to rearrange constantly. The easiest and fastest way to move scenery is horizontal into the wings on one side or into a rear stage.

It can also be vertical up into the flytower or vertical down into a basement. However, the wings are not only the fastest way to move a scenery, they also need to accommodate prop tables and other equipment as well us to provide a quick changing areas for the performers when there is no time to return to the changing room.

Stage structure

The stage must be strong enough, it may often require supporting heavy scaffold structures, with several raised levels, stairs and walkways. Some heavy sceneries will also be places and moved often. It must be able to adapt to different production requirement and this means that most of it should be removable. It should also provide a stable support for the performers and technical equipment. Sometimes it may be necessary to allow any of those things to disappear into the under level, which also require a sufficient free space below the stage. Many stages are constructed with removable timber floor modules which make it simple to open large holes in the floor wherever needed.

Under stage machinery

Under stage machinery is mostly used to enable quick changing of the scene and produce some spectacular effects. It may also be used to reconfigure the scene for different types of events. Different types of under stage machines that are often in use are: traps, lifts and revolves. Traps are the simplest type that usually works as a hinged door at the stage that could be open to enable an actor to enter from below level or to exit down.
Stage lifts are used to raise and lower parts of the scenery as well as some performers. They could be installed in a varies of sizes, often in modular forms and they could also cover the entire stage. They can travel deep down to the basement as well as to rise several meters above the stage.
Another popular machine is the revolve. This is a rotatable platform that can be integrated into the stage or on top of it. It allows the crew to build two or more different scenes and rotate it facing the auditorium during the performance. There are more complexed types of revolves that could be divided into several parts including at the same time a lifting system. (ibid., p.122)

Fig.37: Prodigy automated ragging system

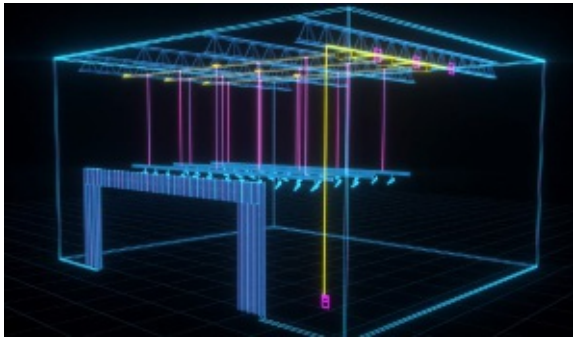


Fig.38: Prodigy automated ragging system

Flying system

The flying system is a system of ropes, pulleys, counterweights and related devices that enable quick and safely lifting of components such as curtains, lights, scenery, stage effects and even sometimes performers. The flying system can be operated manual with counterweights or powered.
Counterweight sets can be either single purchase or double purchase. Counterweight cradles are usually installed on one side of the stage. The most common type used in opera houses is the single purchase sets. With them the cradle goes down to stage level and limits the wing space to the flytower width. With double purchase works by doubling the weight in the cradle. In this way the cradle travel is in the upper half of the flytower so does not necessarily limit the wing. The disadvantage of this type is that twice as many weights must be loaded and unloaded which cost more efforts for the setting crew and the higher price.
Nowadays the powered systems are becoming more practical as they not only save a lot of efforts for the crew, but they are also constructed in a way that do not obstruct the wings which gives freedom to set fly tower and wings width to the ideal dimensions. There are two types of powered flying system: powered assistance and direct lift.

The powered assistance system is a counterweight system with cradles operated by an electrical motor. This solution is used only as an improvement to an already existing counterweight system. The direct lift system is the most modern system. This uses a single winch with a short drive shaft for each line set. The shaft holds a series of cable drums. Each drum has an associated pulley which directs a lift line to the loft blocks. The motors, which are computer controlled are powerful enough to lift the loads without counterweight being necessary. A good example for an automated ragging system that is currently on a market is: Prodigy automated rigging system. (ibid., p.119)

Flying tower and flying tower grid

The flying grid is placed in the upper part of the flytower. The height of the grid location must be at least 2.5 times higher than the structural proscenium height. It is used to support and provide access to many of a rigging system's components. If a powered flying system is installed, the flying motor can be easily accommodated at grid level, at the sides to leave the central area clear for temporary rigging. (ibid., p.116)

Flytower Galleries

Side galleries are used as operating position for the flying system as well as for the side lighting. All the galleries should be in pairs, one on each side of the stage with their onstage edge set back from the proscenium opening and lining up vertically. (ibid., p.117)

Lighting and sound

Control room

The best location for the control room for the lighting and sound is on the center line at the back of the auditorium. It has must be acoustically separate from the auditorium and provide a perfect direct view to the stage. The access to the control room should be from the outside of the auditorium, preferable separate from the public route and should allow equipment to be carried. (ibid., p.121)

Lighting Bridges / Catwalks

Stage lighting must provide the ability to light any part of the stage from a wide range of angles. The lighting bridges must be integrated into the ceiling of the auditorium. Their position can vary, depending on their elevation. Normally two or three bridges at the top of the ceiling are enough to cover the whole stage. (ibid., p.137)

Lighting truss

Usually integrated into the fly system in a form of series of flown lighting bridges. (ibid., p.45)

Booms

Vertical poles with lights attached, usually supported from the floor and located at the side of the stage. (ibid., p.136)

Ladders

A flown vertical structure at the side of the stage, used for cross lighting. They can usually be tracked or flown to varied positions. (ibid., p.136)

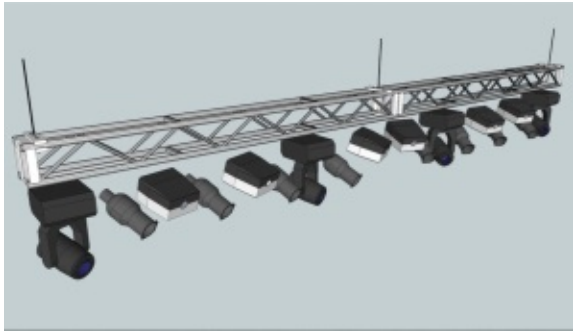


Fig.39: Lighting truss

Fig.40: Ladders

Backstage area

The backstage areas of a theatre must meet the needs of both the performers and of the production and technical staff responsible for the delivery and preparation of sets, costumes and technical equipment. The whole backstage area should not be visible for the spectators and the routes that connect the stage with it should not pass through any public area of the building.

Get In and technical area

Get-in is the access point for every facility that must be installed for a performance and often require a huge space. The get-in point is mostly designed directly on street level. However, if the stage is above or below the ground level it will be necessary to provide a lift for either the trailer or the scenery to get to stage level. The list can be located inside or outside the building. The entrance doors should be at least 3 m wide and 4-meter-high to allow any equipment to get in. There will need to be sufficient technical area between the get-in and the stage for the off-loading, handling and storage of sets and equipment. (ibid., p.154)

Production spaces, repair and maintenance workshops

Production spaces such as workshops, wardrobe and laundry facilities are required to maintenance during the tun of the show. Repair and maintenance workshops must be linked to the performance area. (ibid., p.157)

Scenery workshop is the place where some small repairs to the set during the performance can be carried out. It is usually directly connected to the stage (ibid., p.157)

Technical maintenance workshop must be provided in order to repair and maintenance the stage lighting, sound and audio-visual equipment. The space must have an easy access to the stage or to the lighting galleries and to the lantern store. (ibid., p.157)

Painters 'room is needed to store paints and some chemical cleaning agents for creating and maintenance of some paintings needed for the scenery. The room need to be near the stage. (ibid., p.158)

Running wardrobe is separate from the manufacturing wardrobe and provides facilities for quick fixing and minor alterations of costumes in the current production.
The best location for it must be close to the dressing rooms. (ibid., p.158)

Laundry room should be placed right next to the running wardrobe.
Wig room is very essential, as the wigs require daily maintenance. (ibid., p.158)

A store for running properties must be located close to the actors 'entrance to the stage. There some properties used by the actors in the current production should be prepared for collecting by actors before their entrances.
Several separated storages must be considered: for Lighting, Sound, Props and for musical instruments. (ibid., p.158)

Staff Accommodation

Production staff facilities

There must be separated facilities for male and female staff members including changing rooms, lockers, toilets and showers. (ibid., p.159)

Technical offices

The stage chief technician must have a small office near the stage or to the repair workshop.
The chief lighting technician must have a similar office near the technical maintenance workshop or to the control room.
The stage management team usually includes at least 3 people up to 6 or 7. Their responsibilities include not only the performance, but also the rehearsal period. For that reason, their office should be ideally close to both the stage and the rehearsal room. Where this is not possible it may be necessary to duplicate some of the facilities. It is important that the office will have a window, as they will spend more hours there.
Company management
In case of touring theaters an office for the company management should be provided. The requirements for the company management's office are similar those for the stage management, although their job is less concerned with the running of the show. (ibid., p.160)

Rest and treatment

A small restroom for someone who is currently not feeling well or have a small injury can be very useful. It should be equipped with a bed, small washbasin and a cupboard for first aid supplies. A treatment room for physiotherapy for some of the performers is also very common. (ibid., p.160)

Freelance staff

"Increasingly designers of sets, costumes, lighting and sound, together with choreographers, fight directors, voice coaches are engaged on a freelance basis. During production periods, they require space where they can leave their coats and work between rehearsals." (ibid., p.160)

Dressing rooms

"Accommodation is required for performers to dress, make-up and prepare for the performance. Dressing facilities should generally be as close to the stage as possible but with sufficient separation to prevent noise from reaching the stage." Large opera houses may need to accommodate for up to 200 performers. The dressing facilities are divided into different types of rooms: principal rooms – for 1 or 2 persons only, group room – for up to 6 persons and chorus rooms – for up to 15 people. The dressing facilities will require additional support facilities nearby, such as a wardrobe, for the maintenance of costumes, and green rooms." Performers often must spend a long time of preparation. For this reason, it is preferable to have access to natural sunlight.
Dressing rooms must be provided with toilets, showers and washbasins, large enough to hairwash. It is preferable that the entrance to the toilet is not directly from the dressing room. Sometimes it is very useful to add an additional toilet for both genders close to the stage. (ibid., p.161)

Children`s dressing room

An additional separated dressing room should be provided for the children in the cast. Children must be accommodated separately from the adults in the cast and supervised by chaperones, who may also need some additional space for administrative facilities. Children`s dressing room must also be provided with separate toilets. (ibid., p.163)

Conductors`room

"In opera houses the conductor`s room is group with the dressing rooms of the principal singers." The rooms should be able to accommodate a piano. The minimum required size is 14m². However, it is preferable to design them bigger as they may also hold auditions or a small ensemble practice. (ibid., p.163)

Band room

In large opera houses the band rooms may need to accommodate up to 80 musicians. The musicians also need separated accommodation for male and female providing dressing facilities and enough space for musical instrument cases. The band rooms should be located close to the entrance to the orchestra pit. (ibid., p.164)

Green room

This is the place where actors and other staff members - technicians, workshop staff, front of house
and administration can relax, eat or wait, away from their dressing rooms or offices. "As it is for use during rehearsals and performances the green room should be near the dressing rooms and the stage. It must have daylight and, wherever possible, a pleasant outlook." (ibid., p.164)

Construction spaces

Construction space aims to provide facilities for the construction and painting the scenery as well as for making and dyeing the costumes. Nowadays these activities are likely to be outsourced, so their function could be questioned. However, they could be placed anywhere in the back area of the building where there is a plenty of space. (ibid., p.164)

Recording Studio

The recording studio for creating, recording and editing digital sound effects and music is a requirement for many opera houses. "The recording equipment should be in the control room separated from the studio by a double-glazed sound-insulating window." (ibid., p.167)

Rehearsal facilities
Rehearsal and practice rooms

The dimensions of the rehearsal room must be same to the size of the acting stage, plus a minimum of 1m at the back and sides and 3 meters at the front for the director, stage manager and the conductor. The height of the rehearsal rooms must be related to the height of the proscenium opening or to have a minimum height of 4.5 meter. "Daylight should not be excluded but wall space and a background that does not distract are essential, so windows should be at a high level." Separated rehearsal rooms for operatic, ballet and orchestra should be considered. The rooms should be close to the dressing rooms and to the stage management`s office. Smaller practice rooms for individuals and small groups should be also provided. (ibid., p.169)

Administration

"*A theatre will require office space for the staff who work in the building. It is often desirable to group all the offices together in one location, but in some cases, such as front of house management, technical or catering staff, the offices may need to be located close to their respective areas of responsibility. The ideal location for the offices is mid-way between the backstage and front of house zones so that easy access to both areas is possible.*" (Theatre buildings - A design guide, Judith Strong, 2010, p. 38)

The organization of the producing theater is separated into several department:

1.Producing team management including artistic director and his/her crew including an assistant director, associate director, musical director and composer, creative team including designers of costumes, lighting and set and a general manager. Most of the positions require having a separate office. "The office of the artistic director must be large enough to hold meetings and conferences of heads of the departments."

2.An opera house also needs a Chief Executive who is managing the theater and negotiating with producers. There must be a separated large enough to hold meetings office provided for him/her.

3.Marketing department
Its team usually consists of four to five members who need to me located near one another.

4.Administration department
As this is the biggest department it needs a receptionist suited at the entrance of the department. The team usually includes at least 10 people among whom are an accountant, sales ledger, office administrator, IT Manager, health and safety manager and more.
All the offices may need to have a storage for all the materials and office supplies need.

Storage

"Storage needs to be positioned so that goods can be easily transported from the delivery areas as well as taken to where they are eventually needed." In addition to the storage of the front house, the back of the house will require a huge space to store event equipment such as tables and chairs, technical equipment, scenery, display boards, uniforms and also a storage for the cleaning staff. (ibid., p.175)

Access for people with disabilities

Wheelchair users and people with walking disabilities should be able to enter the building by the same route as all the other people and enjoy easy access to all services. "This will affect the detailed design of various elements, such as counters, toilets and seating in the auditorium. "
The auditorium should offer enough wheelchair places. The required number is generally considered as 1 percent of the total seating capacity or six, whichever is greater. These places are often provided in a form of seats, which can be removed easily to provide a wheelchair space, if it is necessary. Usually up to four seats must be removed to provide one wheelchair space.
In the foyers wheelchairs users should be able to enjoy all the facilities of the foyer. The backstage must also be adapted for wheelchair users and people with walking disabilities. Performers who are wheelchair users need to be provided with accessible dressing, toilet and shower accommodation, preferably at the same level as the stage.
The must have access to the stage, orchestra pit and communal facilities such as green rooms. Also, directors and technicians who are wheelchair users must be able to access the stage, auditorium and technical control rooms. (ibid., p.45)

3. Site Analysis

3.1. Estonia and the city of Tallinn

Fig.41 Estonia in Europe

Fig.42 Tallinn in Estonia

Estonia

Estonia is a country in Northern Europe that belongs to the Baltic States. It is the northernmost of the three Baltic States and borders with Latvia in the south and Russia in the east. In the north and west borders Estonia with the Baltic Sea. There are close ties to Finland via the Gulf of Finland in the north. In the west is Estonia separated from Sweden by the Baltic Sea. Estonian culture and language are closely related to Finnish, there are no similarities with the languages of the other Baltic states of Latvia and Lithuania or with the Russian language.
The coast of Estonia is 3 794 km long.
Estonia has been a member of the European Union since 1st of May. In the same year, the country also became a member of NATO.
Estonia was occupied by the Soviet Union since 1940 and was a member of the Soviet Union until its independence in 1991.After gaining their independence, the country started rebuilding its economy. Estonia followed example of the Scandinavian countries and has been constantly relying on digitization since then. Estonia is considered as the first country in Europe which has created a digital administration. As a result, the economy has improved, and corruption has been significantly reduced.
The most important economic sectors for Estonia are financial services, the real estate and construction industry.
As Estonia is a transit country between the EU countries and Russia, is trade also an important sector, as well as tourism in last years.
Estonia has 1.3 million inhabitants. The capital and the largest city is Tallinn.
(Estland, <de.wikipedia.org>)

Tallinn

Tallinn is the economic and cultural center of Estonia. Since Estonians`independence from the Soviet Union in 1991, Tallinn has become one of the most important cities in Eastern Europe and the Baltic States thanks to its high-tech industry and tourist flow.
The population is about 400.000.
The city is located on the Gulf of Finland in the Baltic Sea, about 80 kilometers south of Helsinki. The coast of Tallinn is about 50 km long. The climate in Tallinn is characterized by cold winters, cool springs with some rain, moderately warm summers, and a long and rainy autumns. The warmest month is July with average temperatures of 17 degrees and peaks up to 30 degrees and the coldest month is February with average temperatures of -6 degrees. (Tallinn, <de.wikipedia.org>)

Fig.43 Tallin Old City

History of the city

The first castle in Tallinn was built on Toompea Hill in 1050. As the city is located between Russia, Europe and Scandinavia, which is a very good and strategic location, it has been a destination for many populations since its inception, especially the Danes who conquered the city in 1219.
In 1346 the Danes sold the city to the Teutonic Order. At that time, the medieval city of Tallinn had 8.000 inhabitants and was very well protected. Tallinn was surrounded by a fortress wall and around 70 defensive towers.
Over time, Tallinn was ruled by Russians, Swedes, and Danes. During the Russian rule in the 19th century, the city harbor was expanded. In the 20th century, after the war between Germany and Russia, the city became the capital of free Estonia. After the occupation of Soviet Union in 1944, Tallinn became the capital of Soviet Estonia. In 1980, when the Summer Olympics were taking place in Moscow, a regatta was held in the town of Pirita, northeast of Tallinn. Because of this, many new buildings have been built in Tallinn. Construction of new and modern buildings continued rapidly after Estonia gained independence from the Soviet Union.
Although the city was bombed during the Second World War, the character of the old town remains. Since 1997 the old town has been a UNESCO World Heritage Site.
(Tallinn, Geschichte, <de.wikipedia.org>)

Fig.44: Tallinn 1154


Fig.45: Tallinn after the 2nd

Fig.46 Tallinn Old city

Tourisms

Tallinn is one of the best preserved medieval cities in Europe. Number of tourists has grown steadily over the past ten years. Half of the international tourists come from Finland. Tallinn is also a very popular destination for tourists from Russia, Germany, Latvia, and Sweden. Around 70 % of all visitors of the city are leisure tourists, 23 % come for business purposes and the rest for other reasons.
Old Town of Tallinn, a UNESCO World Heritage Site, is a major tourist attraction. Tourists can also visit the seaplane port of the Estonian Maritime Museum, the Tallinn Zoo, the Kadriorg Park and the Estonian Open Air Museum. (<https://wikitravel.org/en/Tallinn>)

Fig.48: Kadriorg Park

Fig.47 Tallinn Old City

Fig.49: Lennusadam, Seaplane Harbour

Fig.50 up: Estonian Song and Dance Festival

Fig.51 down left: Estonian Song and Dance Festival

Fig.52 down right: Estonian Song and Dance Festival

CULTURE AND TRADITIONS

Several famous music festivals are held in Tallinn every year.

Tallinn Winter Festival for Classical Music with performances by top Estonian soloists and young artists from the Estonian Academy of Music and Theatre.

Tallinn International Festival Jazzkaar, which takes place in April.

The Estonian Song and Dance Festival first took place in 1869 and now it takes place every five years. In 2009, 35,000 choirs gathered to perform in front of 90,000 spectators. It is recognized by UNESCO as a masterpiece of the oral and intangible heritage of humanity.

Õllesummer Festival is the largest outdoor music festival in the Baltic States. For four days in July, the festival is visited by around 70,000 people annually.

Birgitta Festival is a music and theatre festival that takes place every August in the ruins of the historic Pirita Convent.

(Tallinn- Music festivals, <https://wikitravel.org/en/Tallinn>)

Fig.53 left: Õllesummer Festival

Fig.54 right: Brigitta Festival

3.1. Location and surroundings

Fig.55 Project-surrounding

3.2.Old town harbor

The old town port in Tallinn is one of the largest and busiest ports for passengers in the world and also the largest passenger port in Estonia. The port has a total length of 4.2 kilometers and there are currently three passenger terminals (A, B and D). In 2019, there were 10.64 million passengers. The number of passengers in the port of Tallinn increased for 12 years in a row. The most popular shipping route is Tallinn-Helsinki with 8.8 million passengers. Other regular travel destinations are Stockholm and Saint Petersburg. The port currently has a capacity of 7 cruise ships. In 2018, a project to build a new cruise terminal was approved, which is scheduled for completion by July 2021. The new terminal will double the capacity of the port. (Tallinn Passenger Port, Wikipedia, <https://de.wikipedia.org>)

Bauplatz Opernhaus

Fig.56 : Old city harbor

Fig.57 : Old city harbor

Fig.58 : Old City Harbour Masterplan 2030

3.3. Port of Tallinn - Master Plan 2030

Tallinn is one of the fastest growing ports in Europe. Due to the increasing demand for its service the port of Tallinn launched the competition for ideas for the development plans or Masterplan 2030 for the Old City Harbor in 2016. The aim was to find a long-term solution to connect the city and its public spaces with the function of the port. Masterplan 2030 is the basis for the redevelopment in the port area into an urban space that is both attractive and easy to traverse. The plan was focused on future expansion of the harbor to accommodate its fast-growing cargo and tourist activity, as well as the surrounding area. Areas not needed for port activities are about to be developed for tourism, culture and commercial purposes. The intent of the competition is to incorporate the ideas resulting from it by year 2030.

The port area was devided into three areas with different purpose: port area + expansion, semi-public areas and public areas. (Old City Harbour Masterplan 2030, Competitions`brief)

Fig. 59 Developing areas

port areas + expansion, Developing and improving of logistic area of Terminal A and D, designing a new cruise terminal

Semi-public areas, Developing of Terminal A and D buildings, Improving of the Old City Marina, Designing a pedestrian bridge over the canal to Old City Marina

Public areas, Urban development with a mixed use

Port of Tallinn Master plan 2030 Proposal
by Zaha Hadid architects

Fig. 60 Masterplan 2030 by Zaha Hadid architects

Zaha Hadid Architects has been selected as the winners of an international competition to masterplan the revitalization of the Old City Harbour. Later in 2017 Zaha Hadid Architects worked together with Latvian architectural firm RemPro, engineering consultant Tyrens UK real estate consultants Colliers Estonia and RLB UK and VA-Render for visuals to further develop the project to complete a detailed architectural and economic plans. (Archdaily, Patrick Lynch, 31.08.2017)

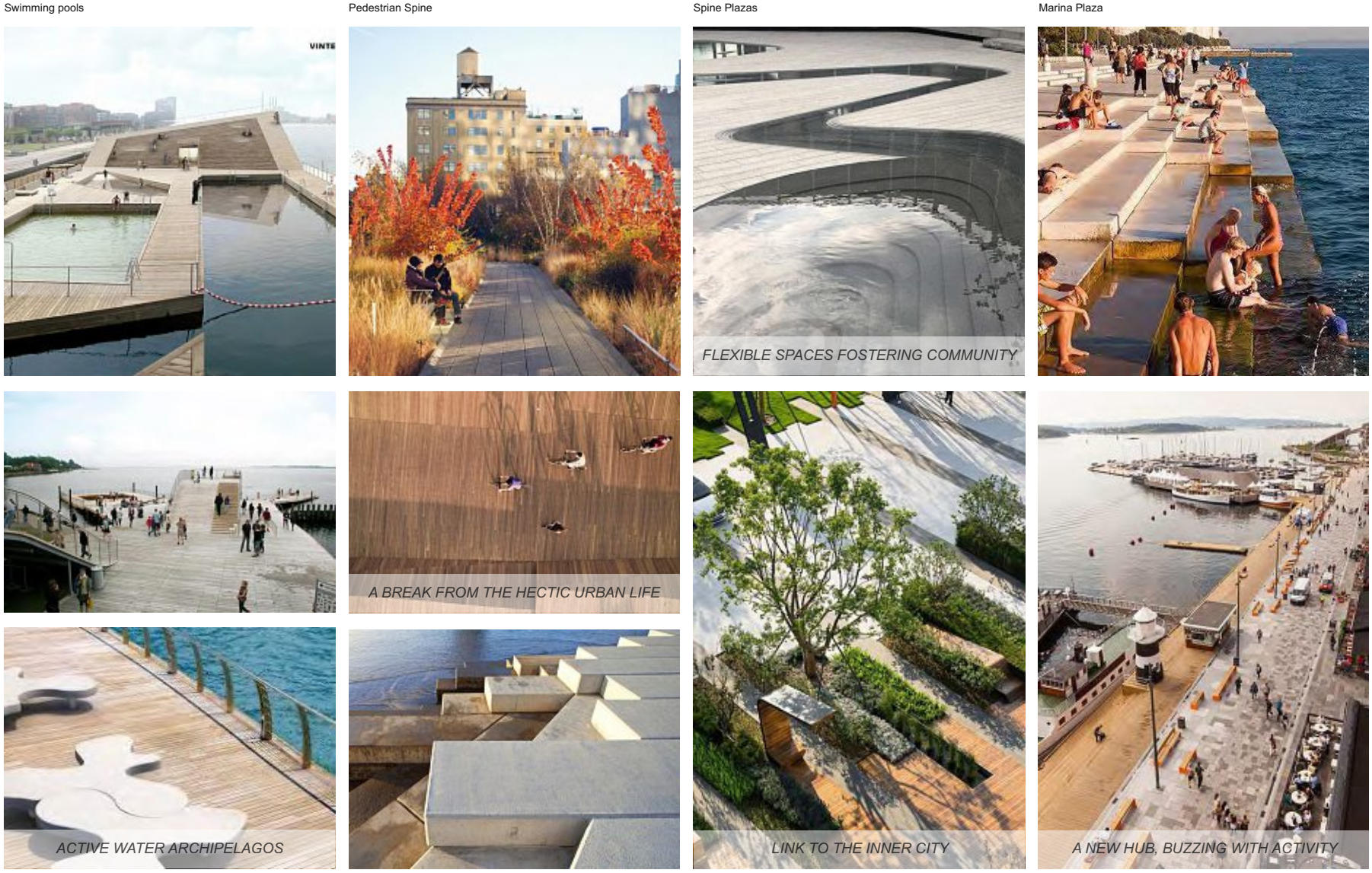


Fig.61 Port of Tallinn Masterplan Visualisations

Port of Tallinn Masterplan 2030 by Zaha Hadid architects

Developing areas and program

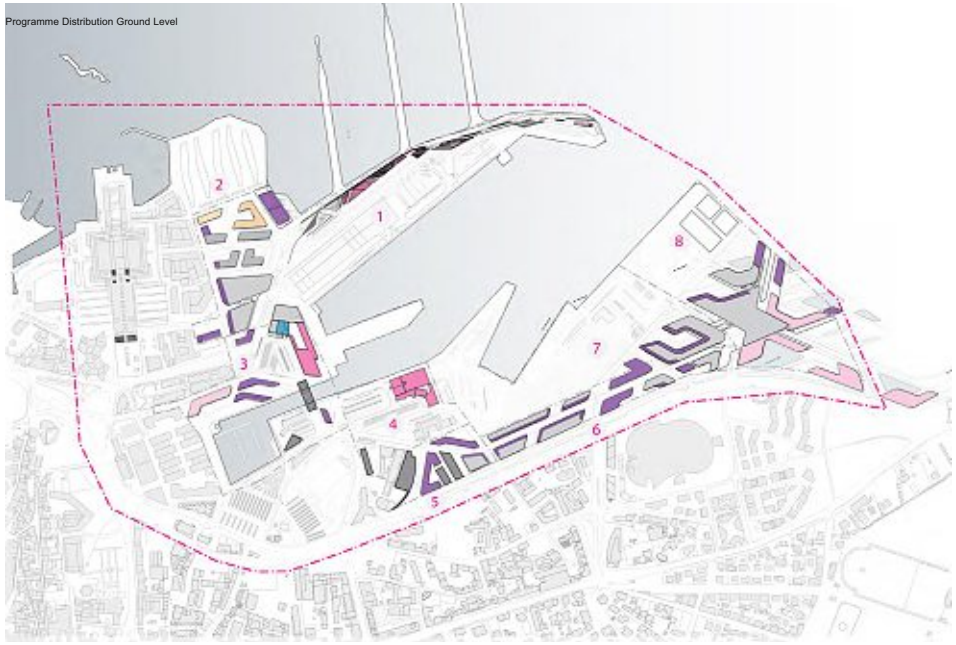
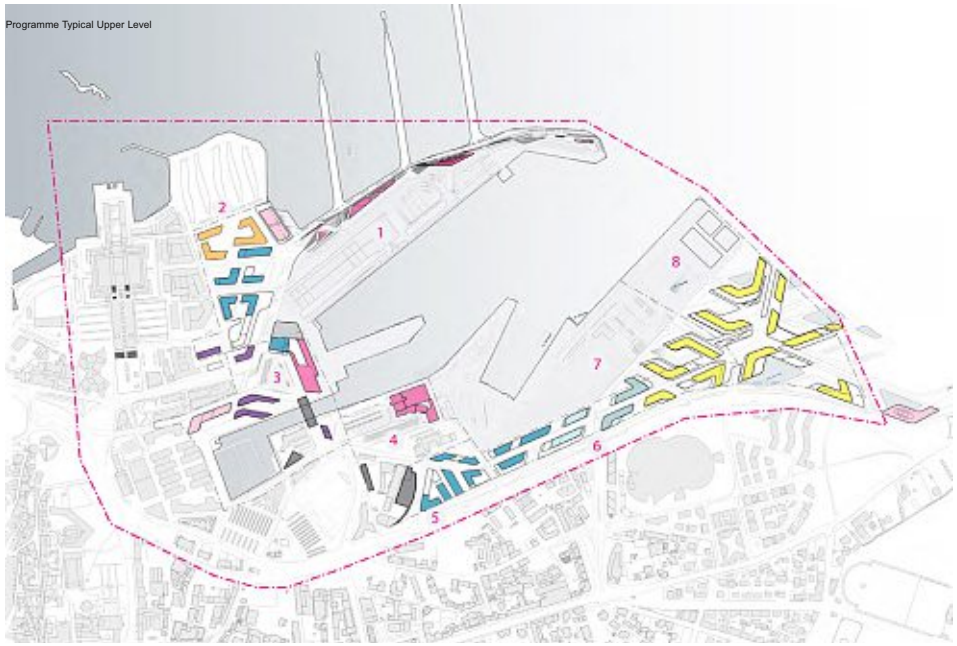


Fig.62 up: Competition areas and program, Ground level

Fig. 63 down: Competition areas and program, Upper level

- Residential
- Hotel
- Serviced Flats
- University Facilities
- University Housing
- Office
- Commercial
- Leisure
- Terminal
- Parking
- Fixed Buildings



The site area was divided into 8 competition area

Area 1 – New Terminal building (Terminal A), Port facilities and pedestrian promenade

Area 2 – Offices, Hotel and commercial usage

Area 3 – Developing of the yacht and small vessels terminal; terminal facilities, commercial and leisure usage

Area 4 – Reconstruction of the D Terminal Building

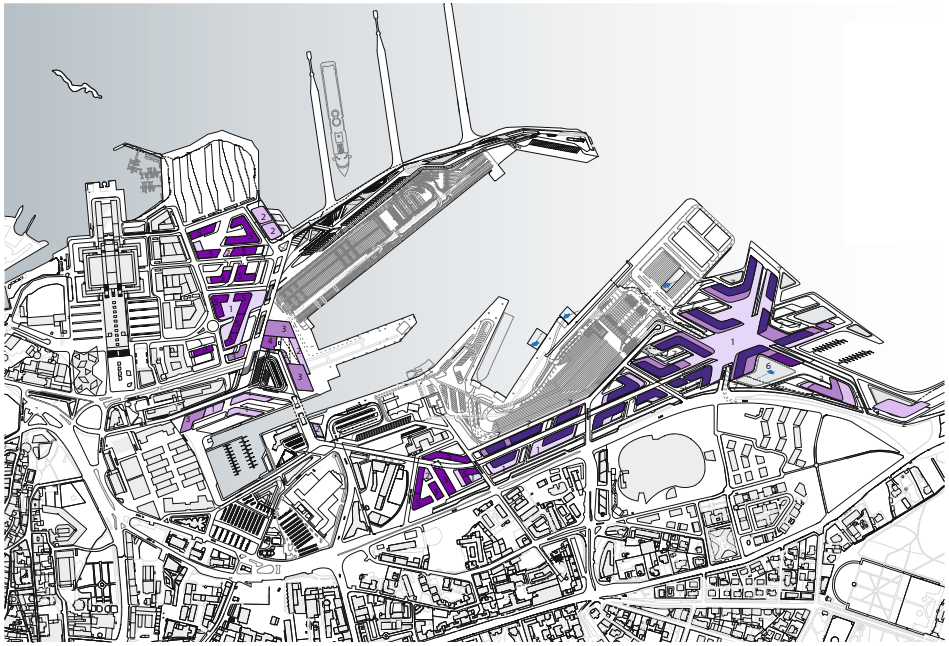
Area 5 – office and commercial usage

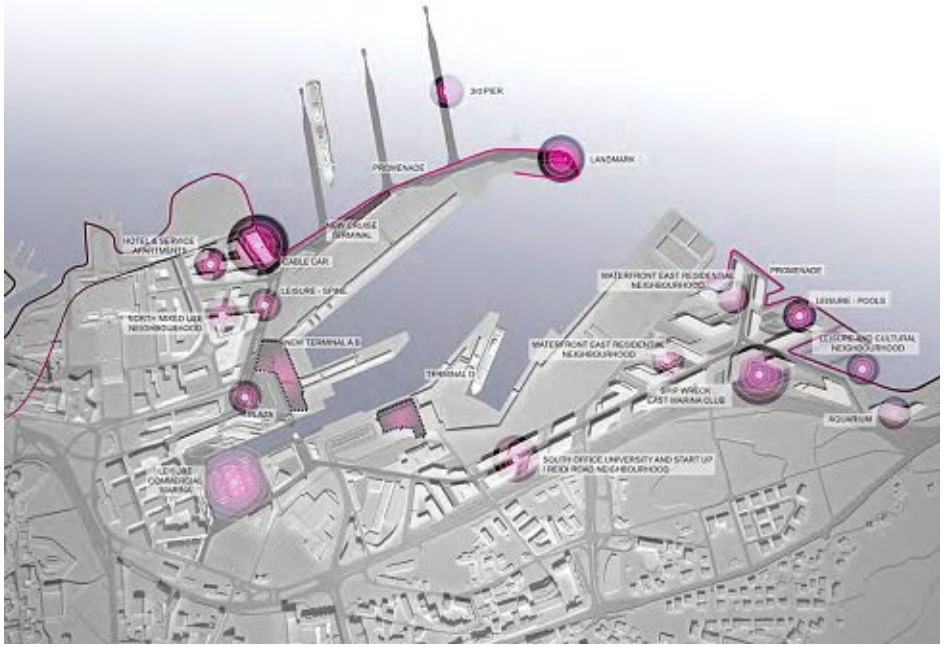
Area 6 – University Facilities, university housing and Residential area

Area 7 – port facilities

Area 8 – porta facilities and residential area
(Masterplan 2030 report, Zaha Hadid architects, 2017)

Heights Levels | Attractors





1 Level
2 Levels
3 Levels
4 Levels
5 Levels
6 Levels
7 Levels

Fig. 64 up: Heights levels

Fig. 65 down: Attractors

A series of attractors are planned in the area. This proposal aims to create a sense of community for both user and visitors. Some of the main attractions are a cable car that will go above the terminal A promenade, connecting the business area in the north with the end of the promenade. There are also many leisure pools and activities planned in the waterfront areas. Restaurants, cafes and a plaza will take place along the old yacht port. The plaza will support a variety of attractions, such as temporal events, food and beverage facilities, markets and exhibitions. It will also provide a great view to the old town and the sea. The second promenade on the east part of the area will provide not only leisure, but also some cultural activities such as an Aquarium and a shipwreck. (Masterplan 2030 report, Zaha Hadid architects, 2017)

Circulation Diagramm | Spline Operates

- Ferry Circulation/Trucks-Cars
- Ferry Circulation/Tunnel
- Drop Off Ferry Terminals
- Cruise route
- Pedestrian
- Local access
- Development boundary per phase
- Port area

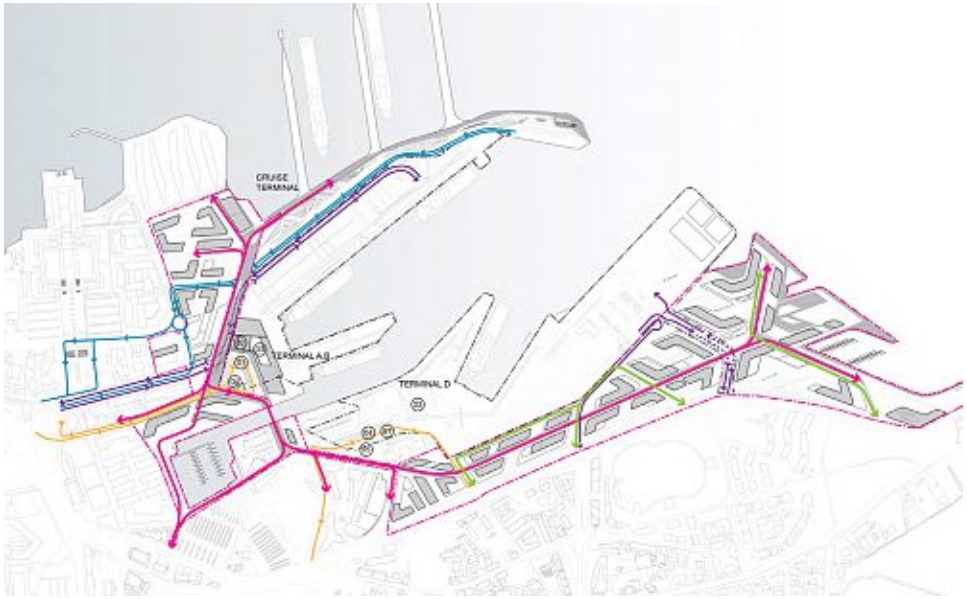


Fig.66: Circulation Diagram

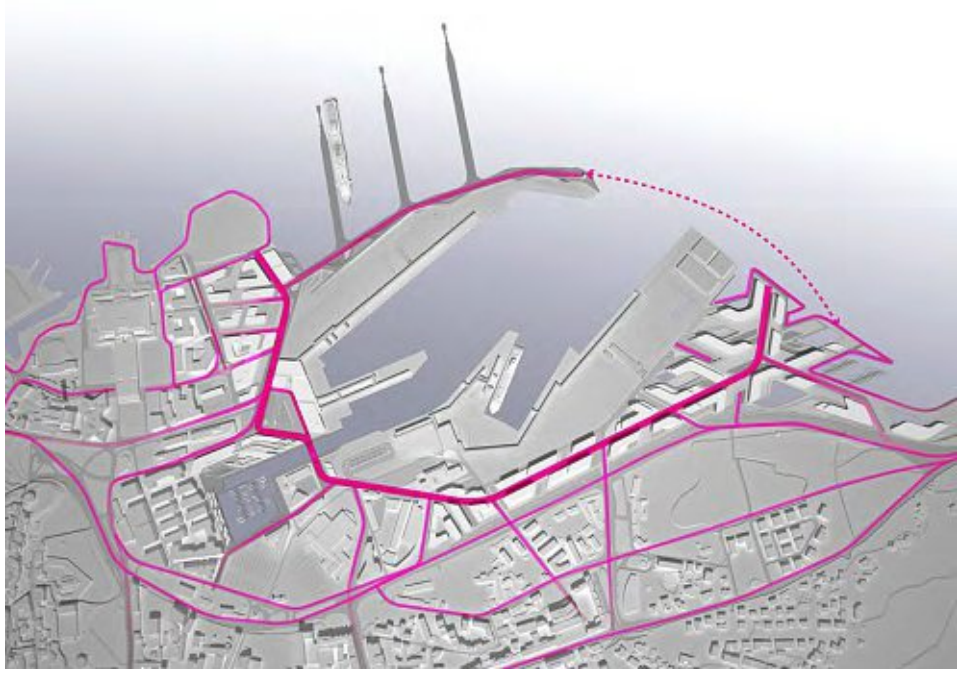
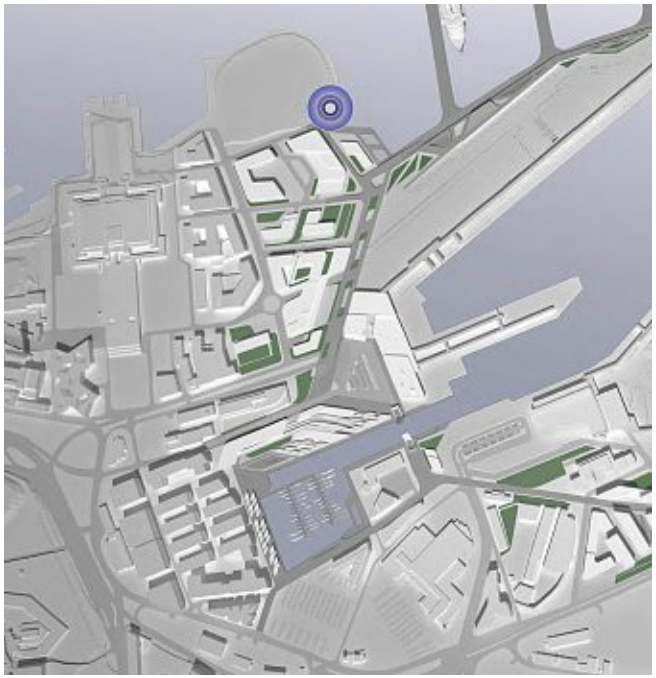
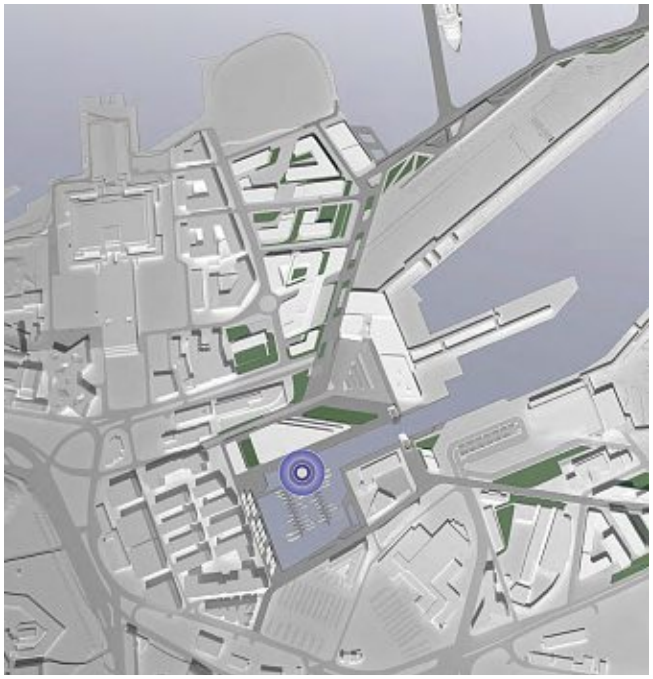


Fig.67: Spline Operates

Spline operates shows the connections of the area with the city.





Opera house location options

In the Masterplan 2030 Zaha Hadid architects gave two proposals for the new opera house of the city. Option one is on the northern edge of the North Mixed- use Neighborhood, close to the cruise Terminal. Option two is to locate the opera house in the area of the Marina, which is closer to the old town, but restricted as space.
(Masterplan 2030 report, Zaha Hadid architects, 2017)

Fig.68: Opera house location proposal

Fig.69: Opera house location proposal

3.4. Ongoing Projects in the area

Based on the results of Master Plan 2030 the port have already announced several on going projects in the area.

Fig.70 New cruise terminal

New cruise Terminal

In early-November 2019, Port Tallinn announced public procurement (by December 6, 2019) for the construction of a new cruise terminal facility in the Old City. The also includes the construction of an esplanade (pedestrian promenade), kids playground, car parking. During no-ship days, the facility (with capacity ~2000 people) will be used as a multi-functional (event) space housing conferences, musical concerts, exhibitions. Building's indoor area is sized ~4000 m2 (43050 ft2), including a cafe restaurant. The 900-m long esplanade will have a cycle road, pedestrian roads, green areas, open shelters, activity zones (for kids and outdoor sports). (New cruise terminal, Port of Tallinn, 2020)

Fig.71 right : Movable pedestrian bridge

Movable Pedestrian Bridge

The bridge will be build over the Admiralty Basin Channel to connect the A- and D-terminal areas whereas continuing servicing small vessels in the Old City Marina situated in the Admiralty Basin. A team comprising Witteveen+Bos, plein06 and Novarc Group (a team representing by Dutch and Latvian architects) recently won a global competition to design Estonia's first movable pedestrian bridge in the old harbor of the Tallinn capital. The presented bridge design was chosen because of the combination between a highly aesthetic form and innovative technical balancing solutions. (Old City Harbor 2019-2023, Movable pedestrian bridge)

Fig.72 left up : Movable pedestrian bridge

Fig.73 left down : Movable pedestrian bridge

Fig.74 up: Linnahall

Fig.75 left down : Linnahall

Fig.76 right down: Linahall inside

3.5. Linnahall

The former Lenin Palace for Culture and Sports was built on occasion of the 22nd Summer Olympics in Moscow in 1980, when the sailing events were held in Tallinn. It is located on the coast near the port, just behind the walls of the old town. The project was led by Raine Karp, the most important Estonian architect of Soviet modernism. The building comprised a concert hall with 5000 seats and an ice rink with 3000 seats, an exhibition hall, restaurants, and a huge roof area with a wonderful view of the Baltic Sea. The complex was later renamed Linnahall.
Linnahall is a symmetrical monumental slab concrete structure that looks like a pointer from the city to the sea. The building roof has a very low height, and it is completely accessible for visitors. The architect wanted to create a connection between the city and the sea without compromising the view of the silhouette of the medieval old town.
After independence in 1991, the Linnahall remained a venue with diverse activities: a heliport and a small ferry terminal were added, various bars, disco, concert halls were opened, and the assembly hall was used for political parties and Jehovah's Witnesses. In 2004 the Linnahall was listed as a protected monument. (Linnahalle, Wikipedia, <https://de.wikipedia.org>)

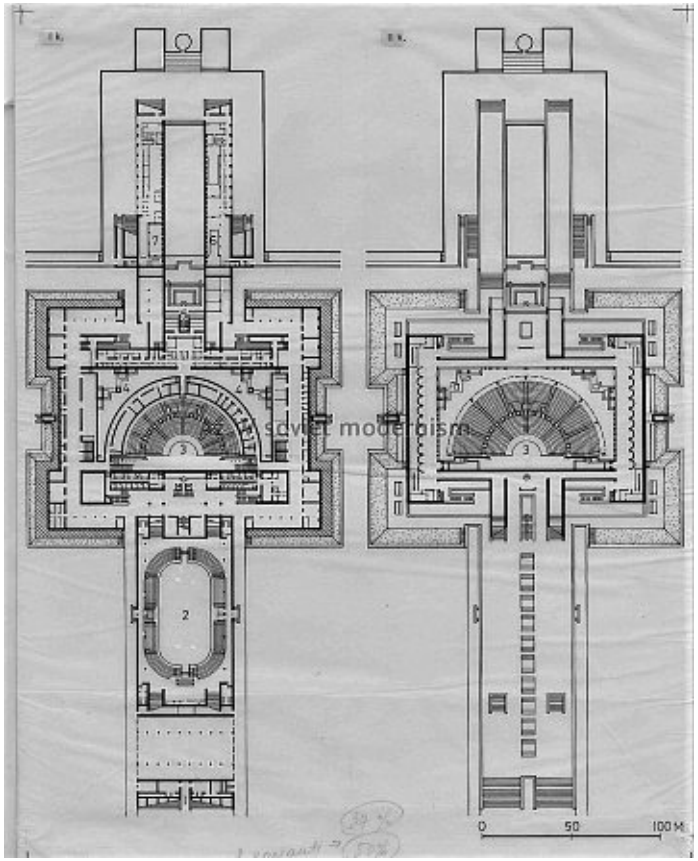


Fig.77 oben: Linnahall floor plan
Quelle: https://www.wiki.azw.at

Fig.78 left down : Linnahall Konzertsaal
Quelle: https://www.wiki.azw.at

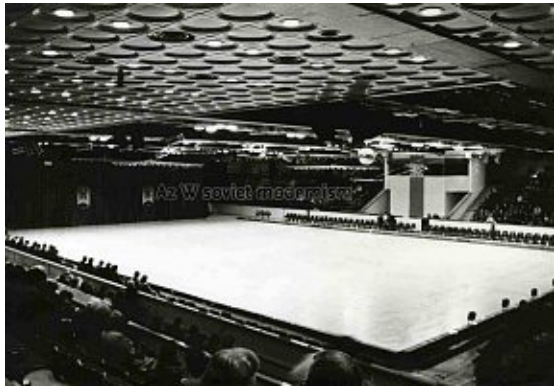


Fig.79 right down : Linahall Eishalle
Quelle: https://www.wiki.azw.at

Abb. links up : Linnahall today
Quelle: https://www.daveygranger.co.uk

Abb. links down : Linnahall today
Quelle: https://www.daveygranger.co.uk

Abb. right up : Linnahall today
Quelle: https://www.daveygranger.co.uk

Abb. right down : Linnahall today
Quelle: https://www.daveygranger.co.uk

Linnahall current stage

The entire complex is currently not in use. The ice rink has been closed since 2009 and the concert hall since 2010. Nevertheless, the place is used by the public. Visitors can often be seen there, especially on nice days. The workers from the area often enjoy their lunch break with a view of the Baltic Sea. Graffiti artists use the Linnahall as their canvas. The unusual structure makes it very attractive to parkour enthusiasts. It is also a popular place to have a beer and just chill out (Linnahalle, Wikipedia, <https://de.wikipedia.org>). On the other hand, the current state of the building is very sad. According to the Estonian Minister of Culture, it is shame that a building with such history behind it has been neglected. Also, the building is in a very visible place and changes the view of the city from the sea. (Culture minister: Tallinn has been involved in Linnahall plans, ERR News, 23.10.2019)

Reconstruction

At the end of February 2020, the Ministry of Culture decided to convert the Linnahall into an international conference centre. Their idea is to develop Estonia as a conference and tourism destination. The area is owned by Tallink, one of the largest shipping companies in the Baltic Sea. It will be a joint project between the city of Tallinn and the private company Tallink. The aim is to convert the Linnahall into a building with a multifunctional conference and concert hall with 5,000 seats and to add smaller conference rooms. A hotel, shopping center and a separate port for Tallink are also planned there. The company would like to move there its ferries to Tallinn-Helsinki. It was also discussed in the project that the already heavily frequented traffic in this area will have to run underground.
(Tallink to develop port at Tallinn's iconic Linnahall, ERR News, 26.02.2020)

3.6. A need for a new opera house

Discussions were also held about the possible conversion of the Linnahall into an opera house. This idea, however, collided with plans by Tallinn City Council, which owns the building, to make it a destination for conference-related tourism. The city is now looking for a new home for the opera and ballet productions of the Estonian National Opera. The reason for this is that the current Tallinn Opera House was designed as a "spoken word" theatre and does not offer good conditions to produce opera and ballet. Estonia is a nation best known for its musical culture. Because of this, the construction of a new opera house would be essential for the capital city. (Linnahall redevelopment discussions moving forward, ERR News, 08.11.2019)

3.7. Site area and project environment

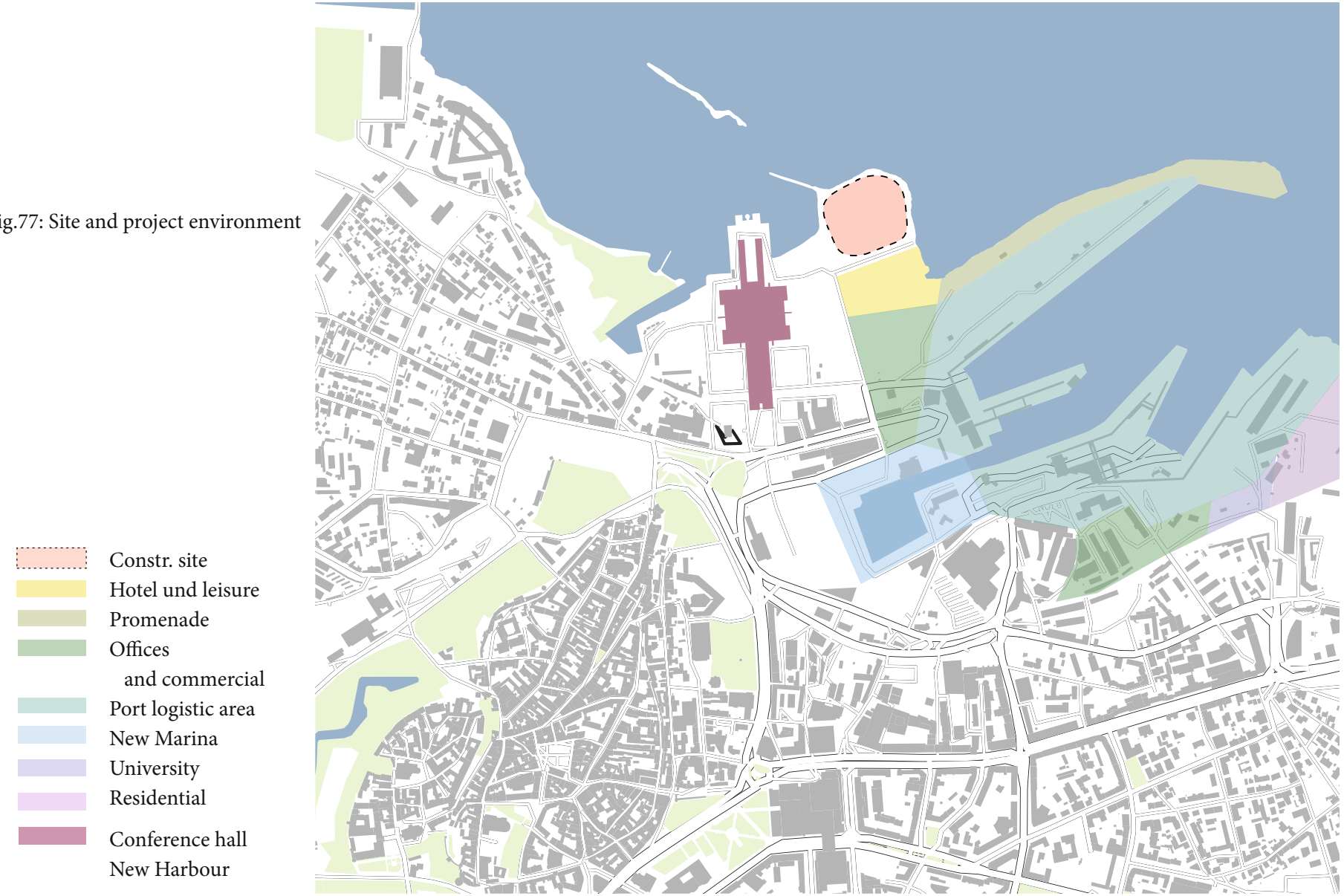
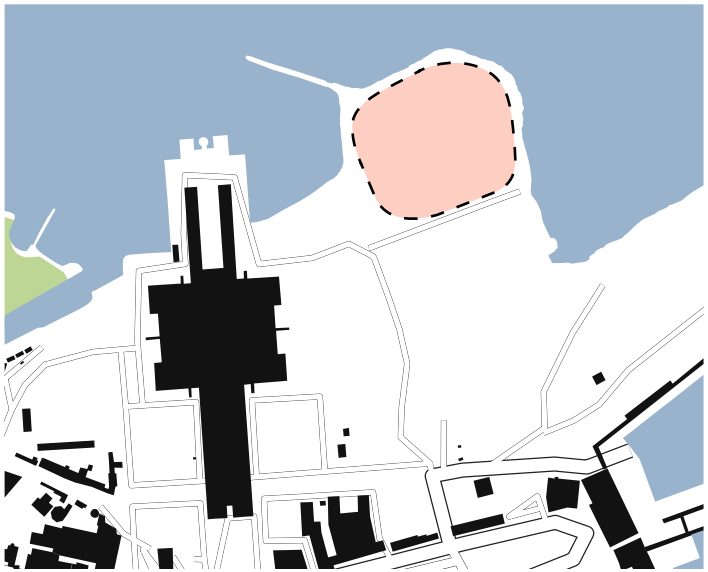


Fig.77: Site and project environment



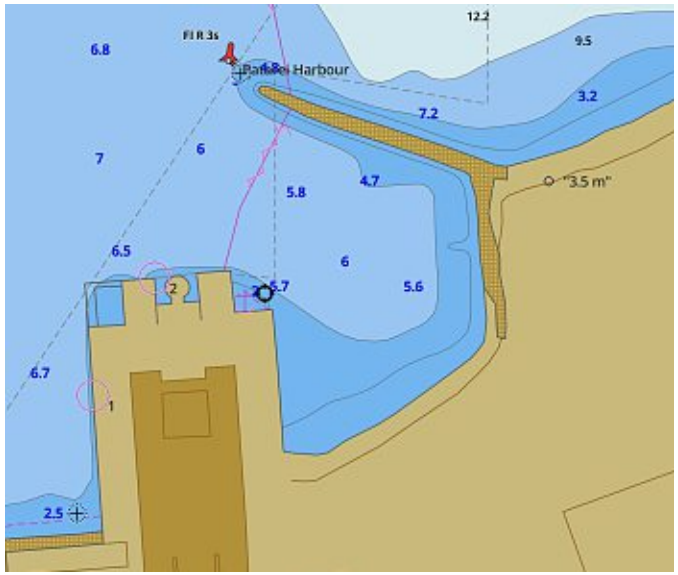


Fig. 78 left: Site area

Fig. 79 right: Sea deepness

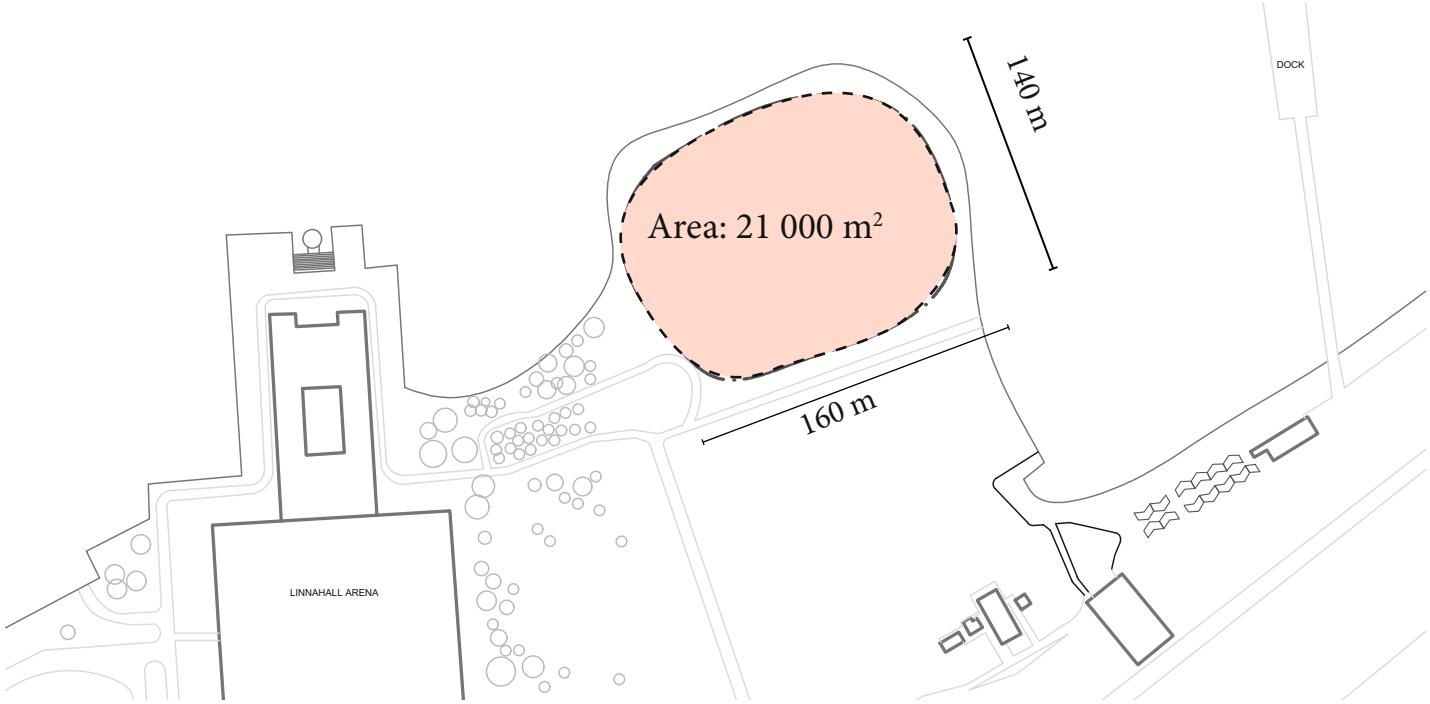


Fig. 79: Site area

Road network in the area

Main streets
Side streets
P Parking

Fig. 80 Road network

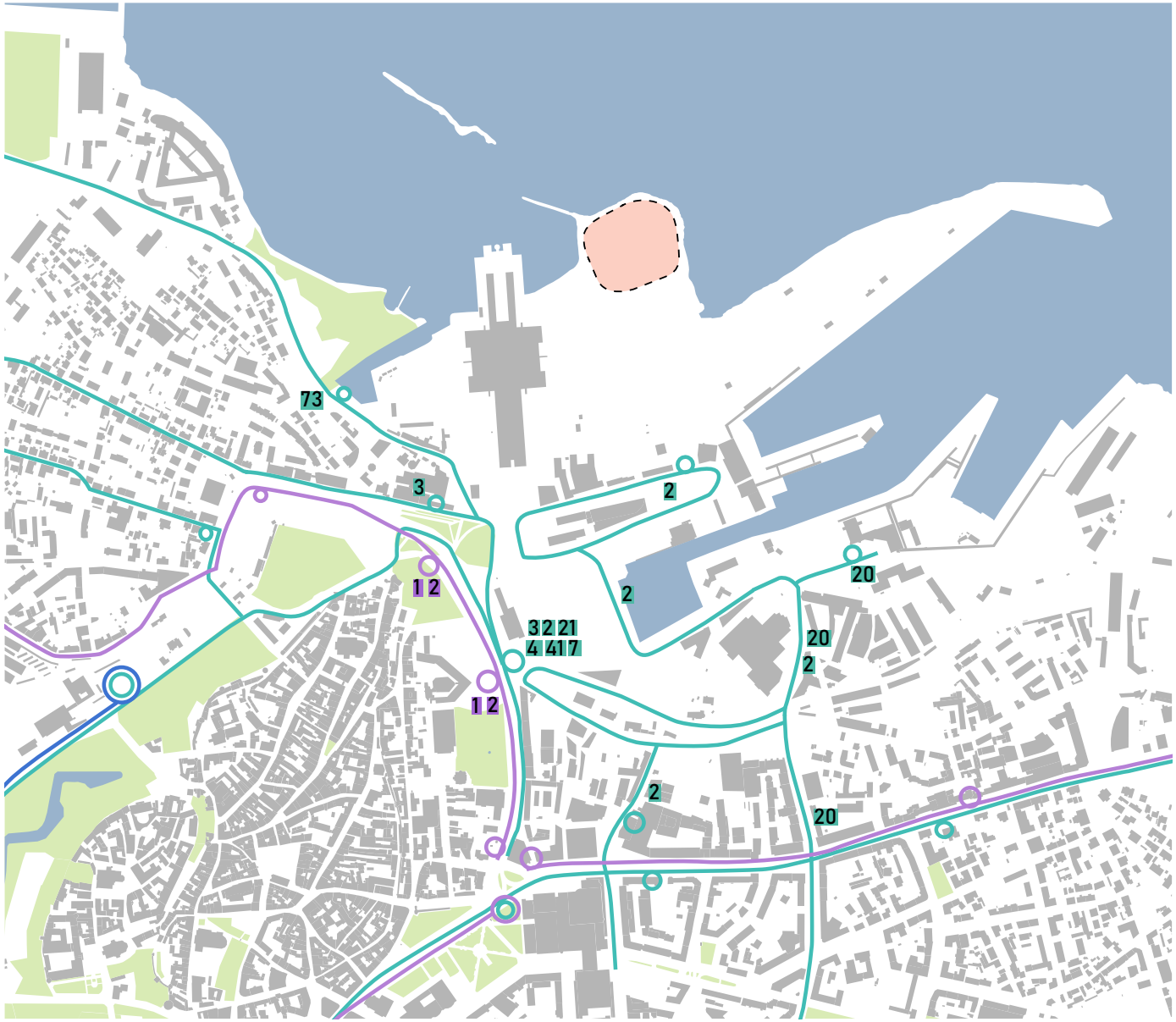


Fig.81 Public transportation in the area

III. GOALS OF THE PROJECT

In the past opera houses used to be considered as "hight culture". Nowadays Opera is more likely to become a part of peoples`everyday cultural life. Opera houses have always been symbolic buildings for the cities, but the goal today is to make them more open and attractive for every individual.

The aim of the project is to design a public building that create a connection between the old Linnahall and the Fast-Growing Port area, planned to be expanded in Masterplan 2030 of City of Tallinn and makes that Waterfront area more inviting and attractive for both residents and tourists. The project should derives from the location of the building as a border between its situation at the coastline of Tallinn and the close proximity to the city center. As a part of a former strictly controlled border and a military landscape in Soviet times, the site is culturally and infra-structurally uninviting for local people in contemporary Estonian society. The aim of the Opera House is to symbolically contribute to the cultural tradition of the city by gradually overcoming the border between the coast and the city, the sea and the people. Therefore, the form-finding relates to a fluid landscape that connects and activates its surroundings.

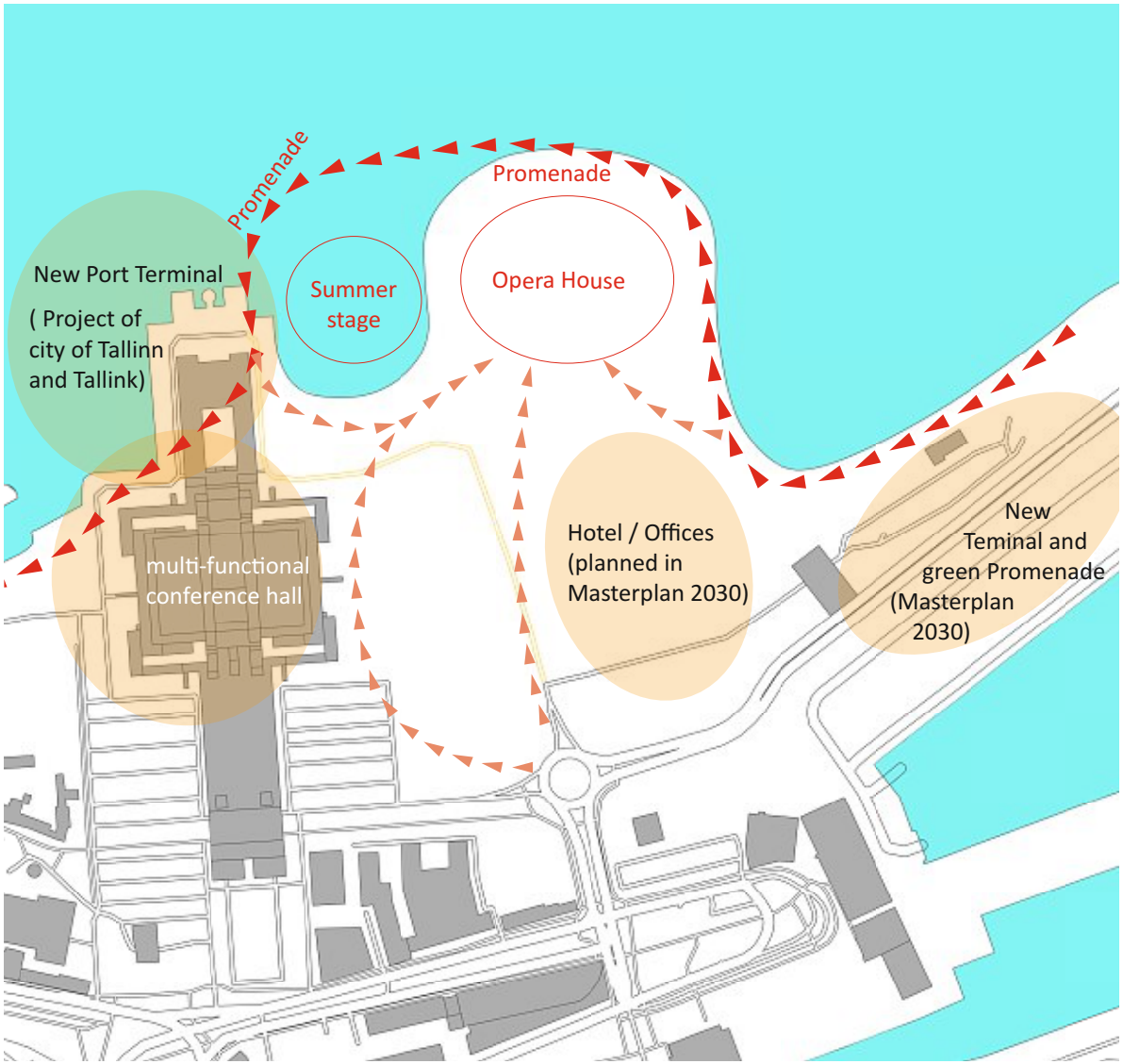
Providing a high quality performance is a crucial part of the project. Therefore, the house should meet all the classical requirements for building an opera house, but also to combine them with an innovative style that fit our modern lifestyle.

IV. METHODOLOGY AND WORK PROCESS

1.Site Context

Spacial Diagram Opera House

Fig.82 Usage and movement concept



The fact that the project is a part of a low-density urban area which is also planned to be redevelop would allow a further area expansion of a project with a large significance as an Opera House. Taking this into account the proposal offers an additional urban planning concept related to the architectural idea. The aim is to create an architectural idea that adapt to the landscape and uses the site qualities of the sea and the cultural heritage Linnahall. One of the main points is the rather underdeveloped coastline which could be used as a cultural promenade and a spatial platform for innovative performances with a view to the sea.

2.Shape Development

Concept 1

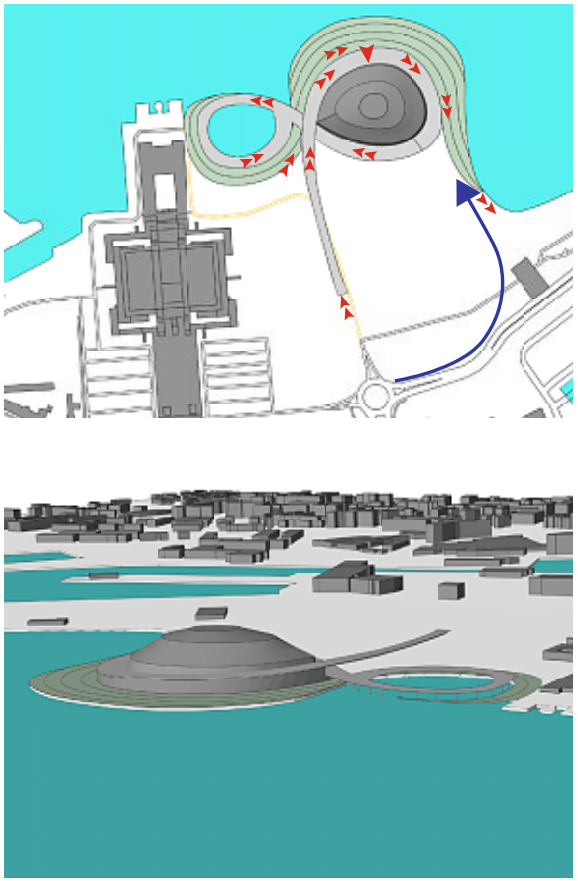


Fig. 83, Shape concept 1

Concept 2

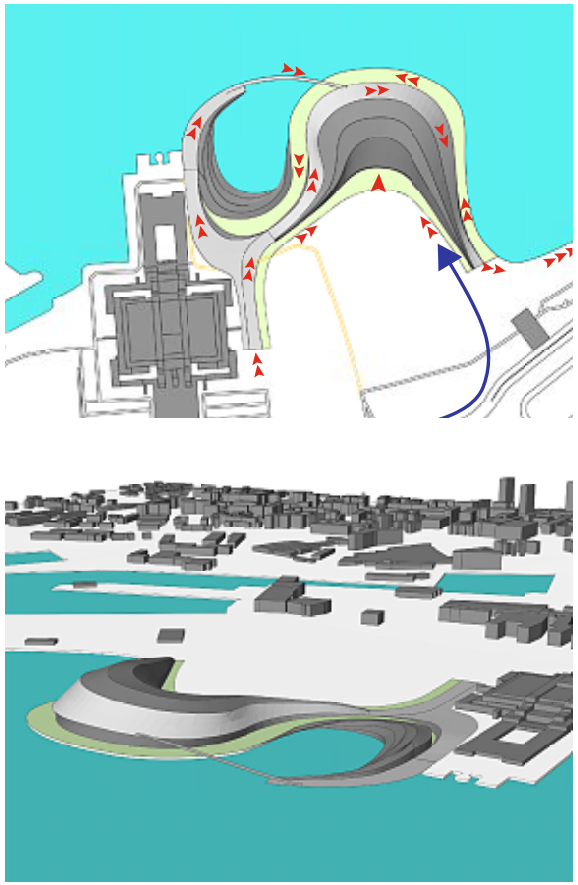


Fig. 84, Shape concept 2

Concept 3

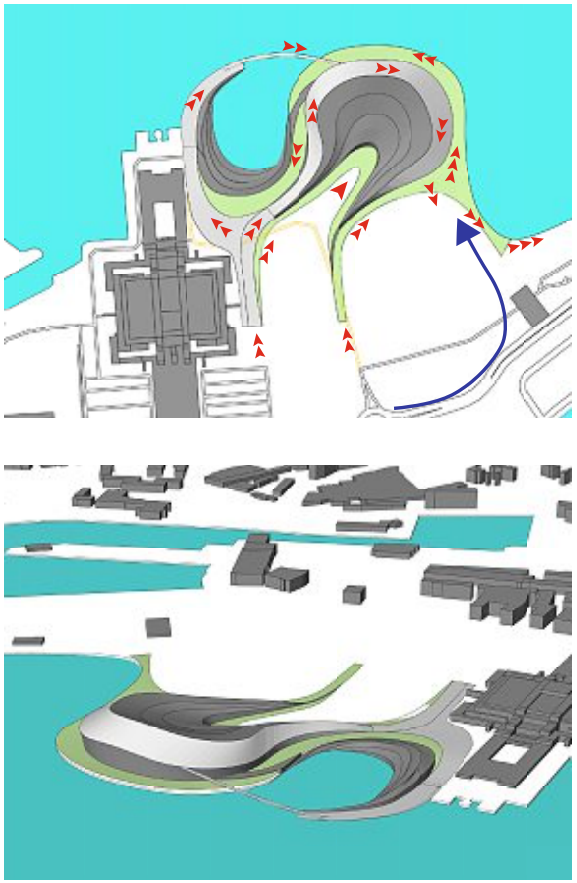
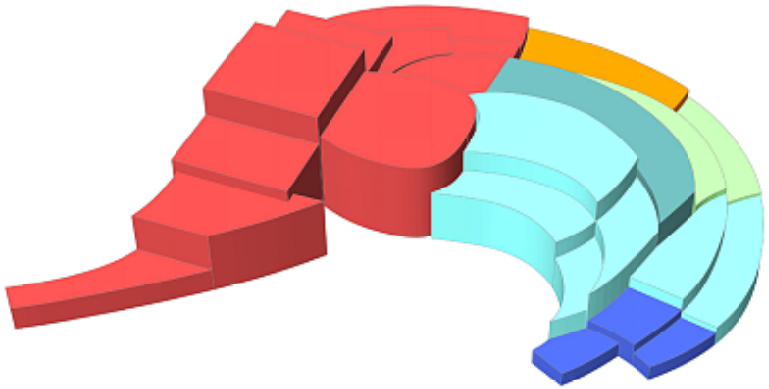


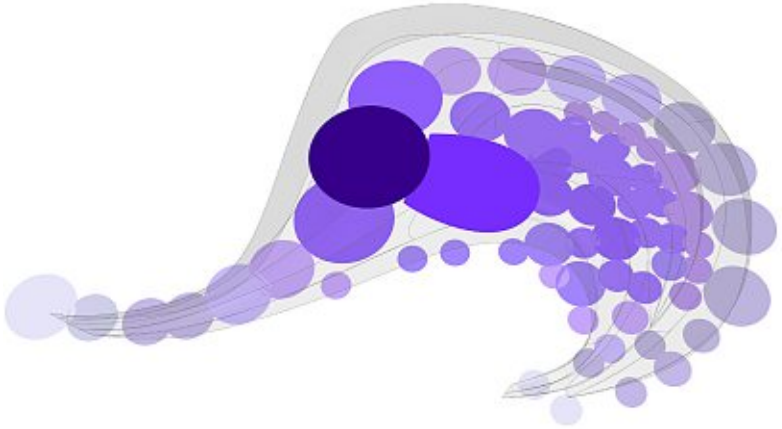
Fig. 85, Shape concept 3

Areas



Foyer
Gallery, Workshops, , Bars/Catering
Tickets, Administration, Cloakroom
Offices, Educational suit
Gastronomy
Auditorium, Stage,Backstage, Rehearsal

Heights



38 m
30 m
25 m
.
.
.
16 m
.
.
6 m
4 m
0 m

Auditorium + Stage

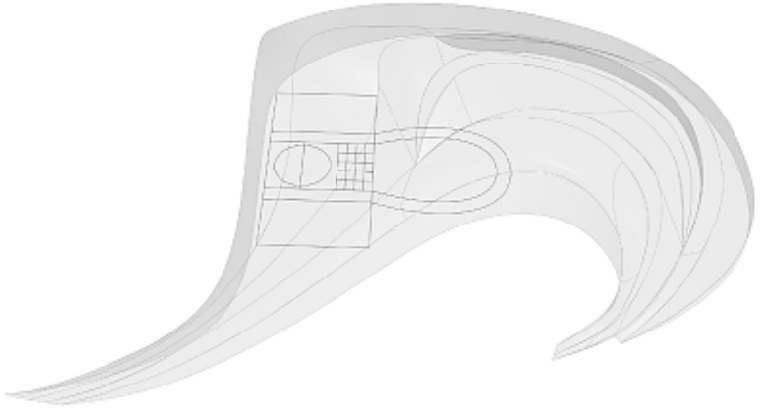
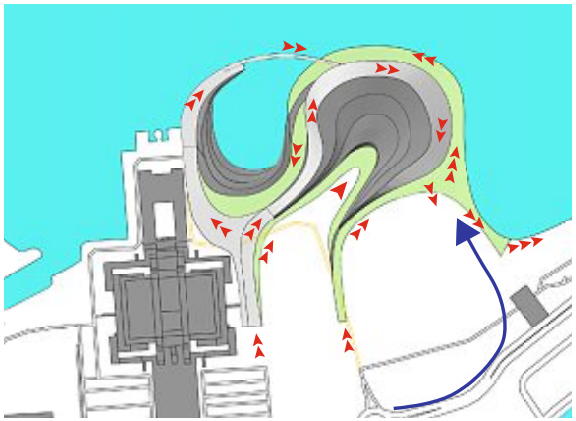


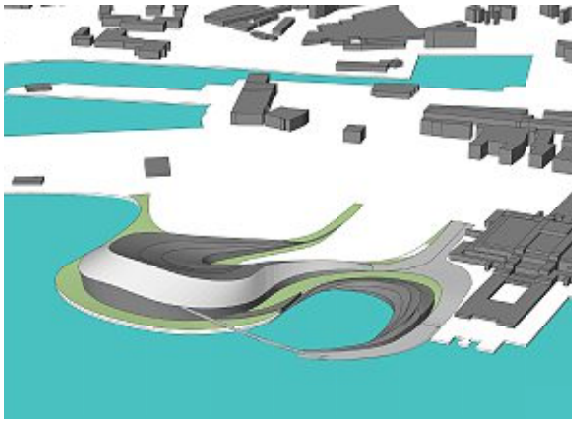
Fig.86 Concept Areas

Fig.87 Concept Height

Fig.88 Concept Auditorium and Stage Placing

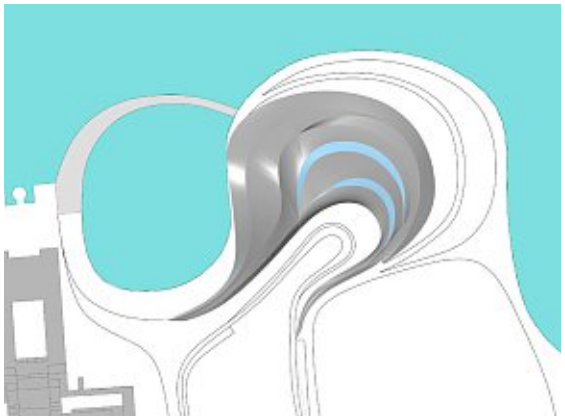
Shape Optimization

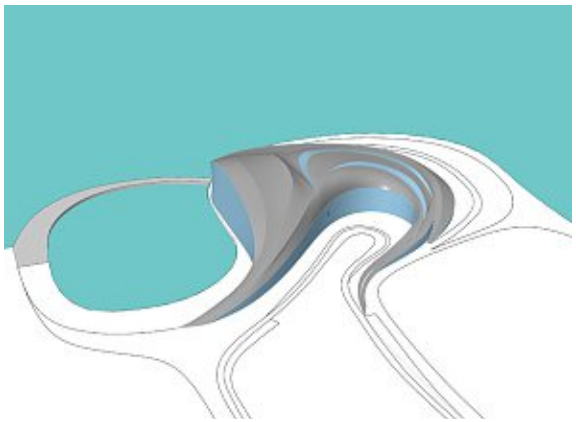




The shape of concept 3 has been chosen for further development as it responds best with the site. Its design follows the landscape and build a connection between the old Linnahall and the fast-growing port area, that plans to be expanded by 2030.

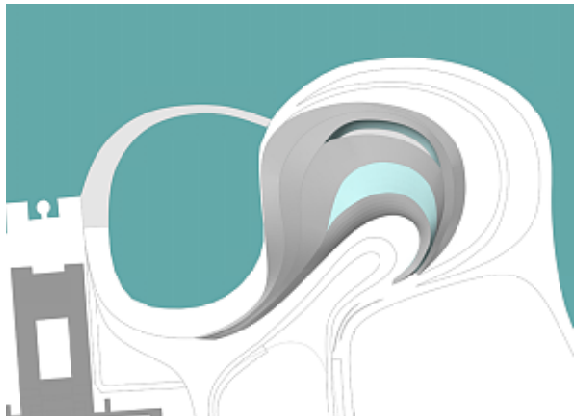
Fig. 89, Fig. 90 Shape concept 1

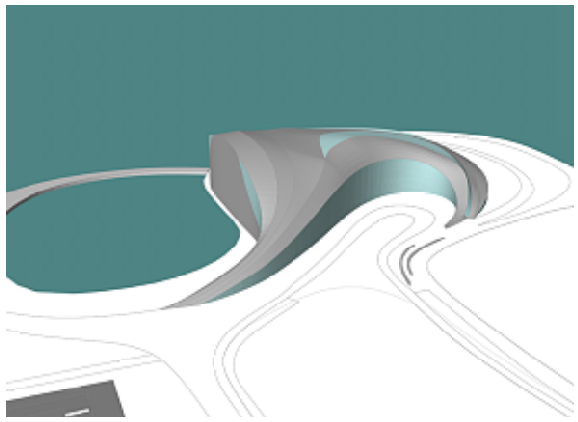




Taking the concept 3 as an example the shape has been optimized to reduce its volume and obtain a better curved shape

Fig. 91, Fig. 92 Shape optimizing





big atrium glazing panel as well as an inner courtyard for additional light has been defined

Fig. 93, Fig. 94 Shape optimizing

3.Performing Scenario

Summer Stage Concept Varieties

Concept 1
Floating stage

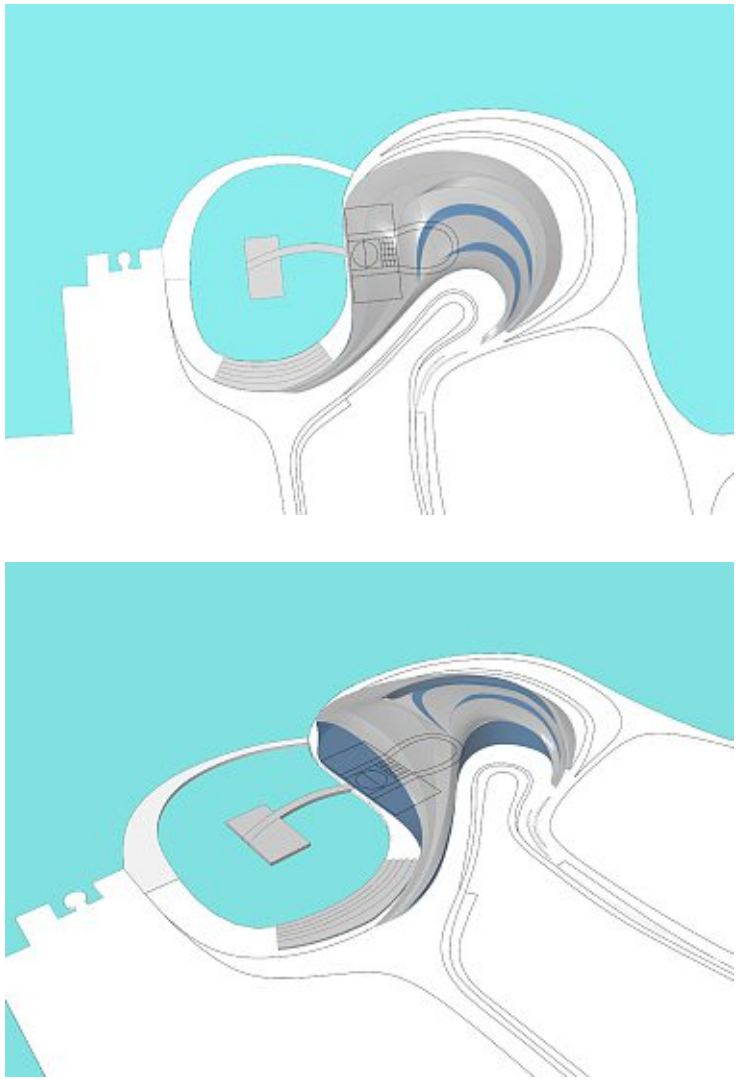


Fig.95, Fig.96: Concept floating stage

Concept 2
Rotating stage

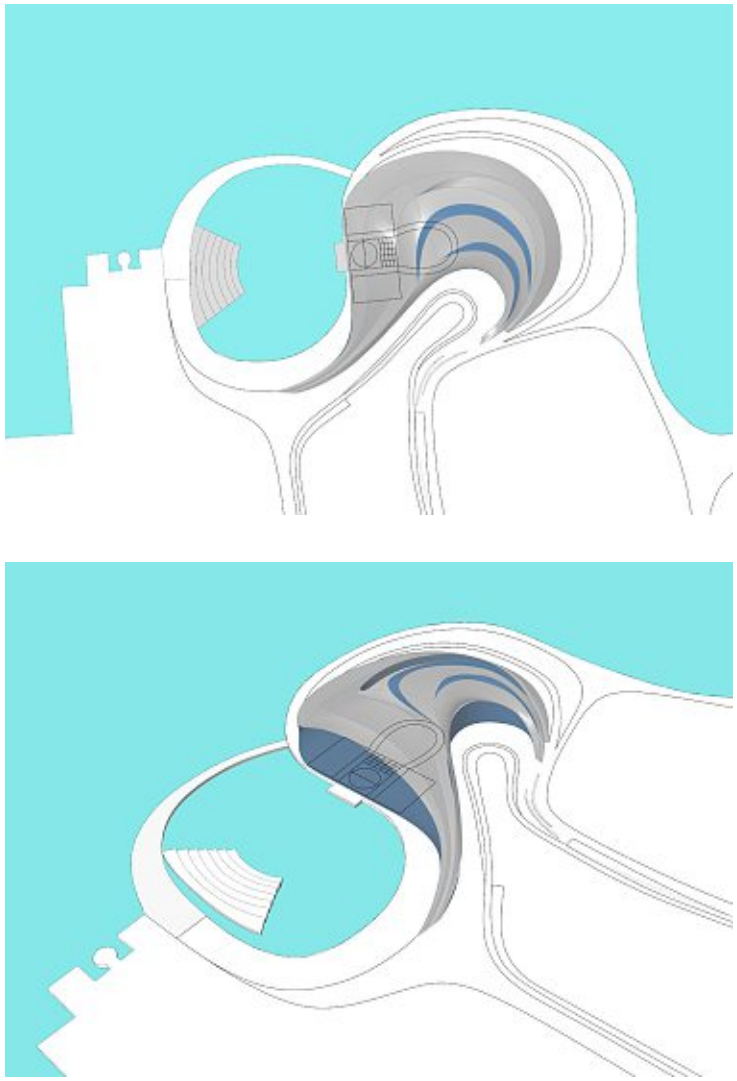


Fig.97, Fig.98: Concept rotating stage

Concept 3
Rotating Floating Auditorium

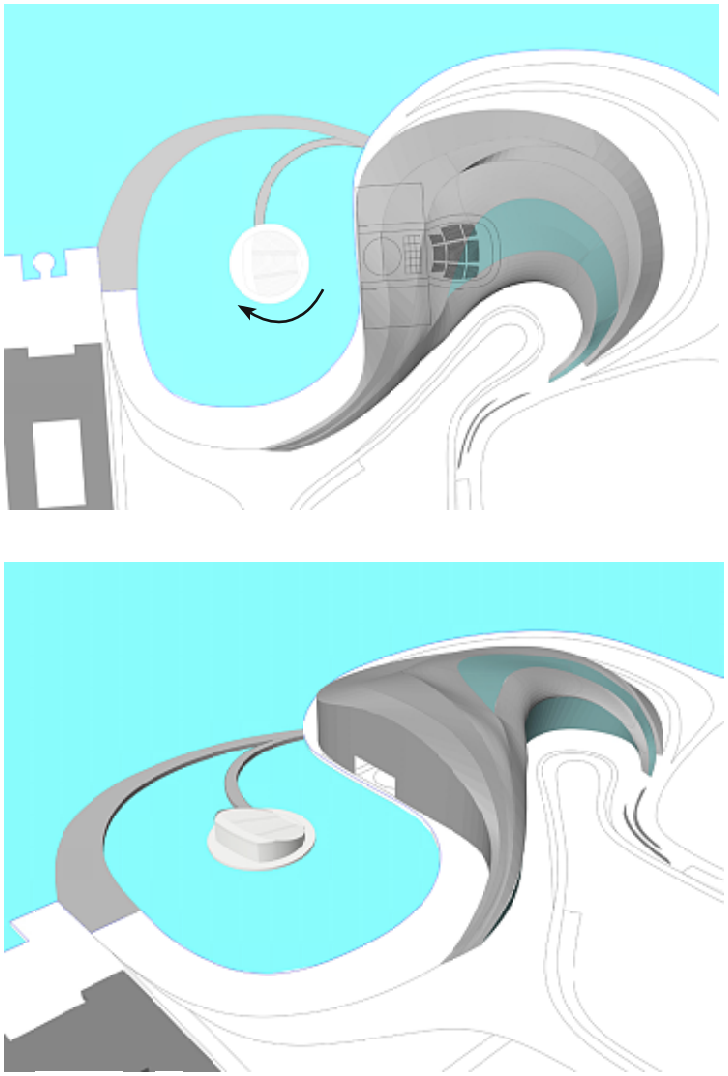


Fig.99, Fig.100: Concept rotating floating auditorium

Concept 4
Inside/Outside Auditorium

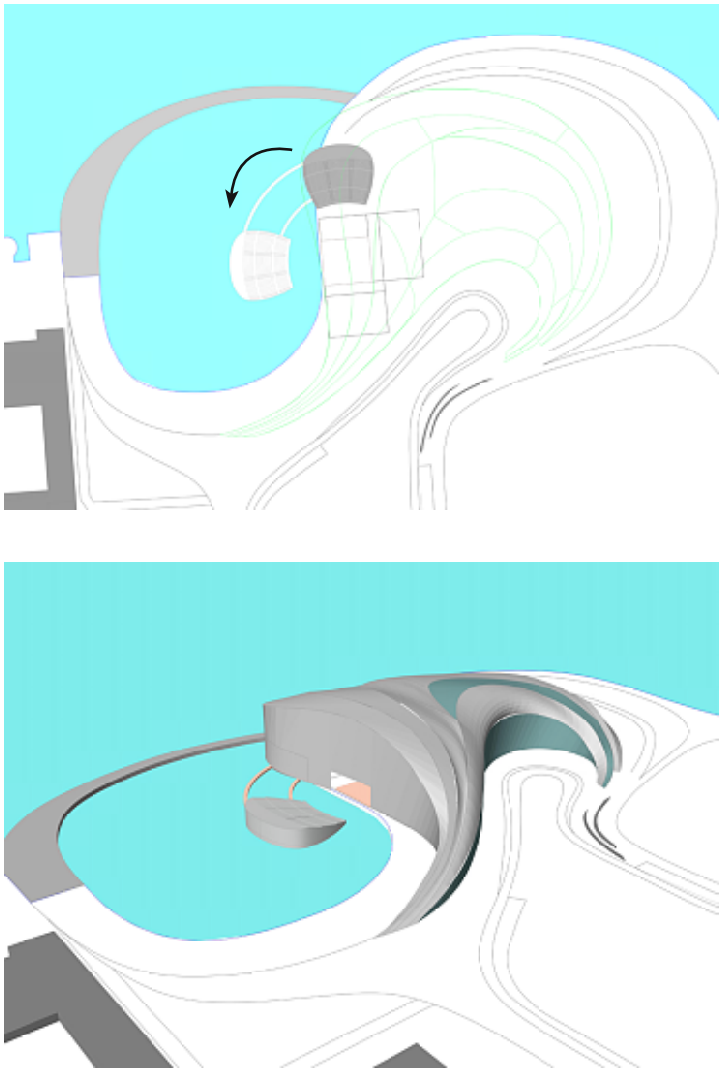


Fig.101, Fig.102: Concept inside/outside auditorium

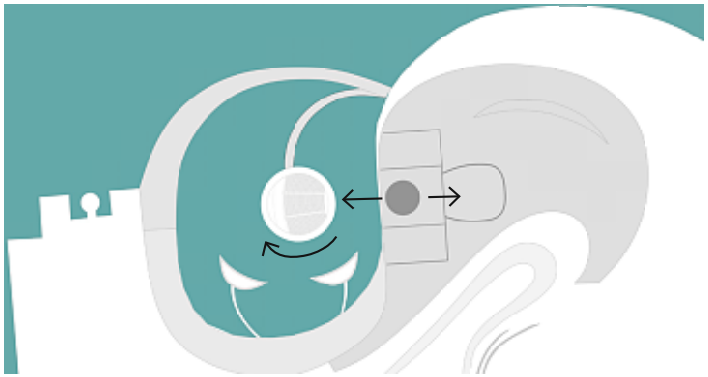


Fig.103. Seasonal scenario

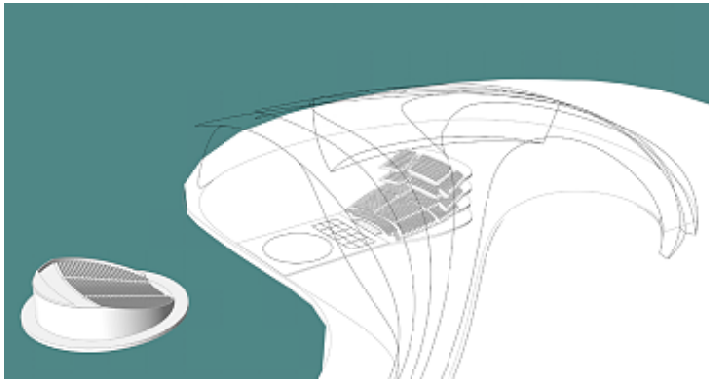
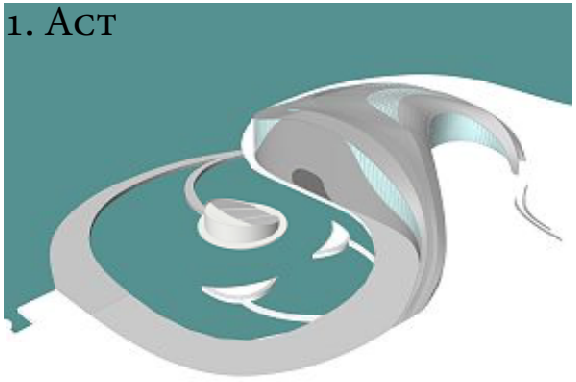
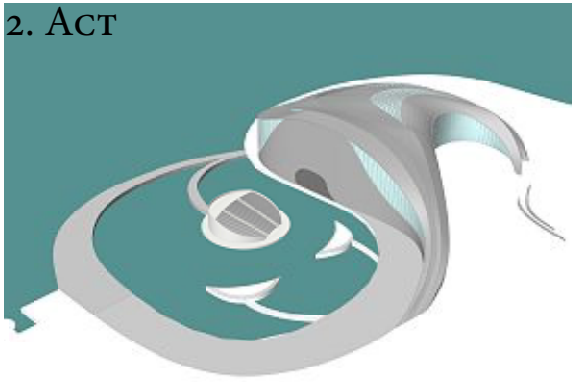


Fig.104: one stage, two aidutorium

The seasonal scenario aims to combine the old Estonian opera culture with a new invitational style. The Innovation of an Opera by the sea consists of its seasonal character enabled using the main stage from two directions. In a Cold-season Scenario a classical opera would take place indoors, whereas in a Summer Scenario an opera production would benefit from the spatial qualities of the open-air area. There the spectators would watch from a floating auditorium that rotates with the change of different opera acts. The three different stages- one indoors and two floating outdoors would encourage the audience to constantly explore the setting and the artists, as well as their background from a different angle. In this way an additional layer of excitement is added to the complex multi scenarios experience of the opera production.





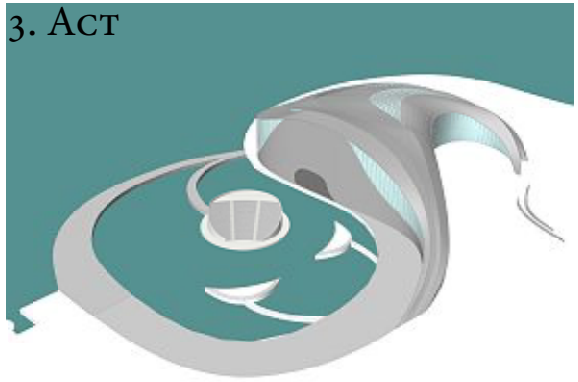


Fig.105, Fig.106, Fig.107: Acts of the performance

4. Connections

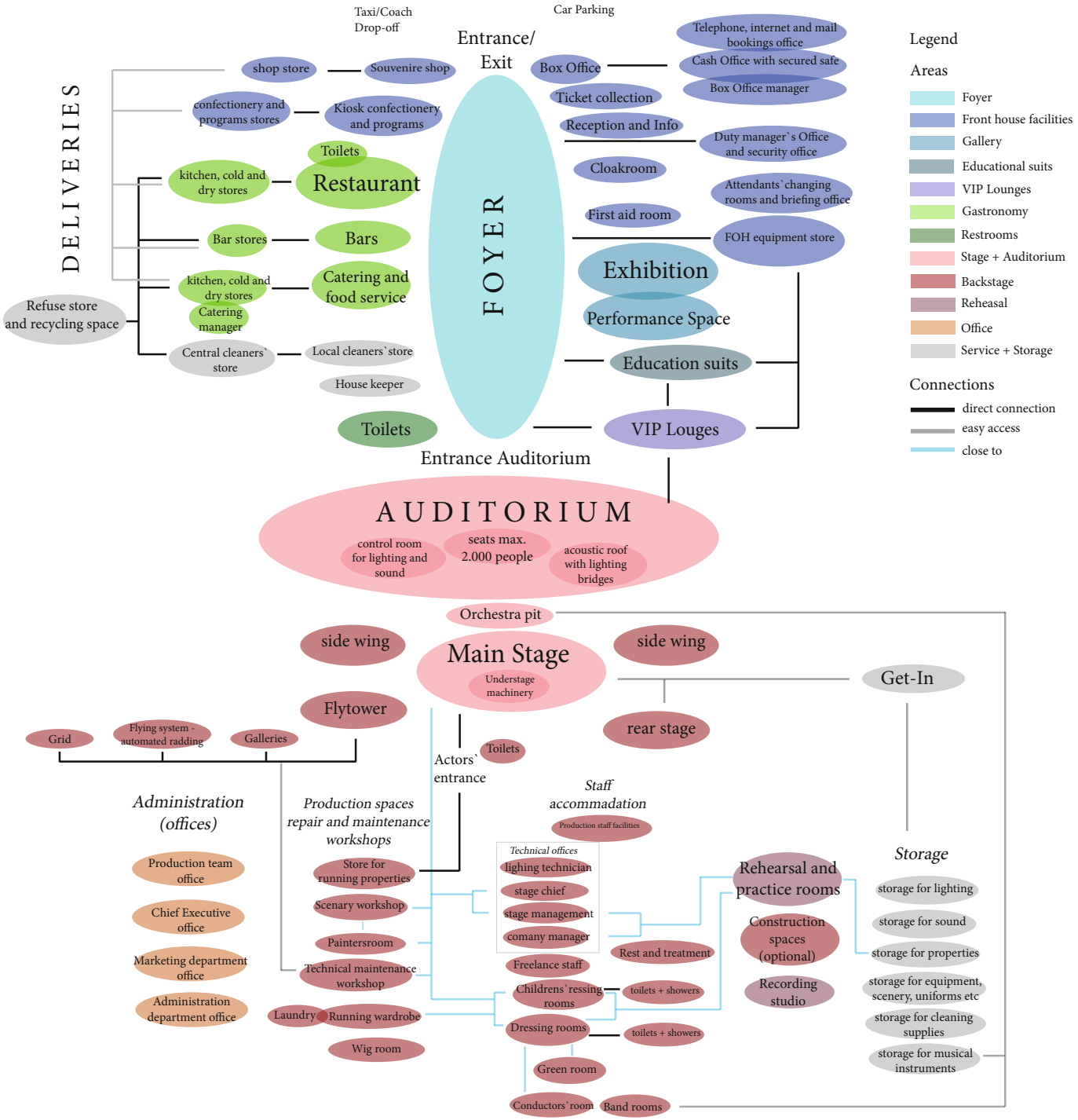
Entrance Opera

Pedestrians

Traffic
(only in one direction)

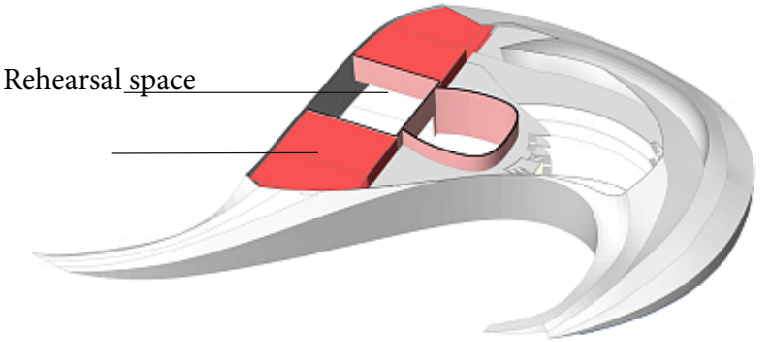
Car/Taxi Drop Off

Fig.108: Concept Connections

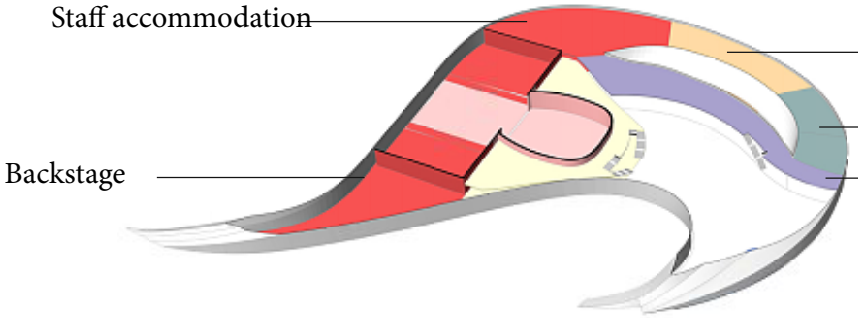


5. Space Concept

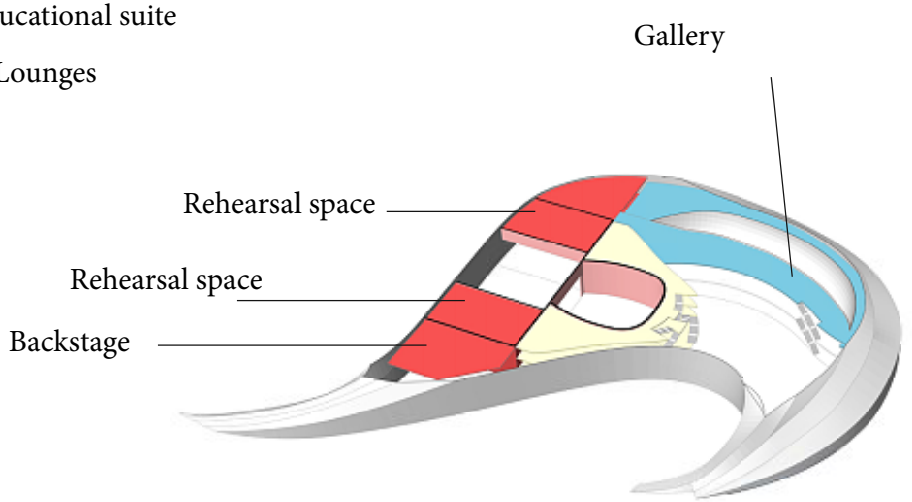
Fig.109: Space concept



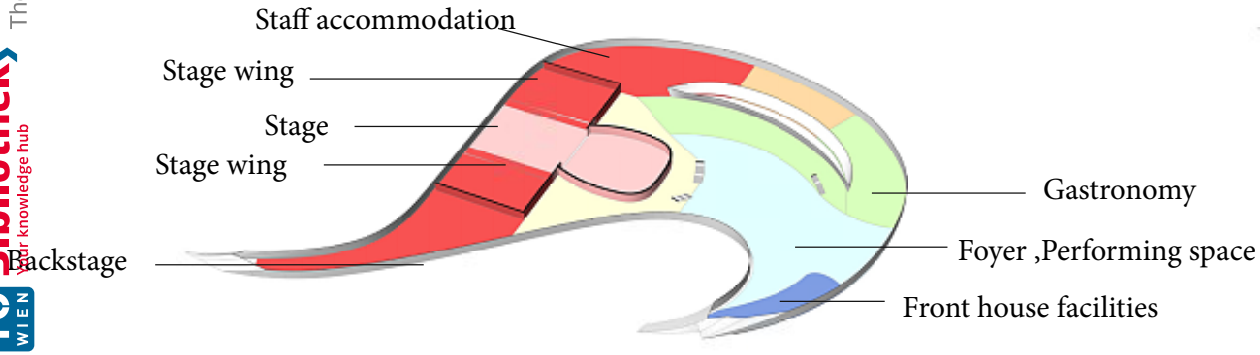
Level +20.00



Level +7.00



Level +15.00

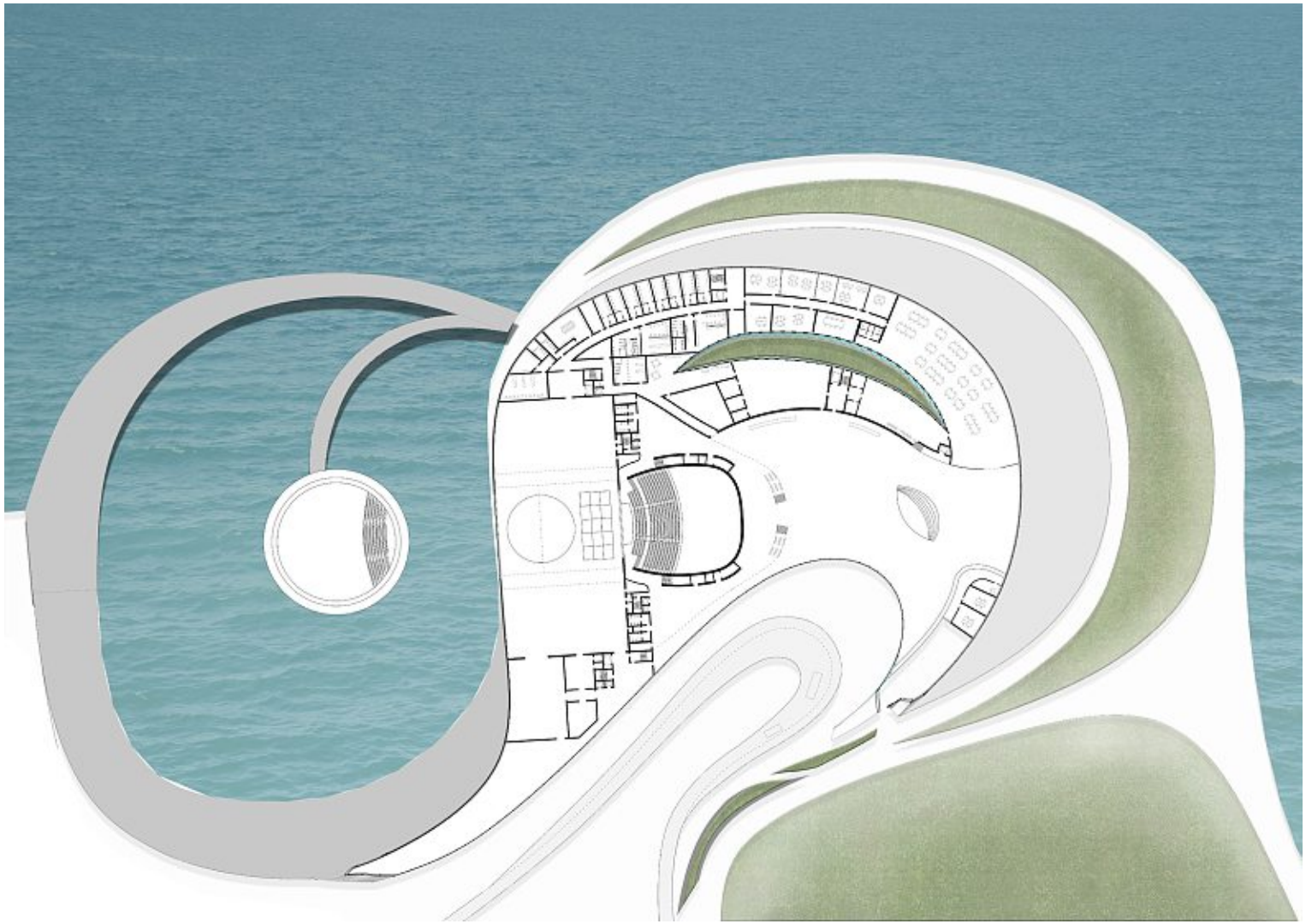


Level +0.00

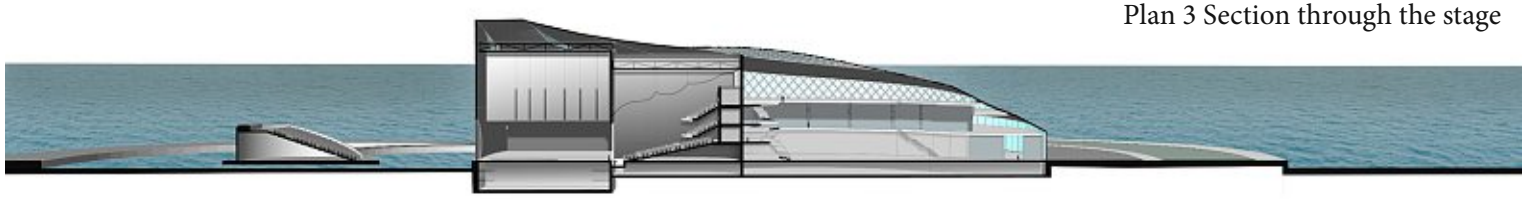
V. Result from the competition
Opera by the sea

Plan1 Site plan, submitted for the competition Opera by the sea

Ground floor plan

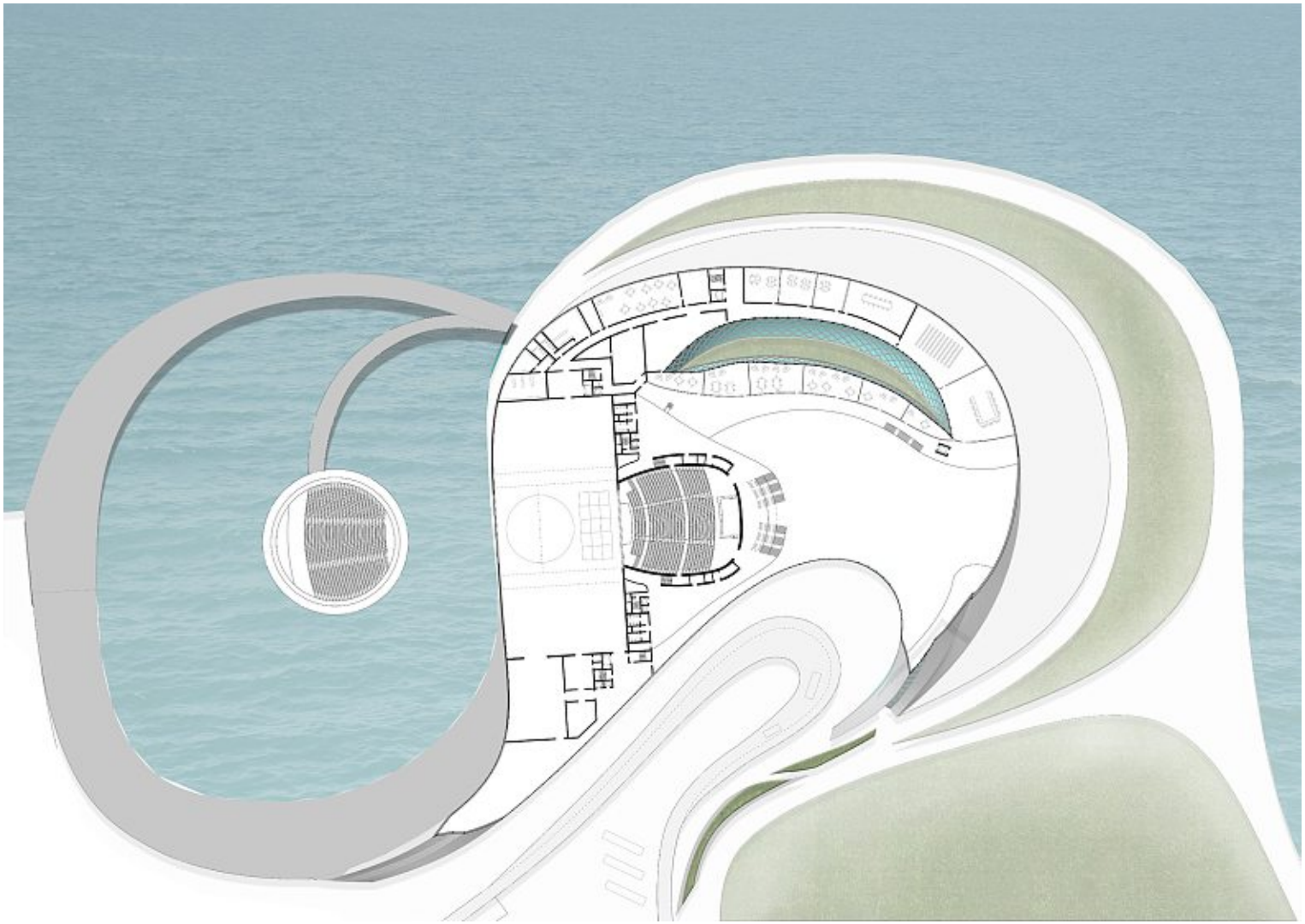


Plan 2 Ground floor plan

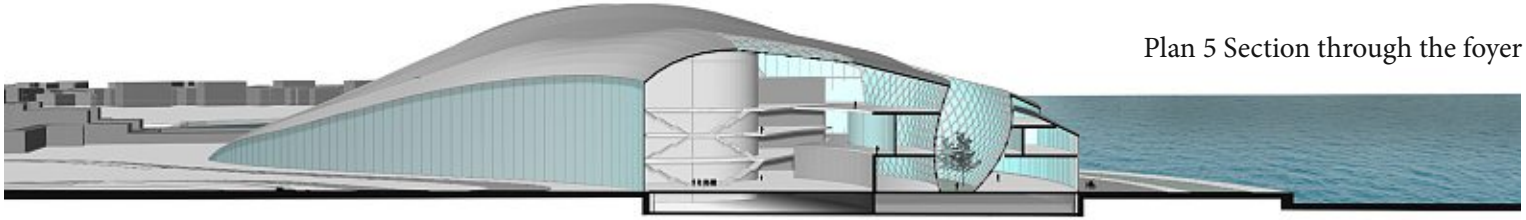


Plan 3 Section through the stage

Floor plan +7.00



Plan 4 Upper floor plan



Plan 5 Section through the foyer

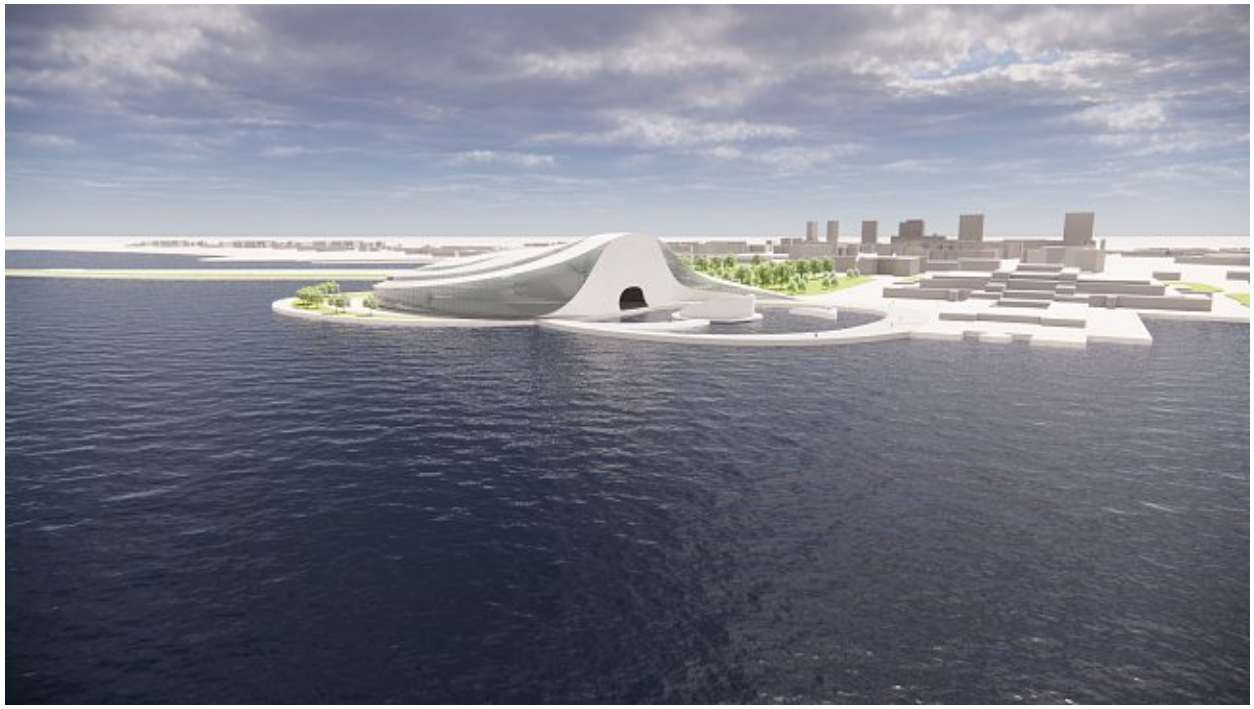


Fig.110 Render,
View from the sea

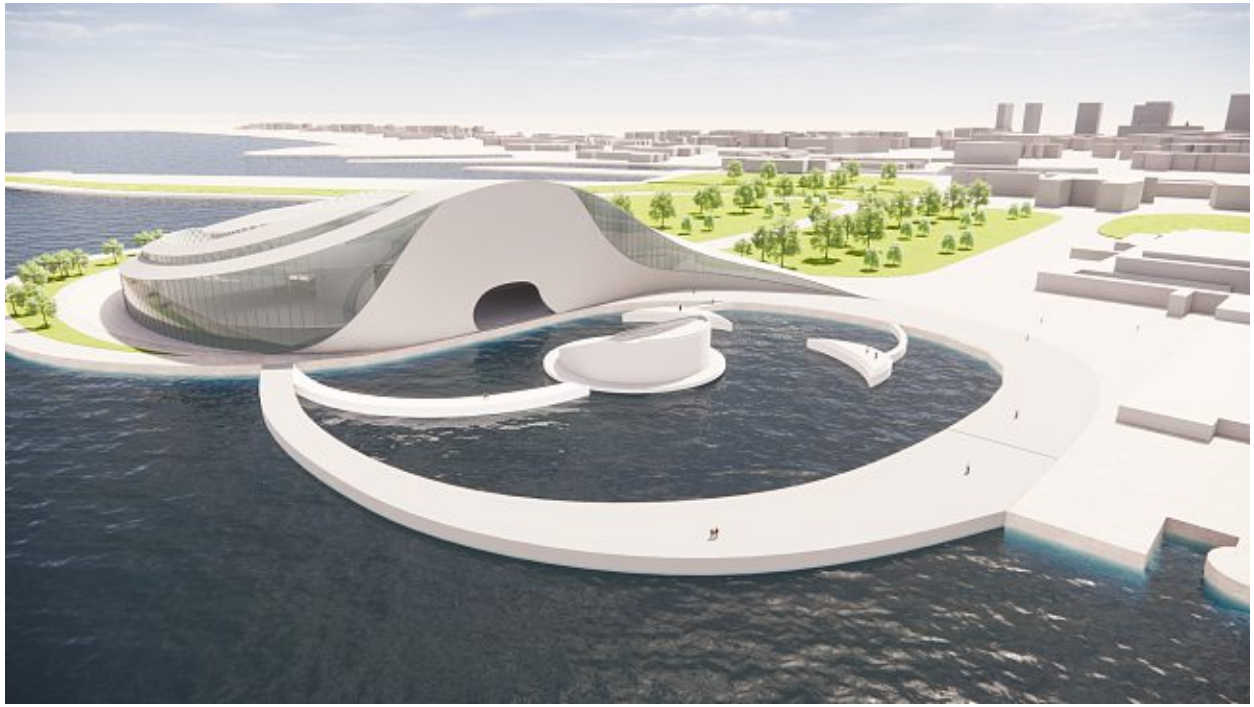


Fig.111 Render,
View from above

Fig.112 Render,
View from the sea

Fig.113 Render,
View from the sea

Fig.114 Insideren-
der, Foyer

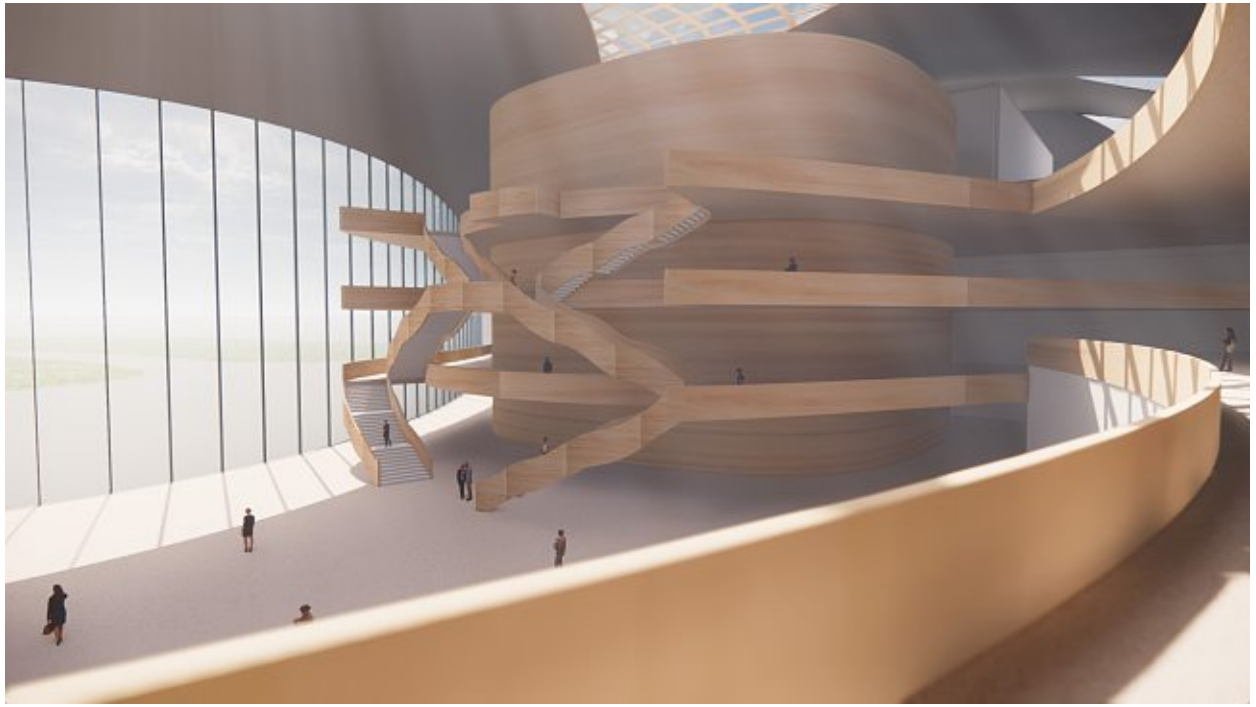


Fig.115 Insideren-
der, Foyer

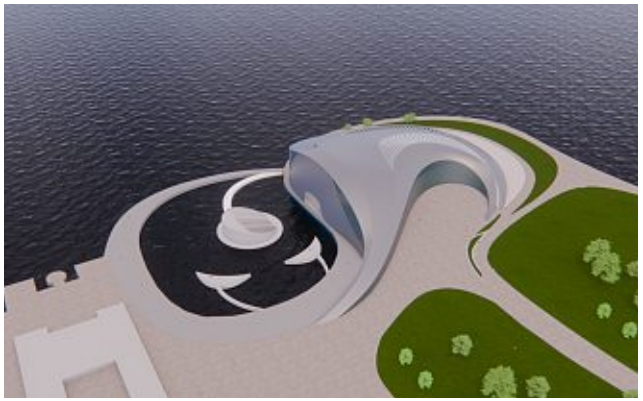
Fig.116: Insideren-der, Foyer

Fig.117:Upper floor

VI. Project further development

Old Stage

Improvement



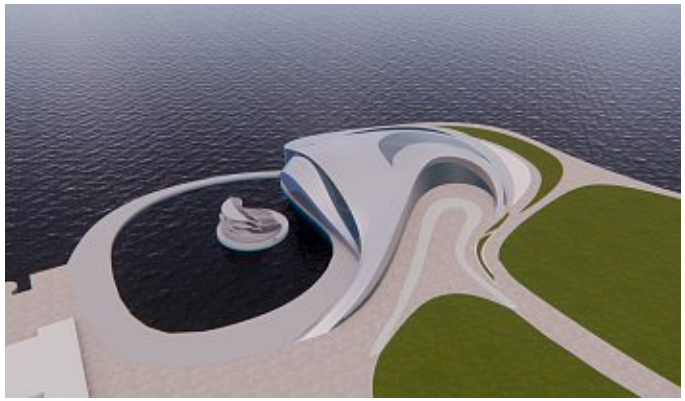


Fig.118 left: Render from above, old design

Fig.119 right: Render from above, improved shape

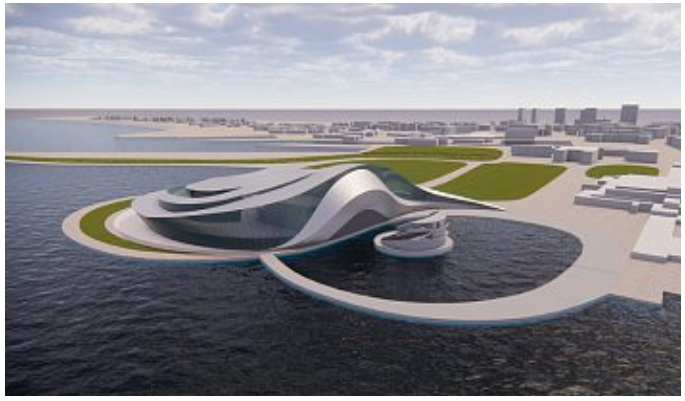


Fig.120 left: Render from above, old design

Fig.121right: Render from above, improved shape

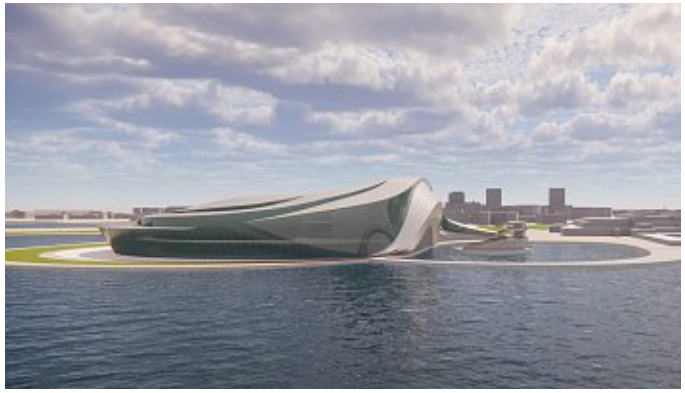
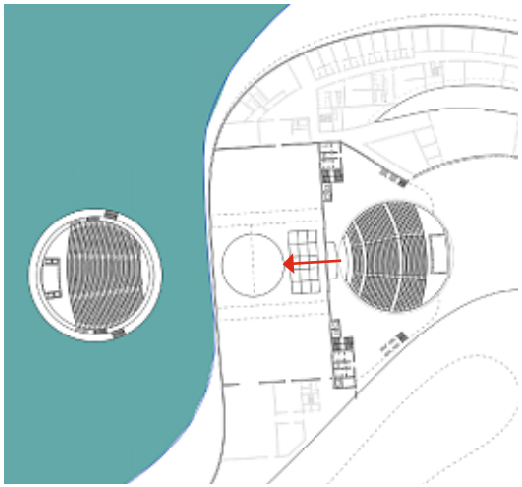
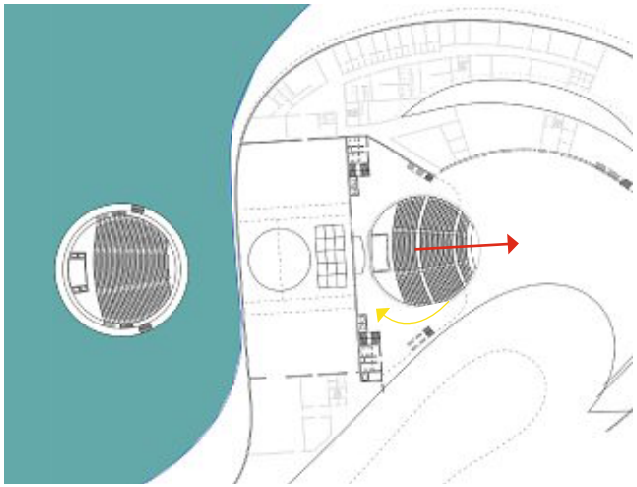


Fig.122 left: Render, view from the sea, old design

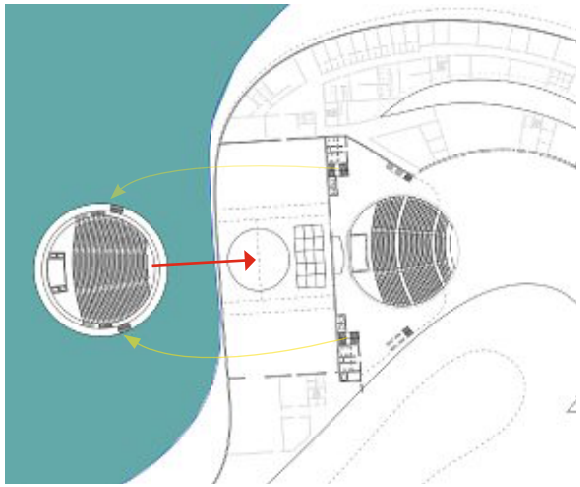
Fig.123right: Render, view from the sea, improved shape



Act 1 - Classical Performance
Auditorium Pointing the main stage



Discussions/ Seminars
Auditorium rotated to the foyer



Act 2 - Spectacular show
Audience into the sea

Fig.124 up: Diagram Classical performance

Fig.125 down: Render Classical performance

Fig.126 up: Diagram Rotated auditorium

Fig.127 down: Render Rotated auditorium

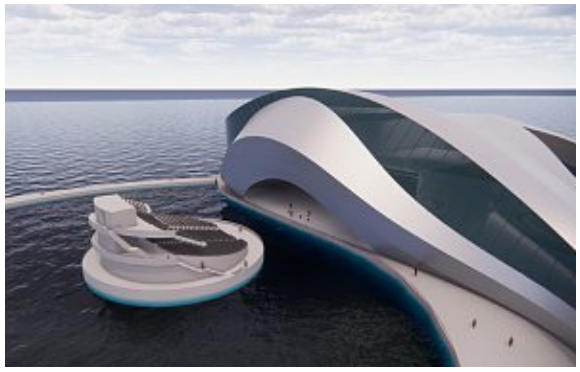


Fig.128 up: Diagram Outside performance

Fig.129 down: Render Outside performance

Underground, underwater tunnels with several glass-openings to the sea are connecting both Auditoriums

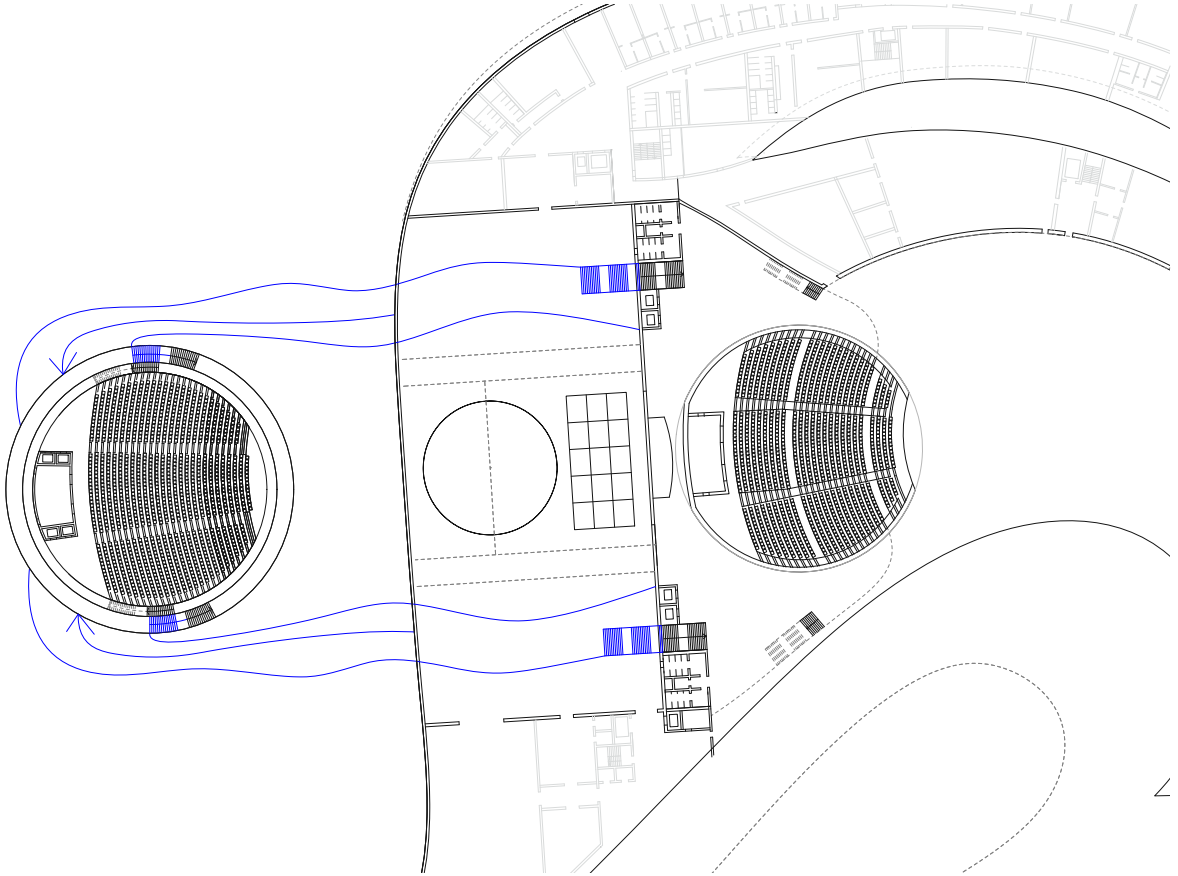


Fig.130: Underground connections

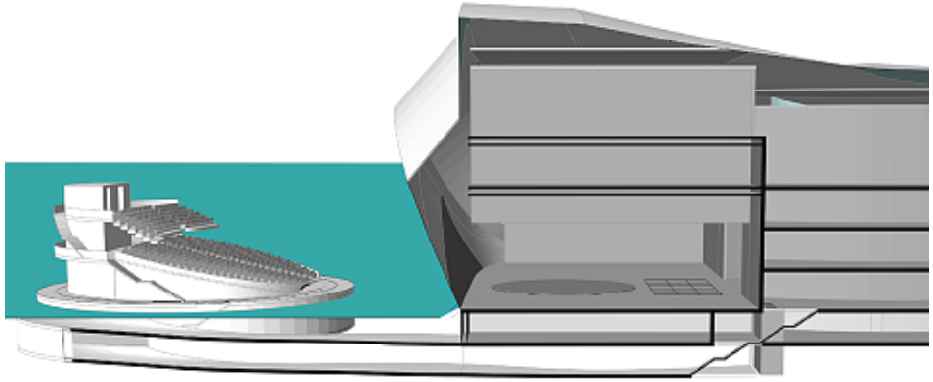


Fig.131: Underground connection, section

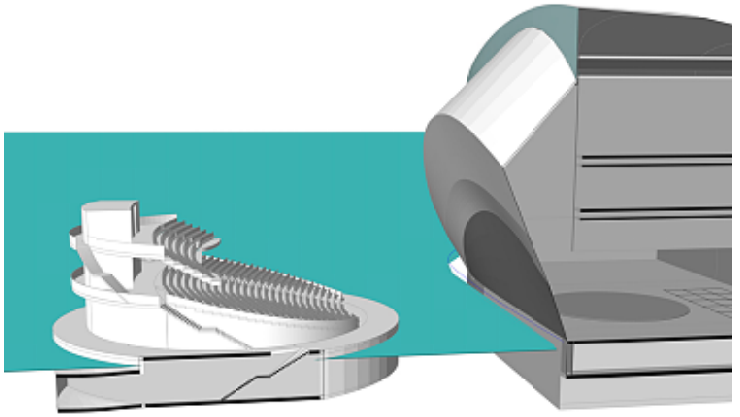
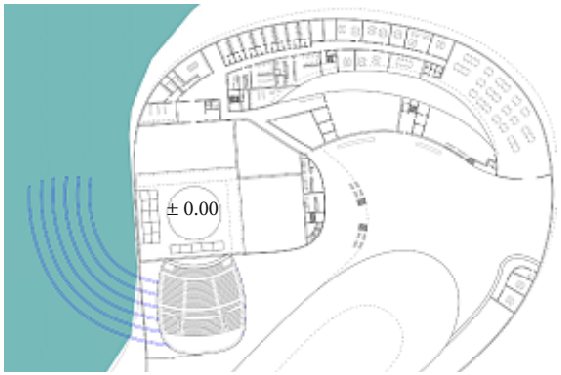
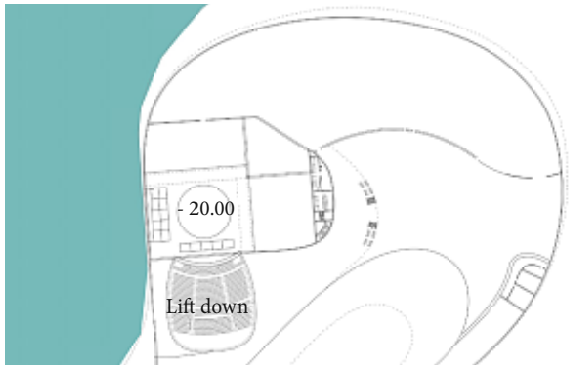


Fig.132: Underground connection, section

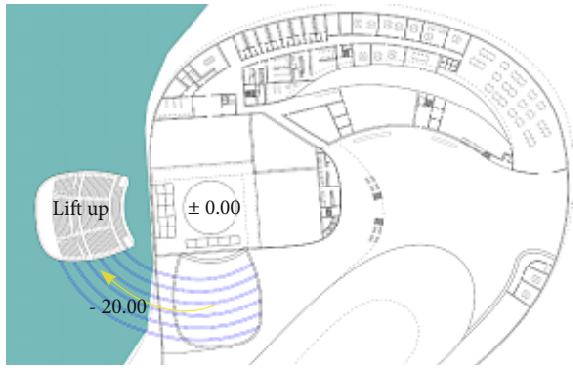
Contrasts



Act 1
main stage inside above water



Act 1
main stage inside under water



Act 1
main stage outside above water

Fig.133 up: Diagram Act 1

Fig.134 down: RenderAcht 1

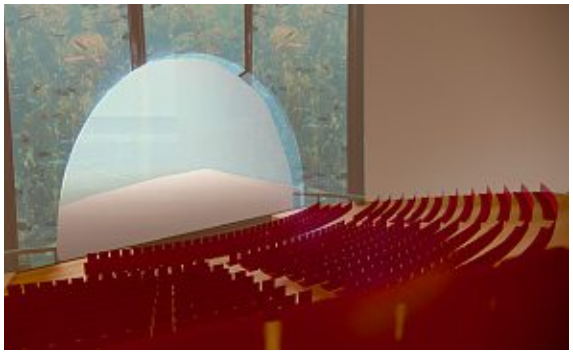


Fig.135 up: Diagram Act 2

Fig.136 down: Render Act 2

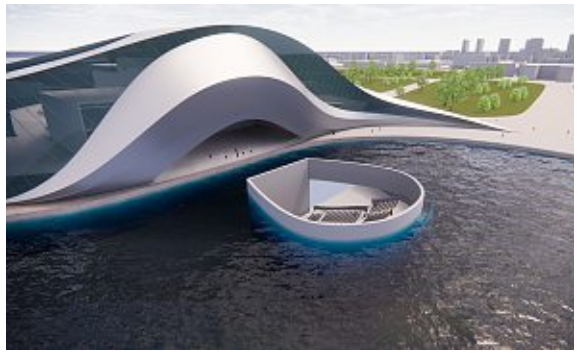


Fig.137 up: Diagram Act 3

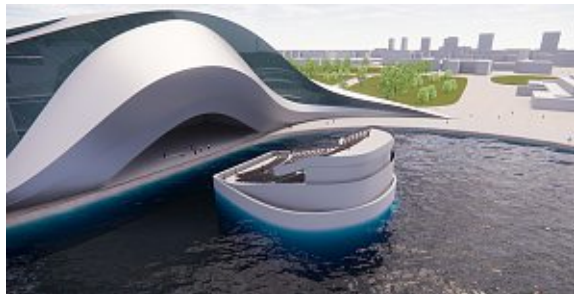
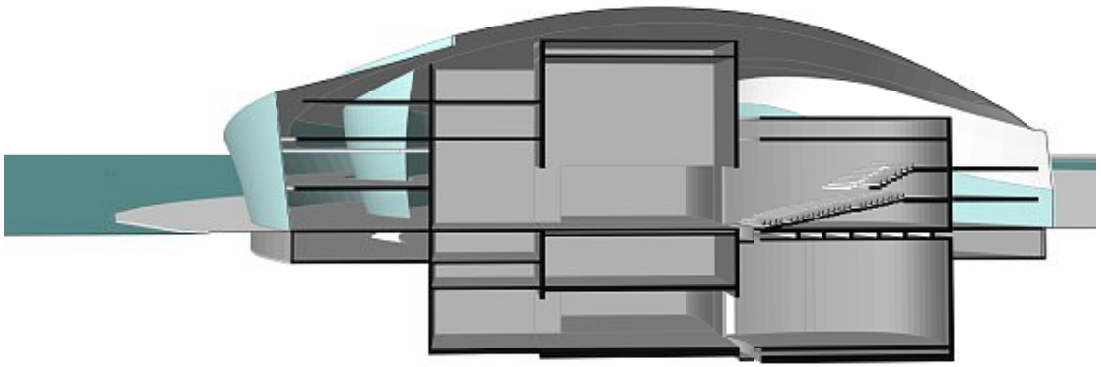


Fig.138, Fig. 139 down: Render Act 3



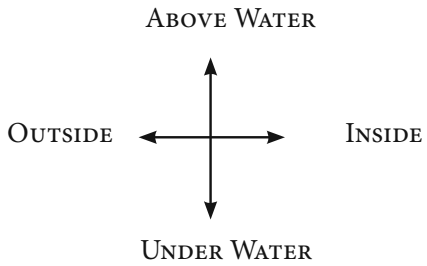


Fig.140: Act 1 Section

Act 1

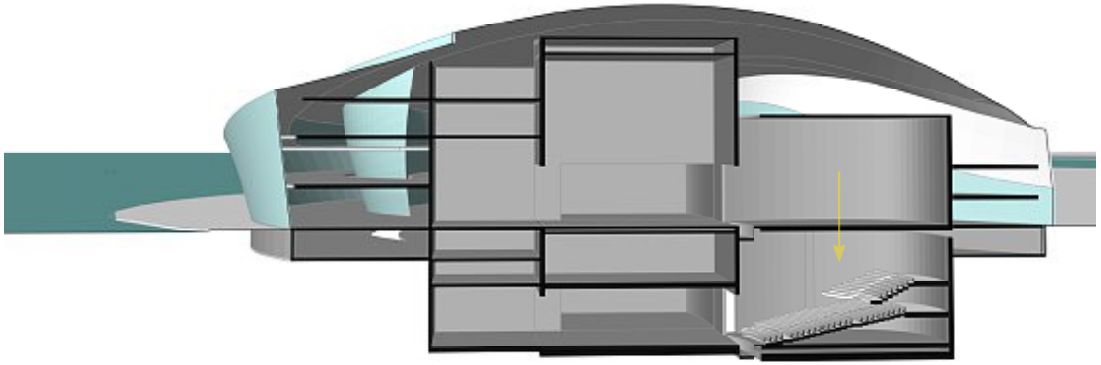


Fig.141: Act 2 Section

Act 2

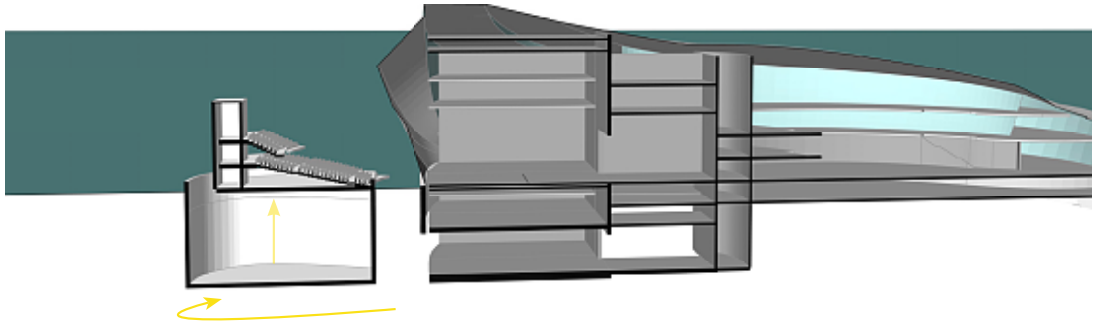


Fig.142: Act 3 Section

Act 3

Comparison

Concept Scenario 1

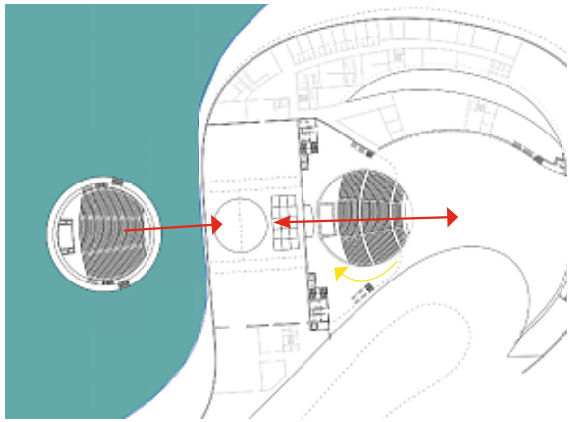


Fig.143 left: Plan Concept Scenario 1

Concept Scenario 2

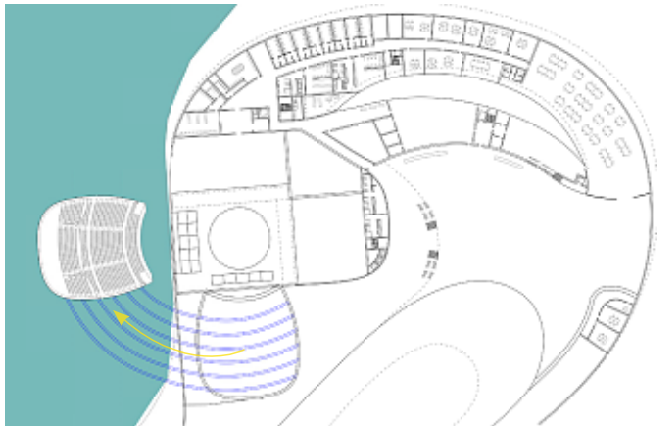


Fig.144 right Plan Concept Scenario 2

Pros

- more movement allowing the guests to explore the building better

- Emergency exit is easy to be planned

- An additional roof would allow the sea audience to be used also in bad weather

- Easier and faster movement

- An additional experience for the audience

Cons

Time - peoples` movement between the acts is timeconsuming

- An optimal Emergency exit is hardly possible

- Lower stage is not optimal (no flytower)

- Ecological unfriendly

Scenario 1 has been chosen for further developments

ROTATING STAGE

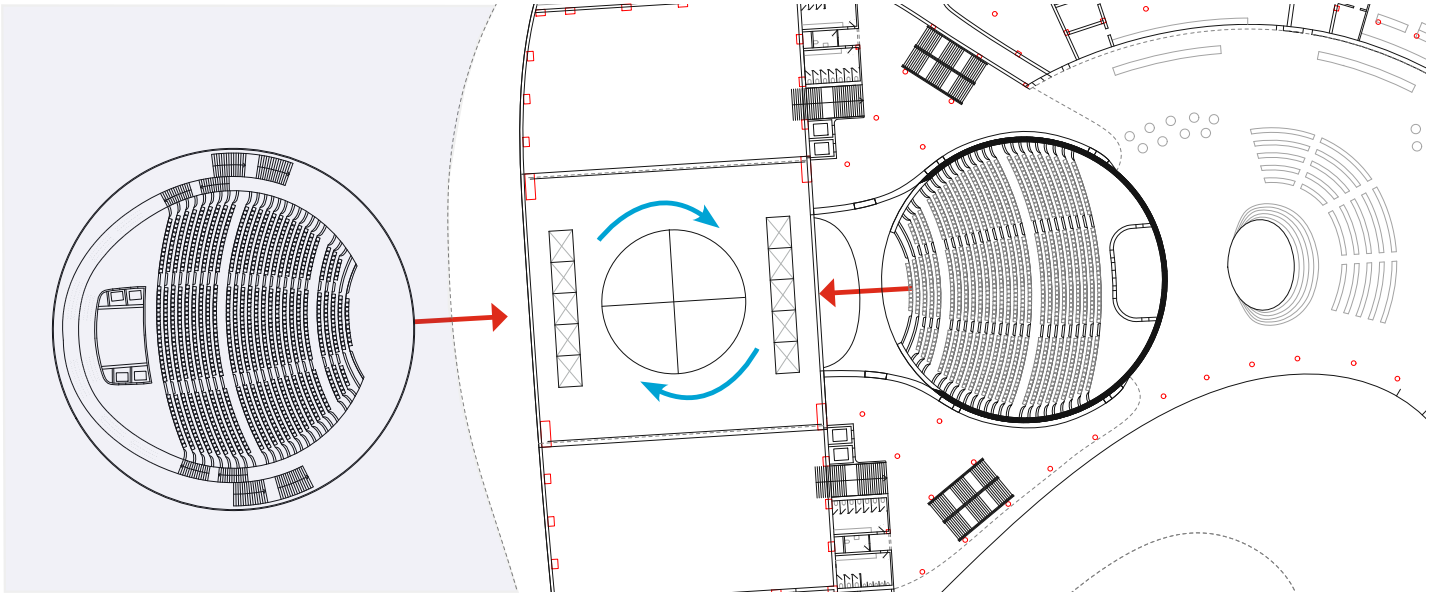


Fig.145 Plan Rotation of the stage

ROTATING AUDITORIUM

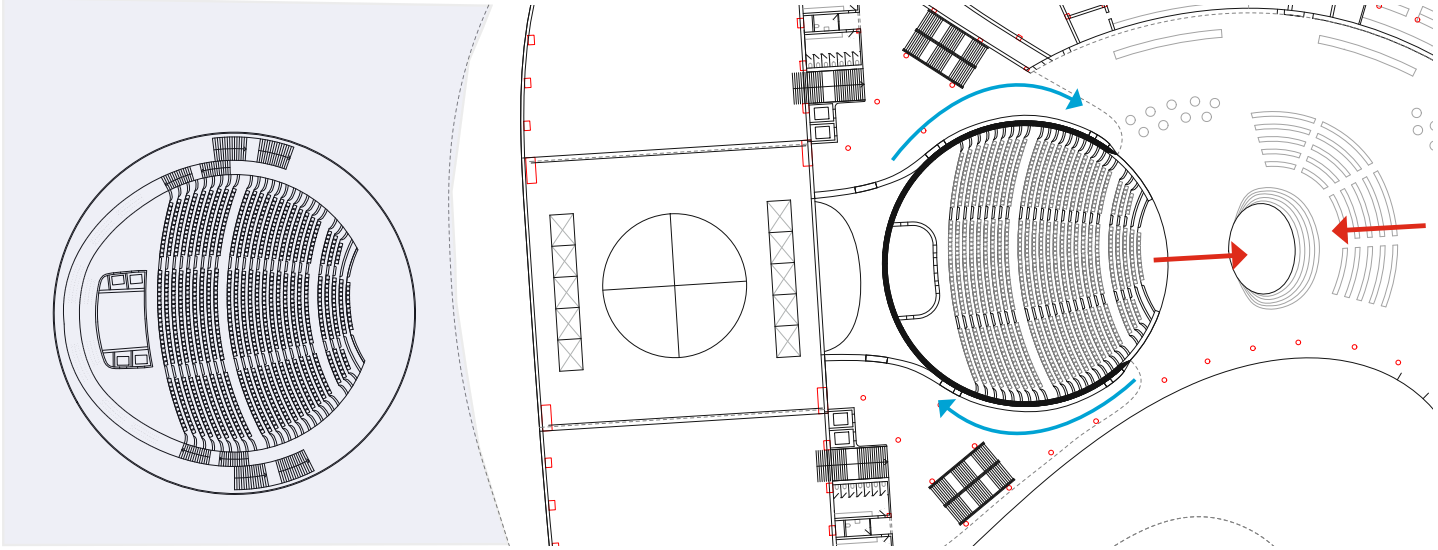


Fig.146 Rotation of inside auditorium

ROTATING LIFTING STAGE SYSTEM

Fig.147 Stage Machinery

Stage information

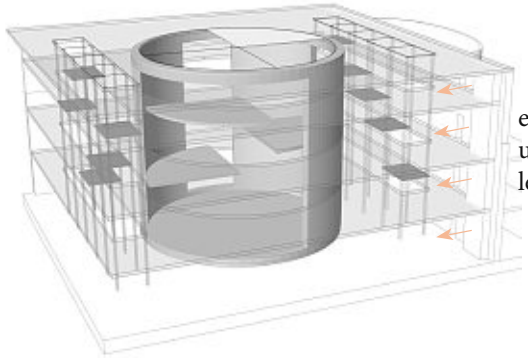
Proscenium opening: 10 meter
Fly tower height: 30 meter
Fly system: automated ranging system
Under-stage machinery deepness:28 meter, accessible from 4 under levels.
Stage wings: 2 on side wings
Orchestra pit located 1 meter below stage level

Fig.148 Stage Machinery, Rotating, lifting platform

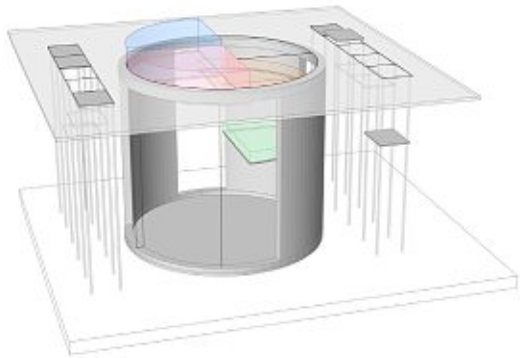
Fig.149 Stage Machinery, side lifts

Fig.150-153 right: Stage Machinery in action

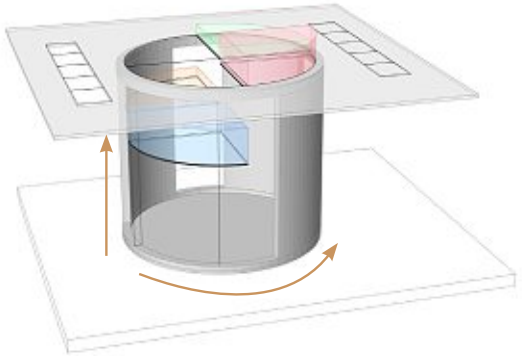
STAGE MACHINERY

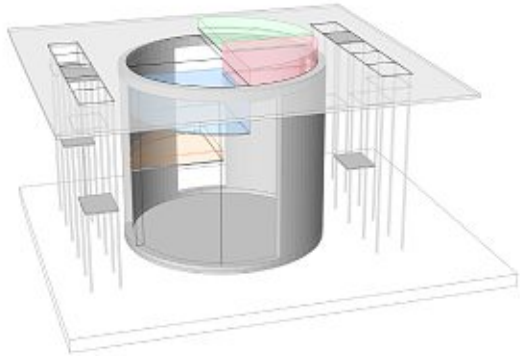


STAGE MACHINERY IN ACTION

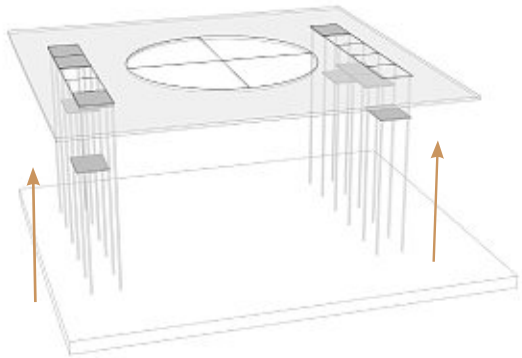


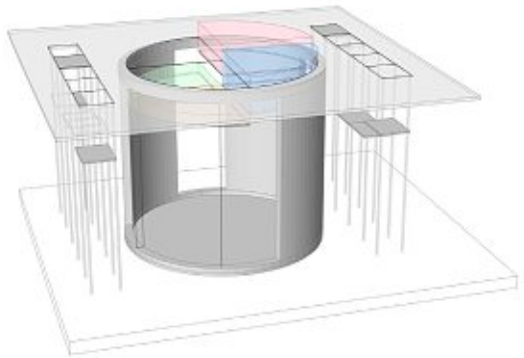
ROTATING LIFTING MAIN SYSTEM



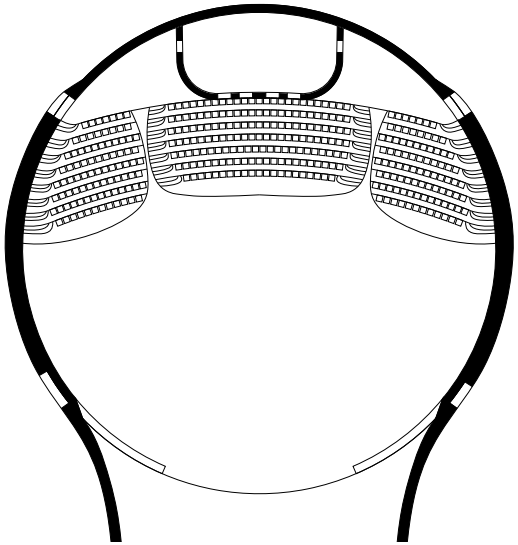


SIDE LIFTS





Auditorium Galleries:
2x330 seating places



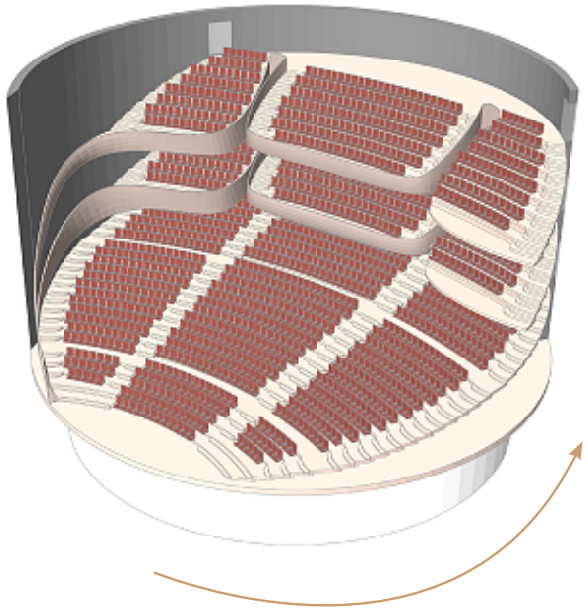
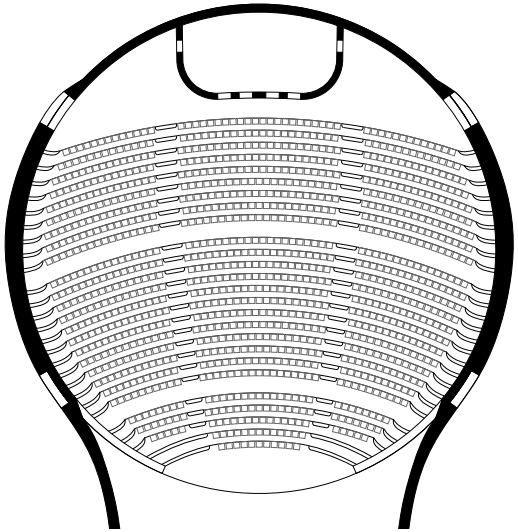


Fig.154 right: Auditorium Galleries

Fig.155 left: Inside auditorium

Both auditoriums - inside and outside have very identical shape and can host up to 1800 spectators.

Auditorium main floor:
11140 seating places



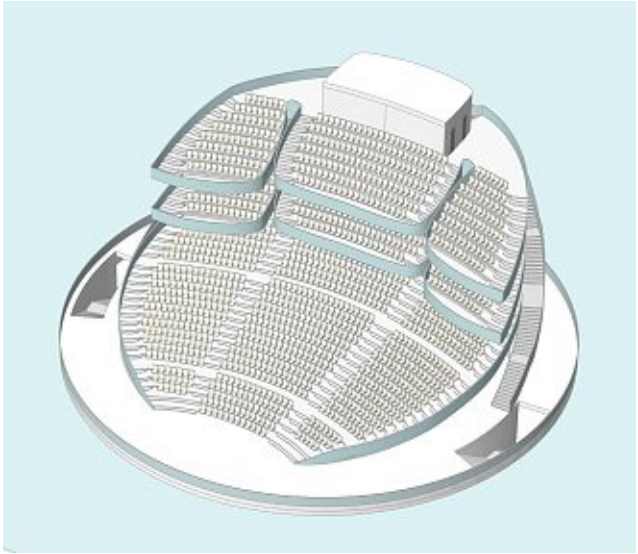


Fig.156 right: Auditorium main floor

Fig.157 left: Outside auditorium

The building is divided into two ways-grid structural system that follows the natural curves of the shape. The distance between the axis varies from 6 to 8 meter. Inside the building three are tree independent structural systems - a column system for the floors, a steel truss system for the stage and a steel truss system for the roof. All three individual systems are following the same structural grid.

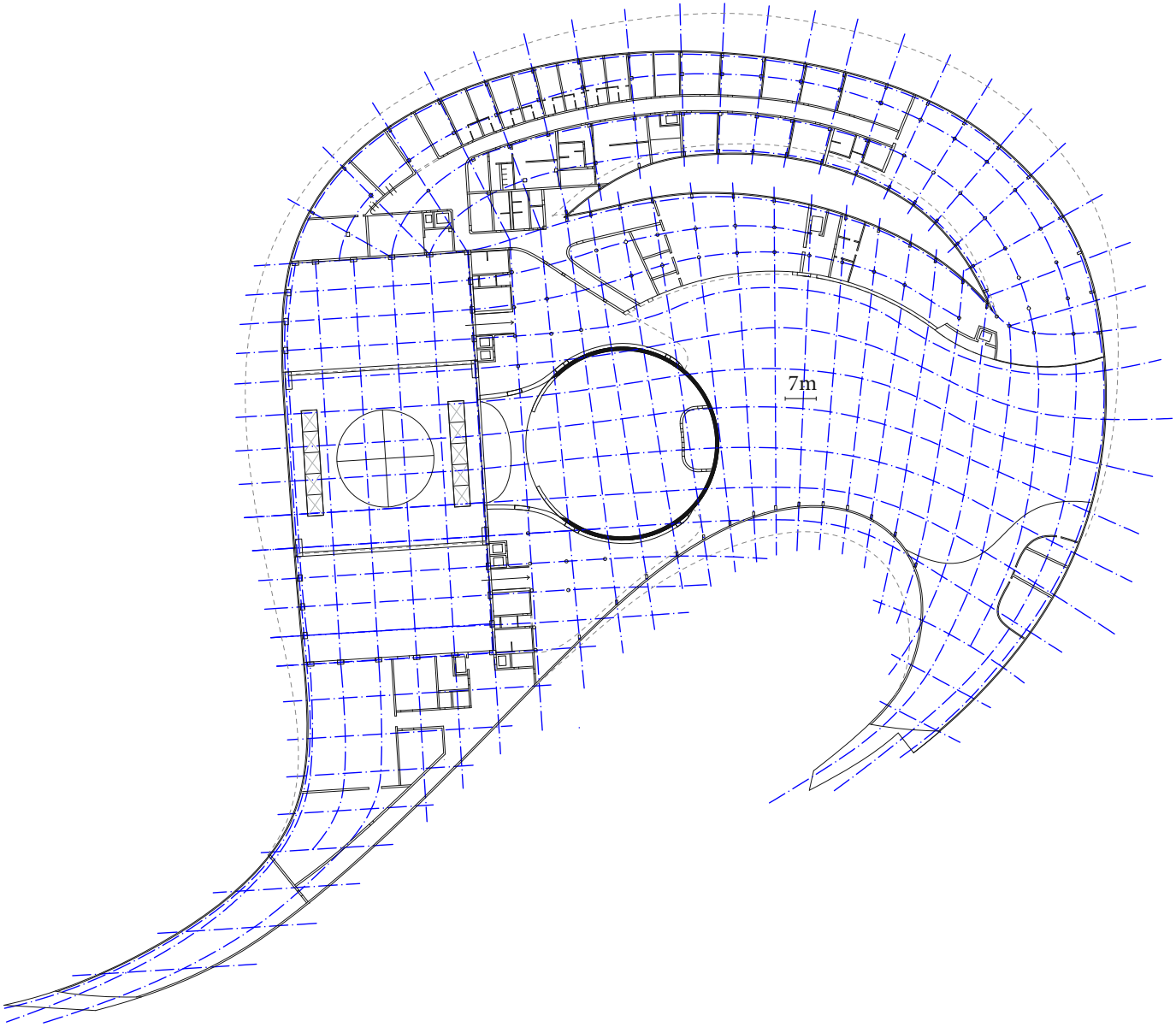


Fig.158: Structural Grid

Column construction of the floor

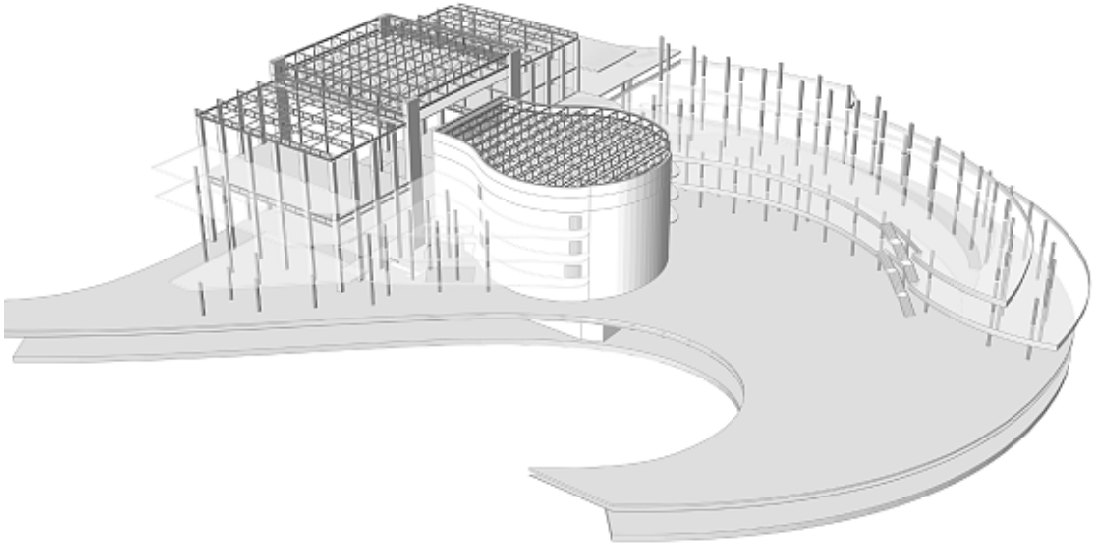


Fig.159: Axonometric view,
column structure of the floor

Stage construction

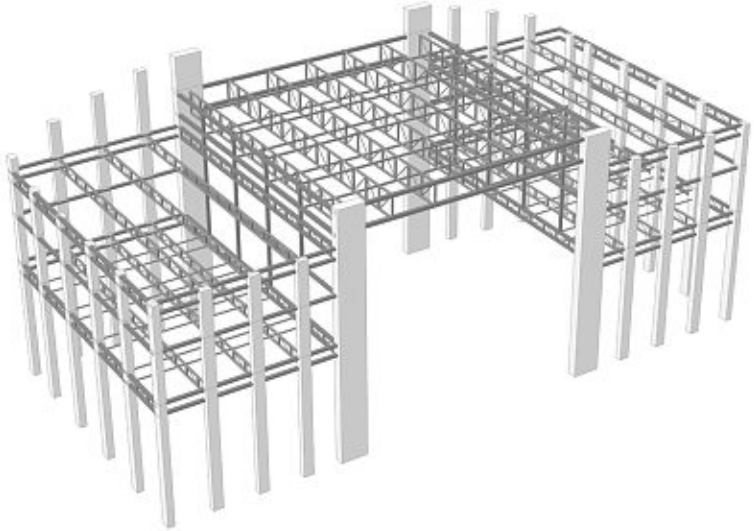


Fig.160: Axonometric view,
Stage truss structure

Roof structural design

Two different concepts have been made in order to find the most efficient and attractive structural system for the roof.

Structural concept 1

This concepts combines Truss-steel-frame elements in the vertical direction following the curved shape of the building roof and continuing along the facade. In the horizontal direction they are supported by additional Truss-Steel beam elements as well as secondary beams. The entire construction reminds a shell structure.

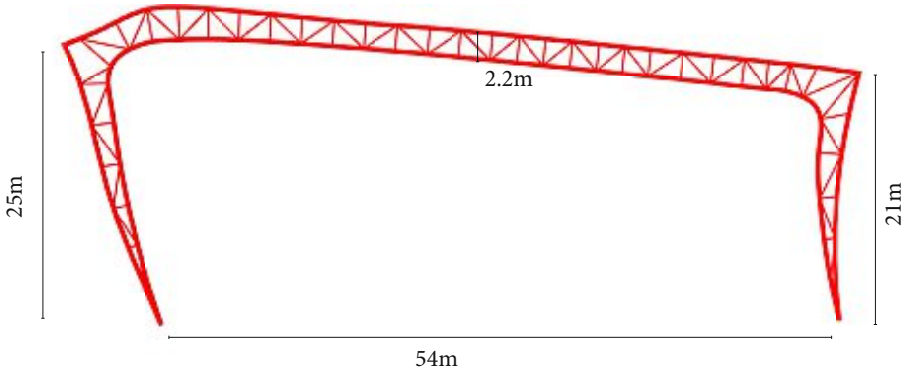
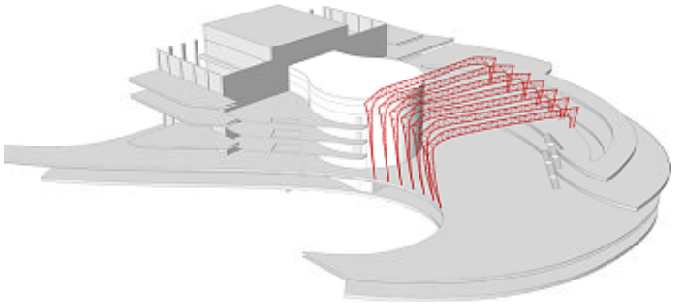
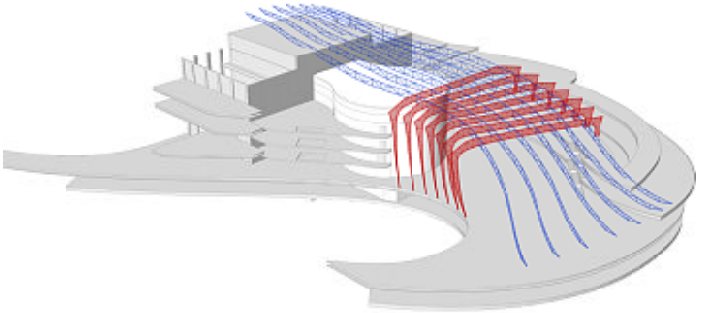


Fig.161: Frame shape

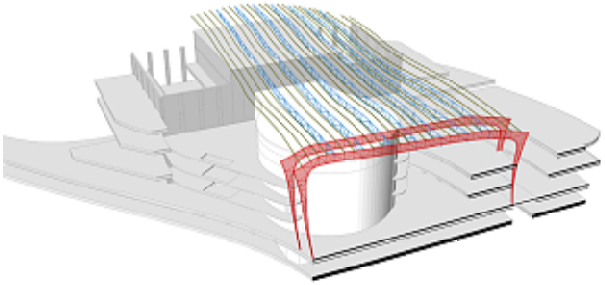
Steel-truss-frames in vertical direction



Steel-truss-beams in horizontal direction



Additional truss steel beams



Whole support structure

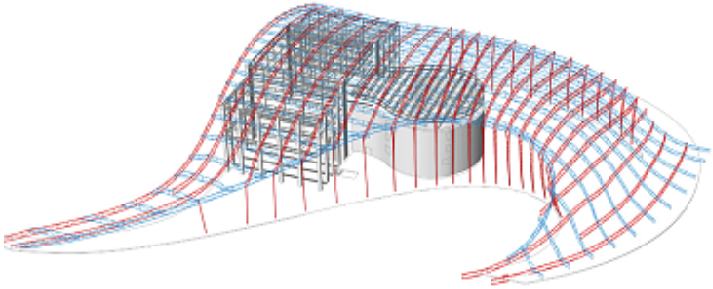


Fig.162-165: Axonometric views, Steel-Truss-Frame Structural elements

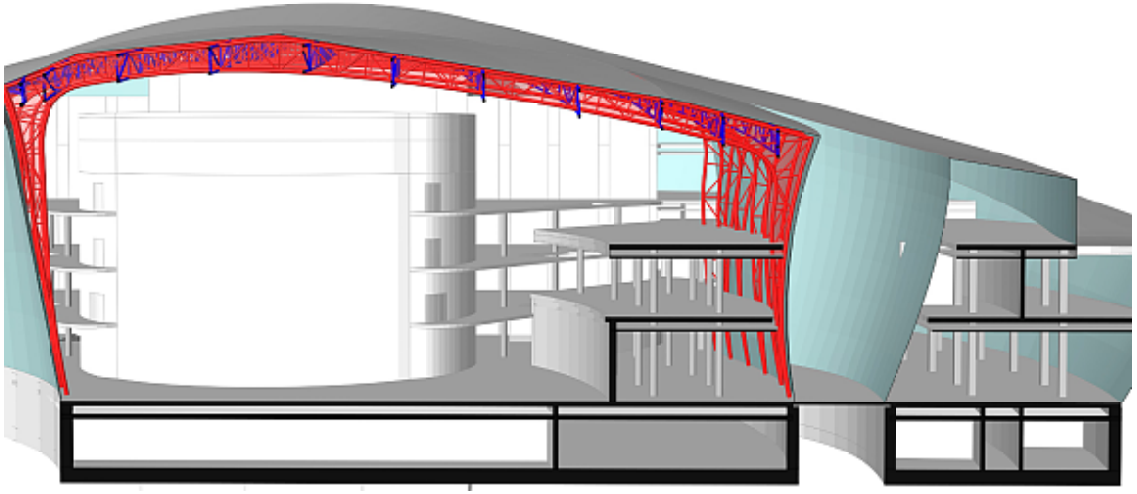


Fig.166: Frame shape, section view

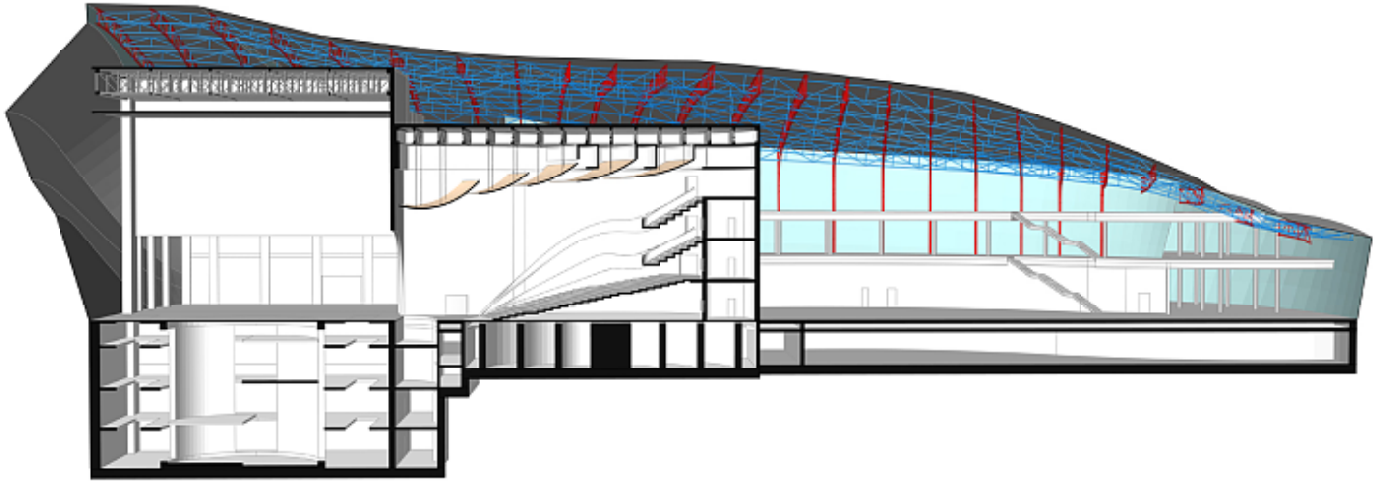


Fig.167: Frame-truss structure, section view

Structural concept 2

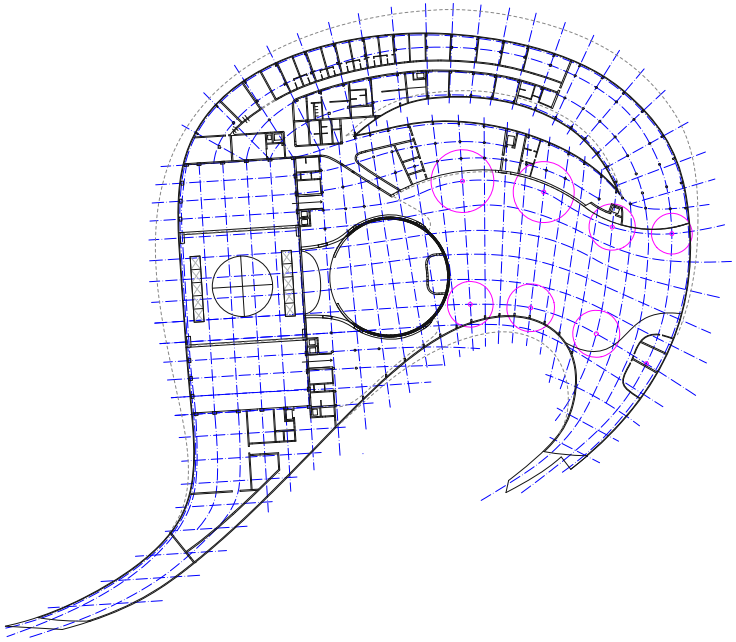


Fig.168: Structural Grid

The second structural idea combines a shell structure with an art of a waffle structure. The construction aims to minimize steel consumption and to enable supporting the whole system in less vertical points. It consists of truss steel elements in both horizontal and vertical directions and additional secondary beams between. In the area with the largest span - the foyer the structure is similar to flat slab. The beams have a thickness of two meter, which increases drastically in a direction to the column. The whole roof in that area is pointed in seven vertical columns with a cross-section steel wrapped in concrete.

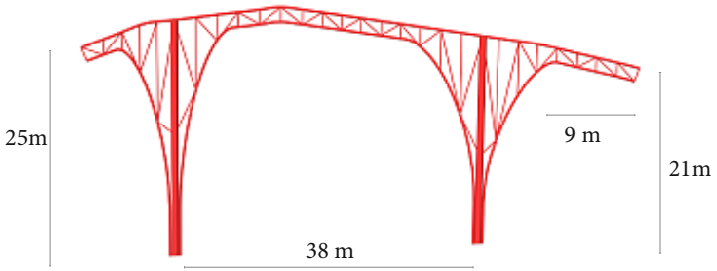


Fig.169 Vertical Truss shape

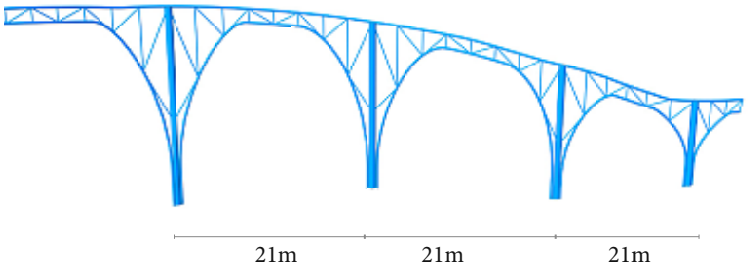
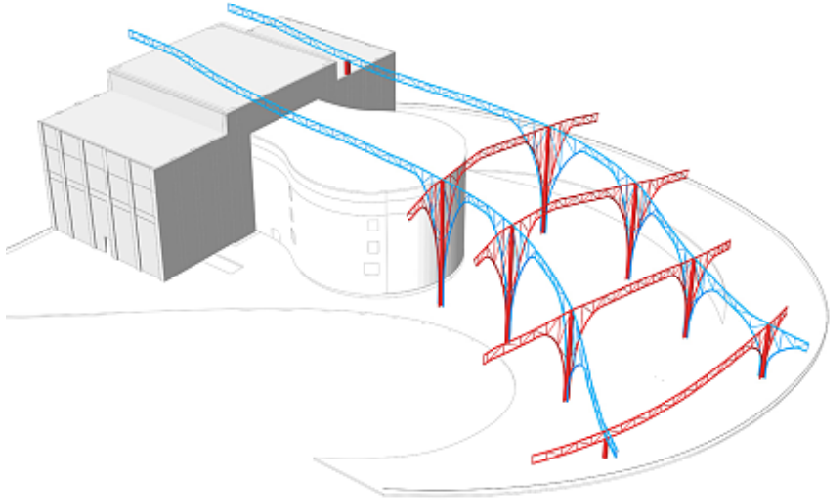


Fig.170: Horizontal Truss shape

Fig.171: Truss-shape both directions



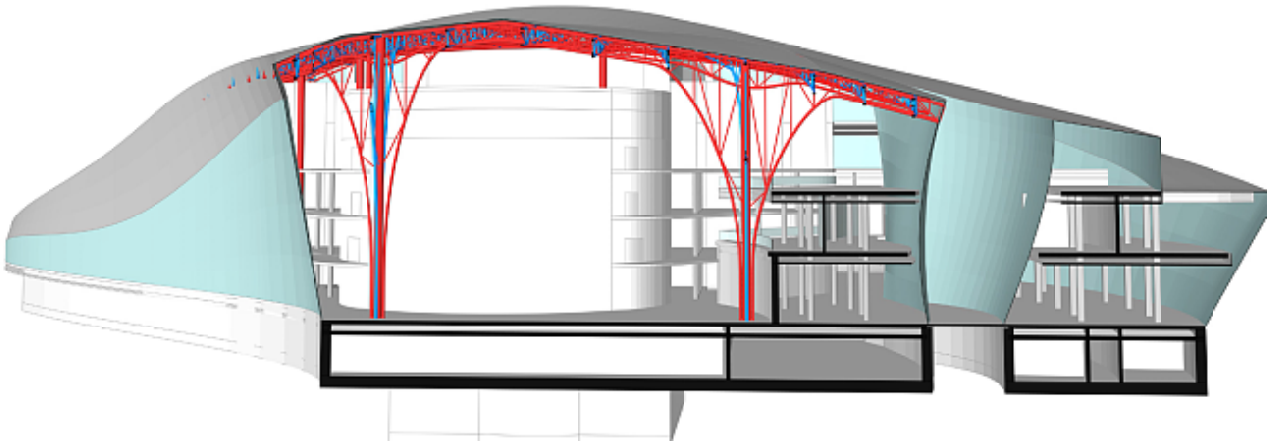


Fig.172: Structural Section

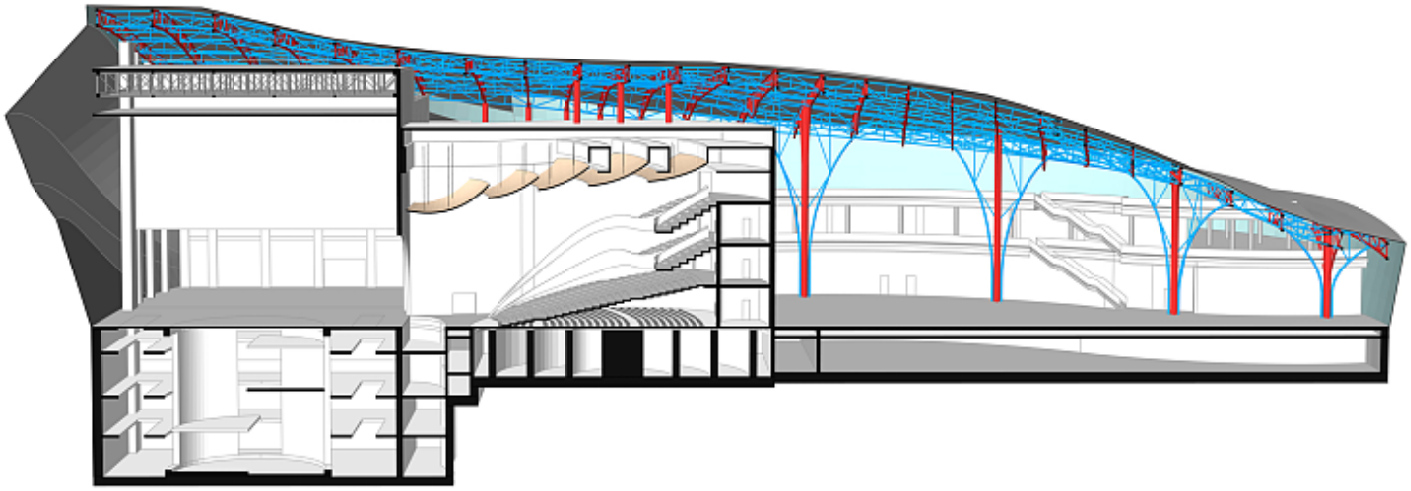


Fig.173: Structural Section

Main support construction

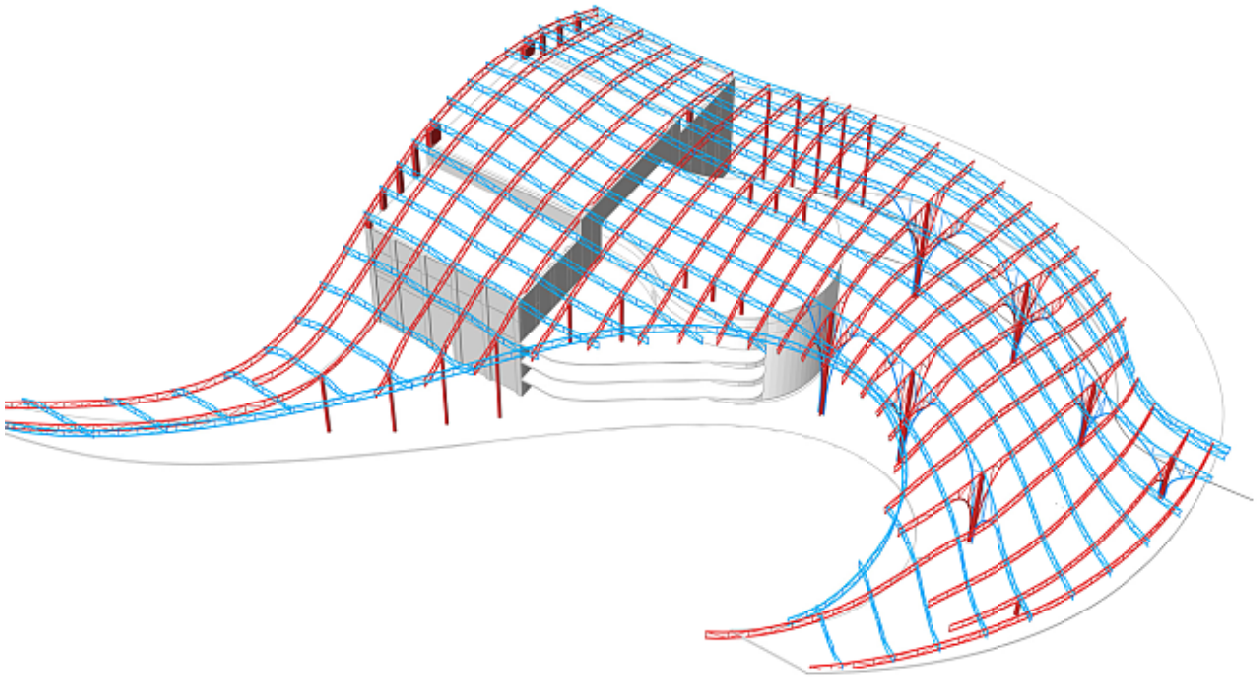


Fig.174: Main structural elements

whole support structure including the secondary beams

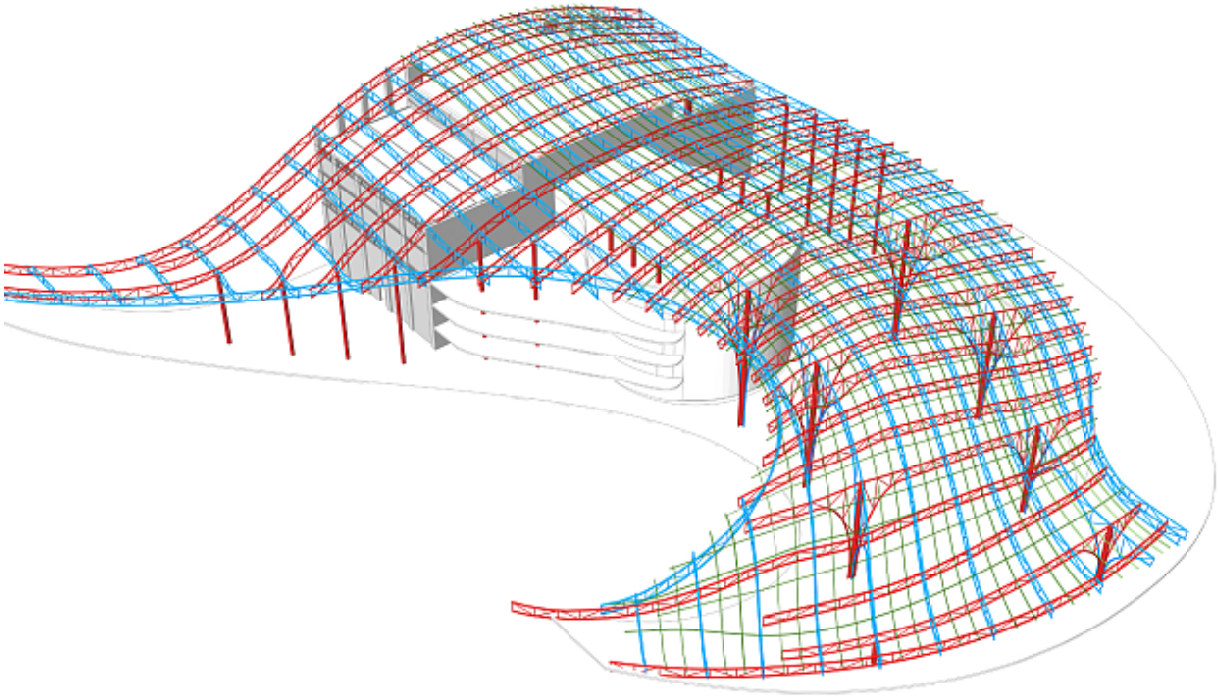
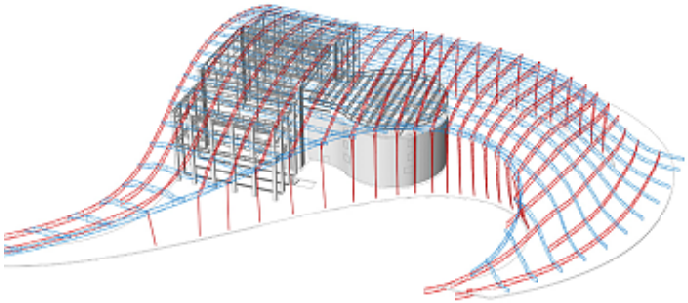


Fig.175: Support elements

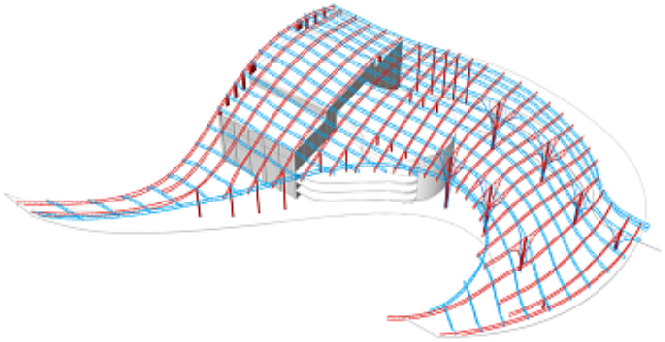
Structural concept 1

steel-frames



Structural concept 2

Cross-section steel columns



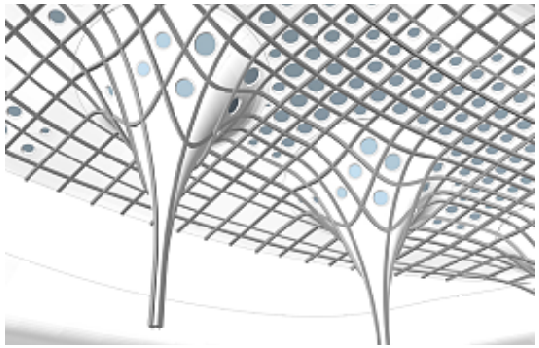


Fig.176: Covering panels

Due to the consumption of less steel vertical elements and the more unique design shape the second structural design idea has been chosen for further development of the building. This design idea has been inspired by the structural design of the airport in Mumbai, planned by SOM architects and engineering group. In order to adjust the structure not only to the required-supporting purpose, but also to the aesthetic design of the building, the structural curves-outlines remain partly visible in the whole foyer areas`roof. Those curves follow the natural curves of shape of the building, bringing some extraordinary atmosphere into the entrance hall. The rest of the structure has been covered with fibre reinforced concrete panels in the ceiling and steel panels on the roof. Both type of panels have multiple elements with in build glass opening, which allow natural light to come inside . The opening have a round shape and their diameter varies according to their location

5. Paneling and Facade

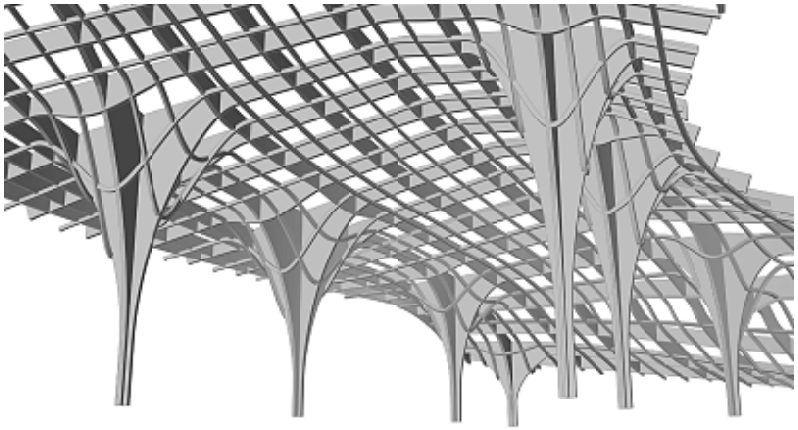


Fig.177: Structural shape

STRUCTURAL DESIGN BODY (TRUSSES)-UNCOVERED

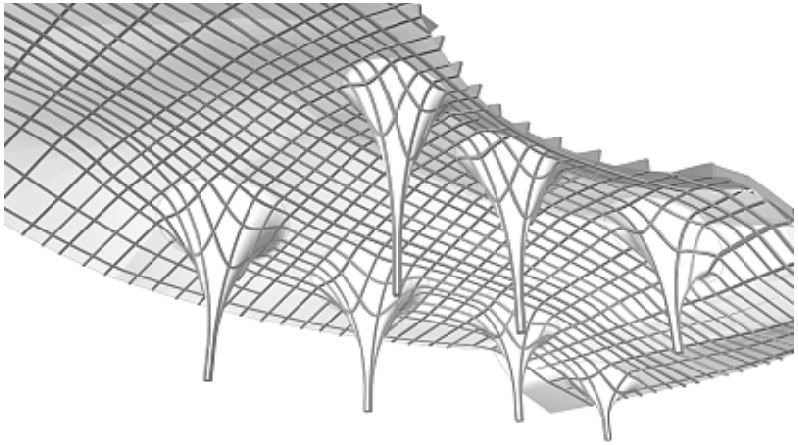


Fig.178: Structural shape covered by panels

STRUCTURAL DESIGN OUTLINE-CURVES AND PANELING COVERAGE

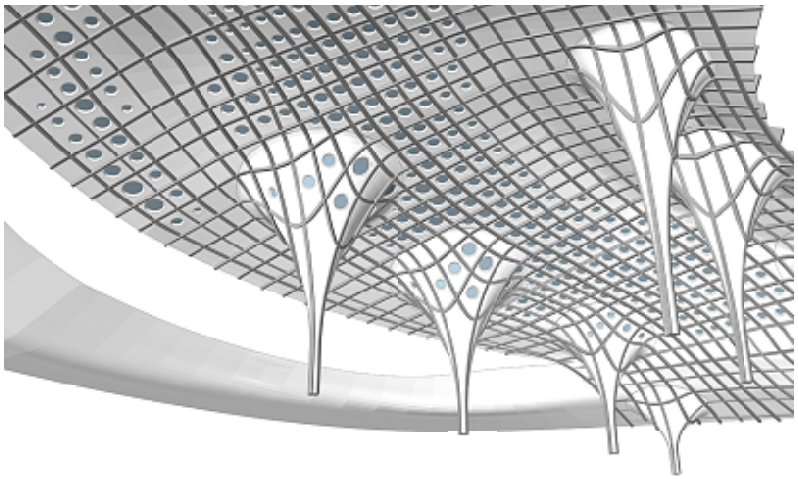


Fig.179: Day-light openings in the panels

FIBRE REINFORCED CONCRETE PANELS WITH GLASS-OPENING FOR NATURAL LIGHT

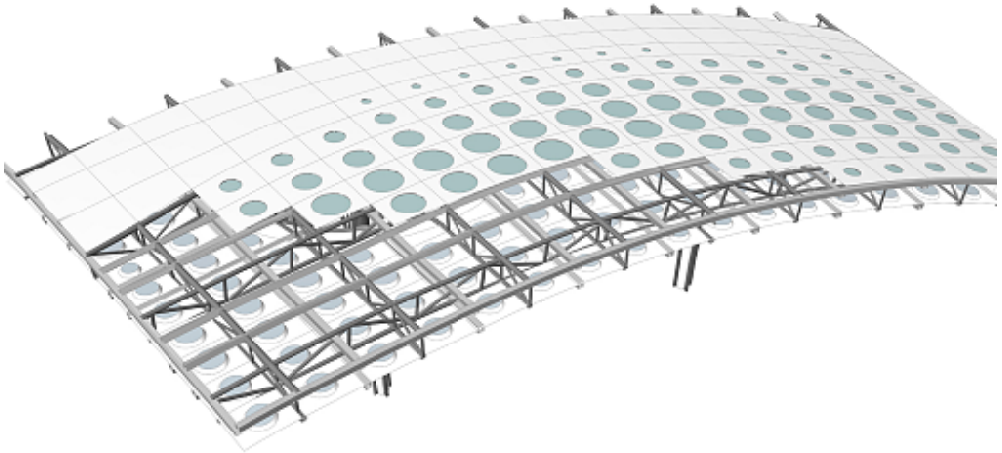


Fig.180: Double skin facade, Structural scheme

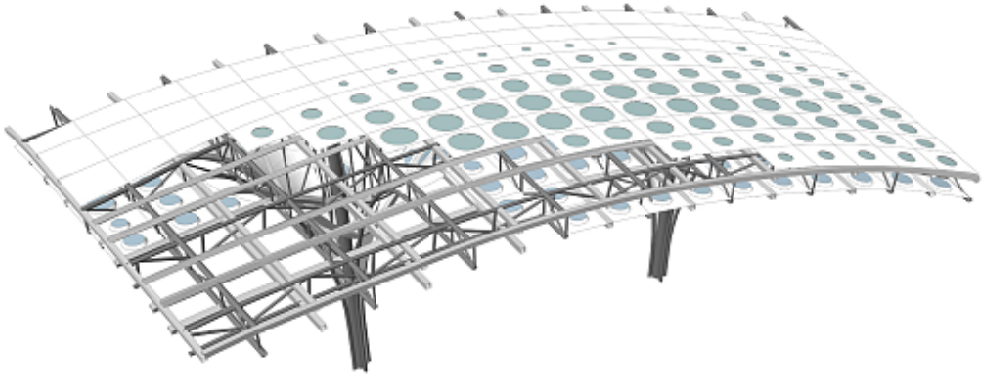


Fig.181: Double skin facade, Structural scheme

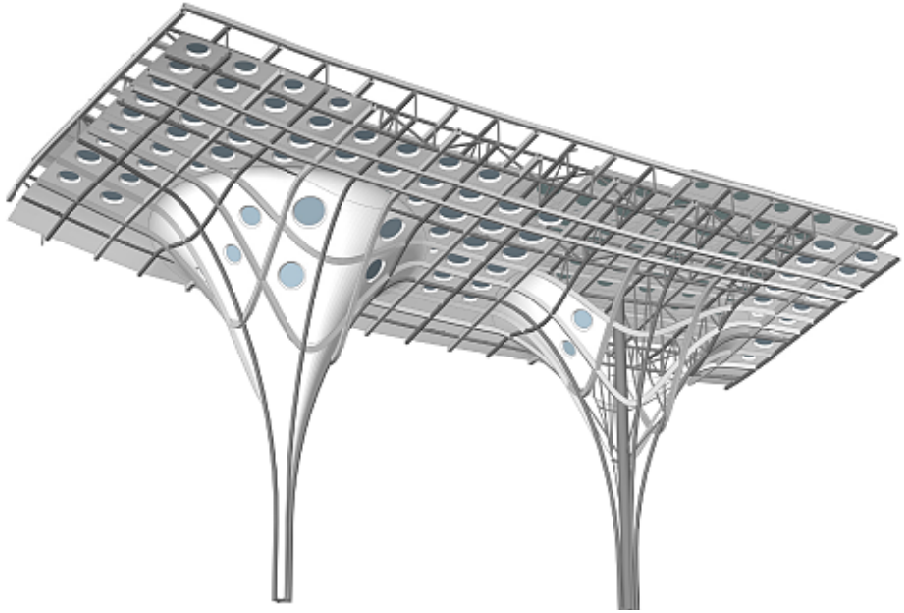
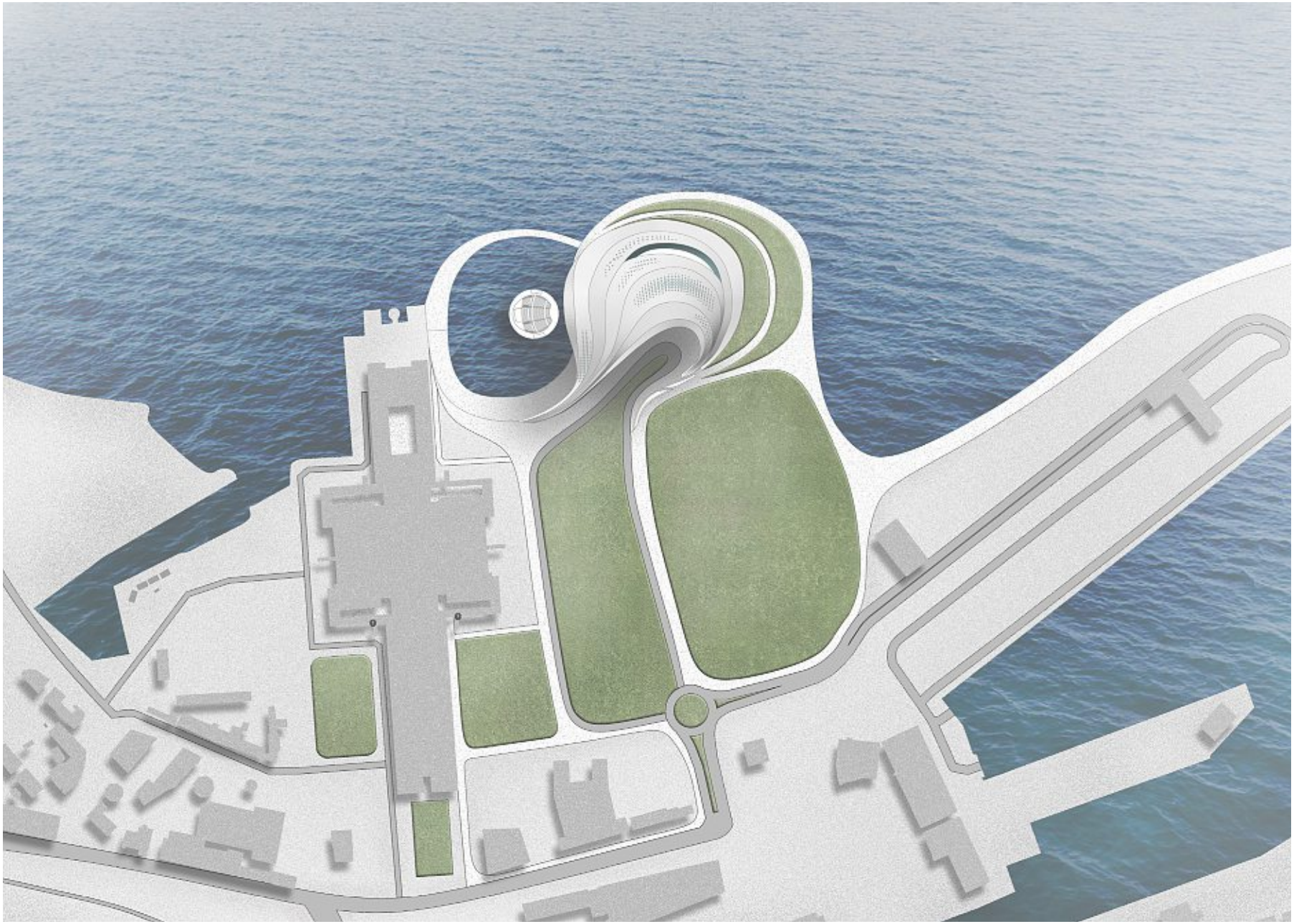


Fig.182: Double skin facade, Structural scheme

VI. RESULTS

Plan 6: Schwarzplan

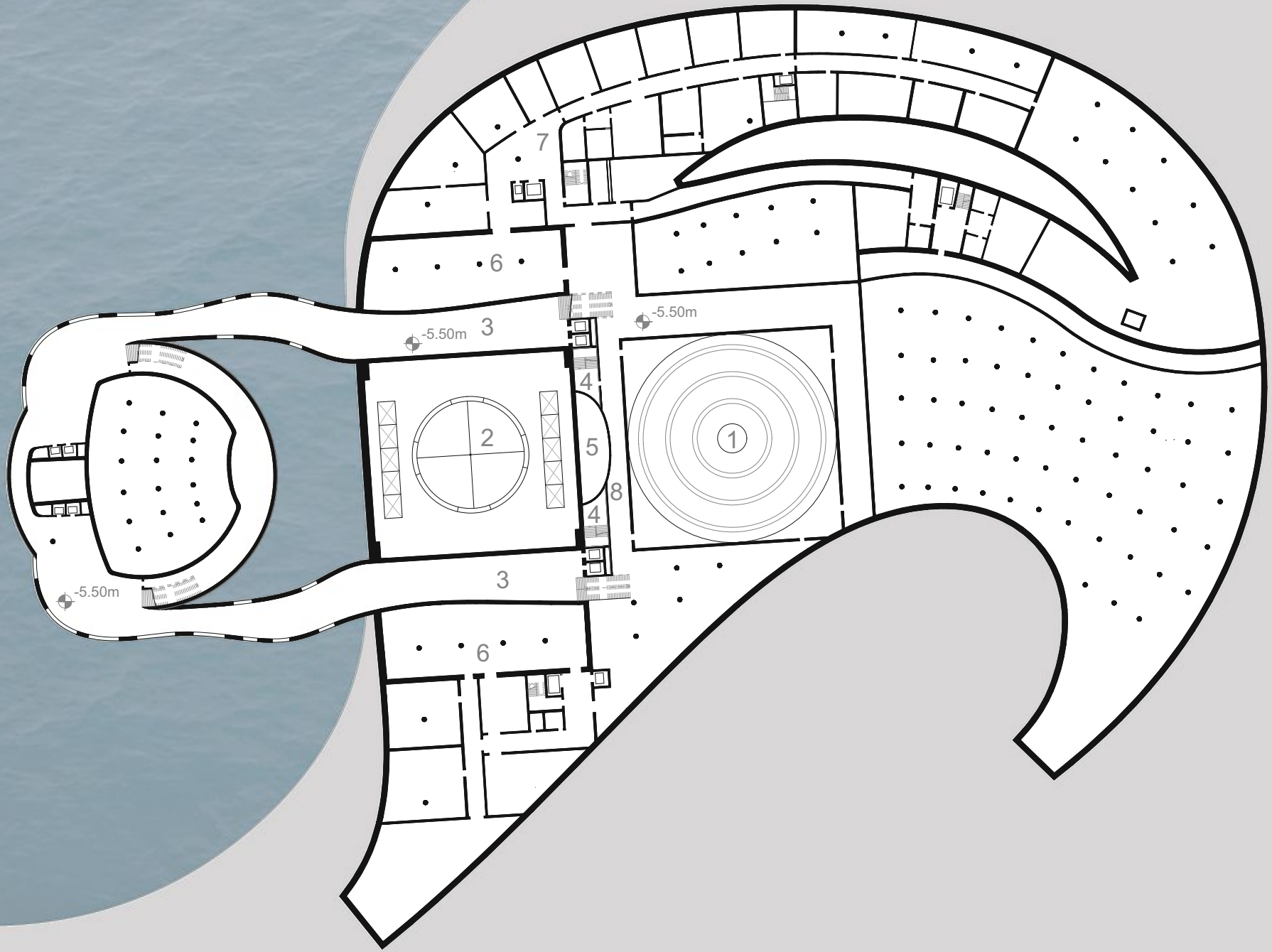


Plan 7: Site plan

20 100

Plan.8: Underground floor plan

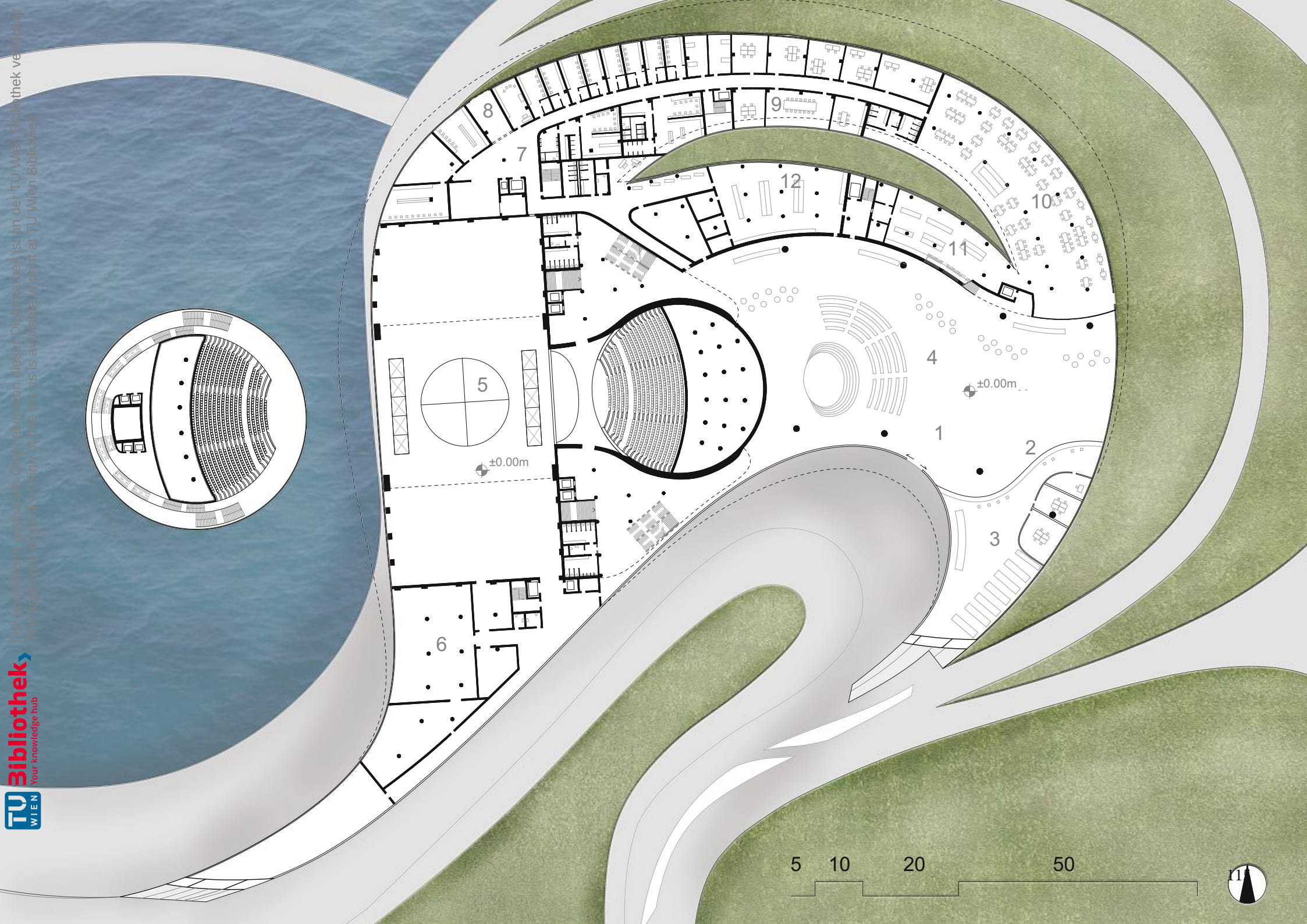
1. Rotating platform machinery
2. Rotating lifting stage machinery
3. Connections to outside auditorium
4. Connections to under-levels machinery
5. Orchestra pit
6. Technical rooms
7. Storages
8. Connection between stage wings



5 10 20 50

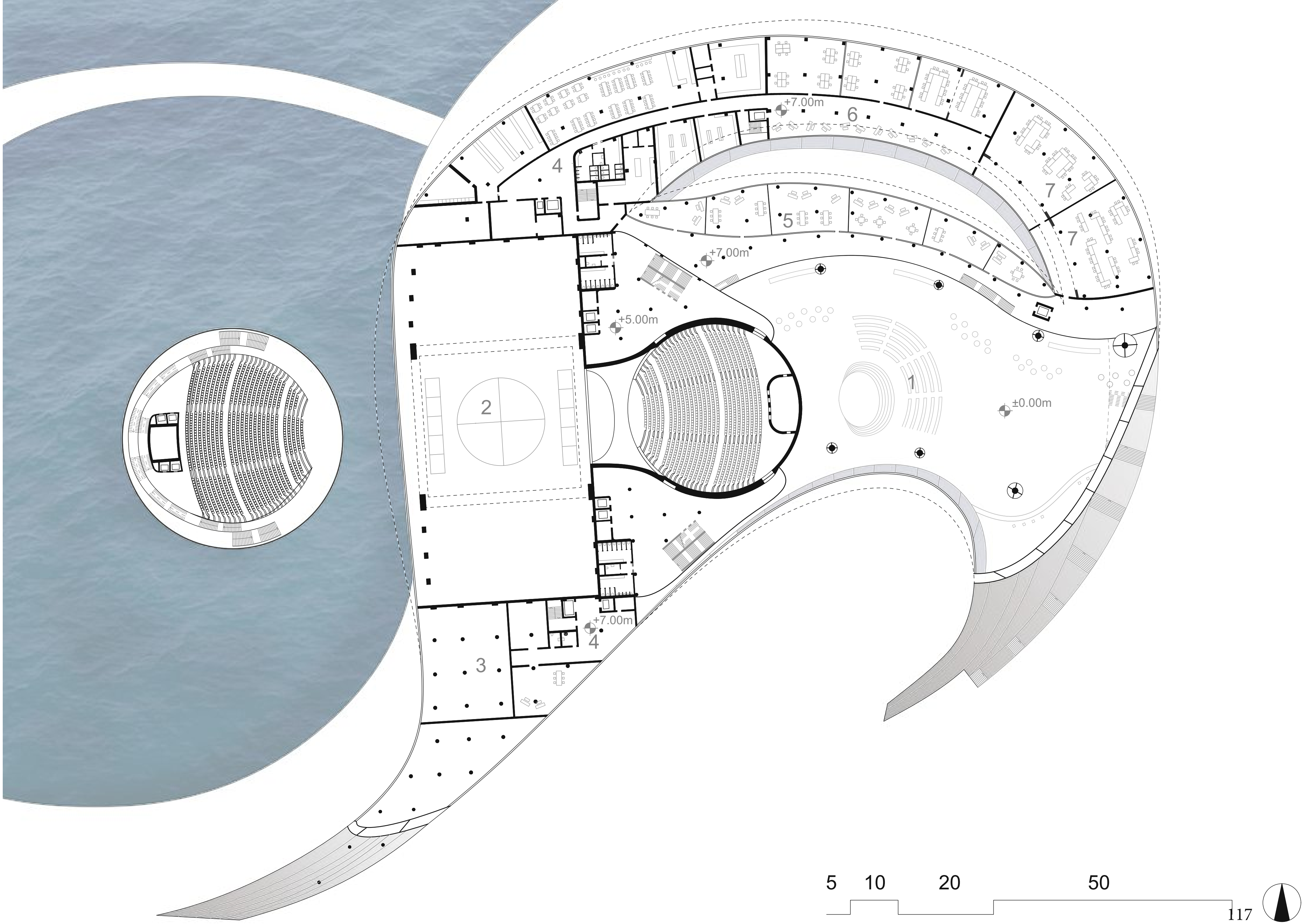
Plan.9: Ground floor plan

1. Entrance
2. Tickets
3. Box Office
4. Foyer
5. Stage
6. Scenery assembly
7. Backstage
8. Staff entrance and deliveries
9. Offices
10. Restaurant
11. Restaurant Kitchen
12. Catering Kitchen



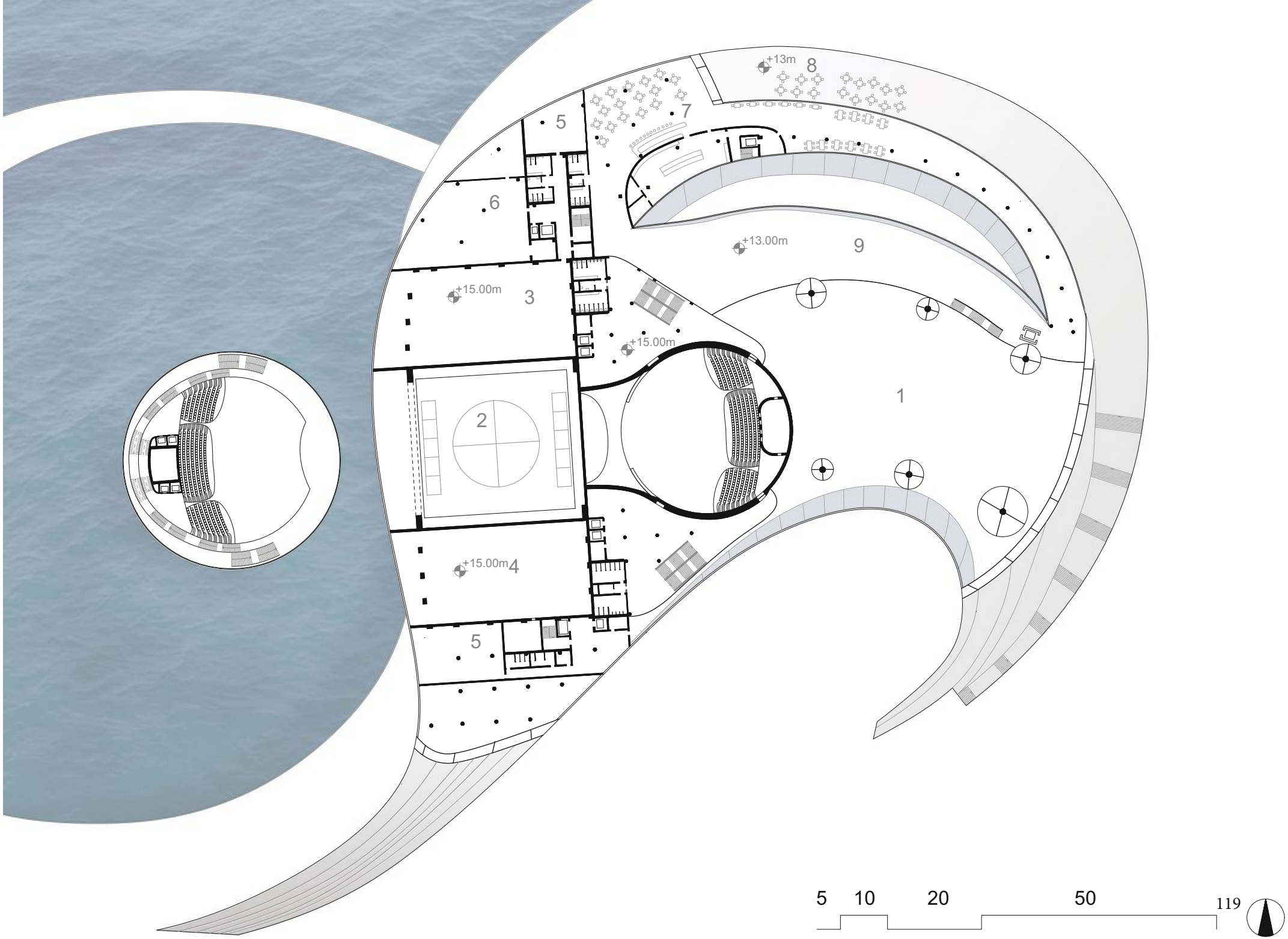
Plan.10: Level +7. Floor Plan

1. Void above foyer
2. Void above stage
3. Void above scenery assembly
4. Backstage
5. VIP Lounges
6. Offices
7. Education suits



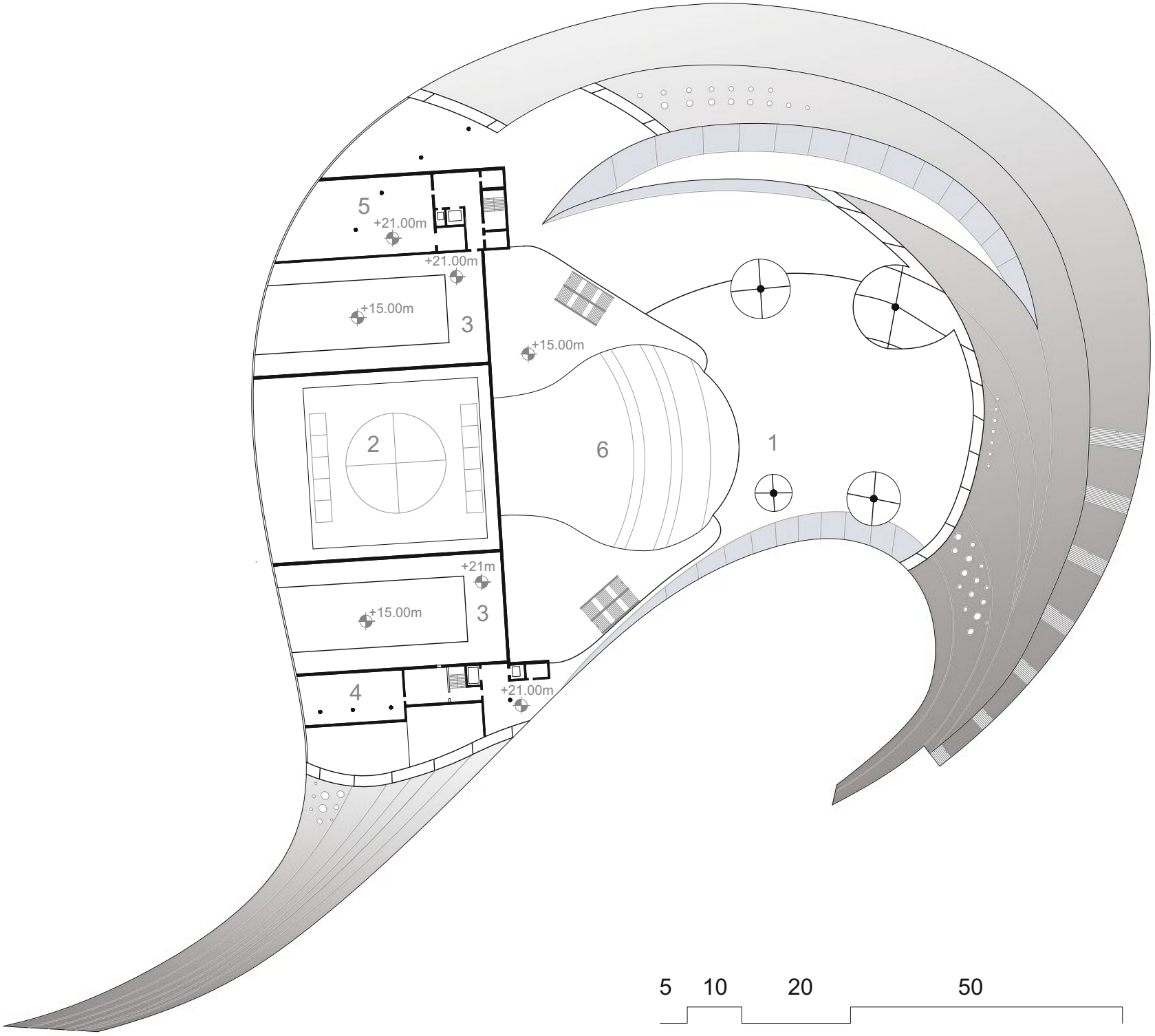
Plan.11 Level +15, Floor plan

1. Void above foyer
2. Void above stage
3. Operatic rehearsal
4. Ballet rehearsal
5.Practice rooms
6. Recording studio
7. Cafe
8.Terrace

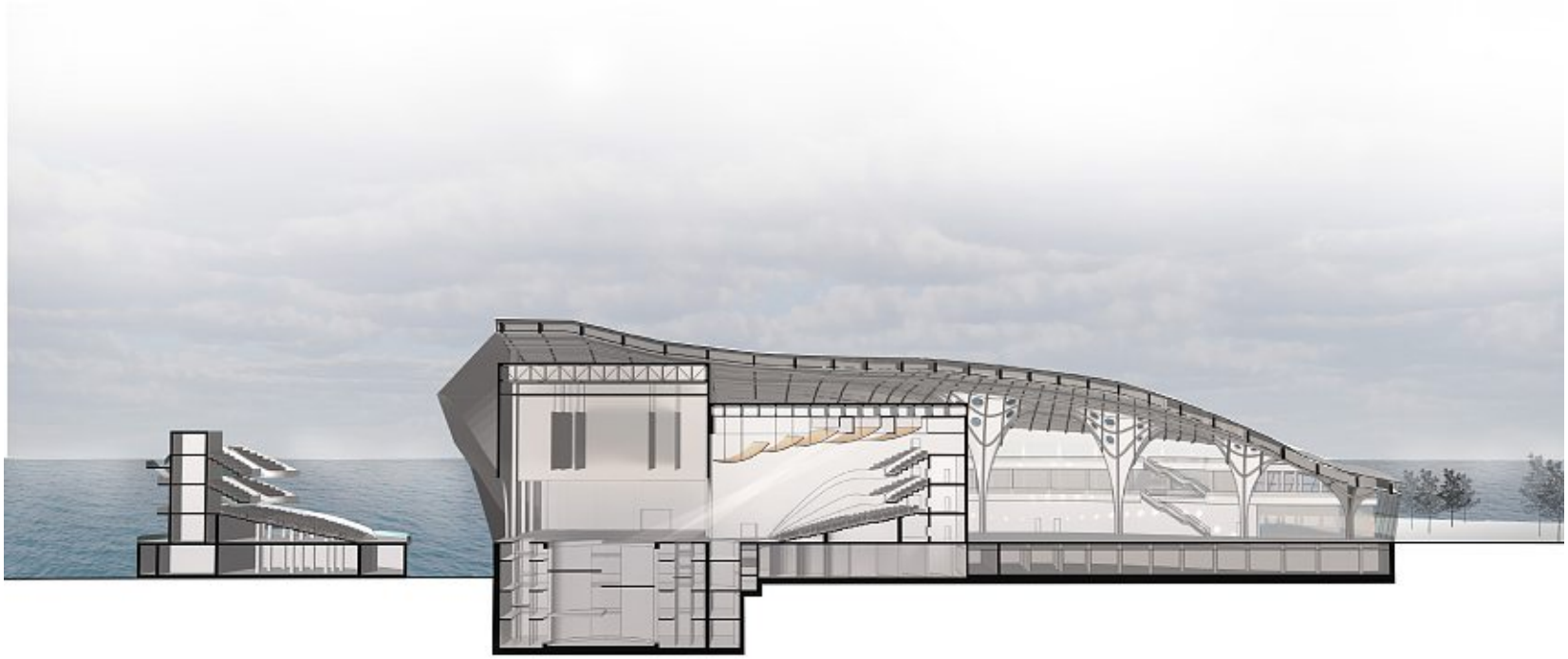


Plan.12 Level +21, Floor plan

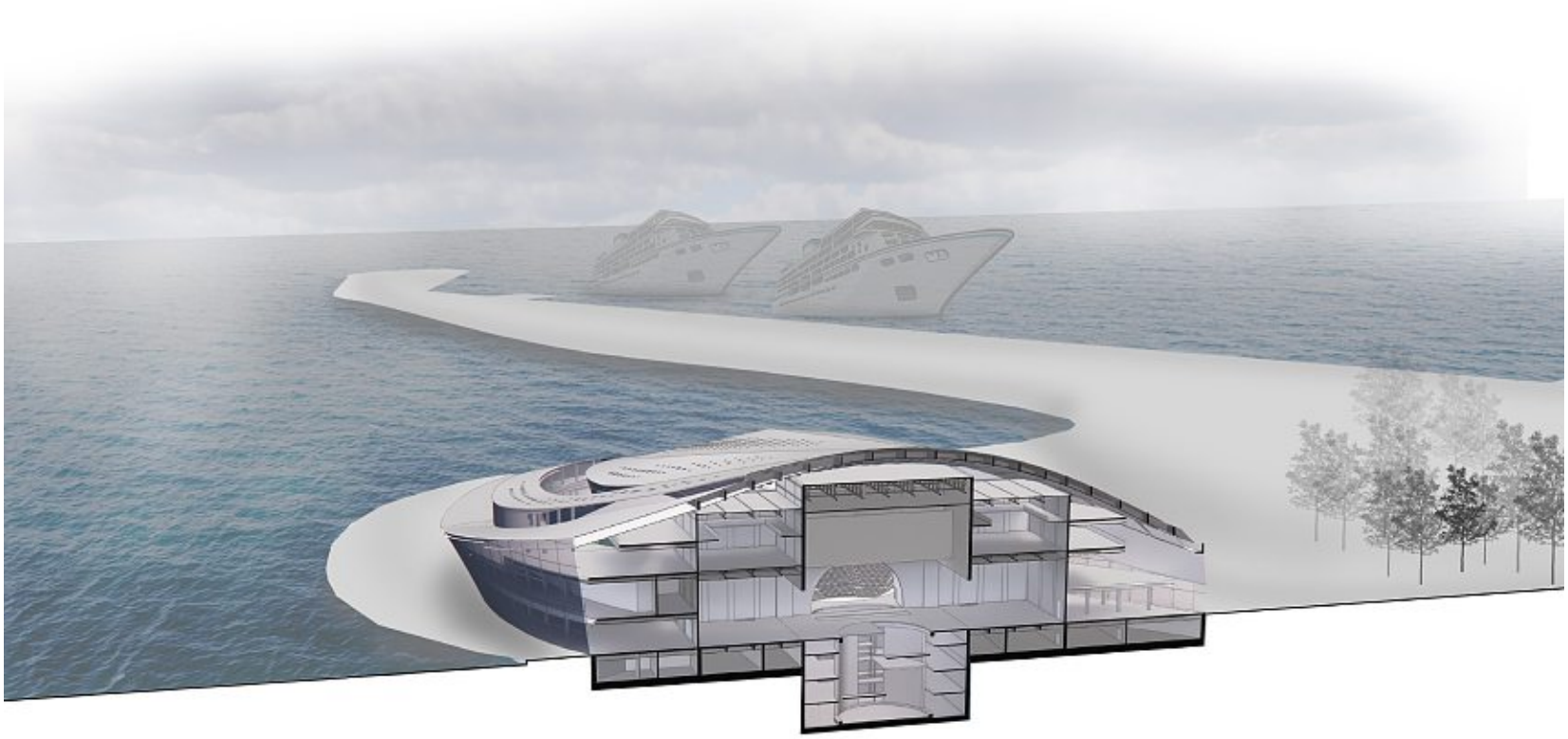
1. Void above foyer
2. Void above stage
3. Rehearsal galleries
4. Practice room
5. Orchestra rehearsal
6. Void above auditorium



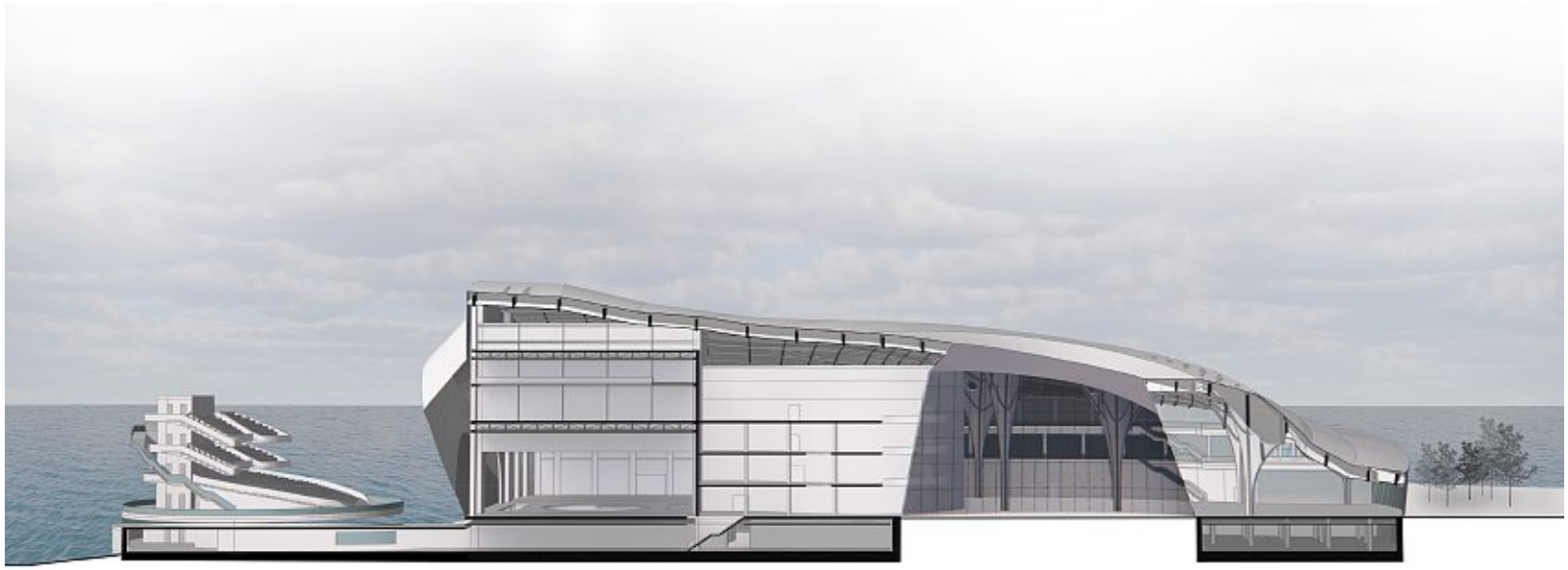
2. Sections



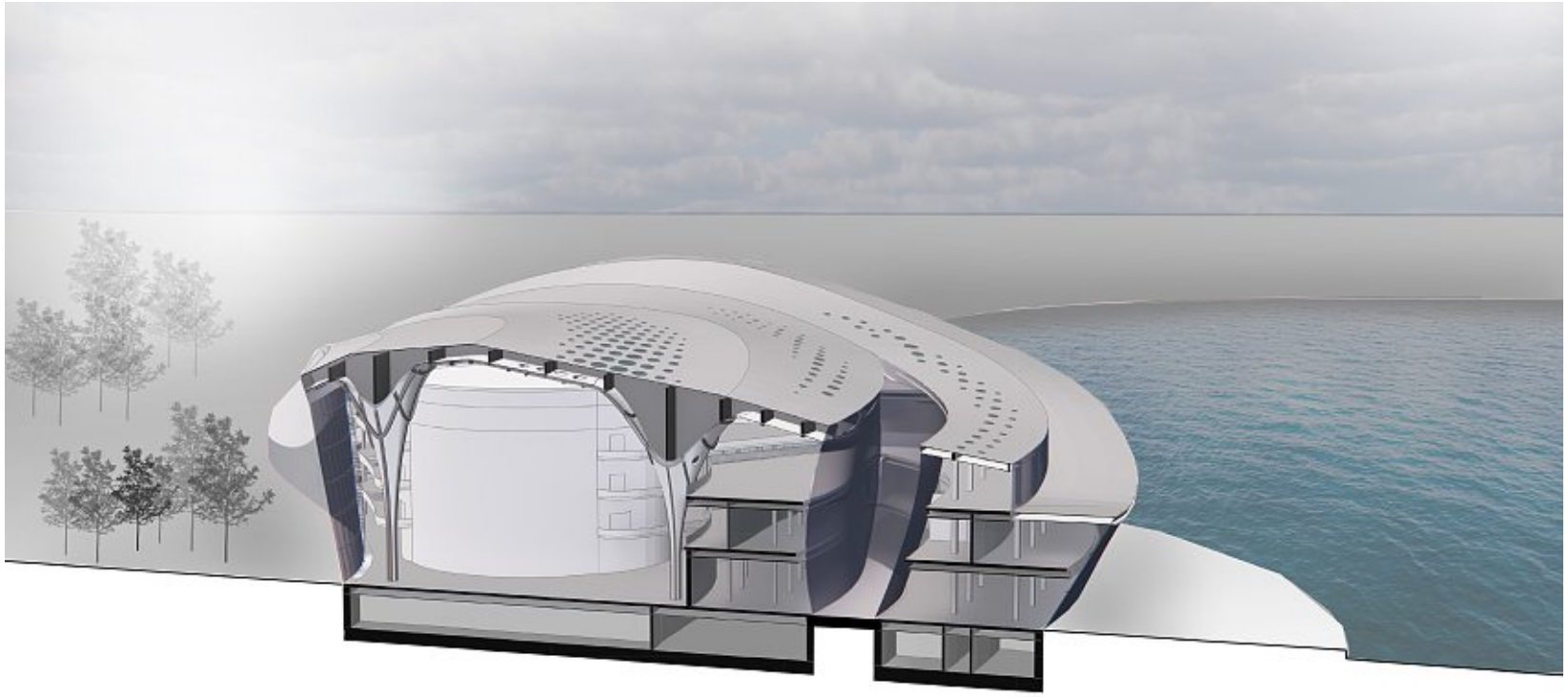
Plan.13 Section through the stage



Plan.14 Section through the stage

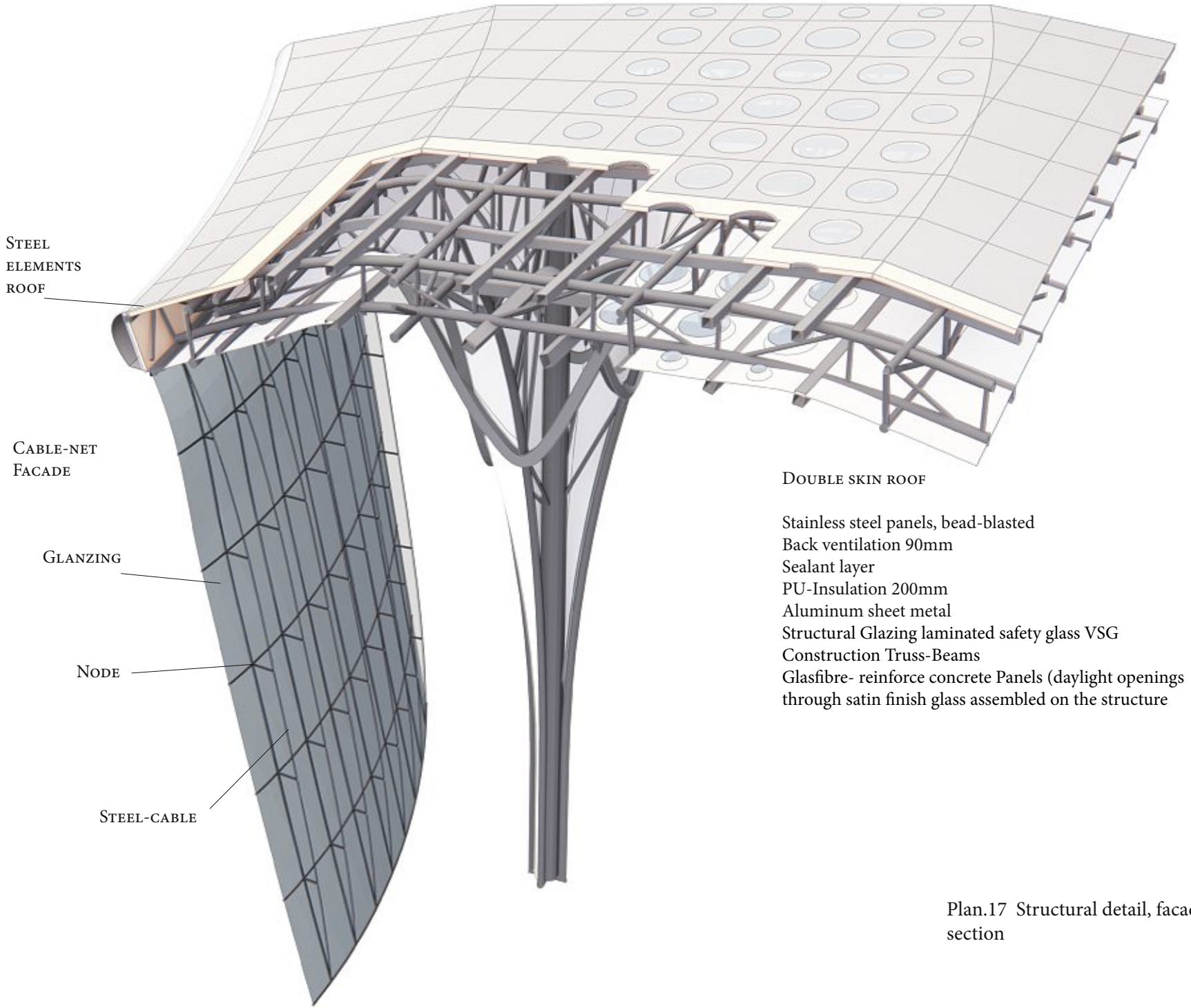


Plan.15 Section through the underground connections



Plan.16 Section through the foyer

3. Structural detail - facade section



Double skin roof

Stainless steel panels, bead-blasted
Back ventilation 90mm
Sealant layer
PU-Insulation 200mm
Aluminum sheet metal
Structural Glazing laminated safety glass VSG
Construction Truss-Beams
Glasfibre- reinforce concrete Panels (daylight openings through satin finish glass assembled on the structure

Plan.17 Structural detail, facade section

4. Renderings

Fig.180 Render, view from above

Fig.181 Render, view from the sea

Fig.182 Render, view from the port

Fig.183 Render, Foyer

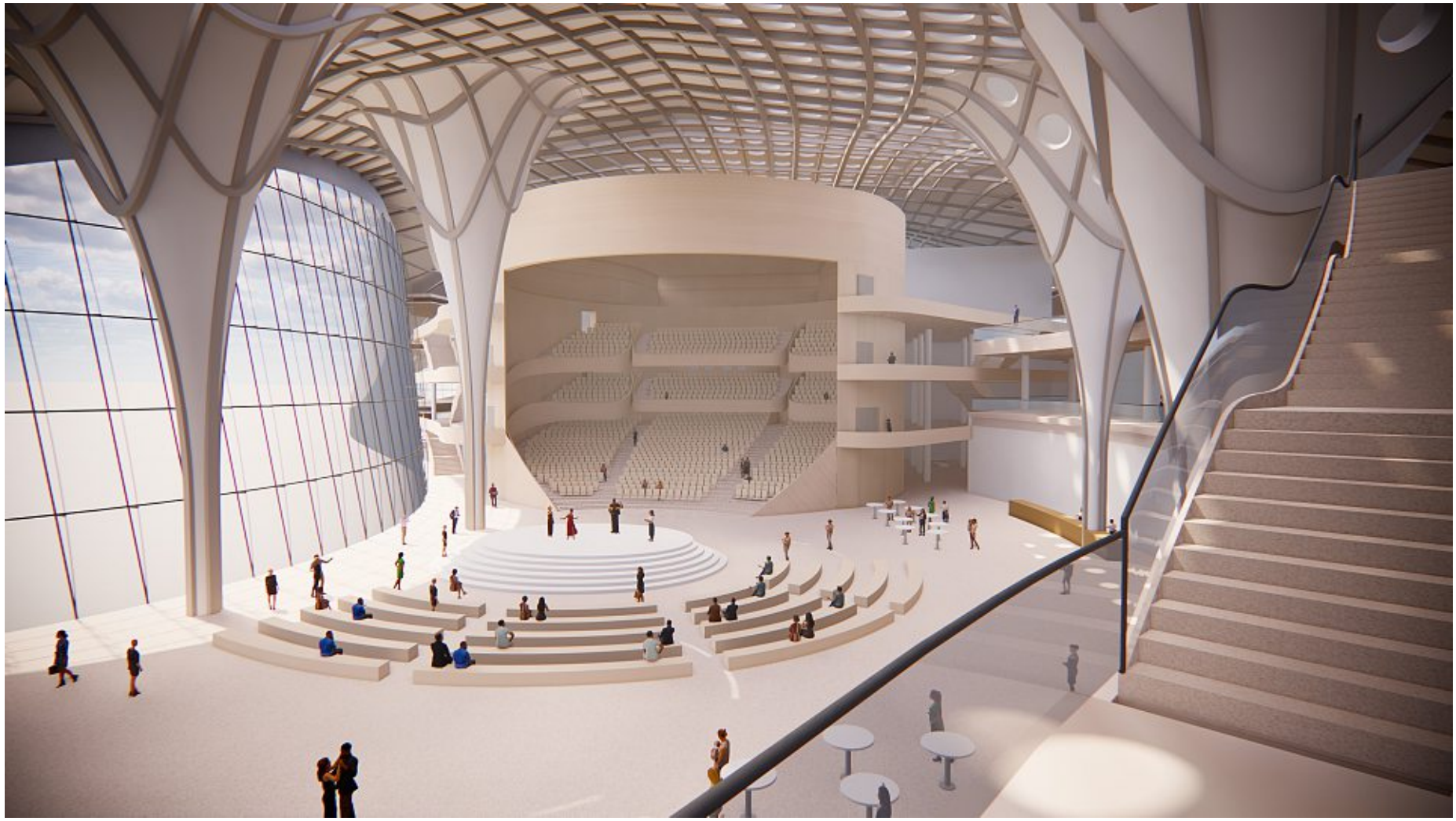


Fig.184 Render, View from the upper floor-gallery

Fig.185 Render, Foyer event

Fig.186 Foyer ceiling column

VIII. Conclusion

The opera house finds its aesthetic expression in a form similar to an aquatic animal which follows the natural landscape of the site. It enables multiple visual axes from the building to the sea and gives visitors exciting spatial experience. The real implementation of these architectural ideas follows through a truss shell structure consisting of steel material which is combined with a waffle slab system.
Main focus of the project is the stage configuration which can be utilized for opera performances, as well as for cultural public discussions based on its rotational principle. It can constantly change and provide with flexibility for various purposes. What is more the indoor large stage can serve also the open-air auditorium which creates the opportunity for outdoor performances during the warmer months. Thus the opera house becomes a place for dynamic experiences which contributes to the cultural value of the opera typology.

IX. Directories

1. Figure directory

2. Literature directory

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3. Plan directory

Plan.1: Site plan, submitted for the competition Opera by the sea, Emiliya Marinova, 20.10.2020

Plan.2: Ground floor plan, submitted for the competition Opera by the sea, Emiliya Marinova, 20.10.2020

Plan.3: Section through the stage, submitted for the competition Opera by the sea, Emiliya Marinova, 20.10.2020

Plan.4: Upper floor plan, submitted for the competition Opera by the sea, Emiliya Marinova, 20.10.2020

Plan.5: Section through the foyer, submitted for the competition Opera by the sea, Emiliya Marinova, 20.10.2020

Plan.6: Schwarzplan, Emiliya Marinova, 25.03.2021

Plan.7: Site plan, Emiliya Marinova, 25.03.2021

Plan.8: Underground floor plan, Emiliya Marinova, 25.03.2021

Plan.9: Ground floor plan, Emiliya Marinova, 25.03.2021

Plan.10: Level +7. Floor Plan Emiliya Marinova, 25.03.2021

Plan.11 Level +15, Floor plan, Emiliya Marinova, 25.03.2021

Plan.12 Level +21, Floor plan, Emiliya Marinova, 25.03.2021

Plan.13 Section through the stage, Emiliya Marinova, 24.03.2021

Plan.14 Section through the stage, Emiliya Marinova, 24.03.2021

Plan.15 Section through the underground connections, Emiliya Marinova, 24.03.2021

Plan.16 Section through the foyer, Emiliya Marinova, 24.03.2021

Plan.17 Structural detail, facade section Emiliya Marinova, 26.03.2021

Curriculum Vitae

Personal Information

Emiliya Marinova
01.12.1993, Varna, Bulgaria
+466766881170
emarinova93@gmail.com

Education

2004 - 2012 National high-school of art and humanities,
Varna, Bulgaria

2014 - 2019 Bachelor of Architecture,
Technical University of Vienna

2019 - 2021 Master of Architecture,
Technical University of Vienna

Workshops participation and trainings

2015 IAH Architectural International Workshop,
Rome, Italy

2016 IAH Architectural International Workshop,
Lecce, Italy

2019 Informative Archetypes,Design Morphine Workshop
Sofia, Bulgaria

Working experience

2018 - 2019 Architekten Lan & Lotz ,
Vienna, Austria

2019 - 2020 Architekt Lan,
Vienna, Austria

2020 - current Architekt Bambuch,
Vienna, Austria