

OAS

DÄR VATTNETS FLÖDE
MÖTER SCENENS DYNAMIK



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Avdelningen för Arkitekturens teori och metod
Chalmers Tekniska Högskola
Göteborg, Sverige, 2025

KURS
ACEX15 Kandidatarbete i Arkitektur och Teknik

PERIOD
VT25

OMFATTNING
15HP

EXAMINATOR
Mats Ander

HANDLEDARE
Morten Lund, Peter Christensson & Wolfgang Kropp

Under vårterminen 2025 har kandidatarbetet genomförts med huvuduppgift att designa och optimera ett teaterhus utefter arkitektoniska önskemål och akustiska kvaliteter. Detta genomfördes genom ett samarbete mellan studenter från Arkitektur & Teknik och Akustik Mastern.

Projektet utformades utefter kraven i ASA Student Design Competition 2025, med fokus på rumsakustik, ljudisolering och bullerkontroll. Utöver tävlingsprogrammets krav efterföljdes kurskraven kring återvunnet trä, kulörta färgsättningar och dagsljus in i teatersalen. Det personliga målet var att utnyttja platsen, Delft i Nederländerna, och dess vatten nära läge. Detta genom att under hela designprocessen fokusera på vatten som huvudkoncept.



OASE

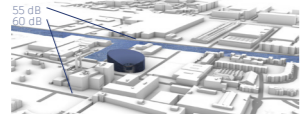
CONCEPT

With water as the main concept, the theater is designed to utilize its qualities in as many elements as possible. This is manifested not only through the use of physical water but also in its design and overall ambiance, while also contributing to several acoustic qualities and sustainable solutions.

Furthermore, the design focuses on sustainability through recycled materials, selected based on the availability of local resources, and the reuse of water. The building features an independent water system capable of operating without external water sources for an extended period.

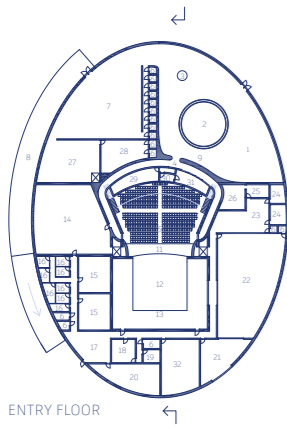
SITE

The theater is located on campus at Delft University known for its research in water management. This location also benefits from Delft's cultural scene, with a growing emphasis on theater studies. By merging the arts with Delft's technological focus, the design aims to create a dynamic space that fosters creativity and innovation.

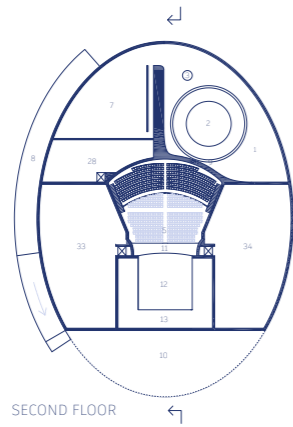


PLAN LAYOUT

The layout is designed to optimize the flow of both staff and visitors. There are separate areas for each department working in the building: administration, restaurant, and theater. The administration is linked to the lobby through the reception area, this space provides easy access to offices and staff areas. The restaurant is located near the lobby, offering visitors a place to sit and wait before a show. It is also connected to a kitchen, storage, and staff facilities. Within the theater department, there are multiple dressing rooms and rehearsal spaces, along with designated areas for both actor preparations and equipment storage.

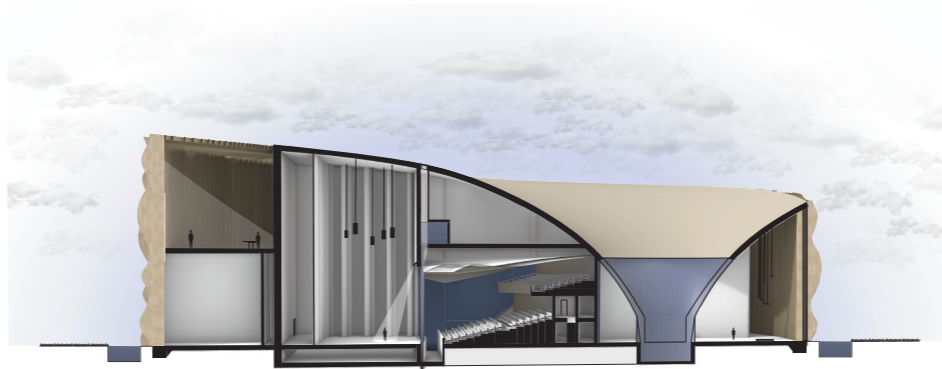


ENTRY FLOOR

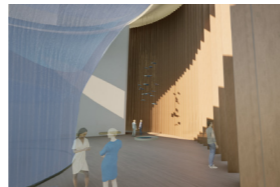


SECOND FLOOR

NC-25	NC-35	NC-40	NC-45	NC-55	NC-60
Public areas					
1	Lobby (480m ²)				
2	Waterfall				
3	Rain chime				
4	Dynamic pathway				
5	Theater (349m ²)				
6	Toilet				
7	Restaurant/cafe (253m ²)				
8	Outdoor seating (237m ²)				
9	Waterwall				
10	Terrace (450m ²)				
Working areas					
11	Orchestra pit (36m ²)				
12	Stage (144m ²)				
13	Wings (188m ²)				
14	Rehearsal hall (222m ²)				
15	Chorus dressing room (56m ²)				
16	Solo dressing room (7m ²)				
17	Green room (52m ²)				
18	Wig & make-up (26m ²)				
19	Prop storage (10m ²)				
20	Costume shop (74m ²)				
21	Loading dock (70m ²)				
22	Scene shop (29m ²)				
23	Staff area (68m ²)				
24	Office (13m ²)				
25	Reception (14m ²)				
26	Wardrobe (28m ²)				
27	Kitchen (120m ²)				
28	Storage/staff (61m ²)				
Technical areas					
29	Control room (29m ²)				
30	Audio mix (6m ²)				
31	Spot booth (20m ²)				
32	Water tank (98m ²)				
33	MEPFI (607m ²)				
34	Water filtering (497m ²)				



LOBBY



Upon entering the building, you are greeted by a waterfall, centered in the bright lobby. Sunlight filters through the water, casting undulating reflections across the floor. The lobby is defined by its expansive glass facade, which faces the campus. In addition to the glass, light wood is mainly used alongside plastered walls, contributing to a natural and harmonious atmosphere.

The lobby features a rain chime made from recycled canal glass. Utilizing the water in the lobby waterfall, water will divert and excite a bell at specified times to emit pleasant ringing/chime to signify:

EVENT
Chime to signify when an event is about to start/end

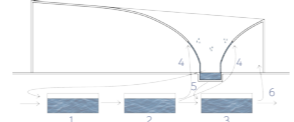
TIME
Chime occurs every hour and act as a "water clock"

WATER FILTERING

By using water from the nearby canal, the building becomes a self-sustaining water filtration system that purifies contaminated water. The transport of water through the building also contributes to architectural qualities as well as acoustic benefits.

Water is taken in from the canal as well as rainwater collected by the roof's slope. The water flows through the first filtration system followed by the main filtration which then directs the water towards the waterfall. This is done through the waterwall at a low speed over a large surface area, after which the waterfall transports the water back down. Some roof water also supplies the rain chime. The water is then chemically treated before it can be used in the building or sent out.

1. Pre-treatment
2. Water filtering
3. Chem. treatment
4. Waterwall
5. Waterfall
6. Use of water



WATERWALL

The water wall in the lobby integrates aesthetics, structural support, and water circulation, channeling water with bubbles between the concrete and glass panels into the waterfall reservoir.

By introducing 1% air into the water, the compressibility of the air-water mixture increases significantly, resulting in a substantial drop in the speed of sound within the medium. This reduction enables a double-wall resonance to occur at approximately 155 Hz.

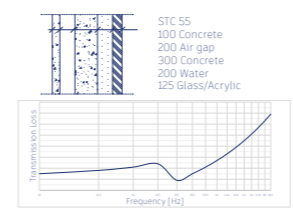
SOUNDSCAPE PATHWAY



To set the tone, guests will be immersed in a curated acoustic experience. After ticket admission, they will pass through an acoustically tuned soundscape corridor on their way to their seats.

This passageway is equipped with an actively controlled speaker array, allowing the soundscape to shift fluidly—from vibrant streets of Manhattan for a rendition of West Side Story to a serene, low-noise environment that clears the mind in preparation for a poetry recitation.

This dynamic soundscape adds a new dimension for playwrights and theater directors to shape the experience before the performance even begins.



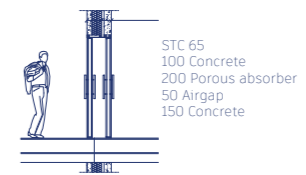
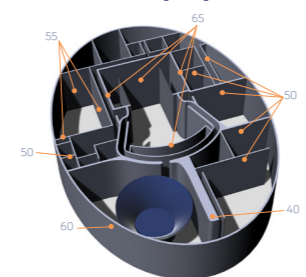
THEATER HALL

The 3,625 m³ theater accommodates 700 patrons across orchestra and balcony levels. Deep blue tones and a wavy ceiling evoke an immersive underwater atmosphere.

A cascading water feature replaces conventional curtains, parting like drapery—first stopping at the center, then gradually revealing the stage. This element admits natural light, offering visitors glimpses of both exterior and stage during intermissions. The transparency heightens anticipation as audiences can peripherally track the production's progression.

The theater's side walls incorporate wedge-shaped panels with sound-absorptive edges, supplemented by adjustable acoustic banners for additional variability.

STC-LEVELS [dB]

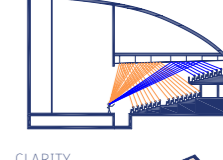
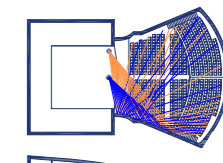


The theater is decoupled from the building via double walls and vibration isolators. Structurally isolated door frames maintain acoustic separation. To meet performance targets, 30% of surfaces use absorptive materials: 25 mm acoustic plaster attached to wood framing for walls, and 13 mm acoustic plaster with 55 mm glass fiber insulation for the ceiling.

REHEARSAL HALL

The rehearsal room is designed to complement the theater, using 25 mm mineral fiber ceiling panels and 25 mm shredded fiberboard on furring with 64 mm glass fiber, achieving 0.7 s reverberation and 4.6 to 9.3 dB at 1 kHz. Bass traps minimize low-frequency reverberation at 125 Hz, while heavy velour curtains enable acoustic variability. The overhead MEPFI area contains isolated rooms for each equipment category to minimize noise transfer. The HVAC zone features a room-within-room design housing two Air Handling Units on inertia bases with vibration isolators, with 90 mm mineral wool lining the walls, ducts use isolation hangers and maintain straight runs three times their diameter after bends to reduce turbulence.

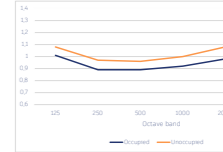
EARLY REFLECTIONS



CLARITY



REVERBERATION TIME



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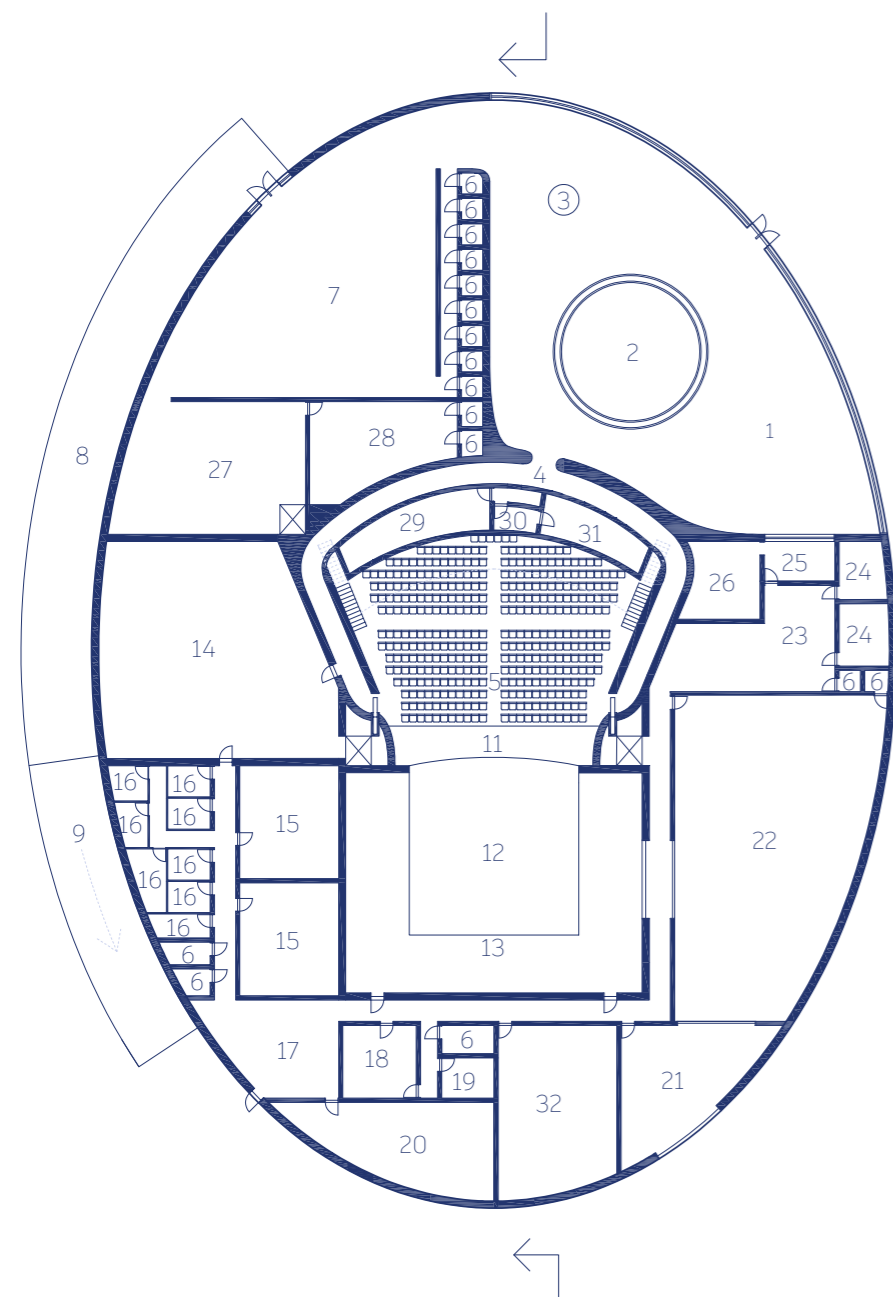
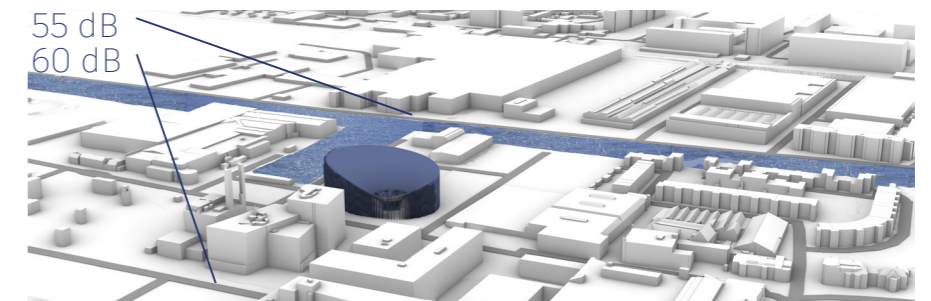
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PLAN LAYOUT

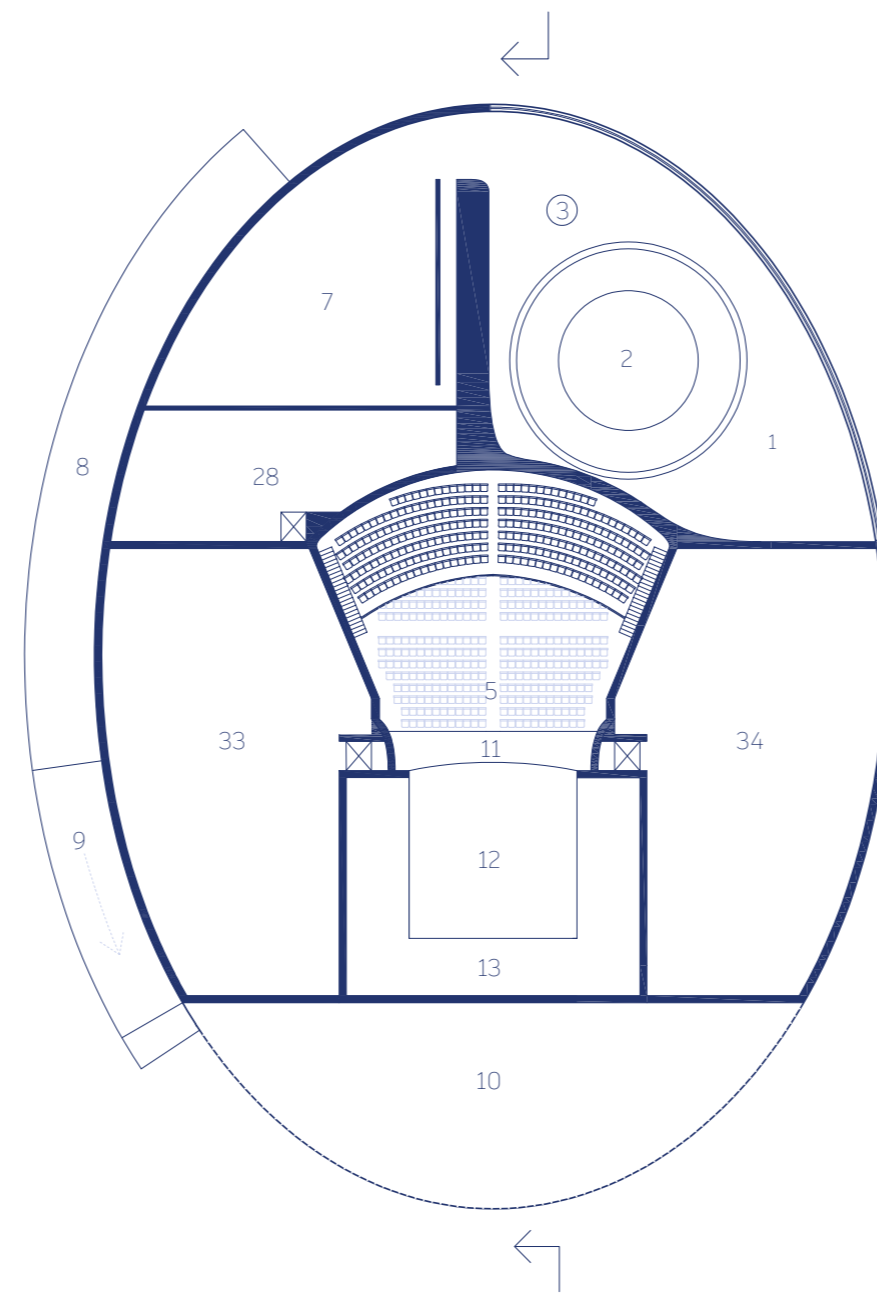
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ENTRY FLOOR



SECOND FLOOR

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Public areas

- 1. Lobby (480m²)
- 2. Waterfall
- 3. Rain chime
- 4. Dynamic pathway
- 5. Theater (349m²)
- 6. Toilet
- 7. Restaurant/cafe (253m²)
- 8. Outdoor seating (237m²)
- 9. Waterwall
- 10. Terrace (450m²)

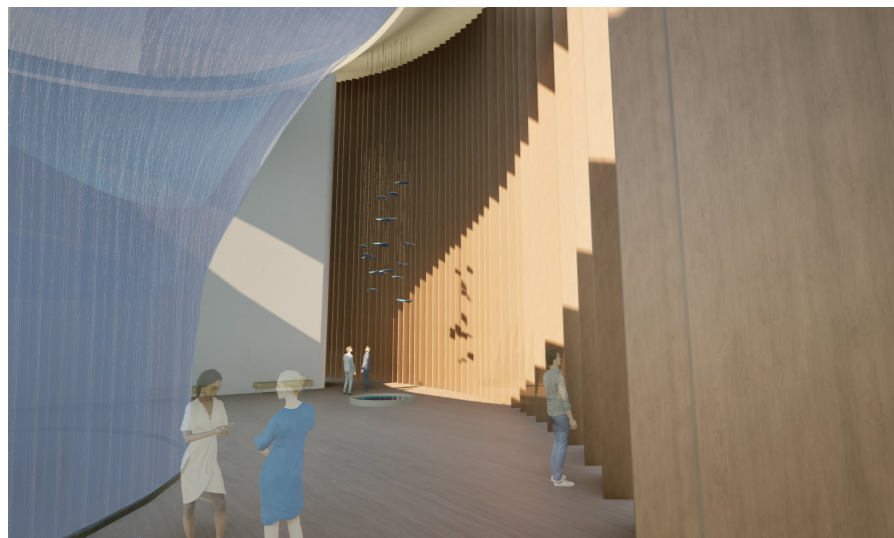
Working areas

- 11. Orchestra pit (36m²)
- 12. Stage (144m²)
- 13. Wings (188m²)
- 14. Rehearsal hall (222m²)
- 15. Chorus dressing room (56m²)
- 16. Solo dressing room (7m²)
- 17. Green room (55m²)
- 18. Wig & make-up (26m²)
- 19. Prop storage (10m²)
- 20. Costume shop (74m²)
- 21. Loading dock (70m²)
- 22. Scene shop (291m²)
- 23. Staff area (68m²)
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- 26. Wardrobe (28m²)
- 27. Kitchen (120m²)
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Technical areas

- 29. Control room (29m²)
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LOBBY

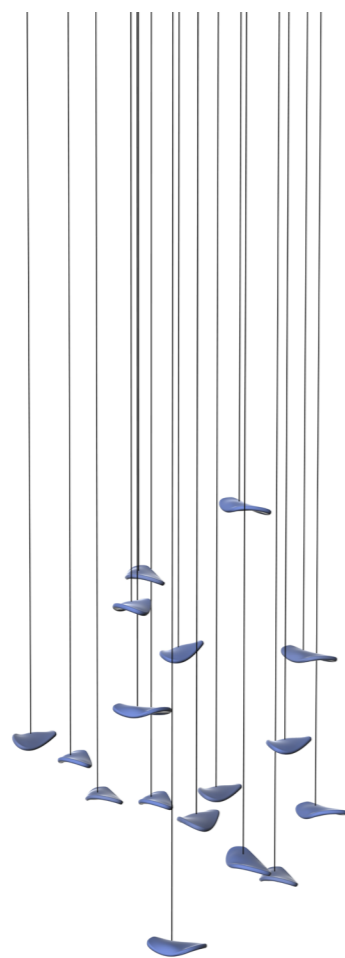


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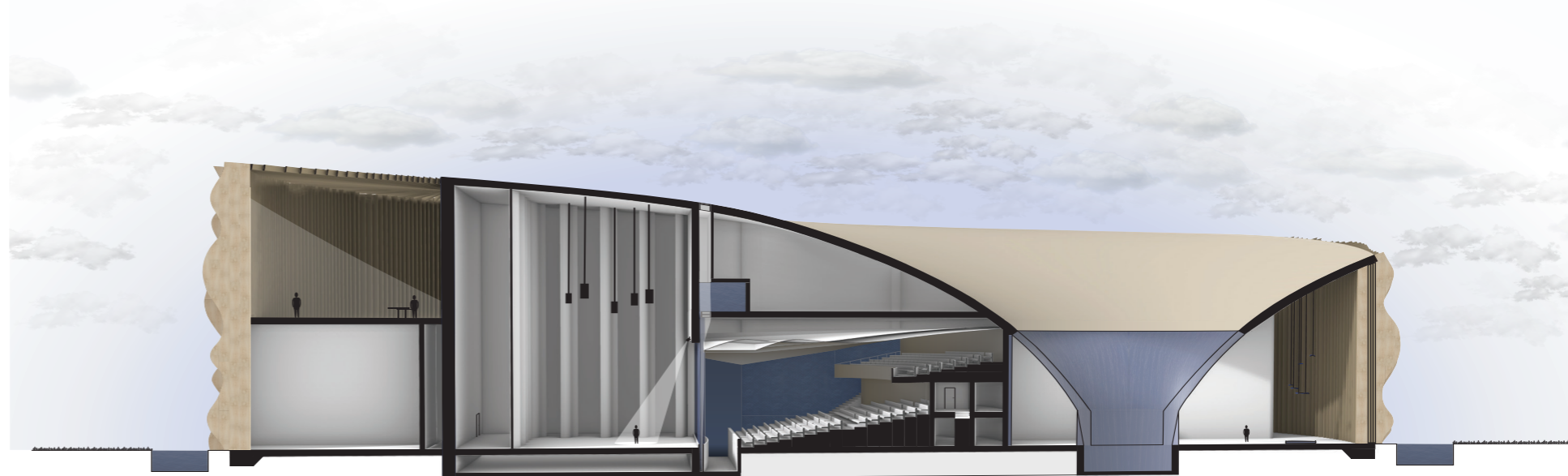
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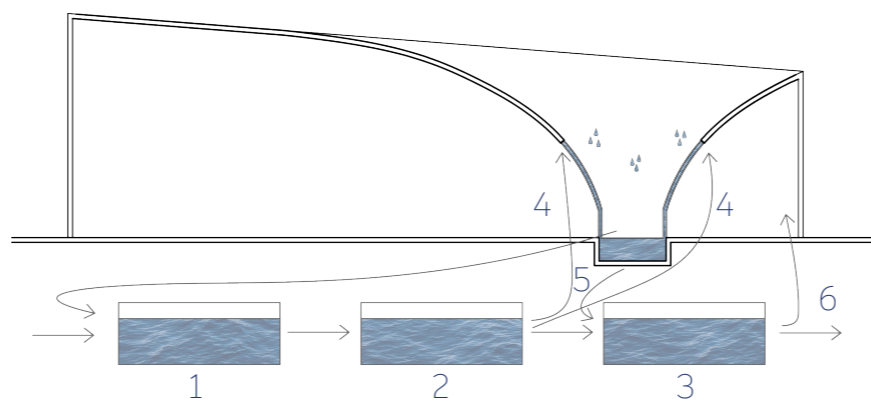


WATER FILTERING

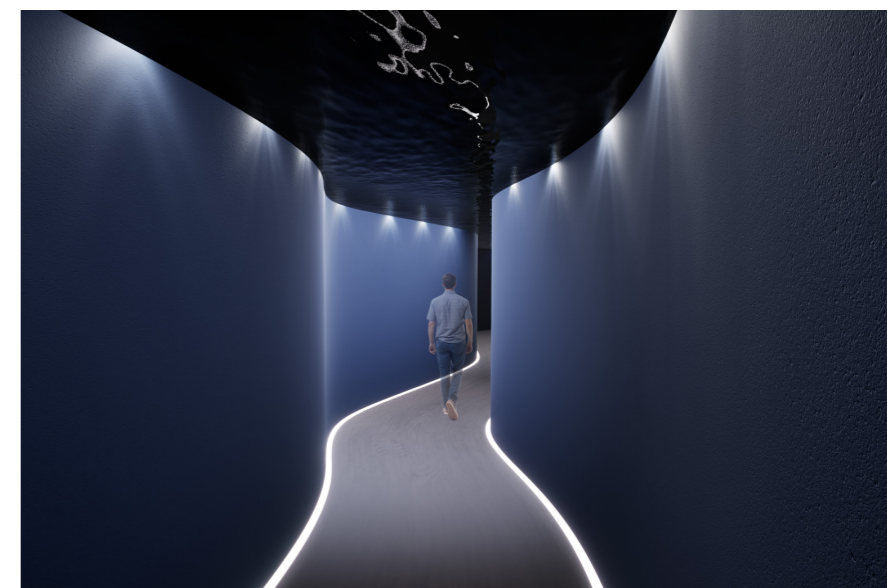
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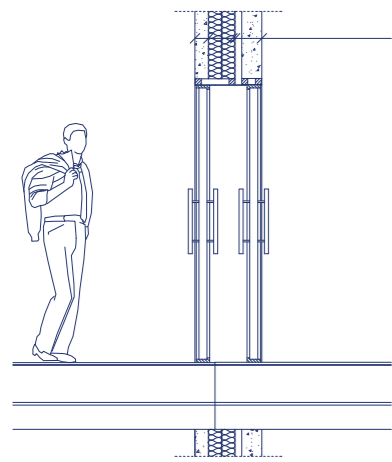
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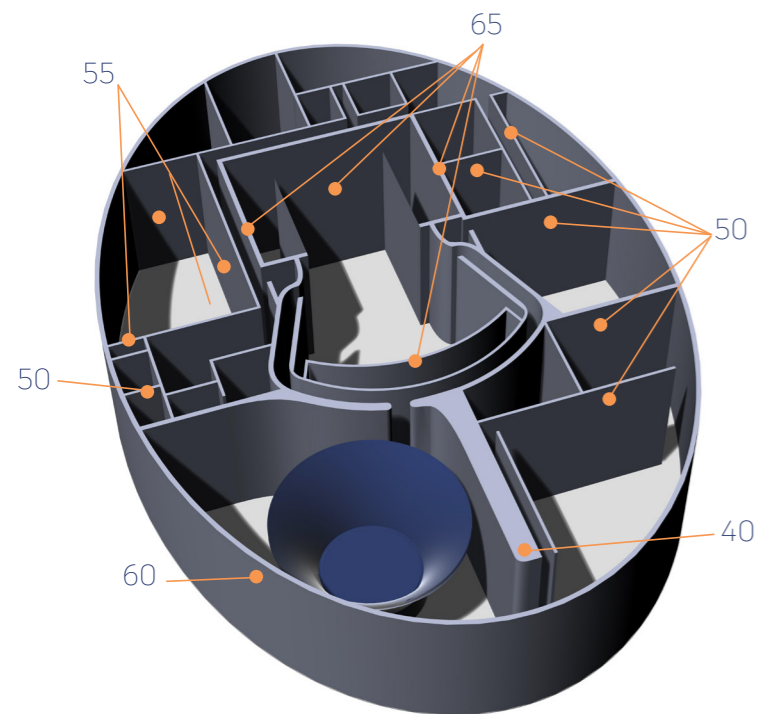
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STC-LEVELS [dB]



REHEARSAL HALL

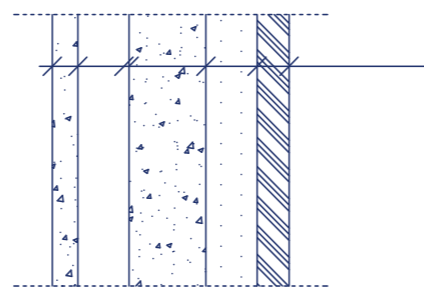
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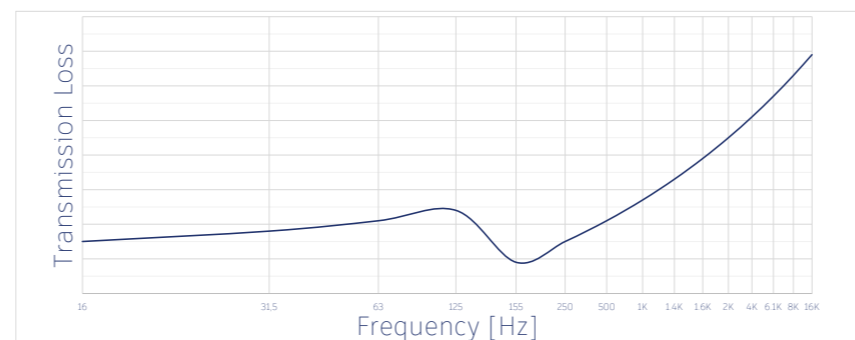
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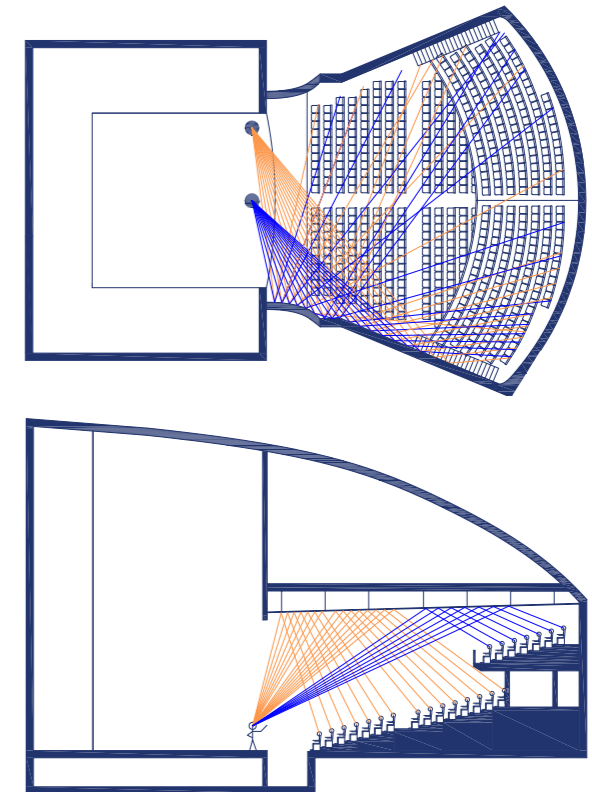
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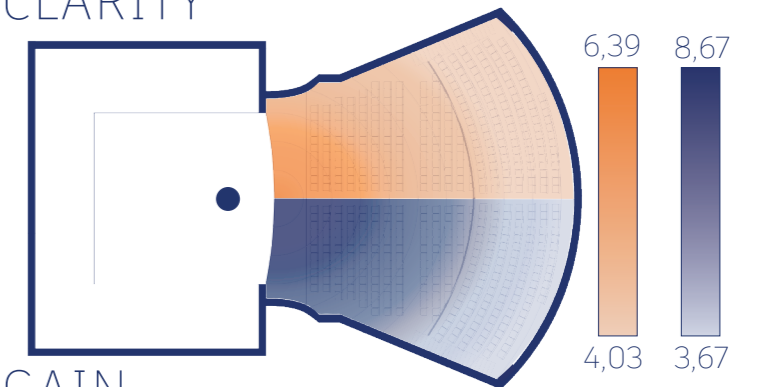
STC 55
 100 Concrete
 200 Air gap
 300 Concrete
 200 Water
 125 Glass/Acrylic



EARLY REFLECTIONS

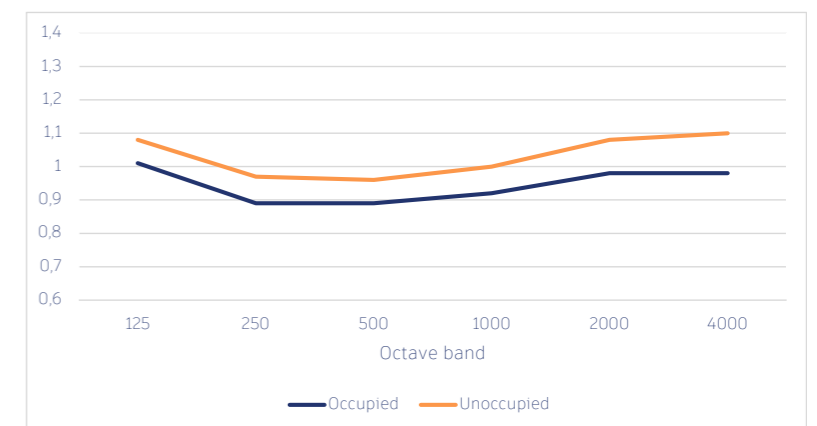


CLARITY



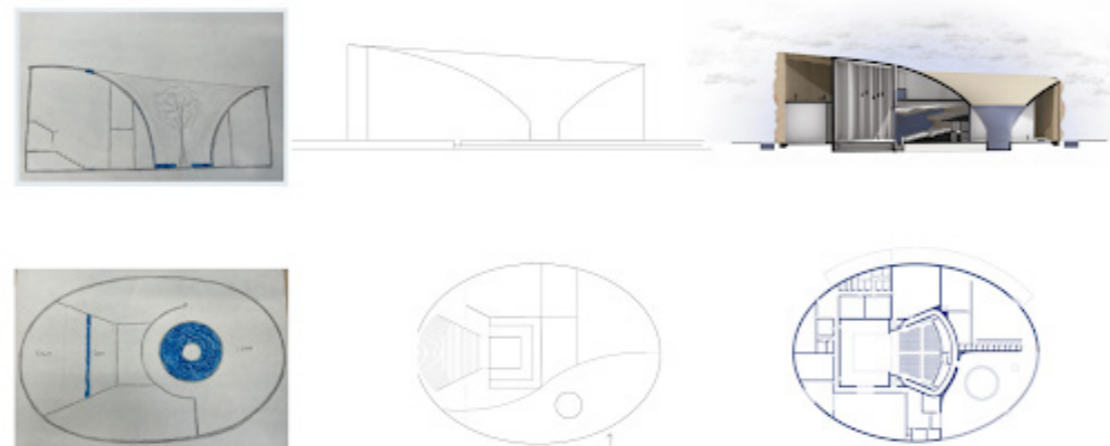
GAIN

REVERBERATION TIME



DESIGNPROCESSEN

Tidigt i processen bestämdes det att ta konceptet vatten till sin spets och försöka att använda vattnets kvaliteter i såväl arkitektur och akustik. I den arkitektoniska processen handlade det mycket om att sammanväva fysiskt vatten med andra material som gav liknande organiska känsla. Det jobbades mycket med vattenfallet i lobbyn, där formen, höjden och placeringen varierade. Detta genom att improvisera olika lösningar utan att tänka på om det faktiskt fungerade. Några förslag som togs fram var vattenfall längs en korridor och längs en enskild vägg, det testades även om vattenfallet skulle vara utomhus eller inomhus. Improvisationen resulterade i ett cirkulärt vattenfall i mitten av lobbyn som upplevs enormt för att karakterisera lobbyn. Hela processen av att placera vattenfallet övergick även i en iterativ process där det testades hur vattenfallets placering påverkade taket och resterande byggnad. Vattenfallets dimensioner och lutning gav takformen, vilket bidrar till att hela byggnaden riktas mot vattenfallet som blir hjärtat i byggnaden.



Fasaden var en annan del av designprocessen som påverkade slutresultatet i stor grad. Olika våglinjer testades och även olika avstånd mellan skivorna för att skapa en lättare eller tyngre effekt.

Då projektet strävade efter att använda så mycket vatten som möjligt, blev det många gånger att gå fram och tillbaka och utvärdera för att det inte skulle upplevas varken som barnsligt eller orimligt mycket vatten. Denna iterativa process ledde bland annat till att den dynamiska korridoren inte innehåller något fysiskt vatten. Detta då det hade blivit för mycket och det är bättre att besökarna får gå igenom en harmonisk plats och få en paus från allt vatten innan man entrar teatern och får därmed en ännu större upplevelse av det vattenfallet.

REFLEKTION

ARKITEKTONISKA KVALITETER

Det personliga målet med projektet var att fullfölja konceptet och använda fysiskt vatten trots dess komplexitet. Detta genomfördes i alla vistelserum vilket jag är nöjd över. Lobbyn blev ett ljus, stort, öppet rum med mycket fokus på vattenfallet, medan teatersalen är en mörkare lugnare plats. Detta gör att man går från ljus till mörker, från buller till lugn, vilket jag tror är en trevlig upplevelse i en teater. Att man dessutom möts av vattenfall i båda rummen gör att man upplever en röd tråd genom byggnaden.

HÅLLBARA STRATEGIER

Det valdes att lägga fokus på hållbarhet genom att göra byggnaden till ett självförsörjande vattensystem, där vattnets transport används i arkitekturen. Stora delar av projektet kretsar kring tekniska lösningar för att hålla byggnaden energieffektiv och ta vara på vattnets kvaliteter. Materialvalen i teatern är även de utvalda med avseende på hållbarhet, där det huvudsakliga materialet är återanvänt trä utvunnet från lokala källor.

INTEGRERING AV FÄRG, LJUS, STRUKTUR & AKUSTIK

Genom projektet var det intressant att jobba med sammankopplingen mellan design och akustik, projektet fokuserades därmed på element i byggnaden som bidrog till akustiken, rumsligheten och tillförde vatten för att stärka konceptet.

Ett exempel på detta var en vattenklocka som skapar behagligt ljud när vattnet faller igenom den. När en fysisk modell gjordes, upplevdes även eleganta ljuskvaliteter genom reflektion av solstrålar genom glasbitarna. Det valdes senare även att färgsätta glaset för ytterligare effekt.

Ytterligare integrering är en vattenvägg som är en bärande konstruktion men som blir en arkitektonisk kvalitet och ljudbarriär. Väggen var från början endast en bärande konstruktion med god akustik men genom laborering mellan 2D-ritningar och 3D-modellering utvecklades idén till att öppna upp ena sidan så att vattnet blev synligt för besökarna.

Det finns även en korridor in till teatersalen som både har kontrollerat ljud och ljus för att skapa stämning för besökarna inför deras besök.

SAMARBETE OCH LEDARSKAP

Det var intressant att få samarbeta med andra yrkesområden där man parallellt med arkitektens roll även fick anta lite av en projektledar roll. För oss som endast gått en kurs i akustik var det kul att se hur akustik och arkitektur kunde sammanfogas i tekniska lösningar som funkar även i större skala i verkligheten. Samarbetet gick bra och jag tror att det var gynnsamt att både arkitekter och akustiker i detta projekt var öppna för att bidra till varandras områden och bolla idéer som kanske egentligen är utanför sin yrkesroll. Detta gav en inblick i hur framtida samarbeten kommer fungera samt hur processen av ett verkligt projekt går till. Om detta projekt skulle genomförts i verkligheten skulle även sakkunniga inom inneklimat, konstruktion, mm, varit med i en mycket större grad. Under projektets gång har vissa lösningar redan genomarbetats exempelvis rum i rum system och vatten transport, men ytterligare tekniska lösningar krävs där tydlig projektledning tillsätter uppgifterna till respektive avdelning.

ARKITEKTUR OCH TEKNIK

Jag kom till AT lite osäker på om jag var mest intresserad av arkitektur eller ingenjör ämnena. Under åren har jag tydligt sett att jag dragits mot hållbarhet i byggnader med tekniska system samt problemlösningen och beräkningarna som ingenjörer utför. Så jag har en tydlig ambition om att fortsätta på ingenjörspåret och jobba med hållbar utveckling. Under utbildningen har jag dock fått en stor förståelse för arkitektens arbete och tror att det kommer hjälpa mig mycket i framtida roller där jag kan se från fler perspektiv och förhoppningsvis även projektleda mellan parterna.