

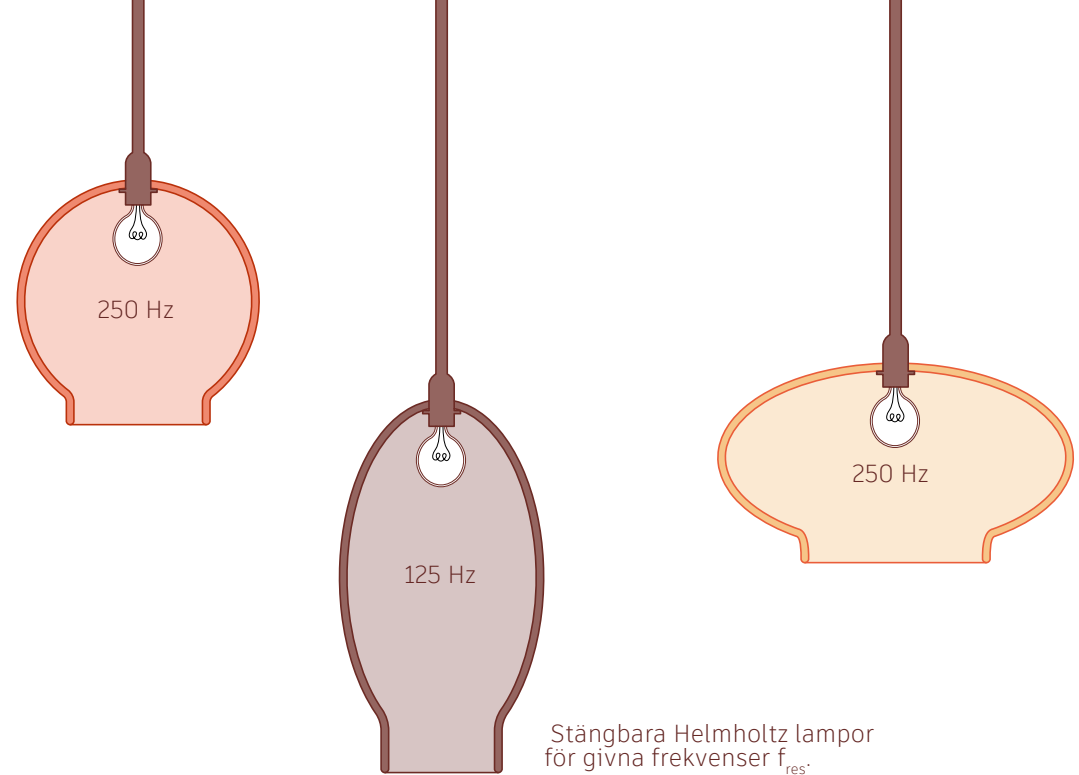
Ridåteatern

En dans av ljus och tyg

Kandidatarbete i Arkitektur och teknik
Tea Johansson

Som kandidatarbete deltog jag tillsammans med två arkitekt- och en akustikstudent i Newman Student Award Fund's 2025 Student Design Competition. Uppgiften var att gestalta en 700-sitsig teater, med fokus på integrerade akustiklösningar, för en högskola, som har starka program inom drama, sång och dans. Vårt förslag, Ridåteatern, bygger på två koncept: ett gradvis ökande inslag av tyg från exteriören in till teatersalen, samt en önskan att möta publikens förväntan när de kliver in i teatersalen med en omfamnande rumslig stämning. Genom att låta den känslan leda processen, skapades ett rum där stämningen bär arkitekturen. Gardinerna rör sig i takt med sorlet, vilket framhävs av ljus som sipprar in genom takfönster bakom tyget. Ljuset dämpas och draperierna stillnar samtidigt som en tystnad sveper över publiken när första akten börjar.

All text på engelska är från tävlingsbidraget.



HELMHOLTZ LAMPS

Lamps hanging from the ceiling in both the rehearsal room and lobby work as resonators of varying volumes, neck lengths and openings for low frequency absorption. To accommodate different acoustical performances during rehearsals, some lamps can be closed and curtain coverage removed from the walls to increase reverberation.





Perspektiv E. Repetitionsrummet med en volym på 1200 m³.



Perspektiv B. Café och bar i lobbyn

LOBBY

An airy, open lobby welcomes visitors with warm wood paneled walls in a buttery yellow color. Fabric is used as room dividers, giving university students an inspiring working environment. This use of fabric keeps the internal noise down and connects the lobby to the theatre hall.

Movable fabric is used in the curtain windows, visible from both the park and the lobby, providing an ideal transition between city life and the calm of the theatre hall. It also improves the acoustic performance of the double lobby windows by absorbing sound in the cavity between panels. As the space closest to traffic, the lobby's walls are engineered for noise reduction, with acoustically detailed windows and solid façade elements achieving $R > [21, 31, 42, 31, 21, 8]$ dB across 125 - 4000 Hz, meeting the NC30 noise criterion for the lobby.

SITE

South of Stadsgraven canal in Copenhagen, Denmark, in a busy junction with a subway station just a few steps away, lies Drapery Theatre. As a natural pathway between Søndre Campus of Copenhagen University and downtown Copenhagen, the entrance park offers a break from the busy city life for passers-by with its social atmosphere. Its proximity to the university ensures easy access for students. A car park designed to match the theatre's blue wooden façade provides convenient parking, complemented by excellent transport options via subway, bicycle and bus.

The fashion center Copenhagen makes a perfect home for this fabric centered building. Using recycled fabric from the neighboring city Malmö and locally produced wood for the framework, the theatre becomes more sustainable.





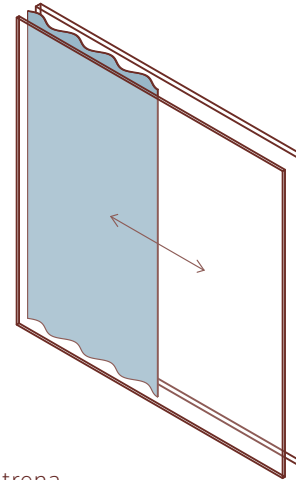
Situationsplan, 1:2000

NOISE

The site is exposed to traffic on all sides, with primary noise sources being a major junction to the southwest and an active construction site to the east. Low frequency vibrations from the adjacent subway, combined with high frequency noise from passing emergency vehicles, define the external noise conditions. To meet noise criteria, we designed a protective shell that integrates the windows, walls, and foundation.

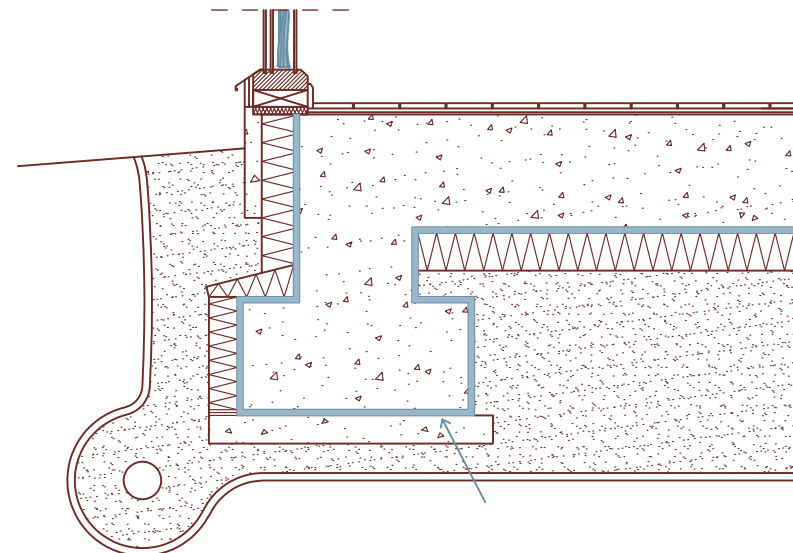
The MEPFIT room, connected to both the rehearsal room and theatre, is also a big source of noise. To reduce airborne sound transmission, it is built using a “room-within-a-room” construction. Additionally, to minimize impact sound, all machinery is mounted on a floating floor system.

Detalj över lobbyfönstrena



PROTECTIVE SHELL - LOBBY WINDOW

The windows consist of two glass panels with a heavy fabric layer suspended in the air gap between, suppressing cavity resonances while also reducing solar heat gain. The façade is designed as a double wall using layers of cross laminated timber on separated studs. Resonance frequencies for both wall and window assemblies are kept below 50 Hz.



Elastisk grunddetalj markerad med en blå linje, 1:20

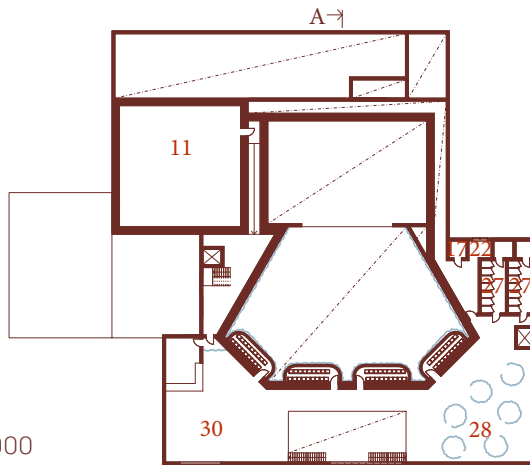
PROTECTIVE SHELL - FOUNDATION

To prevent low frequency vibrations from the subway spreading through the building, the foundation rests on elastic foam with a resonance frequency below 6 Hz. The material is fully dynamic and adapted to the site's frequency and amplitude range. Elastic isolation with the same purpose surrounds parts of the theatre below ground.

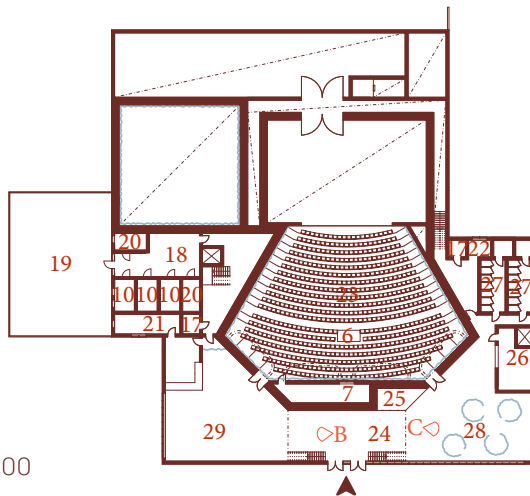


Perspektiv D. Teatersalen med en volym på 3900 m³, sett från scenen

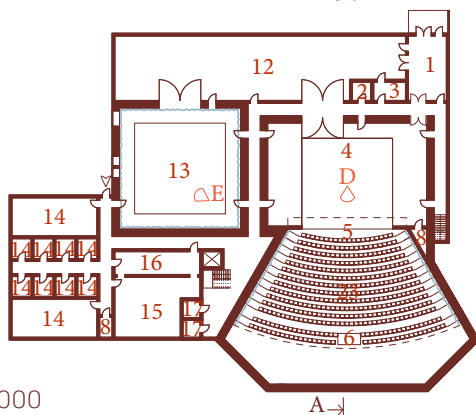




Plan 2, 1:1000



Plan 1, 1:1000



Plan -1, 1:1000

Scenområdet

- 1. Lastentré
- 2. Snabbtoalett bakom scen
- 3. Rekvisitaförråd
- 4. Scen
- 5. Orkesterdike
- 6. Ljudmixer
- 7. Ljus-/scenkontroll
- 8. Förråd
- 9. Följspot-bås
- 10. Teknisk kontor
- 11. Teknik-/driftutrymme

Personalutrymmen

- 12. Verkstad
- 13. Repetitionsaal
- 14. Omklädningsrum
- 15. Kostymateljé
- 16. Peruk/smink
- 17. Toalett
- 18. Green room
- 19. Personalterrass
- 20. Kontor för fast personal
- 21. Café kök
- 22. Pausområde

Publika utrymmen

- 23. Teatersalen
- 24. Foajé
- 25. Reception
- 26. Garderob
- 27. Toalett
- 28. Studieplatser
- 29. Café
- 30. Bar

- NC15
- NC30
- NC40

INSIDE THE CURTAINS

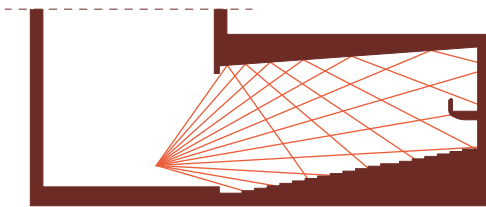
The audience enters the theatre hall with a sense of excitement. Curtains completely surround the room and gently sway to the rhythm of the murmur of voices and footsteps. The movement is enhanced by natural light flowing in from skylights along the drapery covered walls. Light dims and the draperies still, hushing the audience as the first act begins.

Drapery Theatre offers a calming experience where fabric is always present. From the park, visitors are welcomed by draperies flowing from the arcade and softly framing the windows. Stepping into the lobby, the atmosphere is further softened by study areas framed with fabric and a color palette of sky blue and butter yellow, subtly echoing nearby buildings. Upon entering the theatre hall, the fabric takes over entirely. The stage curtains envelop the entire room, wrapping around the audience like a gentle embrace.

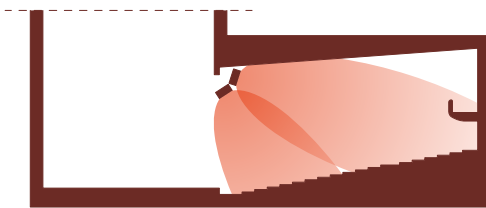
THE AUDITORIUM

The majority of the audience is seated on the floor where the first two rows are placed on a lift with three positions; orchestra pit, seating and stage level, for versatility. The floor is tilted with an angle of 8.5 degrees, giving every seat a line of sight and sound directly from the stage. The longest distance between seats and the front of the stage is 20 m.

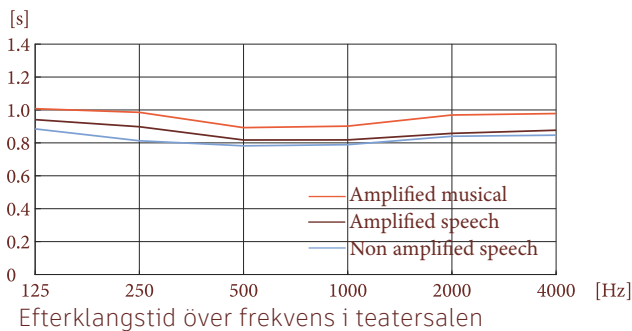
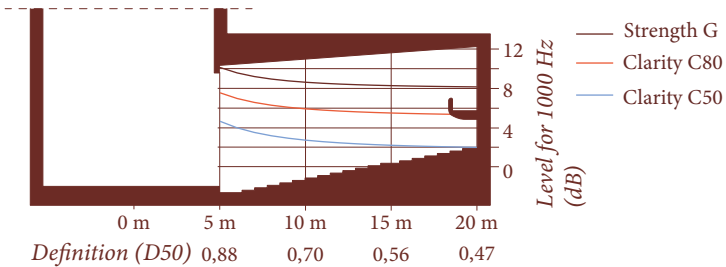
The in-house audio mix position is located behind the passage and the control room situated on the lower level, accessible through openings in the rear wall. The follow spot booth is positioned just below the ceiling. The hall, with a volume of 3900 m³, accommodates 700 seats, including 72 in four balconies wrapped in fabric. Accessible seating is placed at the back, by the entrances to avoid the inclination. All seating is made from absorbent fabric, providing consistent acoustic performance whether occupied or not.



Tidiga reflektioner från taket



Distributionen av ljud för förstärkt tal



VARIABLE ACOUSTICS

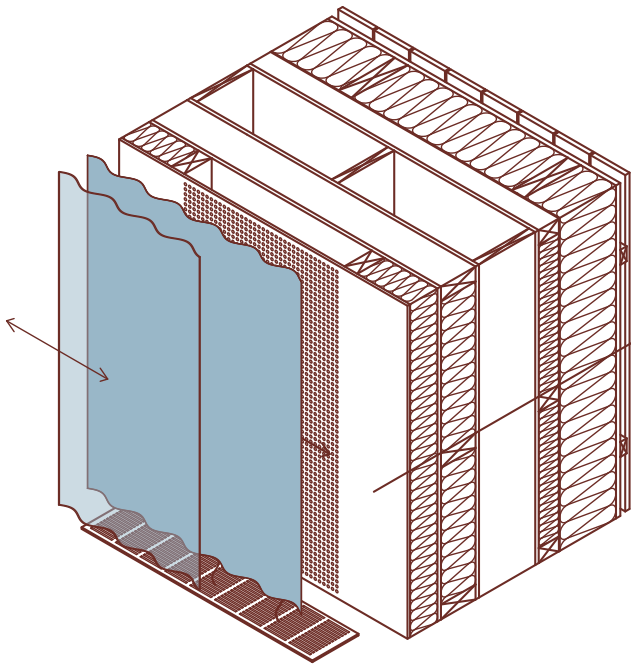
The varied nature of the fabric gives the theatre hall and rehearsal room optimal conditions for variable acoustics. Two types of fabric cover the walls; Ombre 300, a heavy fabric working as an absorbent, and Airy, a light and thin fabric, without any acoustical properties.

Reflecting wood panels and resonators are placed behind both fabrics and by opening or closing the outer heavy fabric, we can adjust the acoustic response of the room to fit different performances. By this we can ensure similar acoustics for rehearsals and performances. The detail shows how the fabric can be moved and the layers that are used to meet the required RT60 values.

To achieve the early reflections, the ceiling is made up of reflective panels covered by the thin fabric, thus not losing the embracing feeling of the room while still being fully functional. The heavy draperies on the angled walls are drawn to the sides to enhance the early reflections, and not get too much absorption of higher frequencies. To achieve varying acoustical properties depending on needs, the walls can be covered with more or less drapery, which can either hang straight or be pleated, for different absorption coefficients.

The orchestra pit is designed to optimize acoustics and flexibility. The overhang allows for sound reflectors and absorbers. It also includes movable panels to vary pit size for different ensemble sizes, with a maximum of 15 musicians including a drum kit booth and a grand piano. The pit is accessed through the elevator in the staff area. It is equipped with a removable solid pit railing to reduce sound level in the front rows. Two loudspeakers are placed to distribute sound evenly and minimize interference.

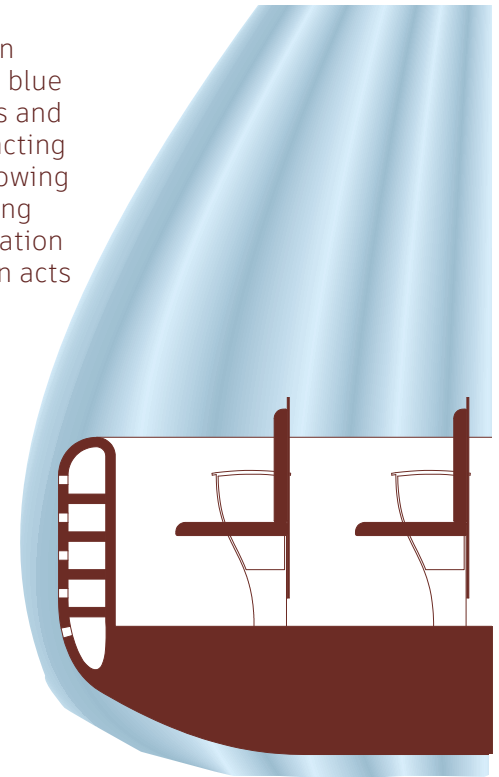




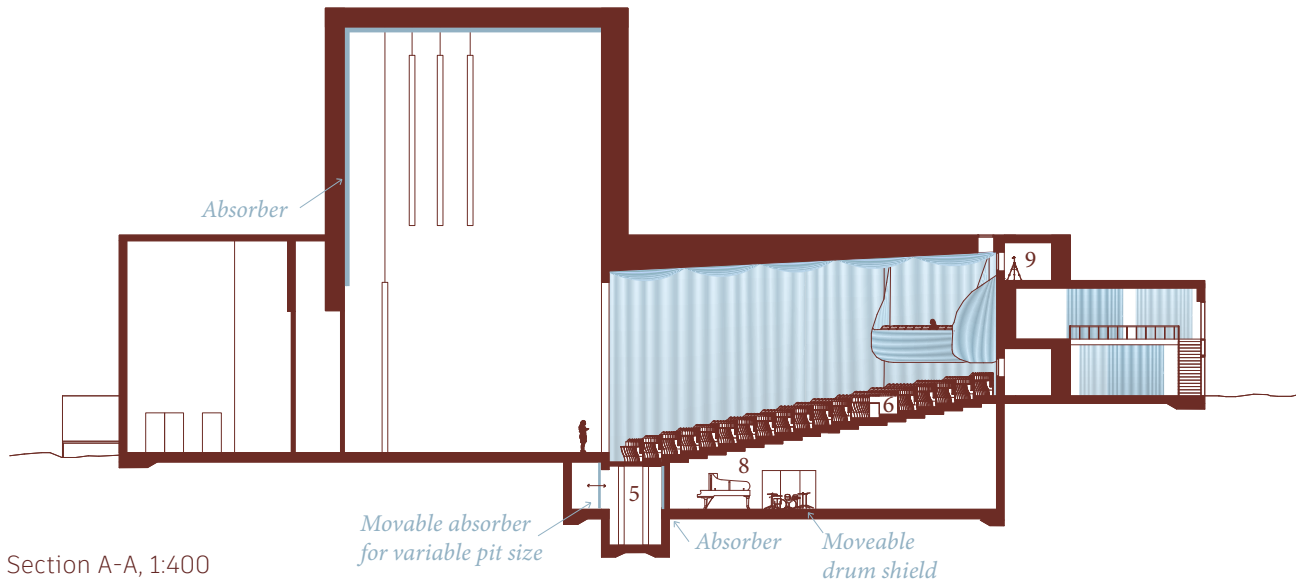
- 3 tungt tyg, ombre 300
- 1 tunnt tyg, airy
- 9 träskiva hemholtz resonator
- 100 mineralull
- 12 träskiva
- 120 isolering
- 195 luftspalt
- 70 isolering
- fuktspär
- 195 isolering
- 12 gipsskiva
- 22 luftspalt
- 15 invändig träpanel

HELMHOLTZ BALCONIES

The balconies fitting up to 18 people seem to be hanging in the fabric that drapes the wall of the theatre hall. The thin blue drapes conceal both the bearing structure of the balconies and acoustic details. The railings of the balconies are hollow, acting as Helmholtz resonators for low frequency absorption, allowing the sound to travel through holes in the panel without being interrupted by the thin fabric. The detail also shows ventilation outlets on the floor, giving the hall a lively feeling between acts as the curtains move from the breeze.



Väggsnitt [mm]



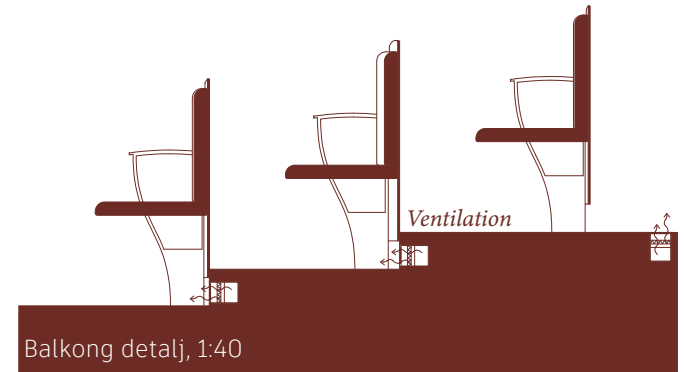
Section A-A, 1:400

Absorber

Movable absorber for variable pit size

Absorber

Moveable drum shield



Balkong detalj, 1:40

Ventilation



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The fashion center Copenhagen makes a perfect home for this fabric centered building. Using recycled fabric from the neighboring city Malmo and locally produced wood for the framework, the theatre becomes more sustainable.

LOBBY
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Movable fabric is used in the curtain windows, visible from both the park and the lobby, providing an ideal transition between city life and the calm of the theatre hall. It also improves the acoustic performance of the double lobby windows by absorbing sound in the cavity between panes. As the space closest to traffic, the lobby's walls are engineered for noise reduction, with acoustically detailed windows and solid facade elements achieving R'_w 21, 31, 42, 31, 21, 41 dB across 125-4000 Hz, meeting the NC30 noise criterion for the lobby.

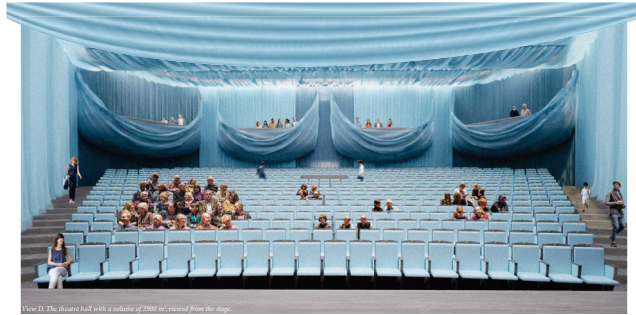
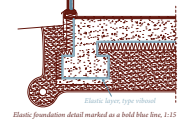
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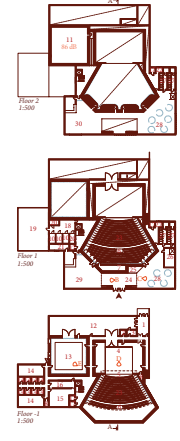
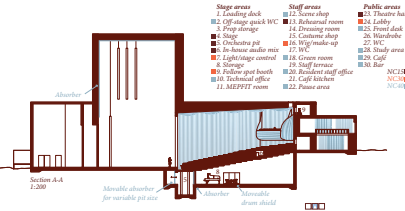
DRAPERY THEATRE

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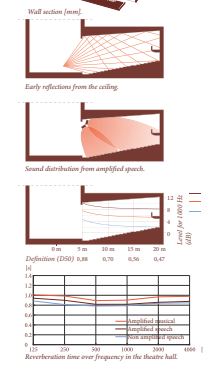
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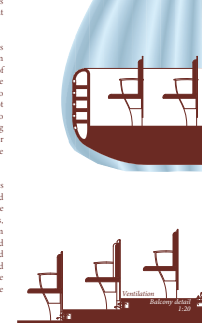
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Reflektion

Ridåteatern bär på flera arkitektoniska kvaliteter som jag är särskilt stolt över. Framför allt upplevelsen av tyget, dess rörelse, färg och ljudabsorberande egenskaper, som får vara en aktiv del av rummet. Genom att arbeta med både det synliga och det akustiska uttrycket skapade vi ett rum där stämning, funktion och arkitektur vävs samman. Den gradvisa övergången från det urbana landskapet utanför till den omslutande teatersalen skapar en poetisk sekvens som förstärker publikens förväntan.

Processen var också starkt präglad av iteration. Våra två koncept, tyg som rumsligt element och ett sätt att bemöta publikens förväntningar, testades, byggdes om och förfinades flera gånger. Genom skisser, modeller och diskussioner med våra handledare formades till slut ett projekt där varje teknisk lösning bar på en akustisk och arkitektonisk idé.

Projektet hade också en tydlig hållbarhetsprofil, genom att använda återbrukat tyg från Malmö och lokalt producerat trä till stomme och fasad. Materialen berättar en lokal historia om nordisk textiltradition och hållbart skogsbruk, vilket skapar en byggnad som är förankrad i sin geografiska och kulturella kontext. På så sätt blev hållbarhet inte bara ett tillägg, utan en bärande del av gestaltningen.

Ett av projektets mest givande aspekter var det täta samarbetet mellan arkitektur och akustik. Det var första gången jag arbetade så integrerat med en annan teknisk disciplin, och det blev snabbt tydligt hur viktiga dessa samarbeten är. Vår akustikstudent var en aktiv del av hela processen, från idé till teknisk detalj. Det kändes som att arbeta i ett riktigt kontor snarare än ett studentprojekt, vilket var en erfarenhet som var både lärorik och inspirerande. Att förstå rummets ljudmässiga kvaliteter som en lika viktig del som dess visuella form har förändrat mitt sätt att tänka som arkitekt och de många discipliner som vävs samman för att skapa en fungerande byggnad.

När jag blickar tillbaka på mina tre år på Arkitektur och teknik känner jag att det här projektet sammanfattar mycket av det jag lärt mig. Utbildningen har gett mig en stark grund i både teknik och gestaltning, och har väckt min nyfikenhet för hur de två kan samverka. Det har varit ett stort steg i rätt riktning.

Till hösten planerar jag att påbörja min master i arkitektur här i Göteborg. På sikt vill jag arbeta som arkitekt, kanske på ett kontor här i Göteborg eller starta ett eget, där teknik, rumslighet och hållbarhet får mötas i varje projekt. Målet är att fortsätta utvecklas i den riktning som Ridåteatern pekade ut.