SOUND GORGE

Ida Lindbäck, Sofia Löfgren & Yanan Liu

BACHELORE PROJECT

Chalmers University of Technology
Architecture & Engineering
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Being partly underground the venue is well protected from outside noise disturbances. The parts above ground mimics the shape of the surrounding rolling hills, blending in well together with landscape. While the soft exterior is quite invisible, the interior is far more dramatic. Visitors will enjoy an unforgettable experience through a venue that both looks ands sounds gorgeous.

MAIN, WING AND LAWN

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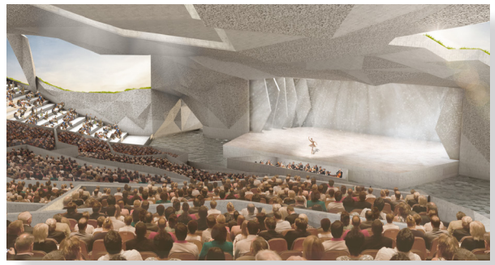
The **main seating** has room for over 5,000 seated people and is covered by a roof that enables a beautiful natural acoustic. By raising or lowering parts of the ceiling the total volume can be adjusted in order to change the reverberation and clarity.

The **wing seating** has in total room for additional 5,000 seated people. They are partly covered by arches and spanning between them is an electro acoustic grid of loudspeakers. The speakers are tuned to mimic the acoustics of the main seating and provide both a sufficient loudness and a suitable reverberation and clarity.

The **lawn seating** has room for 15,000 standing people and is used mainly for larger pop and rock concerts. The audience can enjoy every beat of the music thanks to a large speaker wall and see every move of the performance from the wide projections beside the stage. The cracks divide the lawn into different audience sections and serve as a transportation route from the garages.



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The two wings of side sets have a steeper slope than the main seating, resulting in rising walls on the edges of the main seating which allows for more lateral reflections that increases the sense of enclosement.

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The ceiling adapts to the genre and appurtenant desired clarity and reverberation time by lifting some tiles, opening up the air volume to the reverberation chamber above. Therefore, the pavilion has two different "settings" with two different combinations of clarity and reverberation time.

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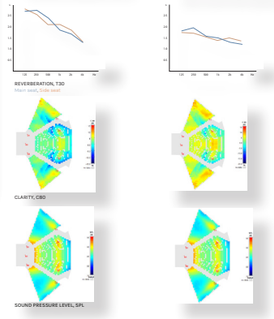

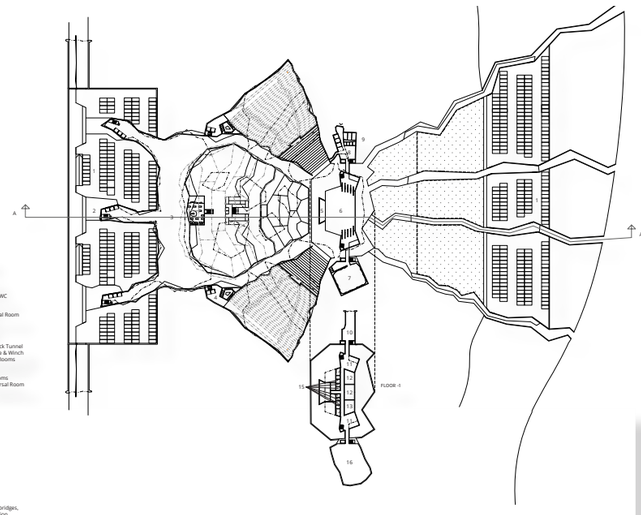

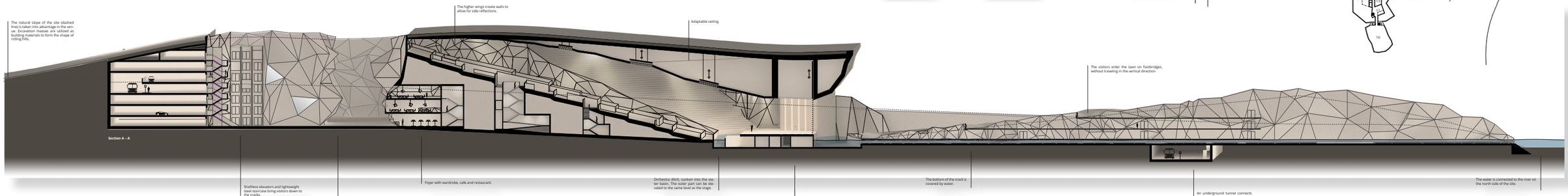

ACOUSTICAL TILES

The triangulated inner walls of Sound Gorge are put together by three different acoustical, concrete tiles, to create varying acoustical environments fitting the purpose of the room.

THE REFLECTIVE TILE

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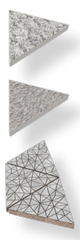

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THE LEADING ROLE OF WATER

Water plays an important part in the sound walk, both visually and acoustically. The sound of water hitting different surfaces creates an aquatic symphony that both sets the atmosphere and gives a hint of what is to come further in.

BEHIND THE SCENES

THE STAGE AREA

The performers enter the venue by an opening in the ground, on the western side of the stage. Inside, the hall is lit by a crack in the ceiling and surrounded it lies staff office spaces. The hallway opens up into the green room, which is also connected to the audience by a crack hallway.

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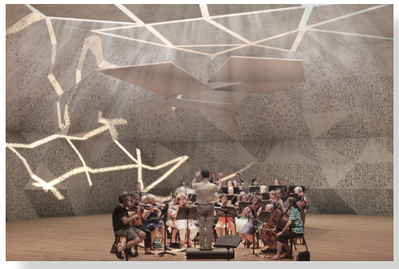

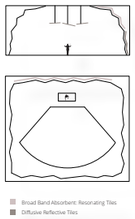

LOUD LAWN

The sloped lawn has room for up to 15,000 audience members and is used when the venue hosts large pop and rock concerts. The performer can choose to only have the audience on the lawn, or to use the main and wing seating as well. The cracks divide the lawn into different audience sections and serve as a transportation route from the garages.

WATER

Drainage water from the lawn and the areas surrounding the cracks is led to the bottom of the cracks where they help create a cooler and fresher enviroment. In dry seasons the water from the nearby river is utilized instead. The huge thermal mass of he venue absorbs heat during the day and provide warmth during the colder evenings. The open air layout provides natural ventilation for all audience members.

ACOUSTICS

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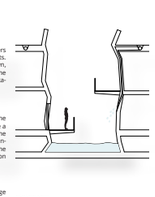

PRESENTATION POSTERS

PROJECT

BACKGROUND

This Bachelor Project was part of a student competition hosted by the American Society of Acoustics. The task for this year was to create a concert pavilion for a summer orchestra that could host a wide variety of performances in different scales.

This project was one of three entires that were given the honor to represent Chalmers University of Technology in the international competition.

INTERDISCIPLINARY COLLABORATION

Sound Gorge was created as a collaboration between two bachelor students from the Architecture & Engineering program and one master student from the Sound & Vibration program. Throughout the process all of us have worked close together in order to find solutions and ideas within each others fields of knowledge. From the beginning our goal have been to create architecture and acoustics that not only function together, but actually help to amplify each other. We wanted to create acoustics that were well integrated with the architecture, as well as architecture that could showcase the variation of acoustics

An example of this are the acoustical tiles that are used to cover the interiors of the project. The different surfaces creates varying acoustical properties as well as a more diverse architectural experience. The tiles also makes it possible for the visitors to not only hear but also see and even feel the change of acoustics as they move through the venue.

With these tiles as a tool our acoustician student could then create acoustical simulations in the software CATT to find the optimized placements and amount of each tile.

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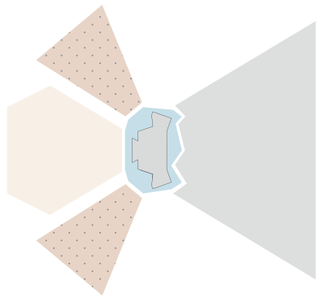

Water
Stage
Main Seating, 5,000 seated people
Wing Seating, 2,500 seated people
Lawn Seating, 15,000 standing people

MAIN, WING & LAWN

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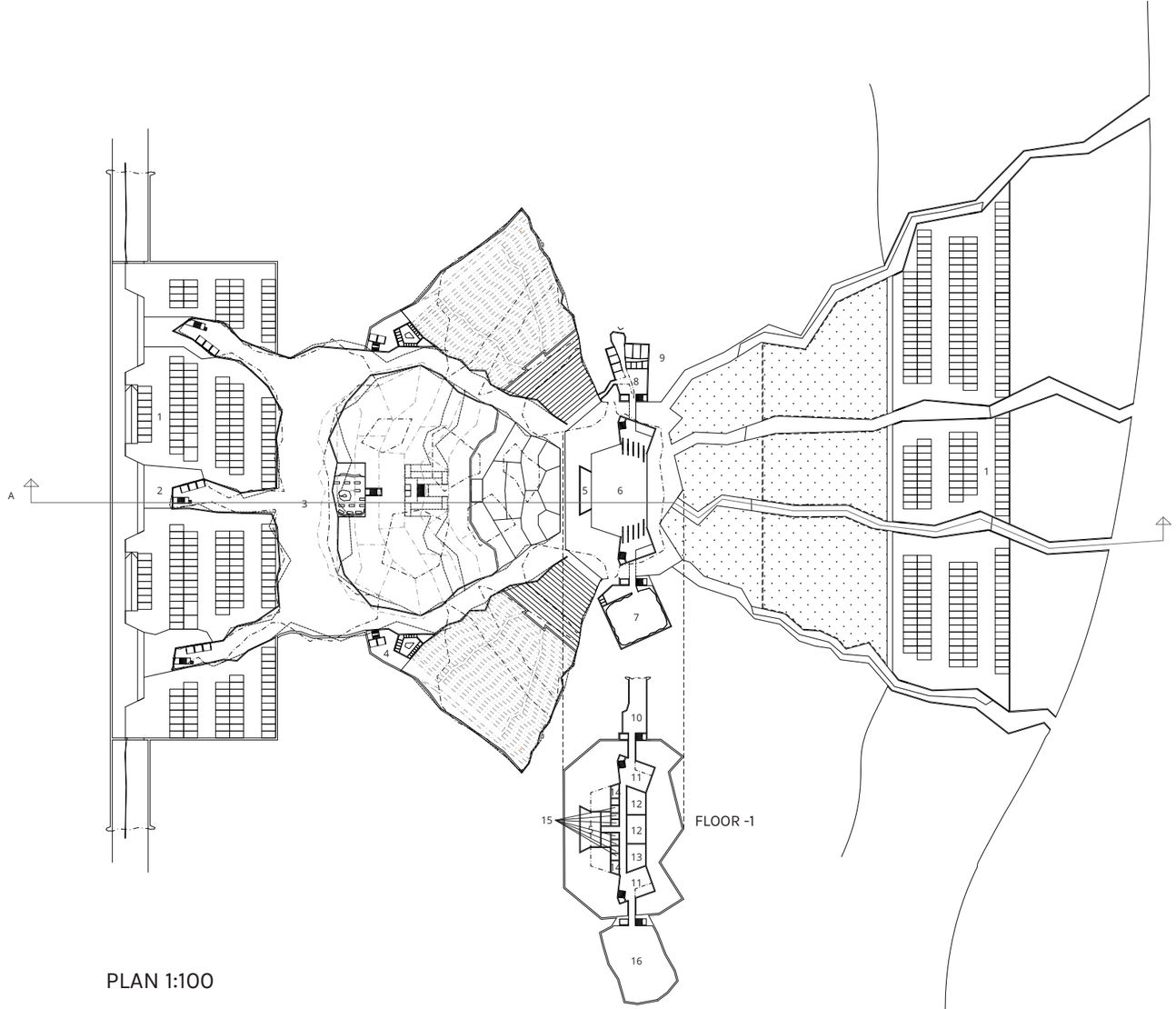
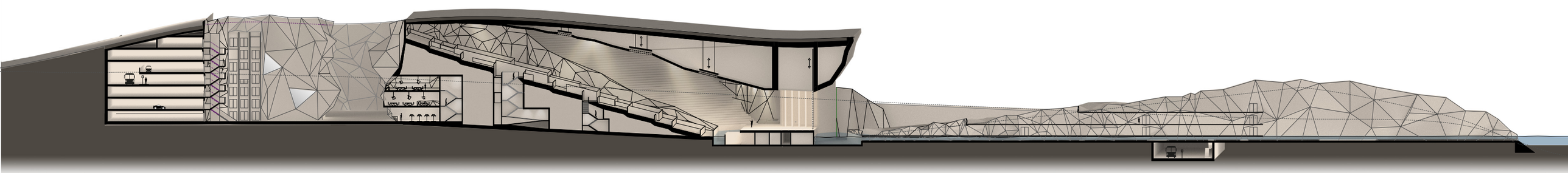


PLAN 1:100

FLOOR 0
1 Parking Garage
2 Stairs & Elevators
3 Foyer
4 Stairs, Elevators & WC
5 Orchestra Pit
6 Stage Area
7 Orchestra Rehearsal Room
8 Green Room
9 Offices & WC

FLOOR -1
10 Underground Truck Tunnel
11 Side Stage Storage & Winch
12 Chorus Dressing Rooms
13 MER Room
14 WC
15 Solo Dressing Rooms
16 Movement Rehearsal Room



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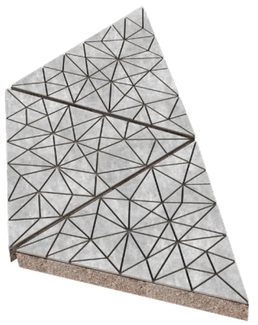

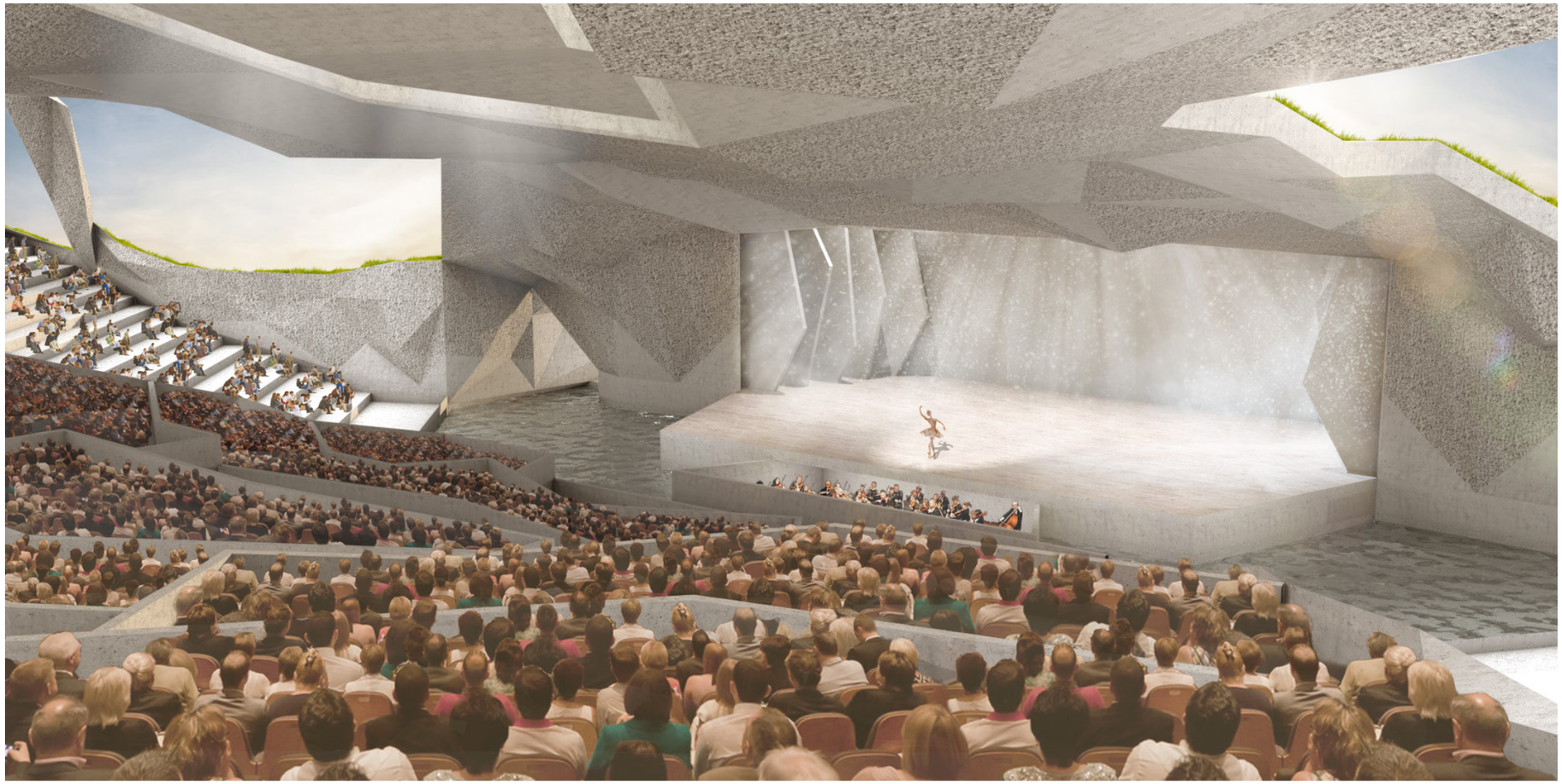

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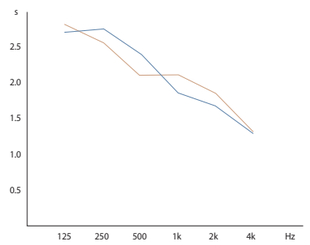
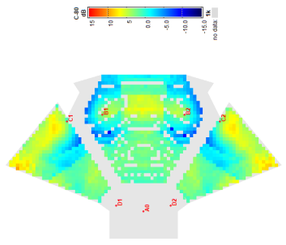


REVERBERATION, T30

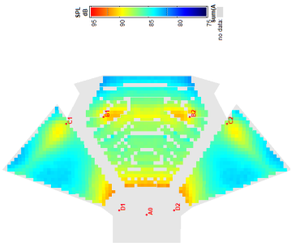
Main seat, Side seat

Music Mode



CLARITY, C80

Music Mode



SOUND PRESSURE LEVEL, SPL

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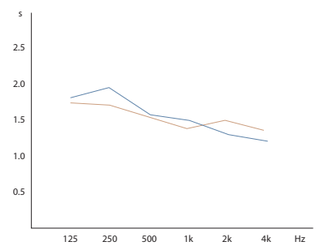
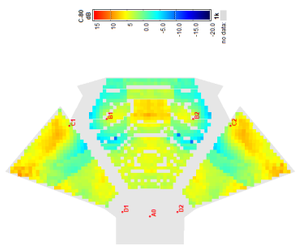


REVERBERATION, T30

Main seat, Side seat

Theater Mode



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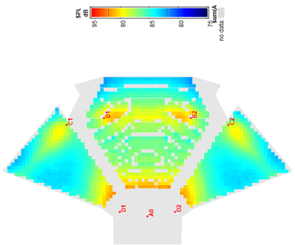

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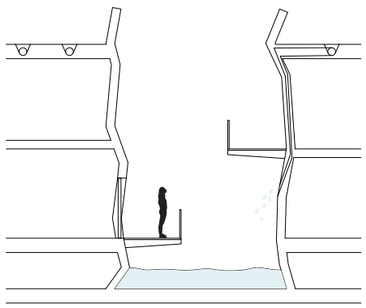
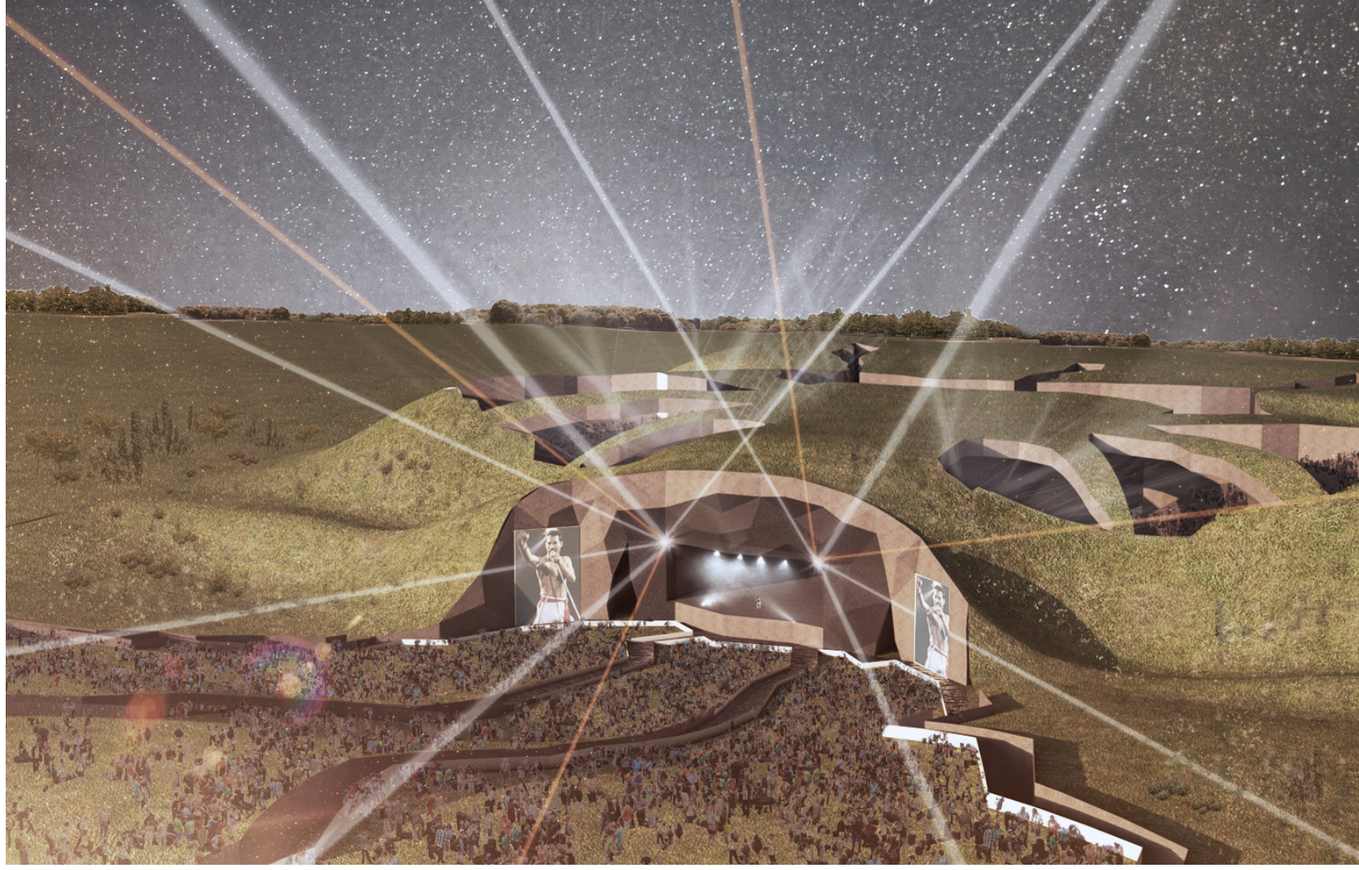


SECTION 1 : 200

LAWN CRACK



BEHIND THE SCENES

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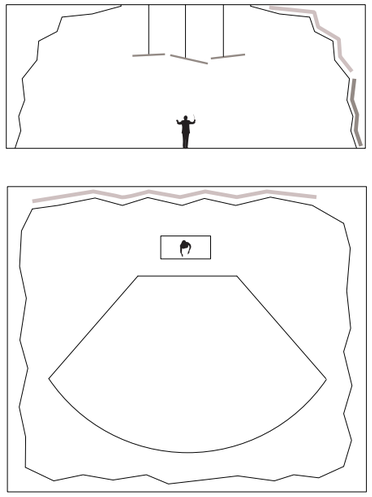


Broad Band Absorbent: Resonating Tiles

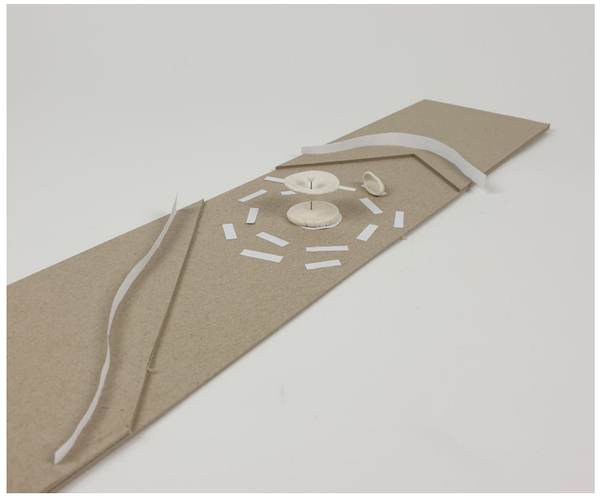
Diffusive Reflective Tiles

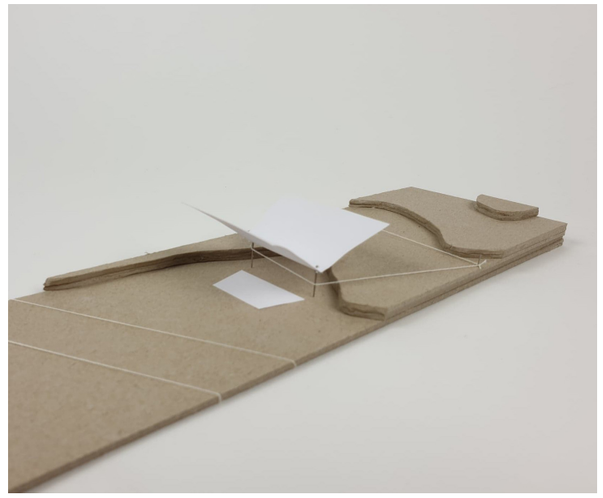
PROCESS

STUDY SITES

The very first thing we did in this project was to make some study excursion to three different sites in Gothenburg together with the class. Here we tried to get a better understanding of how distance, topology and noise affects the acoustics. We then made three proposal models of how to fit the competition program onto these sites.

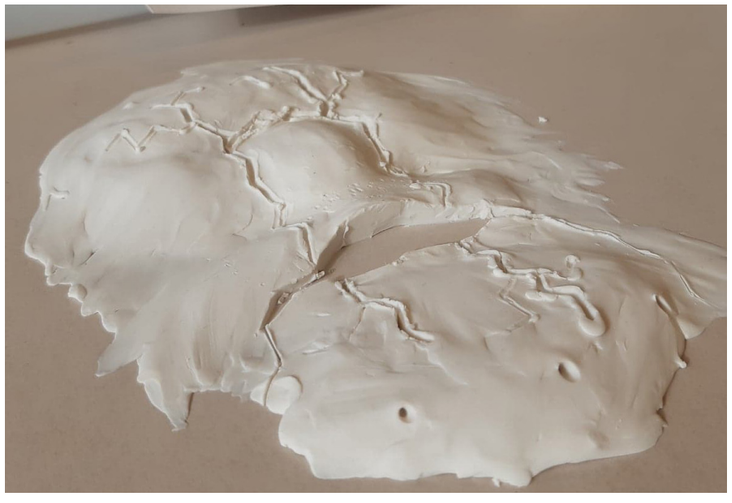
Looking back at these models it's really interesting to see that a lot of our final concepts can actually be found already at this point. For example the idea of having the audience seated in different directions around the scene. We also had the concept of using a speaker grid and using large masses to cancel noise.

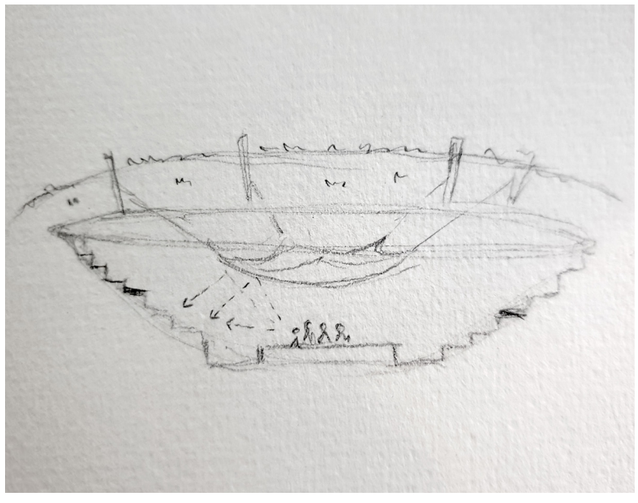




LANDSCAPE SCULPTING

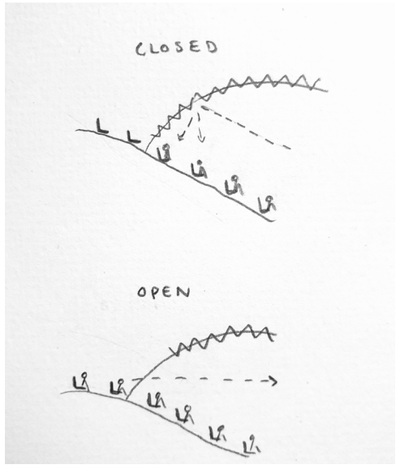
Early on in the project we decided that we really wanted to make use of the existing topology of the site and integrate our pavilion with the landscape. We did many model iterations using clay and cardboard to investigate different architectural ideas. For a while we discussed two parallel concepts; either A) having the audience right on the ground, covered by a light construction or B) actually dig ourselves into the ground and cover parts of the openings with a roof. We finally decided to go with B since we thought it would be more beneficial from an acoustical point of view (it created much more reflective surfaces and the soil acted as a great noise barrier) as well as being a more interesting architectural concept.

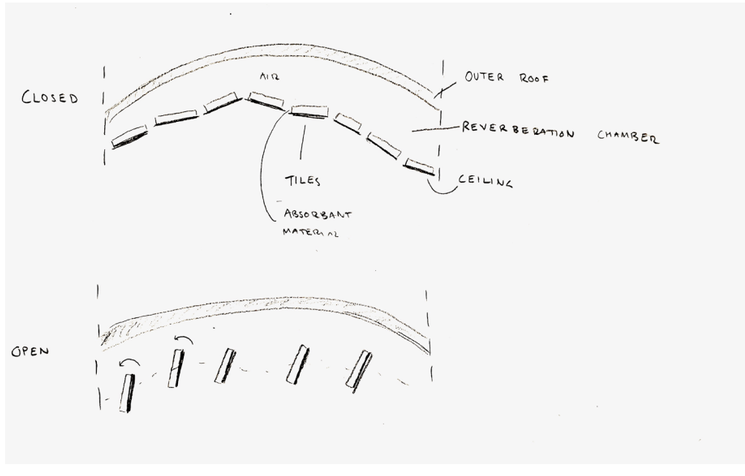




FLEXIBLE CONCEPTS

One of our biggest challenges was to find a way to adapt the acoustics to suite different types of performances. We made a lot of research on this and found that the two most popular solutions was to either create a change of absorbents or a change of volume. But more absorption could also lower the sound strength and since this was something we probably already would have a struggle with we decided to go with the latter choice. We decided to change the volume by having different parts of the ceiling open up to a reverberation chamber. However, we still had to decide how these openings would work. We discussed both a flexible curtain roof and rotating tiles until finally deciding on a few larger groups of tiles simply being lifted up - lowering the clarity while remaining some early reflections.





FINAL THOUGHTS

METHODOLOGY

This project has probably been the biggest challenge I've encountered so far, but also one of the most rewarding one. The competition program we had to follow were incredibly complex and put high demands on both the architecture and acoustics. Early on we decided that we did not only want to create a memorable *concert hall*, but a memorable *concert experience*. We tried to see our project from the eyes of both the audience and the performers and take care of all the spaces, both architecturally and acoustically, that each person would pass during their visit. To make sure that both of us had the same vision in mind, we produced a lot of simple drawings before moving on into CAD-modeling.

RESULTS

I am very proud of our final results and the hard work we've put down. One of the things I'm most happy about is how we managed to integrate the acoustics and architecture through the flexible ceiling and the tiles. I'm also happy with how we were able to integrate the project with the landscape, not only with its shape, but also with the use of local resources such as the water and the topology.

Another thing I'm proud of is that we actually managed to create a concert experience that extended beyond the concert itself. We put a lot of thought into the audience journey, from the motorway to the final seat, and were able to create a dramaturgy through the contrasts of different spaces.

One thing that we were very aware of was to not forget about the people seated in lawn area. Even though we would not be able to give them the exact experience we wanted to give them an equal one. We discussed several alternatives and finally found a solution that worked well with our other concepts and the demands of the lawn area. However, this could maybe have been showcased more clearly on the posters but we had to compromise due to time and space limitations .