



ozawa fields

a landscape shaped by sound

ACEX16 Bachelor project in Architecture and Engineering
Chalmers University of Technology

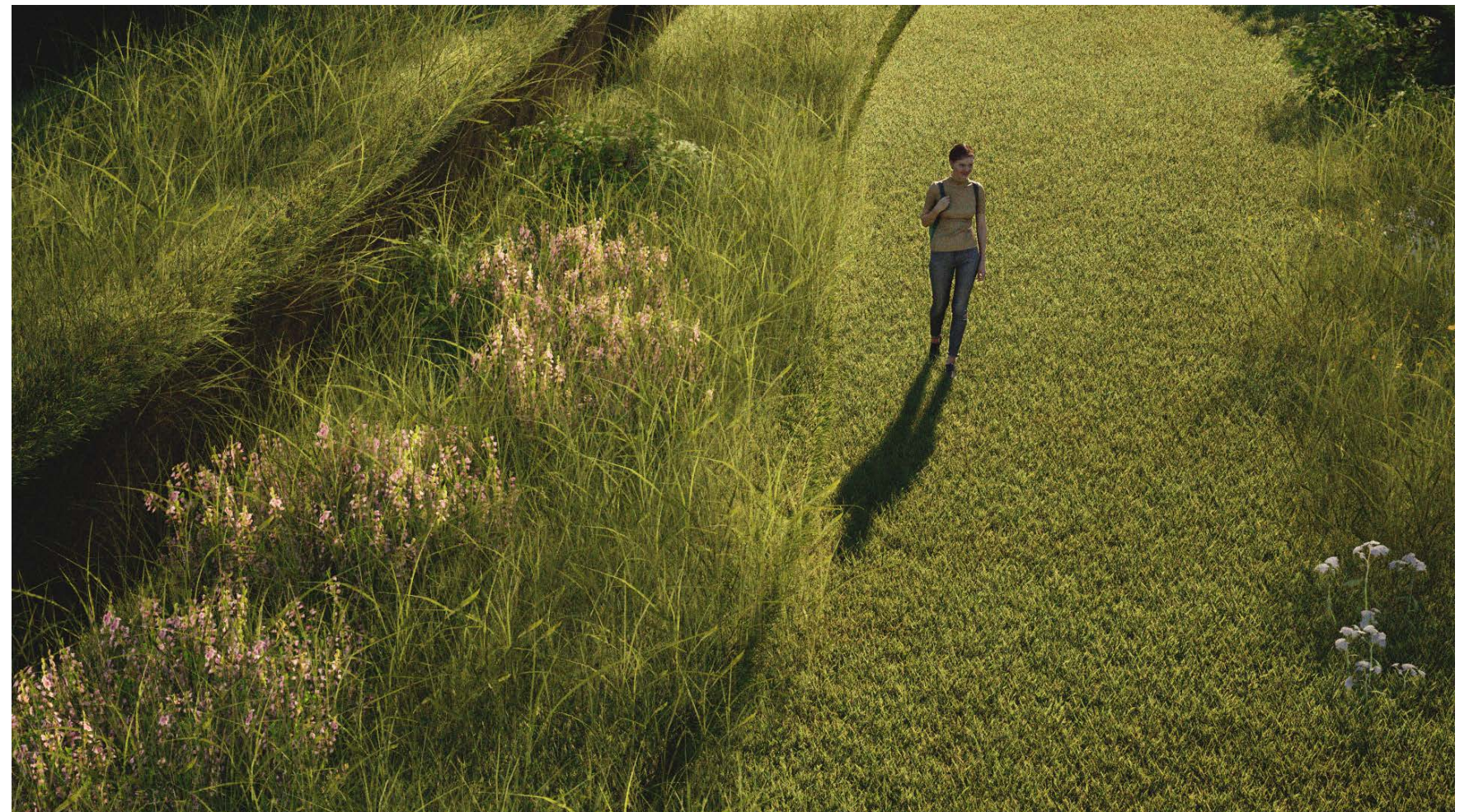
Alma Reinholds
May 2026

introduction

The bachelor project is based on the competition brief for the annual Student Design Competition organised by the Acoustical Society of America and funded by the Newman Student Award Fund. The competition is aimed at students in Architecture, Engineering, Physics, and other related fields with an interest in *acoustical design*.

The design scenario for 2026 involved creating an outdoor music venue intended to serve as a summer home for an orchestra. The venue was designed to accommodate an audience of 13,000 people, including both covered seating and lawn areas. The venue was also intended to host a variety of performances, ranging from orchestral concerts to rock performances.

The project was carried out in collaboration with students from both Architecture and Engineering, as well as master's students in Sound and Vibration. *Ozawa Fields* was developed together with my project partner Rebecka Thor and acoustician Tomas Johansson Ågren.





the proposal

Ozawa Fields is a lush park located near Boston and the Connecticut River, hosting an **outdoor concert venue** for the **Boston Symphony Orchestra** during summer. Named after the BSO's late musical director, the Japanese conductor **Seiji Ozawa**, the architecture draws inspiration from **Japanese rice fields** and **origami**. The design is driven by acoustic performance while also focusing heavily on creating a visually striking experience.

method

site analysis

The work began with an analysis of the site’s qualities and acoustic conditions in order to meet the competition’s requirements. Challenges were identified, and opportunities to create an architectural proposal that is both functional and exciting were explored. Movement, light, sound, and the desired spatial experience were analysed in relation to the surrounding environment. Noise levels, particularly from traffic, were studied and early strategies to lower these were discussed and tested. This analysis informed the placement, orientation, and level of the music venue.

concept

During the conceptual phase, sketching and model-making were used to explore and develop the venue and the site. A design language inspired by Japanese rice fields and origami began to emerge. A lot of focus was placed on the overall experience of the site, and not just the venue itself.

Japanese rice fields

The vision expanded beyond a music venue into a broader landscape experience. The design evolved into a lush garden with terraced hills. This language was extended into the architvecture of the music venue to create a cohesive relationship between the music venue and landscape.

Japanese origami

The stage was designed to meet acoustic demands through an innovative approach that replicates the qualities of an indoor performance space. The result is a folded, origami-inspired structure forming a continuous volume with sharply angled walls. The geometric language of origami is further reflected in the roof structure and architectural detailing throughout the project.

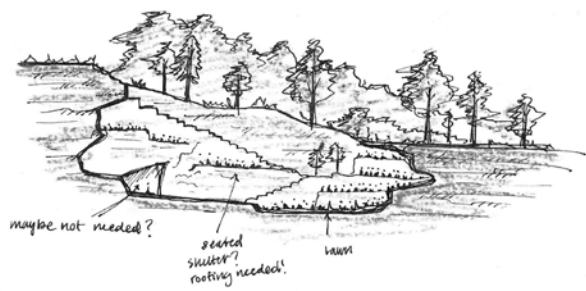
design process

iterations

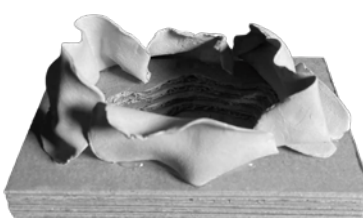
Throughout the project, an iterative design process has been used. It has allowed for ideas to develop into more concrete proposals. Different solutions were tested and adjusted to meet the competition requirements while maintaining our architectural vision.

The course was divided into six different phases, or iterations, which drove the project forward. The phases began with broader assignments aimed at increasing our understanding of acoustics and architecture, before gradually shifting focus toward our own projects. Each time an iteration was done, the outcome was a new, more fine-tuned version of the last one.

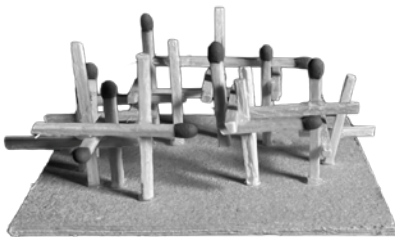
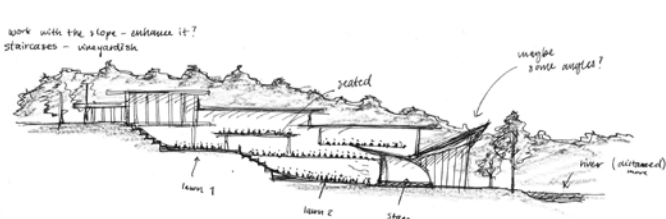
Below ground



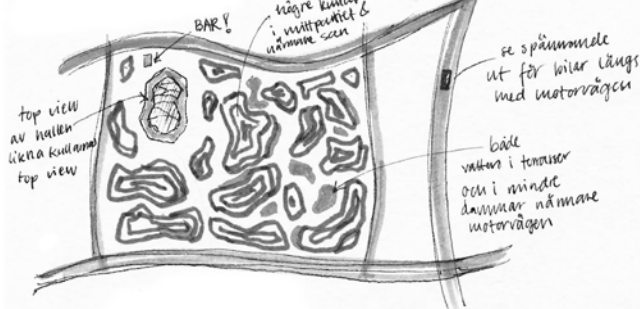
Partially below ground



Above ground



Landscape



early sketches

In the early iterations, we explored our architectural visions and focused on the atmosphere we wanted to create. From the beginning, our ambition was to integrate the landscape with the venue. We explored this through different approaches to how the building could relate to the ground level. The first three prototypes consisted of one venue entirely underground, one partially underground, and one entirely above ground. Hand sketching, clay modelling, and construction using various materials were all part of the early process.

As the project progressed, we decided on a concept in which the venue would be partially above and partially below ground level. Once this concept had been established, additional landscape prototypes were developed. Clay was used to model the terraced hills that act as sound barriers.

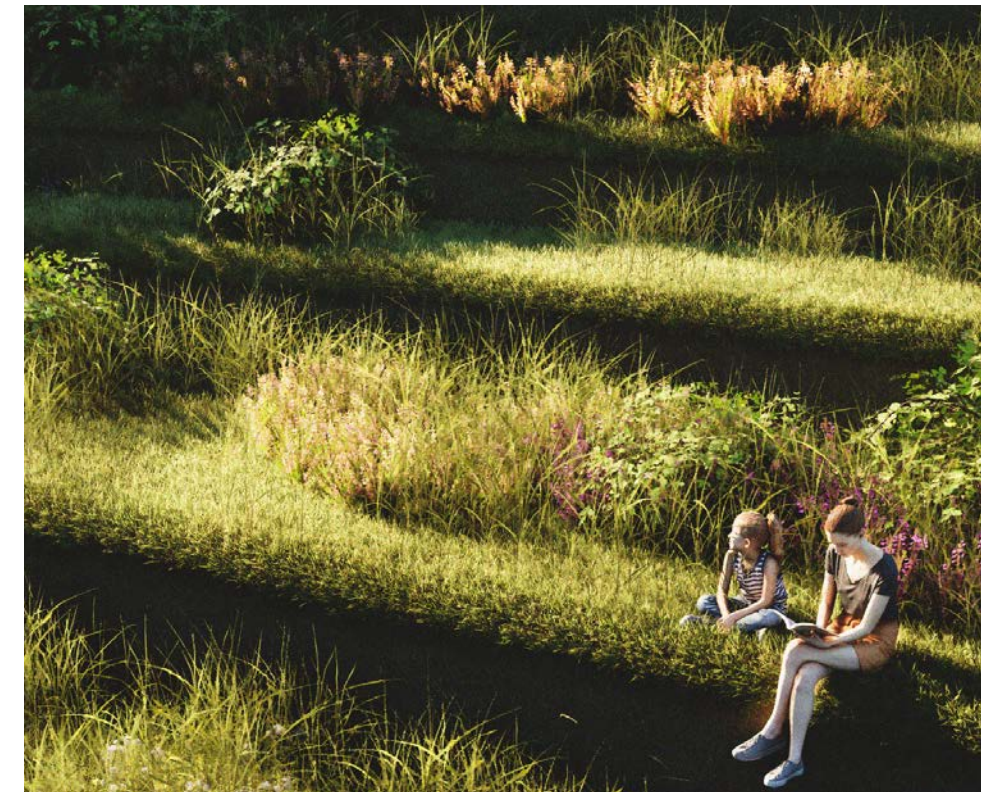


the landscape

a terraced park

The garden provides a public space where people, even if not attending a concert, can enjoy nature and planted greenery. Although thoughtfully designed, the greenery resembles a constructed wilderness that changes over time and with the seasons. It is not intended to be the same as it was yesterday.

The terraced fields are constructed according to traditional techniques, using packed earth, stones and gabions to provide stability at edges. Most of the terraces contain flowering vegetation while others are designed as seating areas and pathways. This creates a spatial experience that evokes curiosity, in which visitors move through the park and gradually discover new views and spatial qualities. The terraces are also designed to manage water through concealed channels that, together with the ponds, form an integrated stormwater system. This system additionally functions as irrigation, supplying the vegetation with the necessary amount of water.



site plan and orientation

To handle the noise coming from the surrounding roads, the venue is situated in the western part of the site. This moves the venue as far as possible from the Interstate, while keeping some distance towards the residential area. The shielding is achieved by sinking the venue into the ground and using the excavated soil to form the terraced hills across the park. In the southwestern part of the site, the stage is oriented to the north to avoid direct sunlight, creating stable conditions for both the orchestra and their instruments. This orientation directs sound away from the residential area and helps to minimize disturbance during performances. The placement further protects the residential area by elevating the Back-of-House area above ground level, forming a physical barrier that limits sound propagation near its source. The elevated building also provides access to daylight for the staff.

an absorbing landscape

The characteristic, vertical terraces in the hills are created using gabions. These steps serve a dual purpose as they help tie the park to its namesake, but also increase the efficiency of the berm, giving a higher insertion loss compared to a regular berm. Tree belts and lush vegetation supply further reduction. They also help to keep the soil permeable and sound absorbing; tree trunks add damping, and tree canopies reduce downward wind propagation.

The achieved insertion loss gives sufficiently low noise levels at the venue and at the residential area. At the venue the noise from the highway is still audible (below NC-30) and in this way underlining the urban setting of the venue.

circulation and flows

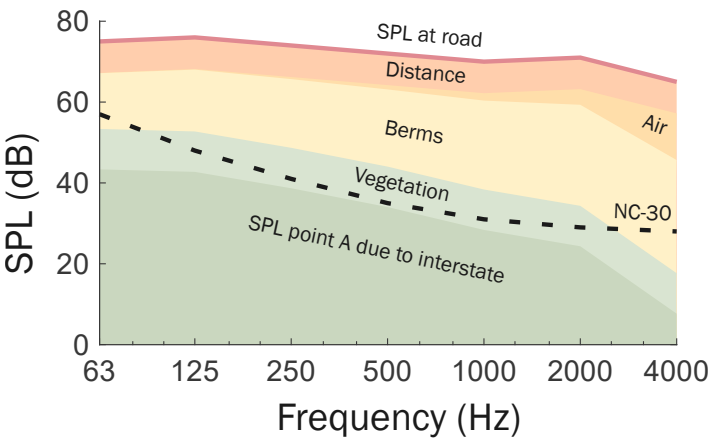
The flows between the staff and audience are clearly separated. The audience accesses the venue from the parking area on the other side of the river. From there, visitors cross a bridge and can either proceed directly to the venue along the river or move through the lush park. Staff access is located on the opposite side, in a concealed part of the site, via two separate roads leading to an open service area connected to the loading dock. This zone, reserved exclusively for performers and staff, ensures efficient logistics.

Section A-A

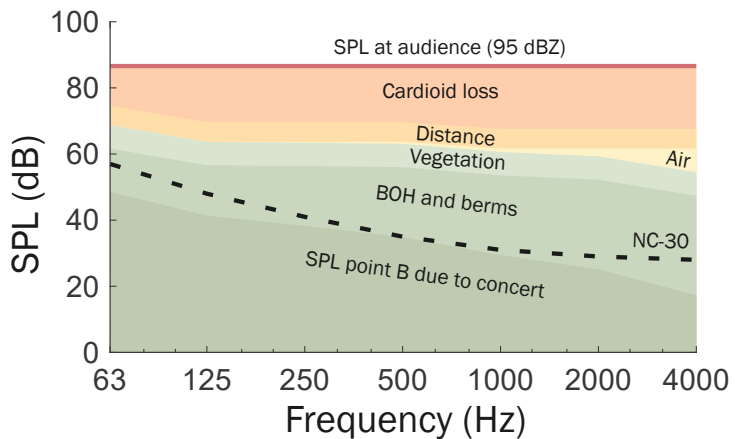


sound pressure levels

SPL point A



SPL point B





plantings

The planted vegetation is selected for ecological sustainability and low maintenance. Flower species that thrive in the area year-round, such as New England Aster, Swamp Milkweed and Joe-Pye Weed, are planted throughout the park. The fields are also used to grow berries and herbs that supply local produce for the cocktail bars and food stalls connected to the concert venue.

Trees provide a green backbone for the park while also acting as sound absorbers, muffling the noise from the surrounding areas. Tree species native to Boston are used, such as Red Oak, White Oak and Red Maple. To further enhance the lushness, both decorative and wild grasses grow across the terraced hills.

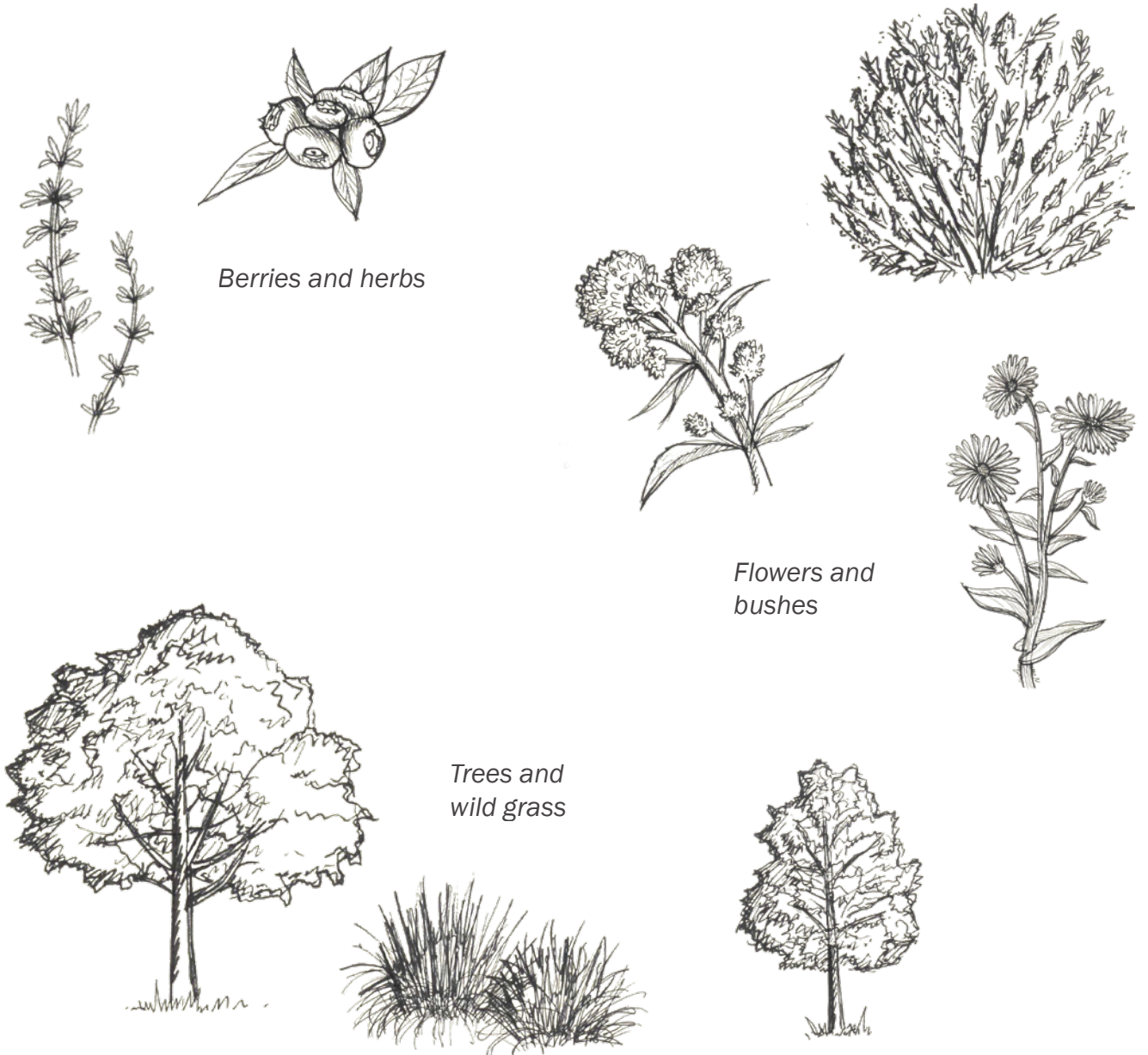
sustainability

Water management

The project embraces sustainability through an integrated water management system in the terraced landscape, where stormwater is collected, guided, and retained on site. Concealed channels lead water between levels and into ponds, reducing runoff while preventing flooding. This system not only handles technical demands but also becomes part of the spatial experience, where water elements enhance the atmosphere of the park. At the same time, the stored water is reused for irrigation, supporting a resource-efficient and self-sustaining environment.

Foliage

Vegetation plays a central role in strengthening both ecological and spatial qualities. The lush planting strategy promotes biodiversity by creating habitats for pollinators such as bees and other insects, while contributing to a richer, more dynamic landscape. Planting is carefully distributed across the terraces to provide seasonal variation, shade, and microclimatic regulation.



the concert venue

seated areas

The design language of the park extends into the sunken music venue through a series of terraces that gradually lead down to the lowest point, where the stage and standing area is located. The venue accommodates 13 000 visitors, with approximately 6 500 seated, including 3 000 covered seats.

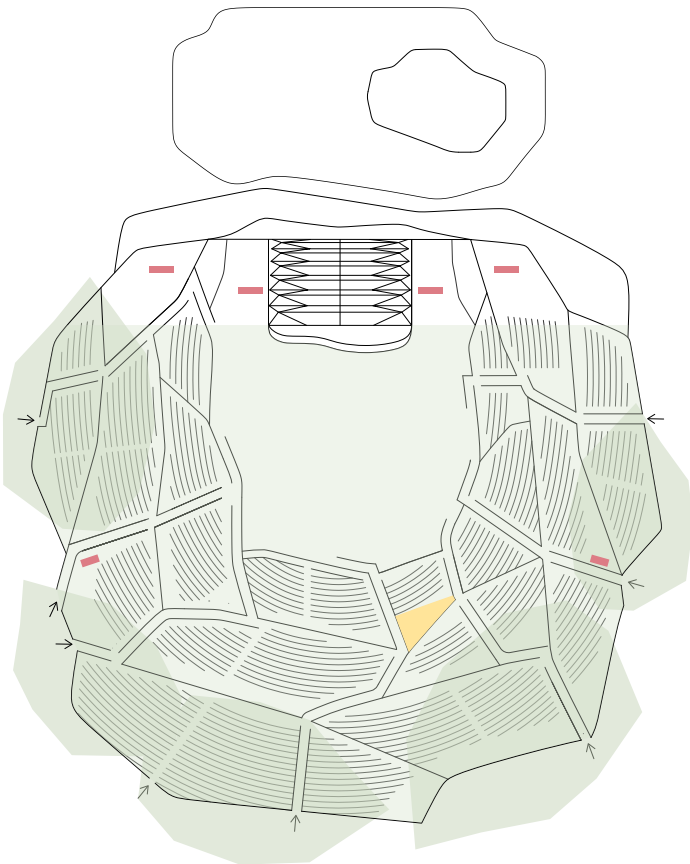
The terracing is organized across three levels, with access from different entrances depending on the ticket type. The upper terrace levels are equipped with a roof, designed to preserve clear sightlines while concealing larger speakers, which enhance the acoustic experience for more distant audiences. These terraces are also fully accessible, with elevators distributed throughout the upper terraces to accommodate visitors with reduced mobility.

Eight entrances lead down to the various seating areas on the terraces, as well as to the standing area at the lowest level. The stairs leading to assigned seatings are located along the sides of the terraces to avoid obstructing sightlines and to maximize seating capacity. They connect the terraces vertically and emerge at the front of each level, from where movement toward the seating continues via a series of flatter stairs. The largest staircases extend all the way down to the standing area in front of the stage.



surface treatment

The surrounding areas along the terracing are designed to absorb as much sound as possible, while electroacoustic systems are used to enhance and control sound levels. Scattering- and absorption strategies are employed to avoid strong reflections that could interfere with the electroacoustic system, while also reducing sound transmission toward the residential area. The seating is formed using gabions, where the gravel provides mid- to high-frequency scattering and low-frequency absorption. In standing areas, absorption is increased by incorporating porous absorbers within the gravel. Vertical surfaces are clad with thick porous absorbers and a rough weathering steel structure that provides additional scattering and supports climbing vegetation.



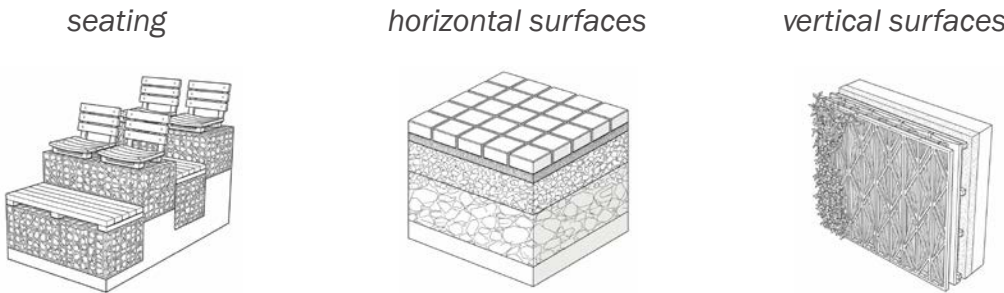
capacity

Orchestra performances
Total of 8277 seated, with 6777 on terraces (3127 under roof) and 1500 stall seats.

Touring acts
Total of 13077, with 6777 seated on terraces and 6300 standing.

electro acoustics

To minimize disturbance, highly directional cardioid arrays are used as the primary speakers, housed in towers with acoustically transparent frames that match the surrounding architecture. Two towers on each side of the stage ensure proper sound localization. Secondary delayed arrays are suspended within the roof structure to cover the rear of the venue, while a network of distributed speakers integrated into lighting poles provides even coverage across the audience area. A calibrated mix of signals from instruments, stage, chamber, and audience is used, with precise delays to satisfy the precedence effect. The aim is to create a soundscape that gives the audience a full acoustic experience.



roof constructions

The roof over the seated audience is an origami-inspired structure, referencing the Japanese art of folding paper with its light color and angled folds. It is formed by a light steel construction resembling branching trees, which supports a bright tensile fabric. This creates a sense of lightness and a distinct identity. The origami-inspired form reinforces the project's Japanese character and the natural qualities of the park, where precision, lightness, and material expression come together in an architectural whole.



back of house

Noise levels

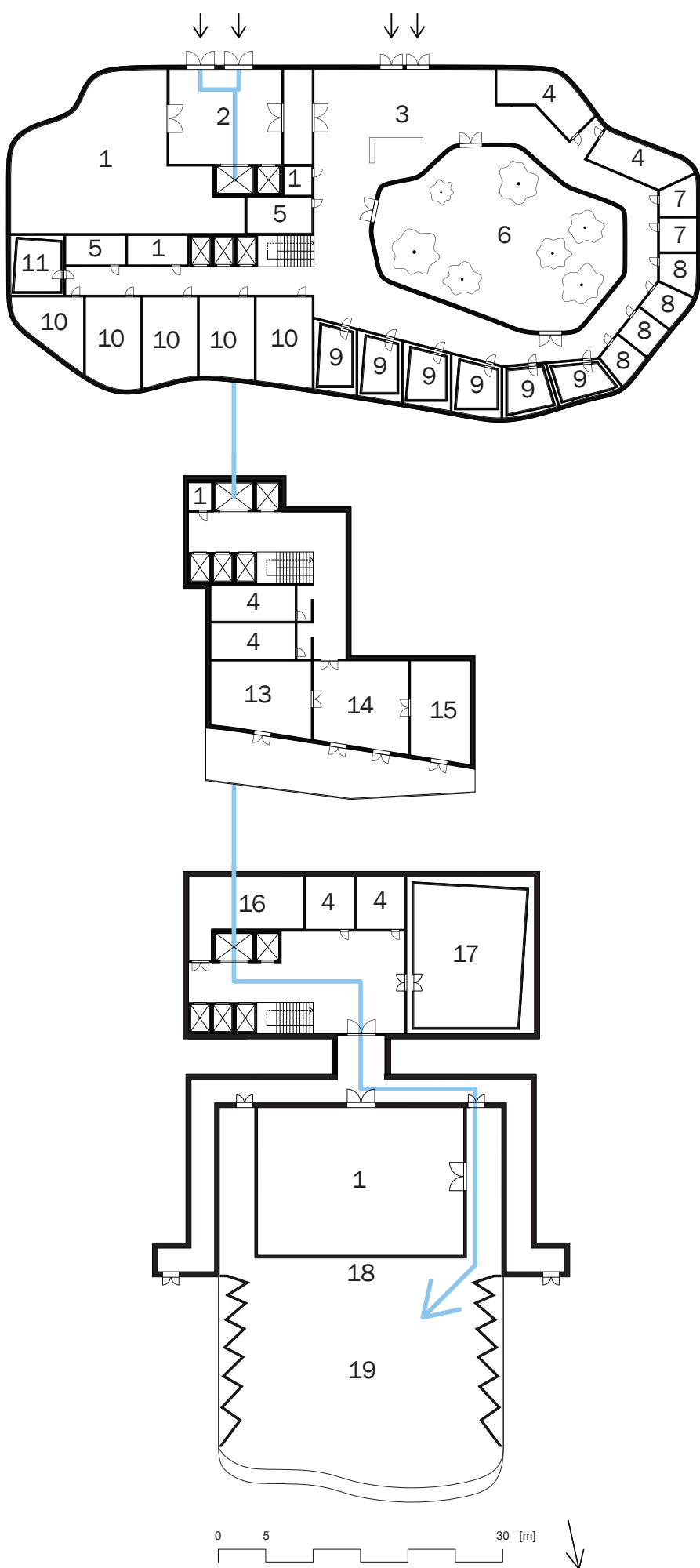
- NC - 40
- NC - 30
- NCB - 15
- Logistics

Small rehearsal rooms
Volume = approx. 50m³
Tmid=0.5 s

Large rehearsal room
Volume = 960 m³
Tmid = 1.2 s

Rooms [m²]

- | | |
|--------------------------------|-----|
| 1. Storage | 607 |
| 2. Loading dock | 119 |
| 3. Reception & lobby | 180 |
| 4. Restrooms | 187 |
| 5. Admin | 26 |
| 6. Atrium | 373 |
| 7. Office (touring staff, 2) | 28 |
| 8. Office (technical staff, 4) | 56 |
| 9. Solo dressing room (6) | 114 |
| 10. Locker room | 247 |
| 11. Star dressing room | 27 |
| 12. Cleaning center | 20 |
| 13. Green room | 80 |
| 14. Dining hall & lounge | 91 |
| 15. Kitchen | 65 |
| 16. MER | 76 |
| 17. Large rehearsal room | 133 |
| 18. Chamber | 299 |
| 19. Stage (under shell) | 468 |



floor plans

The Back-of-House areas are organized across three floors, one above ground and two below ground. The structure above ground has an organic shape, intended to remind of the surrounding hills.

entrance floor

The entrance floor, above ground, is directly connected to the loading dock, allowing instruments to be transported seamlessly from trucks into the building and onto a freight elevator that leads to the lowest floor, where the stage is located. A large storage area is also positioned adjacent to the loading dock.

The entrance floor also includes a spacious entrance with a reception and lounge area designed to welcome the orchestra. An atrium with a Japanese garden brings in natural daylight and creates a pleasant atmosphere for both staff and performers. This level also accommodates all offices and locker rooms, which are placed along the facades to ensure access to daylight. Dressing rooms are located on this floor, combined with rehearsal rooms, as required by the competition brief. These spaces are designed according to the box-in-box principle to isolate them from both airborne and structure-borne sound, ensuring appropriate acoustic conditions.

middle floor

The middle floor serves as a social floor where guests can meet the orchestra. This level is equipped with a kitchen connected to a lounge with a dining area, as well as a separate green room that functions as a meeting space. All of these rooms have direct access to an outdoor terrace overlooking the music venue.

lowest floor

The lowest floor is directly connected to the stage, which opens out toward the music venue. This level includes the chamber directly linked to the stage, with a large storage area located beneath it for props and related equipment. A mechanical equipment room is also located on this floor, near the elevator to create distance from the stage. In addition to the smaller rehearsal rooms on the upper level, this floor contains a larger rehearsal room designed for full ensemble practice.



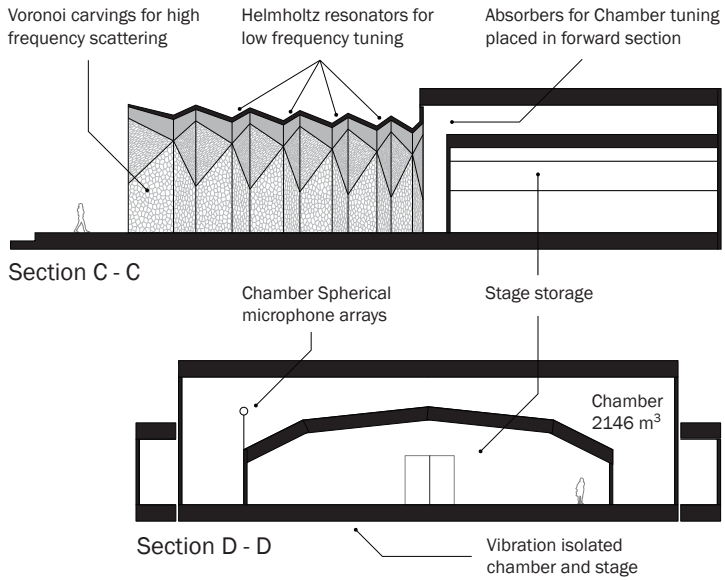
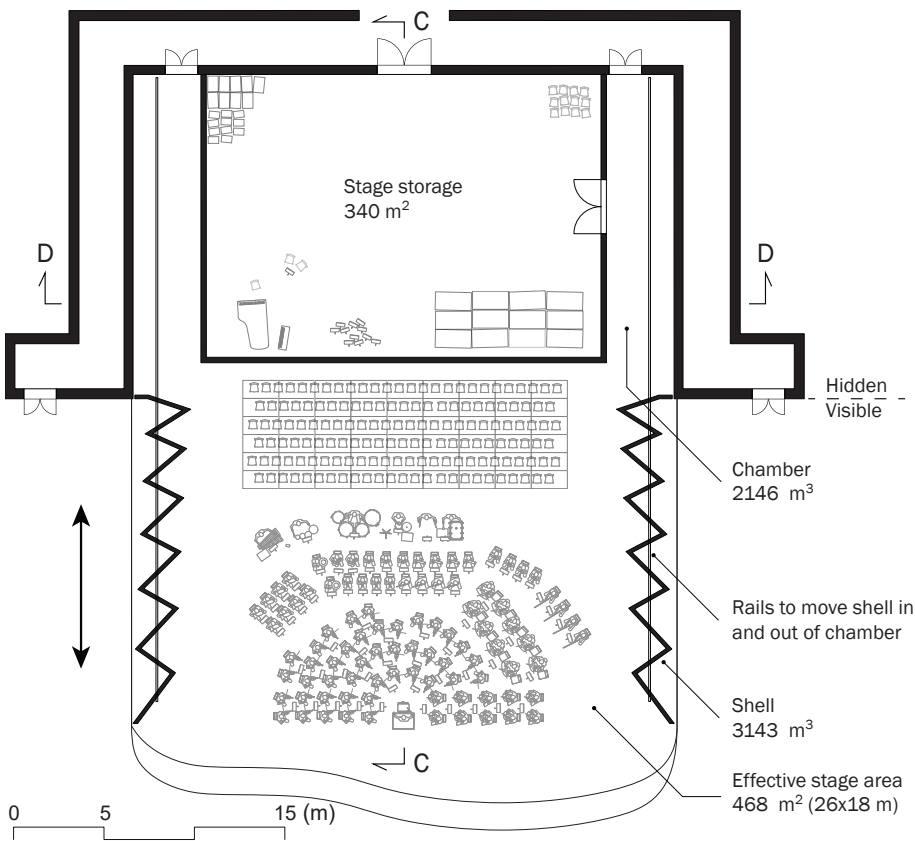
the stage design

a hidden concert hall

The heart of the venue is the stage, designed around the idea of a “hidden concert hall”, where musicians experience the acoustics of a full-scale concert hall without it being visible to the audience. This is achieved through a concealed acoustic chamber coupled directly to the stage, enabling an outdoor performance to attain the richness and spatial qualities of an indoor hall.

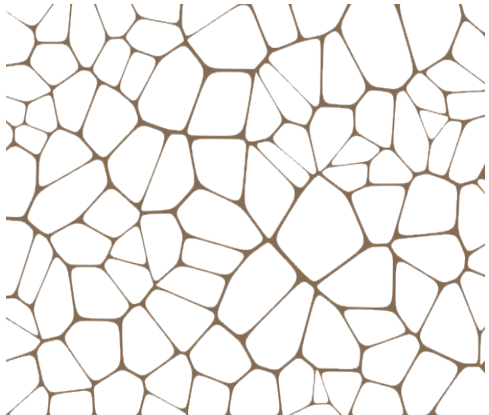
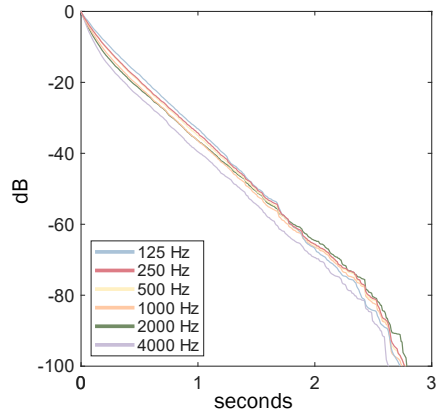
structure and room acoustics

The stage is formed as a continuous CLT volume, where walls and roof are shaped by folded planes inspired by origami. This sculptural geometry integrates function and expression, creating a dynamic space that frames the musicians while generating early sound reflections. This is designed to support internal ensemble hearing without the need for amplification. Directly connected to the stage is a 2146 m³ concrete chamber. Through carefully calibrated volume, coupling and absorption, the two elements act acoustically as a single room, as evidenced by smooth energy decay curves. Although the chamber contains no audience, it provides musicians with an acoustic response equivalent to that of a traditional concert hall.

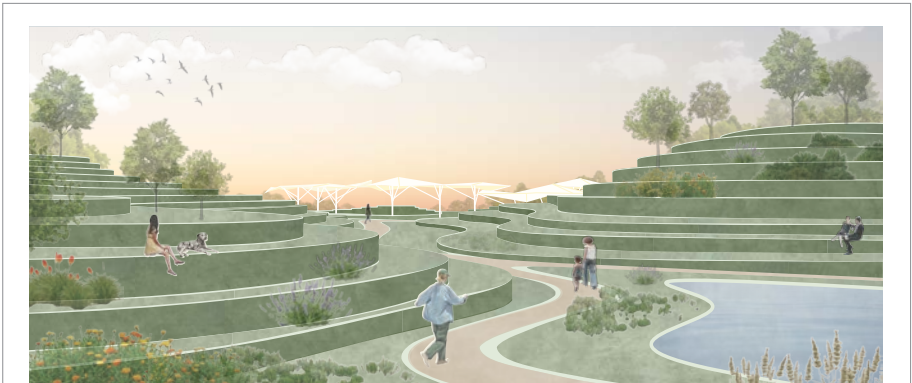


(Hz)	125	250	500	1000	2000	4000
T30 - Full 5289 m ³ (s)	1.84	1.79	1.75	1.69	1.71	1.64
C80 - Full 5289 m ³ (dB)	0.14	0.89	1.02	1.77	2.31	3.5
T30 - Reduced 3523 m ³ (s)	1.45	1.44	1.42	1.40	1.45	1.34
C80 - Reduced 3523 m ³ (dB)	2.08	3.01	3.13	4.09	4.81	6.27

The orchestra shell is adjustable, and when not in use it can be retracted and stored within the chamber. This allows flexibility for touring productions to create custom stage setups and enables the shell to be reduced in size to accommodate smaller ensembles or alternative performance types. The shell is acoustically tuned with Helmholtz resonators for low-frequency absorption and Voronoi carvings for high-frequency scattering. Its origami-inspired geometry provides structural depth while producing directed early reflections. The design also integrates stage lighting within its folds, reinforcing the architectural expression.



competition boards



ozawa fields

proposal

Boston Symphony Orchestra is looking to build an additional outdoor venue, as a complement to Symphony Hall and Tanglewood. The inspiration for the proposal comes from the recently passed, renowned Japanese conductor, Seiji Ozawa, the musical director that led BSO for 29 years. Drawing inspiration from Japanese rice fields and origami, the proposal merges parts of Japanese and American culture into a lush garden acting as venue for classical music.

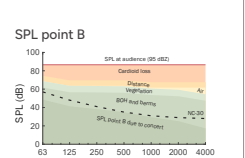
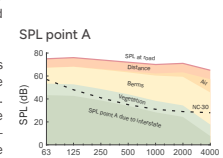
shielding is created by digging the entire venue down into the ground and using the soil to create the rice field inspired hills that make up the park. To further help protect the residential area, the Back of House is raised above ground level to create a high barrier, close to the sound source.

The characteristic, vertical terraces in the hills are created using gabions. These steps serve a dual purpose as they help tie the park to its namesake, but also increase the efficiency of the berm, giving a higher insertion loss compared to a regular berm. Tree belts and lush vegetation supply further reduction. They also help to keep the soil permeable and sound absorbing; tree trunks add damping, and tree canopies reduce downward wind propagation.

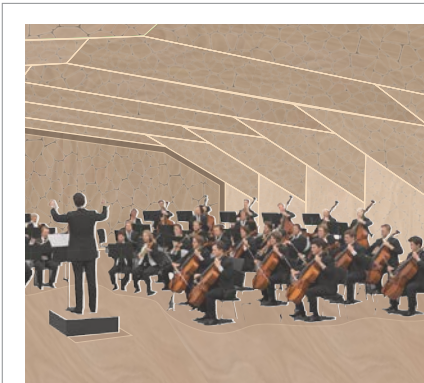
The achieved insertion loss gives sufficiently low noise levels at the venue and at the residential area. At the venue the noise from the highway is still audible (below NC-30) and in this way underlining the urban setting of the venue.

landscape

The site is located an hour outside of Boston, alongside the Connecticut River, Interstate 91 and a residential area. To adjust to these circumstances the venue is situated in the western part of the site. This moves the stage as far as possible from the Interstate, while keeping some distance towards the residential area. To further aid, landscaping is used to shield the venue from the noise generated at Interstate 91, and the residential area from the venue, when it is being used for a performance. The



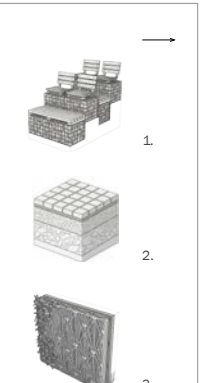
Chalmers University of Technology
Alma Reinhold, Rebecca Thor & Tomas Johansson Agren



surface treatment

The venue utilizes strategies to scatter and absorb sound to avoid strong reflections which could interfere with the electro acoustic system. As an additional effect, less sound is transmitted from the audience to the residential area.

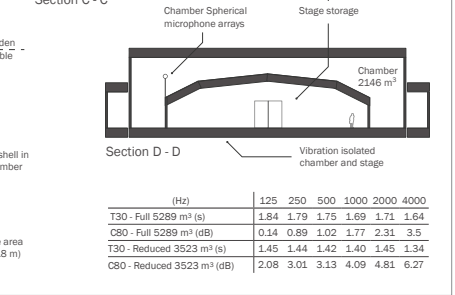
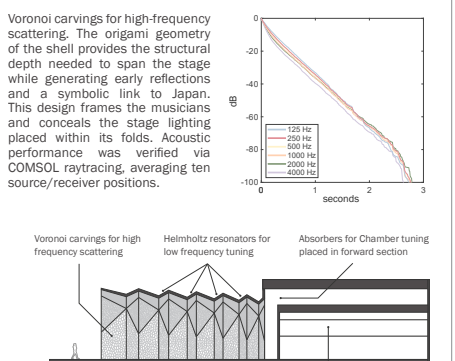
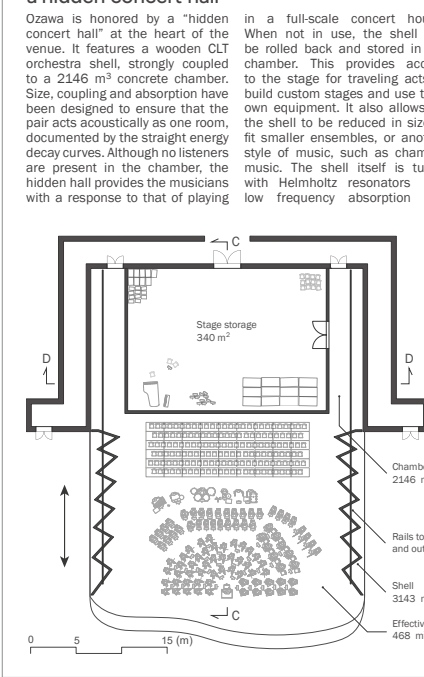
1. The terraced seating is built with gabions where the gravel provides mid-to-high frequency scattering and low-frequency absorption. At certain positions, absorption is increased by adding porous absorbers within the gravel.
2. The bottom horizontal surface uses pavers with a generous gravel layer in between. This roughness scatters mid-to-high frequencies while the underlying gravel is sized to absorb lower frequencies.
3. Vertical surfaces are covered with thick porous absorbers and a rough Corten Steel structure that provides scattering and a skeleton for climbing plants.



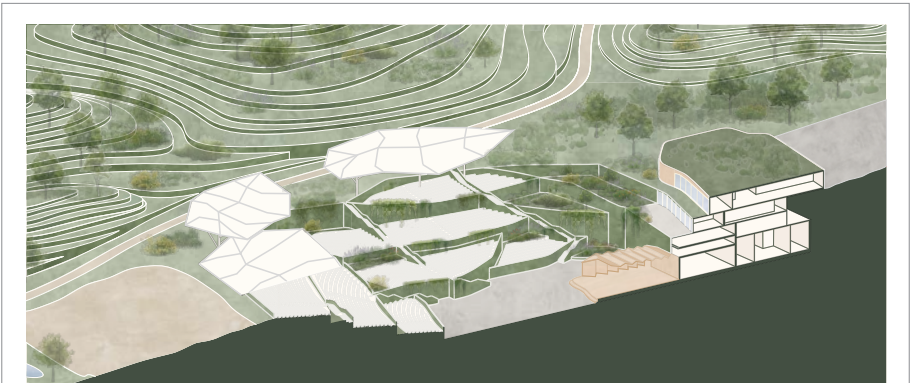
a hidden concert hall

Ozawa is honored by a "hidden concert hall" at the heart of the venue. It features a wooden CLT orchestra shell, strongly coupled to a 2146 m³ concrete chamber. Size, coupling and absorption have been designed to ensure that the pair acts acoustically as one room, documented by the straight energy decay curves. Although no listeners are present in the chamber, the hidden hall provides the musicians with a response to that of playing in a full-scale concert house. When not in use, the shell can be rolled back and stored in the chamber. This provides access to the stage for traveling acts to build custom stages and use their own equipment. It also allows for the shell to be reduced in size to fit smaller ensembles, or another style of music, such as chamber music. The shell itself is tuned with Helmholtz resonators for low frequency absorption and

Voronoi carvings for high-frequency scattering. The origami geometry of the shell provides the structural depth needed to span the stage while generating early reflections and a symbolic link to Japan. This design frames the musicians and conceals the stage lighting placed within its folds. Acoustic performance was verified via COMSOL raytracing, averaging ten source/receiver positions.

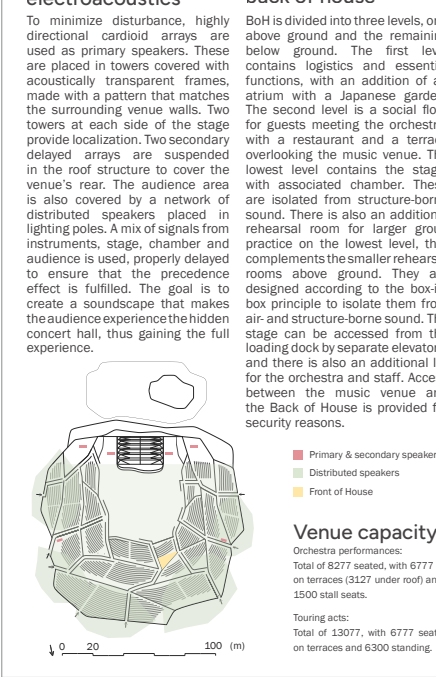


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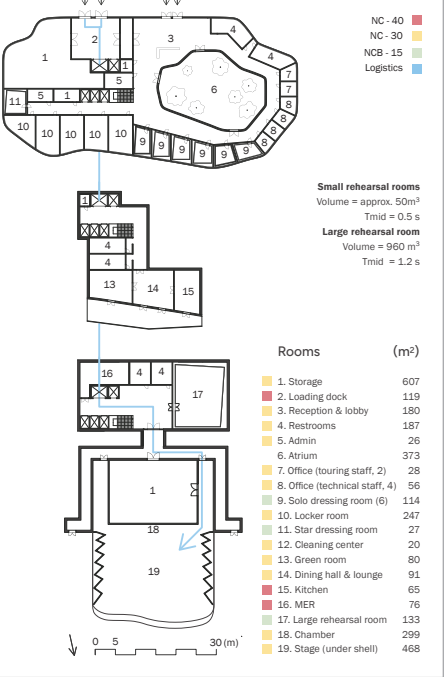
electroacoustics

To minimize disturbance, highly directional cardioid arrays are used as primary speakers. These are placed in towers covered with acoustically transparent frames, made with a pattern that matches the surrounding venue walls. Two towers at each side of the stage provide localization. Two secondary delayed arrays are suspended in the roof structure to cover the venue's rear. The audience area is also covered by a network of distributed speakers placed in lighting poles. A mix of signals from instruments, stage, chamber and audience is used, properly delayed to ensure that the precedence effect is fulfilled. The goal is to create a soundscape that makes the audience experience the hidden concert hall, thus gaining the full experience.



back of house

BoH is divided into three levels, one above ground and the remaining below ground. The first level contains logistics and essential functions, with an addition of an atrium with a Japanese garden. The second level is a social floor for guests meeting the orchestra, with a restaurant and a terrace overlooking the music venue. The lowest level contains the stage, with associated chamber. These are isolated from structure-borne sound. There is also an additional rehearsal room for larger group practice on the lowest level, that complements the smaller rehearsal rooms above ground. They are designed according to the box-in-box principle to isolate them from air- and structure-borne sound. The stage can be accessed from the loading dock by separate elevators, and there is also an additional lift for the orchestra and staff. Access between the music venue and the Back of House is provided for security reasons.



Rooms	(m²)
1. Storage	607
2. Loading dock	119
3. Reception & lobby	180
4. Restrooms	187
5. Admin	26
6. Atrium	373
7. Office (touring staff, 2)	28
8. Office (technical staff, 4)	56
9. Solo dressing room (6)	114
10. Locker room	247
11. Star dressing room	27
12. Cleaning center	20
13. Green room	20
14. Dining hall & lounge	91
15. Kitchen	65
16. MER	76
17. Large rehearsal room	133
18. Chamber	299
19. Stage (under shell)	468

format

The final proposal for the competition was presented on three poster boards, each measuring 51 × 72 cm, in accordance with the competition programme. The posters were then sent to Philadelphia to be judged at the 190th Meeting of the Acoustical Society of America.

contents

The three posters focus on presenting the acoustical concept, from park to stage, in a clear and narrative manner. The posters are intended to be read from left to right, beginning with the landscape, followed by the stage design, and ending with the back-of-house areas. Acoustical material is presented through graphs and tables, while each concept is further explained through text.

layout

It was important for us that the three boards felt coherent and visually connected. A color palette consisting mainly of green and beige tones was chosen to unify the boards and enhance the light and delicate character of the Japanese concepts. Collages of perspective drawings were preferred over realistic renderings in order to communicate the key concepts to the reader more clearly and directly.



reflection

Designing Ozawa Fields has been a challenging yet rewarding experience. The project emerged through an iterative design process in which sustainability and acoustical engineering have driven each stage of development. It allowed for a creative exploration of how landscape architecture can provide versatile solutions to acoustical challenges while creating a place that remains meaningful both during and beyond performances.

I am pleased with the process and the final outcome of the project. I found the collaboration with both my project partner and our acoustical consultant very rewarding. We complemented each other well, and their motivation inspired me to always do my best. Participating in a competition was an exciting experience and served as a strong source of motivation, although my primary goal was always to create work I could be proud of. The process was fun, and I felt that I was able to apply skills developed through previous courses while also acquiring new ones. In particular, I gained insight into acoustics and began reflecting on acoustics as an architectural tool in a way I hadn't done before.



If I could have done something differently, it would have been to explore our concepts further through physical models and prototypes. This was something we did in the early stages, but it could also have been beneficial later in the process. To further elevate the project, I would also have liked to produce renderings of the music venue itself in order to bring it more to life. The collages created for the competition were mainly a strategic decision, partly because rendering is time-consuming and somewhat more challenging to get right.

As a next step in the project, I would like to further develop the architecture of the venue, particularly in terms of lighting, materials, and greenery. It would also be interesting to analyse the park from a sustainability perspective, including water and energy systems. Much of the focus was placed on acoustical performance, leaving some aspects of the project open for further exploration.

