



Bangalore
International
Centre

Hundredhands
2019

"Architecture requires collaboration, and most importantly it is susceptible to the quality of this collaboration. It is difficult to think of another peaceful activity that draws on so many diverse contributions and expectations. It involves commercial forces and social vision; it must deal with the wishes of institutions and corporations and the needs and desires of individuals. Whether we articulate it or not, every major construction is an amazing testament to our ability to join forces and make something on behalf of others. The fact that this effort is so often regarded as negative rather than impressive, only confirms the dysfunctional nature of this process and the difficulty of coordinating commercial forces and public will. Good architecture doesn't happen naturally, it requires a conspiracy of circumstances and participants. While architects can provide ideas and visions, the relevance of these ideas depends on a meaningful engagement with the society they presume to serve.

While good architecture has always involved an attitude of resistance, to the elements and to the forces of chaos and even resistance to norms and prevailing tastes, this attitude shouldn't become, as it has so often, the justification for isolation and rhetoric. In fact the predicament of the architect is at best one of critical compliance. They are both antagonists and service providers."

David Chipperfield, Common Ground



Bangalore International Centre

A search for shared ideals

In 2005 a group of senior bureaucrats and city intellectuals came together to set up the Bangalore International Centre. They modeled it on the India International Centre in Delhi, as a place for informed discussion, public discourse and cultural engagement. Housed for the first fourteen years of its existence within the Sanjay Mohe designed The Energy and Resources Institute (TERI) offices, the Centre held a variety of public events, many in TERI's small 80 seat auditorium, the crowds often spilling out onto the lawns and streets outside. At the core of its mandate was the idea that these events hosted by the BIC would be free for all and not just for its members. Membership was seen more as a token contribution to allow the Centre to pursue its egalitarian and democratic mission.

In 2012, the Centre invited proposals in an open competition for a new facility they were planning to build on a half acre civic amenity site in Domlur, in the eastern part of the city. The site had been allotted to the BIC for a subsidised price and the building was going to be built using funds raised through private donations. This unusual idea, of a public, open institution built with the help of private contributions, and managed by the membership in the interest of the larger community is the foundational principle of this project.

We won the competition and our proposal, a dramatic assembly of the mixed-use program, articulated to respond to its small scale residential context and the neighboring park was received with much acclaim and some derision. An astute BIC member, in a lengthy letter written to the Building Committee, observed that modern architecture (or the Starship Enterprise, as he called it) had crash landed in Domlur. This response may have been because of the particular massing strategy used in the competition scheme. A floating mass cantilevered (out by some 16m) over a wide amphitheater and a two storey plinth, expressed in iconic fashion the public agenda of the BIC. This open verandah above the tree line from where one surveyed the city and onto which the city projected its aspirations had incredible rhetorical flourish, capturing both the heroic ambitions of the BIC and its open, transparent and public mission.

Soon though, this heroism gave way to pragmatic considerations, including the ever increasing requirement for 'enclosed' rentable space, dealing with the odour from the adjoining storm water drain and keeping out the teeming mosquitoes. We plodded along for nearly two years negotiating the Committee, site challenges and working out how to make that humongous cantilever, arriving finally at a scheme ready for building permits in 2014.

While preparing the permit drawings we realised that BIC's actual site holding was smaller (narrower) than the competition site. This was a major setback. Given the new dimensions, we couldn't accommodate the auditorium in the width left after the setbacks required for a four storey building. The scheme lost a floor to reduce setbacks, and that wonderful central idea, that space with no program, a symbol of the institution, was sacrificed.

We continued to pursue the same general organisation – a central entry with program distributed on either side and were close to finalising the scheme – a parti that didn't really excite any of us. We proposed encasing the building in a frame to retain the scale of our earlier iterations and began moving towards the idea of finding a series of shared spaces contained within this frame – the idea of a rich public realm within the building.

And then sometime in 2015 we developed a slightly modified scheme, shifting the main entry to one end of the plan creating in effect a long promenade within the building, connecting the different program components. This fundamental change in the circulation strategy meant that now on each floor the distinct rooms were part of this articulated, and generous public space which was connected across in section, offering places to gather and for prospect. The public life of the building, rather than being isolated on one level as it was in our competition scheme, became the core organising principal of this new scheme. Rather than merely a rhetorical idea it now was a lived, experienced condition - with adjacencies and connections.

Subsequent iterations of the plan cemented the importance of this common shared space, as program was removed from it, the restaurant was moved to the ground floor extending this public realm and new connections were made to the wide setbacks on the east and west. This inner shared

space seemed intimately connected to the world outside through large openings and ample glass facades. It was like being in a deep verandah.

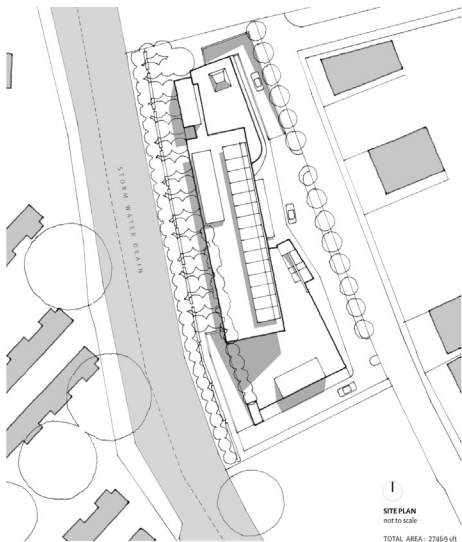
BIC finally opened its doors in February, 2019, dramatically different, formally, from the competition scheme. The expression of publicness now mostly an internal one. Spread over the four levels, the meandering, interconnected series of open volumes now became the symbol of community, engagement and dialogue. Across a cascading north south section one is always aware of connections and inadvertently participating in this idea of communion.

Friends often commiserate when they see the finished building, remembering the dramatic formal expression of our competition scheme and its powerful invocation of public space. But we enjoy this expression of an architecture of collaboration, negotiation and shared ideals.

The BIC is a valid precedent for the constructive coming together of many people and the benefits of a long period of gestation. The facility has become an active cultural hub in the city, appropriated in wonderful ways by the BIC and the larger community. There is a sense that the building is a real representation of shared ideals and authorship.

Like Chipperfield says, our work as architects involves both a critical resistance (the antagonist) – looking at our commissions as the search for deep structure and enduring meaning; but also accommodation (the service provider), listening intently and assimilating the particular exigencies of a commission. Our work finds essential meaning in the coming together of many people and in this shared authorship lies its greatest value. It 'is an amazing testament to our ability to join forces and make something on behalf of others'. An act of profound empathy.

The provocation of the pristine unbuilt work, reveals to us that which is obfuscated in the hustle of our everyday engagement with the world. But it must be brought to confront this everyday world for we must search for resonance, for deep structure. In finding common ground we give life and meaning to what we do as architects. I am interested in this afterlife - in giving expression to our time, our place and our culture. And these are not defined by solitary voices.

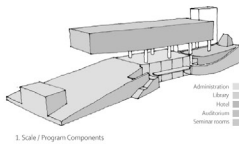


SITE PLAN
not to scale
TOTAL AREA: 27469 sqft

BANGALORE INTERNATIONAL CENTRE

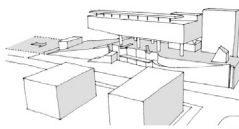
Our proposal for the Bangalore International centre focuses on four aspects:

1. Scale
Aligning 'Scale' as a fundamental ordering principle:
The existing scale of the surrounding buildings is low profile (single-storey and double-storey forms). The neighbourhood has a residential character and we feel it is important that the extension of the public institution forms a subtle extension to this character.
Our proposal creates two clear 'datums': By linking the main auditorium and considering the primary congregational spaces and library on the ground / first floors, we establish the first datum at the second floor datum which is clear of any programmed space and acts as a public realm, aligning flat to the surrounding soffit flat roofscapes. The guest accommodation floats above this floor and establishes the second datum at 5m. This reasoning strategy effectively lightens the impact of the building. The first datum extends the public domain of the street into the envelope of the building, whereas the second datum replicates the firmness of the horizontal ground. Thus the scaling of this public form is through this stratified redefinition of the two 'datums'.



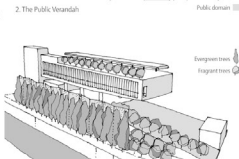
3. Scale / Program Components

2. Public Space in a residential area
Elevation of the public space as a strategy to create a vibrant public domain both programmatically and visually.
By creating this open public realm on the 2nd floor we make the public life of this building visible from the street. The extension and elevation of this public space announces the agenda of the building to be a democratic institution, where public participation remains its core concern. This public domain is sandwiched vertically between other programs, defining a communal hierarchy to the organization of spaces within the building. Events on this floor will have a great impact on the way this building is perceived - it is a place from where to enjoy the garden and the trees, but also a place that others can partake of from outside, visually.



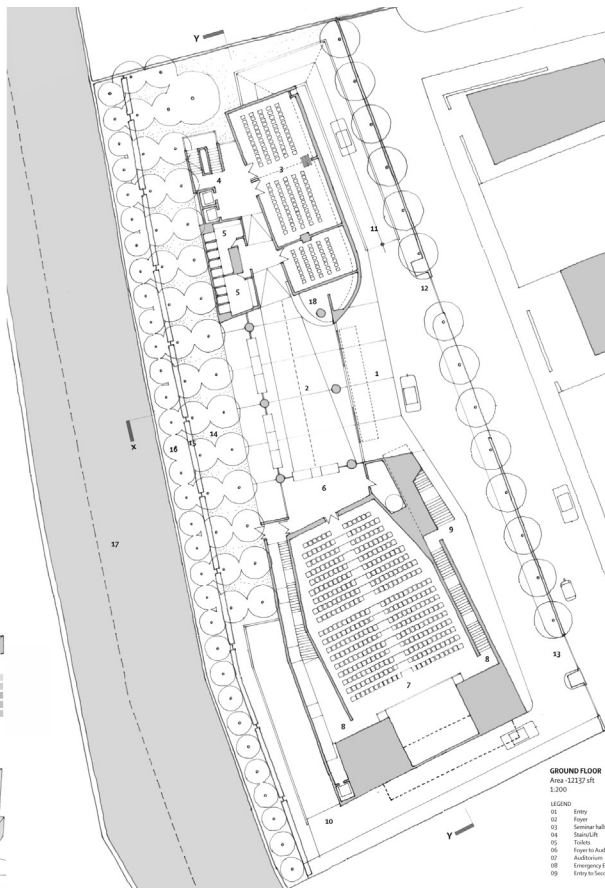
2. The Public Domain

3. The Storm Water Drain
Preference for a natural solution, rather than a mechanical solution
Our proposal to mitigate the small from the storm water drain is to create landscape buffers at multiple points. On the ground or the western edge of the site we lay out 3 folded planting screens with 'soffit' barrier trees planted on the 3m projection path and two rows of fragment trees within our property. Planting (on screens and in garden) spaces on the 2nd floor along the amphitheatre, on the guest accommodation floor (where the corridor runs along this western face), and on the terrace behind the restaurant.



3. Landscape Buffers on the western edge from the storm drain

4. Organization of the Program
Distinct identity of the individual programs through both formal expression and zoning
Features of public space hold the individual programs together. Each program has a distinct character, either through its placement or its form, informing its purpose. The layout of the library, roof of the auditorium, covering planting on the library of the hotel block are 'readable' to forms 'whole', after conforming to 'logic in parts'. This relationship of the 'parts to the whole' informs the intent in space making of creating porous and vibrant public space within a restaurant. The nature of the mixed use program demands an easy association of the space with the user, who in this case would be a visitor for a short term. This strategy, if aligned along with the selection of the user, has a great opportunity to become a delightful public space.

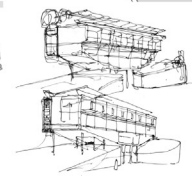


GROUND FLOOR
Area: 12157 sqft
1:3000

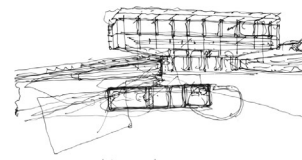
LEGEND			
01	Entry	10	Exit from basement
02	Flow	11	Entry to basement
03	Service halls	12	Podium entry
04	Service lift	13	Vehicle entry
05	Tickets	14	Fragment trees
06	From to Auditorium	15	Landscape screen
07	Auditorium	16	Fragment trees
08	Emergency Exit	17	Storm-water drain
09	Entry to Second Floor	18	Reception

FIRST FLOOR
Area: 5412 sqft
1:3000

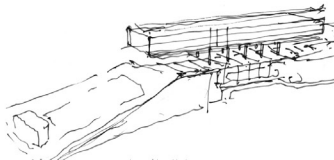
LEGEND			
01	Open air theater		
02	Projector room		
03	Store room		
04	Office with pantry		
05	Computer Room		
06	Director's Room		
07	Administration		
08	Office		
09	UI/PC Room		
10	Stores/IT		
11	Library		



5. Massing study



6. Plan-generating form



7. Articulation of the public domain



SECOND FLOOR
Area: 2325 sq ft
1:200

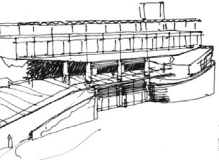
- LEGEND
- 01 Open air Theater
 - 02 Hallway
 - 03 Entry from ground level
 - 04 Cafeteria
 - 05 Faculty
 - 06 Table
 - 07 Staircase

THIRD FLOOR
Area: 6542 sq ft
1:200

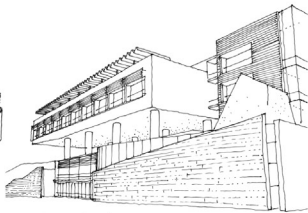
- LEGEND
- 01 Guest accommodation
 - 02 Corridor
 - 03 Male Room
 - 04 Lounge
 - 05 Staircase

BASEMENT
25 Car parking
1:500

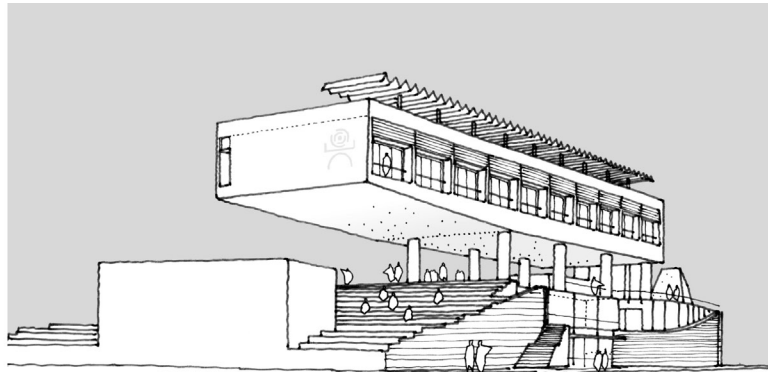
- LEGEND
- 01 Entry to basement
 - 02 Car parking
 - 03 Staircase
 - 04 Exit



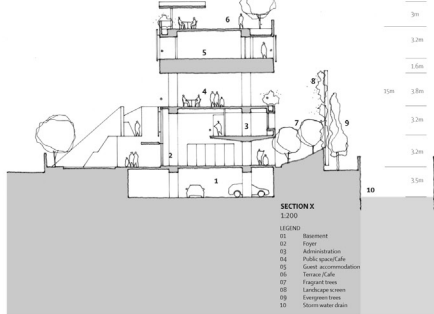
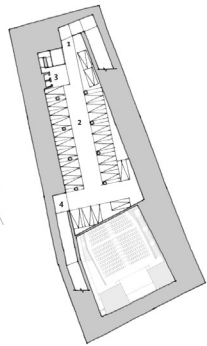
S. View from south east corner



S. View from north east corner



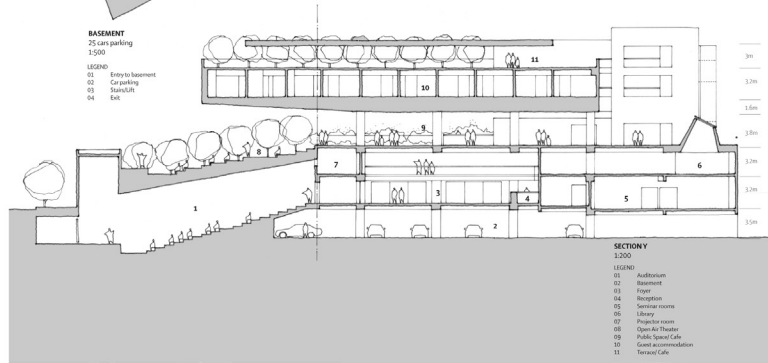
3D View from south east corner



SECTION X
1:200

LEGEND

- 01 Basement
- 02 Foyer
- 03 Administration
- 04 Public special Cafe
- 05 Guest accommodation
- 06 Terrace Cafe
- 07 Foyer and boxes
- 08 Landscape screen
- 09 Evergreen trees
- 10 Storm water drain



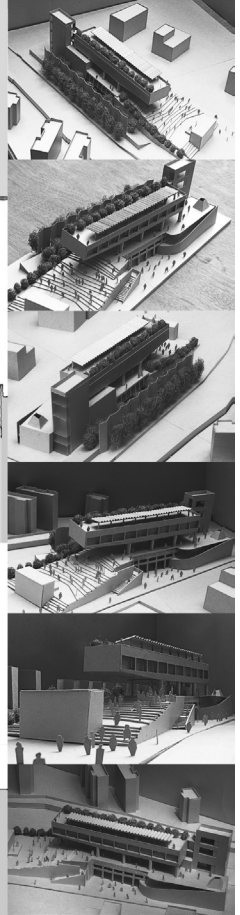
SECTION Y
1:200

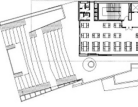
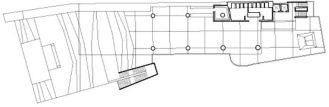
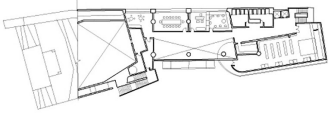
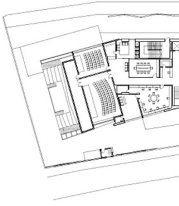
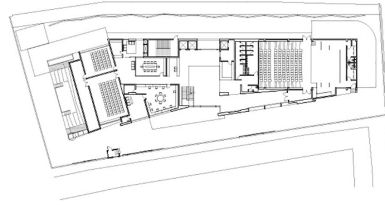
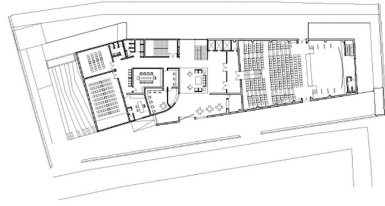
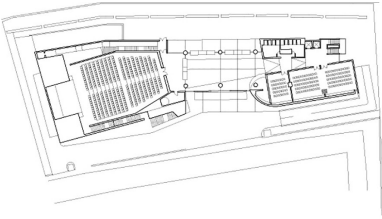
LEGEND

- 01 Auditorium
- 02 Reception
- 03 Foyer
- 04 Reception
- 05 Seminar rooms
- 06 Library
- 07 Proprietor rooms
- 08 Open Air Theater
- 09 Public Special Cafe
- 10 Guest accommodation
- 11 Terrace Cafe

Hundredhands
Competition Proposal / 2012

BANGALORE INTERNATIONAL CENTRE
DOMLUR, BANGALORE



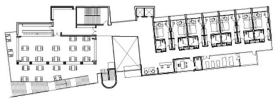
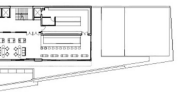
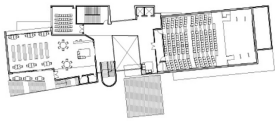
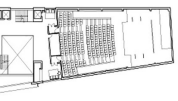
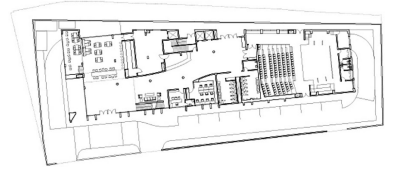
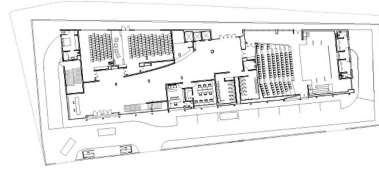
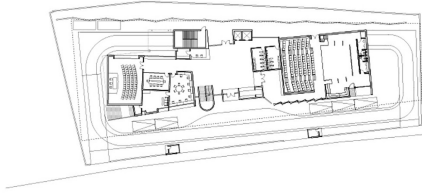
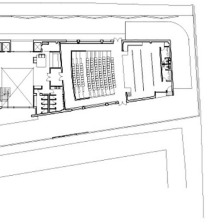


A

B

C

D



E

F

G



↘ *plans are not to scale*

PROCESS

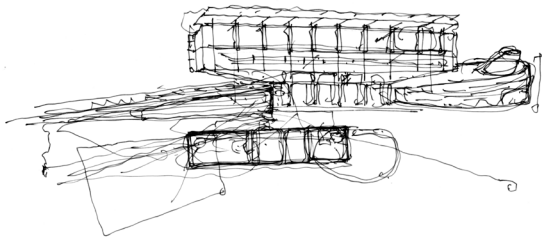
In 2012, the BIC invited proposals through an open competition for its new facility on a 2,000 sqm civic amenities site in Domlur, in the heart of Bangalore. Our proposal was adjudged as the winner from a pool of 90 entries. Central to our scheme was a public space elevated to the second floor and visible from the street. The extension and elevation of this public space announced the agenda of BIC to be a democratic institution, where public participation was its core concern.

The plans went through 18 iterations leading to the one we built. Though incredibly demanding, in hindsight, this process has led to a building which accommodates the client's vision, satisfies our design ambitions and pushed the contractors to produce a highly crafted building within a tight budget.

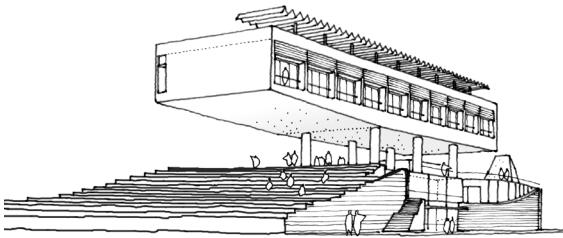
The key challenge was of working with a committee. BIC is a body which has many of the illustrious intellectuals of the city as members. Decisions took longer as a lot of our work was peer reviewed (*see p.92*). The biggest satisfaction for us is the synthesis of all of these various ambitions that have come from such a wide group of people. We've been able to, with the client, come to a place where it is all seamlessly integrated into a building of a certain character and rigour

A The competition scheme was based on four principals:

- i. The public function of the building found an architectural expression. A public plinth was proposed with a large amphitheatre as an extension to the municipal park close by.
- ii. By breaking up the building with a void along the second floor the scale of the surrounding fabric was sensitively addressed.
- iii. The various program components were distinct in terms of massing and easily discernible in terms of circulation through the building.
- iv. Landscape strategies were used to mitigate the odours from the nearby storm water drain.



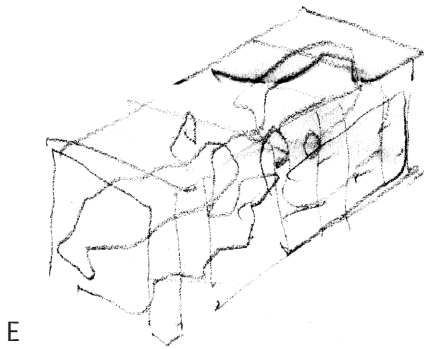
A



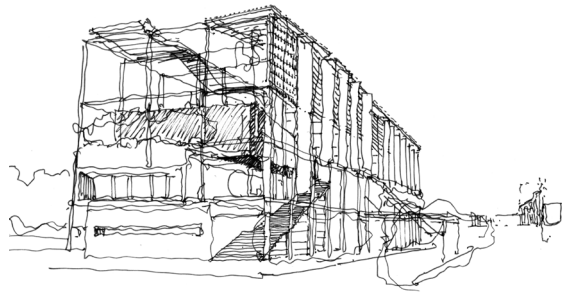
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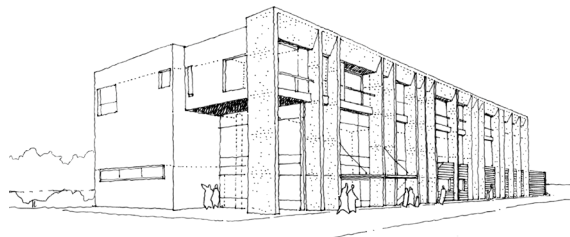
D



E



E

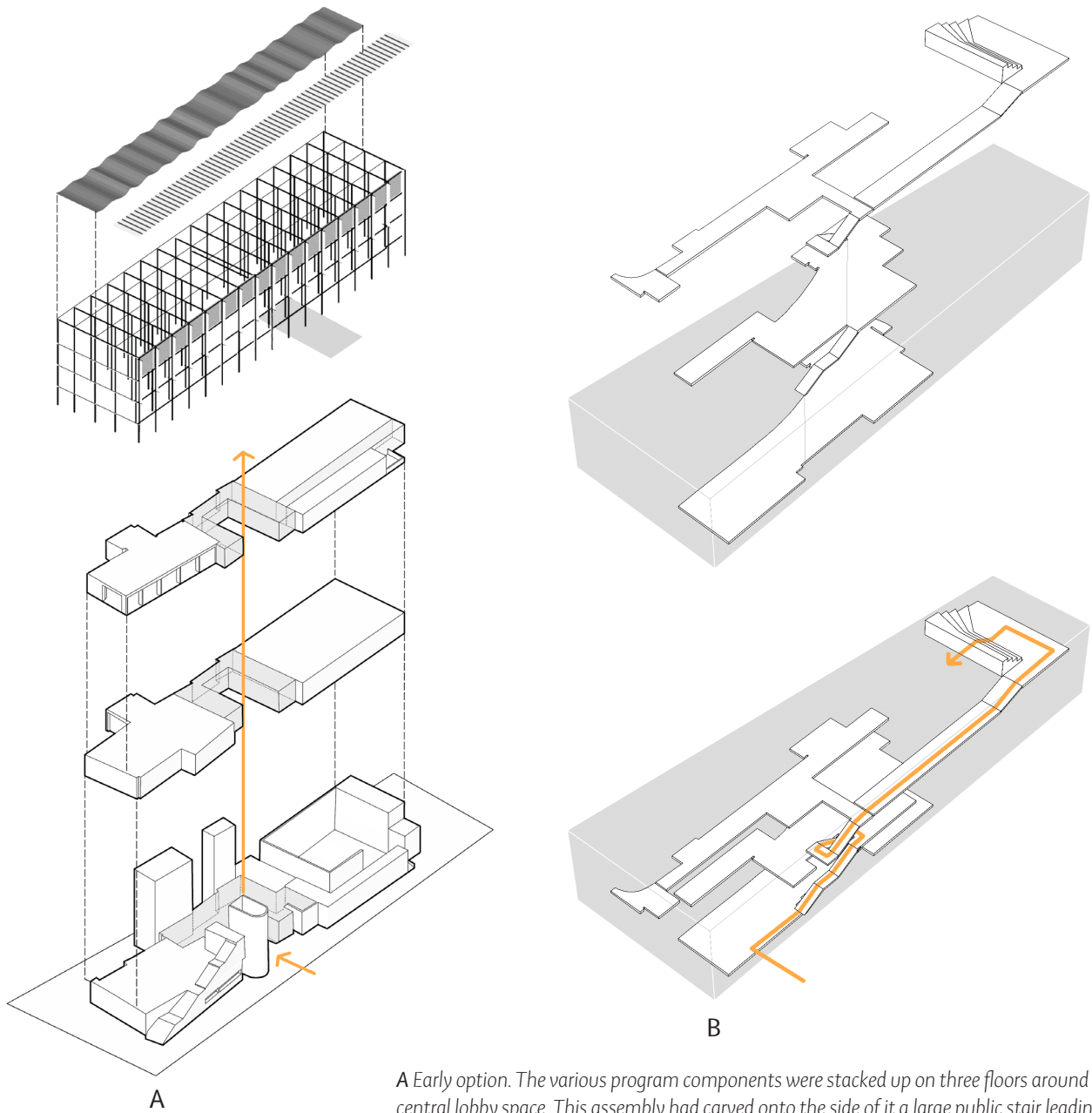


G

B - D The auditorium was shifted to the north end of the plan. These options show various configurations of program within the building. Seen here are two ways to enter the auditorium - in the middle and on the side. These plans also show the closing up of the second floor with glazing which fundamentally compromised the central premise of our competition scheme.

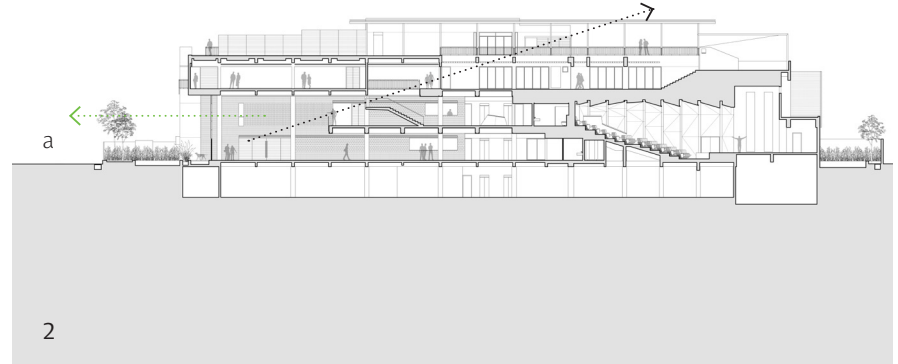
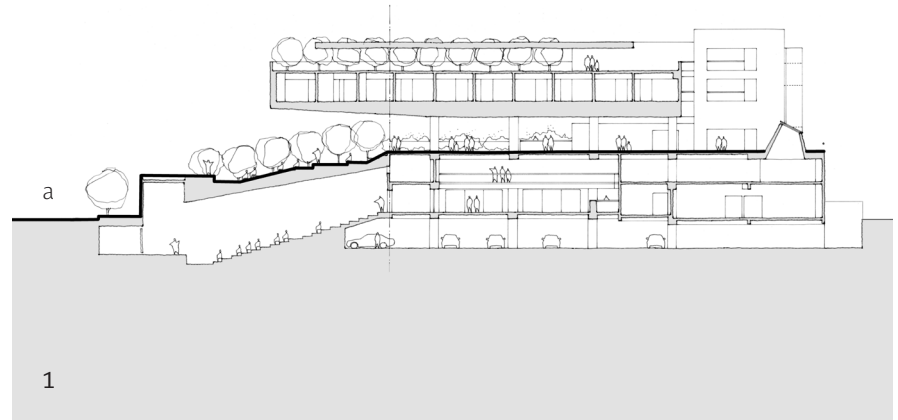
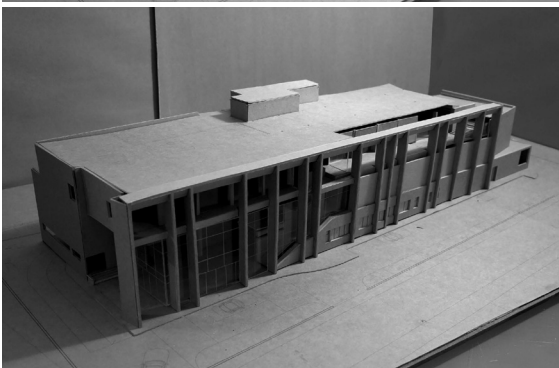
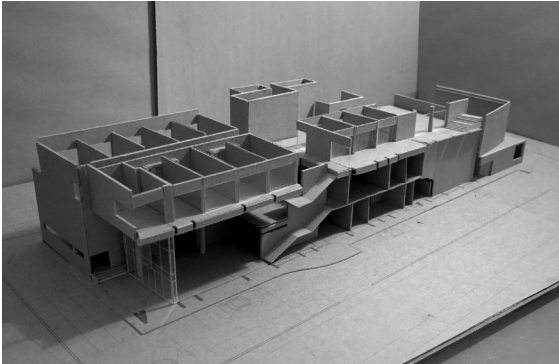
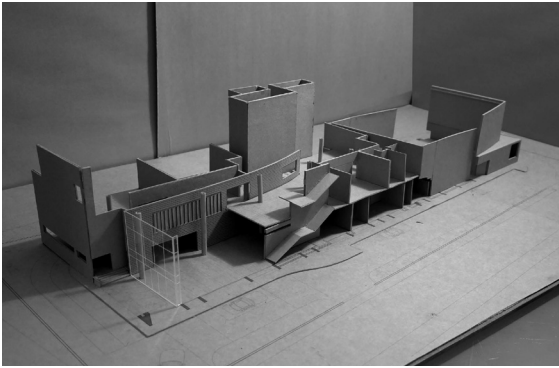
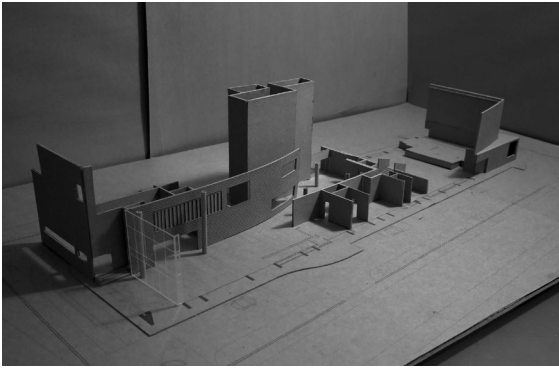
E Just as we were preparing the sanction drawings we realised that the site documents the client had did not match the competition site. Situated on the same civic amenities site, the actual BIC holding was narrower than originally thought. This led to a major redesign of the scheme. To accommodate all the program and the large width required for the auditorium we removed a floor from the building to help reduce setbacks. We lost the second floor public room and amphitheatre - both central ideas. The scheme now revolved around the idea of distinct program components stacked within a large porous metal frame. The primary entrance to the building continued to be in the middle of the plan.

F & G The major change in the plan was the shifting of the primary entrance to the south east corner. This opened up a long promenade within the building to access all the program components. This happens on multiple levels and is a trace of that original idea of a prominent public space finding architectural expression (now on multiple levels) visually connected and revealed to the outside through three storey high concrete portals replacing the metal frame. Guest accommodation rooms, a part of the original competition brief, are seen on the second floor in these plans. These were later removed and an art gallery, board room and the BIC offices took their place. These plans also show additional program on the ground and first floors along the eastern facade. These were subsequently removed to create the generous open lobbies we have in the building now.



A Early option. The various program components were stacked up on three floors around a small central lobby space. This assembly had carved onto the side of it a large public stair leading directly to the uses on the southern side of the lobby. This then was enclosed in a uniform metal frame which was selectively enclosed and gave us both the formality and presence of a public building and the informality and intimacy of small private gatherings (see iteration E, p. 9).

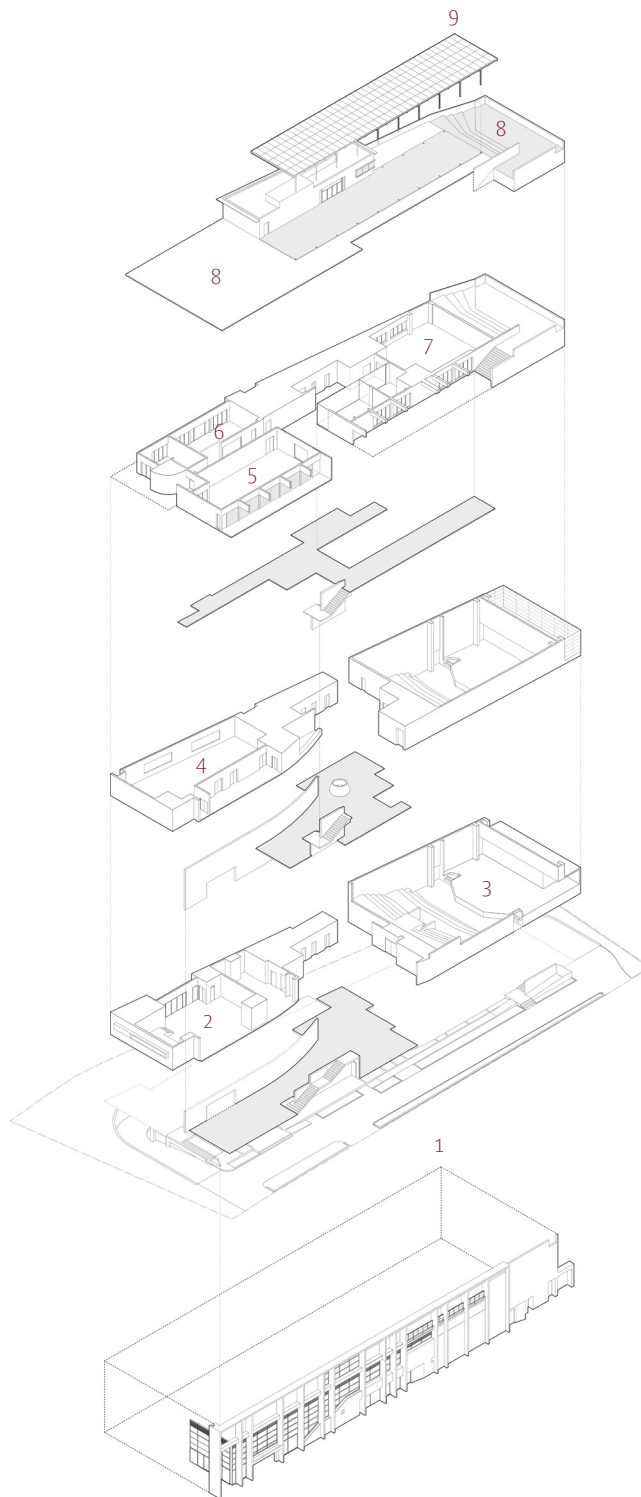
B By shifting the main entrance to the south east corner, the heart of the scheme became large meandering public spaces connecting all the program components spread across three floors (see plans on p. 22-29).



1 The competition scheme section shows the public plinth (in bold line weight) on the second floor as an extension of the municipal park (a).

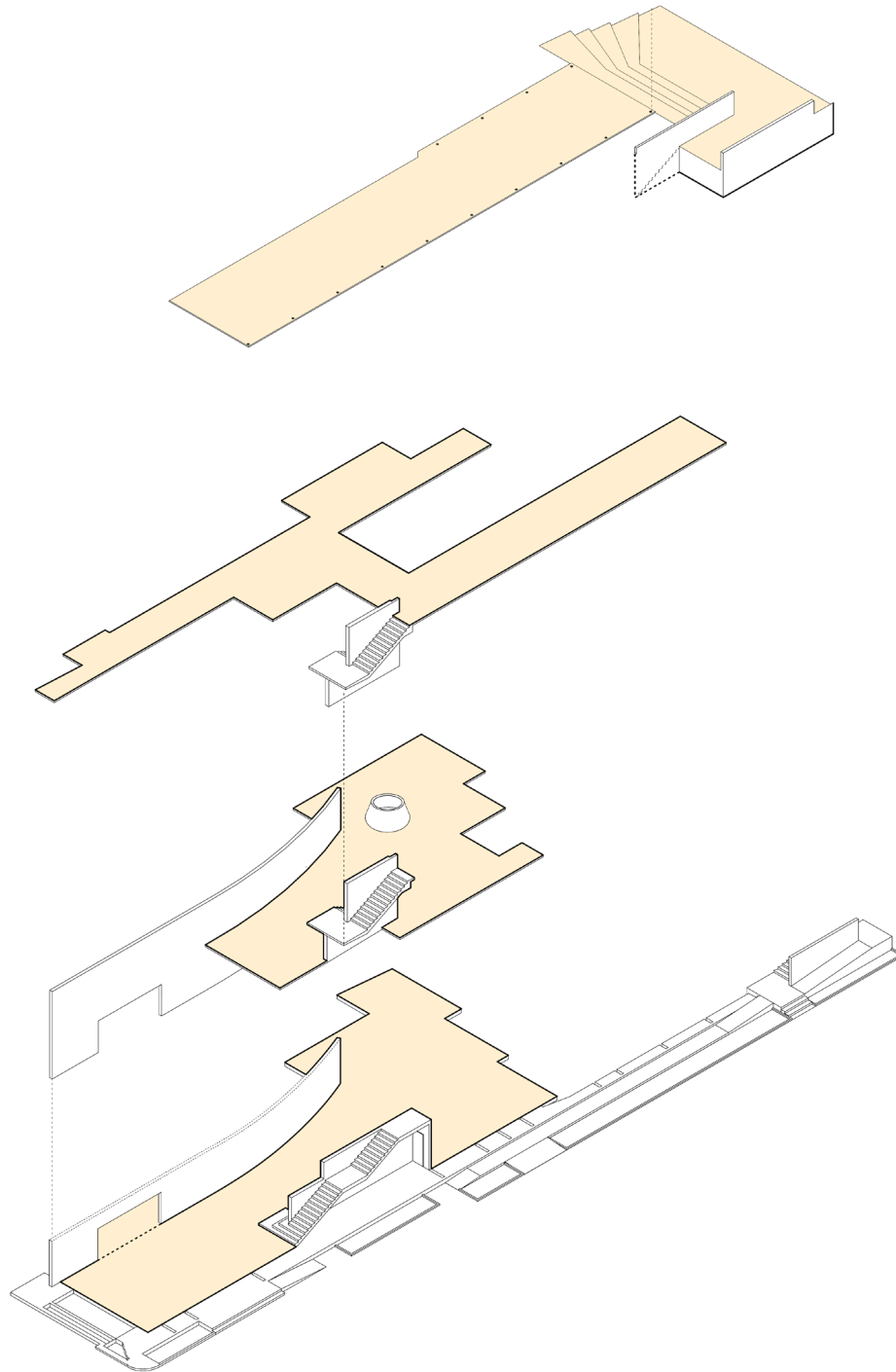
2 The as-built section shows this public realm (in bold line weight) now on multiple levels and visually connected across the floors, all the way to the sky. The municipal park is now seen from multiple levels.

This series of models show the nature of public space within the building vis-a-vis the program components and the frame that organises this varied internal composition. This scheme is the one just before iteration F (see p. 9) where the second floor has a whole enfilade of accommodation rooms along the eastern edge of the second floor.



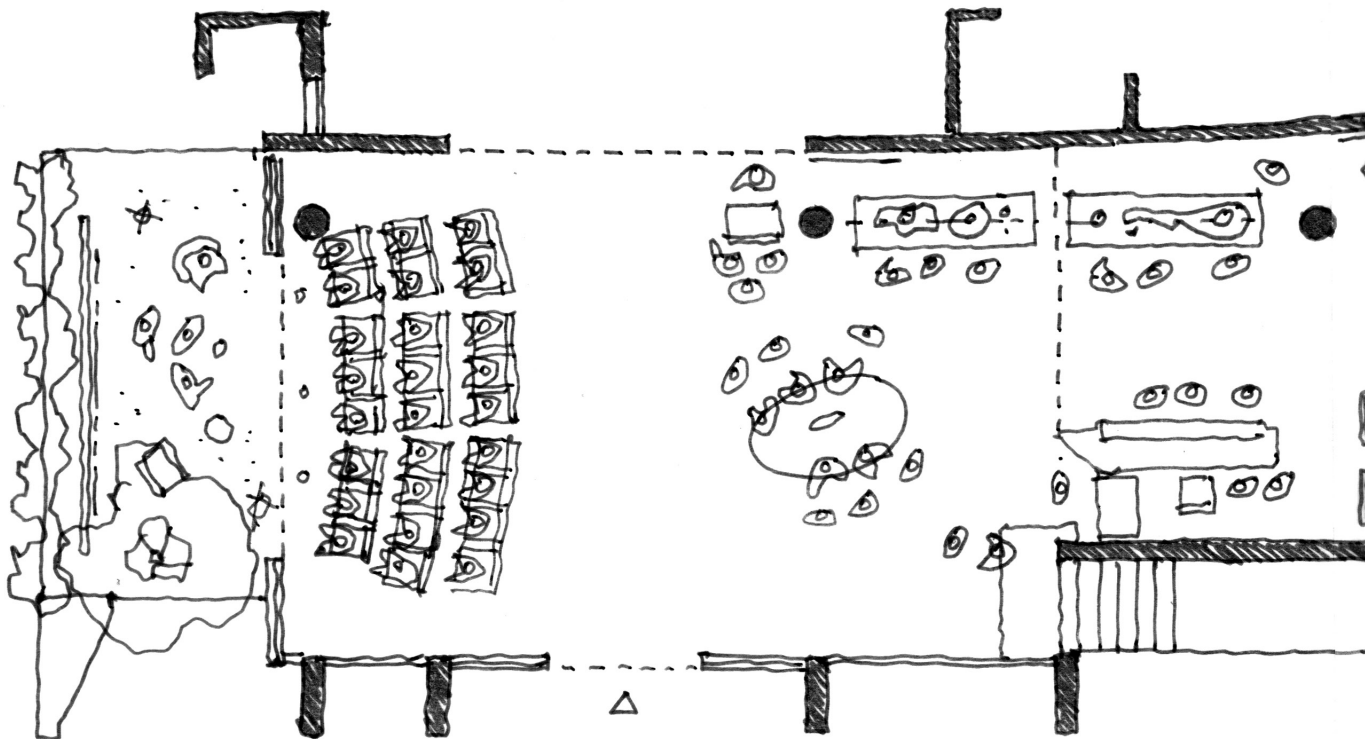
CIRCULATION & PROGRAM

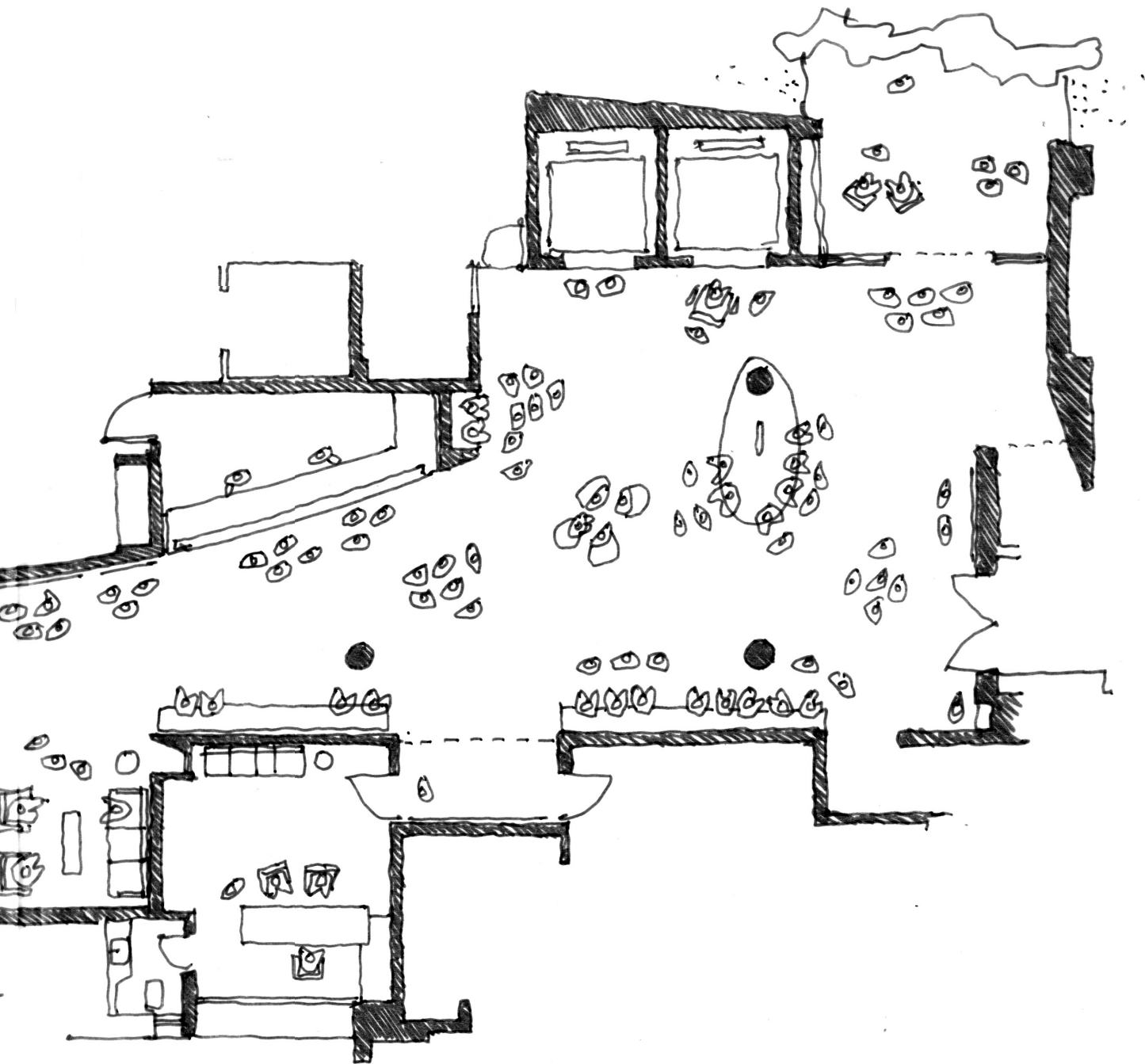
- 1 Facade and enclosure
- 2 Restaurant
- 3 Auditorium
- 4 Seminar rooms
- 5 Gallery
- 6 Board room
- 7 Library
- 8 Roof-top & amphitheatre
- 9 Solar roof



This early sketch shows the ground floor lobby areas used in multiple ways - for discussions and presentations, story telling and performances, art installations, pre-function areas for events in the auditorium, etc. By creating the primary entry to the building on the extreme corner of the plan (south-east), this large swath of common space opens up connecting the restaurant, auditorium, restrooms, pantry, lifts and access to gardens.

Since the building has opened in February, 2019, we have already seen these spaces on the ground and first floors accommodate a textile exhibition, multi-faith ceremonies, art workshops, installations, etc. Though situated on a tight site this generous internal volume suggests a much larger facility and is capable of handling large groups of people. The interconnected nature of these public spaces also gives one the sense of being part of a larger community.

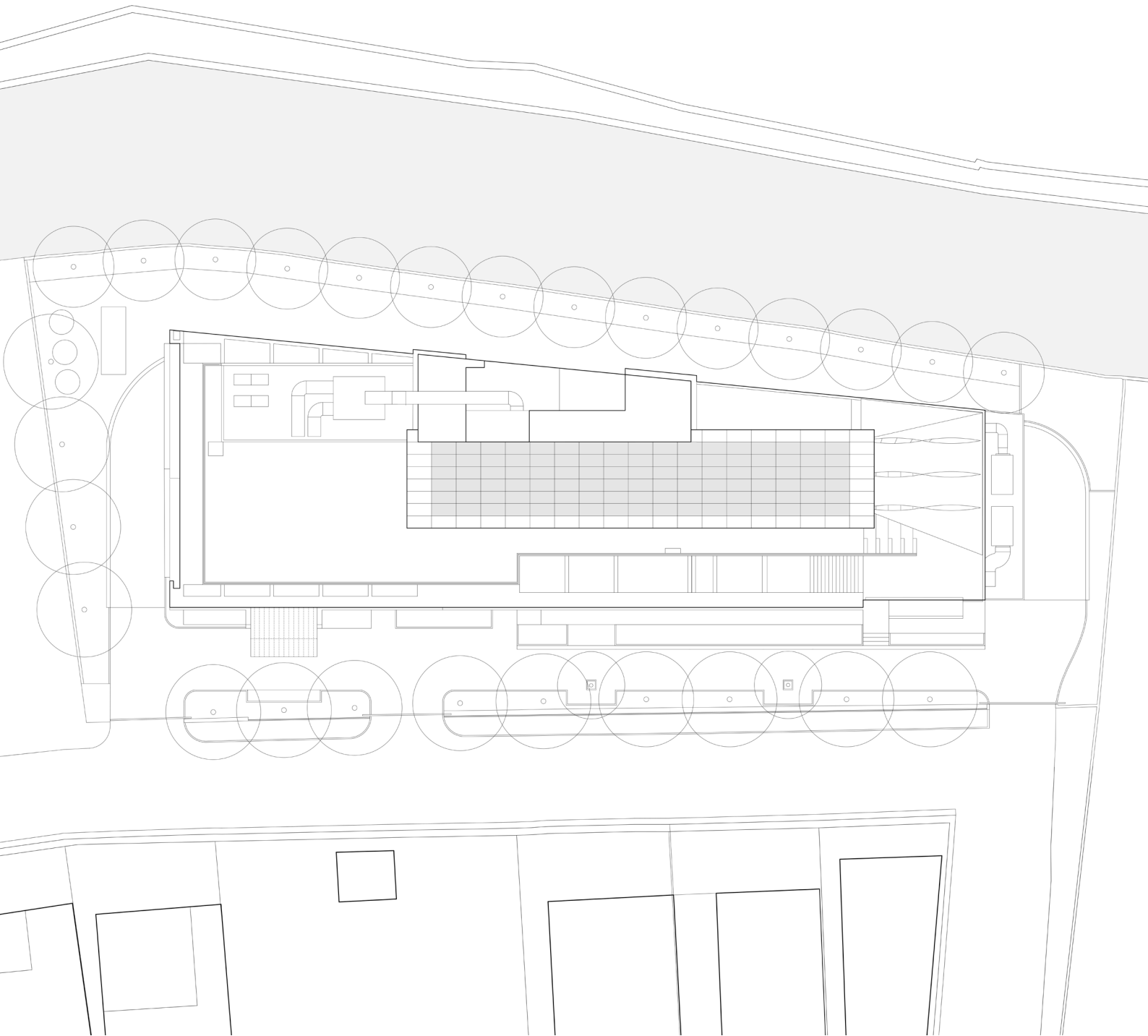






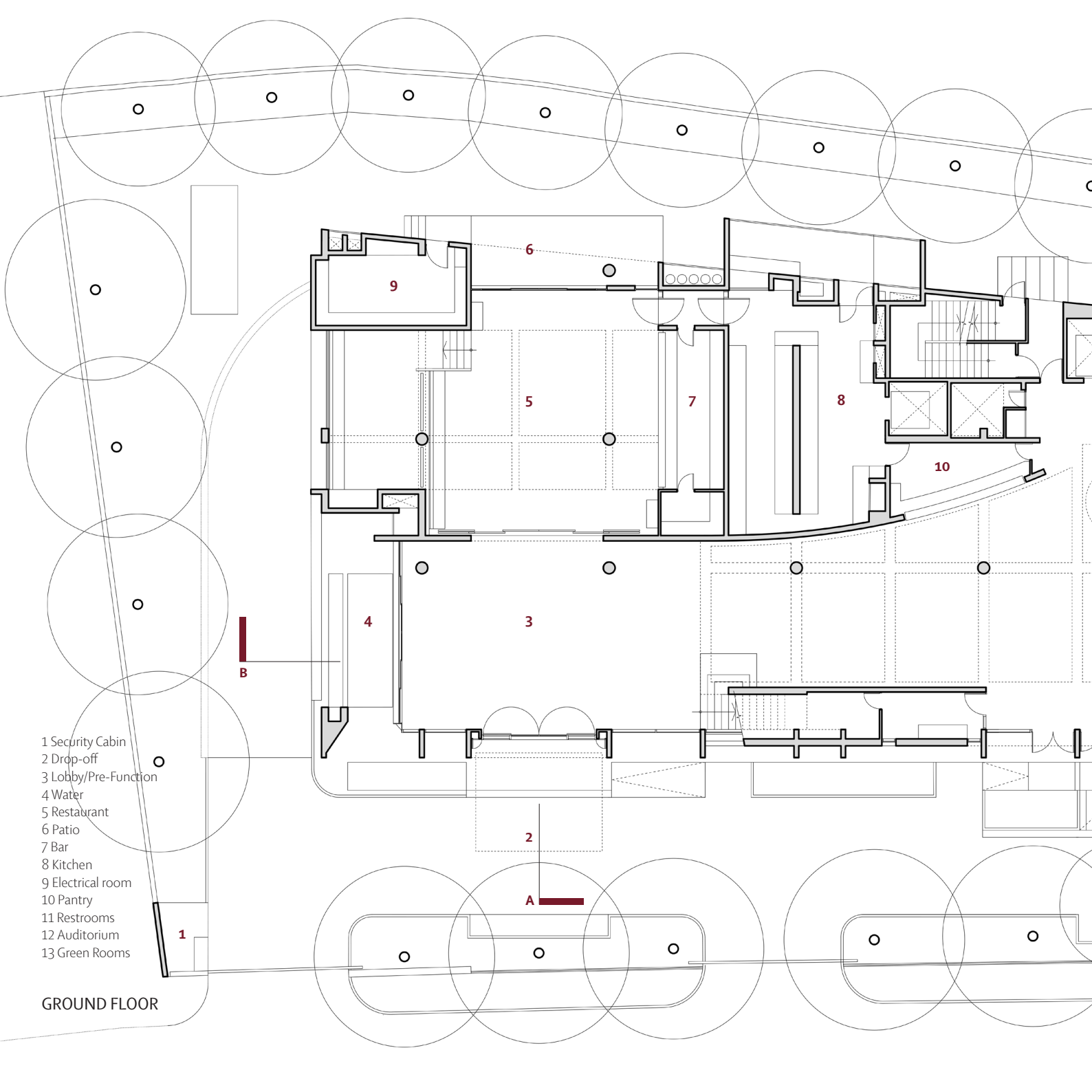
M U N I C I P A L P A R K

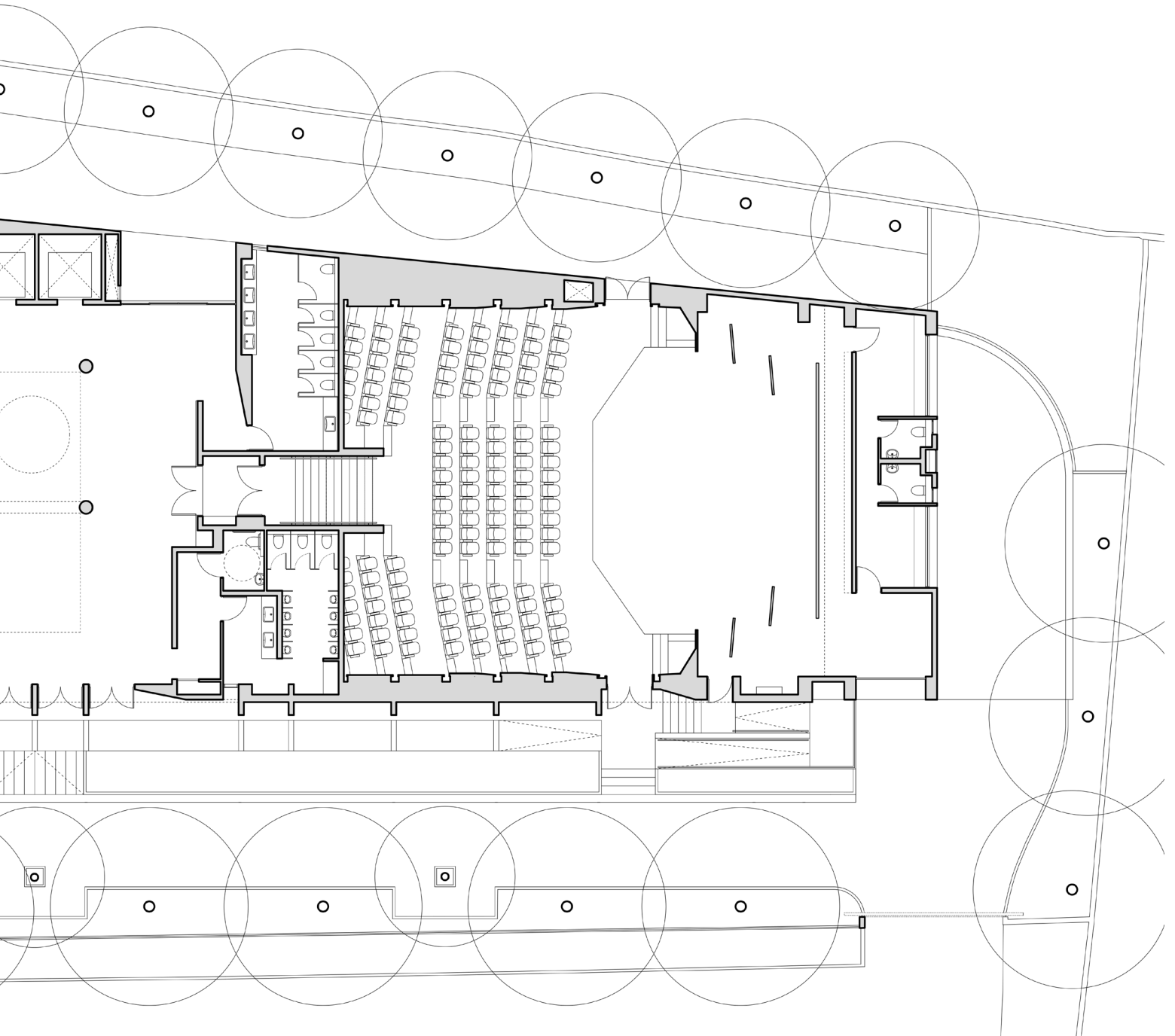
SITE PLAN

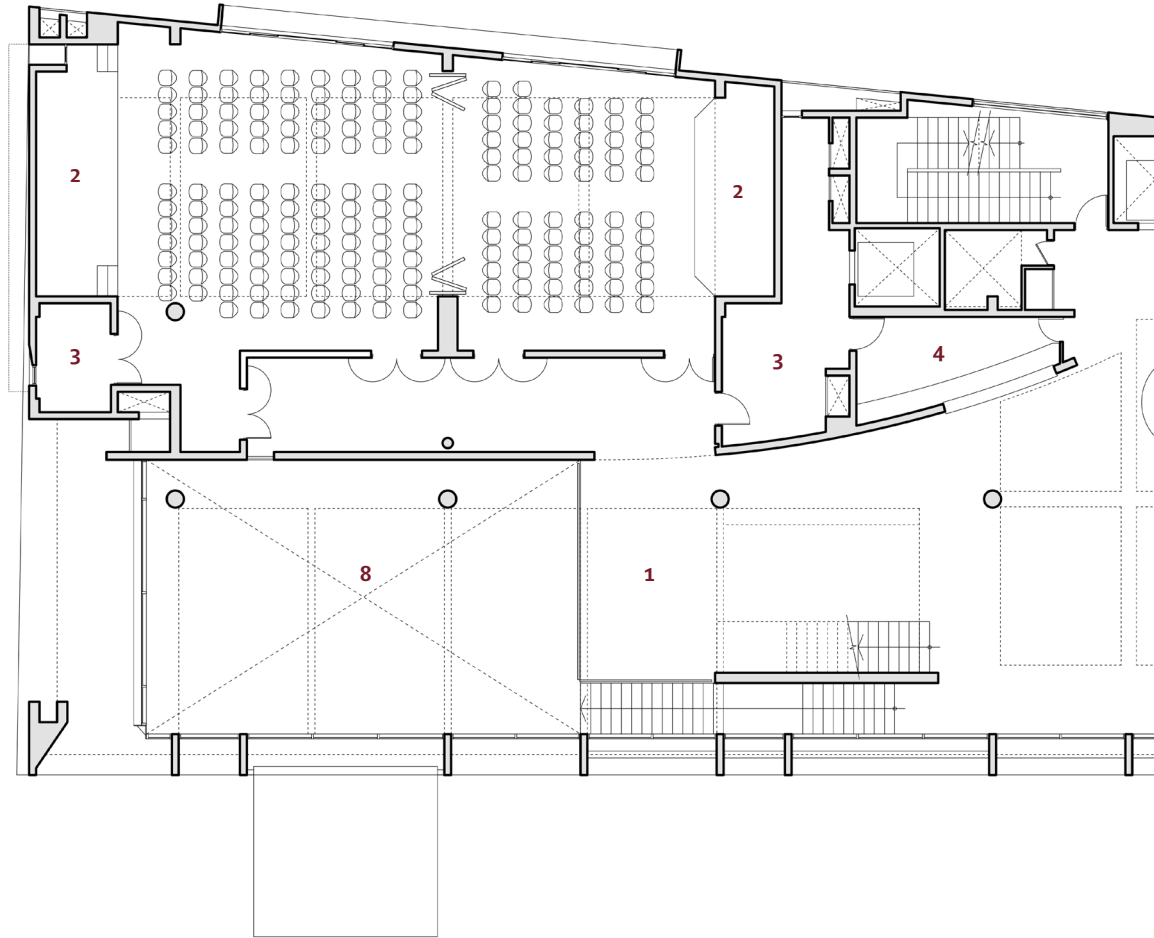


- 1 Security Cabin
- 2 Drop-off
- 3 Lobby/Pre-Function
- 4 Water
- 5 Restaurant
- 6 Patio
- 7 Bar
- 8 Kitchen
- 9 Electrical room
- 10 Pantry
- 11 Restrooms
- 12 Auditorium
- 13 Green Rooms

GROUND FLOOR

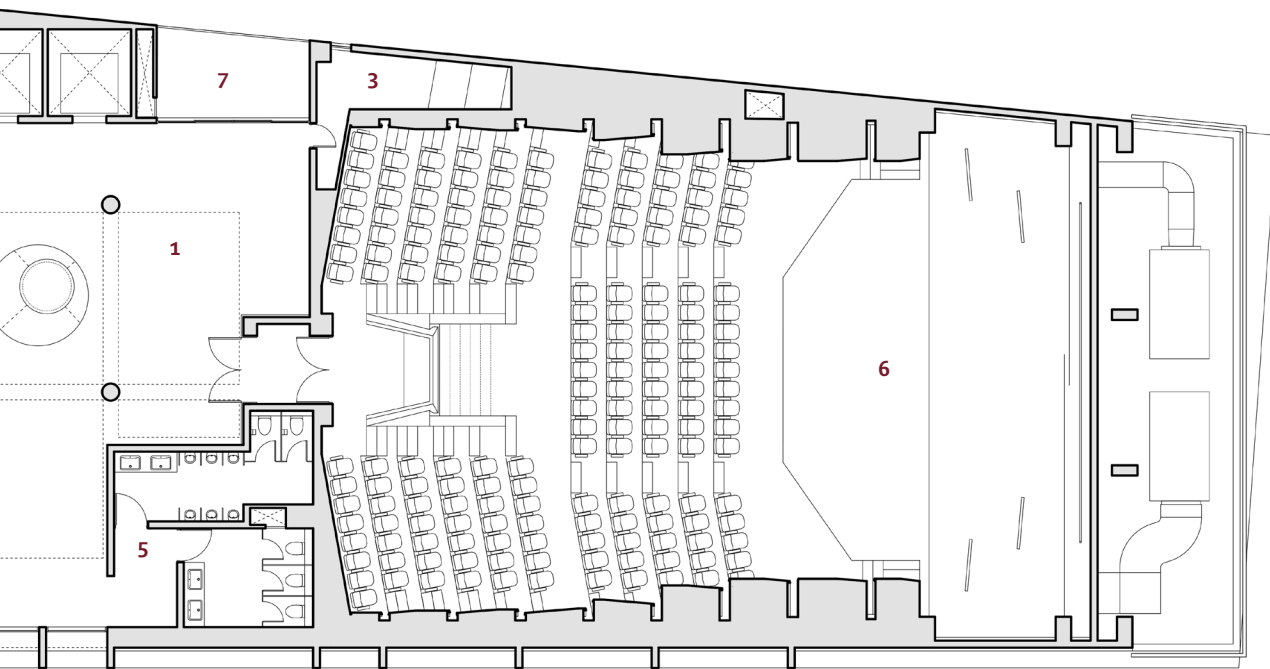


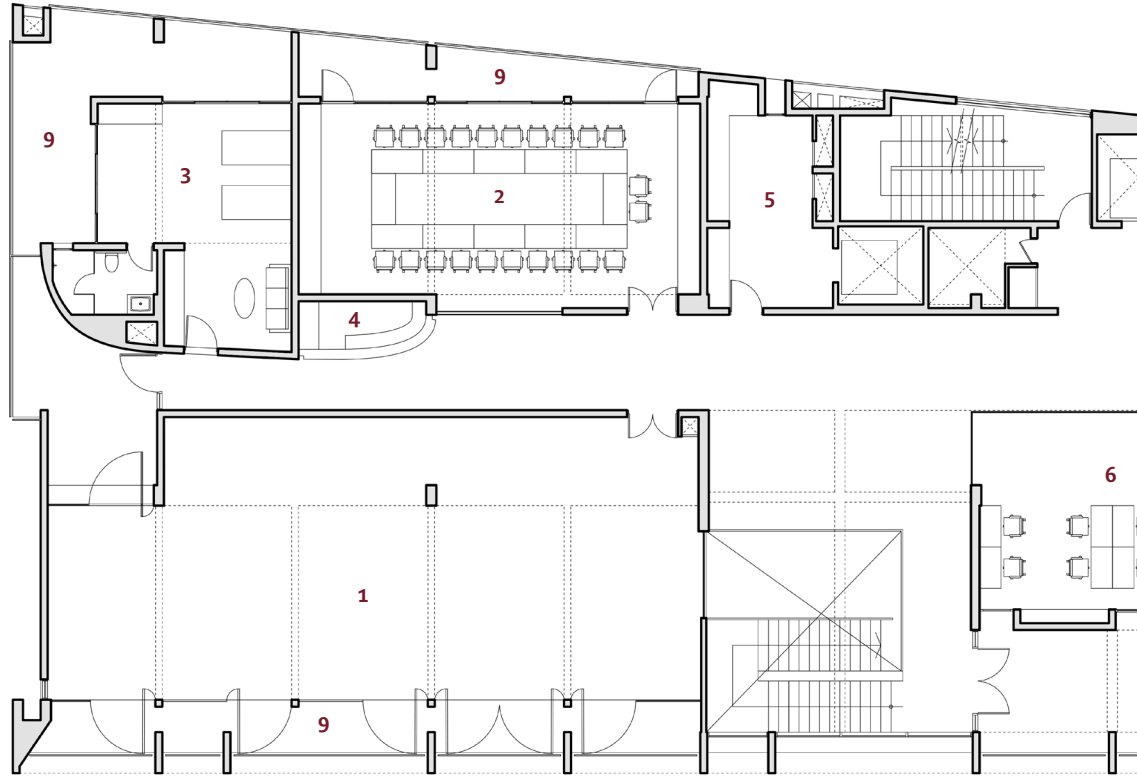




- 1 Lobby / Pre-Function
- 2 Seminar Room
- 3 Service/Storage
- 4 Pantry
- 5 Restrooms
- 6 Auditorium
- 7 Terrace
- 8 Lobby below

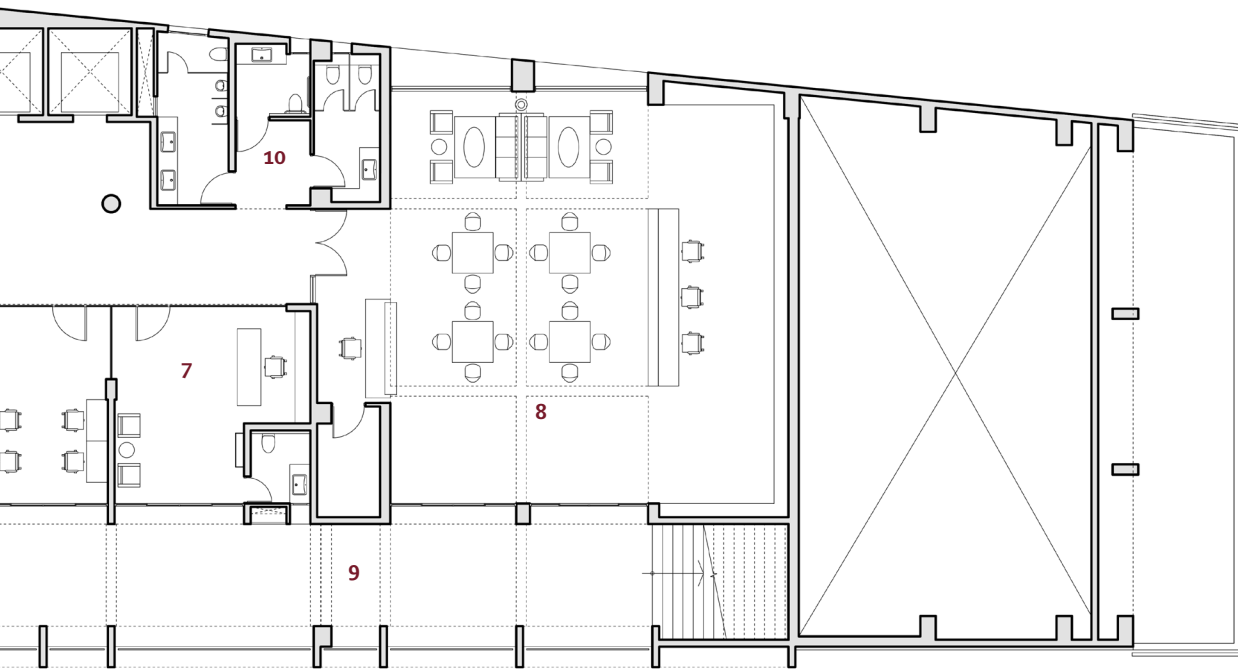
FIRST FLOOR

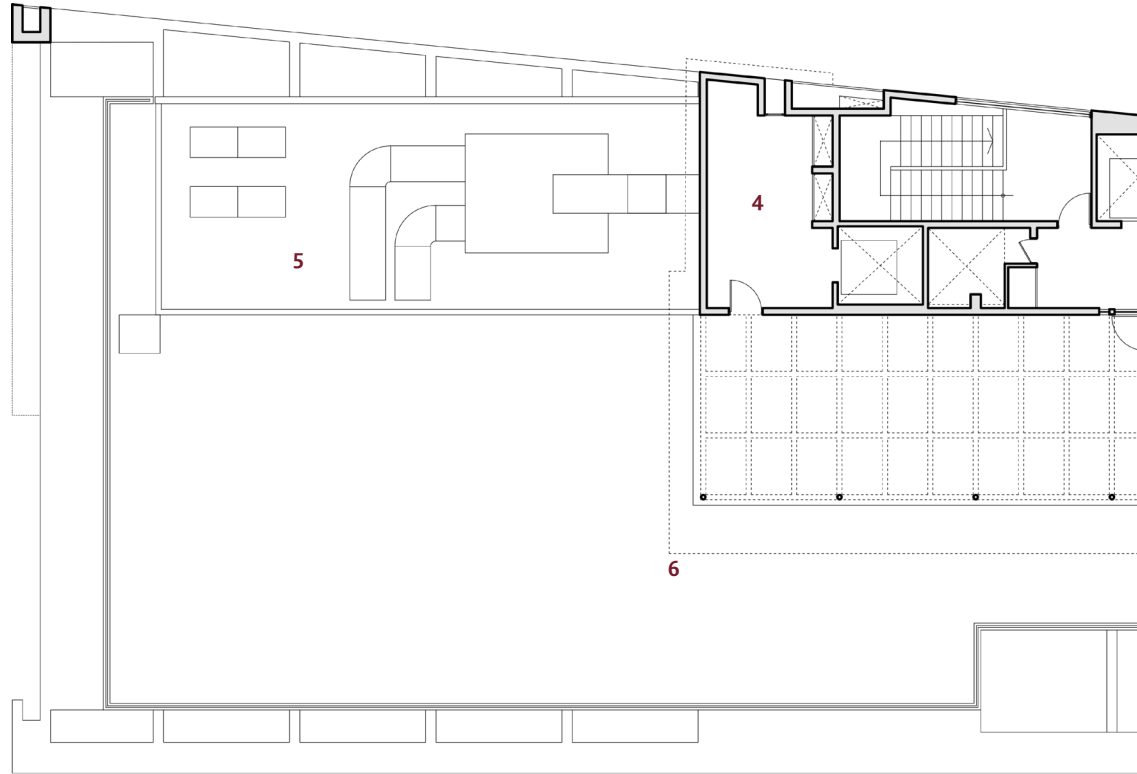




- 1 Gallery
- 2 Boardroom
- 3 Guest Suite
- 4 Pantry
- 5 Service/Storage
- 6 BIC Administrative Office
- 7 Director's Office
- 8 Library
- 9 Terrace
- 10 Restrooms

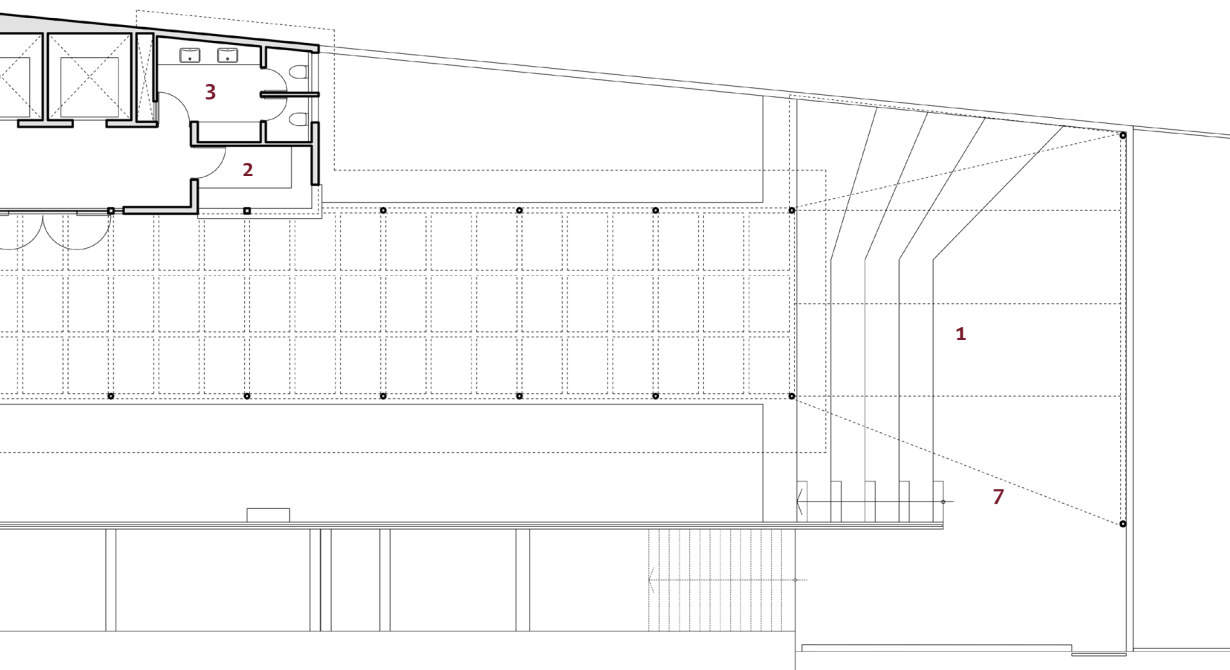
SECOND FLOOR

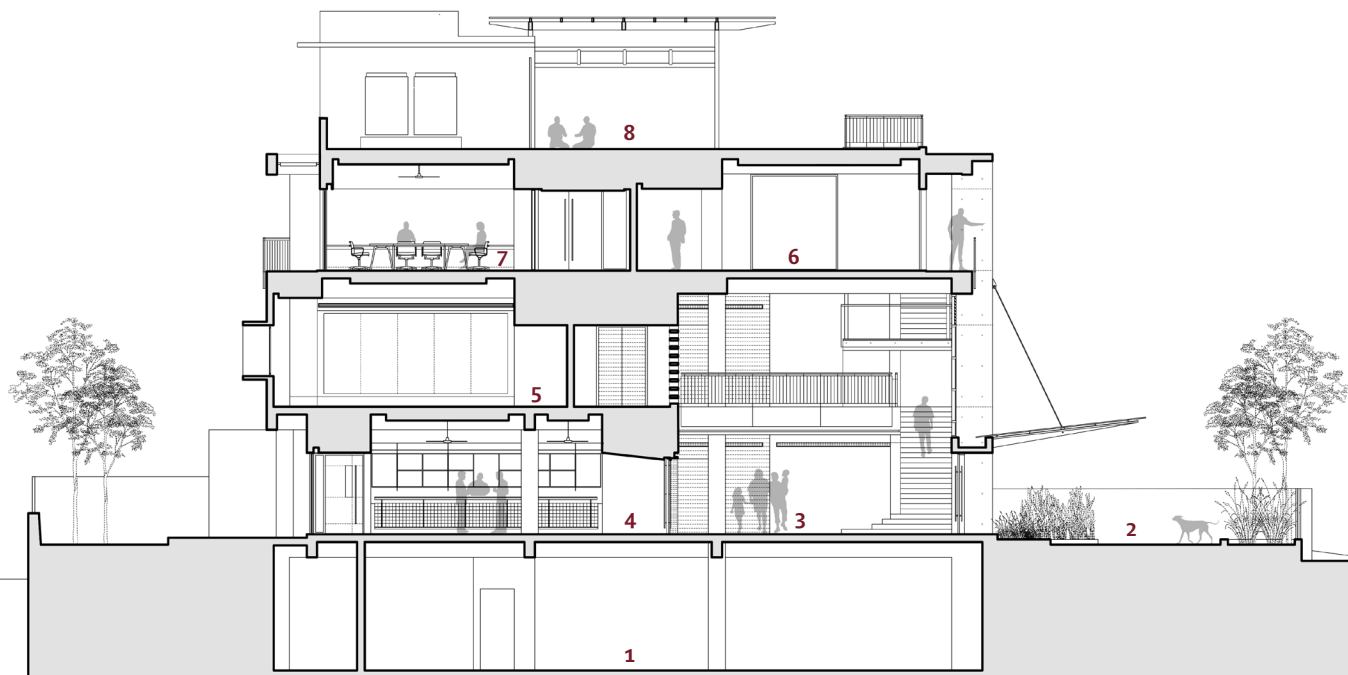




- 1 Amphitheatre
- 2 Bar
- 3 Restrooms
- 4 Service/Storage
- 5 A/C Equipment
- 6 Solar Roof above
- 7 Tensile Roof above

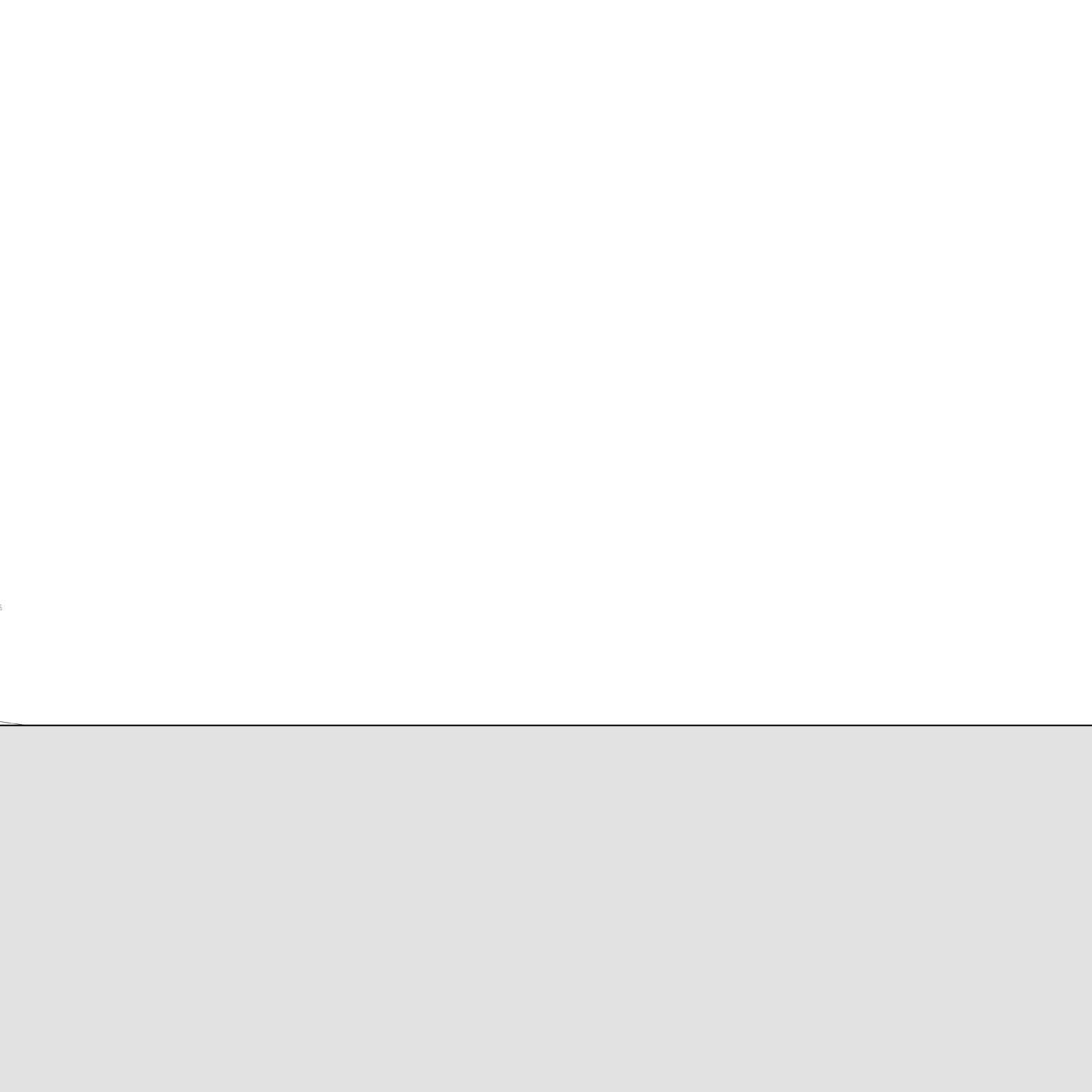
TERRACE

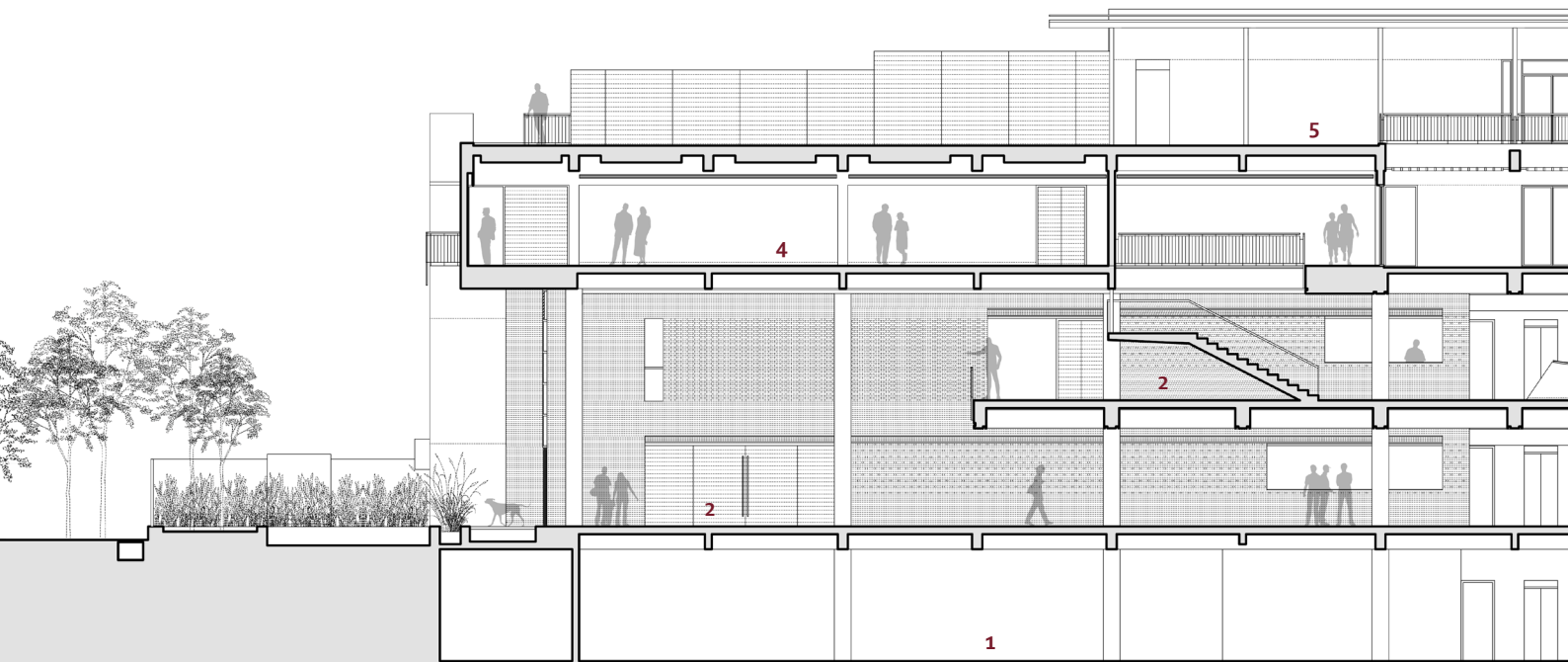




- 1 Basement (parking & services)
- 2 Drop-off
- 3 Lobby/Pre-function
- 4 Restaurant
- 5 Seminar Room
- 6 Gallery
- 7 Board Room
- 8 Roof-top & Amphitheatre

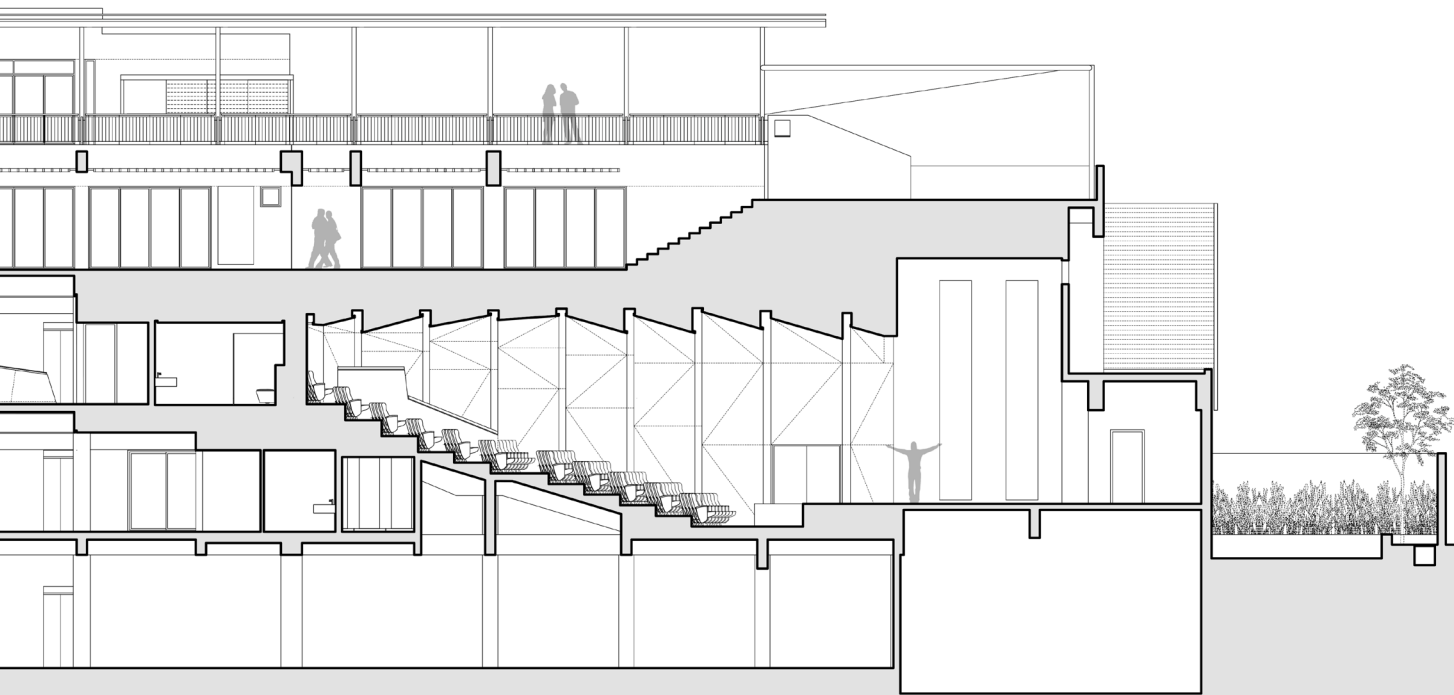
SECTION A

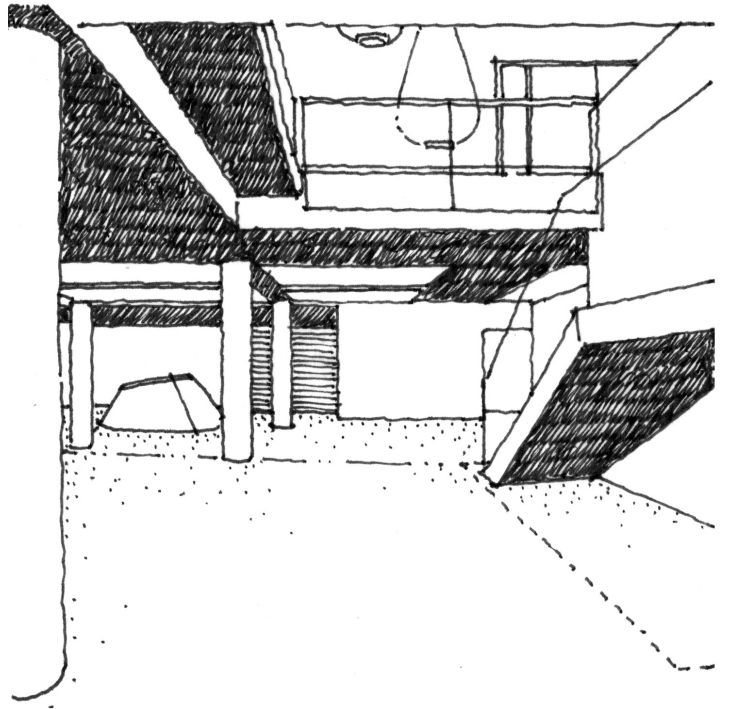
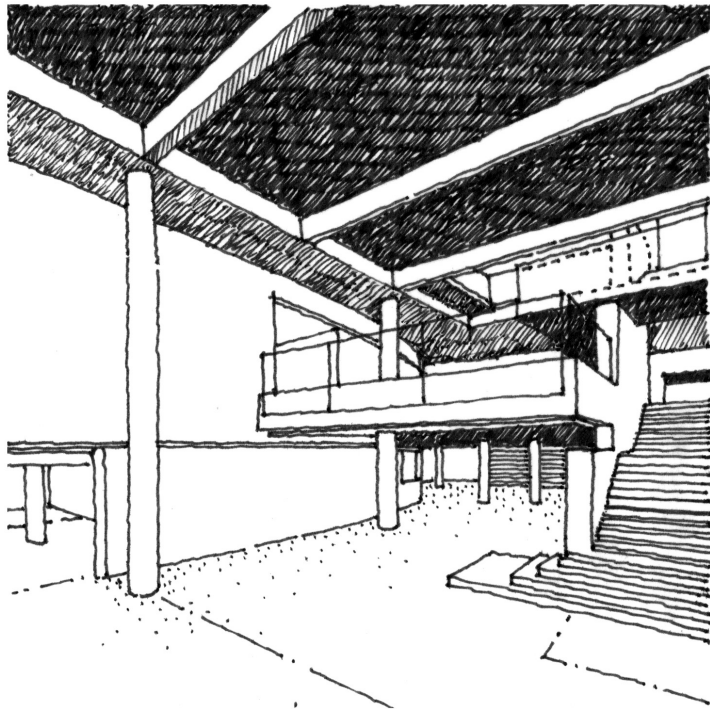
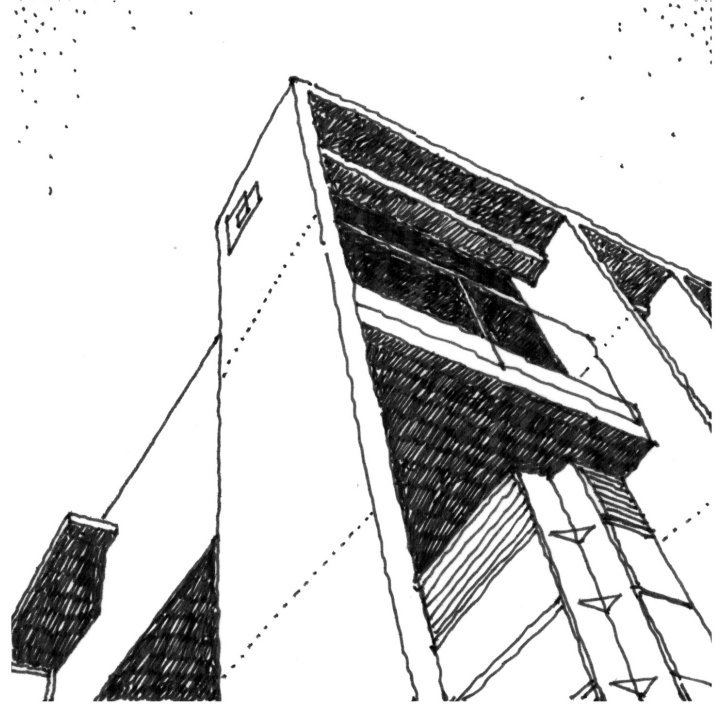




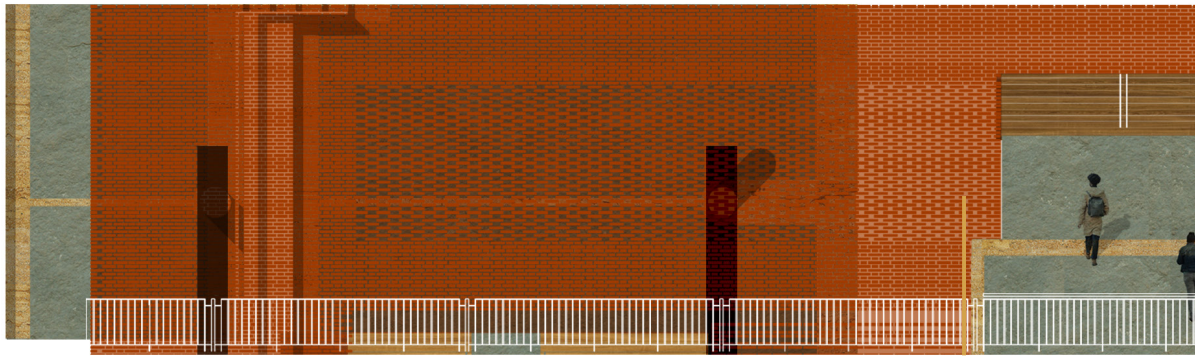
- 1 Basement (parking & services)
- 2 Lobby/Pre-function
- 3 Auditorium
- 4 Gallery
- 5 Roof-top & Amphitheatre

SECTION B

















Sanjay Kumar
Bangalore, India

11
12
13
14
15
16
17
18
19
20





The BIC sits in a low-rise residential neighborhood with a large public park on the south. The primary access is from this side too and the long elevation of the building is always seen obliquely from this end. A concrete frame runs along this eastern facade ordering the various program components within and establishing a vertical datum in contrast to the varying scales and character of the neighboring residential buildings. This austere facade is then enriched by the variations in material expression and spatial compositions as program from within encounters it. The cadence of the columns too is now effected by this engagement resulting in a facade that operates differently based on the distance from which it is perceived.









SINGAPORE
ENVIRONMENTAL
CENTRE





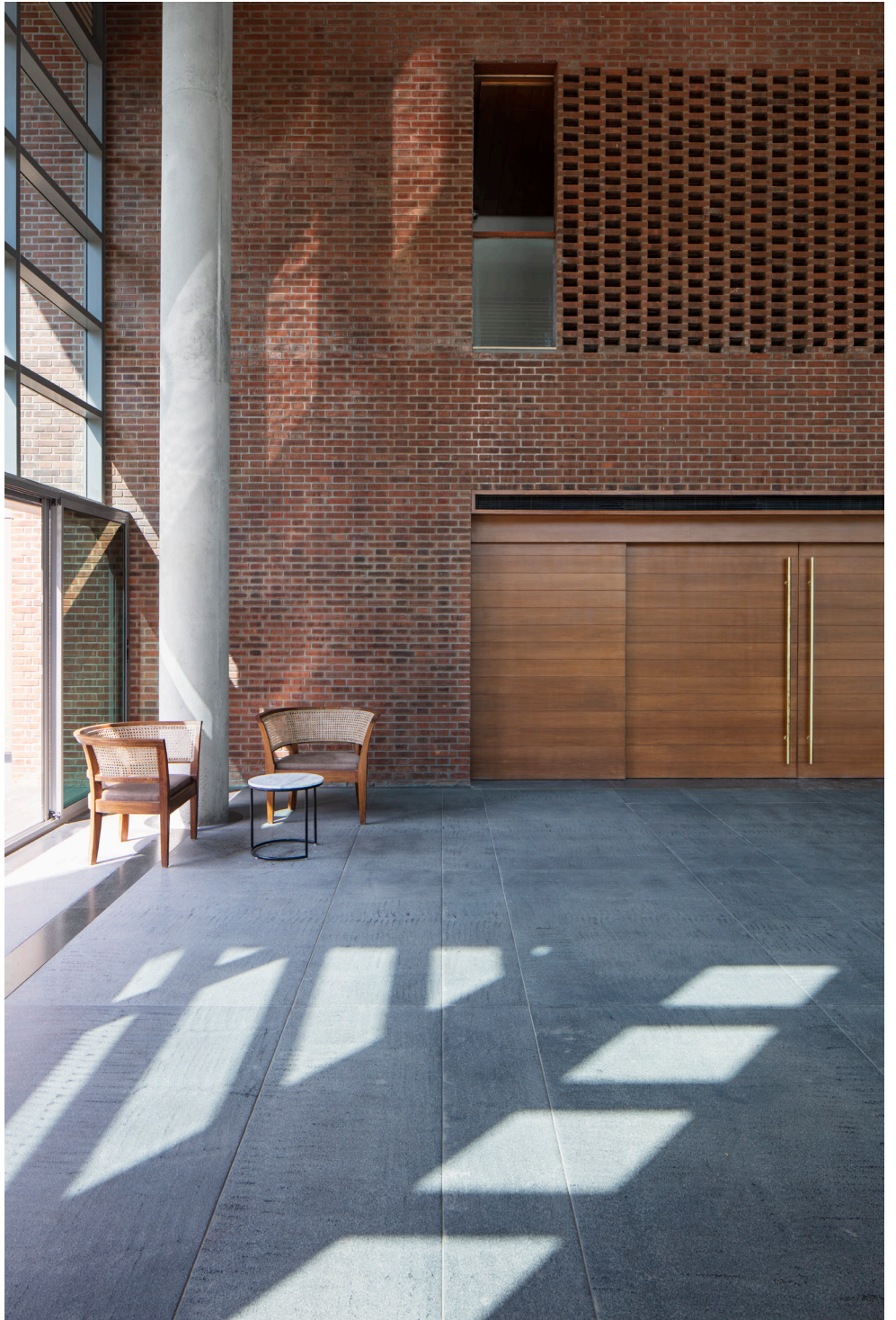
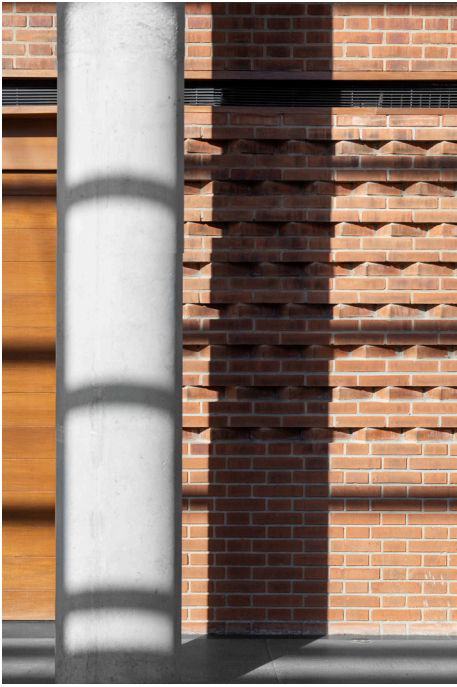
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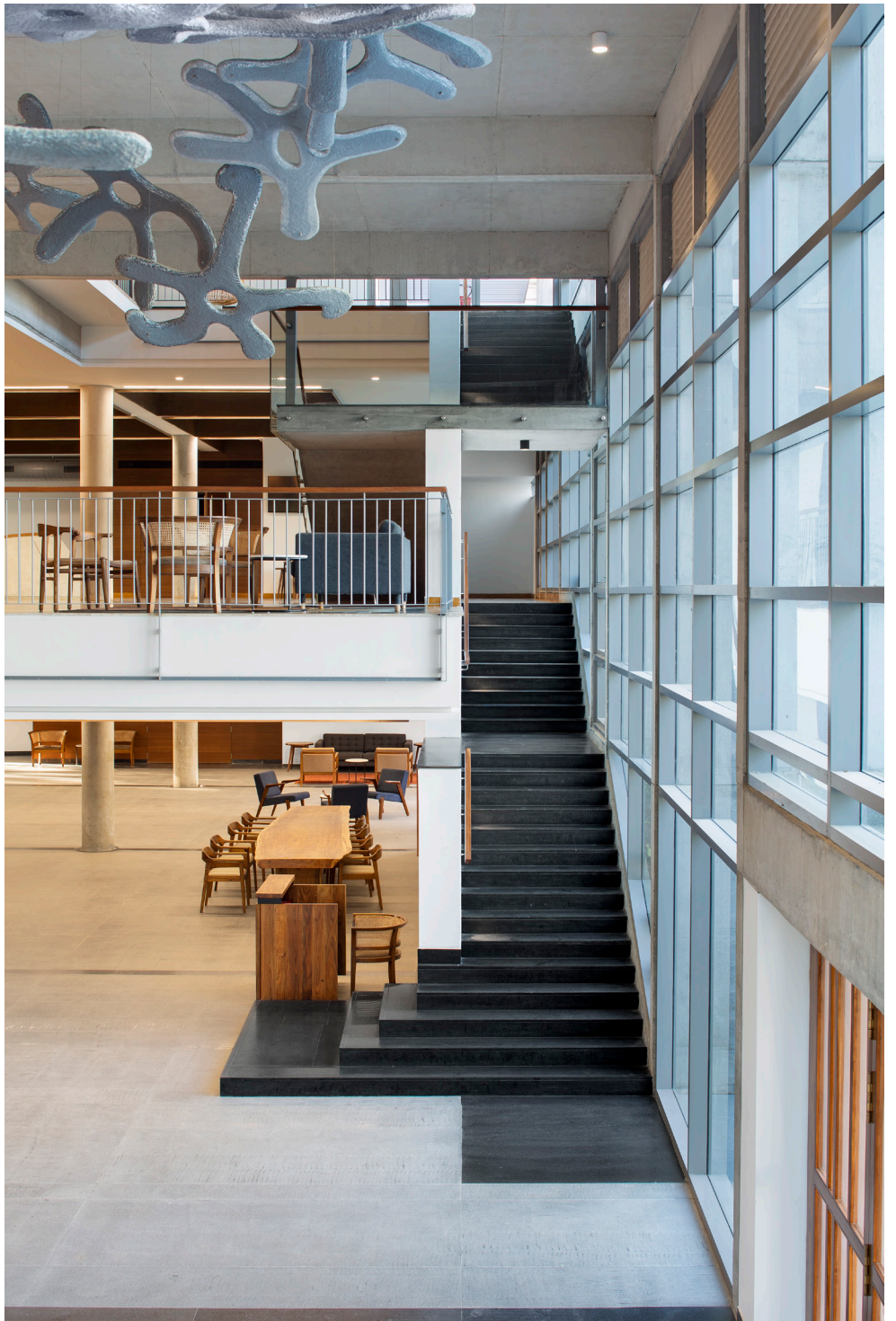
The richly articulated brick wall seemingly floating over the entry to the restaurant. This east west section is a series of layers of different materials, scale and porosity.







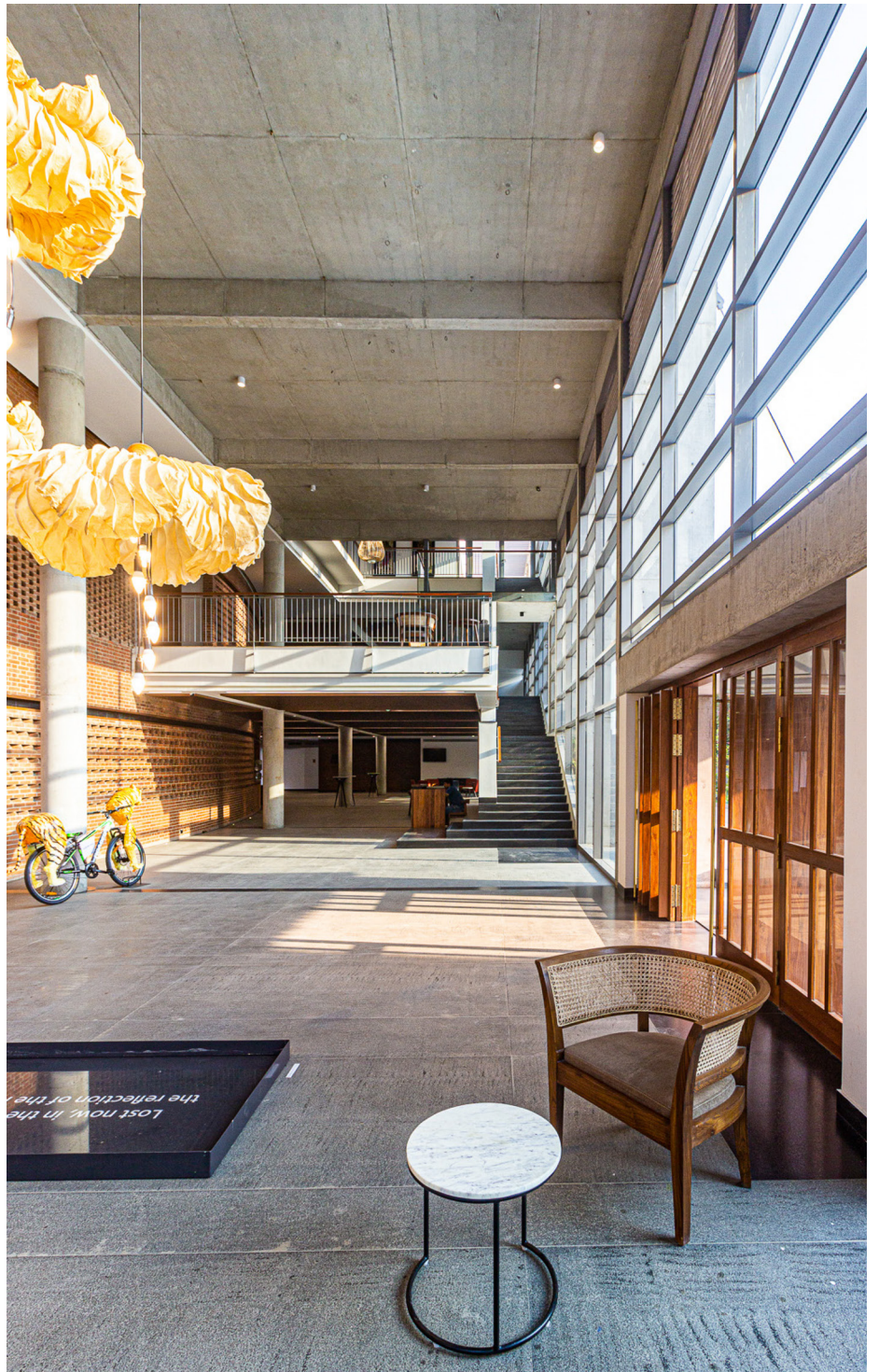










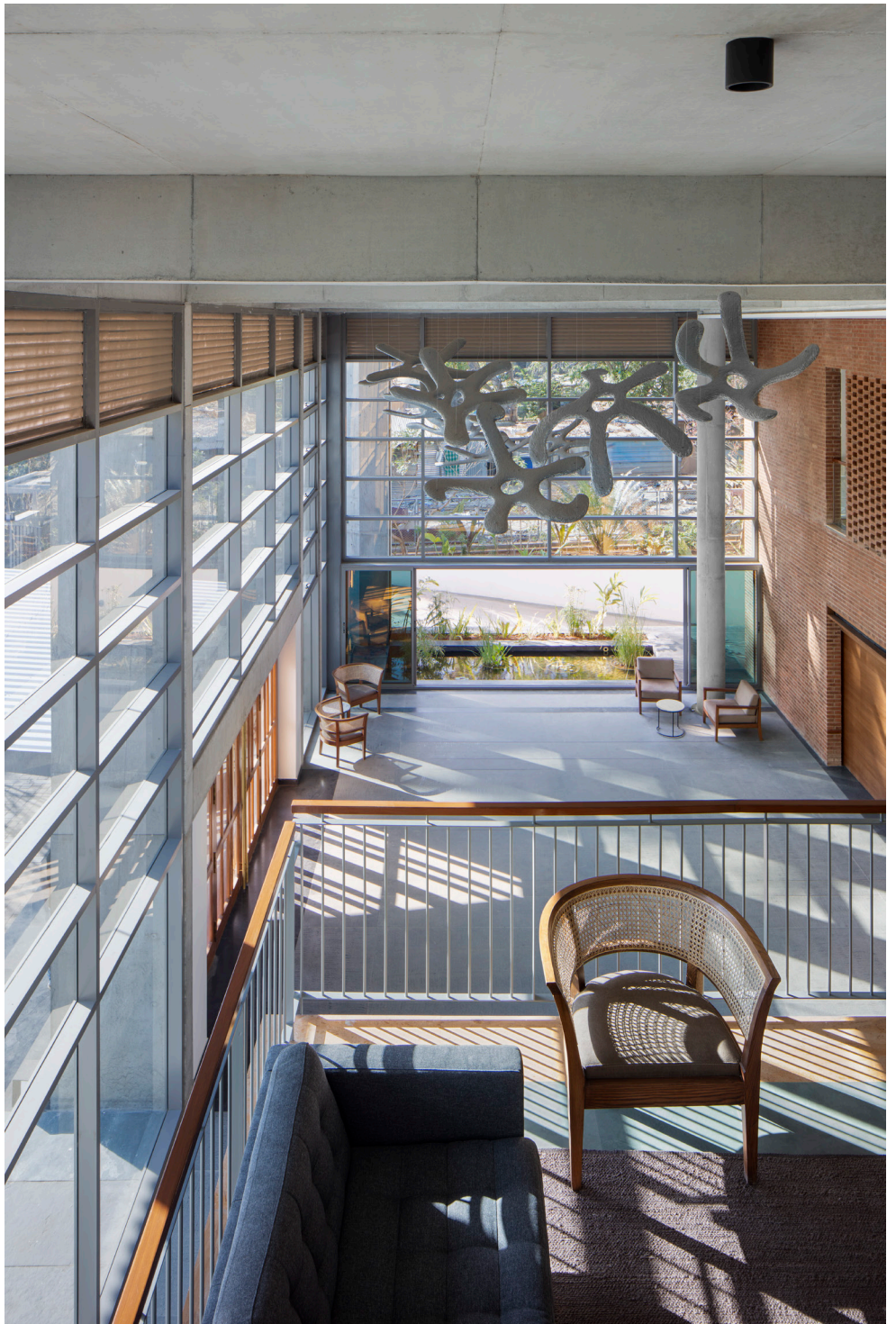








The wide opening on the south brings in prevailing breezes across a water body and through the cascading north south section. Louvres are provided on the upper most part of the glazing to allow hot air to escape and induce the circulation of air through the building.











This page and overleaf: Volumes and 'objects' (brick wall, oculus, stair and bamboo lanterns) as counterpoints to structure.













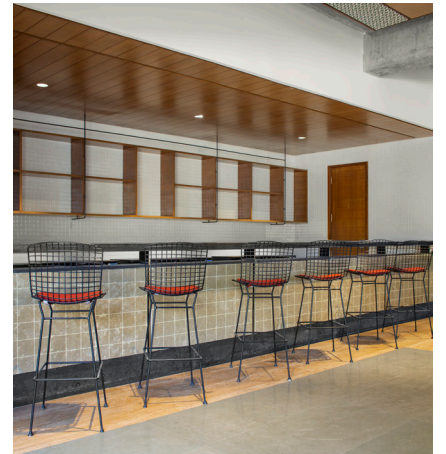
The auditorium is a natural sound box which can accommodate 185 people and an ensemble performance on its large sprung floor stage.







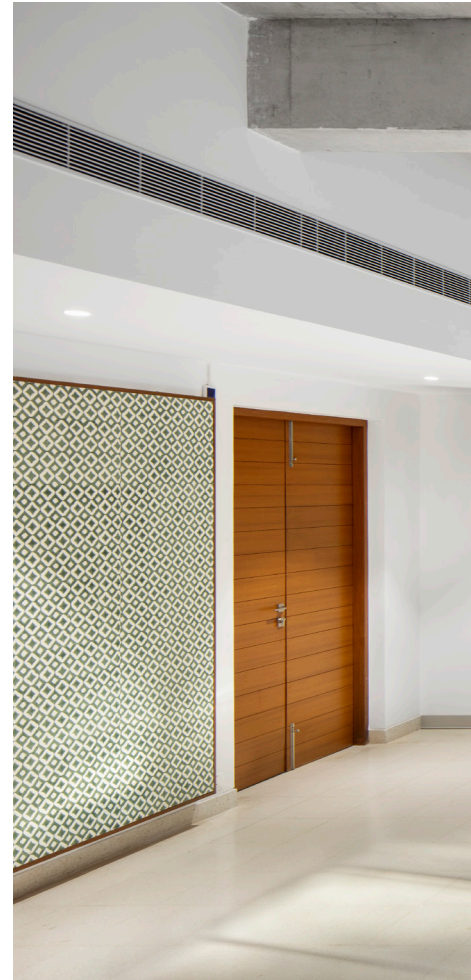




Cafe on the ground floor
78



Library on the second floor





*This page: Seminar Rooms on the first floor and Board Room on the second floor
Overleaf: Art gallery / Exhibition space on the second floor*









Walkway to the terrace along the east



Amphitheatre and Solar Roof on the terrace









LANDSCAPE DESIGN

Varna Shashidhar / VSLA

The location of the site beside a municipal park, army lands and adjoining the city's storm water channel (*nala*) determined the design of the landscape. Due to the high programmatic built requirements and associated services, the amount of open space available was limited. The landscape looked beyond the site & aesthetics, to function as a public amenity as well as to contribute towards environmental remediation.

The landscape was conceived of as a space that would encourage the BIC visitors to engage with the outdoors. The key areas were

- A) linear public garden at the entrance,
- B) a surrounding buffer landscape with a biological pond, and
- C) a meander space / permeable green-way / rain garden along the set back to the rear (west) of the building adjoining the *nala*. This area has highly degraded & polluted soil, with constant seepage from the *nala*, which in addition to storm water also carries a lot of raw sewage. Additionally during summers this waste stagnates creating an unsightly flotsam with foul odor and mosquitoes near the site. The key intention was to look at improving the quality of this space as an ecological corridor, and an amenity for the visitors & residents of the neighborhood. This is conceived of as a performative landscape that aims at creating an urban ecosystem, that now attracts a varied species of urban mammals and birds and also ecologically linking this green-way *nala* corridor with the larger open spaces such as the neighboring park and army open lands.

A Linear Garden

Due to the limited open space available for planting in the project especially towards the front of the building, this has been planned as two linear stretches of greenery of 1.5m width. A green band close to the building provides an experience of the landscape to the occupants of the building and a narrow band on the edge of the site connects to the existing street trees along the main road. From within the building, the occupants feel a connection with two kinds of nature, one whimsical and the other more sedate. Creating an expansive garden experience even in a limited space, this garden is a place to wait, relax and gather. The furniture includes long monolithic stone benches, and movable outdoor furniture. The paving



A. Linear Garden



C. Rain Garden

comprises of cobble with subtle variations.

B Pond & Buffer Landscape

The Landscape recommendations suggested include a bio-pond to the south, which faces a narrow site buffer and the ramp to the basement. The double height lobby opens out to this pond and buffer landscape. Despite the narrow size of the pond and limited space for planting, the vegetation of the pond & buffer still engulfs the occupants. As the planting for the pond & buffer was designed to allow the visitors in the lobby to feel an expanded sense of greenery and contiguity with the visual borrowing of the neighbouring park landscape while concealing the vehicular movement from sight.

C Permeable Green-way / Rain Garden

The Landscape looks at creating a functioning urban ecosystem that now attracts a varied species of urban mammals and birds. As space where you can escape from urbanity while being in the heart of the city. This space is largely a rain garden with a meandering walkway (in local dry laid chapadi stone with gravel). A space for visitors to take a break from performances & conferences while being engulfed in nature. It's a performative landscape, a rain garden that enables biological filtration and this improves storm water quality through an exposure to dense vegetation, gravel and soil before slow infiltration and then collection in a perforated subdrain, thereby reducing pollution of the adjoining *nala*. Plants that facilitate the removal of pollutants in the storm water have been used (such as Cymbopogon, Nerium). The plant species are able to take urban stresses, and require minimal maintenance. The aesthetic manifestation of this performative landscape is one that creates a variety of textural & fragrant plants with seasonal color.

All local species have been used in the project with no exotic planting. This space also adds a touch of whimsy to an otherwise ordered architectural language of the building.

SUSTAINABILITY STRATEGIES

Deepak Kumar / Mindwagon Sustainable Design

The building has been submitted for a GRIHA 5 Star certification. As part of this in the preparation of the site, safety standards during construction, storage of materials, construction methodologies and material specifications, GRIHA norms and recommendations were followed.

The climate classification is under Moderate or Temperate climate as per Energy Conservation Building Code (ECBC) and National Building Code (NBC).

Baseline case and Proposed case considerations for whole building annual performance analysis:

Proposed or Design Case			Baseline Case
U Values		Btu/ft ² F	
Wall	AAC Blocks	0.126	As per ASHRAE 90.1
Roof	Stone Tile	0.068	
Glass	5.7 W/m ² K	1.8 Btu/ft ² F	
LPD	0.4 W/ft ²		1 W/ft ²
EPD	1.5 W/ft ²		1.5 W/ft ²
Process Load	0.5 W/ft ²		0.5 W/ft ²
HVAC	VRF System		Water Cooled Screw Chiller
COP	3.6		5.9

Baseline case model:

Baseline case energy model follows ASHRAE-90.1 2007 Appendix-G, building envelope, HVAC system, indoor and outdoor lighting power Density, ASHRAE 55 and ASHRAE 62.1 for thermal comfort and minimum fresh air standards.



5. Tensile and Solar roof

Proposed Case model:

1. Building envelope with Autoclave Aerated Concrete (AAC) blocks for exterior and interior walls with cement plaster on both sides. AAC block has a certain percentage of Flyash (post industrial recycled content).
2. Single Low-E glass with U-value of $5.7 \text{ W/m}^2\text{K}$, SHGC of 0.35 and visible light transmittance of 30%.
3. Light Power Density (LPD) achieved by Building Area method is 0.4 W/ft^2 (baseline of 0.9 W/ft^2 as per building area method ASHRAE 90.1) by use of LED lights for interior visual comfort lighting. Achieved 60.2% reduction in lighting operational energy consumption and further reduction anticipated with use of Occupancy sensors is 15%.
4. Occupancy sensors controlled indoor artificial lighting for all regularly occupied zones.
5. 28KW of Building Integrated Solar Photovoltaic system (BIPV).

Retscreen analysis as below: Annual generation of 40.5 MWH. Further offsets annual from grid power by 5.45%. BIPV and tensile structure for the terrace Open Air Theatre (OAT) shades atleast 50% of the terrace slab reducing the heat gain and reducing the impact of Urban Heat Island Effect.

6. Outdoor lighting with 0.03 W/ft^2 (baseline case ASHRAE 90.1 of 0.05 W/ft^2). 40% saving in outdoor lighting connected load.
7. Complete outdoor lighting with LED lights with timer based control to switch ON in at 6 PM and Switch OFF at 6 AM.
8. Thermally efficient building envelope (AAC blocks and Single LOW-E glass) + VRF system of COP 3.6 + reduced LPD of 0.4 W/ft^2 (baseline of 0.9 W/ft^2 by building area method) + Elimination of chilled water pumping energy of 42000 KWH (by use of VRF system with higher efficiency at part loads) compare to a Water cooled chilled water system as per ASHRAE Appendix-g baseline case + Outdoor lighting with LPD of 1 W/ft^2 + Taking a step forward by detail thermal comfort analysis for summers of moderate climate of Bangalore (INDIA) we also took a decision of opting for Two-stage evaporative cooler for common area like entrance lobby, common circulation corridors (thermal comfort within the comfort range as per ASHRAE 55).

With all the strategies listed for the proposed or the Design case in comparison to ASHRAE Appendix-g baseline with whole building performance modelling we have achieved an annual energy reduction

or saving of 43% compare to Baseline case. In addition to this the overall annual operational energy saving including energy offset by renewable energy of 28 KW BIPV is 48.45% compare to baseline case.

9. Climate and thermal comfort analysis for recommendation of 2 stage evaporative cooling for common areas like entrance lobby and common circulation corridors as below:

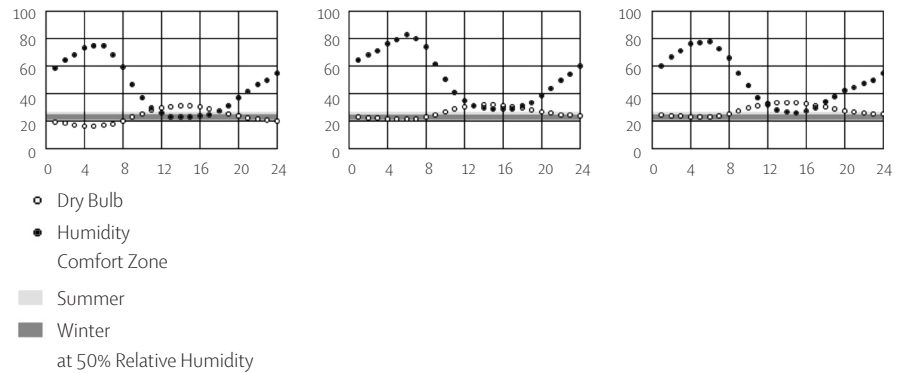
Location: Bangalore, Karnataka Latitude/Longitude: 12.97°N, 77.68°E

Time zone: +5.5GMT

432950 WMO Station Number

Elevation: 921m

Data Source: ISHRAE



Graph above shows clear potential of 2 stage evaporative cooling potential with low relative humidity in daytime for peak and moderate summer months of Bangalore.

Note: thermal comfort and minimum Fresh air standards are as per ASHRAE 55 and ASHRAE 62.1 respectively.

Maintenance:

1. Segregated energy metering to monitor energy performance of HVAC, indoor lighting, outdoor lighting, pumps.
2. All pumps used are BEE 5 star rated equivalent.
3. 10 KLD STP treated water used for flushing and landscaping

ACOUSTICS DESIGN

Didier Weiss / Sound Wizard

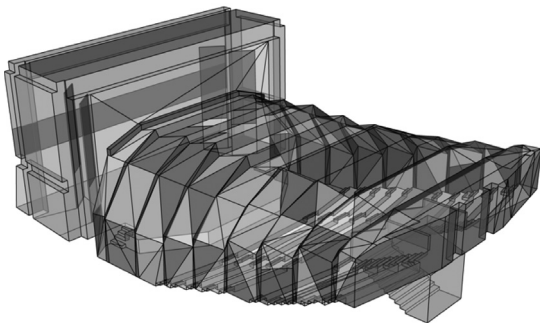
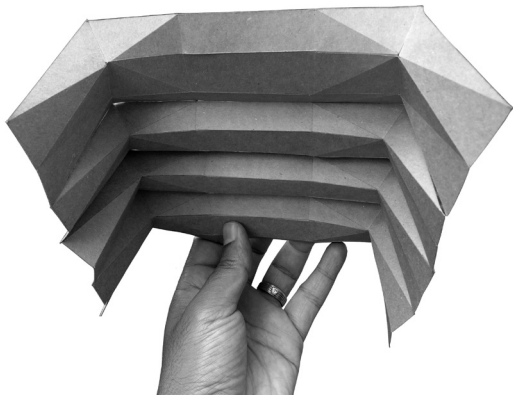
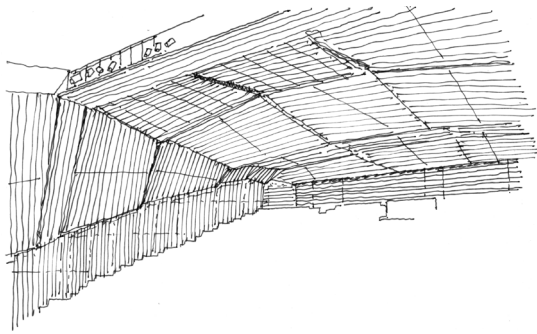
Designing a multipurpose hall requires an understanding of the fundamental compromise involved, since the requirements for amplified performances and acoustic performances are in direct conflict. In the case of amplified performances, reasonable absorption at all frequencies is required to create a comfortable listening experience. However, acoustic (un-amplified) performances require some amount of reflective surfaces in order to naturally amplify the sound within the space.

The modern single surface material shell conceptualised provides many acoustic advantages, allowing this space to serve as an effective multipurpose auditorium. The angular and multi-faceted inner shell creates variably spaced air gaps throughout the auditorium, resulting in excellent absorption across all frequencies.

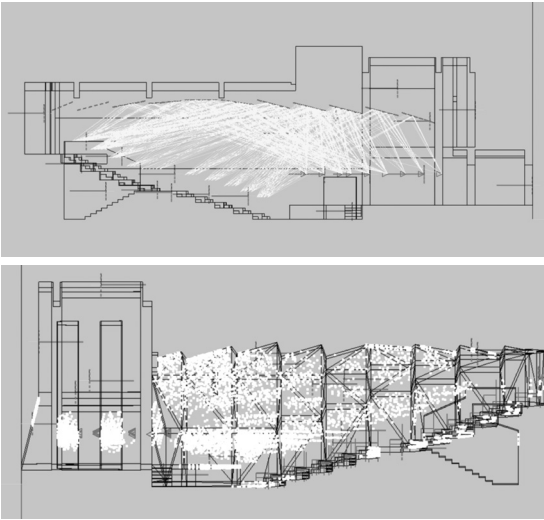
It solves a common issue in auditorium designs where a fixed air gap from a simple rectangular box results in excess absorption at particular frequencies. Using perforation on the inner wooden shell allows acoustic absorption to remain hidden. Varying the perforation allows mid and high frequency energy to be reflected and carried throughout the room, while allowing low frequency energy to still pass through the shell and be absorbed. This might result in a slightly higher reverberation time compared to the average auditorium, but the main benefit of this design is the ability for unamplified sound to carry through the space. The image on the left shows the level of detail in the design, with the different shades of grey representing varying amounts of perforation in the wooden panels.

To arrive at this design, a ray-tracing analysis of the auditorium had to be conducted in order to understand and control the behaviour of mid to high frequencies. Speakers were placed on the stage in the 3D model at human head height to simulate people talking, singing or playing an instrument on stage.

The angles of the wall and ceiling panels were adjusted and angled to reflect the sound created on stage. After many iterations the overall geometry of the space was finalized. From here, the amount and location of perforation



*Varying the density of perforation
(varying the amount of absorption & reflection)*



Simulation (Ray-tracing)

in the various panels had to be determined. By differentiating between the first reflection points of the auditorium line array and the “speakers” placed on the stage, we were able to identify the useful and harmful reflections in the auditorium. This was done by analyzing the bounces on the walls and the ceiling.

The useful reflections were guided with reflective surfaces (with little to no perforation), and the harmful reflections from the line array) were treated with highly perforated panels. Certain compromises had to be carefully weighed up and selected in order to allow the space to truly be considered a “multi-purpose” auditorium.

The key features of the auditorium can be summarized in three main points;

1. Perfect integration between natural acoustics and electro-acoustics: The hall can be used in all applications involving a sound system (amplified music, cinema, conferences, etc.) and also without using amplification, by natural sound transmission from stage to audience (theatre plays, unplugged music events, etc.).
2. Sound system integration is designed as an enhancement of natural acoustics, using a clever combination of both. The system has been primarily designed to provide even coverage in loudness (SPL) and tone (frequency response) all over the audience area, leading to a transparent and seamless result.
3. Silent environment: it is impossible to achieve any level of sound quality when background noise from air conditioning and other sources blur vital micro-information in complex audio signals. We worked extensively to provide solutions for HVAC silencing, while also avoiding any surface rattling (from AC grills, wooden panels and other equipment) at loud levels. The auditorium noise floor has been measured and certified to be NC25, which is an excellent result for a venue of this scale.

Project Details

Client: Bangalore International Centre
Project Type: Mixed Use Public Facility
(185 seat Auditorium, 150 seat
Seminar Room, Library, Gallery & Restaurant)
Built Area: 5,000 sqm
Site Area: 0.5 Acres
Status: Completed in 2019

Major Donors

Rohini & Nandan Nilekani Philanthropies
Wipro
The Energy and Resources Institute (TERI)
-
Prof. Thomas Kailath
Sarah Kailath Auditorium
Kusumlatha & T.V. Mohandas Pai
BIC Library & Seminar Rooms
Parwathi Mirlay & Sukumar Srinivas
Gallery Saanchi
The Shibulal Family Philanthropic Initiatives
Tamara Amphitheatre

Photographs:

A. J. Fanthome / Naughts and Crosses
Premjit Ramachandran (p. 94)
Nandan Nagarad / Curious Case of Design
(p. 36, 37, 41, 50, 51, 52, 53, 62, 63, 64, 73, 74,
85)
Mallikarjun Katakol (p.39, 42, 43, 70,71)
Ujwal Sannala & Sharanya Satoor (p. 76, 77)

Hundredhands Project Team:

Harshith Nayak (Project Architect)
Kiran Kumar, Nia Puliyl, Rajendra Hegde, Harriet Walton, Tannay Bothara,
Anna Rose, Rohan Patankar
Sunitha Kondur & Bijoy Ramachandran (Partners)

Consultants:

Structural Consultant: B. L. Manjunath / Manjunath & Co.
Landscape Architect: Varna Shashidhar / VSLA
HVAC & Electrical Consultants: Jayathirtha Narayana / Airtron Consulting
Engineers
PHE & Fire Consultants: Sampath Kumar / Sampath Kumar Associates
Acoustical Consultant: Didier Weiss / Sound Wizard
Performance Lighting Consultant: Pritham Kumar & DIEM Consultants
Sustainability Consultant: Deepak Kumar / Mindwagon Sustainable Design
Networking & Security: L. Sugandaraju / LS Consultants
Project Management: A. N. Prakash / A. N. Prakash Construction Project
Management Consultants Pvt. Ltd.

BIC founder trustees & Building Committee:

Dr. A. Ramachandran, T. R. Satish Chandran, Dr. R. K. Pachauri, Girish Karnad,
K. K. Misra, S. Sundar, C. Dasgupta, Prof. S. L. Rao, Ashok Jaitly, Dr. Prakash G.
Apte, Prof. J. Philip, Raj Chengappa, Mr. K. N. Shanth Kumar, and Dr. Leena
Srivastava
V. Ravichandar (Building Committee Chairman, Board member and Hon.
Director), Hari Prasad Hegde (Board member), Naresh V. Narasimhan,
Sanchali Harsha, and K. Jaisim

Additional Support (BIC):

Raghu Tenkayala & Irina Snissar

Peer Reviewers:

Auditorium: Arundhati Nag, Girish Karnad, M. S. Sathyu, Anmol Vellani
Structure: Ashok Rao
HVAC & Electrical: M. Selvarasu / LEAD Consultants
Site Drainage (French Drain): B. R. SrInivas Murthy
Building Management System: Bhaskar / Miniput
Sustainable Strategies: Dr. Chandrashekar Hariharan

Contractors, Vendors & Suppliers:

Civil & PHE: SV Constructions Pvt. Ltd

Interiors: Raj Interiors Pvt. Ltd.

Electrical & Networking: Micron, Surround u IT

HVAC: Vayucon Systems / Bluestar

Landscape works: Pavan Landscape, Arumugam Construction

Audio/Video: Flamencotech

Performance lighting and auditorium equipment: Leksa

Stage Flooring: Kingsmen Enterprises

Aluminium Glazing: Teamworks Glass Solution/ AluK

Auditorium Seating: Cadmus Enterprises / Ferco

Furniture: SFA Works, Prakrit, Warisan, Ikea, Red Oak, Bristol, Steelcase, Ergotek

Lights: Prism, One Good Chair, Oorja, Havells, Studio Plus, Light Alive, Reflections, Source

Rugs: Source

Blinds & Fabrics: HR Tats (Srilanka), Tarangini Studio, Anutone

Lobby Art Installation: Nivedita Deshpande

Waterbody (Bio-filtration): Millennium Pools

Solar Panels: Aster Udyam

Tensile Roof: Uni Tech Inc.

Sanitary Fittings: Kohler

Fire Protection: Total Solutions

Kitchen: Trade Links Corporation, Pooja Equipments

RO systems: Crystal Drops

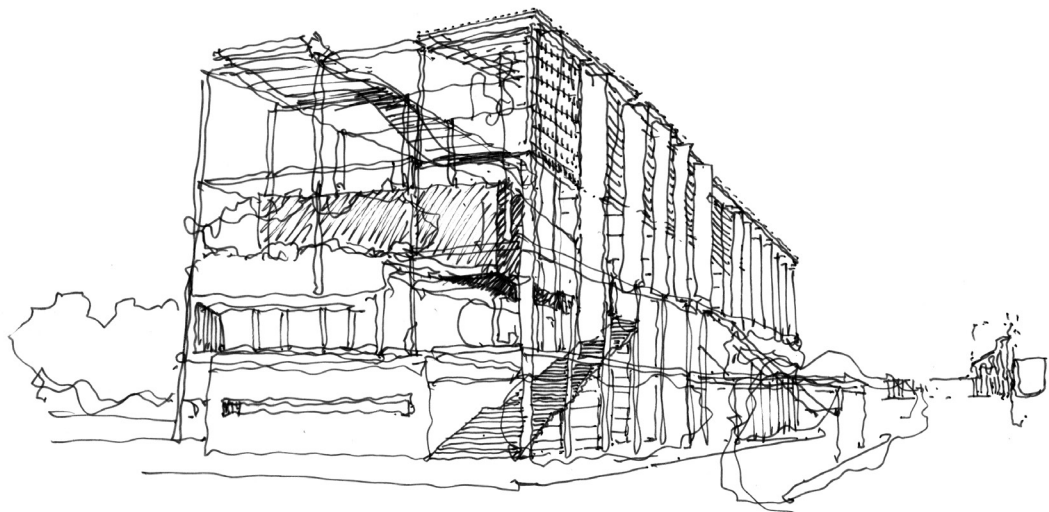
Signage: Welpac

STP: Thermax

DG: Powerica

Lifts: ThyssenKrupp







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