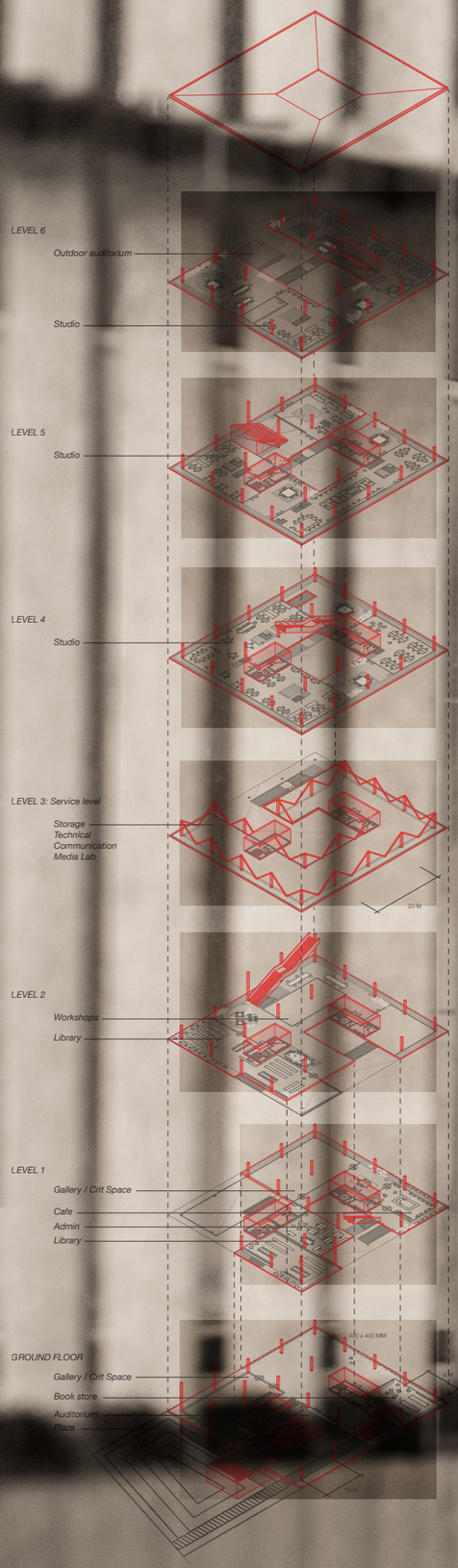
VIETNAM NATIONAL UNIVERSITY
POST GRADUATE DESIGN HUB

BUILDING TECHNOLOGY COMPONENT



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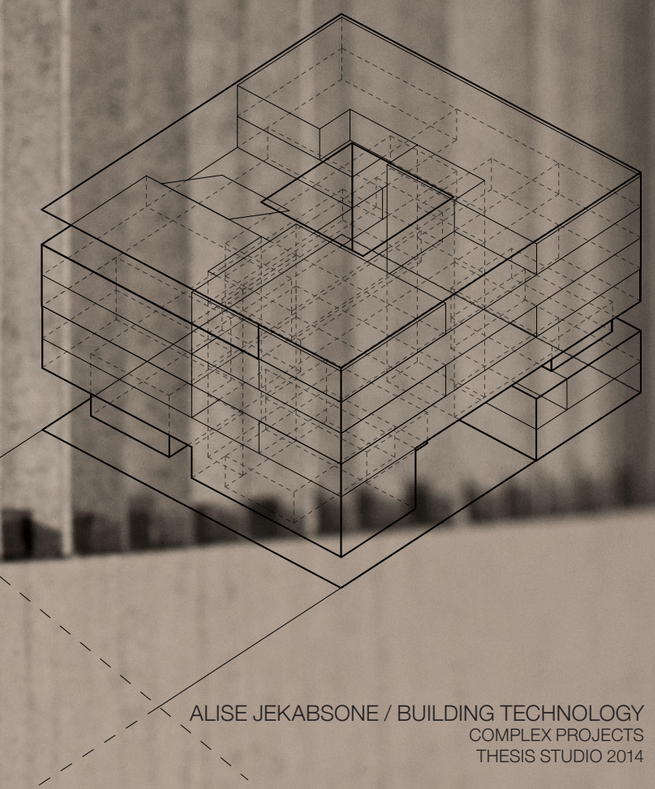
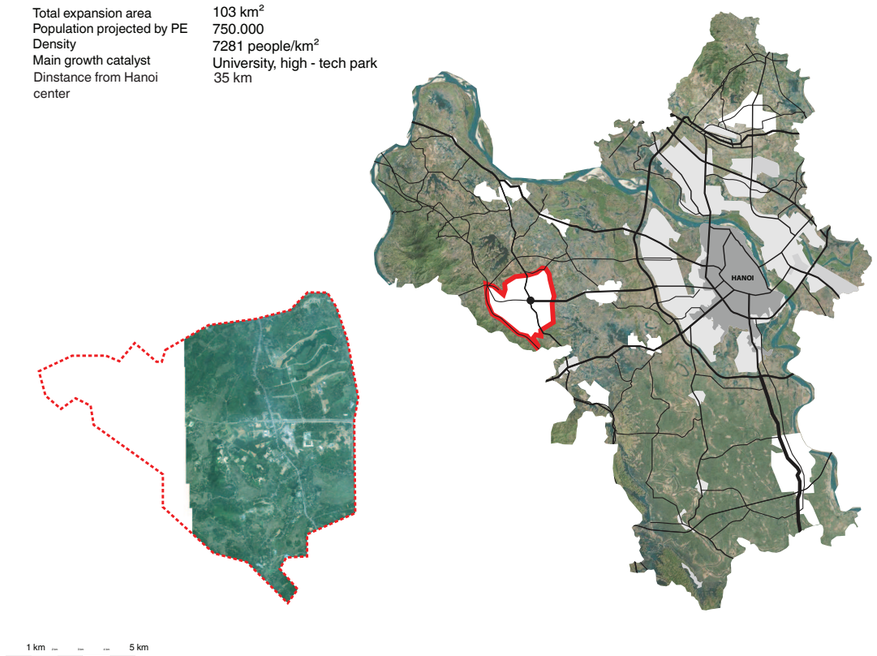
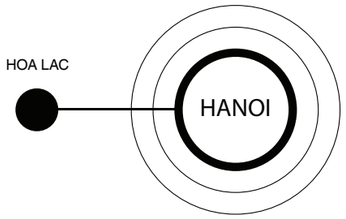
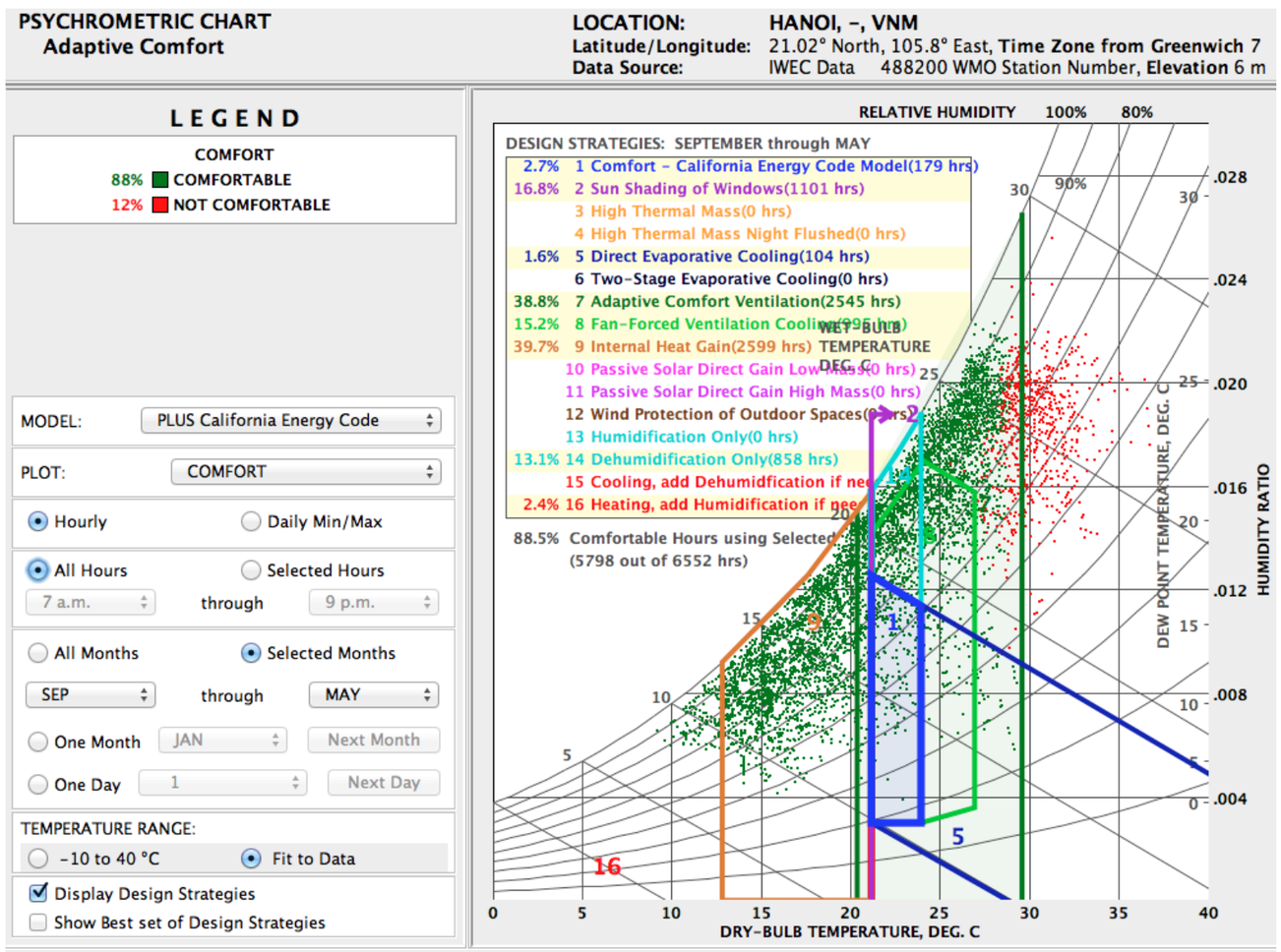


ALISE JEKABSONE / BUILDING TECHNOLOGY
COMPLEX PROJECTS
THESIS STUDIO 2014







The project is located in Hoa Lac, one of the new proposed satellite cities of Hanoi. It is located 40 km from Hanoi.

The climate zone is subtropical. Temperature ranges from 10’ C at the lowest in winter up to 40’C in summer. Throughout the year cloud coverage is relatively high - in average 75%.

The wind speed all year around is very low - average 1 m/s, which becomes a problem if in climate design cross ventilation is considered. An annual typhoon season brings very high winds, which must be considered.

Annual rainfall is two times higher than that of Rotterdam exceeding 1000 ml.

It is evident, that in terms of passive climate design Hoa Lac is not the most desirable location to work within - low wind speed, hot, humid. Therefore, in my design I propose to work with a certain typology, which is a courtyard building type, thus creating an opportunity to use a combination of cross ventilation and stack effect to ventilate the rooms, and also adding ceiling fans, which would help to move the air and also would create better comfort for the users.

I have also considered a possibility of radiant cooling systems, such as cooling with chilled water that is integrated as piping in floors, however that is not possible in this climate since the groundwater temperatures even 30 m deep are still too high reaching up to 30’C.

All climate conditions considering, during the operating hours of the university building, without application of mechanical ventilation and only using stack effect, cross ventilation and ceiling fans,it is possible to reach human comfort up to 88% of the time, which in the case of the project I consider appropriate.

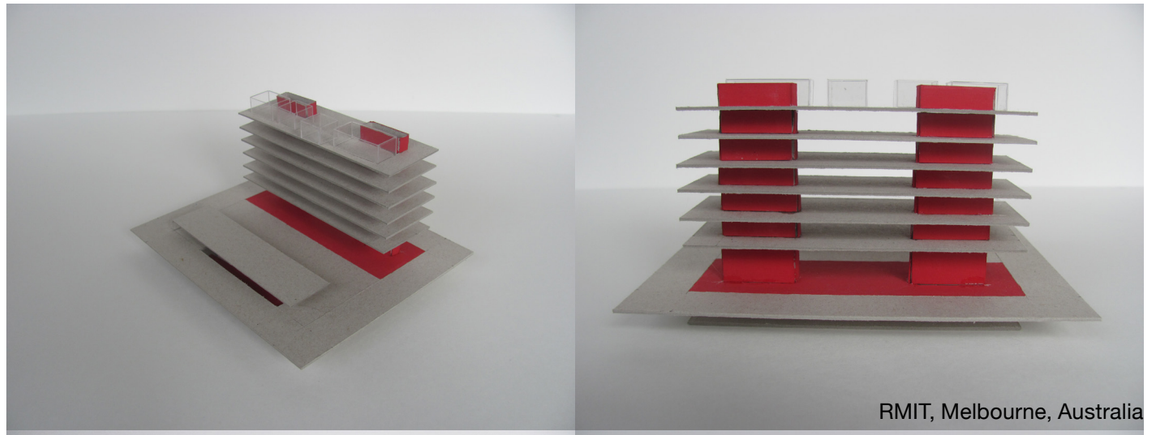
In a couple of rooms in the building, such as the library, where a certain temperature and humidity level is required, I have incorporated mechanical ventilation. Also, in terms of flexibility, in the future it is possible to install mechanical ventilation in the whole building, because the design of the building: floor to ceiling height is 3.4 m, which allows for raised floors, and ducting can be directed to the two cores of the building located on the opposite sides.

Source: Climate Consultant

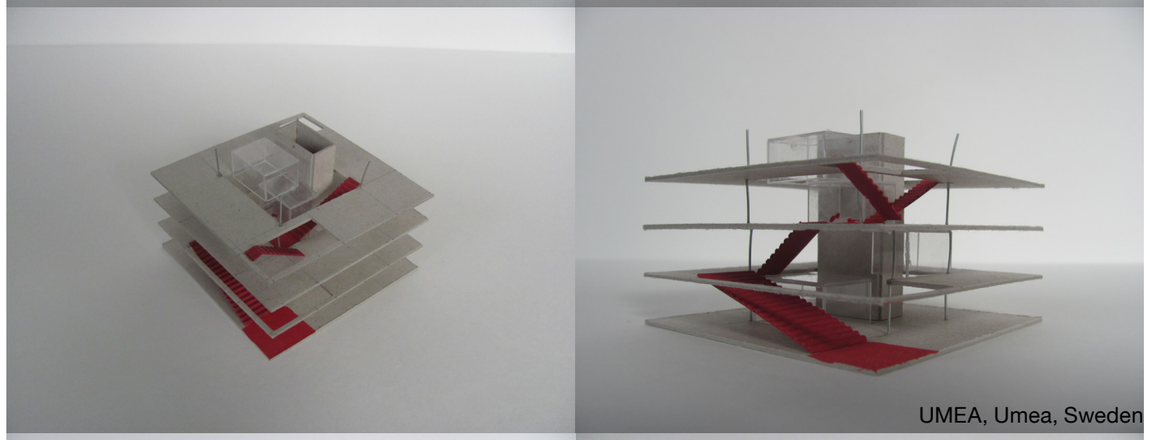
Most of the current facilities were built around the mid-20th century and have not been refurbished significantly since. The socialist regime is a significant part of the educational system and also is reflected in the built environment.

Most schools in Vietnam do not have qualified labs, libraries, and recreational areas for students. With the cooperation of various industry sectors and the investment from society as a whole, the school infrastructure has been upgraded day by day, but it is still not enough to significantly change enrollment and the learners' needs, especially in the remote, mountainous, and isolated areas of the country. As schools develop their infrastructure and facilities, they are better able to support their students learning and studies. In addition, reducing class size is another initiative that schools are making to reduce the pressure of teachers.

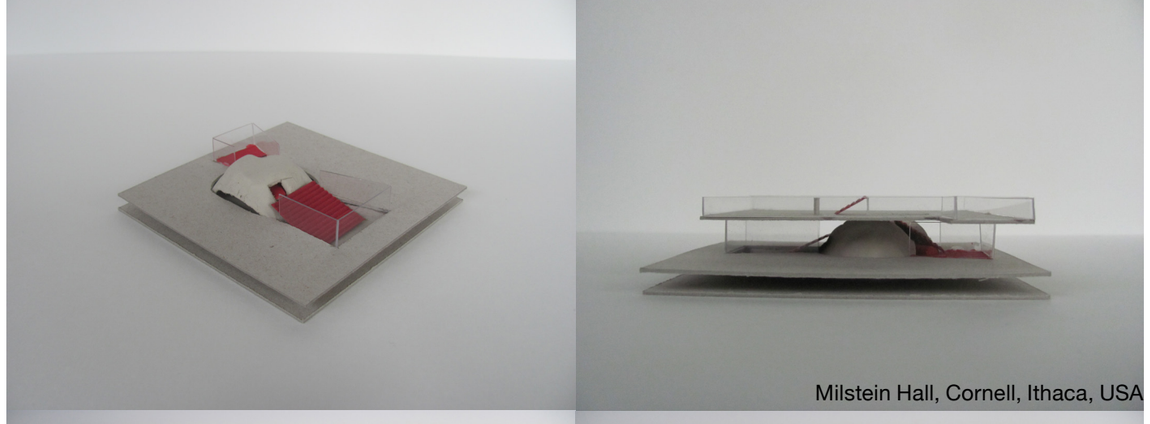
As the Vietnam National University is moving to the proposed campus in one of the satellite cities Hoa Lac, it creates an opportunity to design new, more up to date facilities for the future learners of the Net-generation.



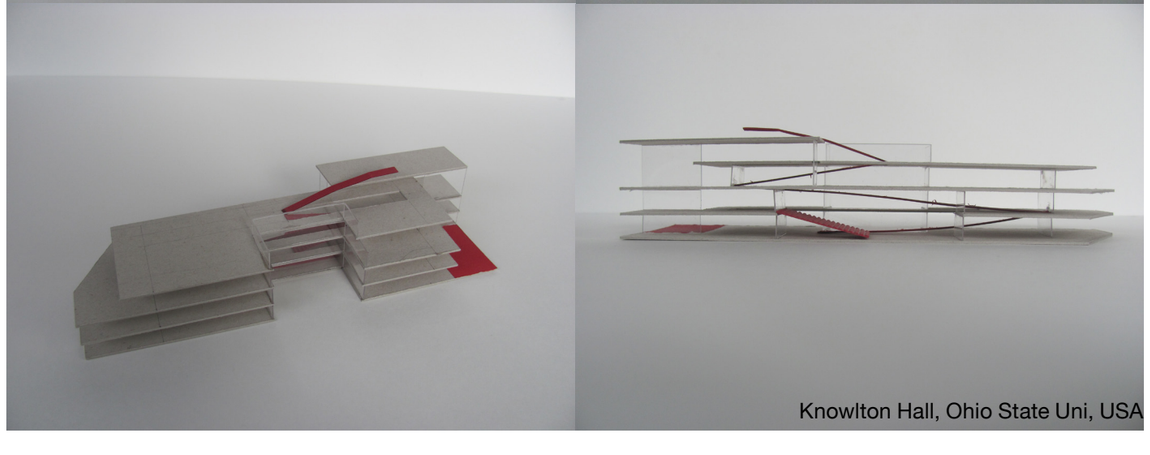
RMIT, Melbourne, Australia



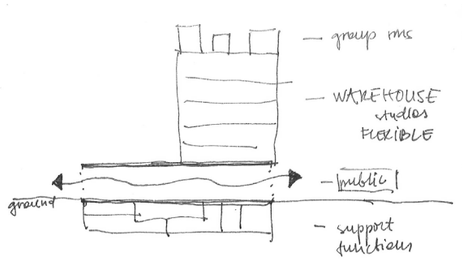
UMEA, Umea, Sweden



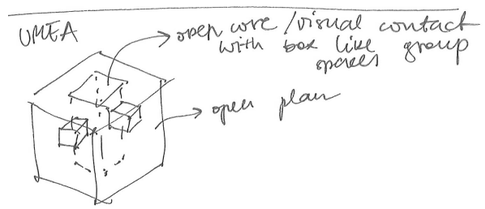
Milstein Hall, Cornell, Ithaca, USA



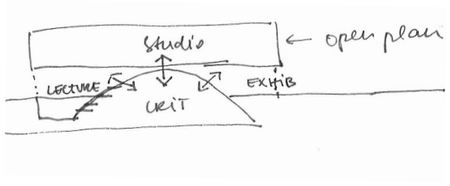
Knowlton Hall, Ohio State Uni, USA



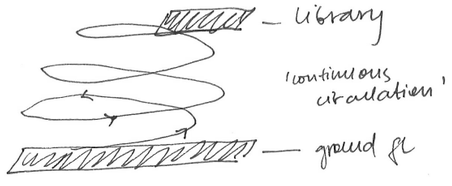
VERTICAL CIRCULATION



SMALL SCALE: VERTICAL & HORIZONTAL CIRCULATION



HORIZONTAL CIRCULATION



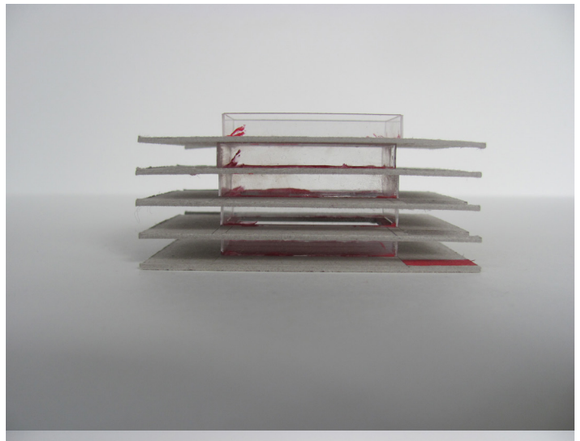
HORIZONTAL CIRCULATION

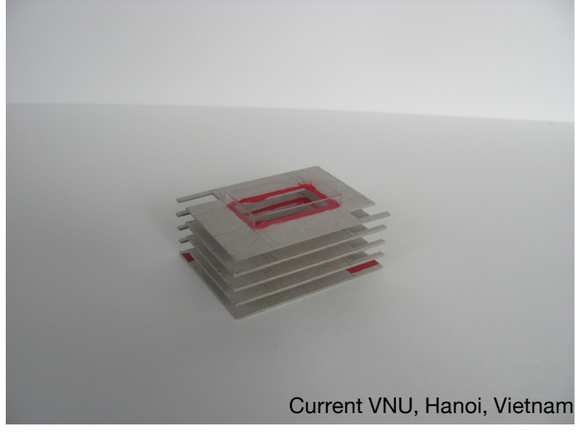
Vietnam's economy has been increasingly booming since the Doi Moi reform in late 60's. This also affects education system, which is considered to be outdated for the newly established modern economy that Vietnam is becoming, which needs young professionals, who are not only well educated, but also posses excellent communication and interdisciplinary skills. As we interviewed students and professors at VNU in Hanoi, these are exactly some of the few skills that the students lack.

This is mostly due to the political regime and the kind of educational system it has been carrying out for decades, but also due to the outdated facilities and the way they accommodate (poorly) teaching and learning.

While analyzing some case studies, I noticed that a lot of educational buildings have very distinct circulation, which is either very horizontal or vertical. This way the users would most likely limit their location to one floor in the building, which then limits their interaction with other users.

In my project the aim was to explore how to implement both vertical and horizontal circulation in a compact building that would make it more efficient in terms of accessibility and would allow for easier access to the different facilities that the building houses. By allowing for the users to





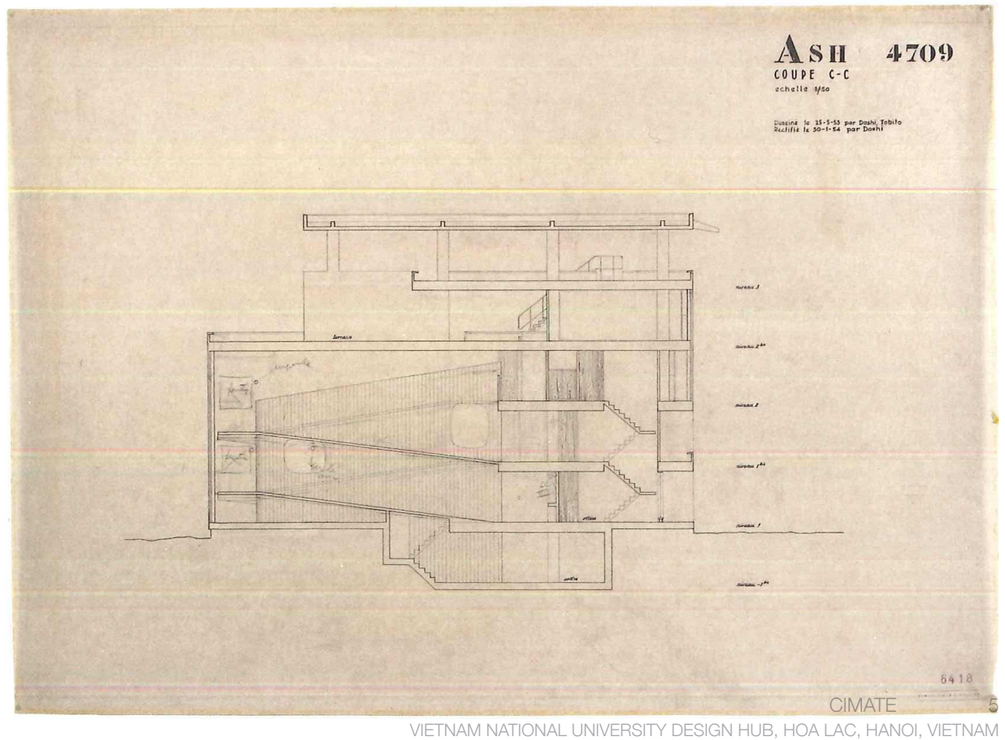
Current VNU, Hanoi, Vietnam

VERTICAL CIRCULATION

Porosity of a building as a volume is an important aspect that can work efficiently in terms of passive climate design. Therefore, I have taken inspiration of Le Corbusier's Villa Shodhan (1951) in Ahmedabad, India, where the climate is similar.

This villa has protected double story outdoor terraces. While protected from sun, they also serve as usable and comfortable outdoor spaces. Wind passes through freely, slightly cooling the air.

Architecturally, porous buildings can create dynamic and interesting spaces.

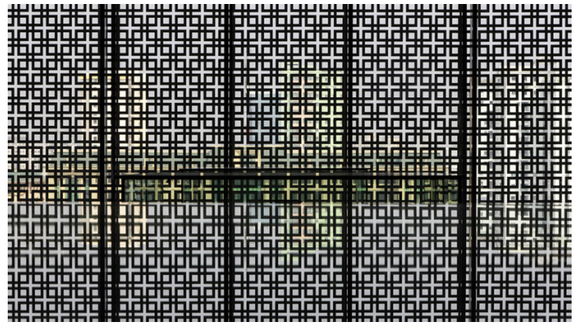


Hanoi Railway station (50’s)

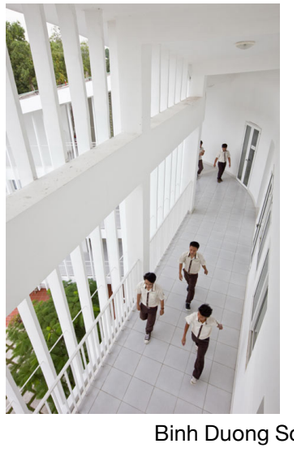
The most used construction method for public buildings in Hanoi and Vietnam in general is in-situ poured concrete. It is also the cheapest one, since the workforce is still relatively affordable.

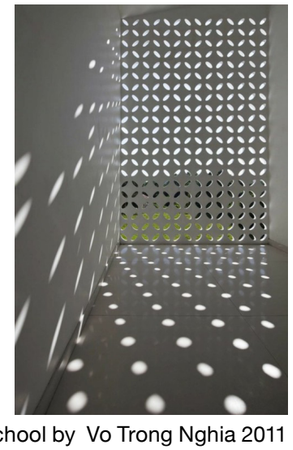
A rather old wall treatment system is porous or perforated screens instead of solid walls. These have been used for centuries mainly to protect the interior space from heavy rainfalls and from overheating, while still allowing for air movement.

One of the most progressive architecture forms in Vietnam Vo Trong Nghia implements such facade system in many of their projects.



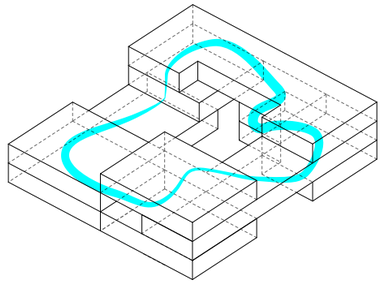
Hanoi Museum by GMP Architects 2010



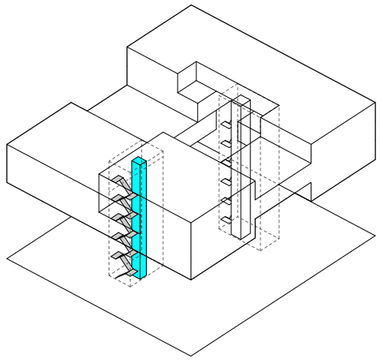


Binh Duong School by Vo Trong Nghia 2011

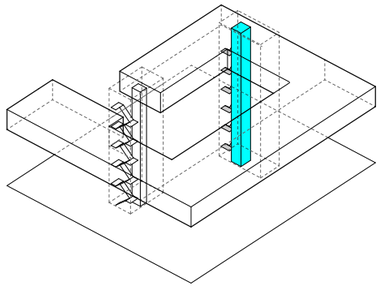
Binh Thanh House by Vo Trong Nghia 2013



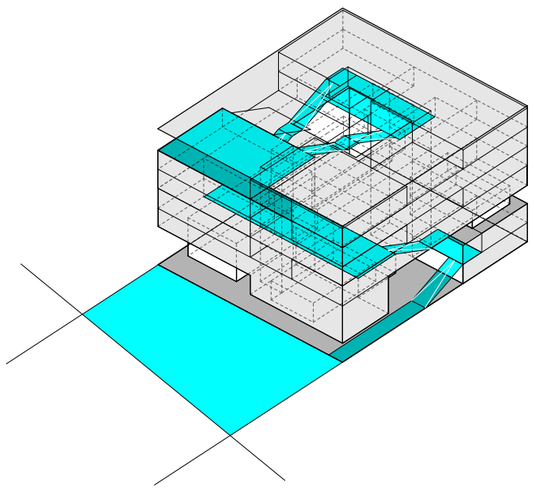
STUDIO LEVELS HAVE INTERNAL CIRCULATION OF STAIRCASES CONNECTING ALL THREE LEVELS



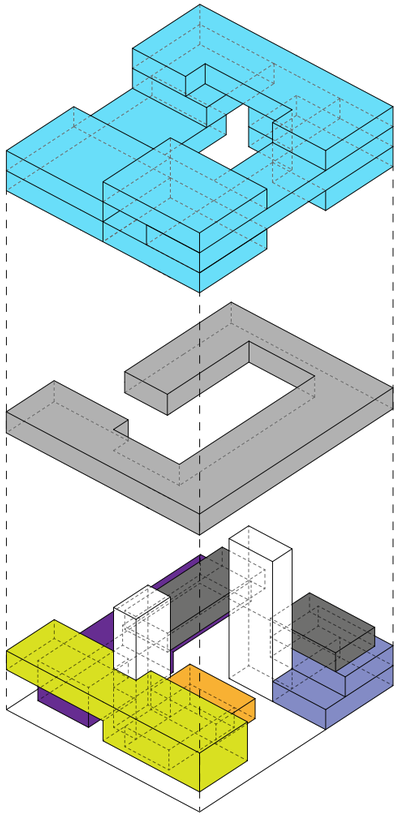
FRONT ELEVATOR SERVING THE UPPER THREE FLOORS OF STUDIO



BACK ELEVATOR SERVING THE SERVICE LEVEL



PUBLIC PROGRAM IS ACCESSED THROUGH THE PUBLIC ROUTE



PROGRAM CLUSTERS - STUDIO / SERVICE / PUBLIC PROGRAM

14% cores

14% exhibition

4% commercial
4% auditorium
1% administration
5% library
5% workshops
12% service / storage

25% studio

13% ‘streets & squares’

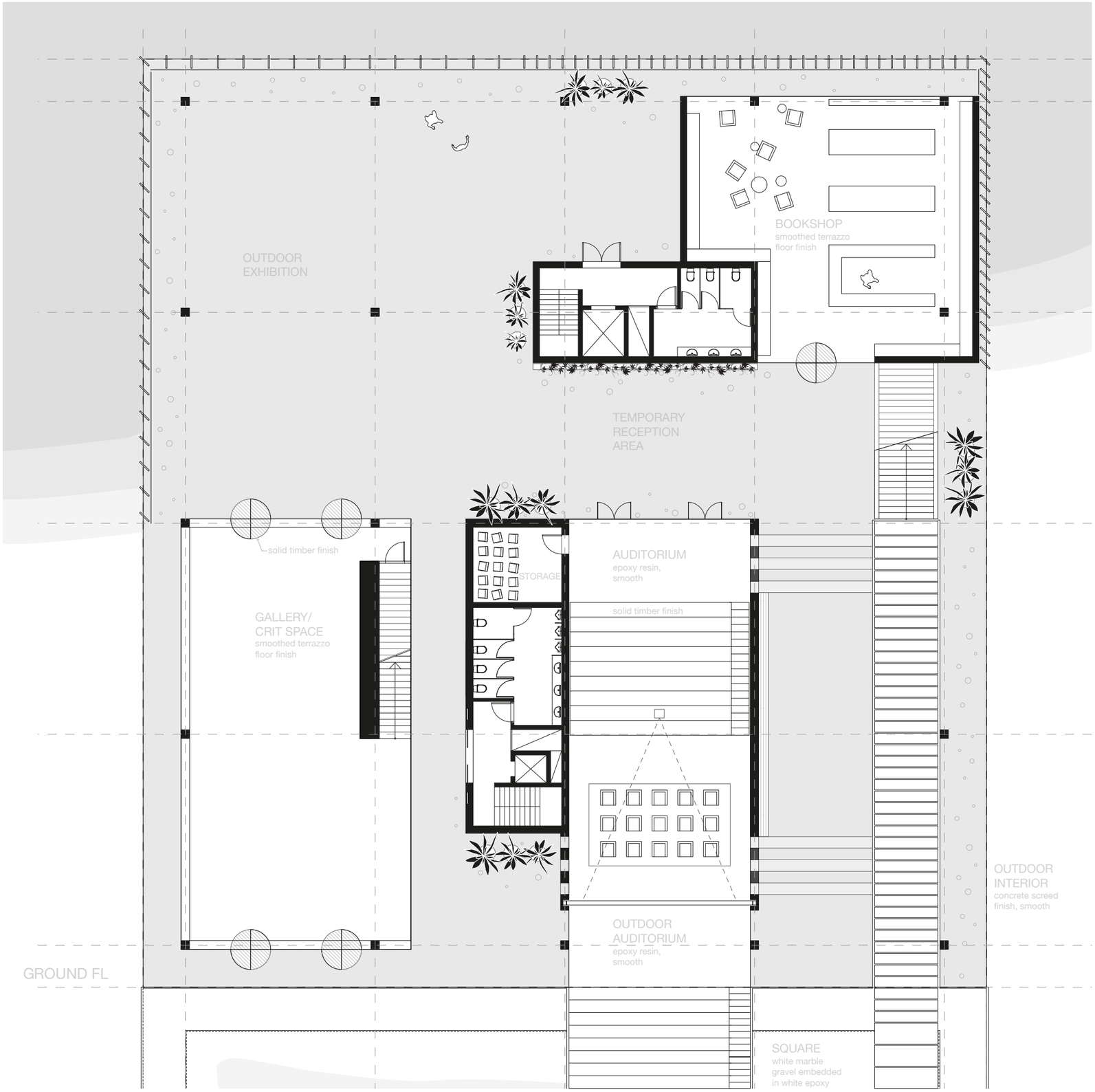
The educational building typology - usually has either a distinct horizontal or vertical circulation as discussed before.

In this project the clustering of program and the implementation of different types of circulation creates both.

This affects how the building is used, thus interaction of users within the building.

FLOOR PLANS / INTERIOR VS. EXTERIOR

SCALE 1/200

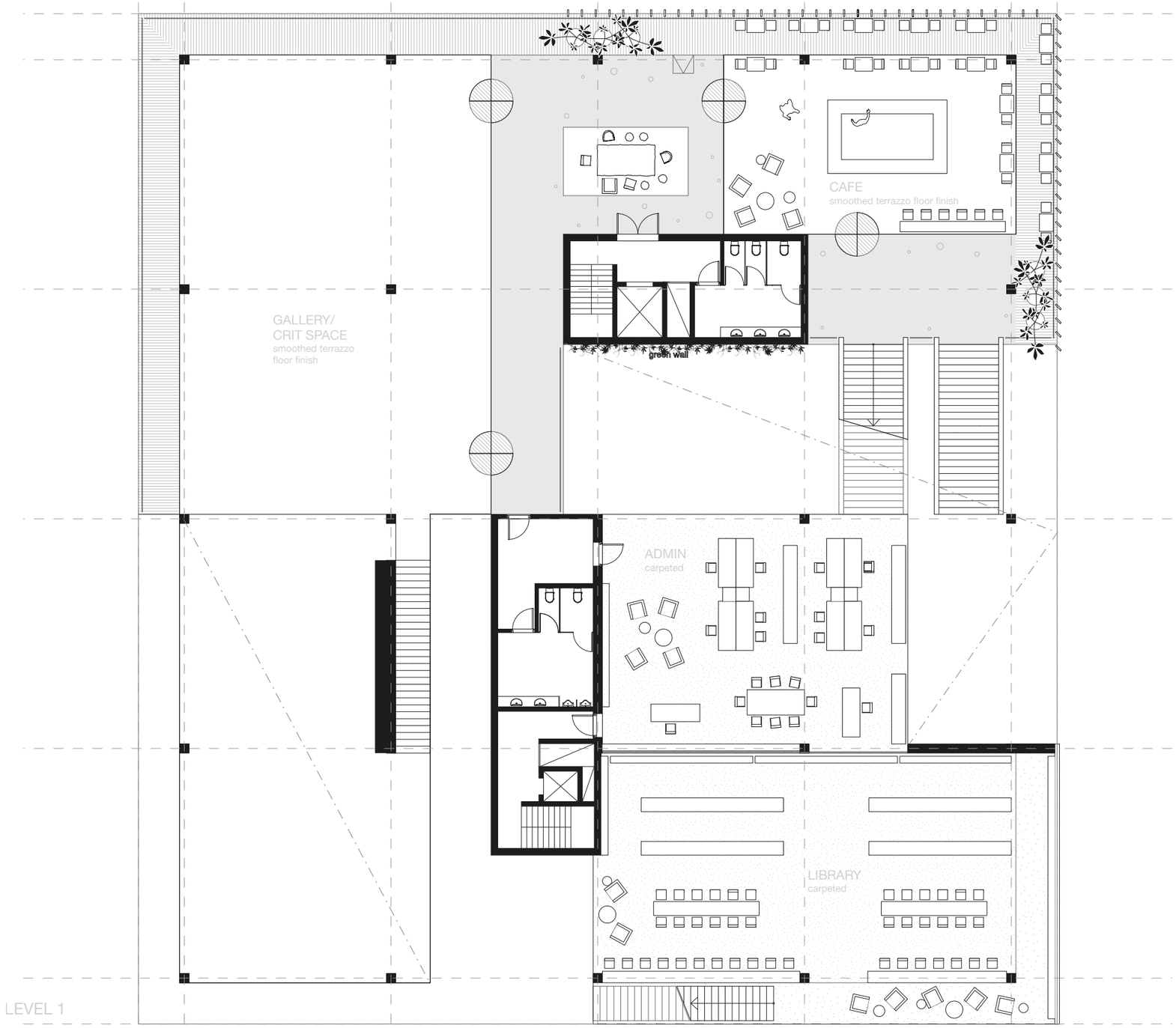


The main public circulation route in this scenario becomes a part of the usable outdoor space within the building on every level, thus minimizing the actual circulation square meters.

The difference between inside learning/teaching space and the outdoor more informal learning space becomes a blurred line.

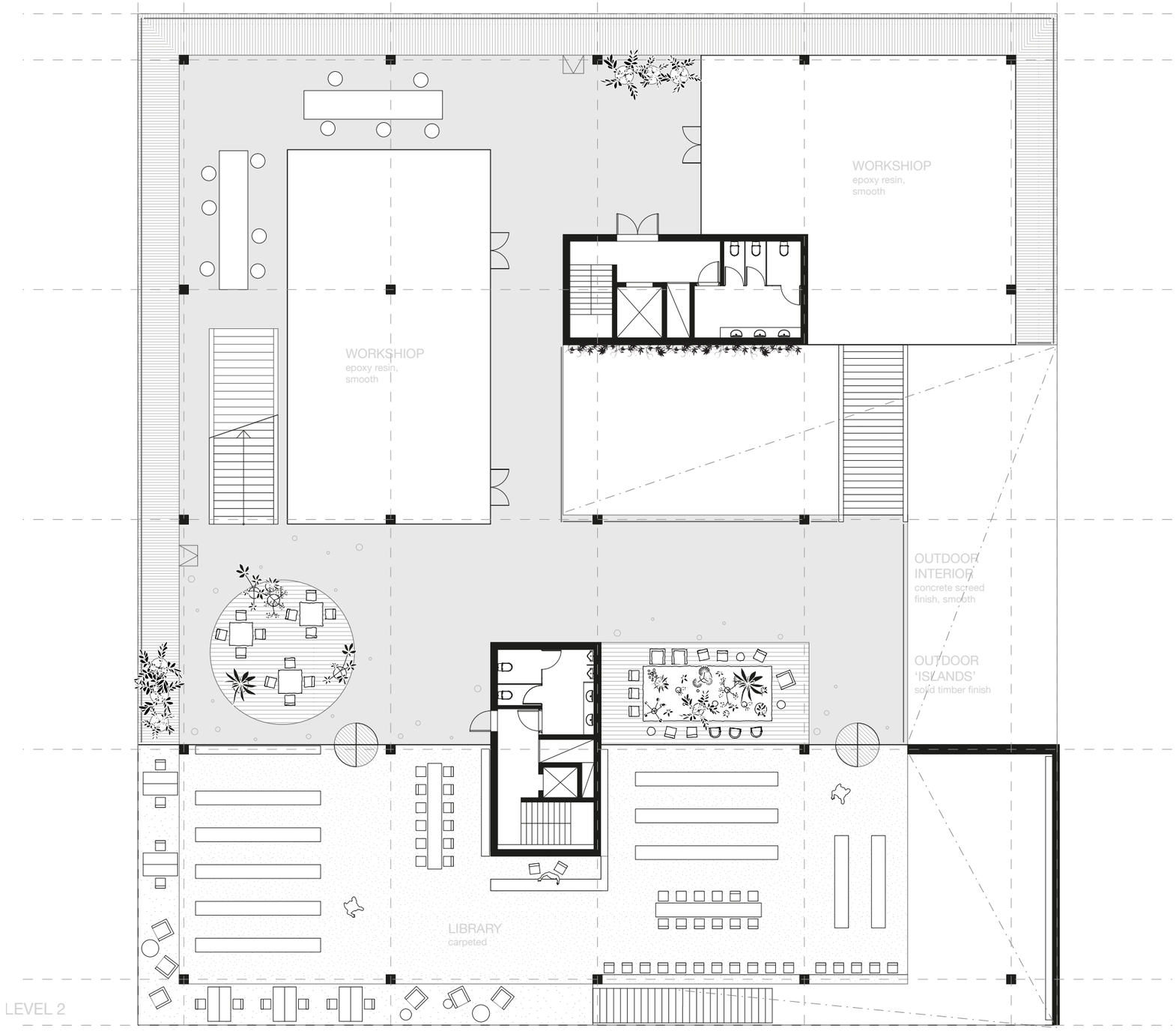
FLOOR PLANS / INTERIOR VS. EXTERIOR

SCALE 1/200



FLOOR PLANS / INTERIOR VS. EXTERIOR

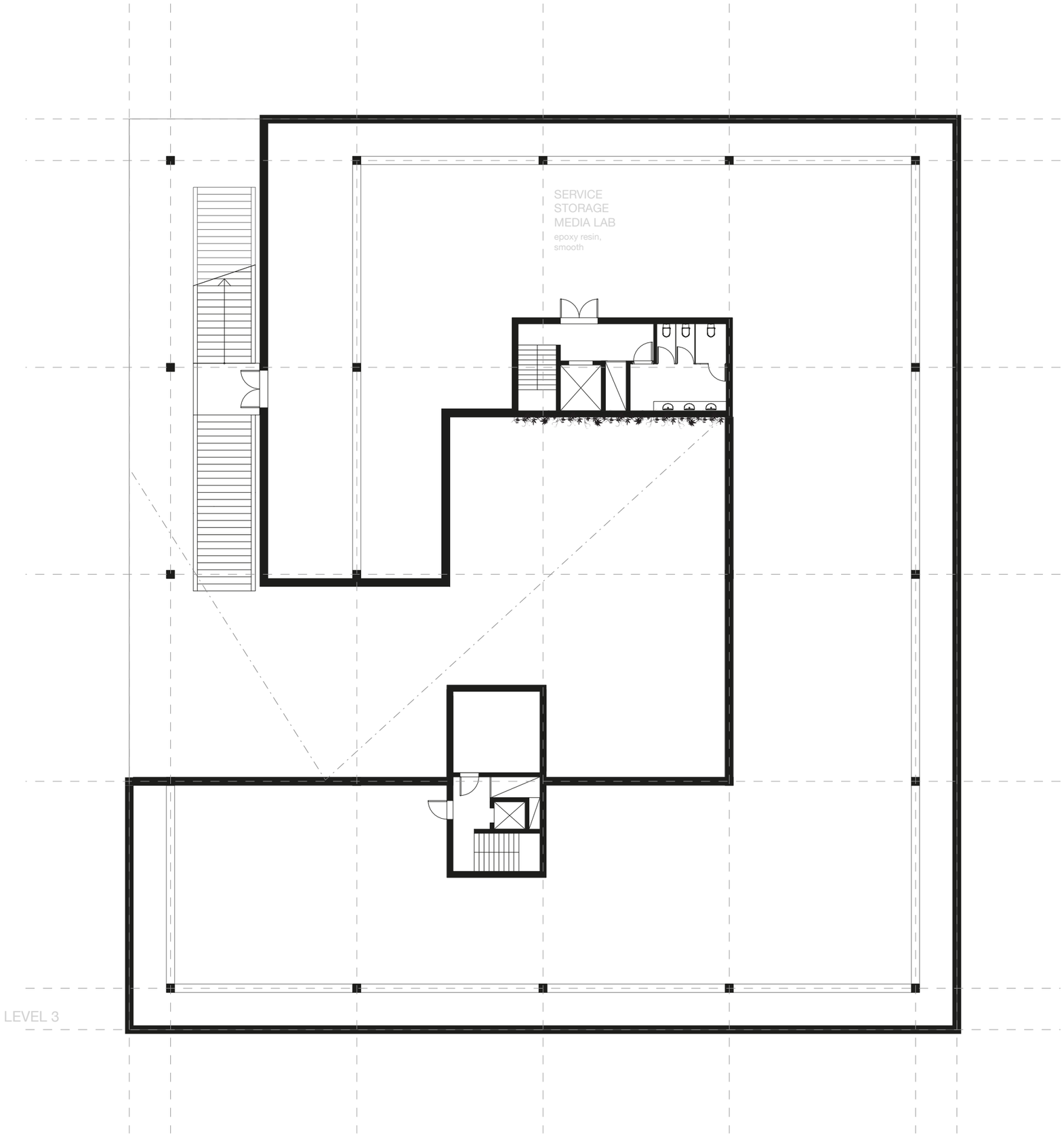
SCALE 1/200



FLOOR PLANS / INTERIOR VS. EXTERIOR

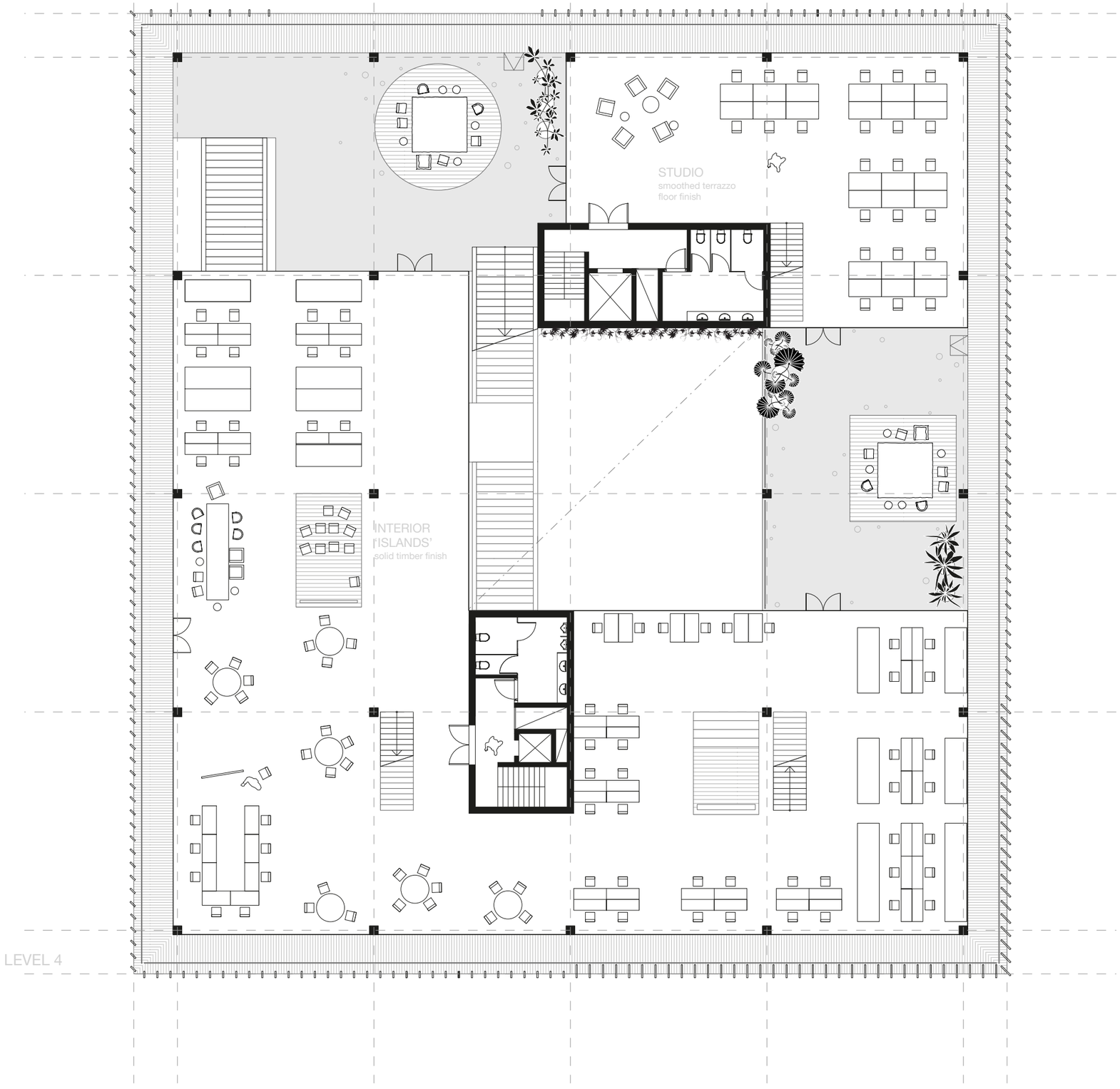
SCALE 1/200

Service level is strategically placed in the middle of the building thus making all the communications and services easier accessible on every floor.



FLOOR PLANS / INTERIOR VS. EXTERIOR

SCALE 1/200

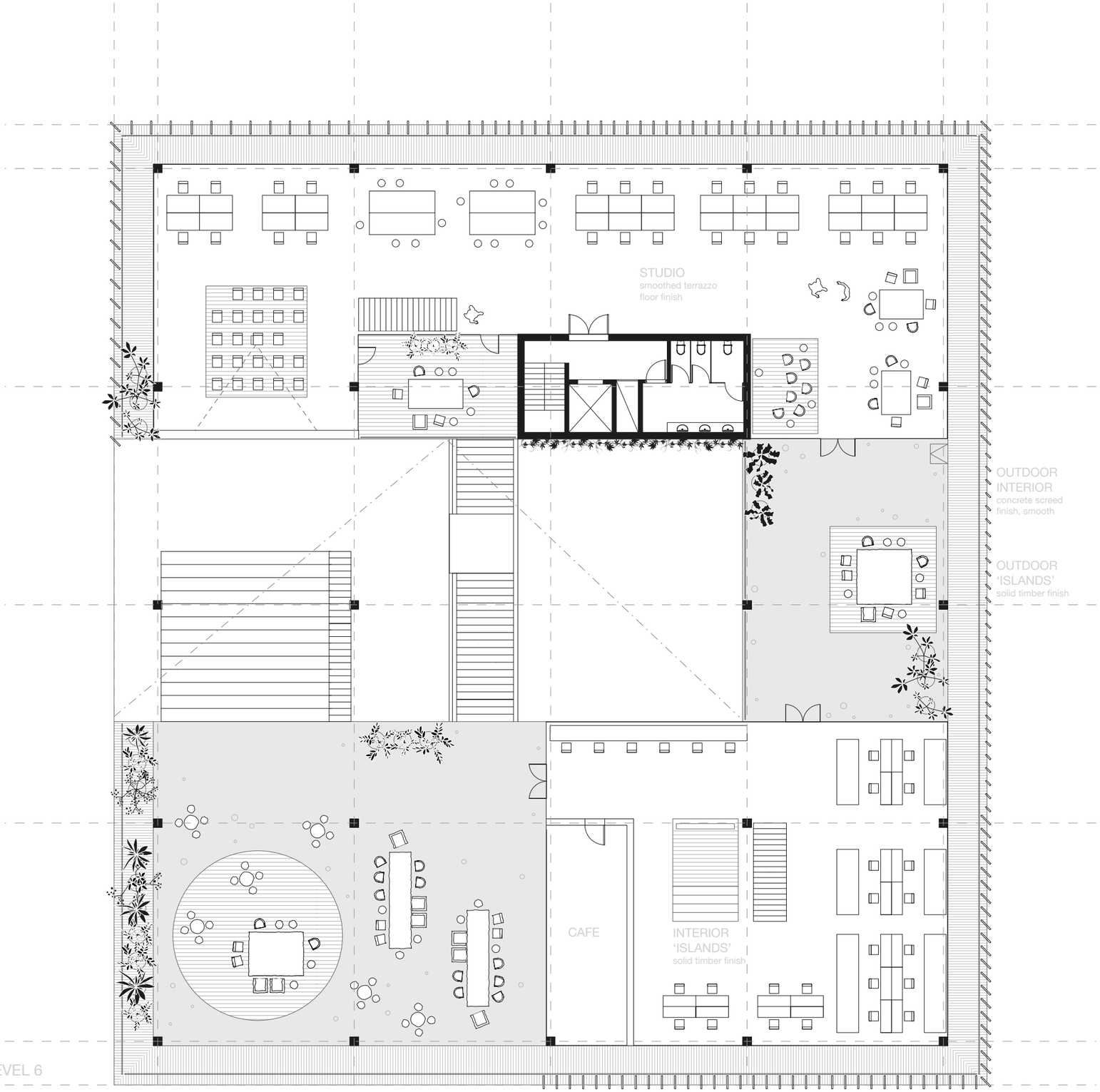


FLOOR PLANS / INTERIOR VS. EXTERIOR

SCALE 1/200

FLOOR PLANS / INTERIOR VS. EXTERIOR

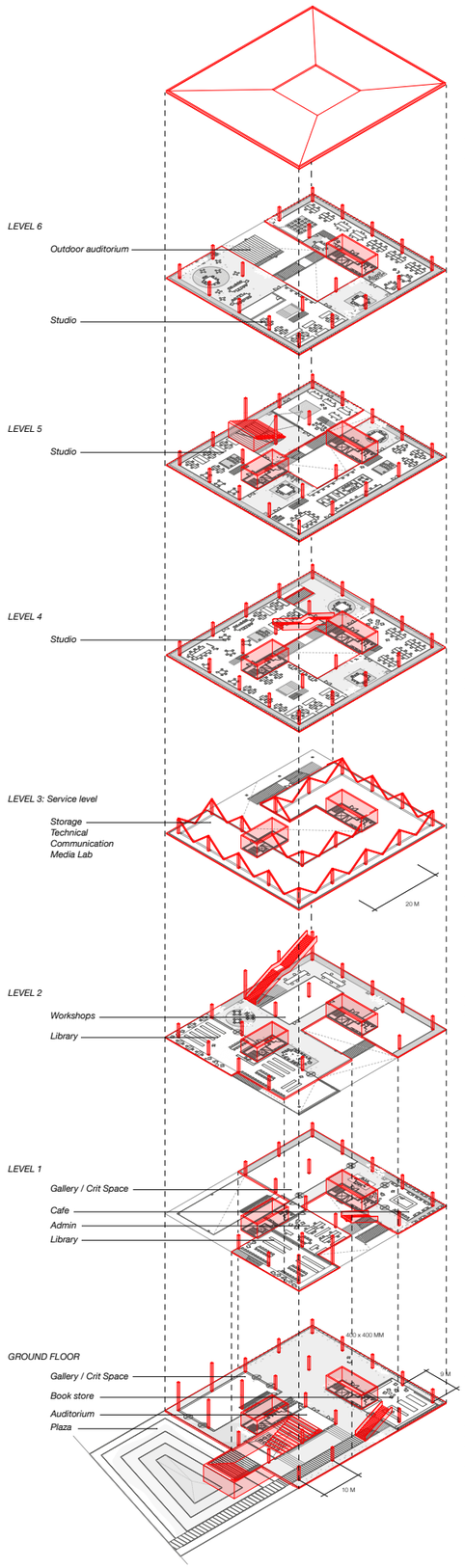
SCALE 1/200



LOAD BEARING STRUCTURE

Locally cheapest and most used public building construction method is used in the design - in-situ cast concrete slab and column system.

Explanation of separate elements is in the following pages.



Drainage from roof is collected at the lowest point of the roof - the courtyard opening, and directed to the ground level through the 2 cores.

The two cores are strategically placed on opposite sides of the building to house fire stairs, elevators and building services ducts, as well as drainage from roof.

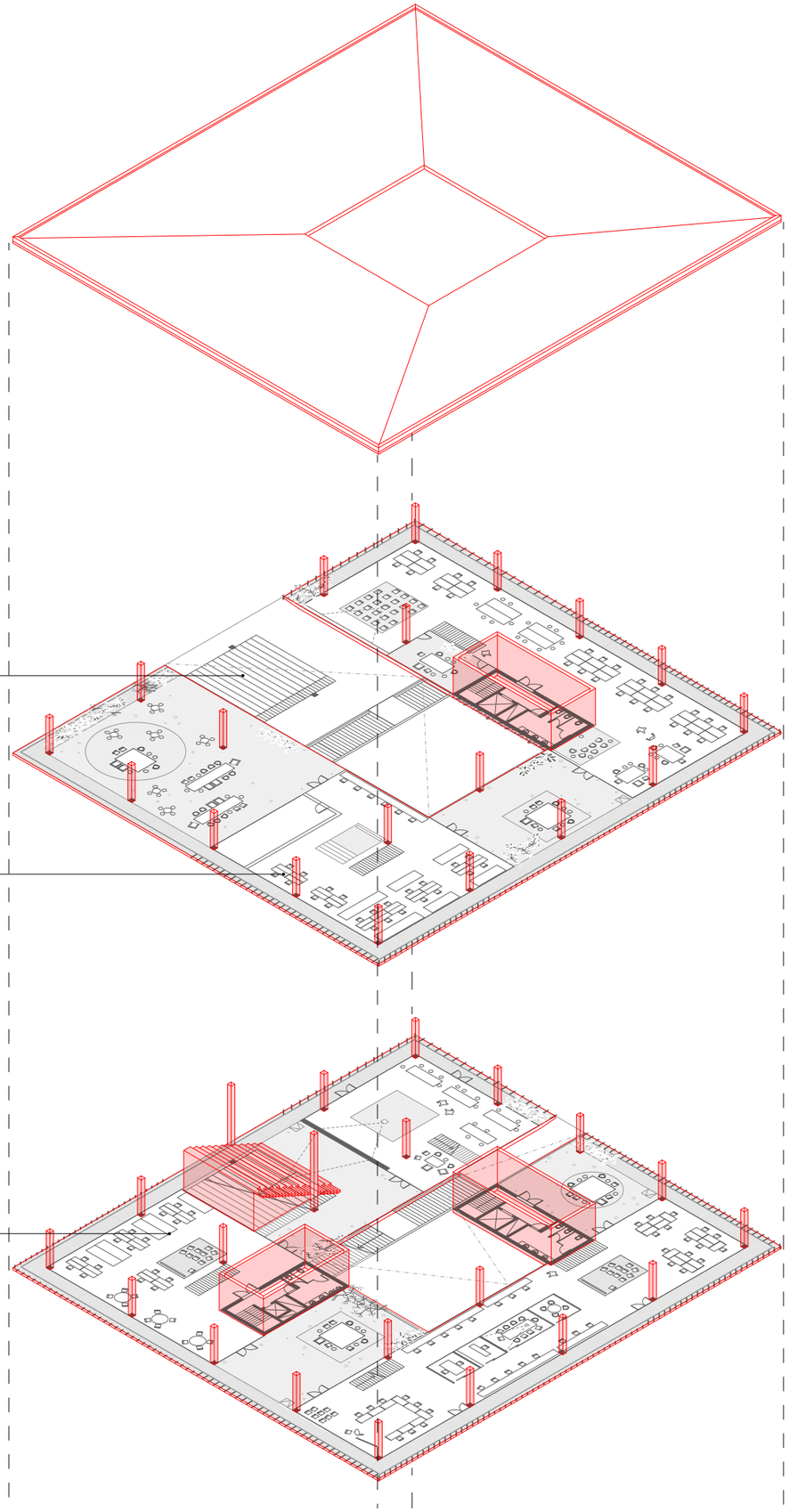
Service level structurally is a steel beam space frame in order to allow for the 20 M span for the opening below.

All the extrernal stairs structurally are reinforced concrete beams. The longest one on Level 2 is also attached to the service level floor in the middle with reinforcement, in order for it to withstand vertical movement.

The construction is in-situ cast concrete, which is the cheapest and most available construction method in Vietnam.

The 400 x 400 mm columns are spaced 9 m apart one directiona, and 10 m apart the other. Connected to the 350 mm thick two way slabs through reinforcement.

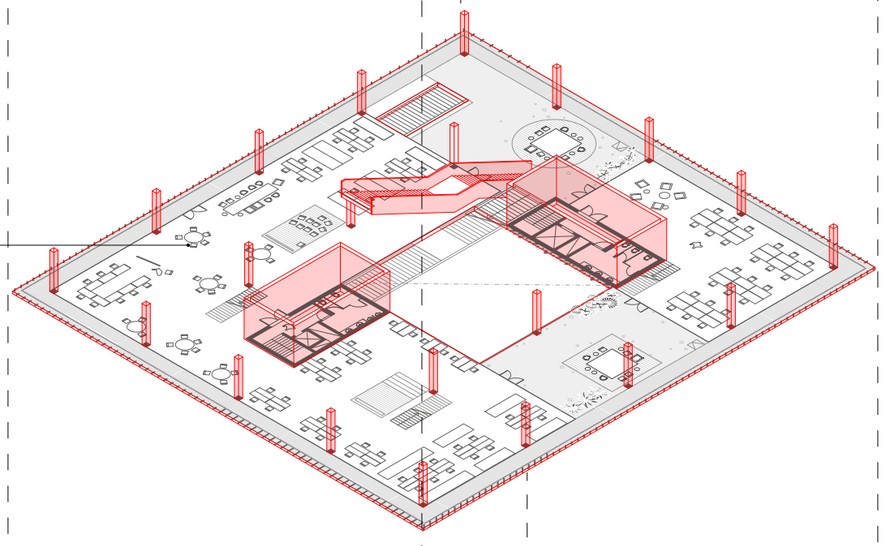
A combination of strip footing and pile footing (where it goes partly under water) is propposed for the foundation.



Drainage from roof is collected at the lowest point of the roof - the courtyard opening, and directed to the ground level through the 2 cores.

LEVEL 4

Studio



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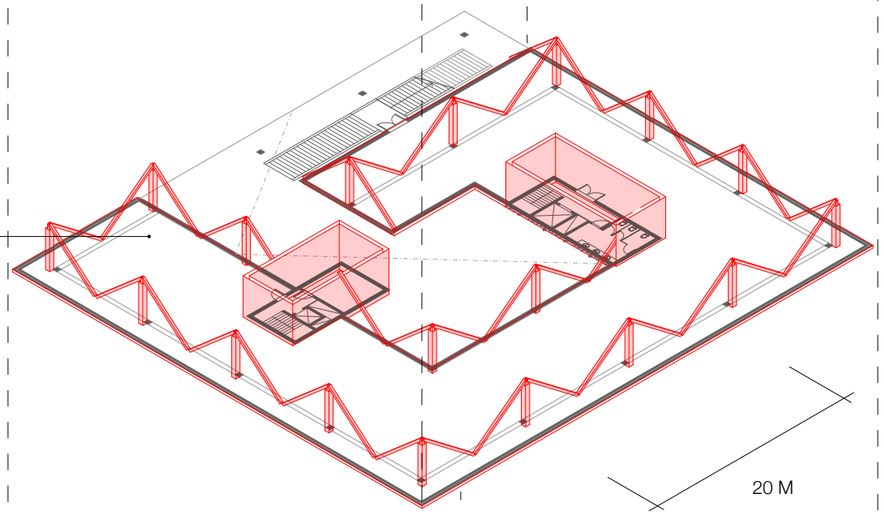
LEVEL 3: Service level

Storage
Technical
Communication
Media Lab

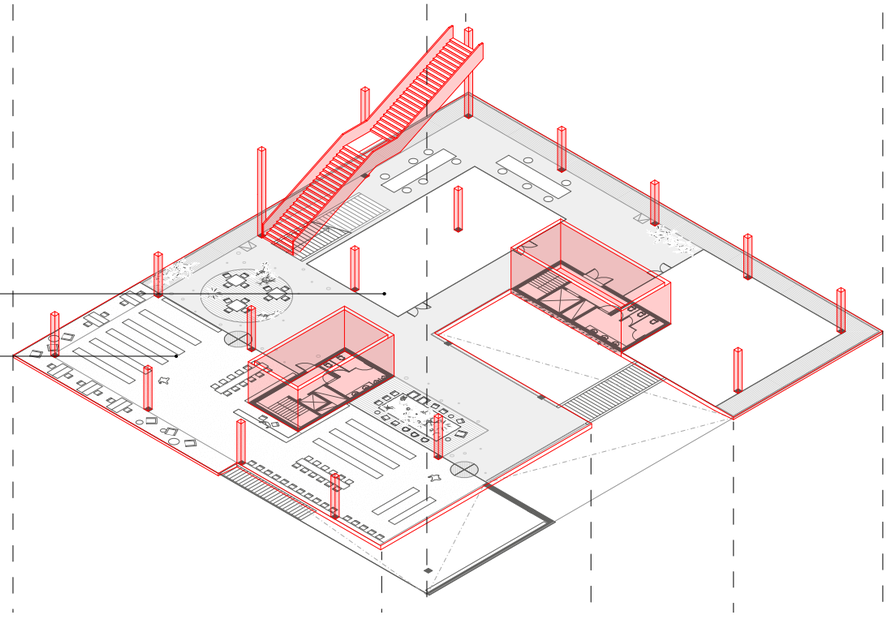


Service level structurally is a steel beam space frame in order to allow for the 20 M span for the opening below.

LEVEL 2

Workshops

Library



All the extrernal stairs structurally are reinforced concrete beams. The longest one on Level 2 is also attached to the service level floor in the middle with reinforcement, in order for it to withstand vertical movement.

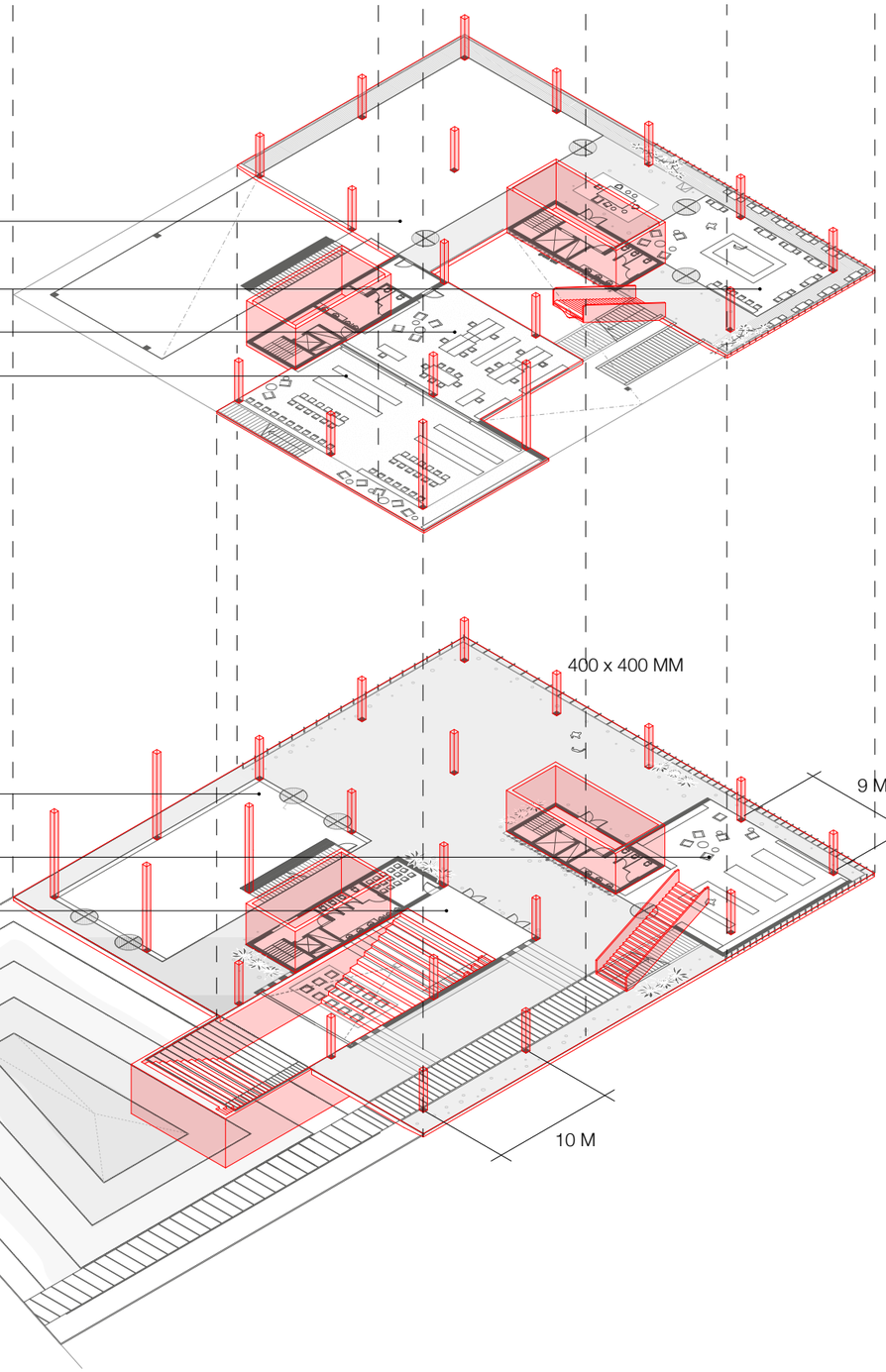
LEVEL 1

Gallery / Crit Space

Cafe

Admin

Library



GROUND FLOOR

Gallery / Crit Space

Book store

Auditorium

Plaza

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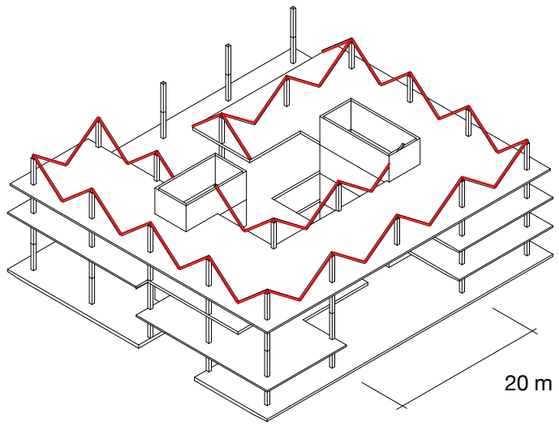


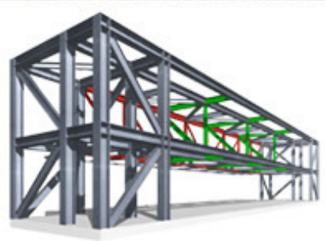
Located in the middle of the building for flexibility for services and communication systems.

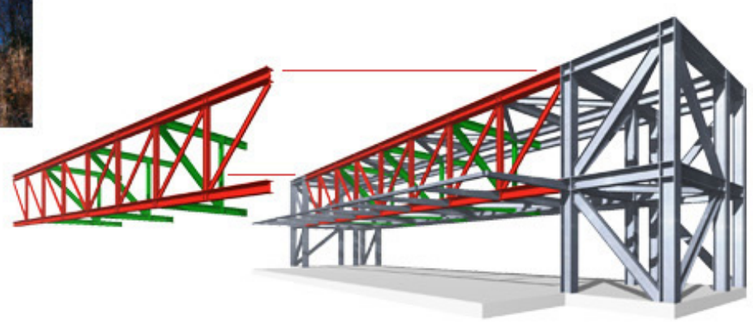
Service level is structurally different as the rest of the building, because it needed to allow for large 20 m span to allow for a large opening underneath.

It is structurally a space-frame, made of steel beams that are welded together and attached to the floor and ceiling through steel elements.

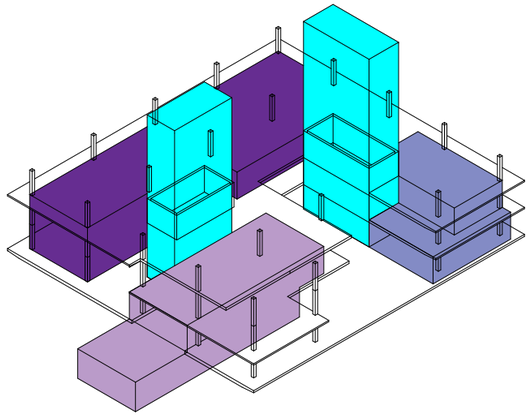
Case studies show, how large spans or long overhangs of buildings use the same structural method.

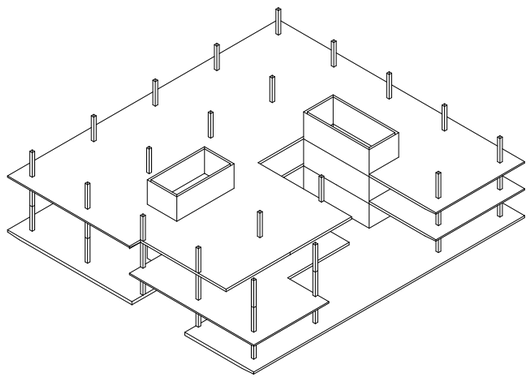
Milstein Hall, Cornell University, OMA 2011

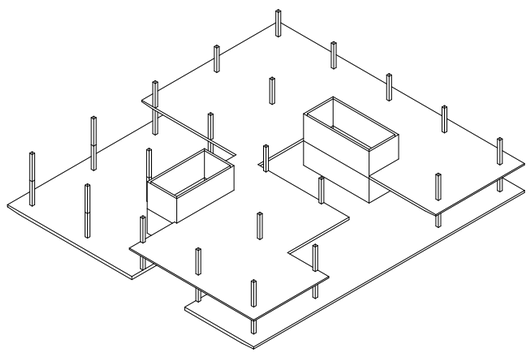


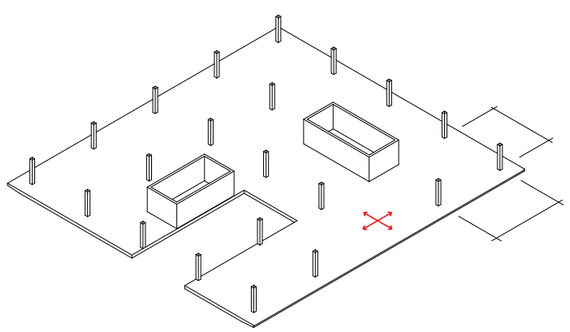


Picture Window House, Shigeru Ban, 2002



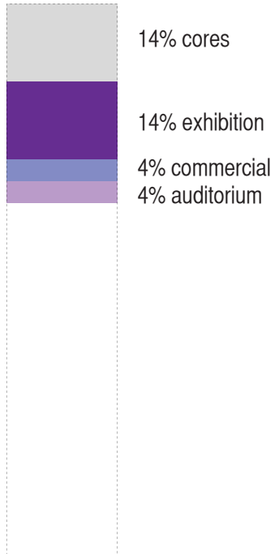




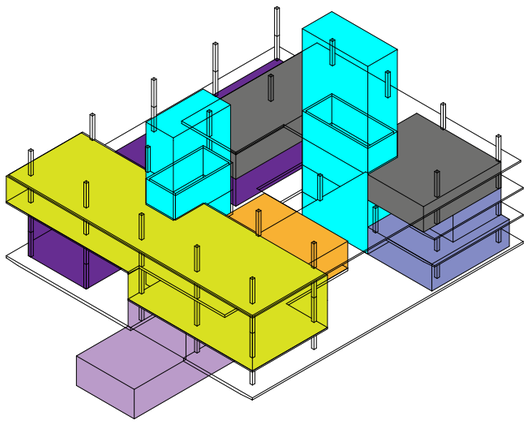


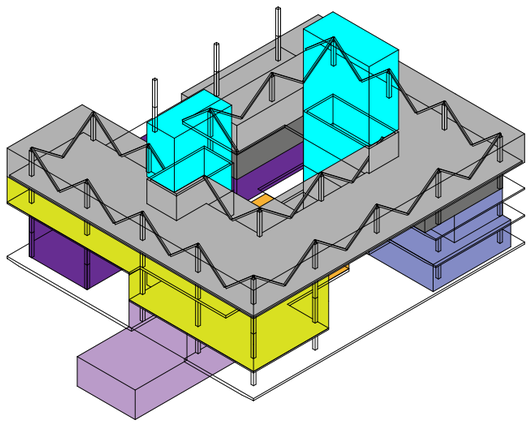
SLABS VS. VOLUMES / DYNAMIC SPACE
FLEXIBLE CONSTRUCTION

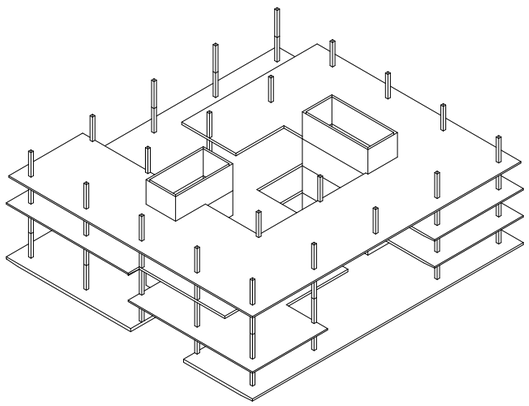
The construction method is slabs and columns, as discussed before. However, it can also be seen as a compilation of intersecting volumes. Therefore the floors labs are all different in sizes so that double height rooms can be created and connected vertically breaking the horizontality of slab construction system.

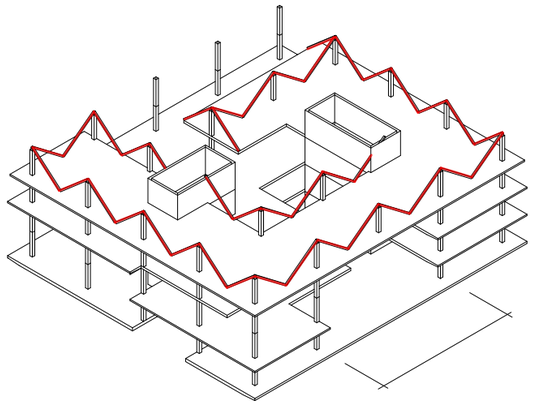


SLABS VS. VOLUMES / DYNAMIC SPACE
FLEXIBLE CONSTRUCTION







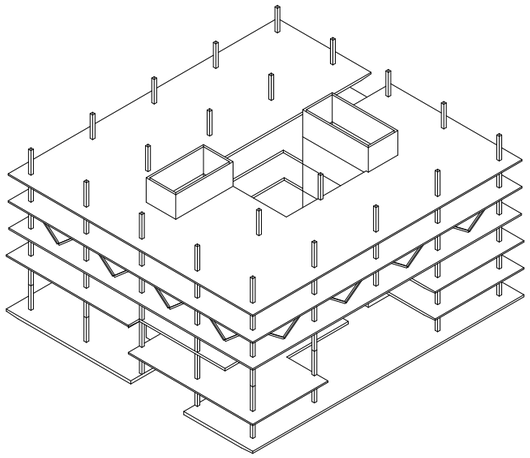


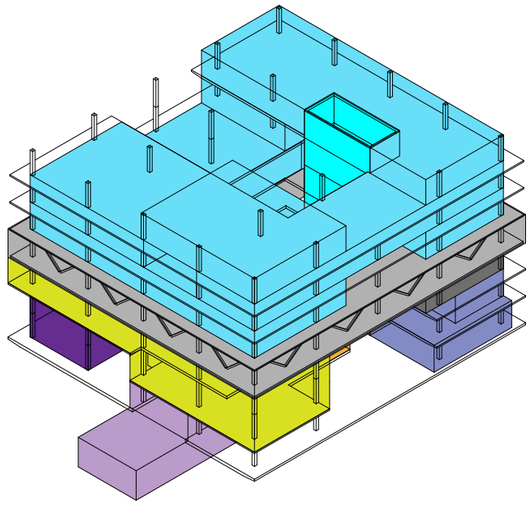
14% cores

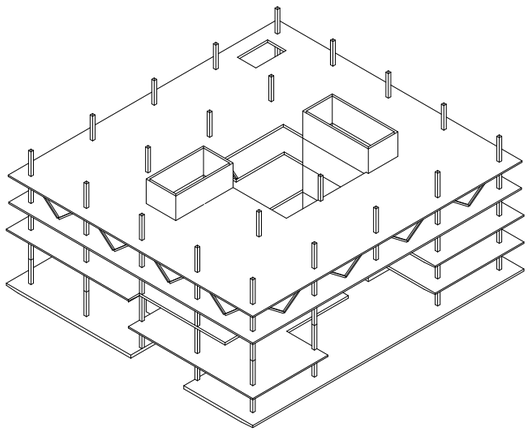
14% exhibition

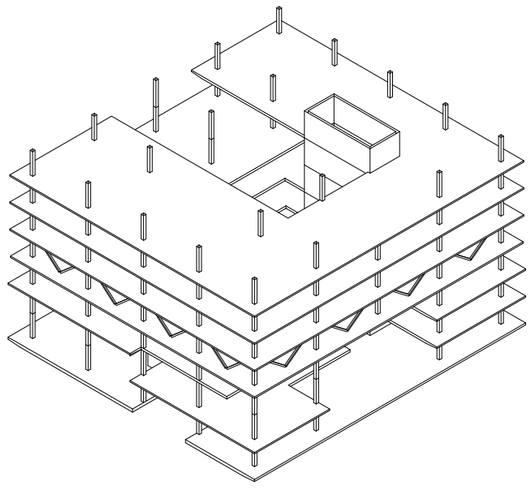
4% commercial
4% auditorium
1% administration
5% library
5% workshops

12% service / storage









14% cores

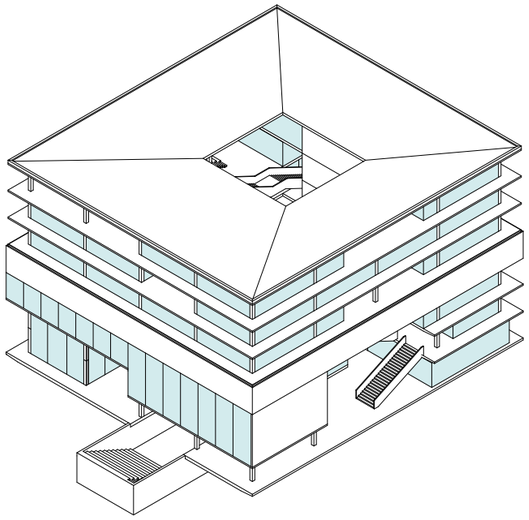
14% exhibition

4% commercial
4% auditorium

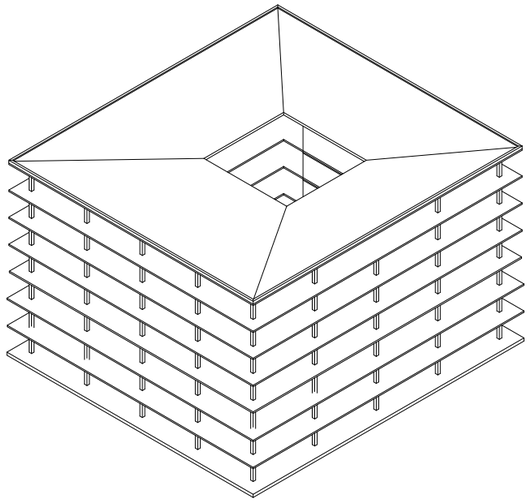
1% administration

5% library
5% workshops
12% service / storage

25% studio



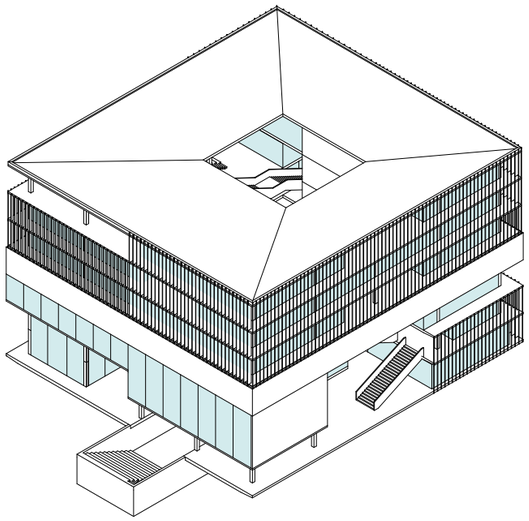
FACADE LAYER 1



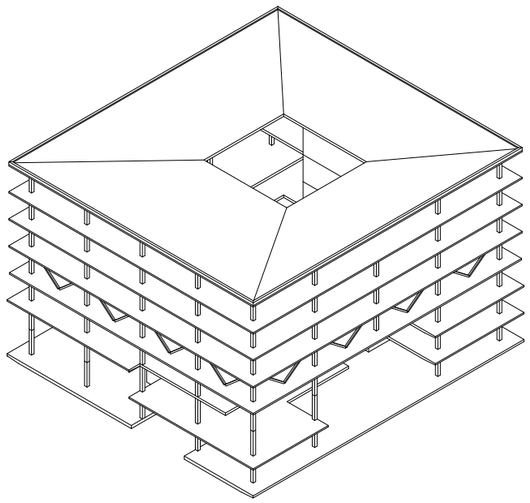
In the future if the total FAR needs to be met, due to the simple slab and column construction method it is possible to fill in all the floors and have the maximum floor area.

The inner facade layer is operable floor to ceiling lazing, which can be easily removed.

The outer facade layer is the louver system which is completely independent from the structure thus can be also easily removed.



FACADE LAYER 2

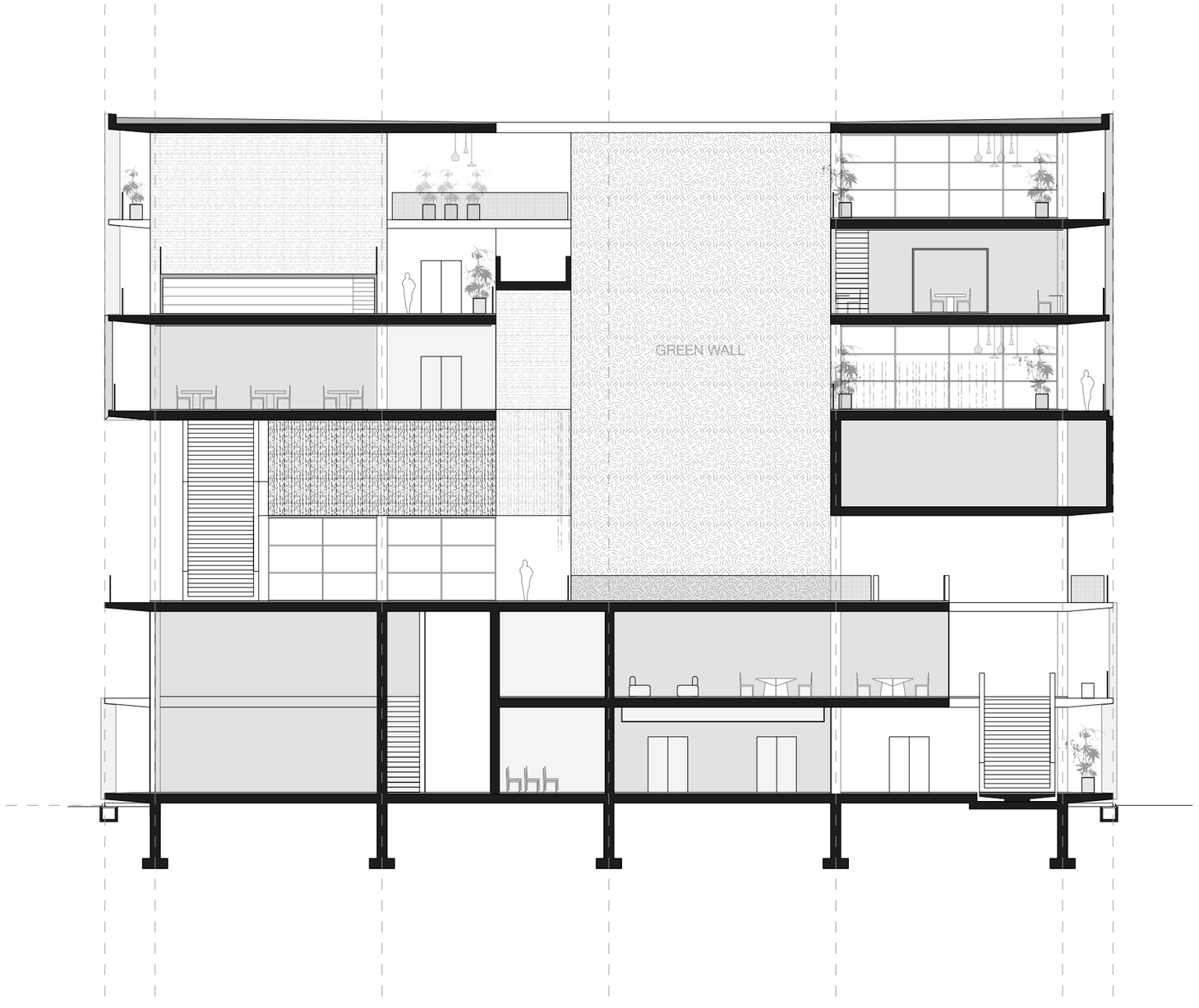


FLEXIBLE STRUCTURE

DYNAMIC SPACE / SLABS VS. VOLUMES

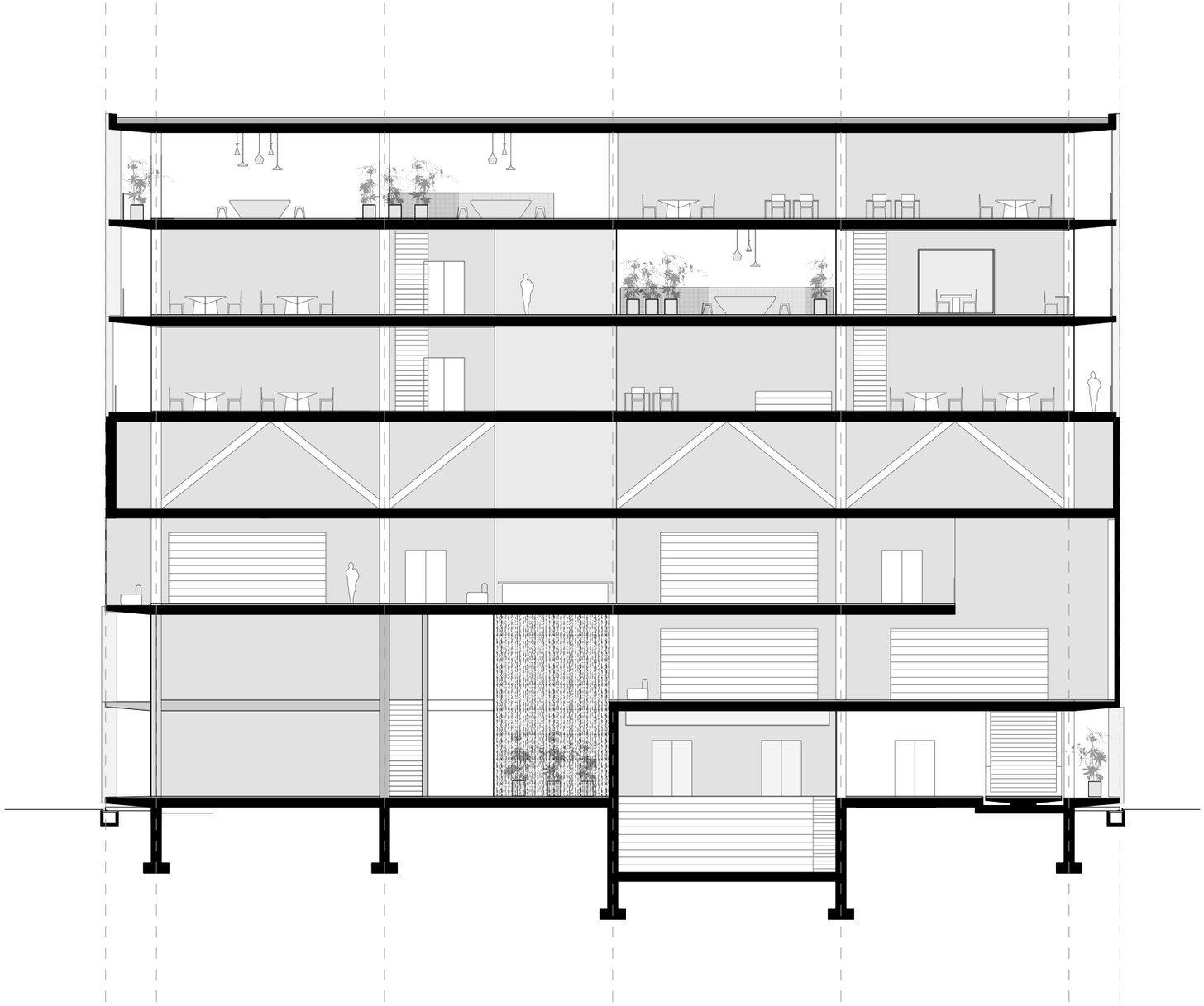
SECTION SCALE 1/200

Creating porous building and seeing spaces as three dimensional intersecting volumes create dynamic three dimensional spaces.



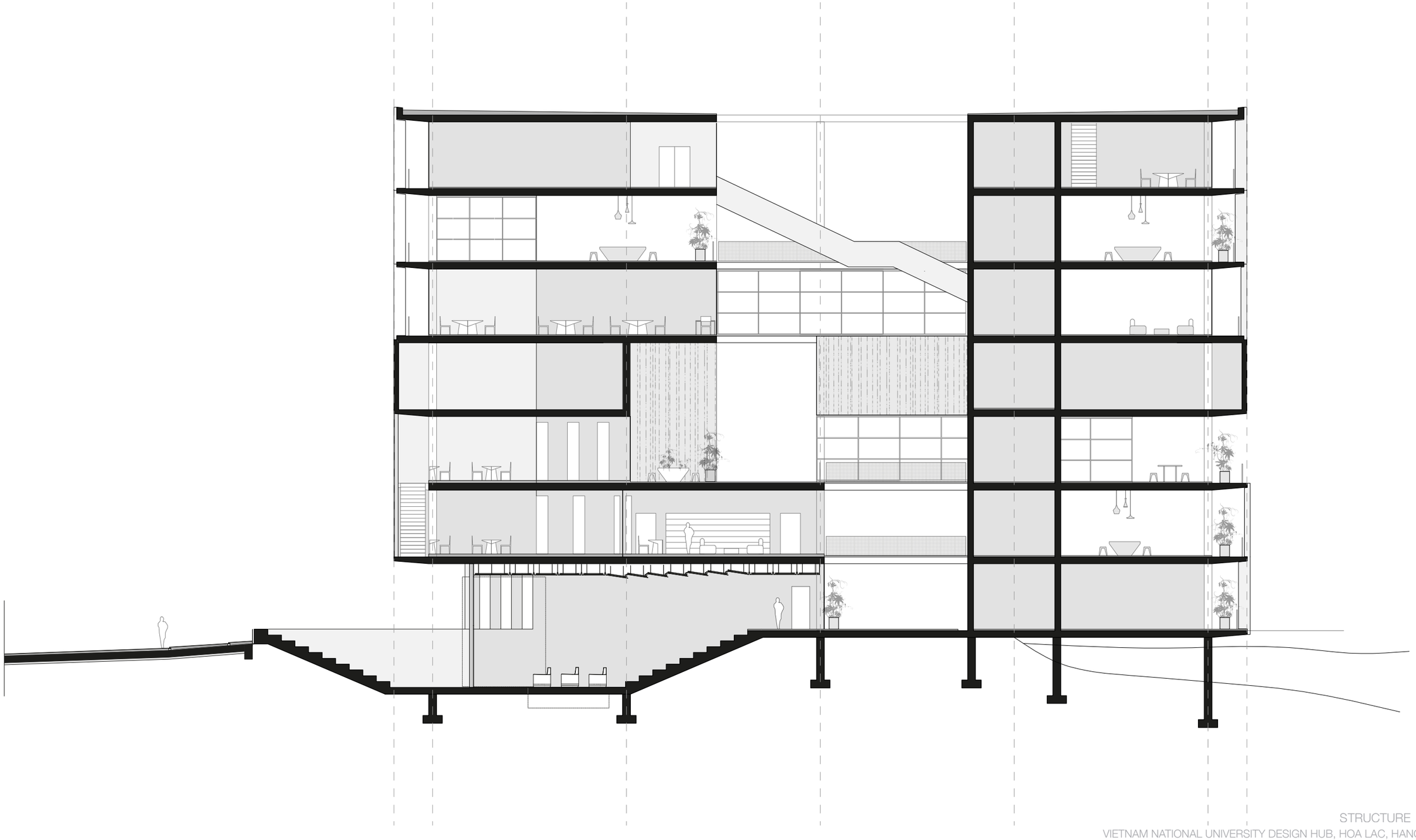
DYNAMIC SPACE / SLABS VS. VOLUMES

SECTION SCALE 1/200

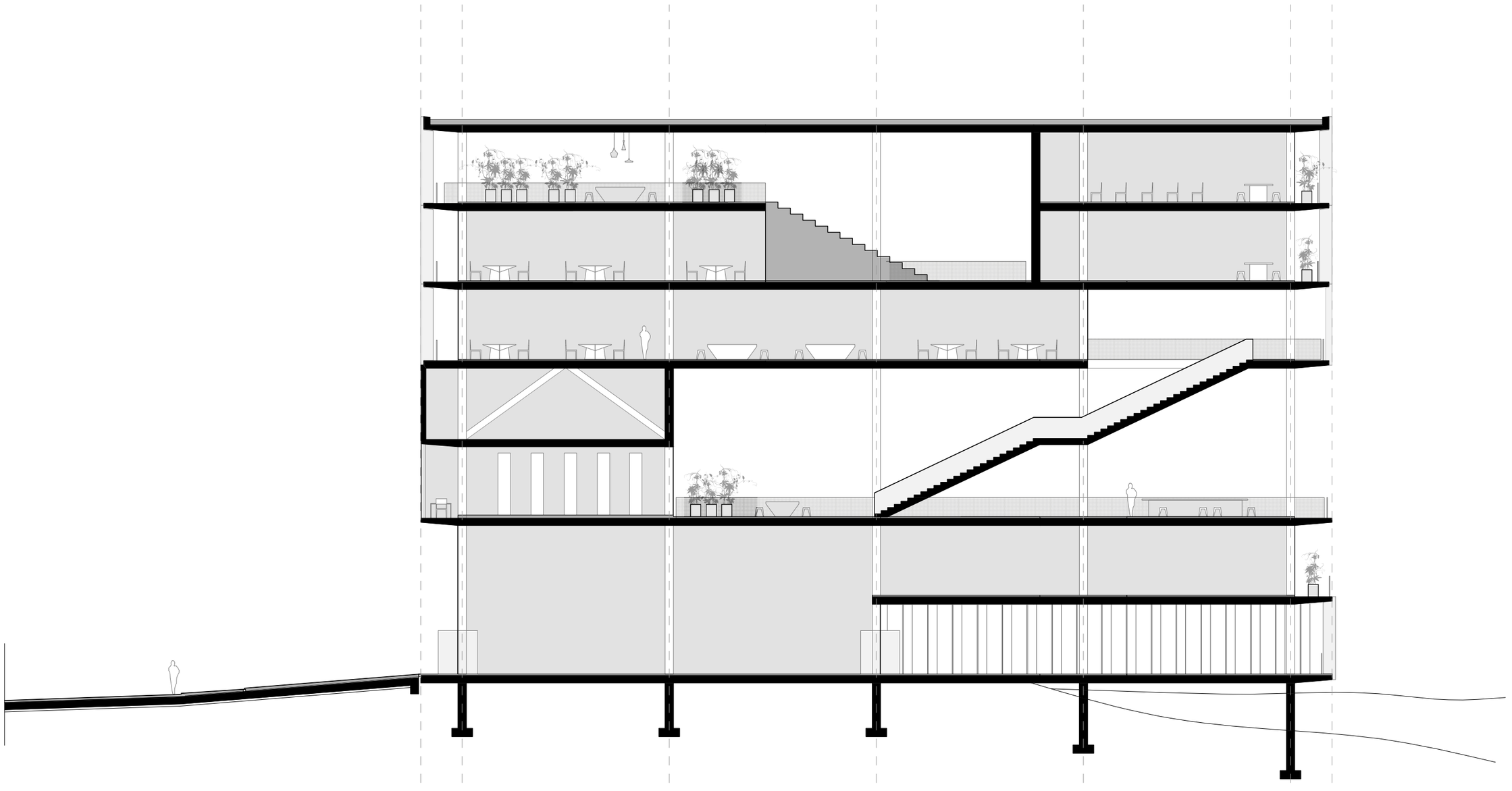


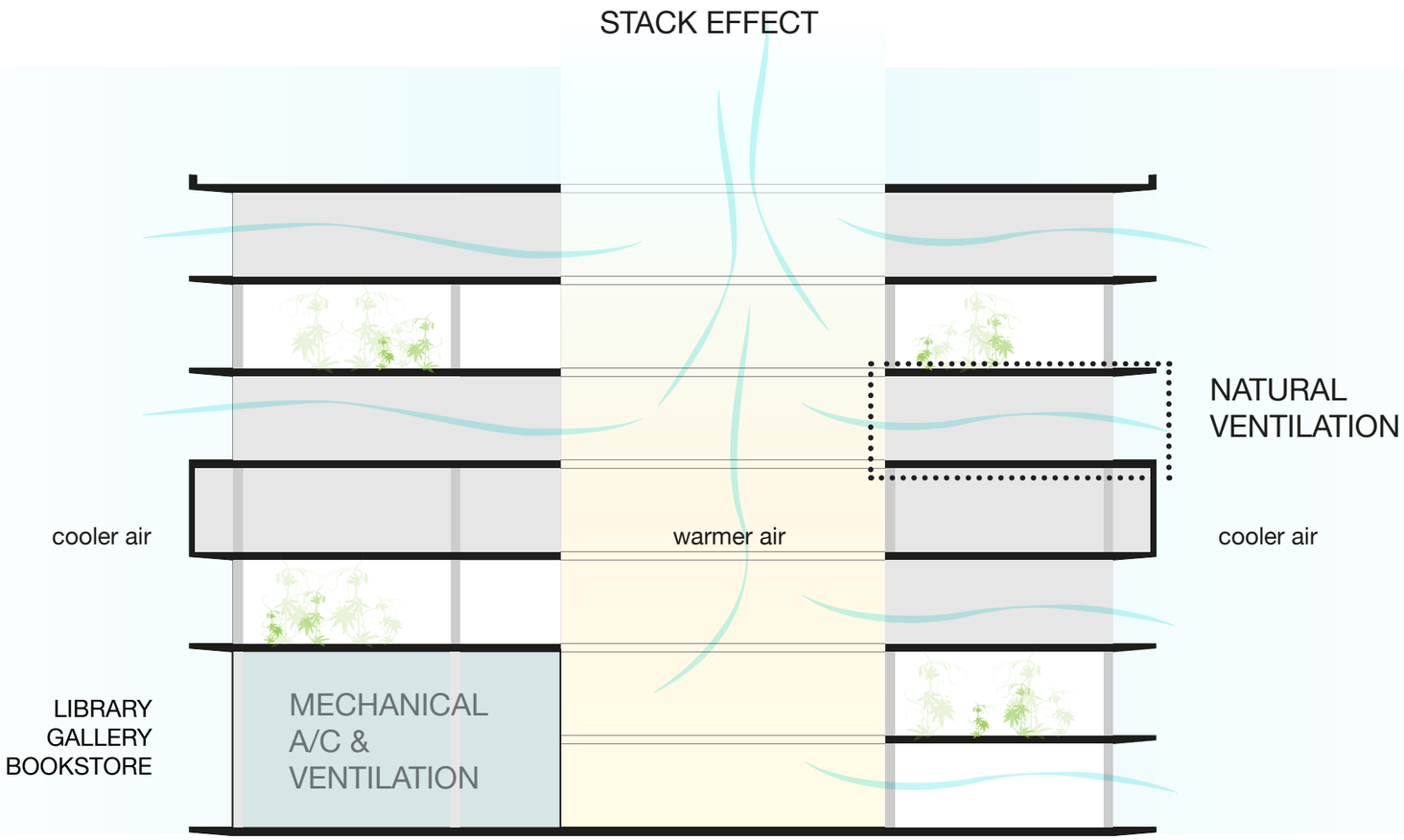
DYNAMIC SPACE / SLABS VS. VOLUMES

SECTION SCALE 1/200



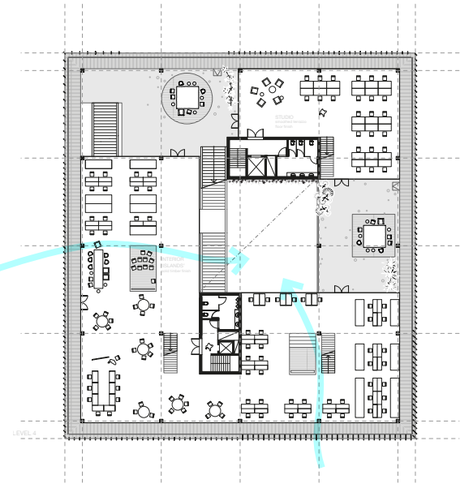
SECTION SCALE 1/200

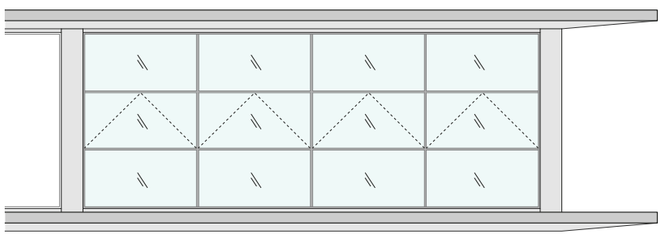




The facade consists of two layers as explained earlier, which play a role in passive means of reaching human comfort level within the building.

The courtyard typology creates warmer air inside the courtyard than it is on the outside the building, and through application of natural ventilation, the cooler air moves through the building into the courtyard and through stack effect escapes upwards.

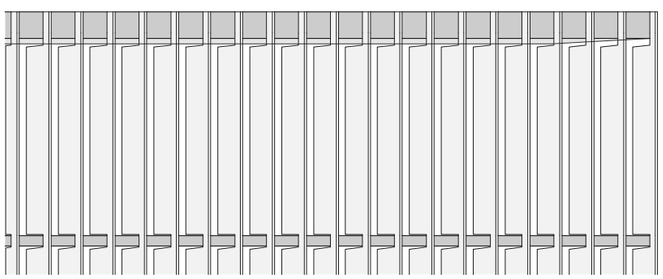




1

OPERABLE
WINDOWS

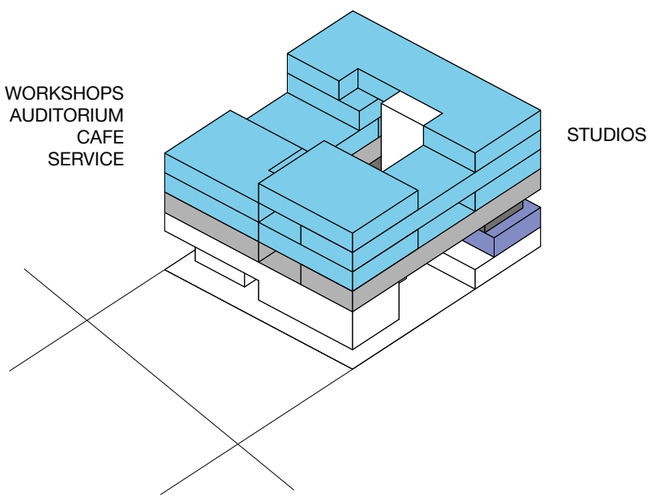
CROSS VENTILATION



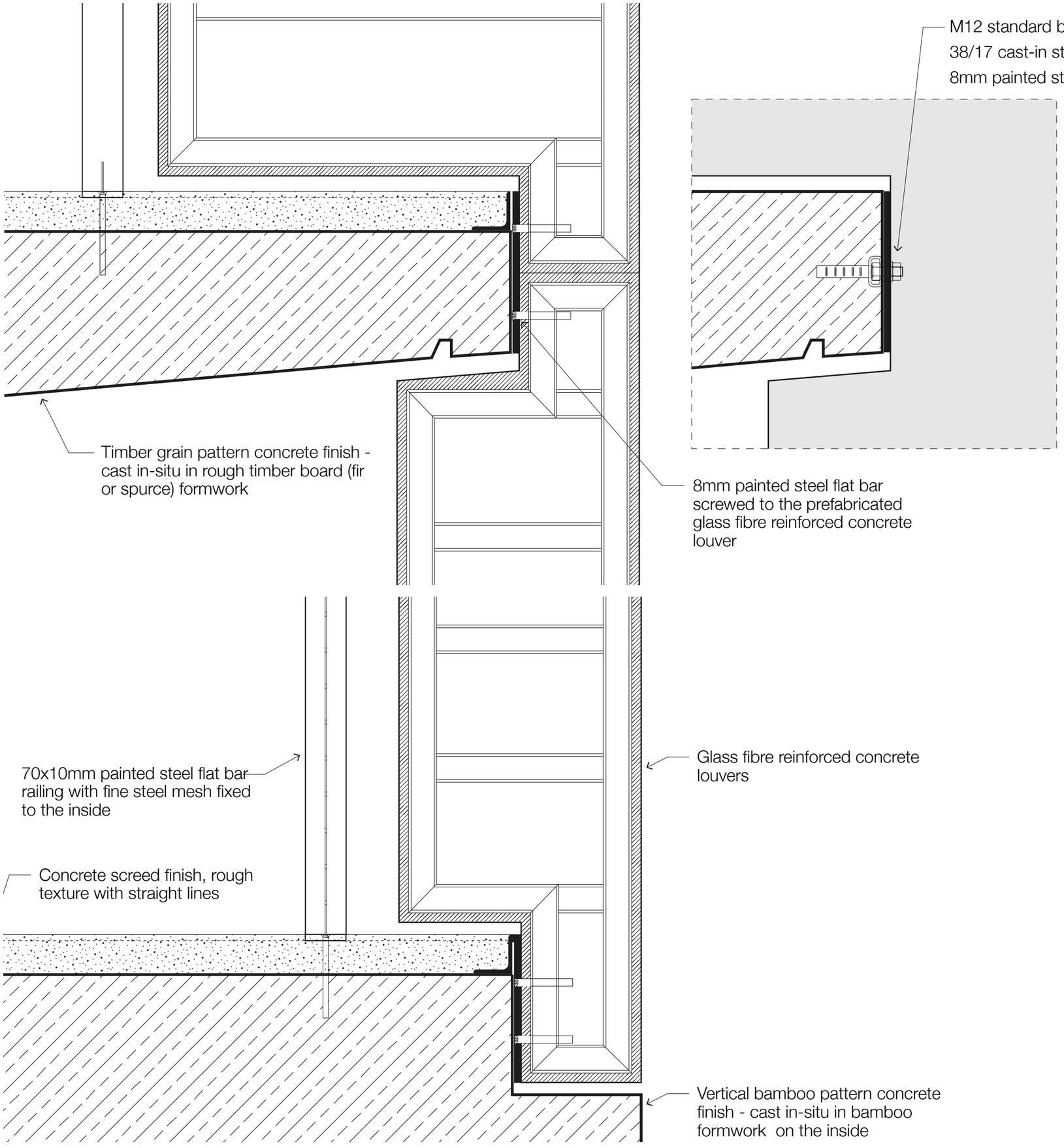
2

LOUVRES

RAIN
SUN

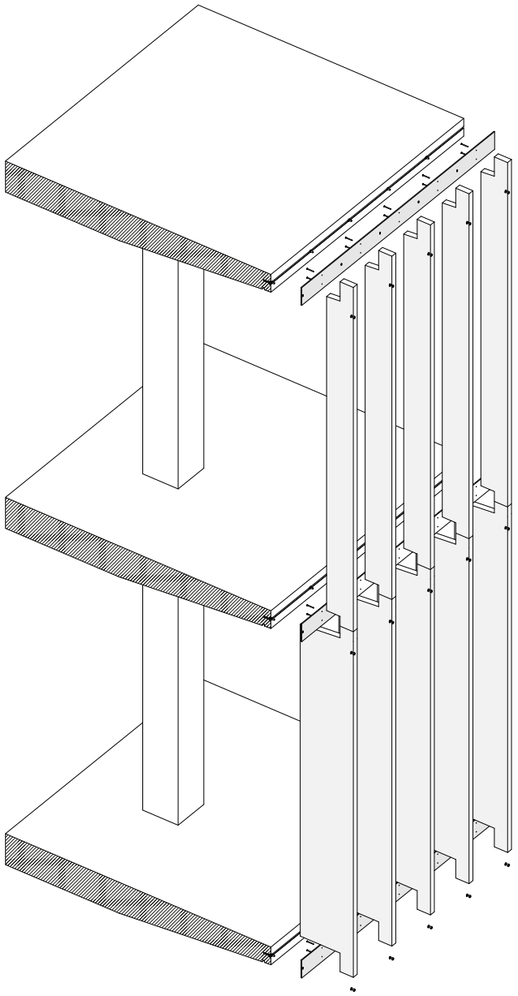


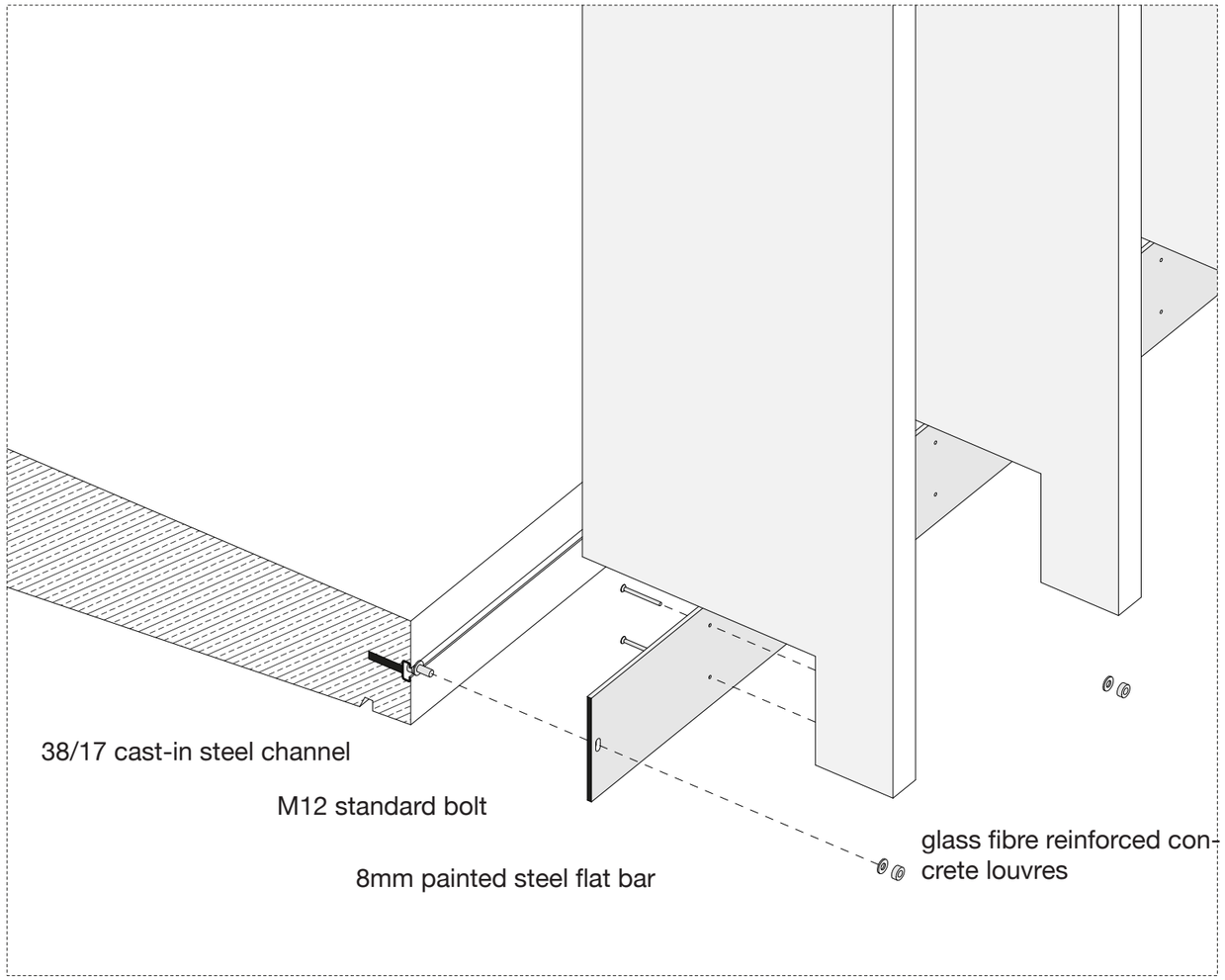
The facade louvers protect the structure ans interior space from overheating, and from heavy rainfalls, while allowing for natural ventilation.



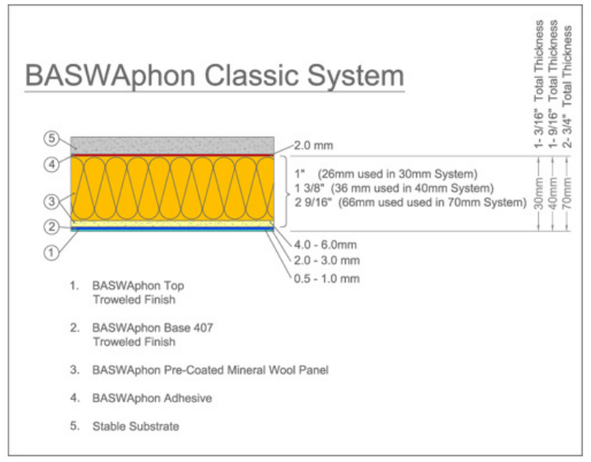
The facade louvers protect the structure ans interior space from overheating, and from heavy rainfalls, while allowing for natural ventilation.

The assembly system is cast in steel channel and bolt system that are 3 m wide and can be attached to the facade one by one.





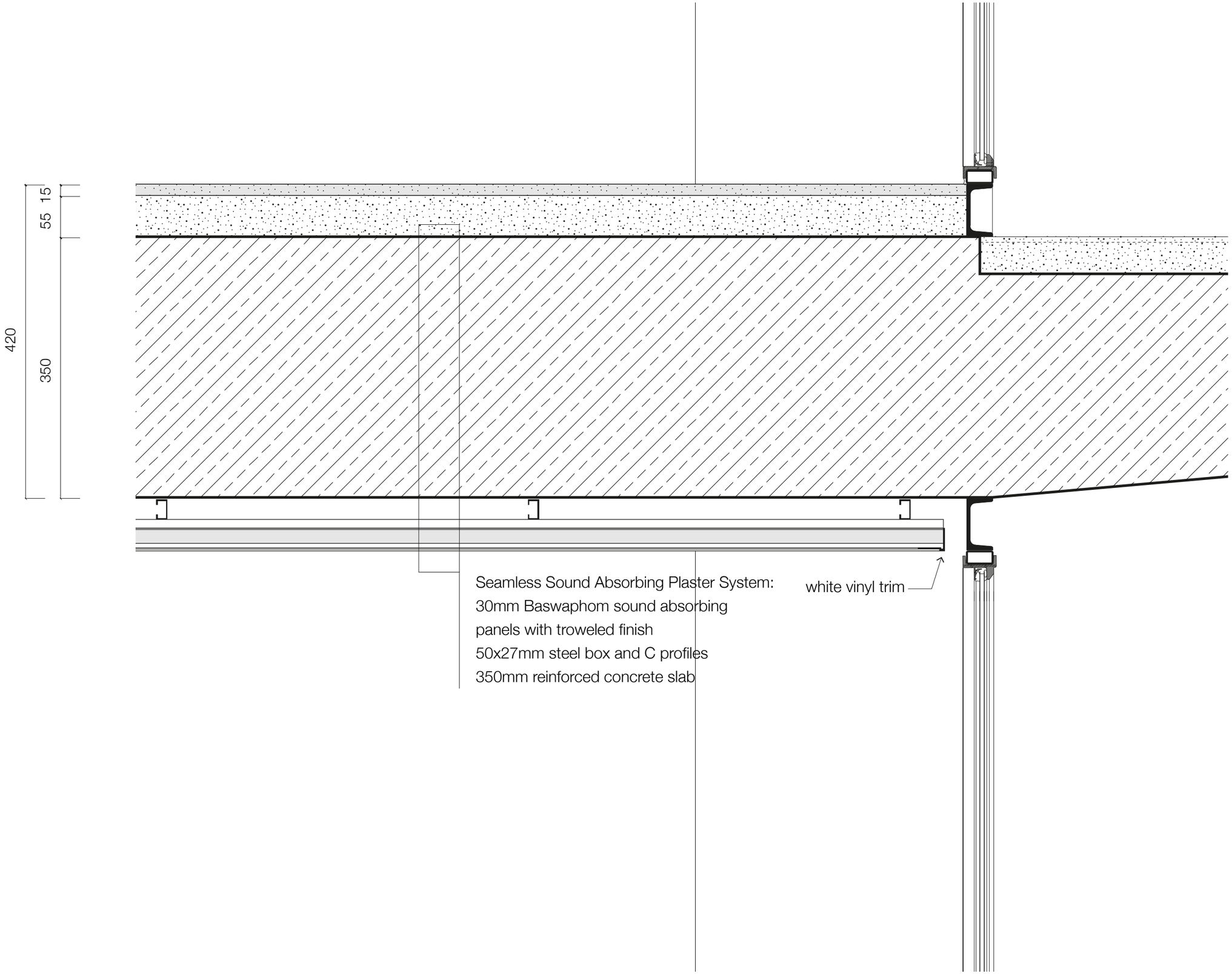
Since all the materials used in studio spaces are very hard and bounce sound back easily, it could get very noisy and uncomfortable to work. Therefore I did some basic acoustics calculations with design target reverberation time that is globally accepted. By in implementing acoustic ceiling panels, in this case Baswaphon seamless panel system, the target was reached.

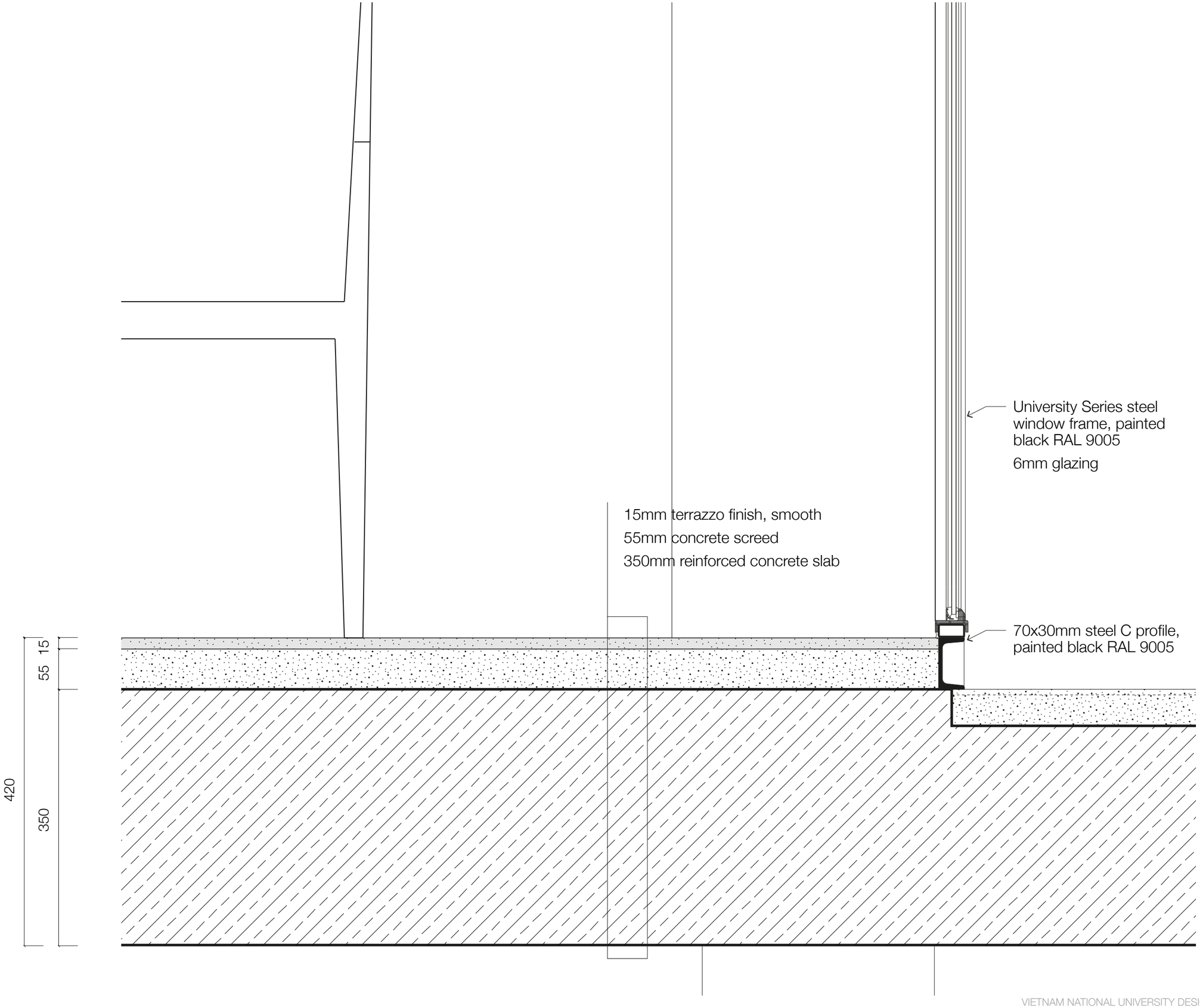


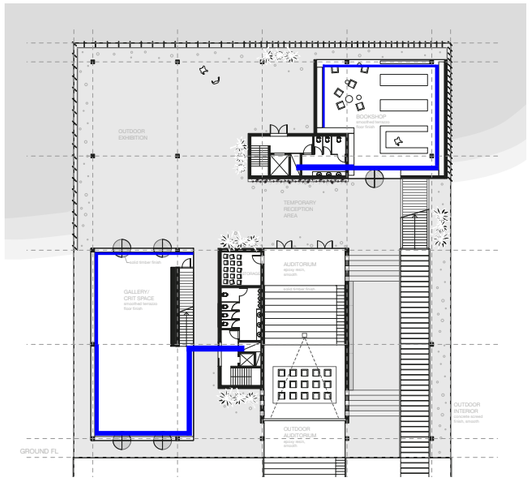
ACOUSTICS - Reverberation Time Estimate

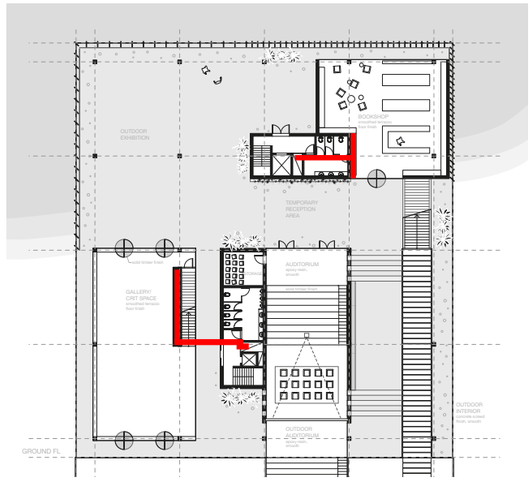
Name of Room / Space:	**Design Hub Hoa Lac / Studio Space Assesment**	
Length:	**41 M**	ALISE JEKABSONE, ID: 325
Width:	**9 M**	
Height:	**3 M**	
Volume:	**1205.28**	

ROOM ABSORPTION COMPONENTS			**ABSORPTION COEFFICIENTS**							**ABSORPTION**					
Surface Location	**Area**	**Description of Finish**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**NRC**	**125**	**250**	**500**	**1000**	**2000**	**4000**
Air Absorption		Air Absorption (approx)	0	0	0	0	0.01	0.024	0.0025	0	0	0	0	12	29
Ceiling 1	380	acoustic panels / finish	0.32	0.34	0.86	0.98	0.89	0.72	0.77	122	129	327	372	338	274
Floor 1	380	concrete, poured	0.01	0.01	0.02	0.02	0.02	0.03	0.02	4	4	8	8	8	11
South ("Long") Wall 1	300	glass	0.30	0.20	0.20	0.10	0.07	0.04	0.14	90	60	60	30	21	12
No of People /Audience	50 people	(Metric sabins /person)	0.25	0.40	0.55	0.65	0.65	0.60	0.56	13	20	28	33	33	30
Total Absorption (and Area)	**1060**									228	213	422	443	411	356
										125	**250**	**500**	**1k**	**2k**	**4k**
SABINE RT										**0.9**	**0.9**	**0.5**	**0.4**	**0.5**	**0.5**
Design /Target RT (Enter)										1.1	1.1	1.1	1.1	1.1	1.1
Required additional (or adjustment to) Ab										-51	-37	-245	-266	-235	-180


420
15
55
350
Seamless Sound Absorbing Plaster System:
30mm Baswaphom sound absorbing
panels with troweled finish
50x27mm steel box and C profiles
350mm reinforced concrete slab
white vinyl trim

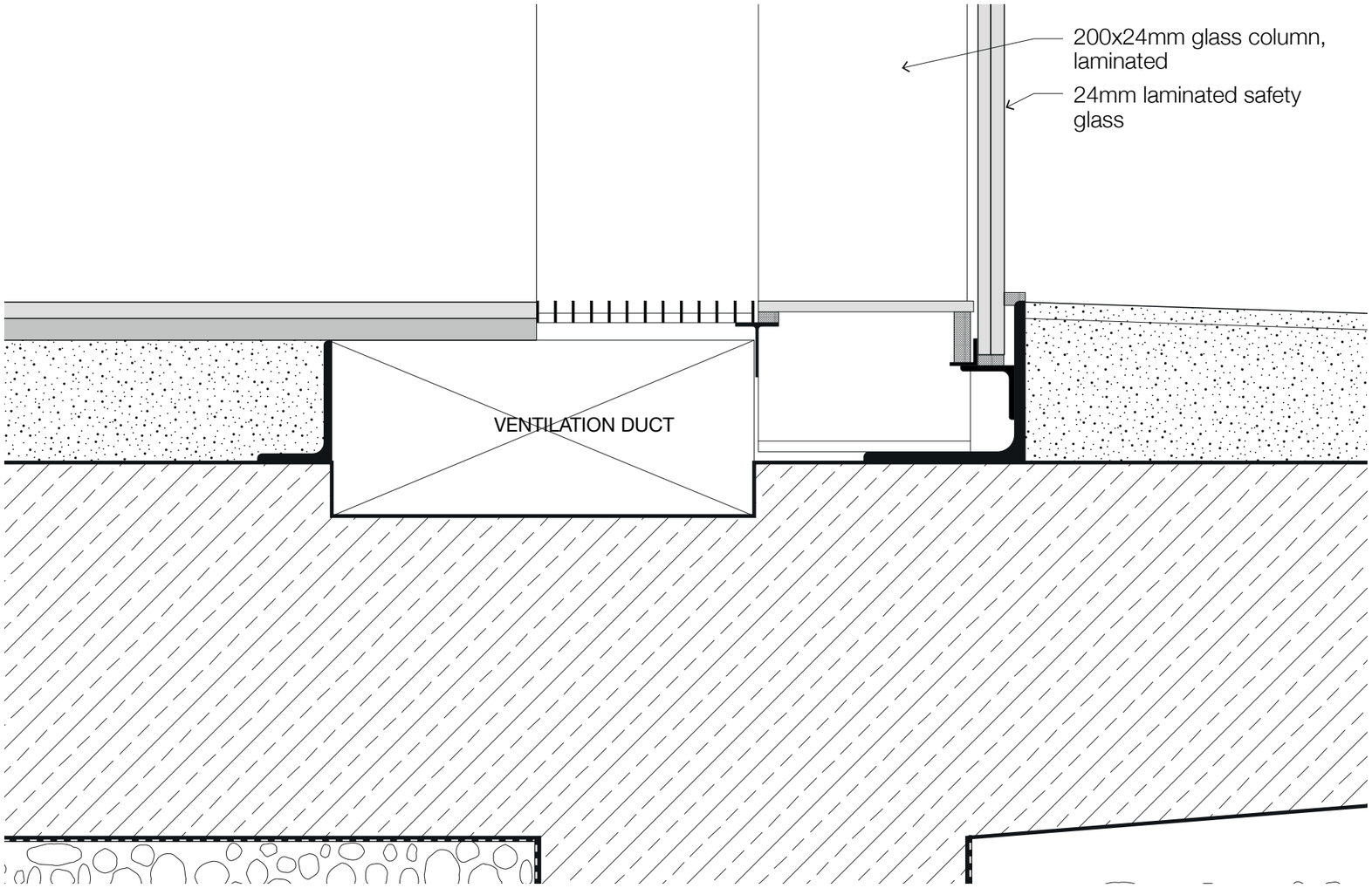

University Series steel window frame, painted black RAL 9005
6mm glazing
15mm terrazzo finish, smooth
55mm concrete screed
350mm reinforced concrete slab
70x30mm steel C profile, painted black RAL 9005
420
15
55
350

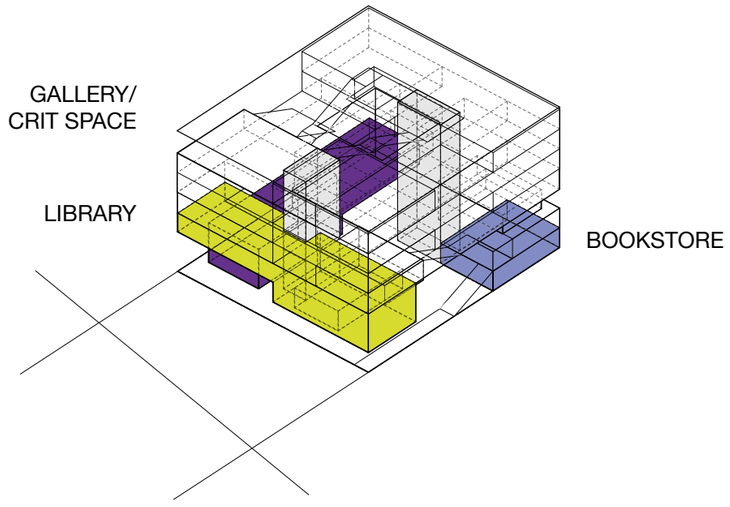


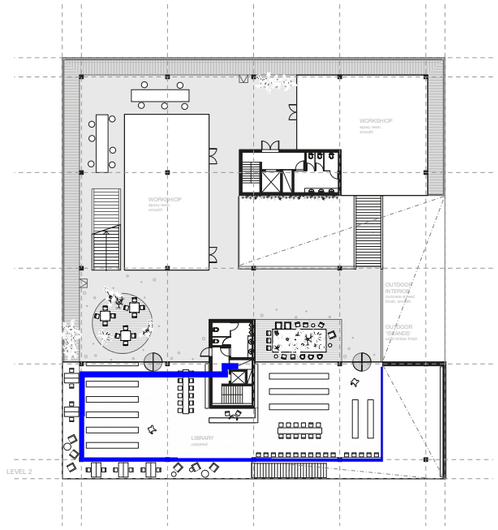


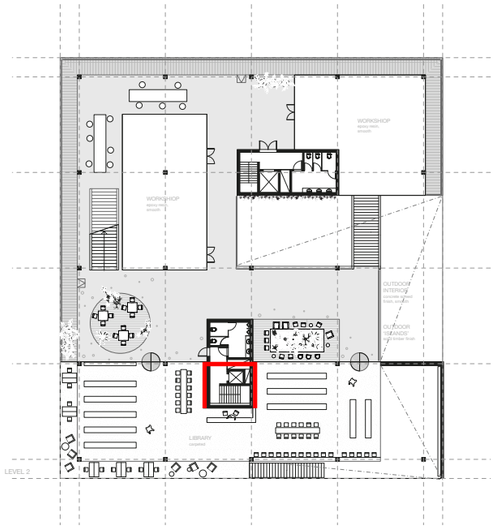
Mechanical ventilation is implemented in spaces, where it is crucial to have climate control - library, bookstore and gallery space.

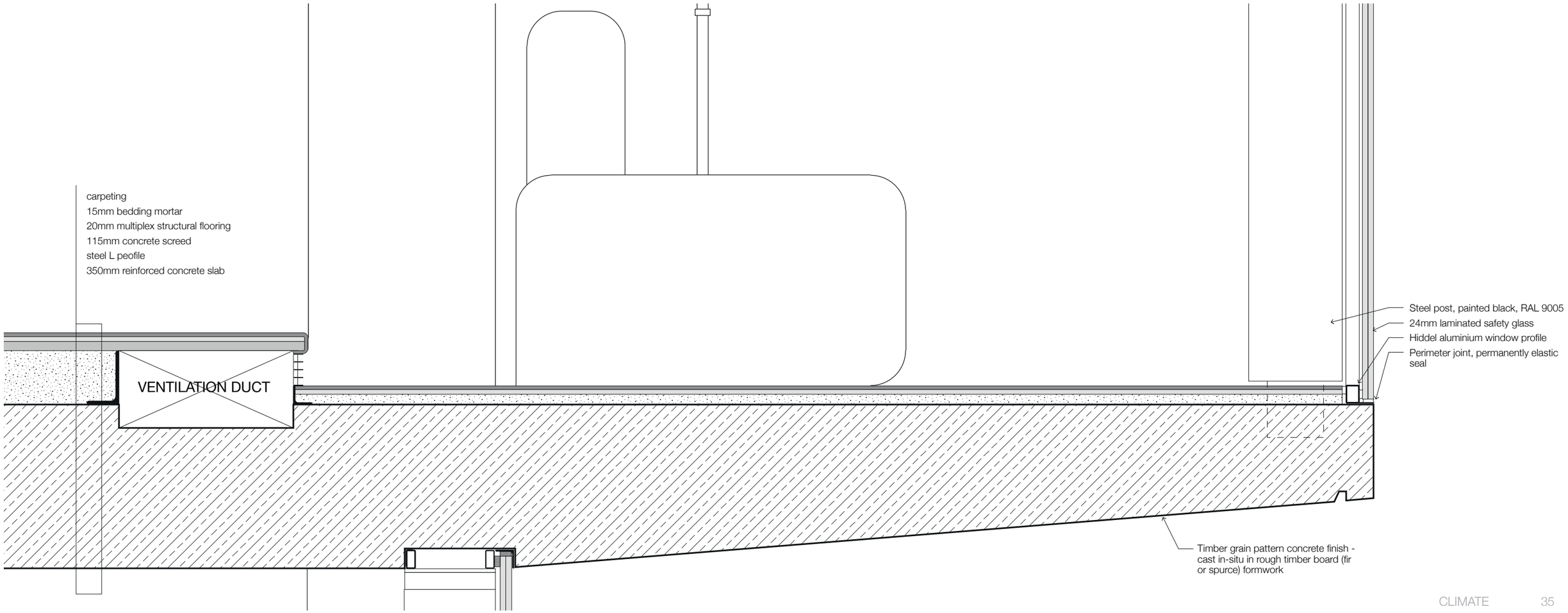
However, the construction of the building and the structure allows in the future for mechanical ventilation to be installed everywhere in the building if necessary.






WORKSHOP
OUTDOOR INTERIOR
OUTDOOR ISLANDS
LIBRARY
LEVEL 2

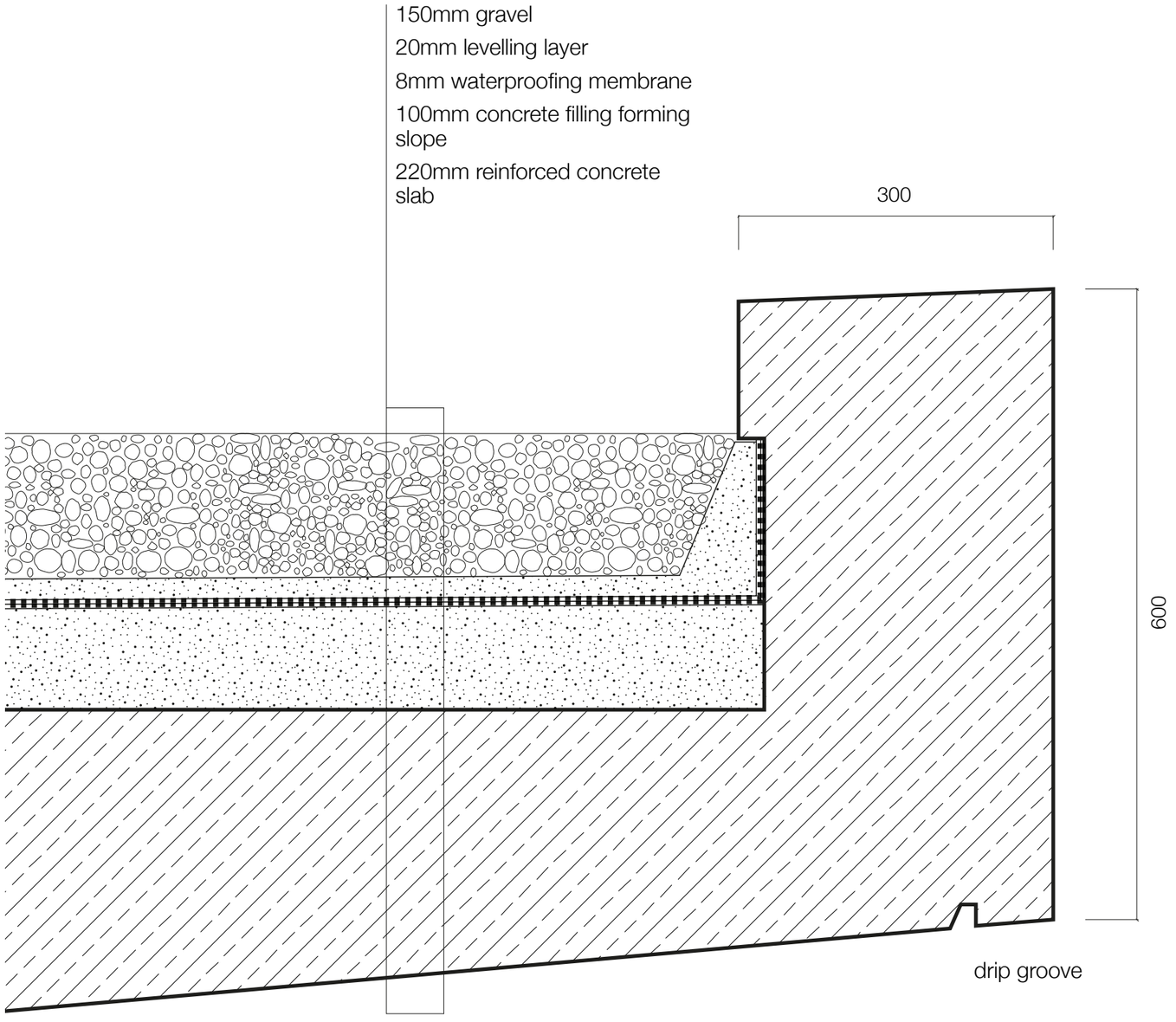

WORKSHOP
OUTDOOR INTERIOR
OUTDOOR ISLANDS
LIBRARY
LEVEL 2


carpeting
15mm bedding mortar
20mm multiplex structural flooring
115mm concrete screed
steel L peofile
350mm reinforced concrete slab
VENTILATION DUCT
Steel post, painted black, RAL 9005
24mm laminated safety glass
Hiddel aluminium window profile
Perimeter joint, permanently elastic seal
Timber grain pattern concrete finish - cast in-situ in rough timber board (fir or spurce) formwork

DETAILS 1:5

ROOF

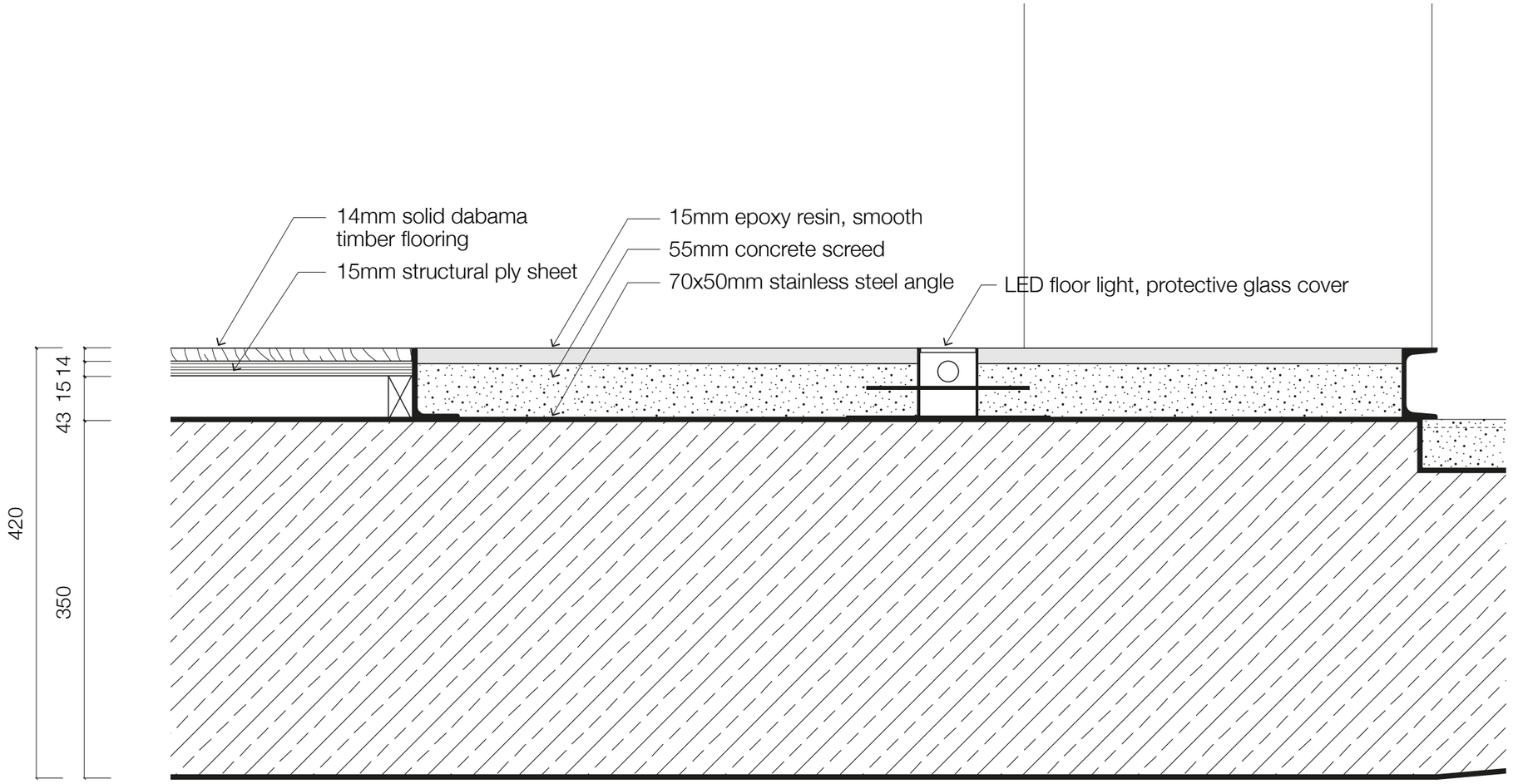
All the detailing was done considering the local climate. There are many opportunities to design interesting details. For example, in Hanoi climate there is no need to consider thermal bridges, therefore a continuous concrete floor slab can house both interior space and a terrace. Also, there is no need for double or triple glazing, therefore I have chosen very slim steel frames for glazing. No insulation is needed for walls or roof, therefore the roof can be very slim, noting that it has to withstand the annual rainfalls.

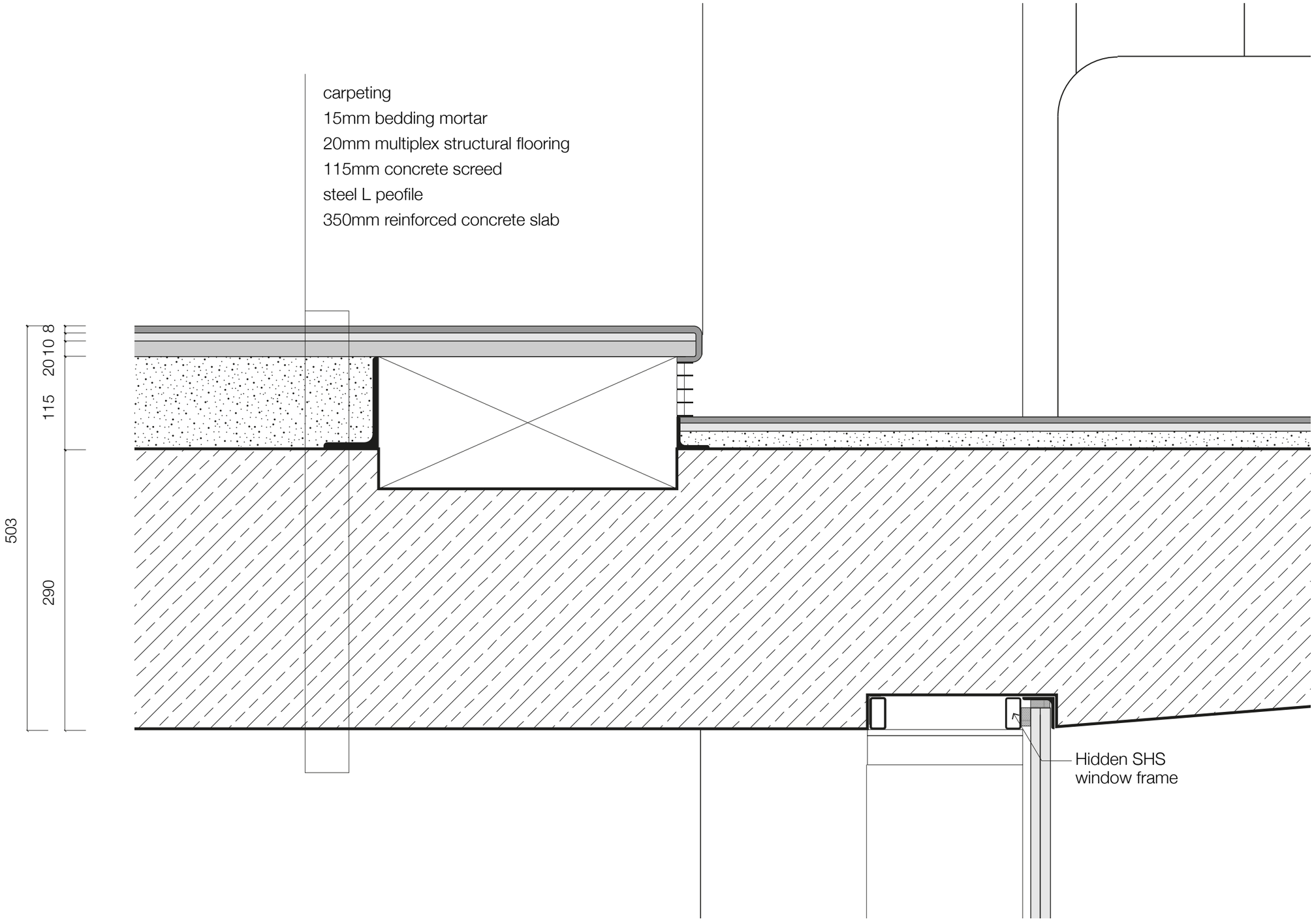


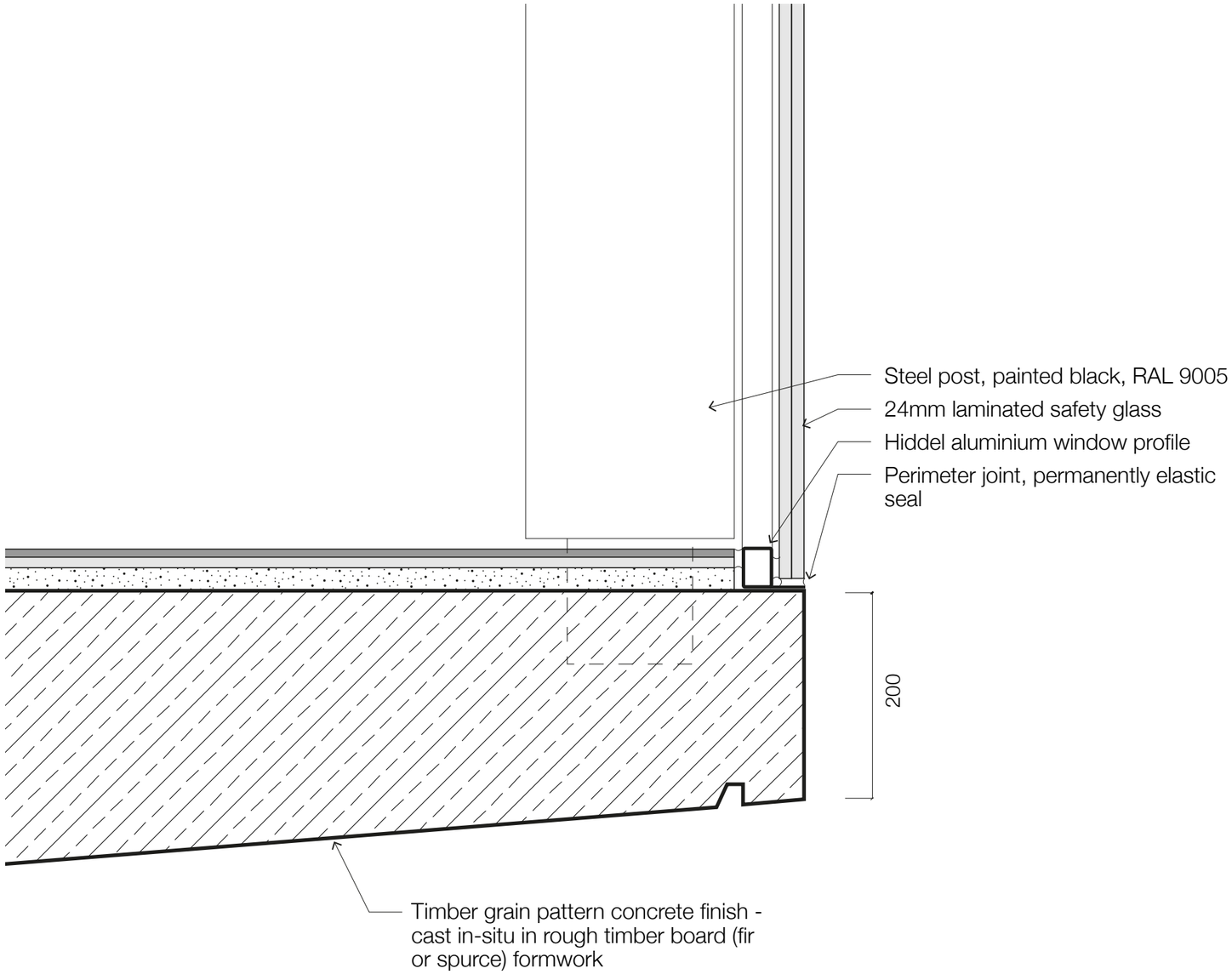
DETAILS 1:5

TERRACE

All the detailing was done considering the local climate. There are many opportunities to design interesting details. For example, in Hanoi climate there is no need to consider thermal bridges, therefore a continuous concrete floor slab can house both interior space and a terrace. Also, there is no need for double or triple glazing, therefore I have chosen very slim steel frames for glazing. No insulation is needed for walls or roof, therefore the roof can be very slim, noting that it has to withstand the annual rainfalls.




carpeting
15mm bedding mortar
20mm multiplex structural flooring
115mm concrete screed
steel L peofile
350mm reinforced concrete slab
8
20
10
115
503
290
Hidden SHS
window frame


Steel post, painted black, RAL 9005
24mm laminated safety glass
Hiddel aluminium window profile
Perimeter joint, permanently elastic seal
200
Timber grain pattern concrete finish - cast in-situ in rough timber board (fir or spurce) formwork

DETAILS 1:5

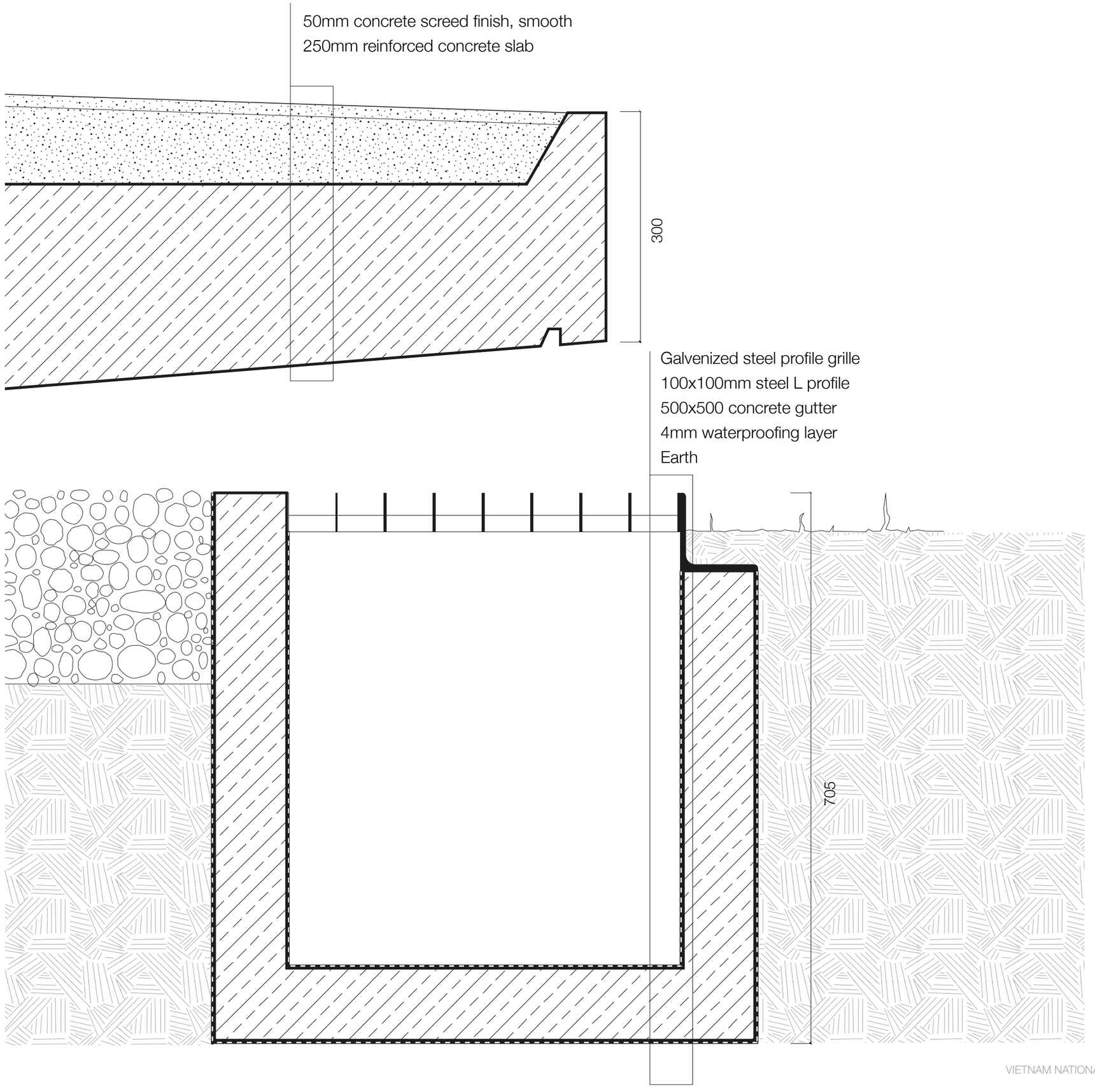
GROUND FLOOR / GALLERY

50mm concrete screed finish, smooth
250mm reinforced concrete slab
280mm gravel
earth

10mm laminated safety glass
Acrylic glass mounting
Steel support bracket

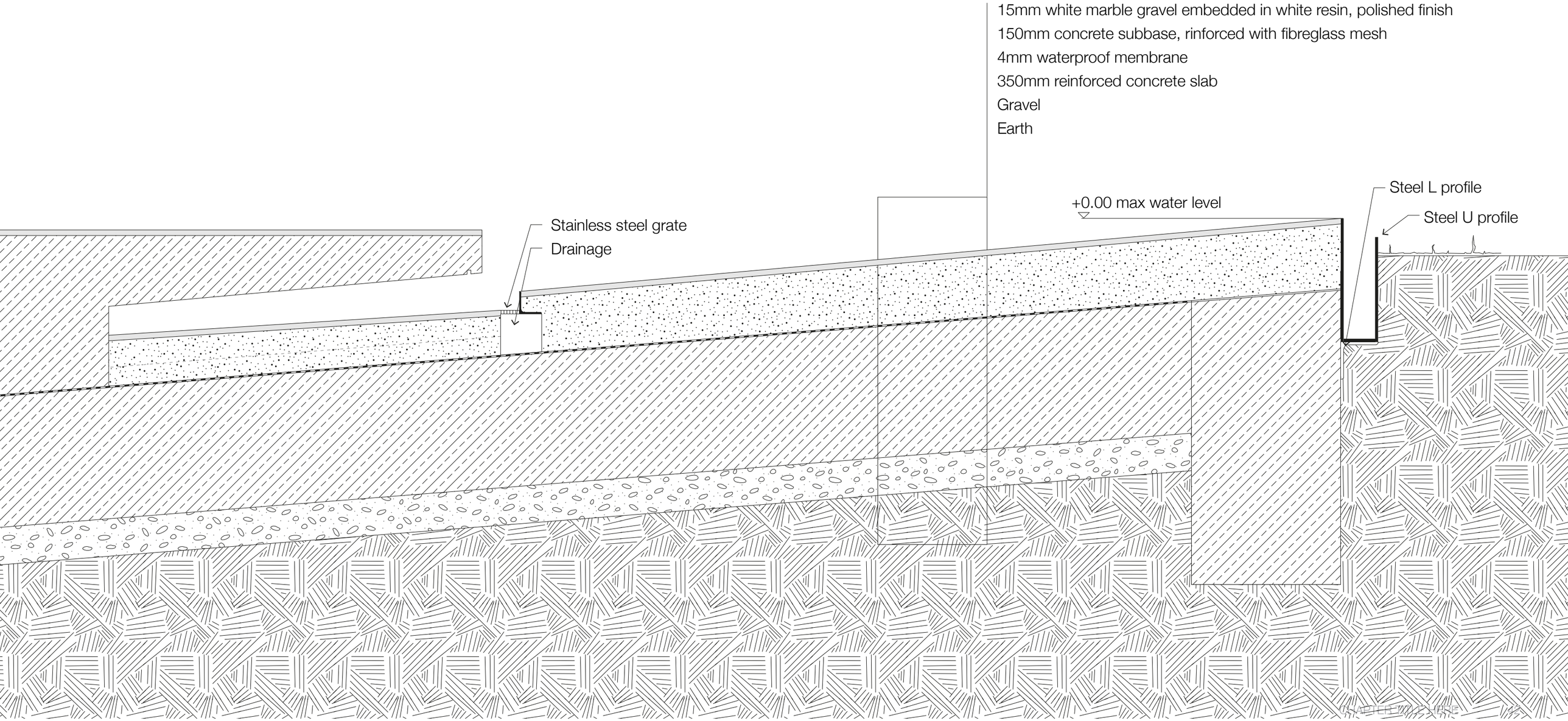
200x24mm glass column, laminated
24mm laminated safety glass

790
15
20
115
300
290


50mm concrete screed finish, smooth
250mm reinforced concrete slab
300
Galvenized steel profile grille
100x100mm steel L profile
500x500 concrete gutter
4mm waterproofing layer
Earth
705

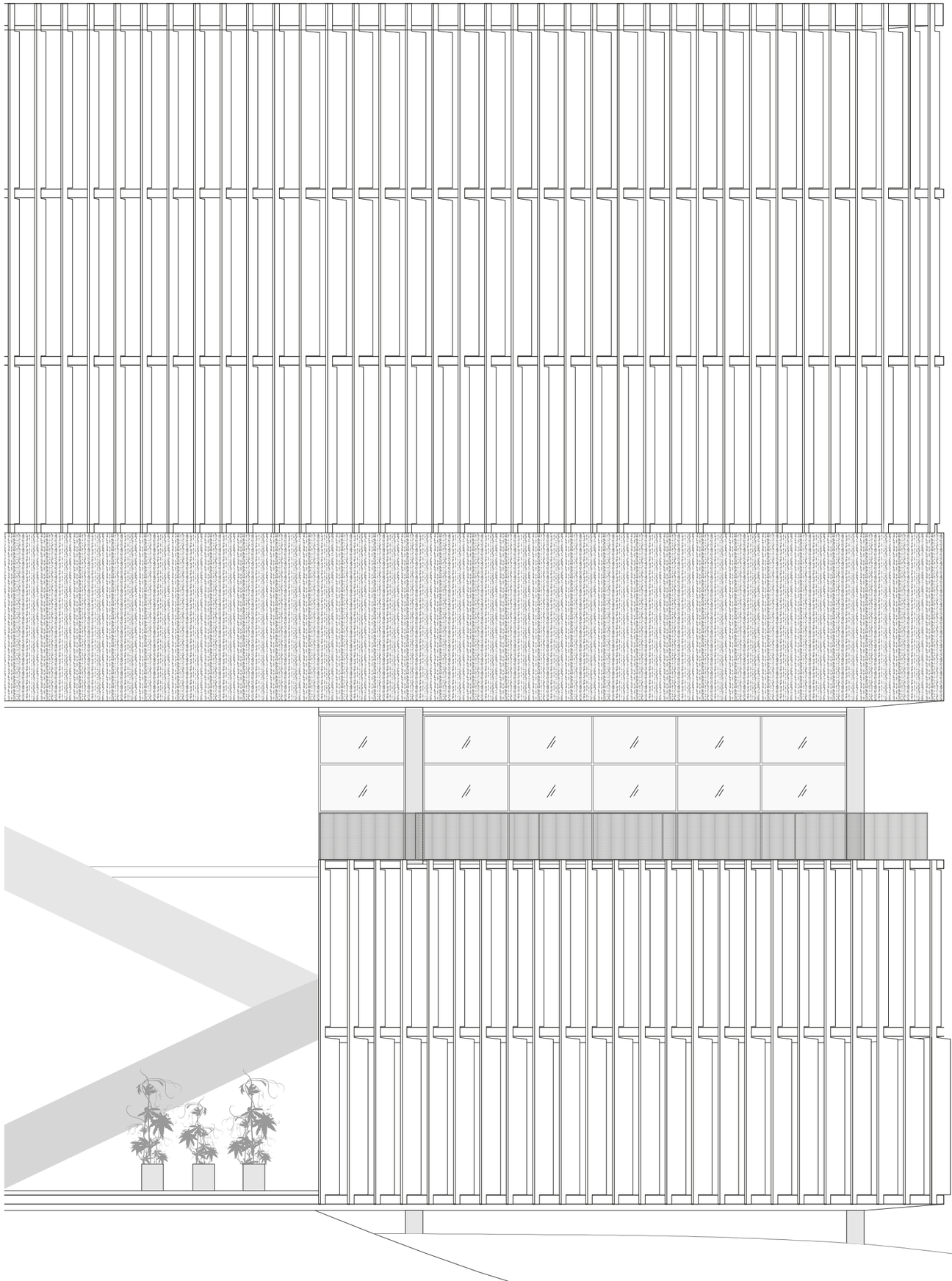
PLAZA DETAILS 1:10

The design of the plaza in front of the building is also a response to the climate conditionas. Since the annual rainfall is very high the plaza was designed as a giantic sink - filling up completely in the rainy season.



MATERIALISATION

SERVICE LEVEL / OUTSIDE



BAMBOO FORM WORK FINISH

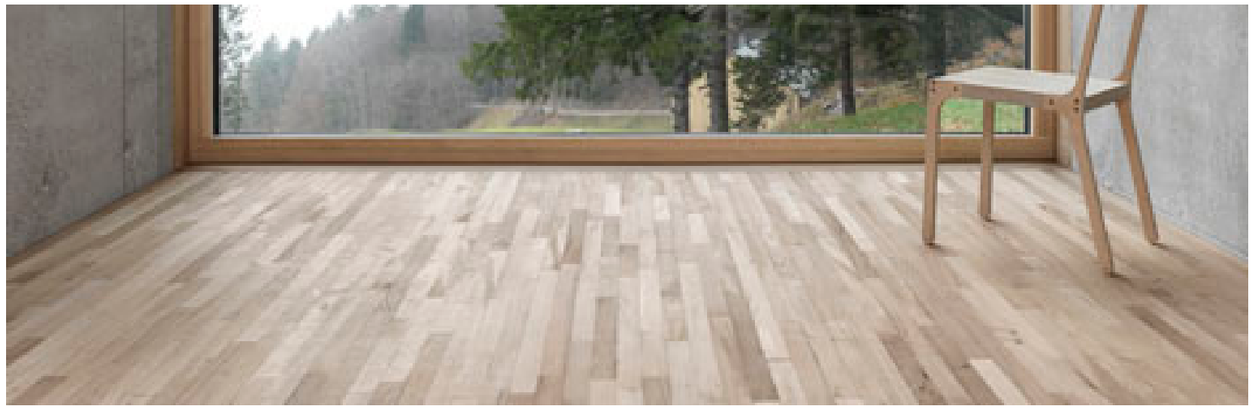
FLOOR / TEXTURED
CONCRETE SCREED

OUTDOOR CEILING /
ROUGH TIMBER TEXTURE

FLOOR / POLISHED TERRAZZO

WALLS / SMOOTH CONCRETE

Detail example: Peter Zumthor

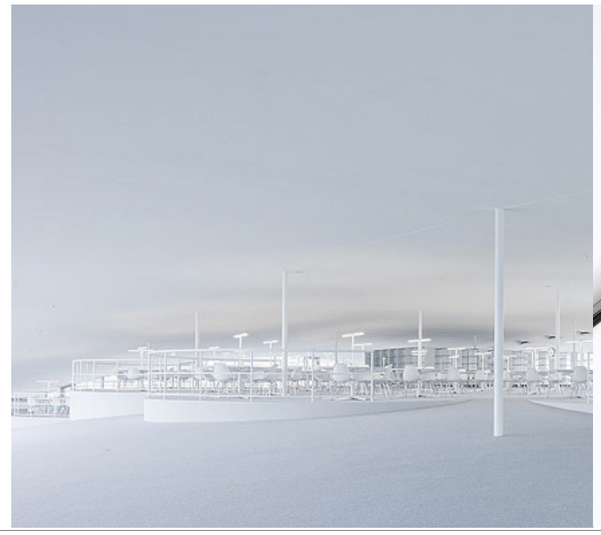


‘ISLANDS’ / SOLID TIMBER FINISH

Haus Rüscher by OLKRÜF

CEILING / BASWAPHON SEAMLESS
ACOUSTIC PLASTER

Example: SANAA Rolex Center



SUPERNOVA XS PIVOT
TRACKLIGHTS