

Montreal Opera

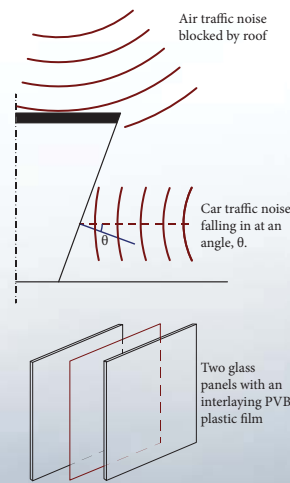
Montreal University Opera, housed inside of a swiveling facade of wood and glass.

Giving the students a wonderful place to practice and hone their skills, as well as being a place for gatherings of sorts, art exhibitions, dinings and more.

ACOUSTICAL CONSIDERATIONS

The key to effectively blocking out noise is mass, heavier construction means less sound transmitted. The most problematic area of the building is therefore the glass façade, where mass is not an option. It is also the most exposed façade of the building, facing the busy intersection of Rue Peel and Rue Saint-Jacques. The problem is coped with partly by the sheer form of the façade. By the outward tilting the façade is fully shielded from the direct air traffic noise by the heavier, and thus better sound isolating, roof construction. The tilting of the surface will also make noise from traffic on the ground approach the façade at an angle which will contribute to reflecting the sound rather than transmitting it into the building.

Apart from the façade shape the glass is constructed to minimize sound transmission. Two glass sheets are laminated together with an interlayer of polyvinyl butyral (PVB) plastic. Approximate STC rating: 34.



Maximum background noise levels

	NC	dB(A)
Auditorium	20	25
Green room	30	35
Rehearsal room	25	30
Individual rehearsal rooms	30	35
Dressing rooms	30	35
Shops	40	40

Surrounding noise levels

	dB(A)
Airplane traffic	60
Car traffic	60
Train traffic	50

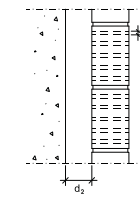


SECTION A-A

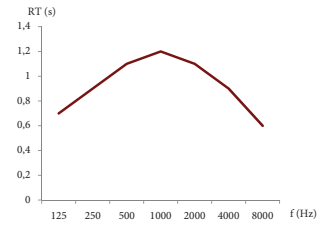




LOBBY NOISE CONTROL

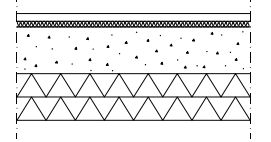


Hollow bricks integrated in lobby walls work as Helmholtz resonators and contribute to lowering the noise level and reverberation time in the lobby.
The hole size, d_1 , and distance from back wall, d_2 , varies to get diverse resonance frequencies and gain absorption over a wider range of frequencies.



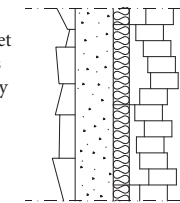
A glass-wool quilt reduces the impact sound of steps in the lobby.

50 mm wooden floor
25 mm glasswool quilt
300 mm concrete slab
300 mm insulation

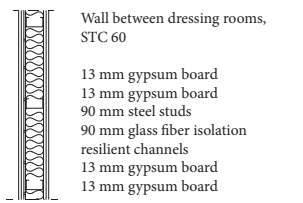


ASSORTED WALL DETAILS

Details to the right are examples of solutions to meet the rooms NC requirements and to assure the possibility of simultaneous activities in different parts of the complex.

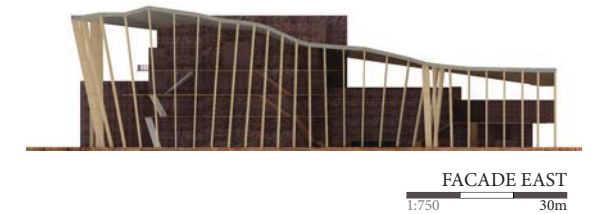
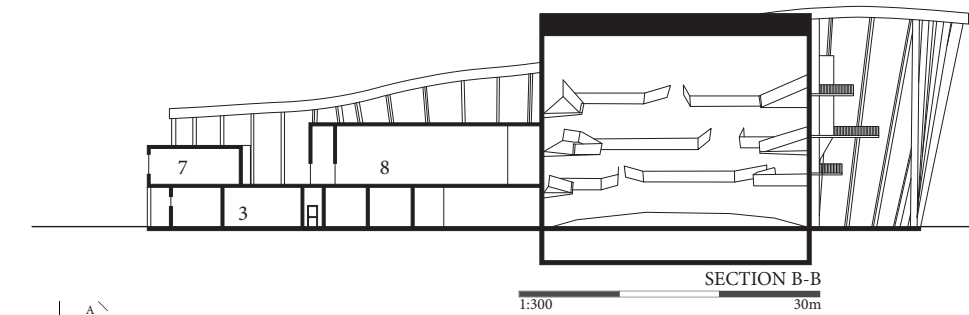
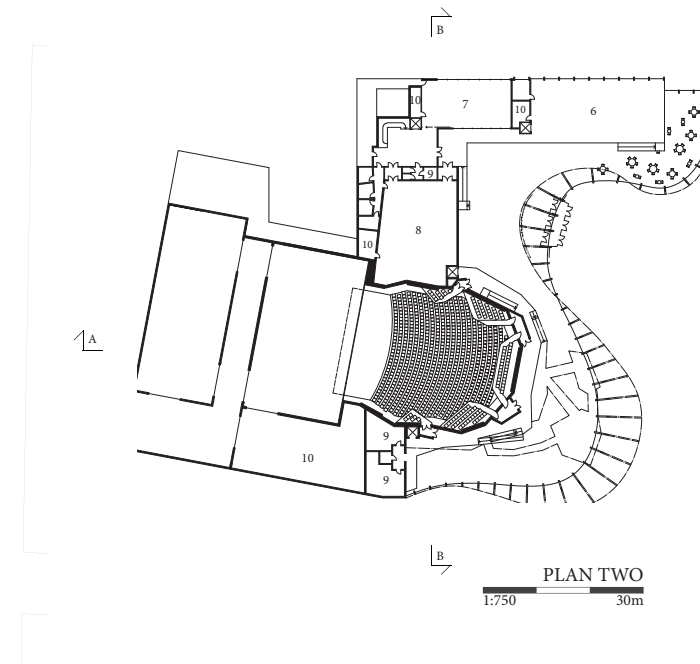
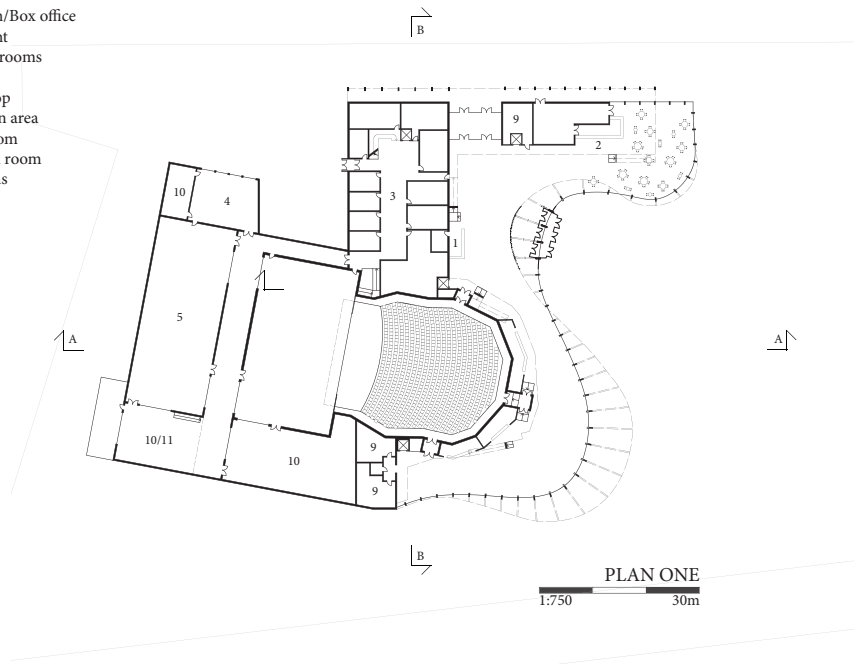


Wall between rehearsal room and auditorium, STC 75
Diffusive wooden panel
190 mm concrete
90 mm insulation
Air gap
Diffusive brick wall



Wall between dressing rooms, STC 60
13 mm gypsum board
13 mm gypsum board
90 mm steel studs
90 mm glass fiber isolation resilient channels
13 mm gypsum board
13 mm gypsum board

1. Reception/Box office
2. Restaurant
3. Dressing rooms
4. Wig shop
5. Scene shop
6. Exhibition area
7. Green room
8. Rehearsal room
9. Restrooms
10. Storage
11. MER



THE LOBBY

Entering through the glass facade, you come into a plaza that nests the lobby together along with its two main areas. The first main area is the area around the opera hall, and the other is an exhibition area connected to a restaurant.

The exhibition deck is intended for small galleries, poetry readings, music performances etc. The deck can also be used for banquets and other festivities.

Underneath is a cafeteria/restaurant with its tables spread around in a veck created by the facade. The facades inwards tilt wraps the area in, resulting in making it somewhat distanced from activities in the lobby.

A system of decks and stairs makes for the entrance to the auditorium balconies seats.

The plaza provides an easy and elegant access to the green room and rehearsal area.

REHEARSAL AND GREEN ROOM AREA

The area is connected to both the lobby and the performers dressing rooms.

The rehearsal room has a high ceiling, stretching other the adjacent solo rehearsal rooms, which gives space for letting sunlight in.

For relaxation in between of the rehearsals, the green room is situated close by.

The rehearsal room is weaved together with both the performers areas and the lobby's exhibition area. The connection lobby makes the room useful for a variety of occasions such as lectures, workshops and public events.

REHEARSAL ROOM ACOUSTICS

Angled walls in both large rehearsal room and small ones prevents flutter echo.

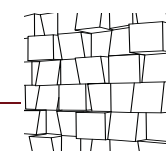


Windows for daylight and mirrors for dance practice

Heavy drapery (800 g/m²) for flexible absorption and for possibility to cover mirrors and windows.

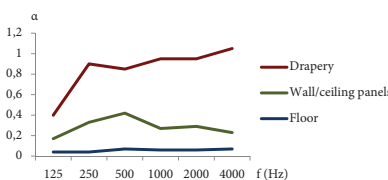
Spacious storage for musical instruments, risers etc.

Sound locks prevents disturbing noise from corridor and lobby during practise.



Diffusive wooden wall and ceiling panels.

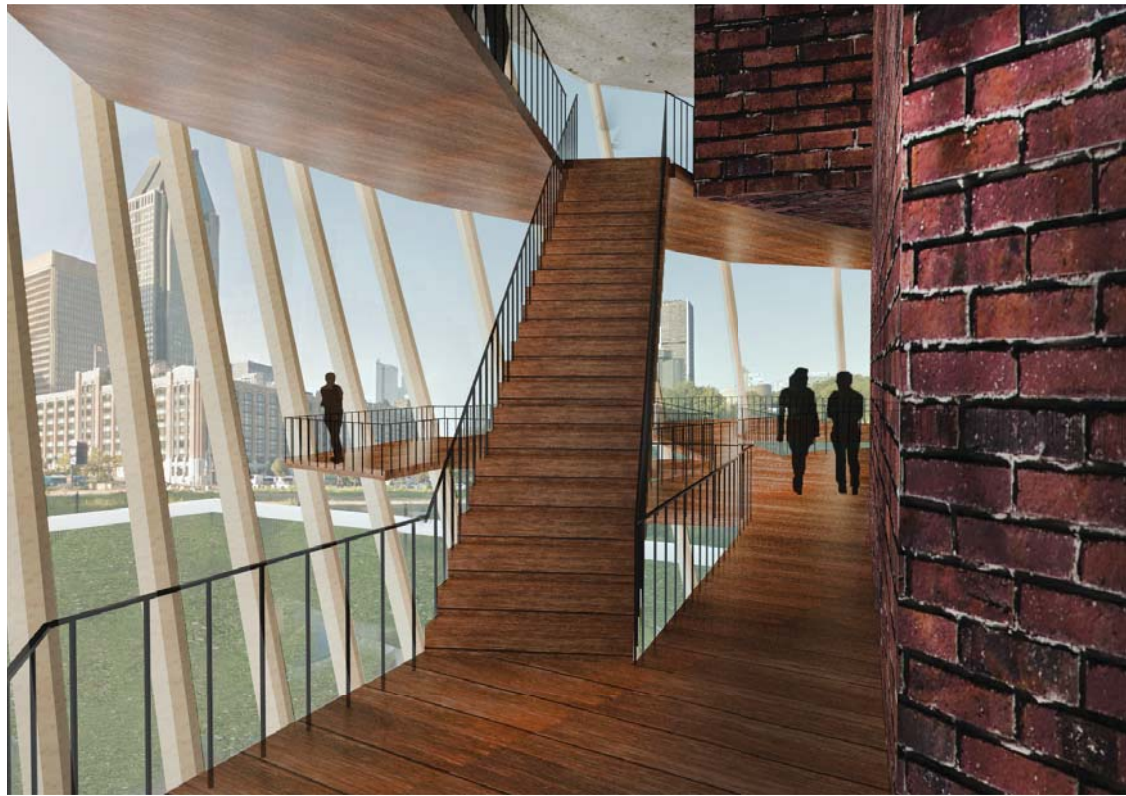
Mobile choral risers with different constellation abilities for maximum flexibility.



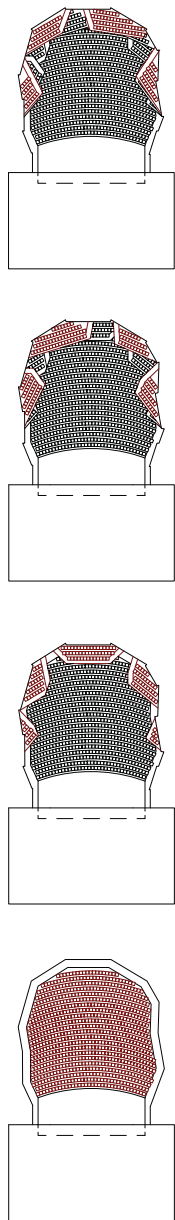
Approximate calculations by Sabine's formula indicates a reverberation time in the rehearsal room around 0,9-1,0 s. These calculations are based on absorption coefficients as shown beside, with the drapery fully evolved and a room volume of 1620 m³.

Desired RT is around 0,4-0,6 s, but then one should notice that the calculations were done without regard to people occupying the room.



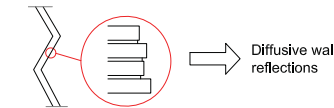


AUDITORIUM



WALLS

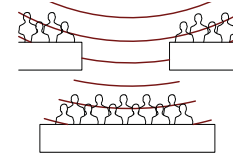
In order to create a diffusive sound the auditorium walls are unevenly tiled, creating both local and global irregularities for wide frequency range scattering.



BALCONIES

The balconies are broken up into smaller boxes and scattered along the auditorium walls. This constellation allows the seats to be straightened up towards the stage, resulting in better visual contact with performers on stage.

From an acoustical point of view the broken up balconies enable sound reflections from the ceiling to reach down to lower balcony levels through the gaps.



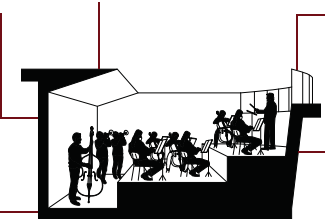
ORCHESTRA PIT

The rear wall of the pit (and some of the side walls' area) is equipped with reversible panels to enable either absorption or reflection depending on performance type and situation in the pit. E.g. one might want to place absorbers near loud instruments, such as brass and percussion, to control their level without diminishing the sound from other instruments.

The underside of the stage overhang is slightly slanted to direct the sound out of the area and to prevent flutter echo.

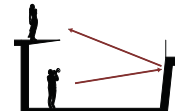
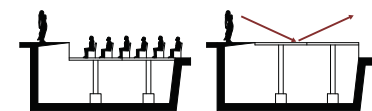
The pit railing is solid to provide the stage and pit with useful reflections for better communication between singers and orchestra as well as to reduce the high level of direct sound for the audience in the front rows. The railing is removable to make room for more seats when pit floor is raised if more seats are required.

The pit floor is hydraulically adjustable in height to enable more audience seats or a larger stage (when orchestra pit is not needed). When heighten to stage level the pit floor will act as a reflector producing nice early reflections. The pit floor can also be used as a lift for e.g. grand pianos.

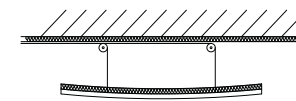


Unlike the back wall, the front wall have no absorbers but is instead equipped with diffusers to create a homogenous sound picture and get a uniform early-to-late energy ratio in the pit.

The front wall of the pit is also slanted to prevent flutter echo and contribute to better communication between singers and orchestra.



FLEXIBLE CEILING PANELS



The auditorium ceiling is covered with lowerable panels to enable different sound properties for different types of performances. Every panel is individually adjustable in height and incline, with pre-programmed dispositions for opera and concert.

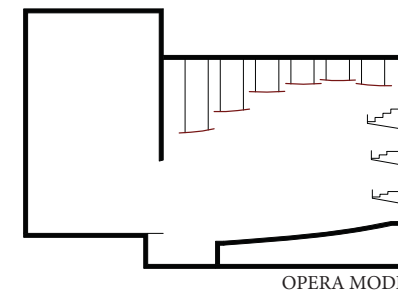
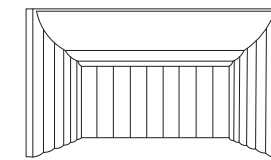
With the panels lowered one will gain earlier reflections and therefore higher clarity. The clarity is important for the song and its lyrics to be heard. The lowered panels will also contribute to shorter reverberation time as the volume of the hall 'shrinks'.

Sound finding its way up in the space between ceiling and panels will be absorbed by the absorbing surfaces in the ceiling and on the upper side of the panels.

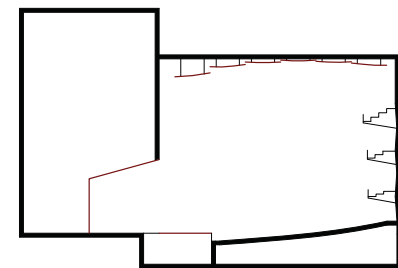
With the panels in their high position one will get later reflections and longer reverberation time.

ORCHESTRA SHELL

An orchestra shell is provided (from e.g. Wenger) for use during concert to close out the stage tower and direct the sound towards the audience.

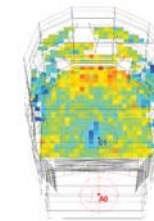


OPERA MODE

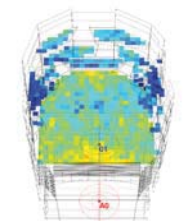


CONCERT MODE

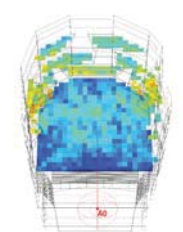
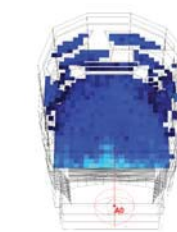
OPERA MODE



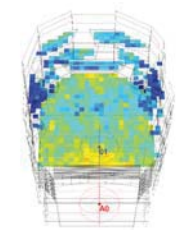
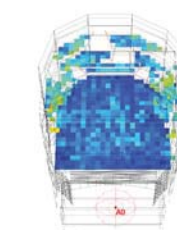
CONCERT MODE



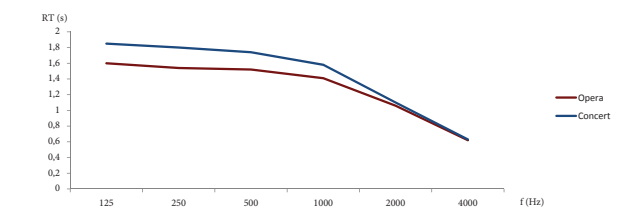
CLARITY, C₈₀



STRENGTH,



REVERBERATION TIME, s



MONTREAL OPERA

Kandidatprojekt

Kurs: ARKX01

Lärare: Morten Lund och Mendel Kleiner

Gruppmedlemmar: Johan Berggren
Samuel Hofverberg
Daniel Norgren

Uppgiften var att utforma ett operahus för en musikskola.
Skolan ligger alldeles intill tomten för projektet.

Byggnaden skulle rymma:

- Lobby
- Operasal
- Övningsrum
- Omklädningsrum
- Verkstad
- Green room

Operasalen skulle ha en bra ljudbild.

Reflektion

Det slutgiltiga resultatet har mycket kvar av många tidiga idéer. En tidig idé var att först börja med form och sedan göra hus av den. Så vi laborerade med lutande och svepande.

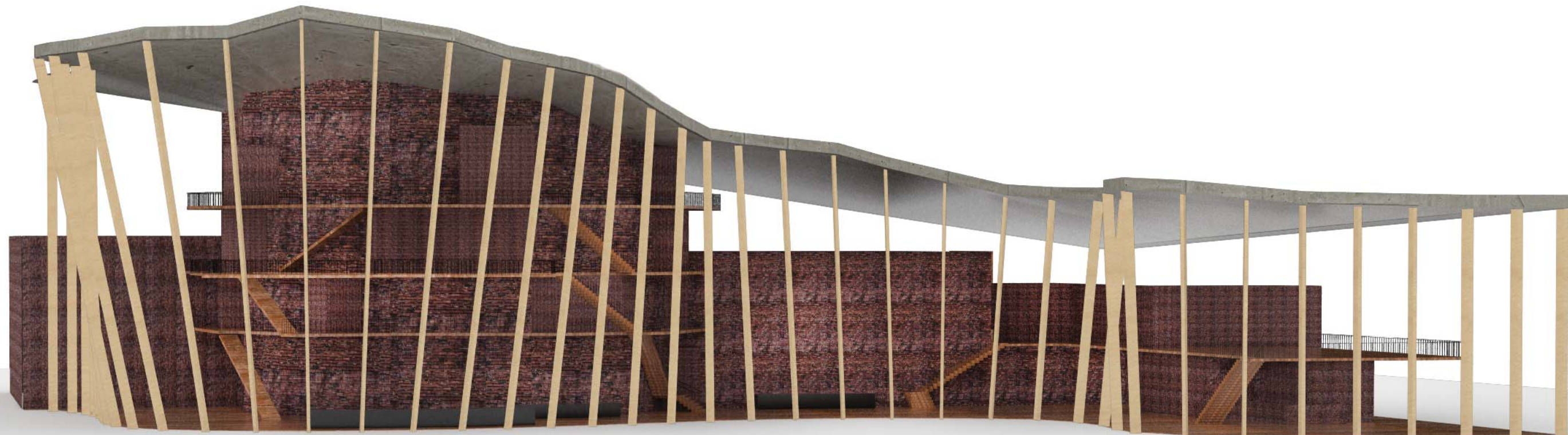
Jag är nöjd med hur det yttrar sig i det färdiga förslaget. Jag tycker lutningarna ger ett fint stöd åt foajéns rumsligheter.

Det fanns också idéer som det inte blev något av, som att ha en huvudentré och en bearbetad uteplats. Vi ville placera huvudentrén i den svepande fasaden, men det var svårt och vi gav upp och tänkte "det löser sig". Och uteplatsen lades till högen "om vi hinner".

Jag är nöjd med repetitionsalens och greenroomets koppling till foajén. Överlag känns den ändan av foajén rätt så färdig.

Mindre färdig blev den norra delen av foajén, utan förblev något av en ändtarm. Tankar fanns om något uppehållsrumsliknande men de konkretiserades bara delvis (genom balkong och trappsystemet)

Avslutningsvis, operasalen tycker jag blev fin.

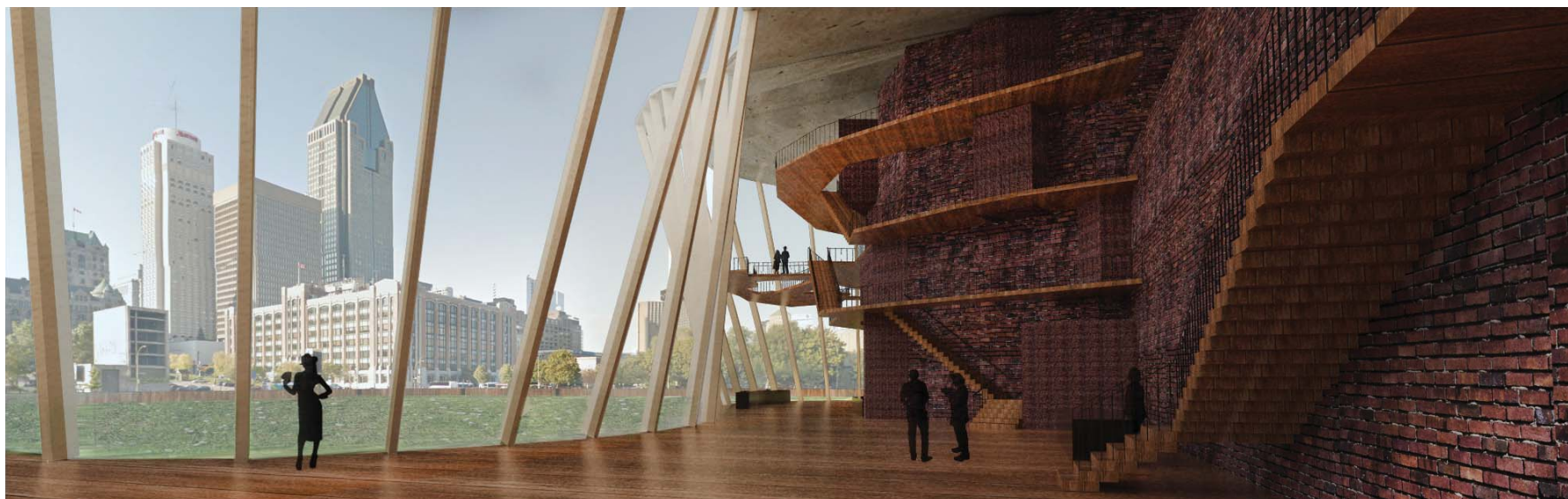
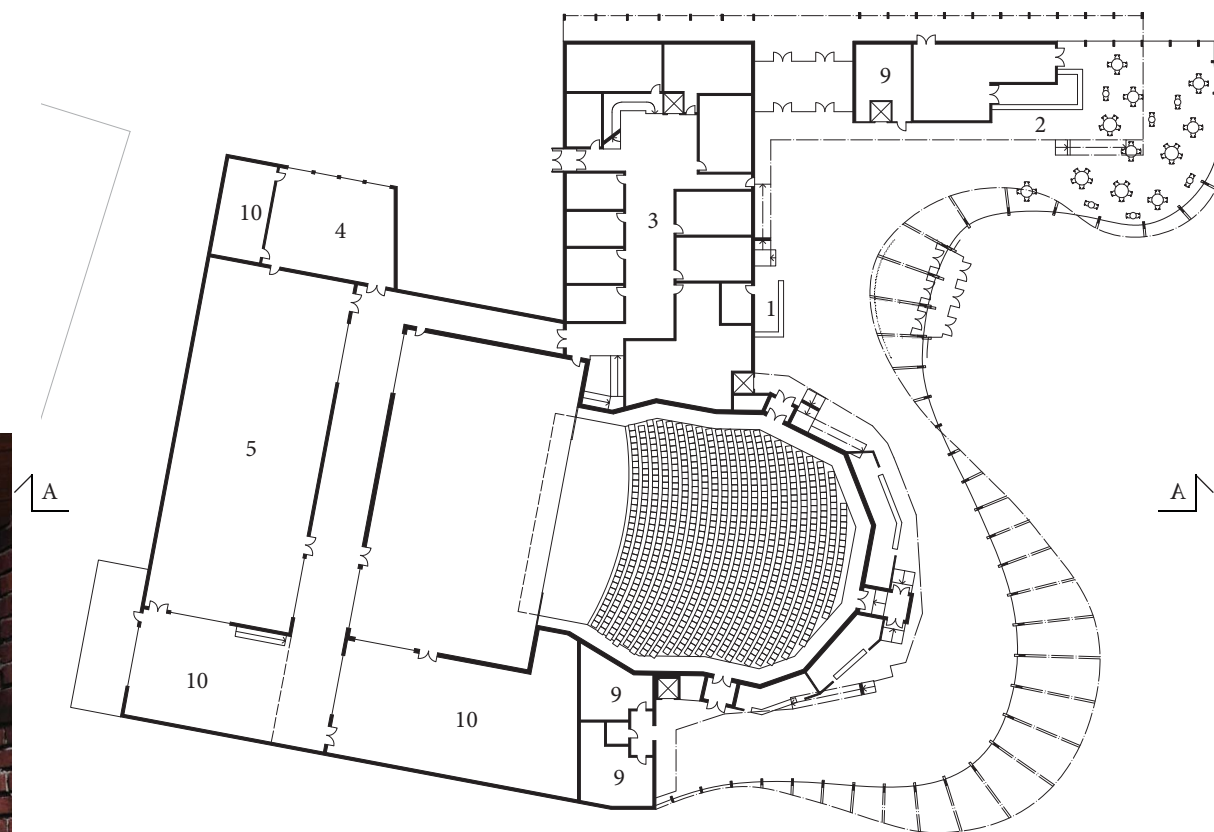


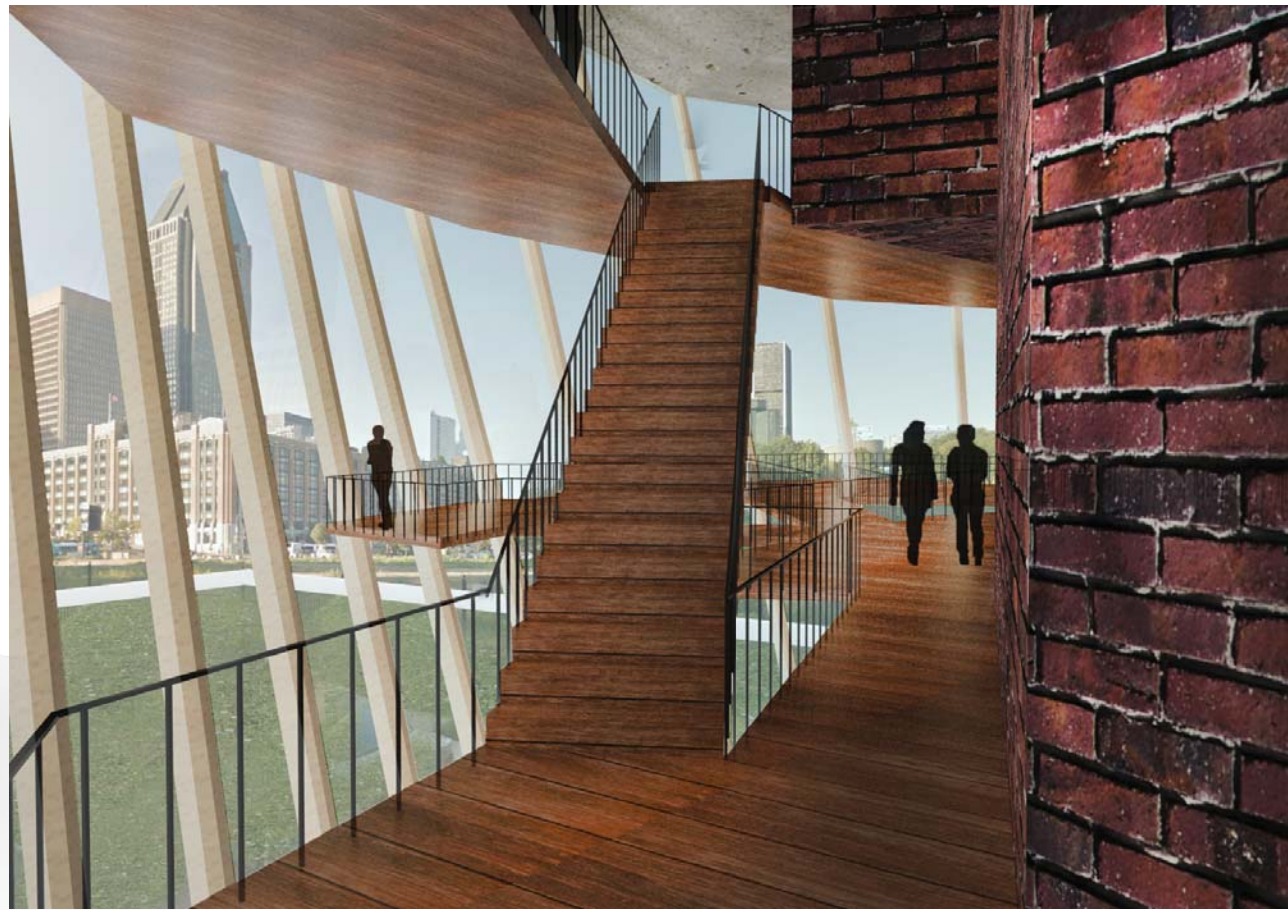
Välkommen in i operahuset. Lobbyn är utformad för att göra operabesöket angenämt, och är även till för besökare som är där för att se på utställningar, äta eller kanske gå på föredrag.

Utställningsdelen är ihopkopplad med en resaturang och operahusets övningssal. Övningssalen kan öppnas för föredrag av olika slag. Även greenroomet kan göras tillgängligt för publika ändamål.

Innan föreställningen kan du koppla av i restaraungdelen, se på utställningar eller ta dig direkt upp till balkongerna utanför operasalen. Balkongerna är stora så det finns gott om plats för att så väl slå sig ner och se på utsikten som för att låta alla runt omkring flöda upp för trapporna, längs balkongerna och in i operasalen.

Operahuset är även utformat med operaeleverna i åtanke: Omklädningsrummen är nära både scenen och övnings-salen.





Operabesöket

Det är festligt att gå på opera, och operahuset vill ära upplevelsen du får av elevernas framtranände. Byggnaden signeras av en glasfasad som slingrar sig runt lobbyn. Slingrandet markeras av fasadens lutningar.

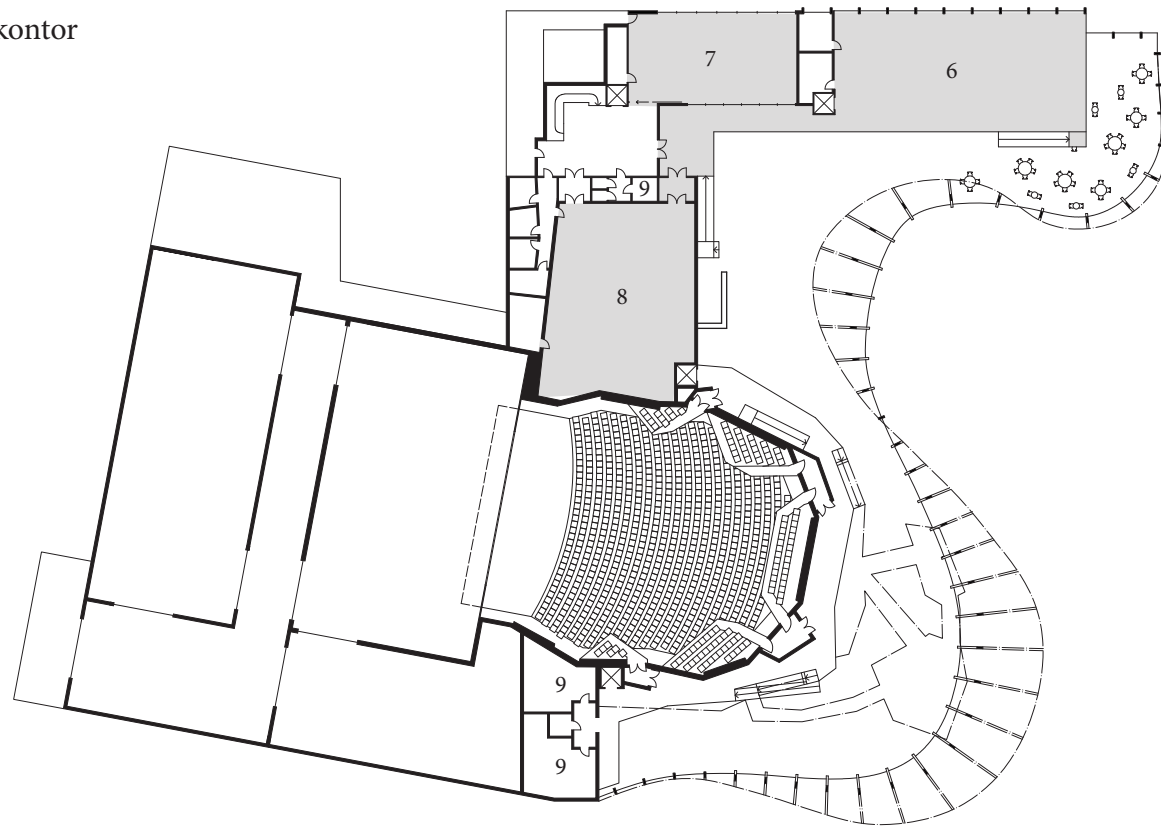
Operasalen omringas av väl tilltagna balkonger. De är utformade för att ge en spännande promenad upp till din stol inne i operasalen och även för att kunna rymma dig och de andra besökarna i pauserna.

Plats för aktiviteter

I lobbyn finns en stor utställningsyta. Utställningsytan kan användas för framträdanden, mingel eller som extra serveringsyta för restaurangen.

Utställningsytan är också en del av operahusets aktivitetsområde: Tillsammans med övningsalen, greenroomet och restaurangen är operahuset väl anpassat för många slags tillställningar. Övningsalen har dörrar ut mot utställningsytan, så aktiviteter så som föredrag ges enkelt en social klang.

1. Reception/Biljettkontor
2. Restaurang
3. Omklädning
4. Perukeri
5. Verkstad
6. Utställningsyta
7. Green room
8. Övningsrum
9. Toalett
10. Förråd



Plan +1

1:750 30m



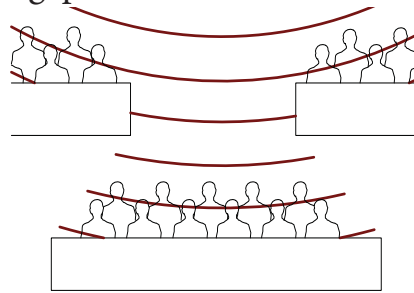




Uppbrutna balkonger

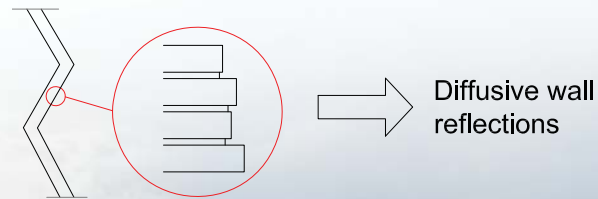
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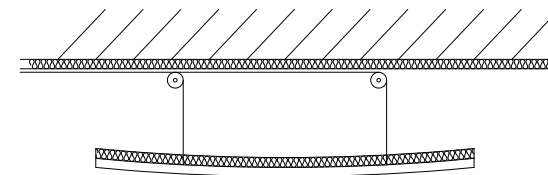


Lutande väggar

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Höj- och sänkbara takpaneler



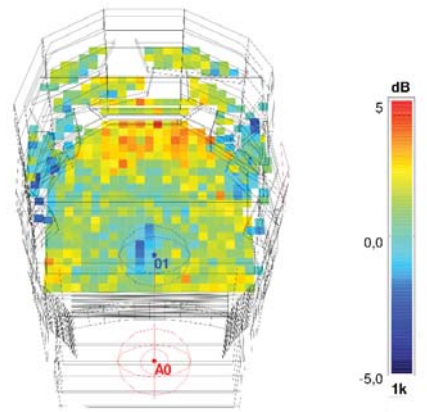
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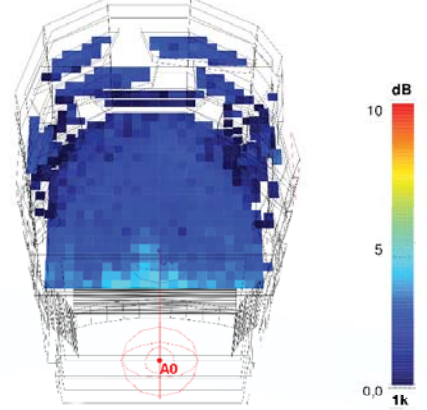
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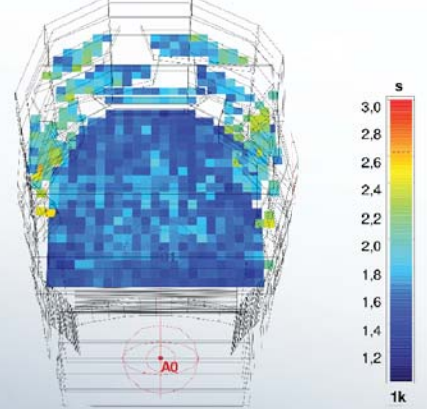
Klarhet, C80

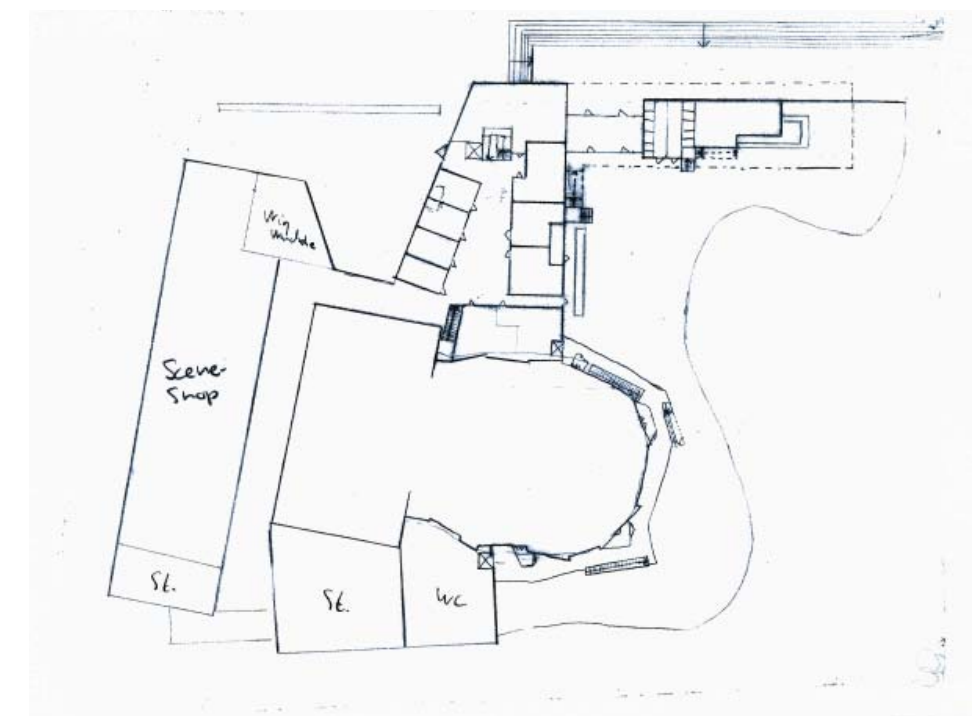
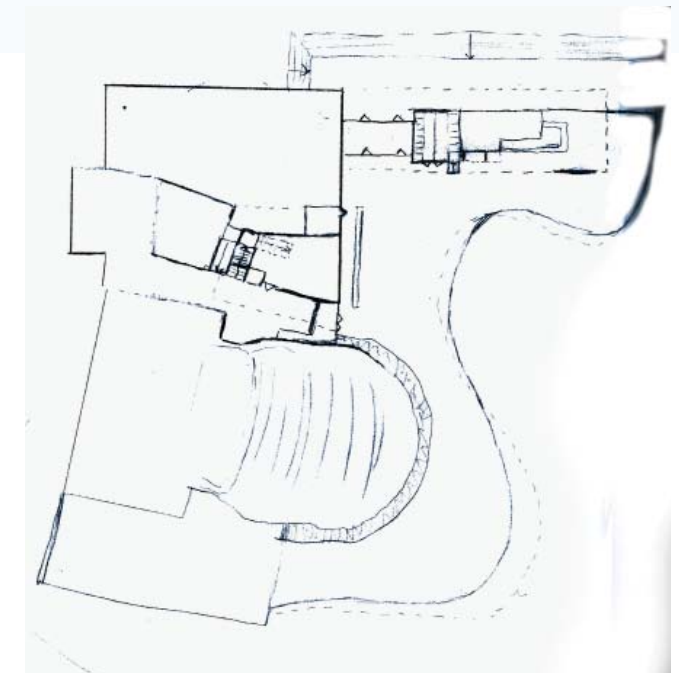
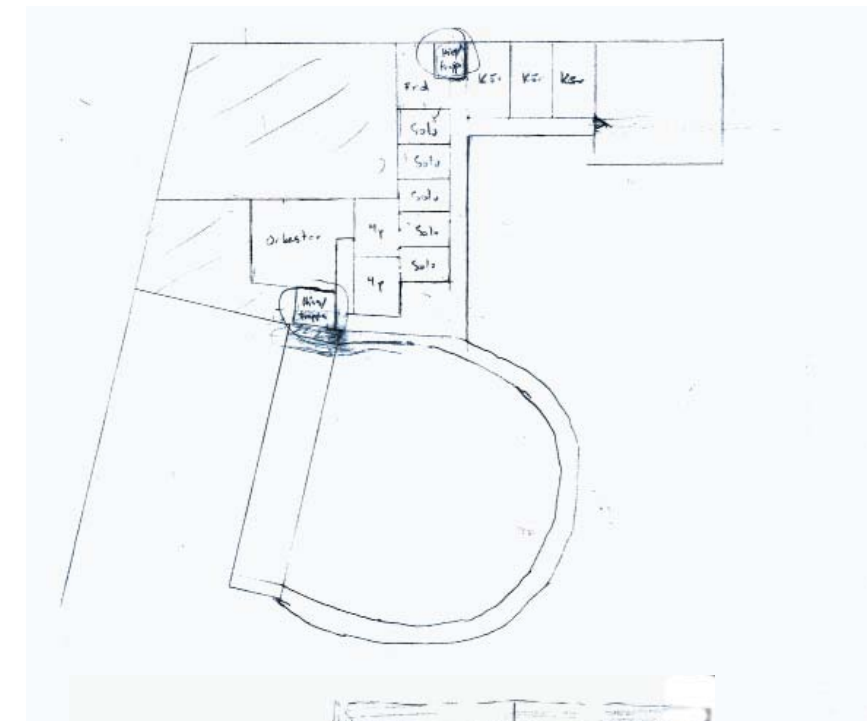


Ljudstyrka, dB(A)



Efterklangstid, s





Reflektion procesen - Arbetet med baksidan

Foajéns utformning styrde över resten av huset, och det var svårt att få in verkstad, omklädning osv i byggnaden på ett meningsfullt sätt.

Vi arbetade med många olika planer, där vi försökte få in allt som skulle rymmas i byggnaden. Dock var vi inte nöjda med hur omklädning och övningsalen hamnade i förhållande till foajén.

Slutligen prioriterade vi upp omklädning, övningsal och green-room på bekostnad av en sammanhållen baksida.