

# GIOIA 22, RE-ARTICULATING PORTA NUOVA AREA

A public high-rise proposal in Milan skyline



**POLITECNICO**  
MILANO 1863

MEASURE:

Building Architecture  
AY 2020/21

PROFESSOR:

ARCHITECTURE DESIGN Prof. Maria Frazia Folli  
STRUCTURAL DESIGN Prof. Corrado Pecora  
INNOVATIVE MATERIALS Prof. Giovanni Dotelli  
BUILDING SERVICES Prof. Francesco Romano  
BIM MANAGEMENT Prof. Marco Imperadori

MEMBERS:

GROUP 3 IN TALL BUILDING  
Esha Shrivastava 10704665  
Gino André Segura D'Angelo 10706875  
Yiqi Lai 10703809

CAPTION:

PERSPECTIVE SECTION VIEW

PAGES:

1

SCALE:

-

ORIENTATION:

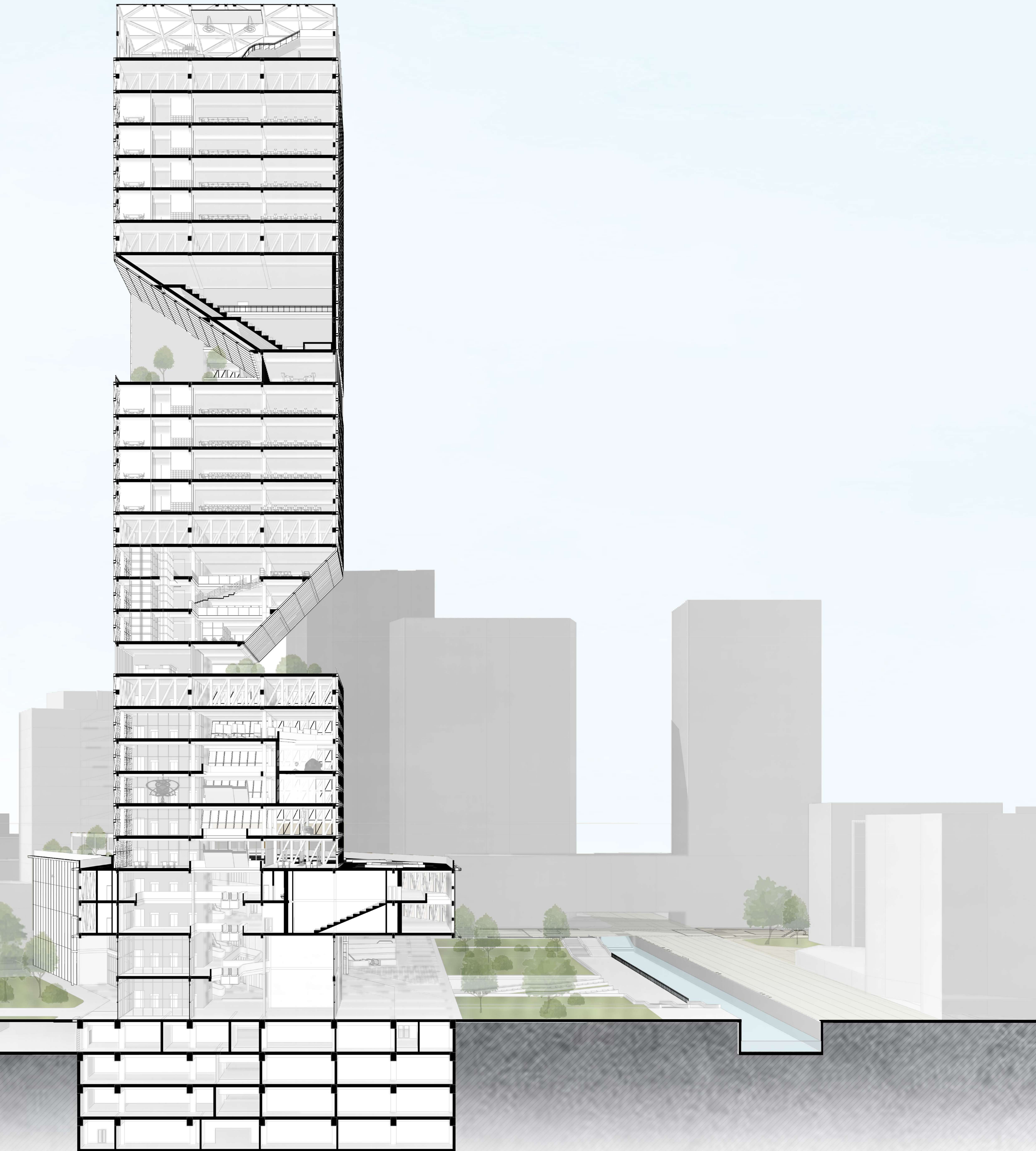
-

LEVEL:

-

DATES:

25/11/2021



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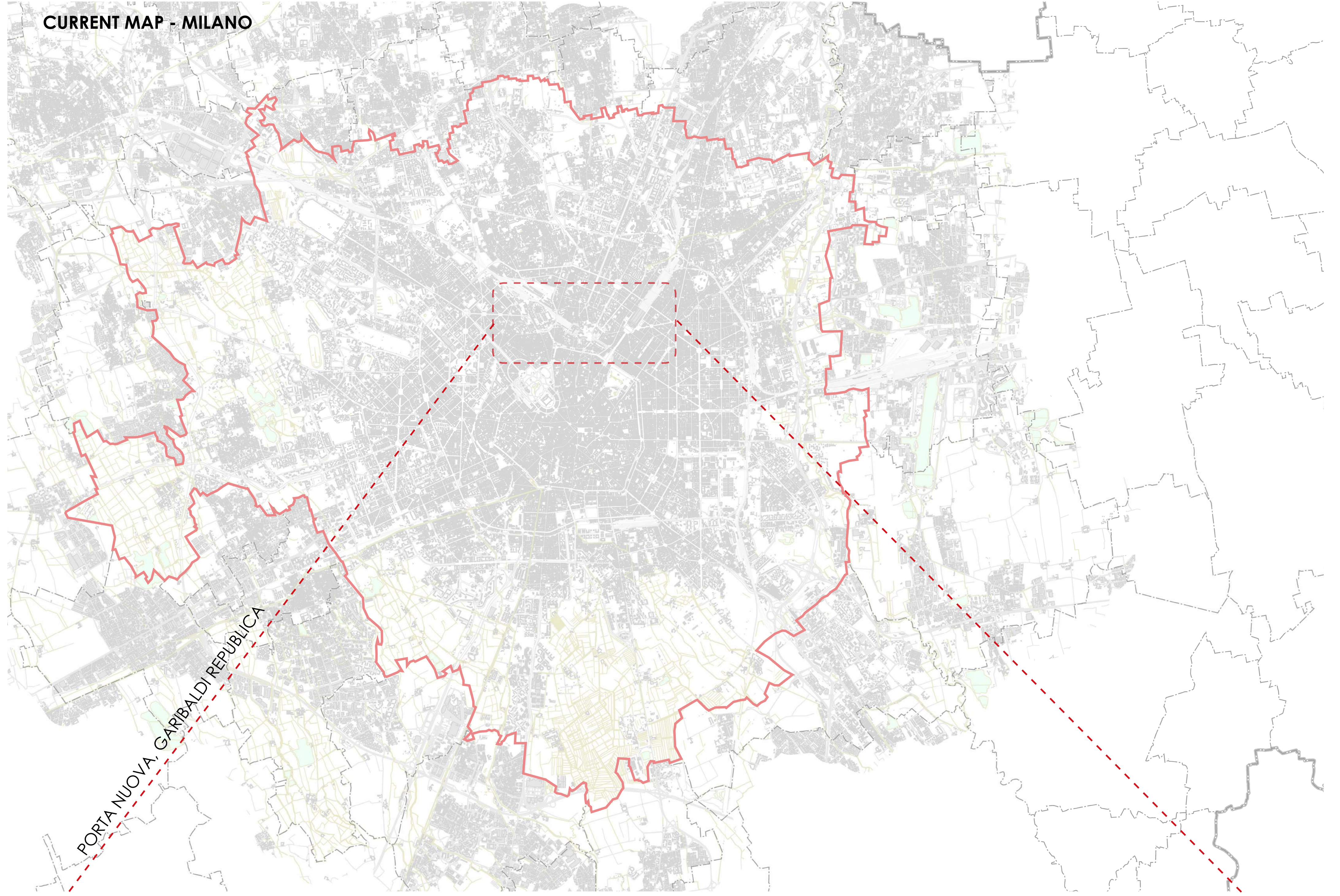
ORIENTATION:

LEVEL:

-

DATES:

25/11/2021



**HISTORICAL BACKGROUND**



1840

Historical Map



1889

Cesare Beruto Master Plan, 1889



1911

Pavia Masera Master Plan, 1911



1934

Overlapping of Albertini Master Plan (1934) & Pavia Masera (1911)



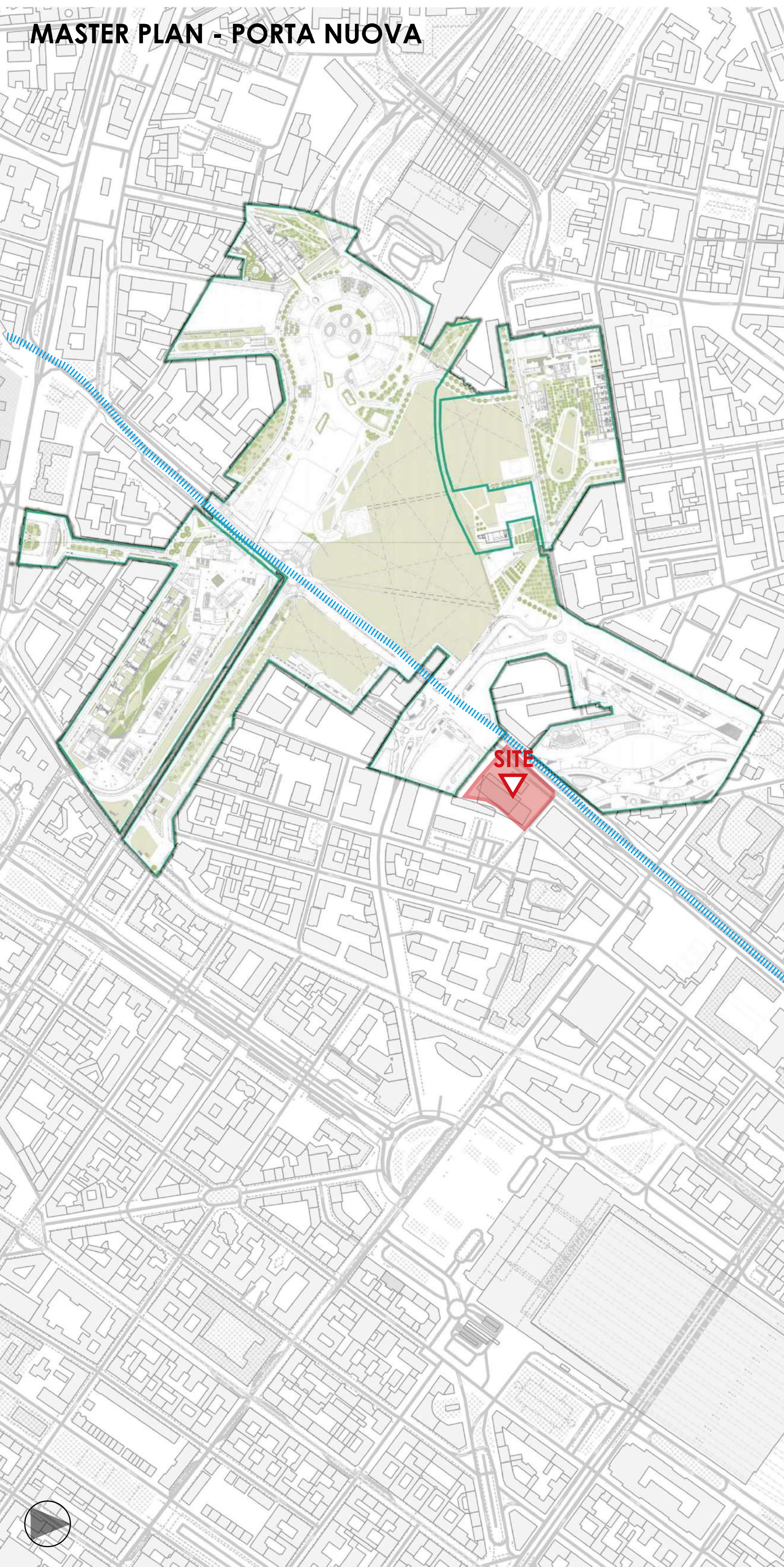
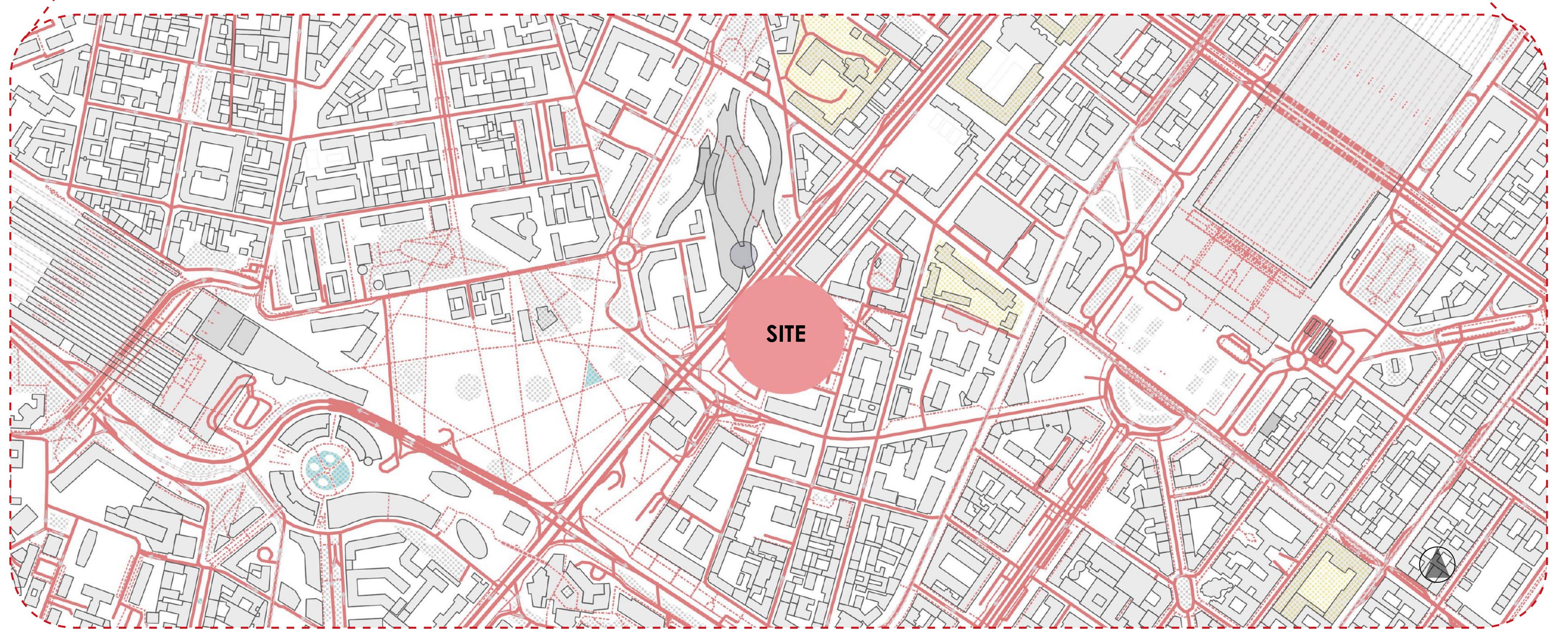
1953

Milano, Il Piano Regolatore Generale 1953

The Cesare Beruto plan, which tab to organise the emerging city through large urban blocks to be situated between the Spanish walls and its outermost boundary, was unable to overcome the barriers set by the existing infrastructural system.

The plan stood out for its intention to reorganise the transport infrastructures and for this reason, it includes a new location for the Central Station, the introduction of the new rail yard of Via Farini

On the Garibaldi-Repubblica areas, the plan confirms the moving back of the railway to Via Carlo Farini. Although the street network layout conceived by Albertini was not actually realised, his plan draws the attention on the reallocation of the railway system to the present Porta Garibaldi Station.



1840

**HISTORICAL BACKGROUND**

As many important transport routes in Milan, Porta Nuova was characterized by a water



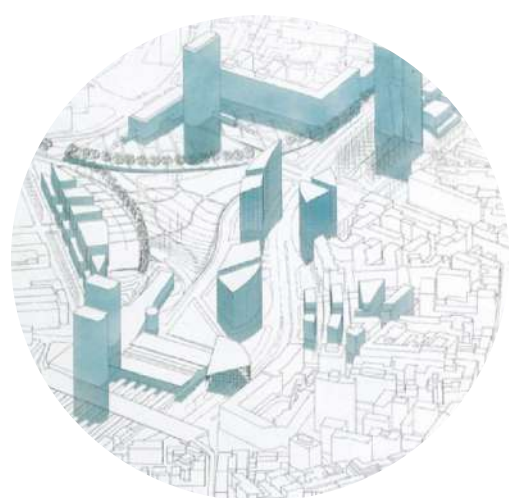
1857

The Piazza della Repubblica location, the construction of the new Central Station railway hub began. The location ended up setting a barrier for the future development of the city, and worsening an ongoing urban fragmentation including breaking the network of historical roads that formed the framework.



1955-1962

(1955 and 1962) Construction was problematic until it was completely halted at the end of the sixties. Despite its partial implementation with the creation of a few tall buildings (the City Hall, the Galfa Tower, the INPS building)



1991

International Competition of ideas for Garibaldi (1991, won by Nicolini). The difficulty in planning this part of the city can possibly be found in the rigidity of the model imposed for the business centre

**REOPENING THE NAVIGLIO**

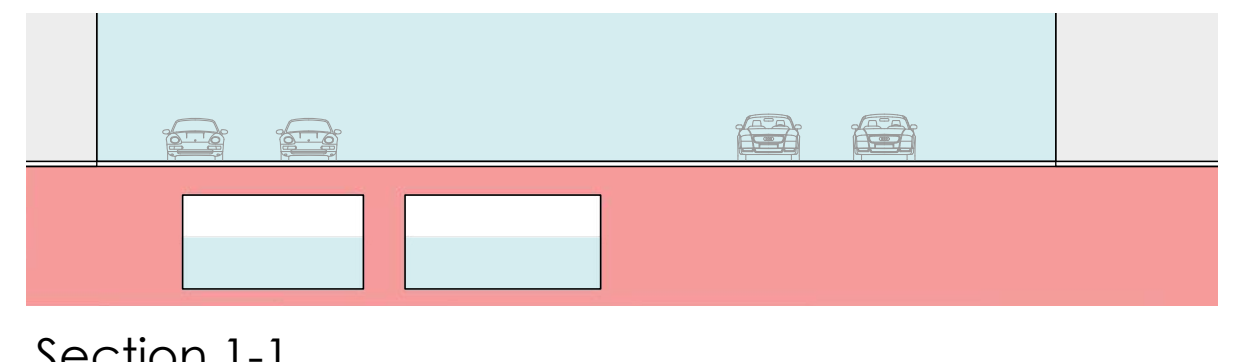
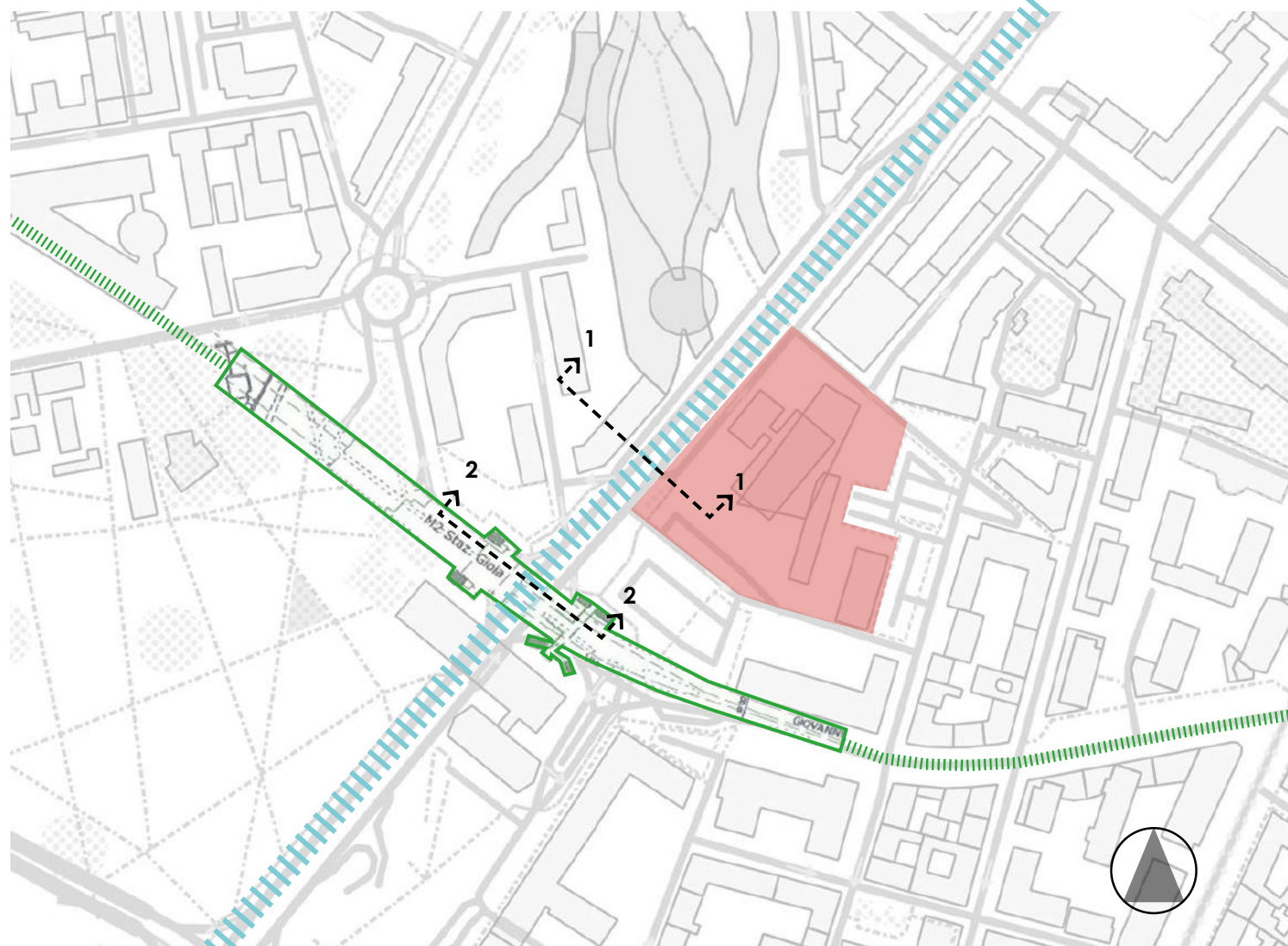
- » The reopening of naviglio is playing crucial role in our design by shaping an interactive foreground for our proposal at Via Melchiorre Gioia
- » The abundance of water flowing from the north through the Martesana canal (whose banks can still be seen on Via San Marco - 1840).

**NAVIGLIO CANAL INTERVENTION ROUTE**

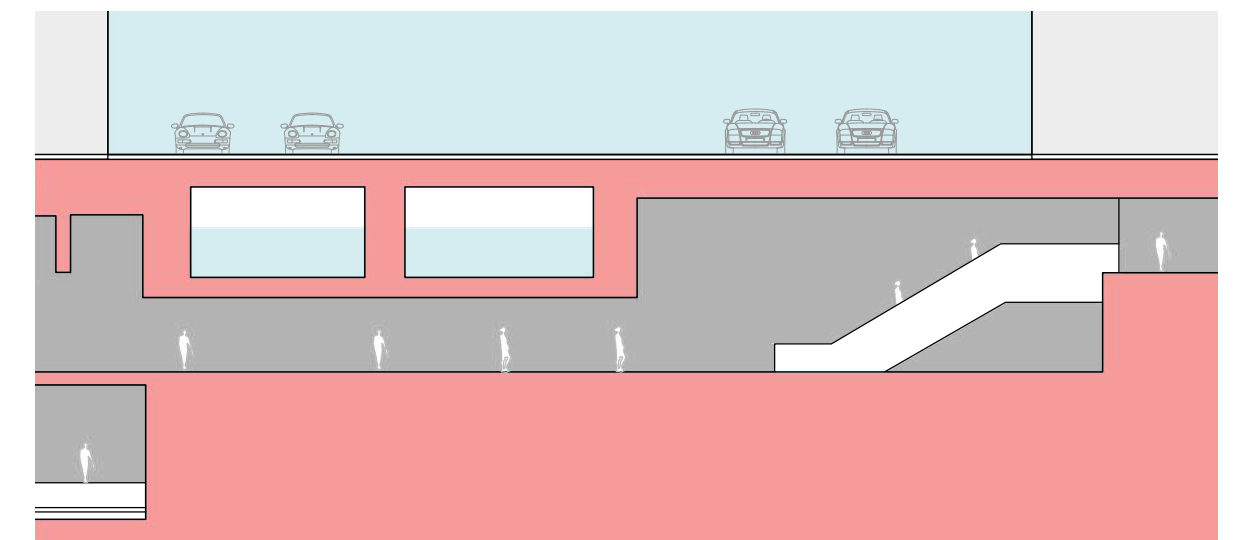


**CURRENT FOUNDATION : NAVIGLIO & GIOIA METRO STATION**

Floor Plan



Section 1-1

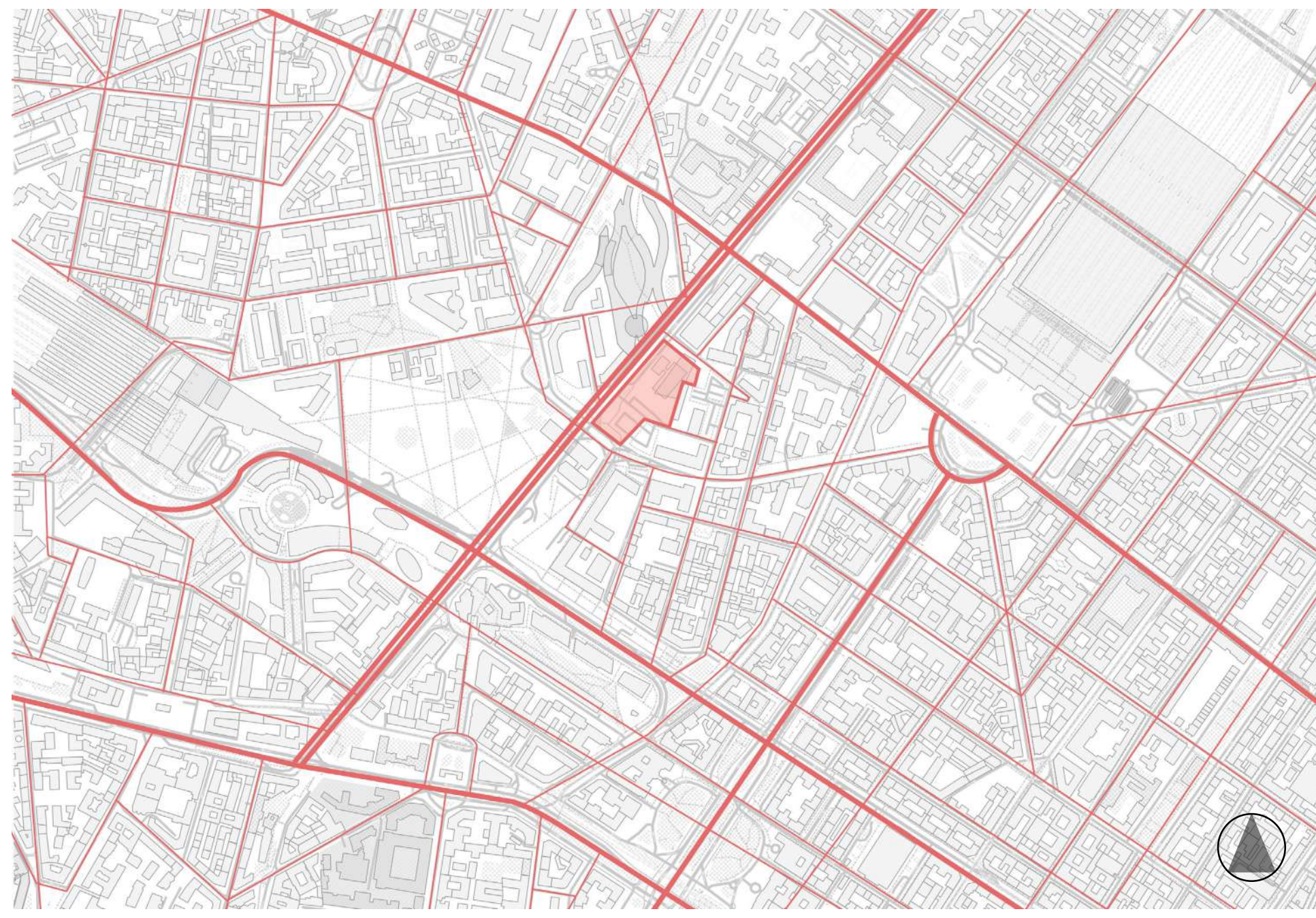


Section 2-2

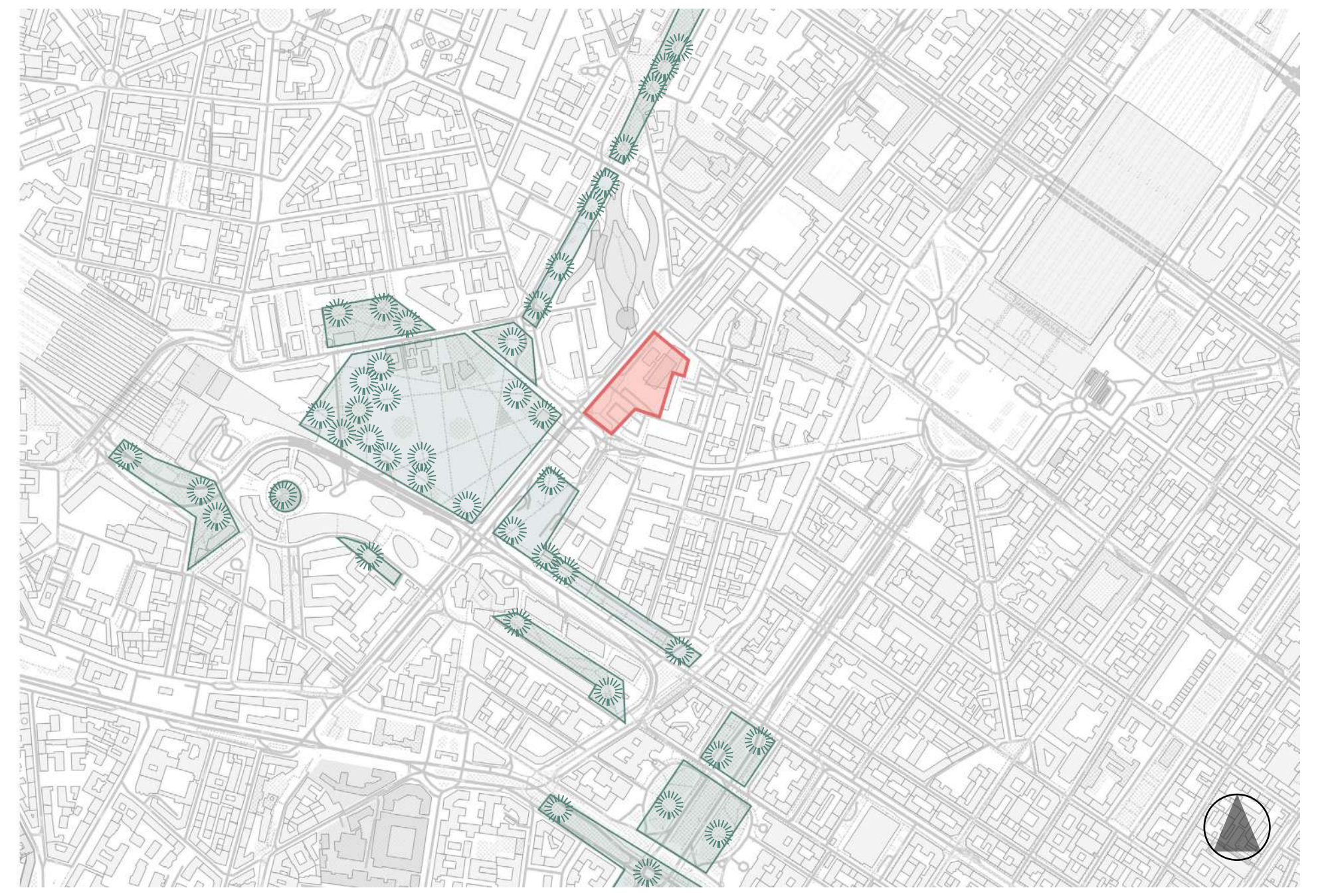
**URBAN ANALYSIS**



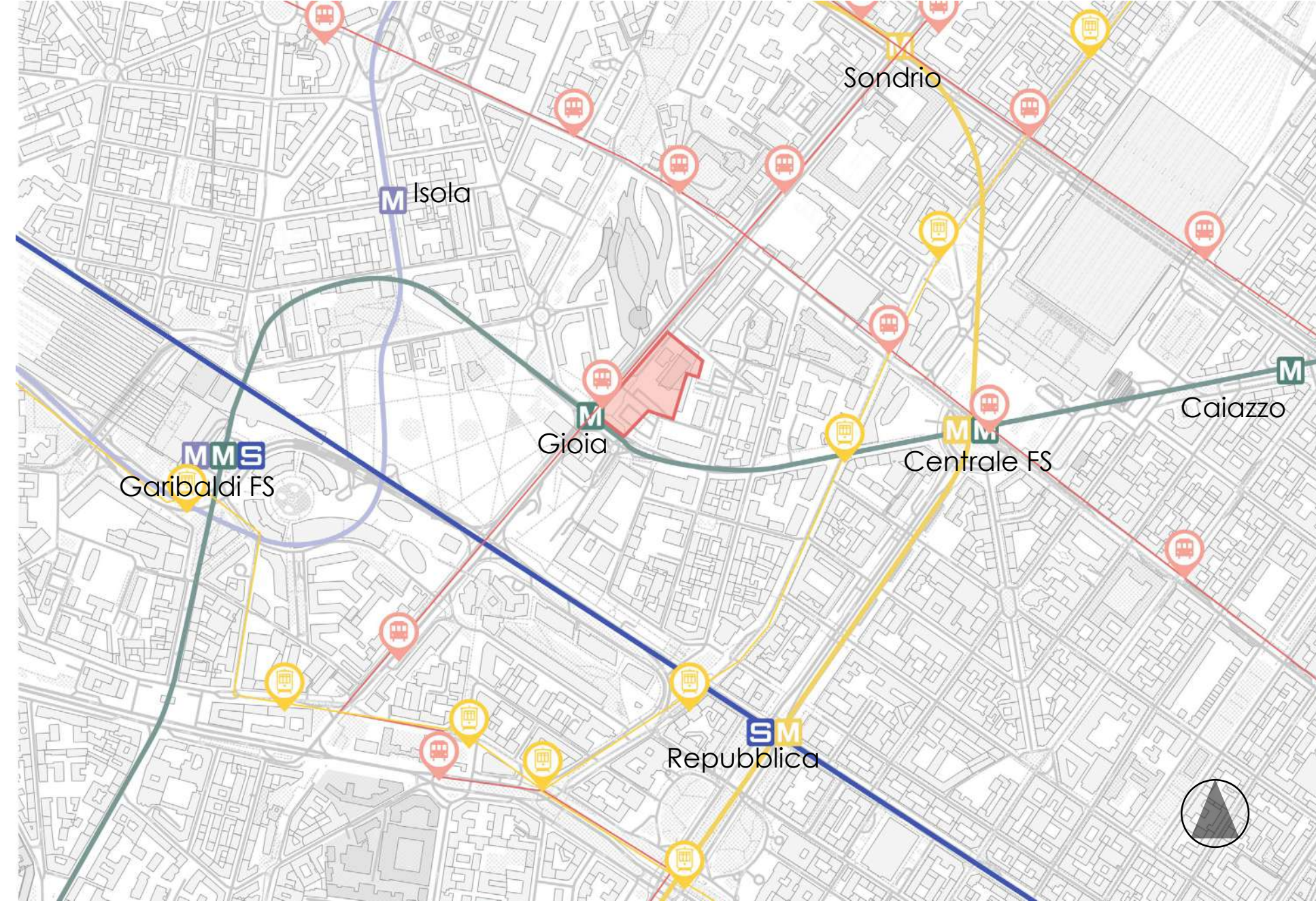
- SITE LOCATION**
- 1 - Central Station
  - 2 - Garibaldi Station
  - 3 - Pakazzo Regione Lombardia
  - 4 - Parco Biblioteca degli Alberi
  - 5 - Varsine
  - 6 - Piazza Gae Aulenti



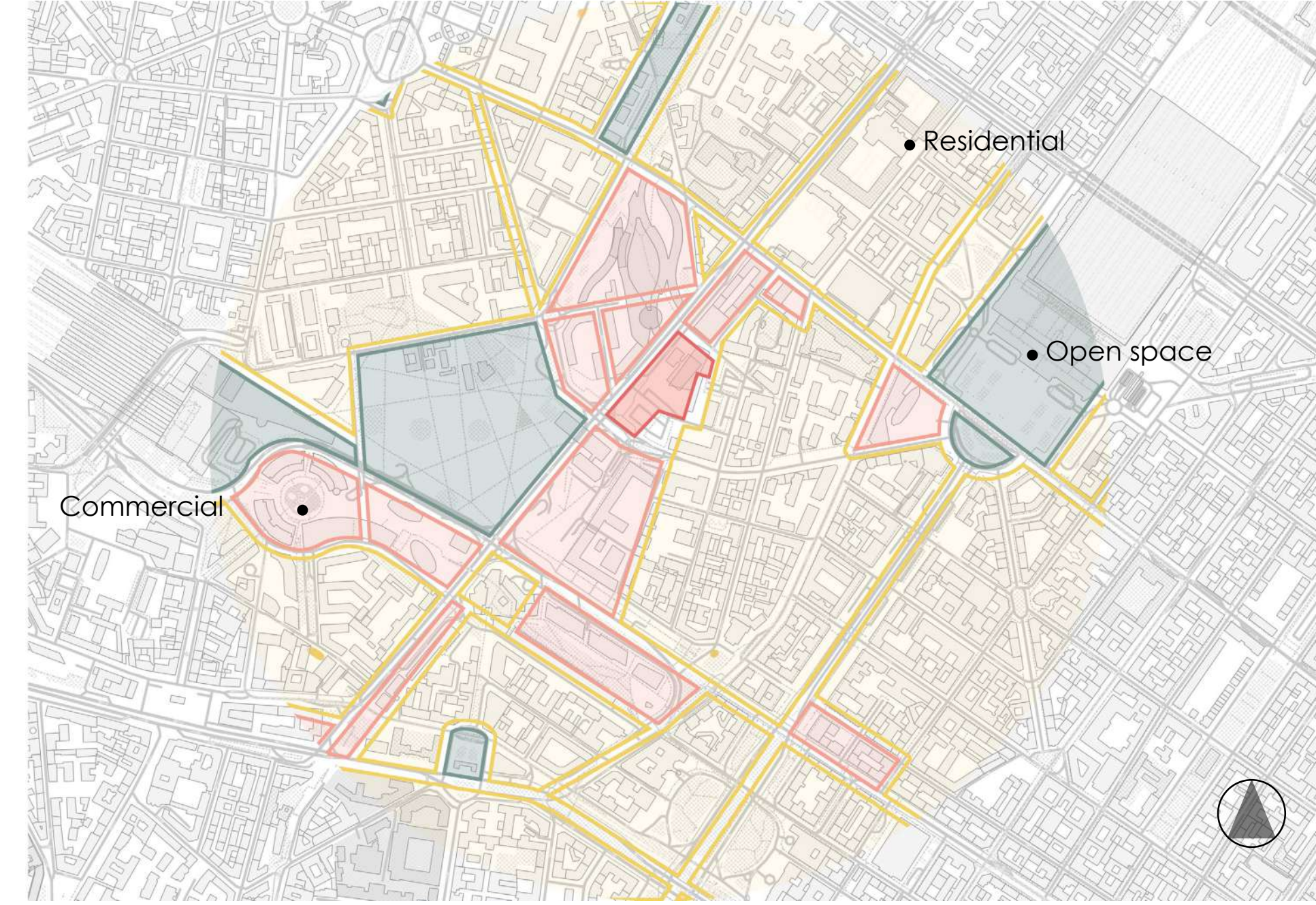
- CAR LOOP & PEDESTRIAN**
- Pedestrian
  - Car Loop
  - Site



- LANDSCAPE**
- Trees
  - Landscaped Area
  - Site



- METRO & BUS AND TRAM**
- Bus Stop
  - Tram Stop
  - Site

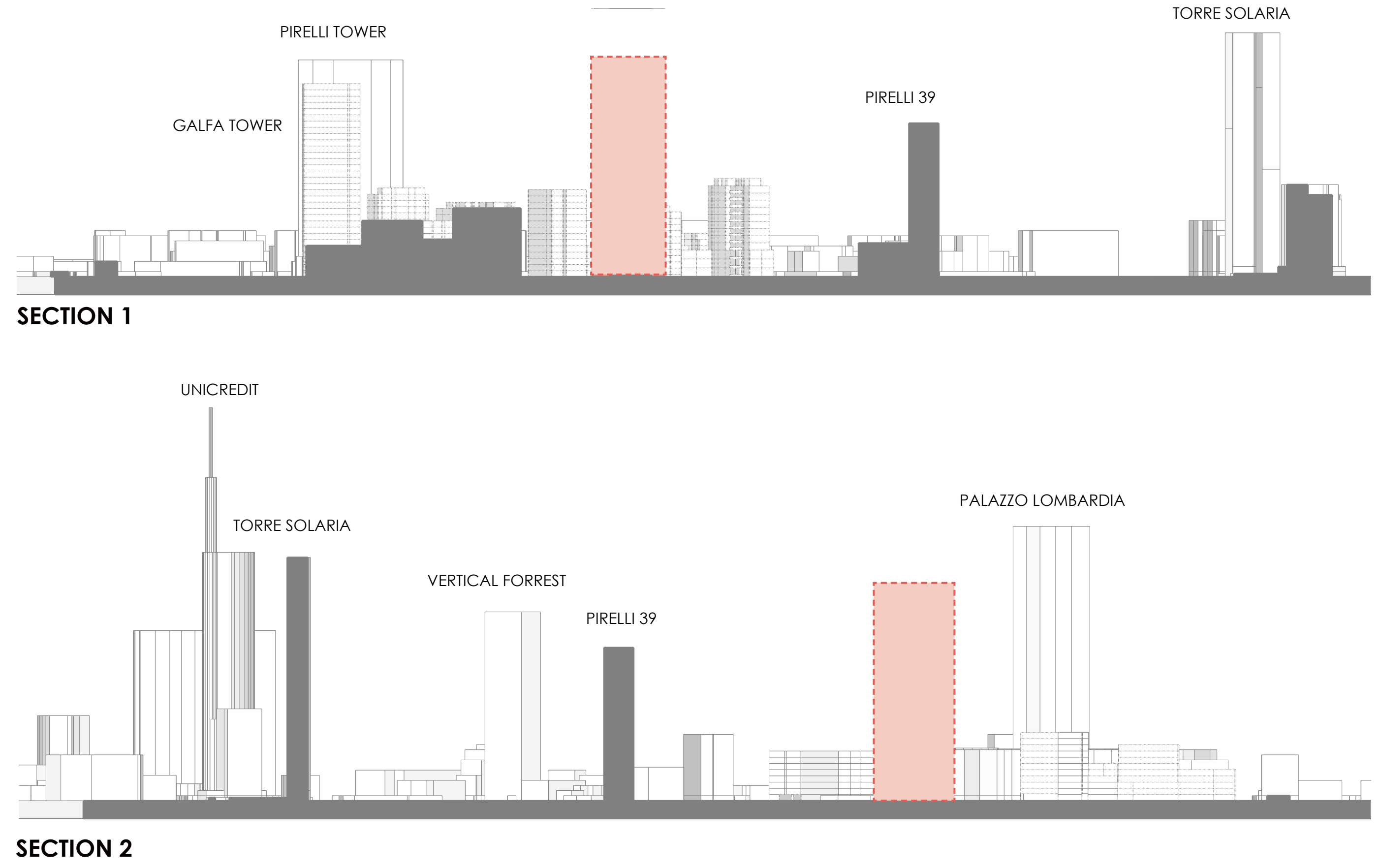
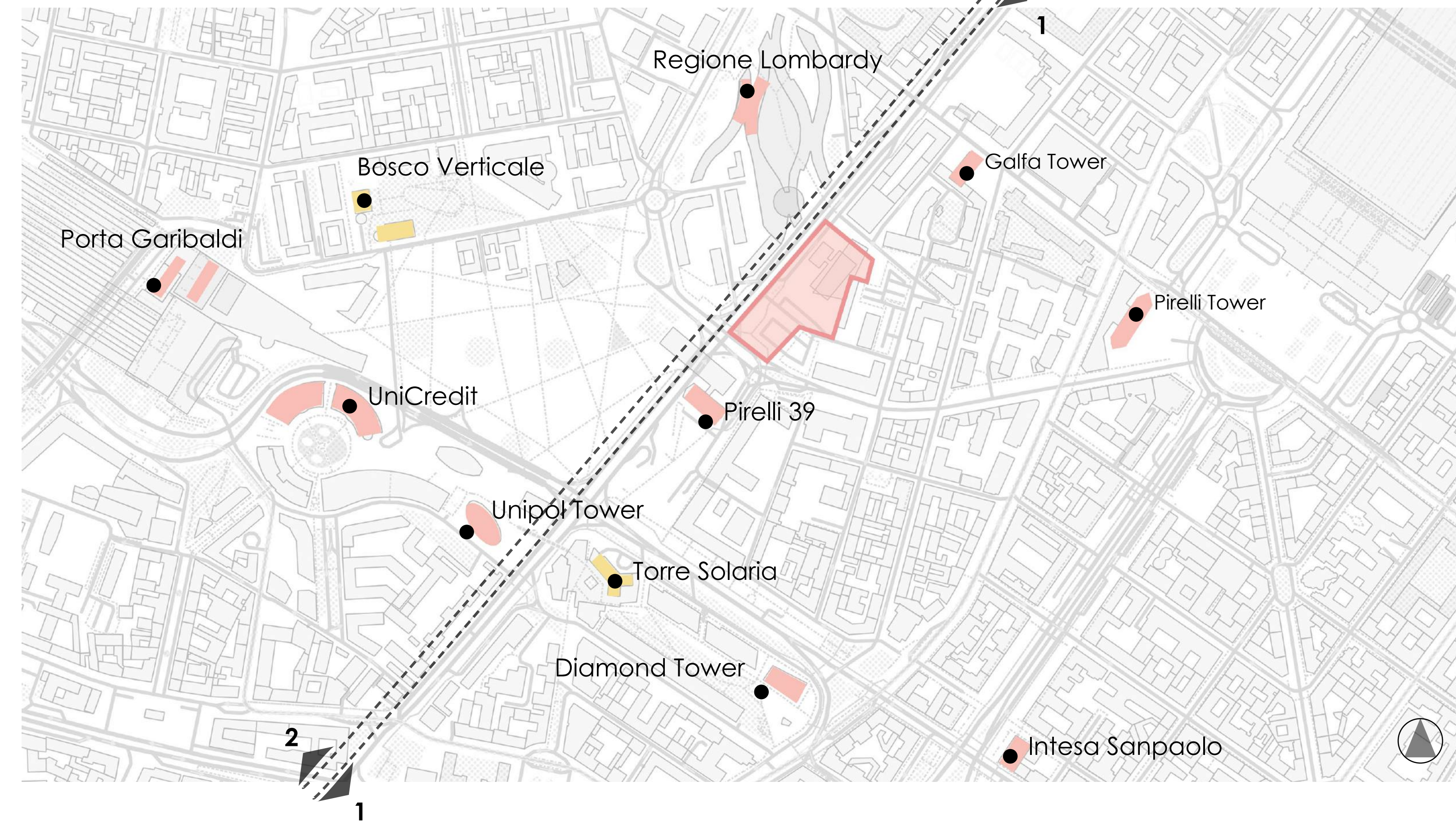


- FUNCTION**
- Residential
  - Commercial
  - Open space

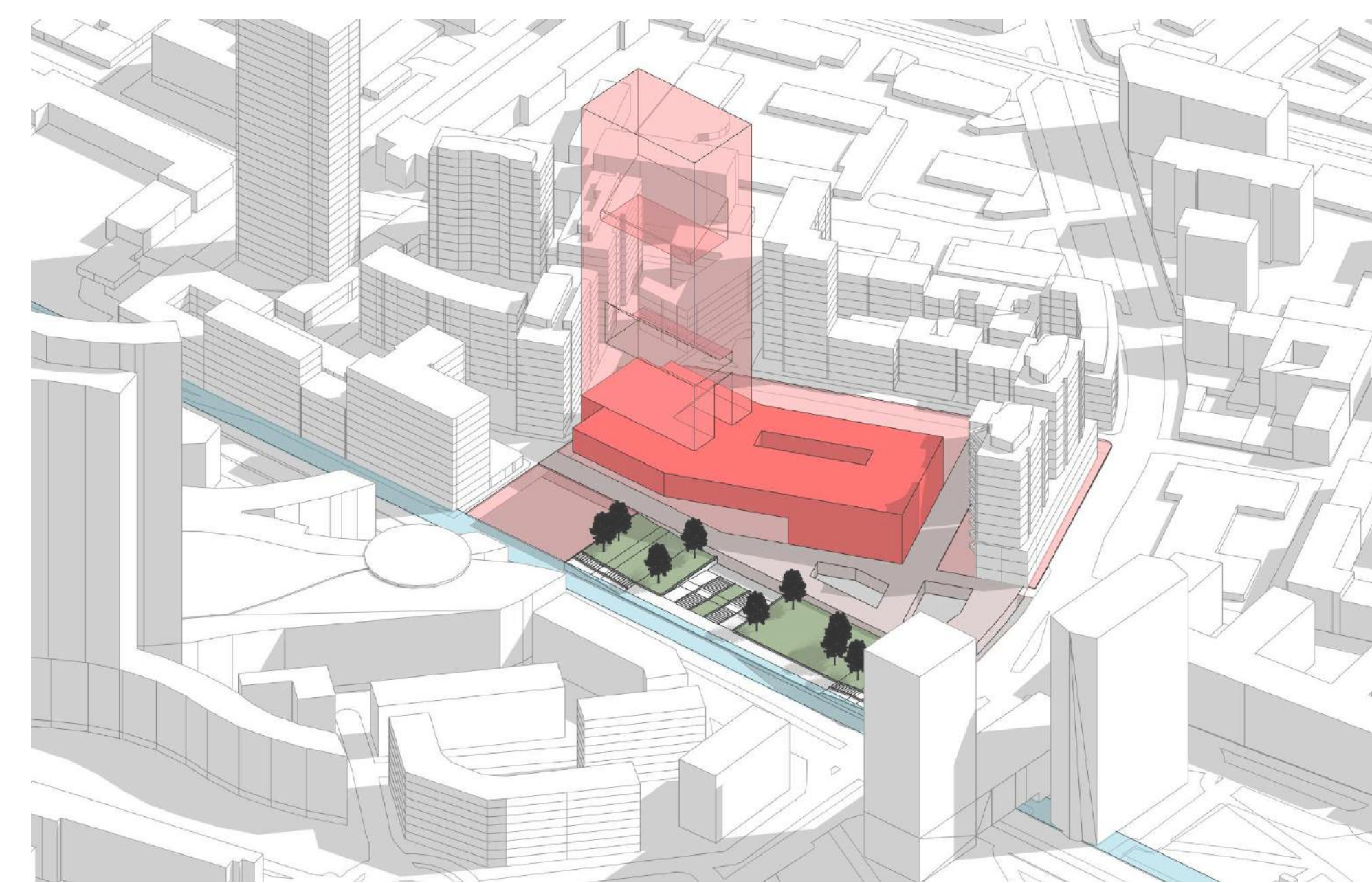
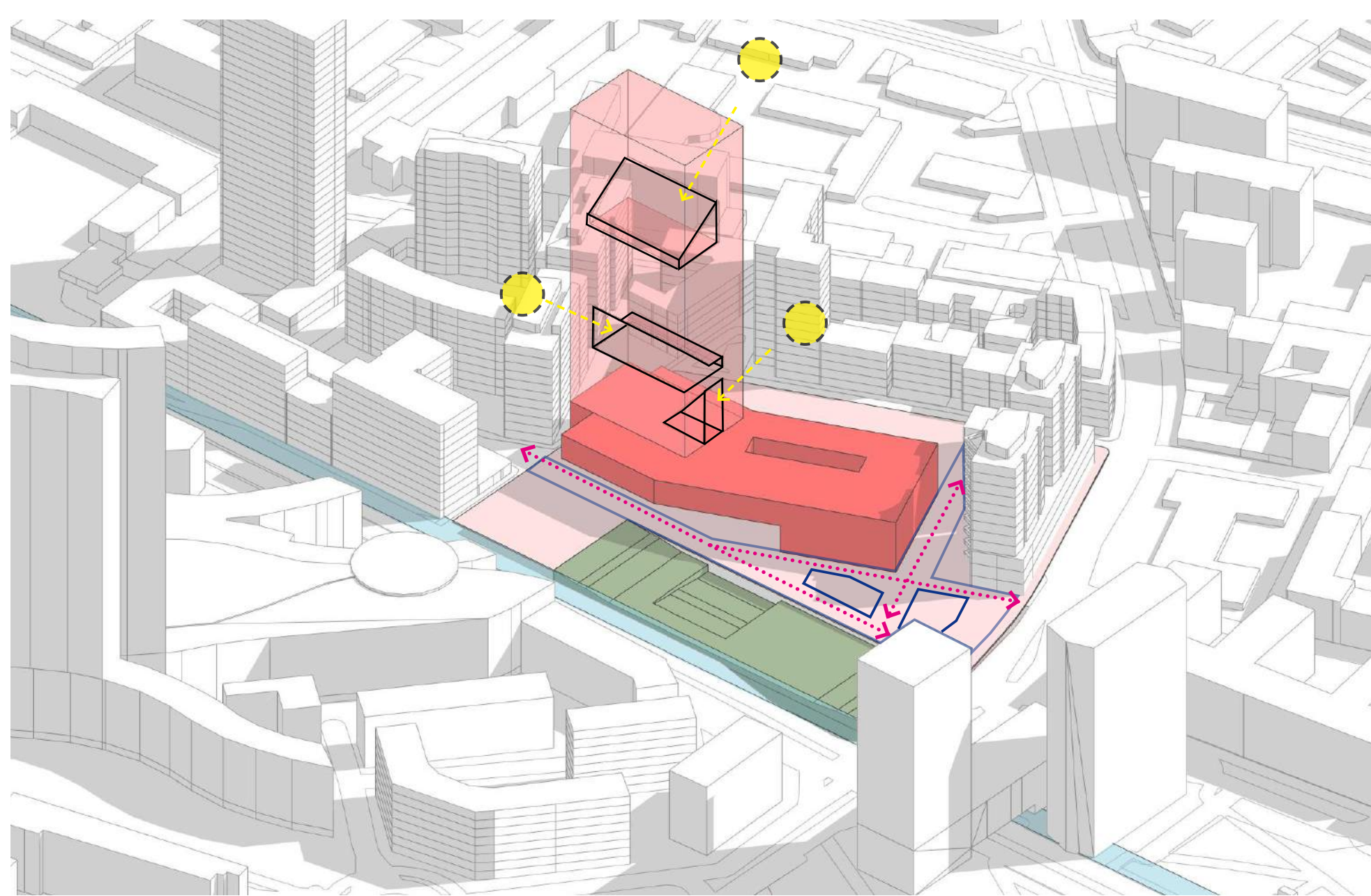
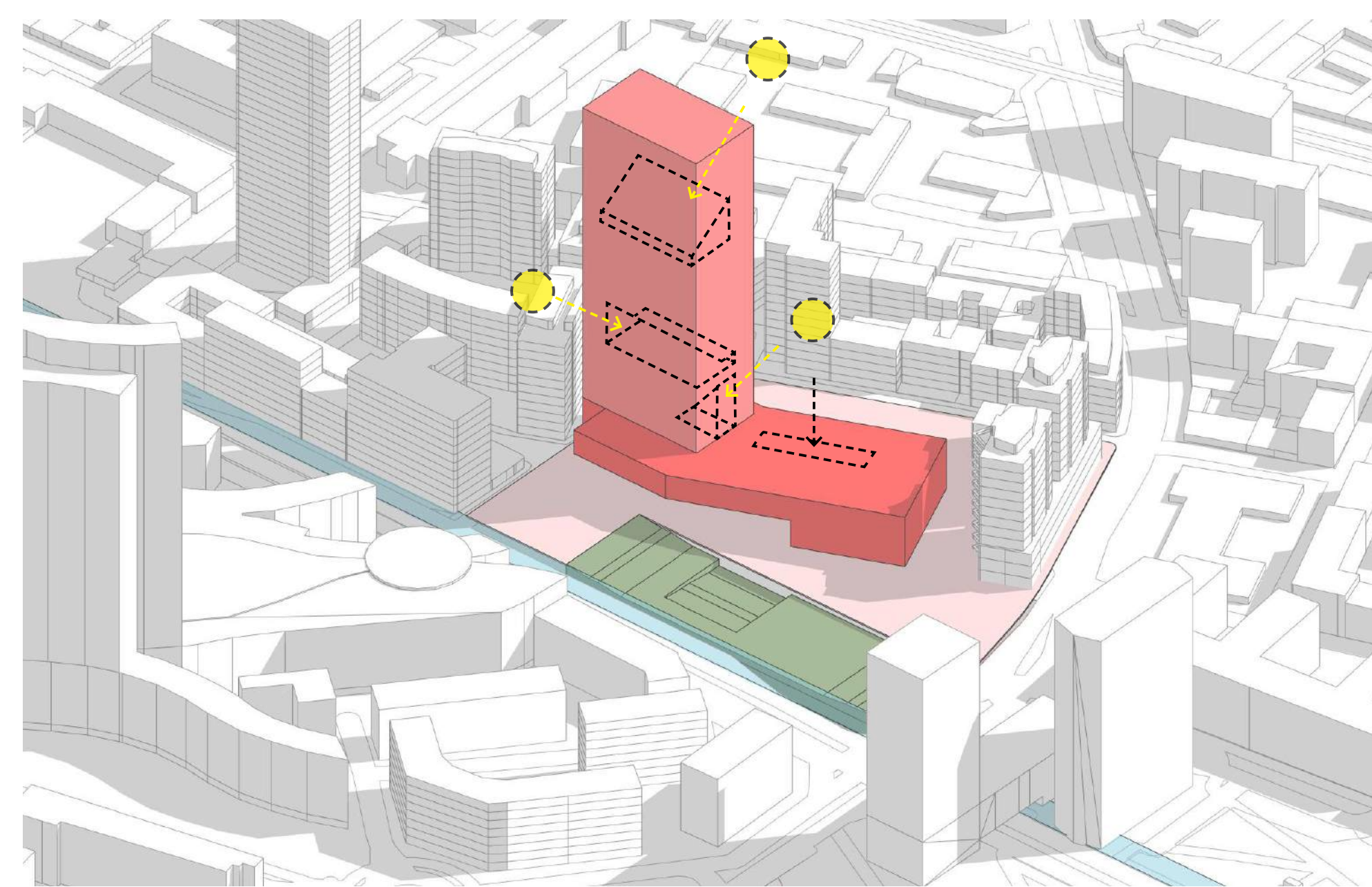
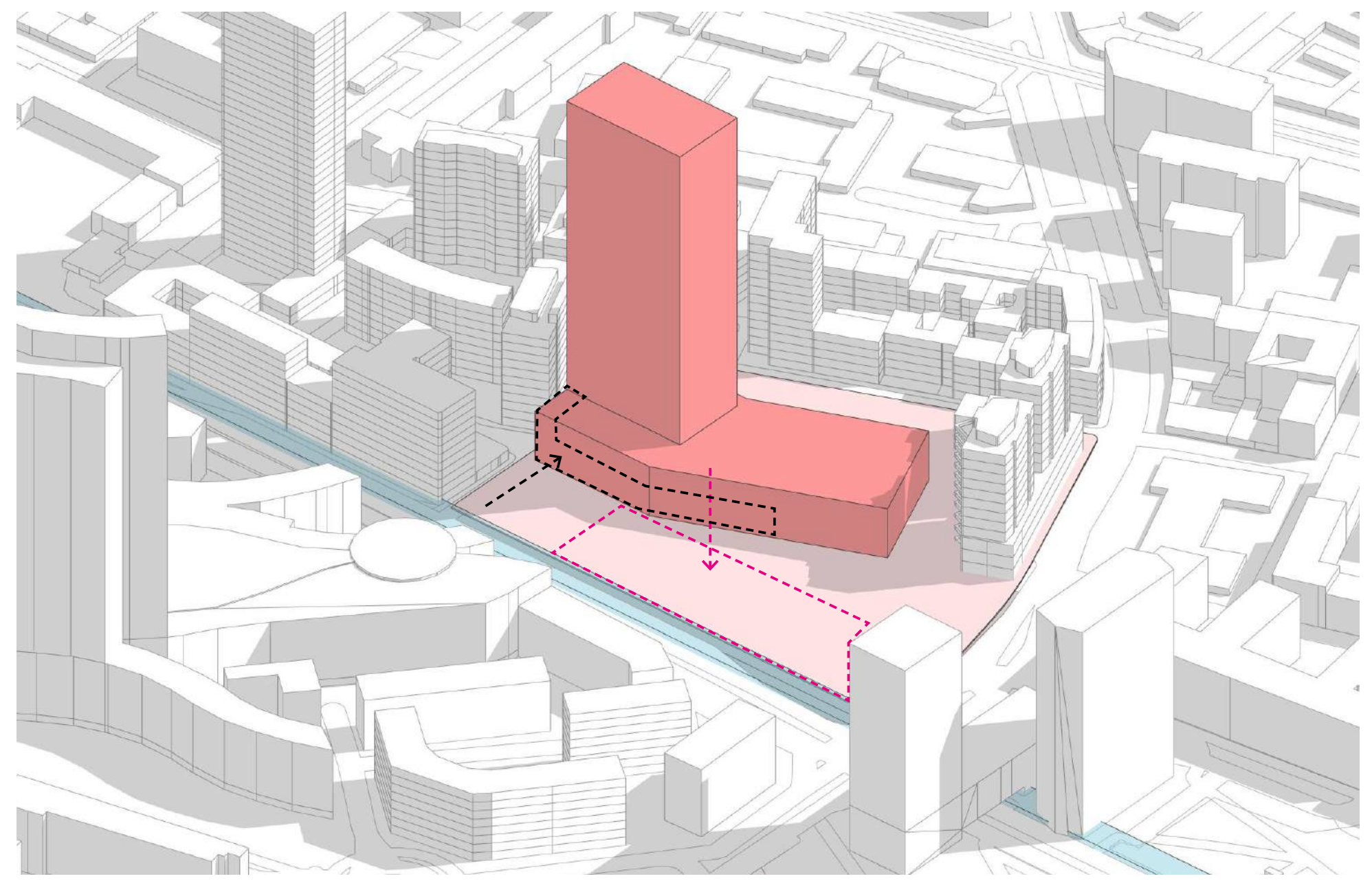
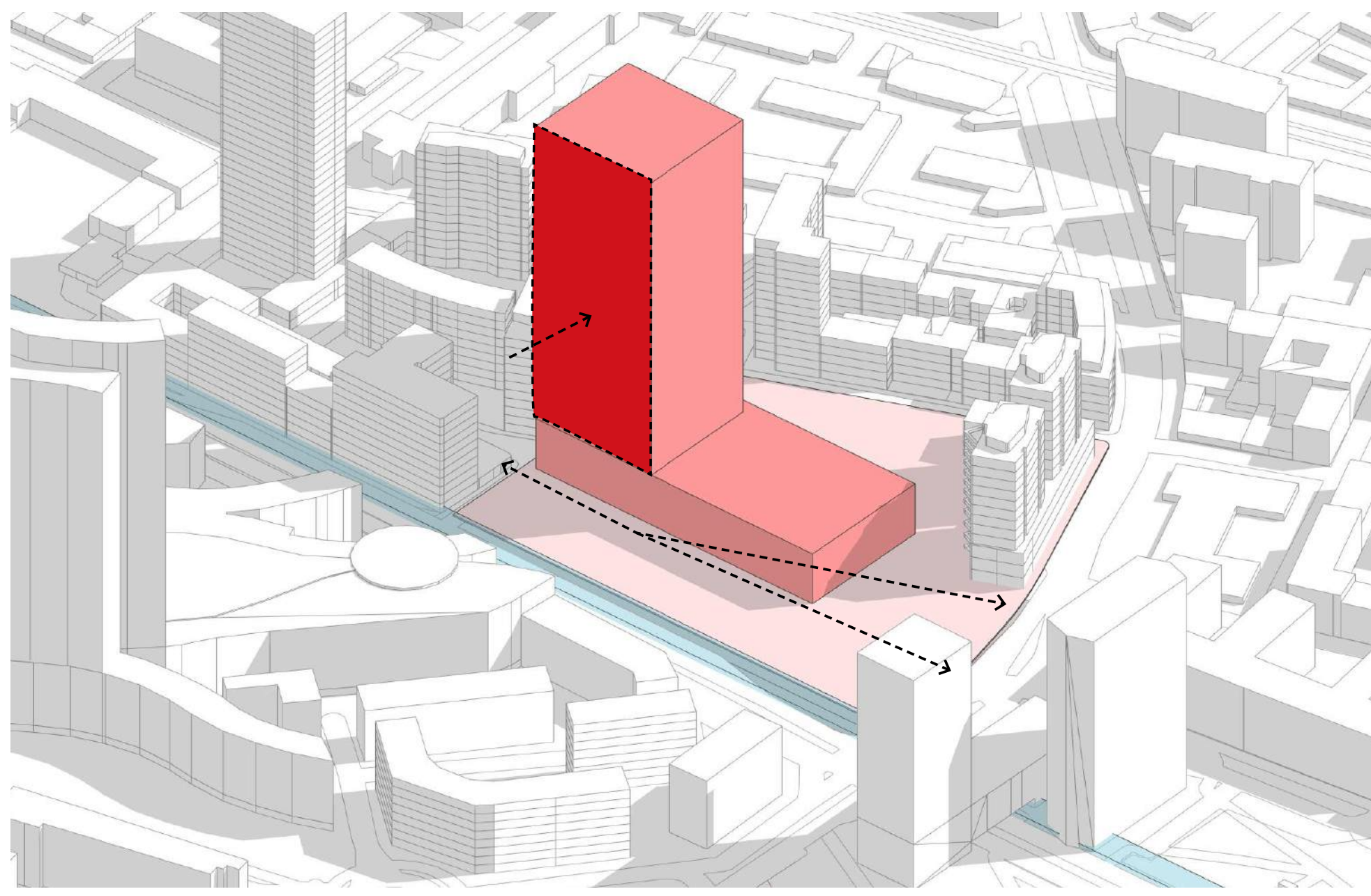
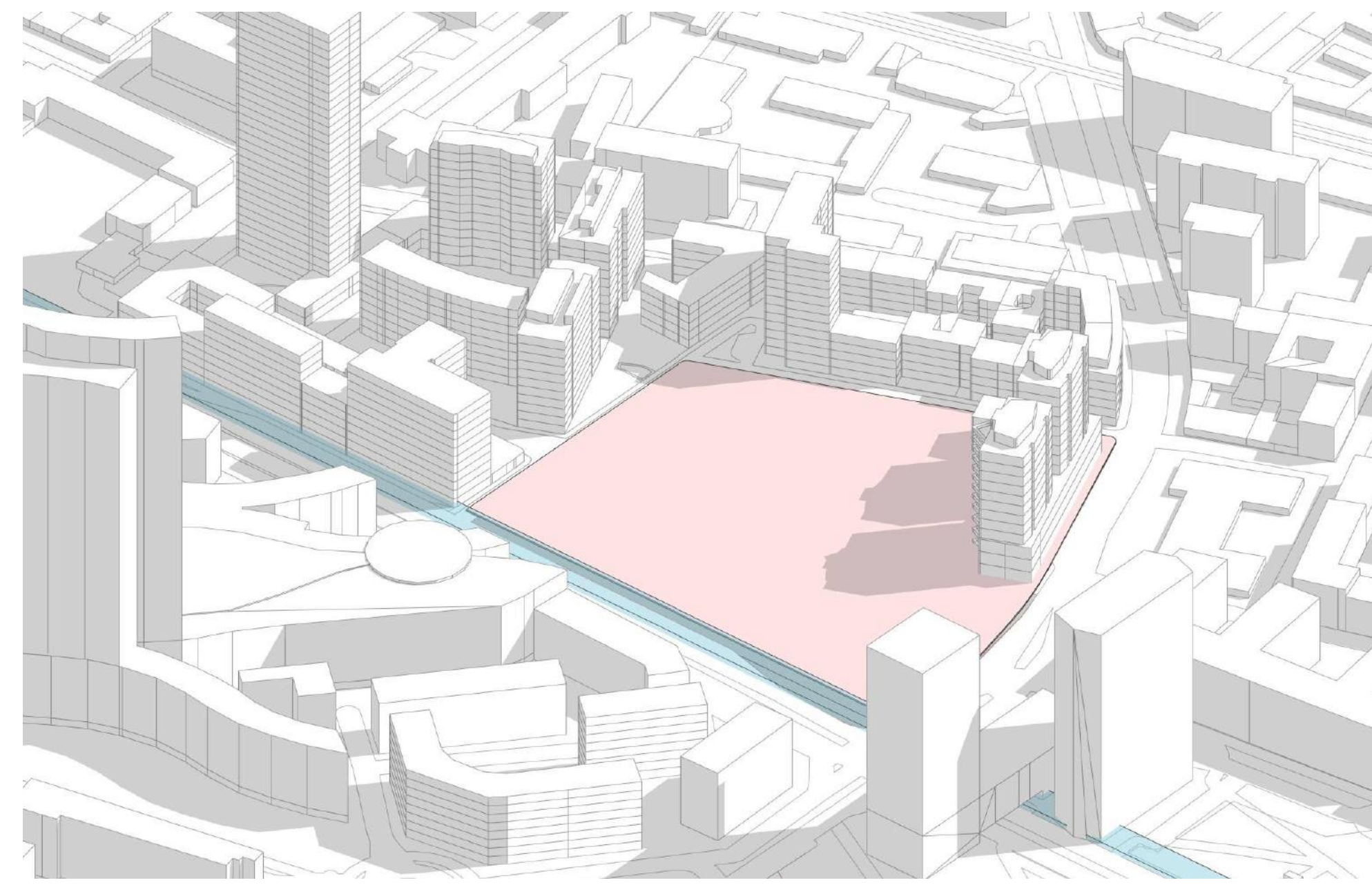


- URBAN FABRIC**

**HIGH RISE NEARBY**



**CONCEPTUAL MASSING**





MASTERPLAN 1:2000

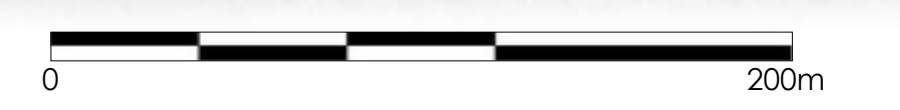


Palazzo Lombardia

Gioia 22

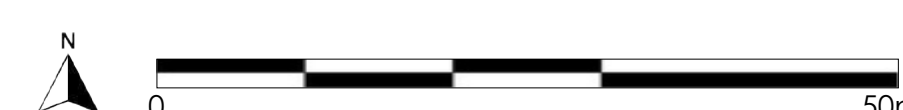
Pirelli Tower

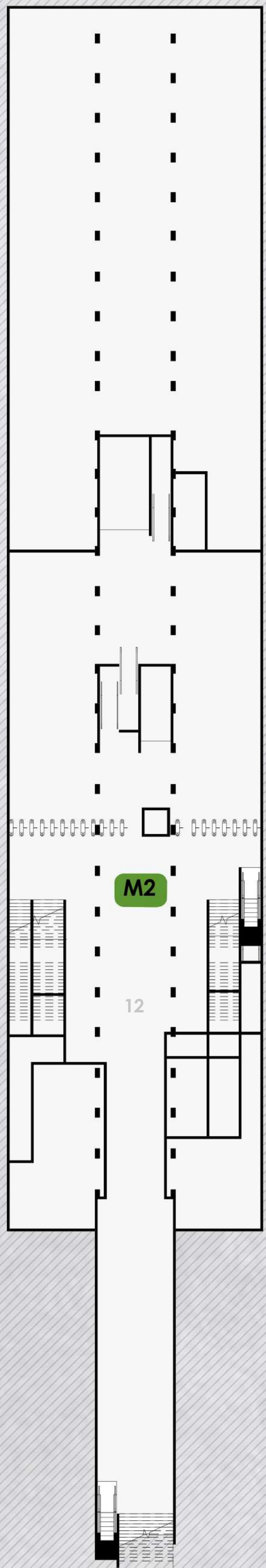
URBAN SECTION U-U 1:2000



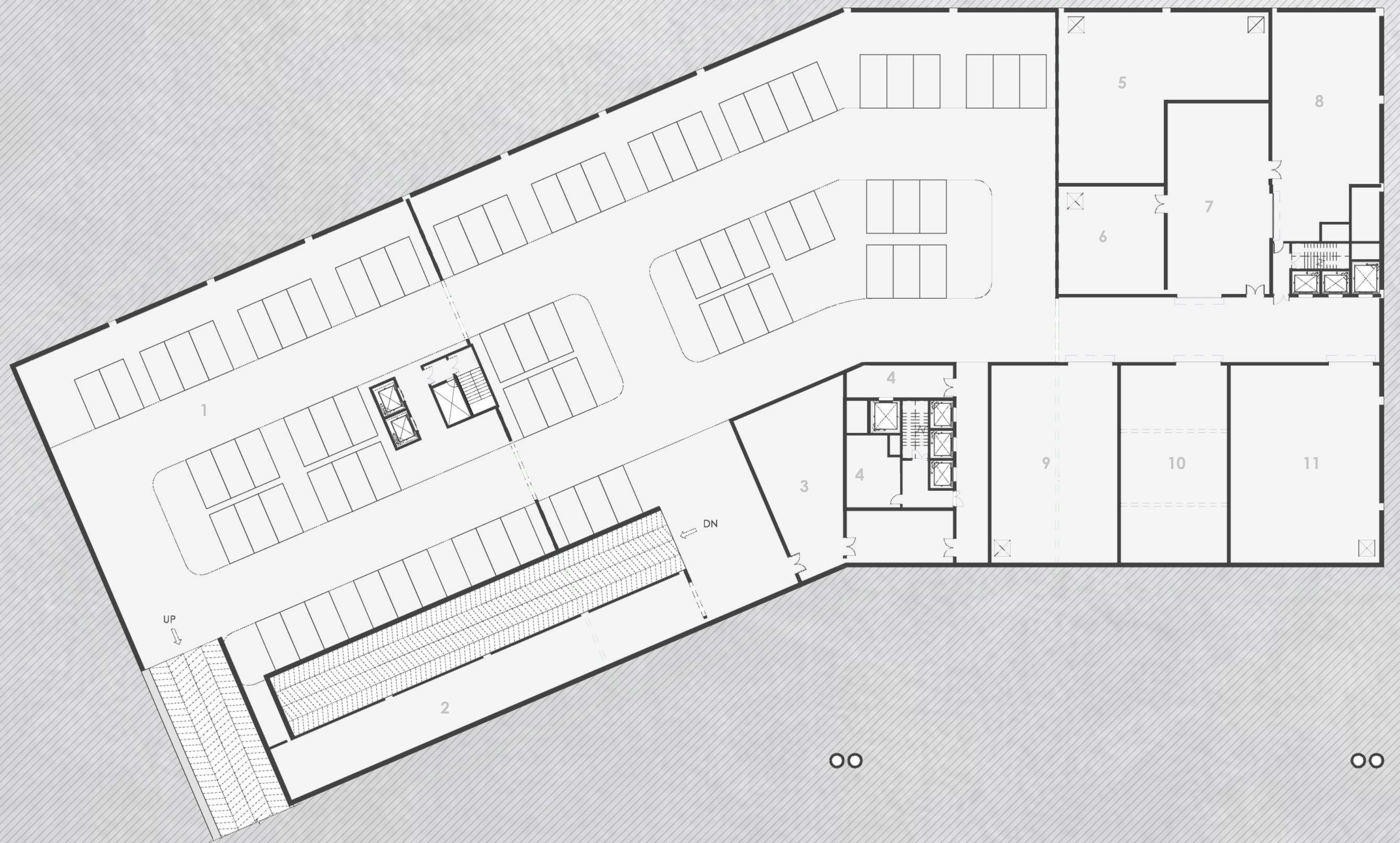


SITE PLAN 1:500

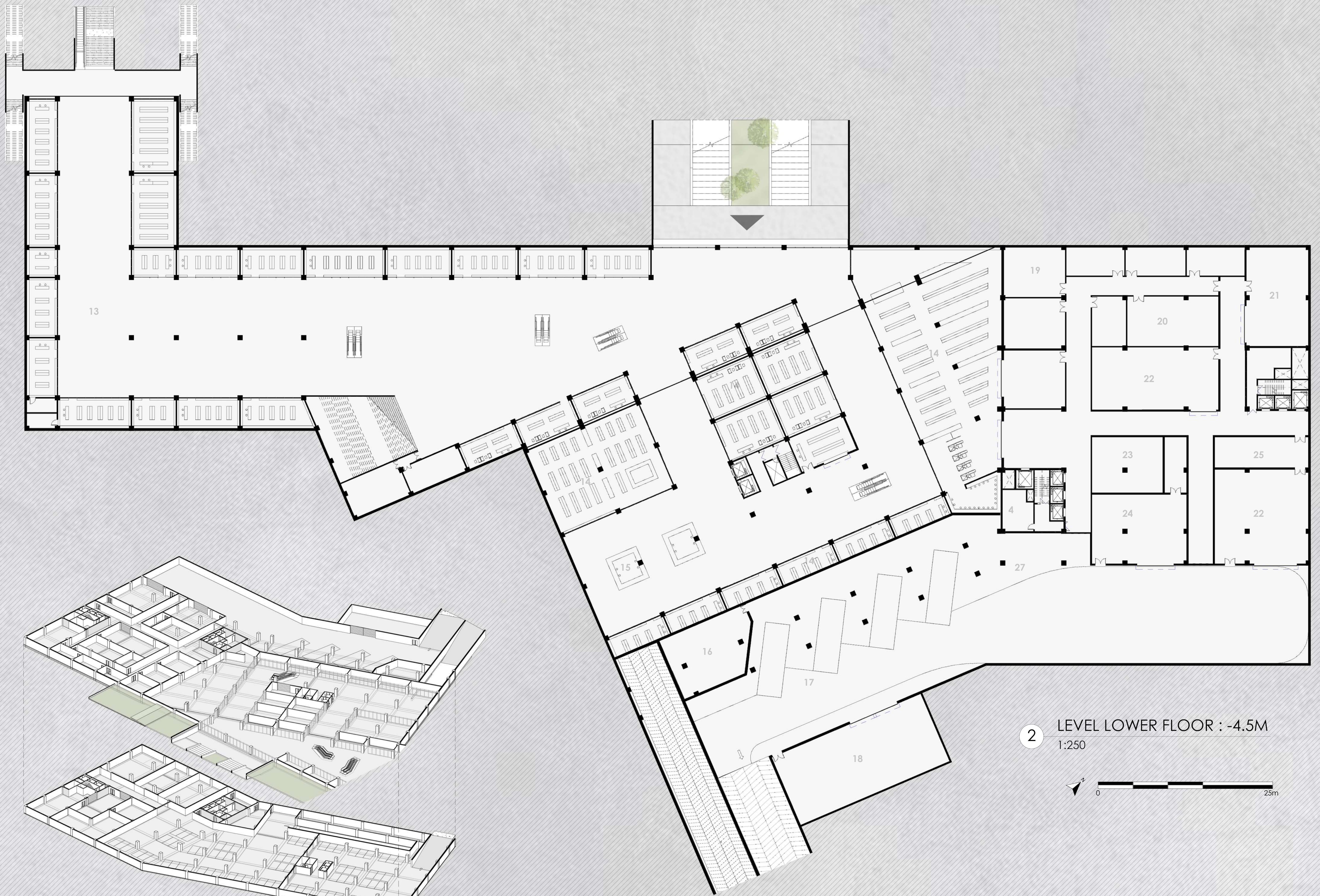




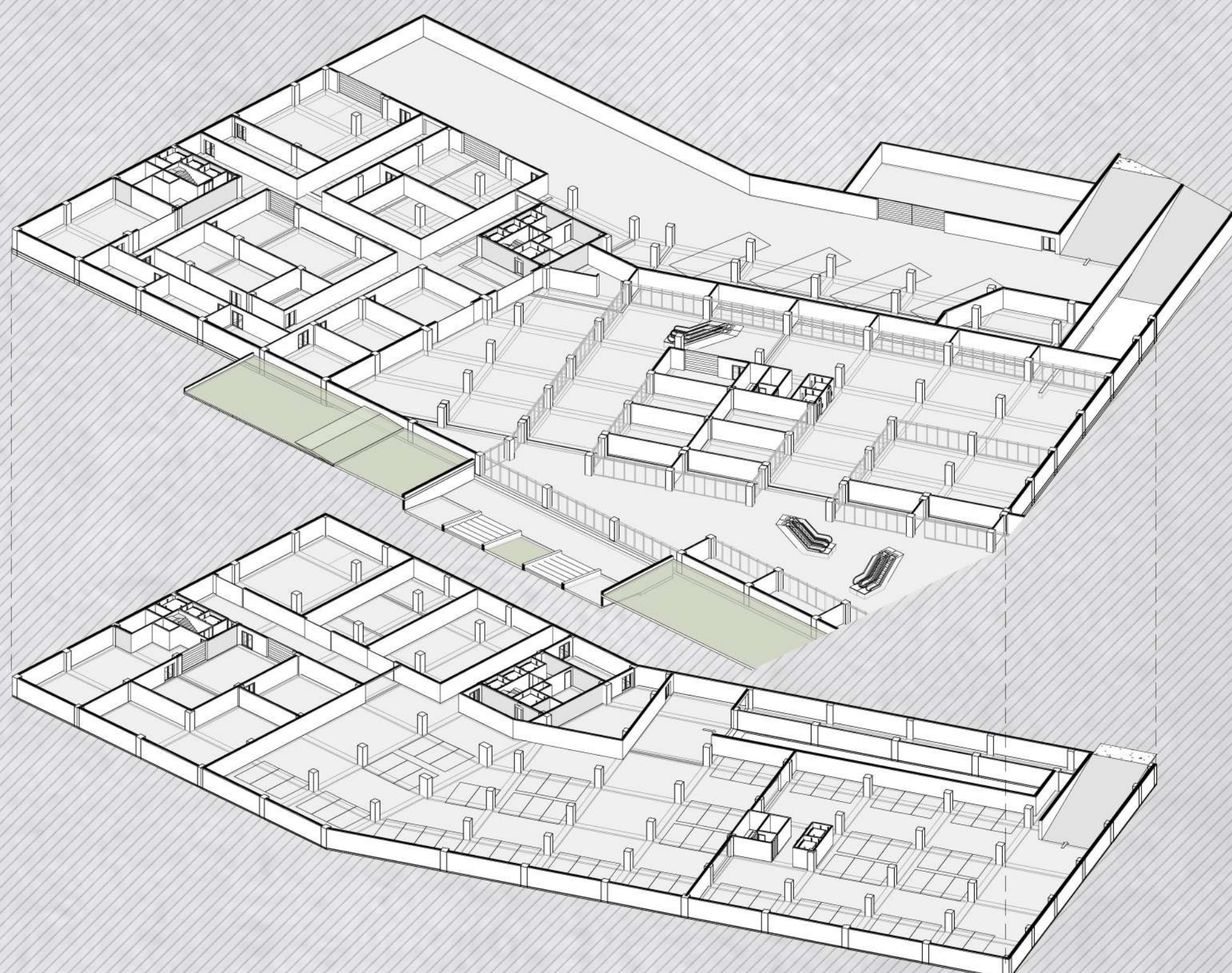
1. CAR PARKING
2. WORKSHOP AND STORAGE
3. WORKER LOCKER ROOM
4. SERVICE AND MAINTENANCE
5. MAIN WATER TANK AND MAINTENANCE
6. FIRE TANK AND MAINTENANCE
7. MAIN FIRE PUMP ROOM
8. MAIN PUMP ROOM
9. GREY WATER TANK AND MAINTENANCE
10. WASTE WATER TREATMENT PLANT
11. BLACK WATER TANK
12. GIOIA METRO STATION
13. METRO CONNECTION
14. RETAILS
15. BAR
16. PODIUM ELECTRICAL ROOM
17. TRUCK PARKING
18. MAIN ELECTRICAL ROOM
19. STORAGE
20. SECURITY AND SURVEILLANCE
21. EQUIPMENT ROOM AND MAINTENANCE
22. AIR HANDLER AND EQUIPMENT ROOM
23. HOT WATER TANK
24. REVERSIBLE GEOTHERMAL HEAT PUMP
25. HVAC CONTROL ROOM



1 LEVEL PARKING : -18M, -13.5M, -9M  
1:250

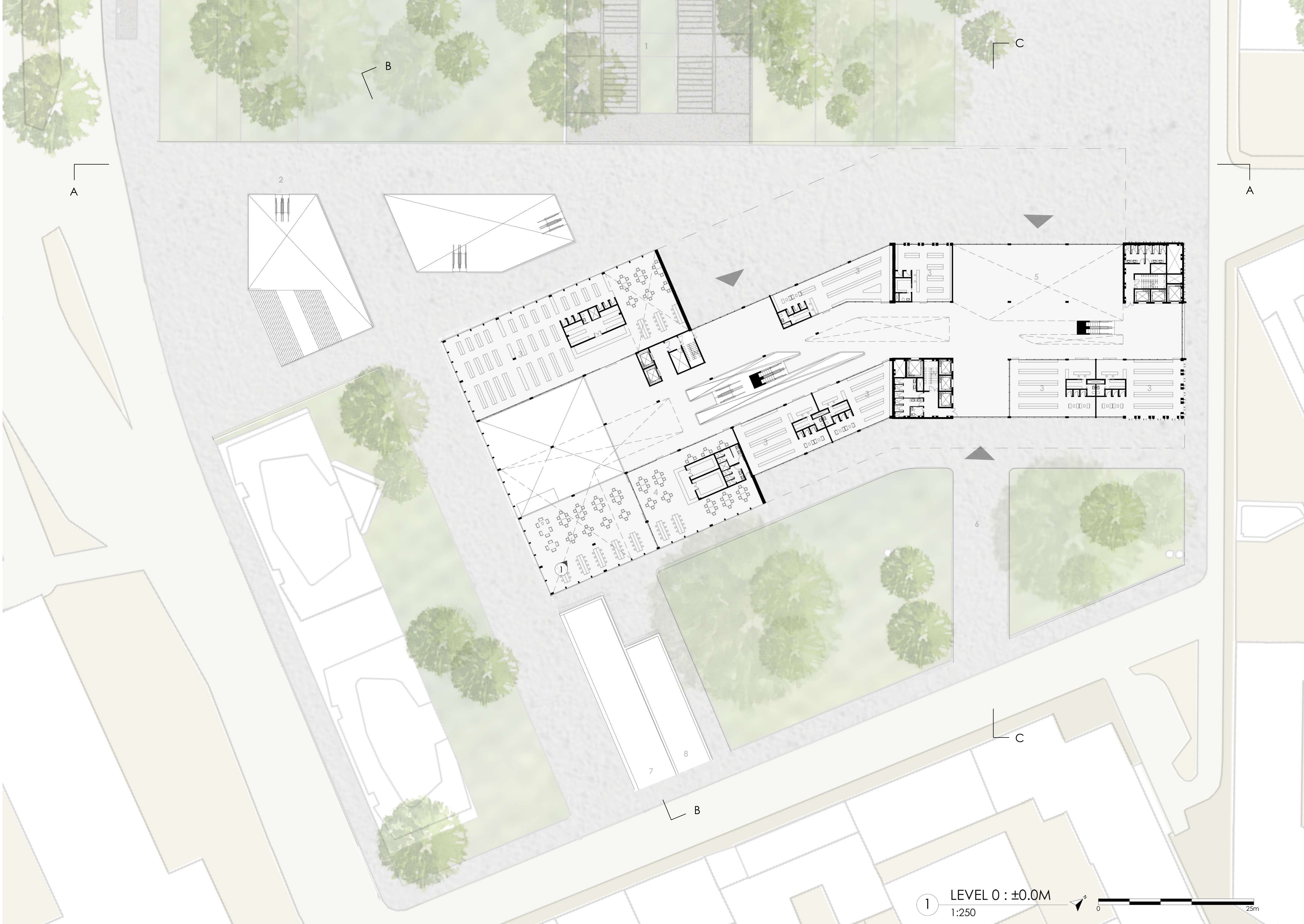


2 LEVEL LOWER FLOOR : -4.5M  
1:250

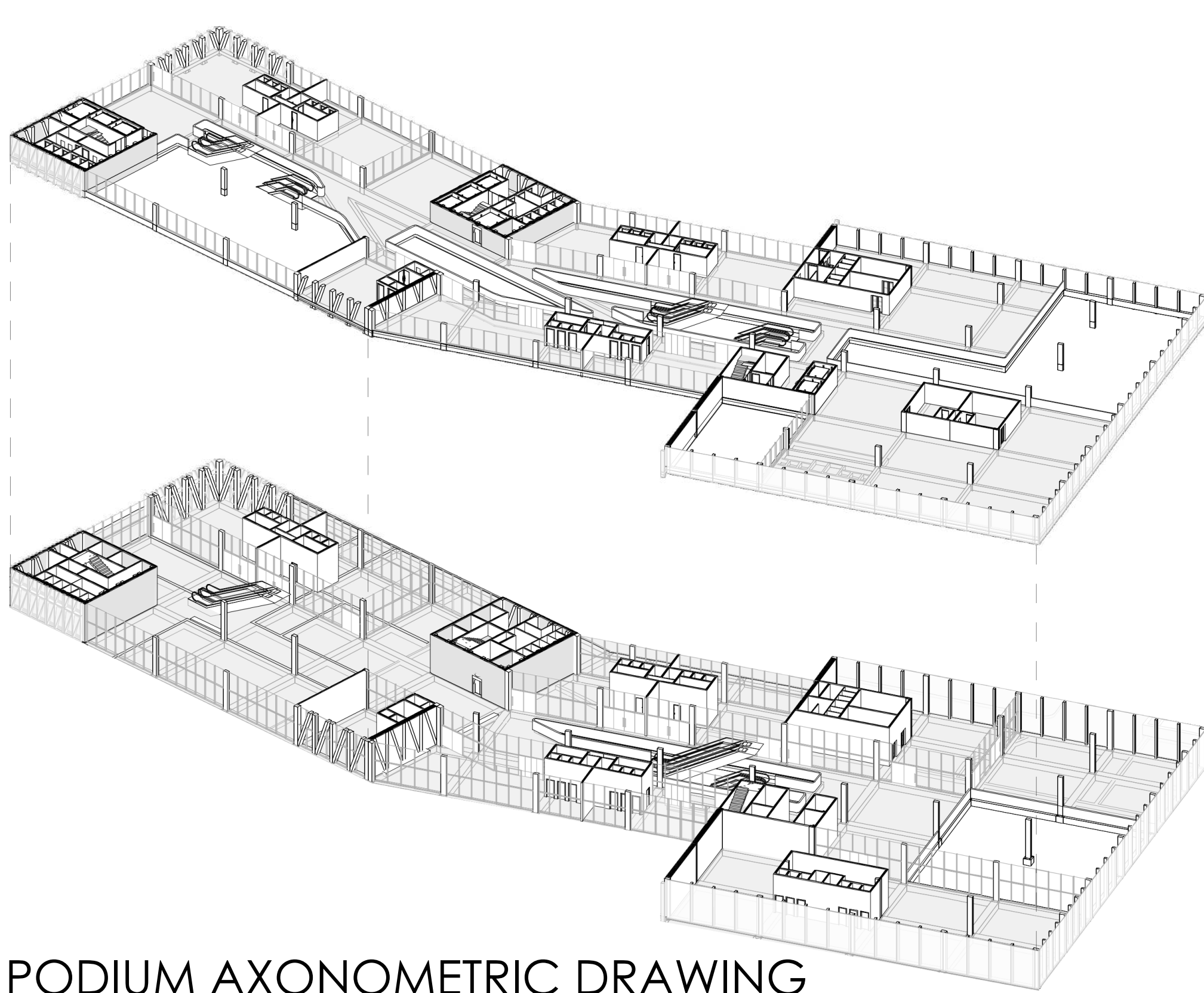


UNDERGROUND AXONOMETRIC DRAWING

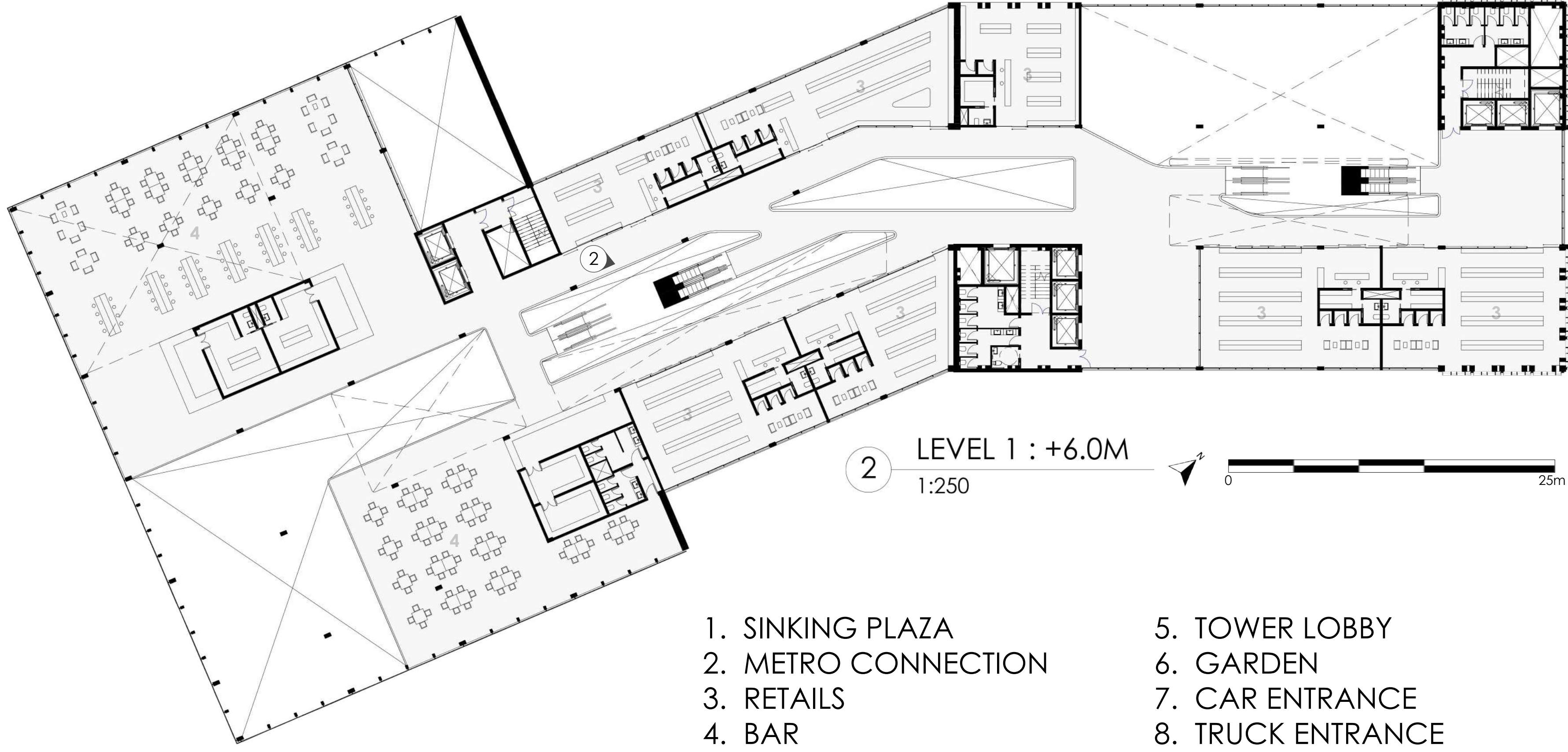




① LEVEL 0 : ±0.0M  
1:250



PODIUM AXONOMETRIC DRAWING

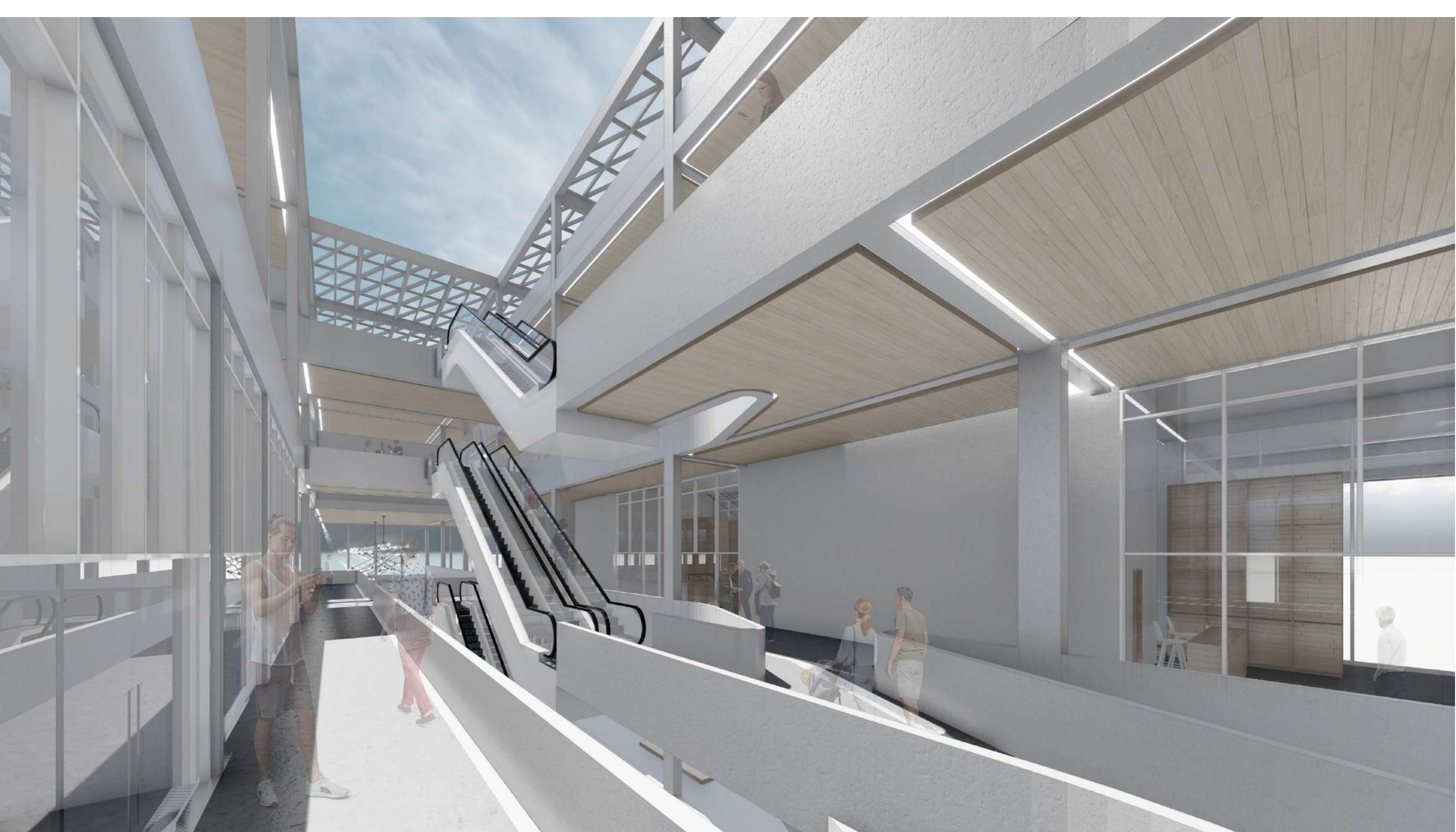


② LEVEL 1 : +6.0M  
1:250

- 1. SINKING PLAZA
- 2. METRO CONNECTION
- 3. RETAILS
- 4. BAR
- 5. TOWER LOBBY
- 6. GARDEN
- 7. CAR ENTRANCE
- 8. TRUCK ENTRANCE

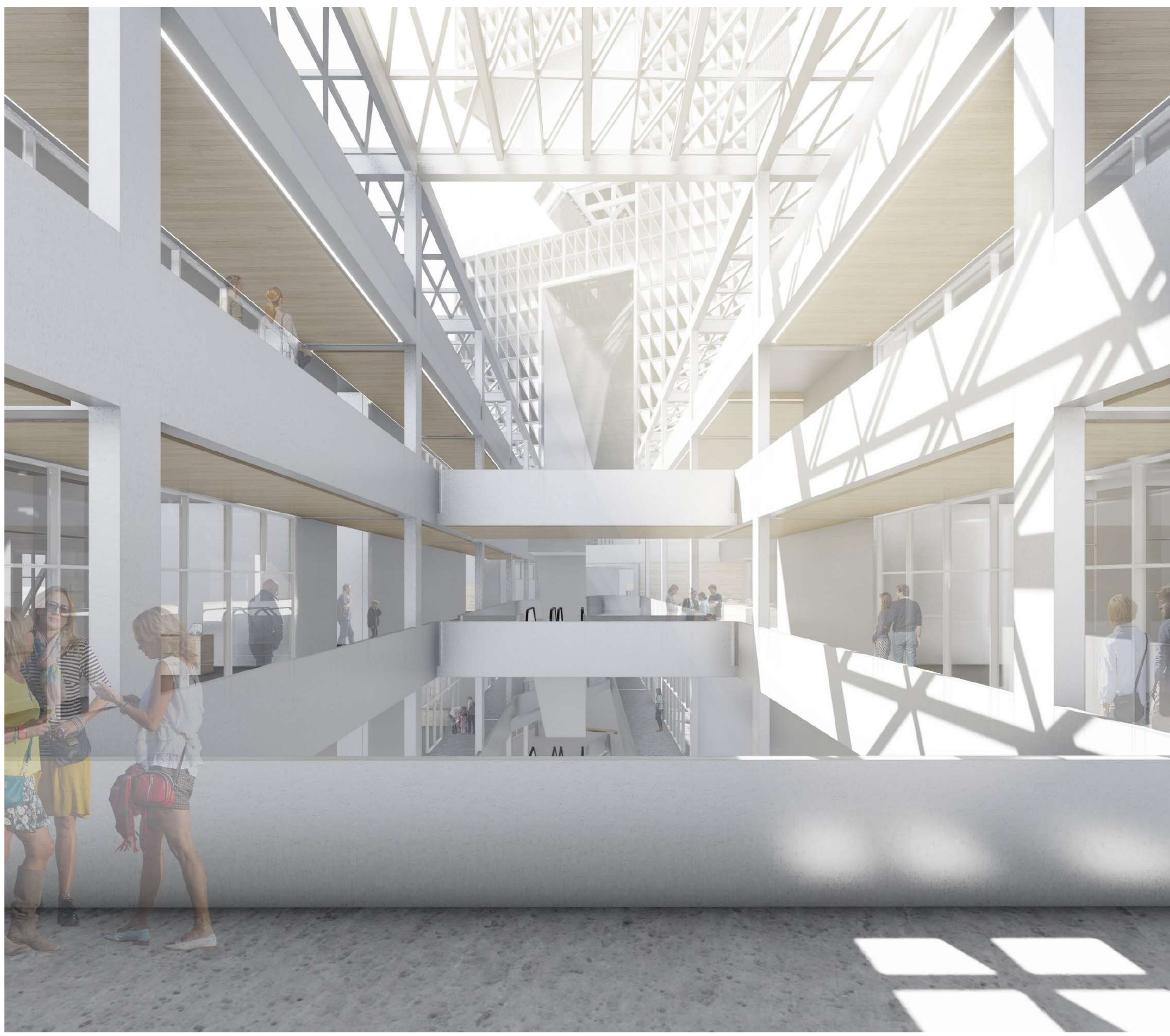


PODIUM VIEW 1



PODIUM VIEW 2





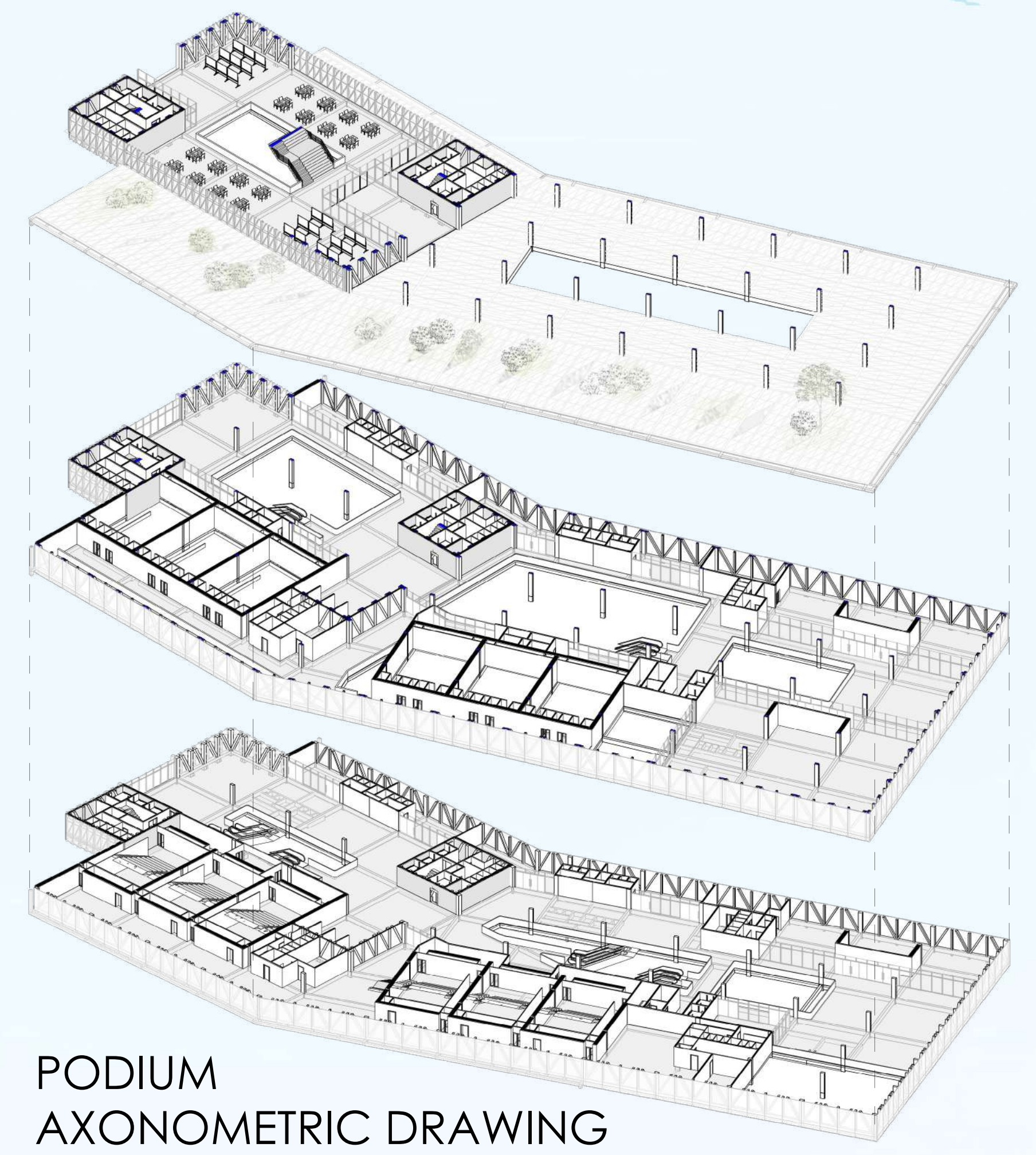
PODIUM VIEW 1



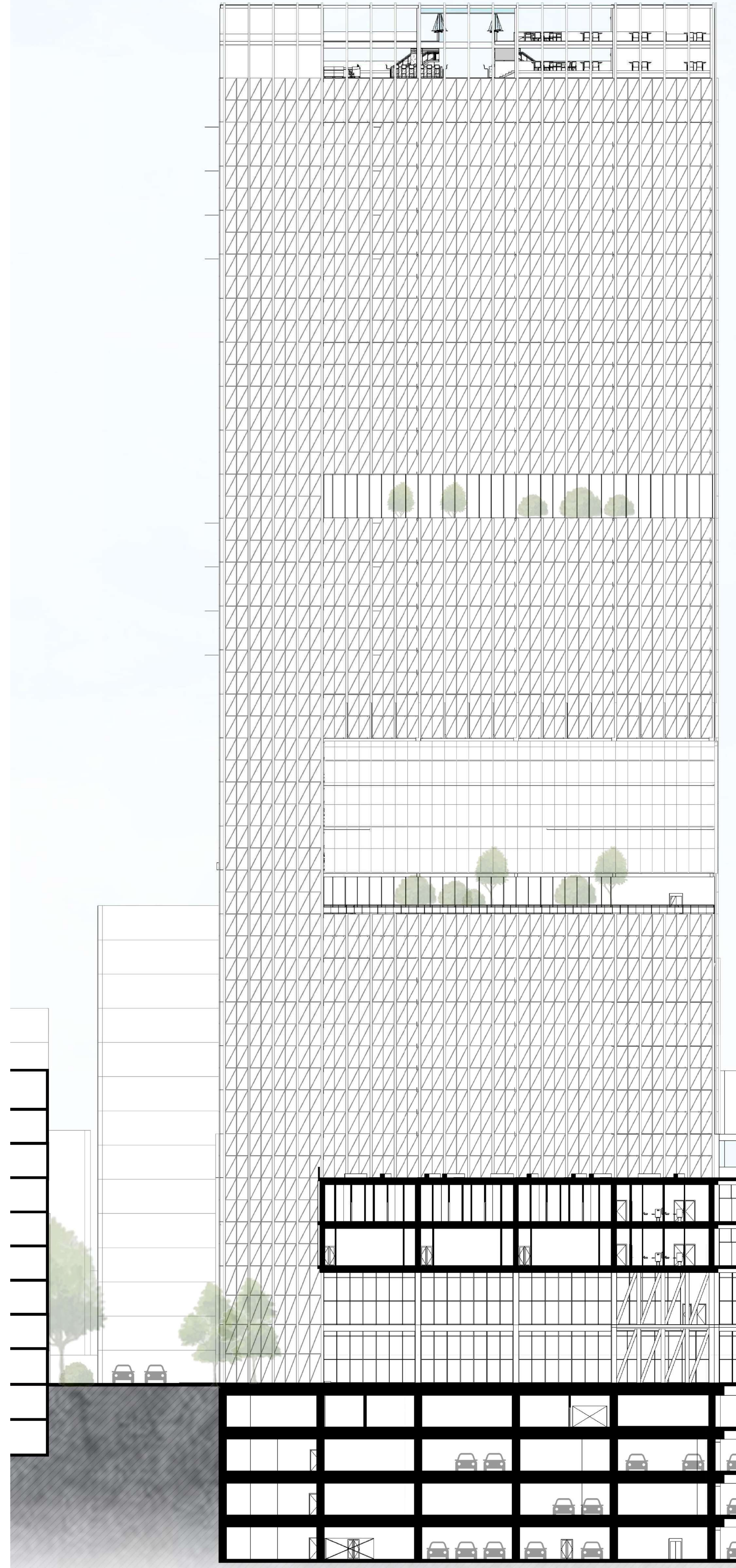
PODIUM VIEW 2

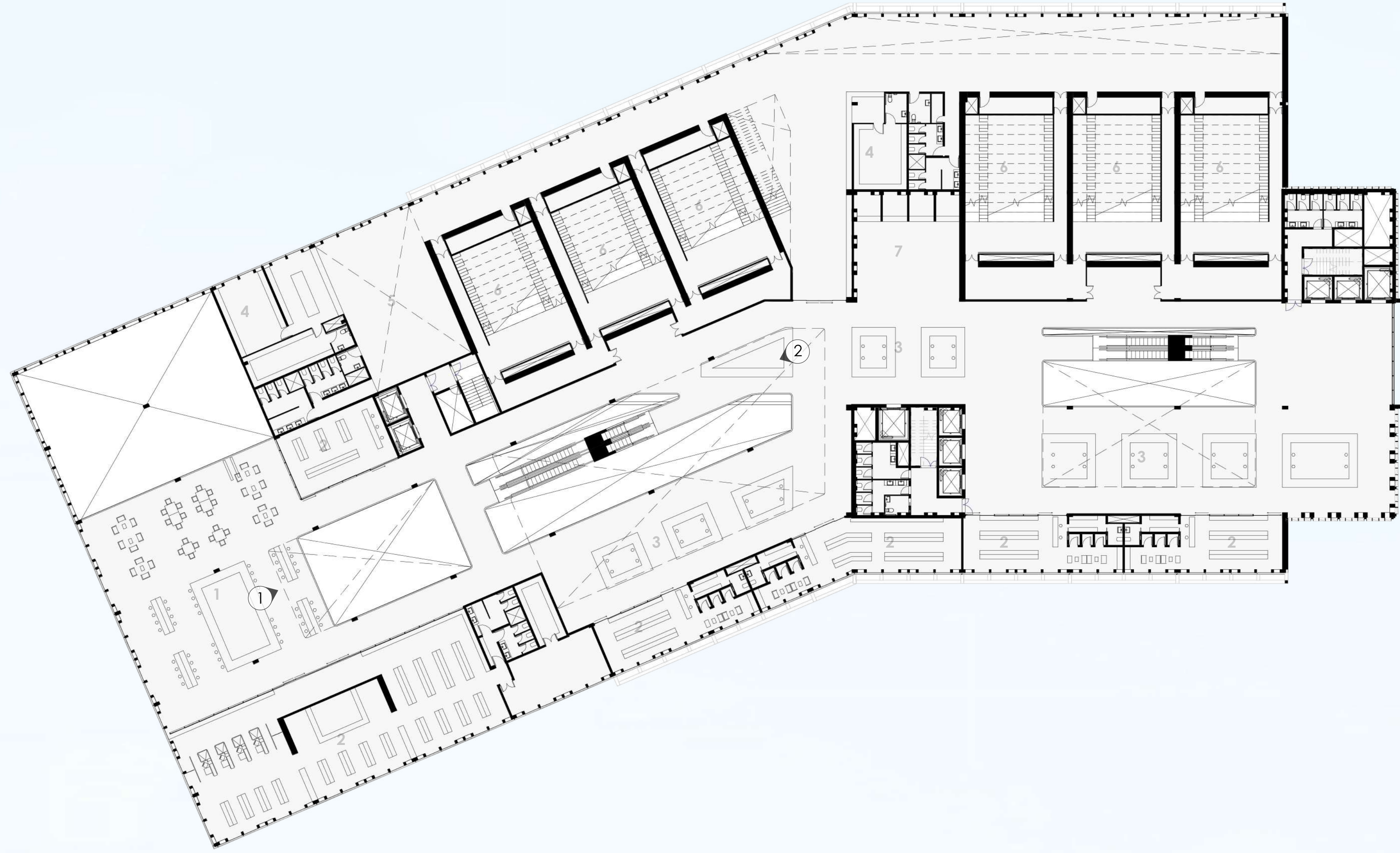


PODIUM VIEW 3

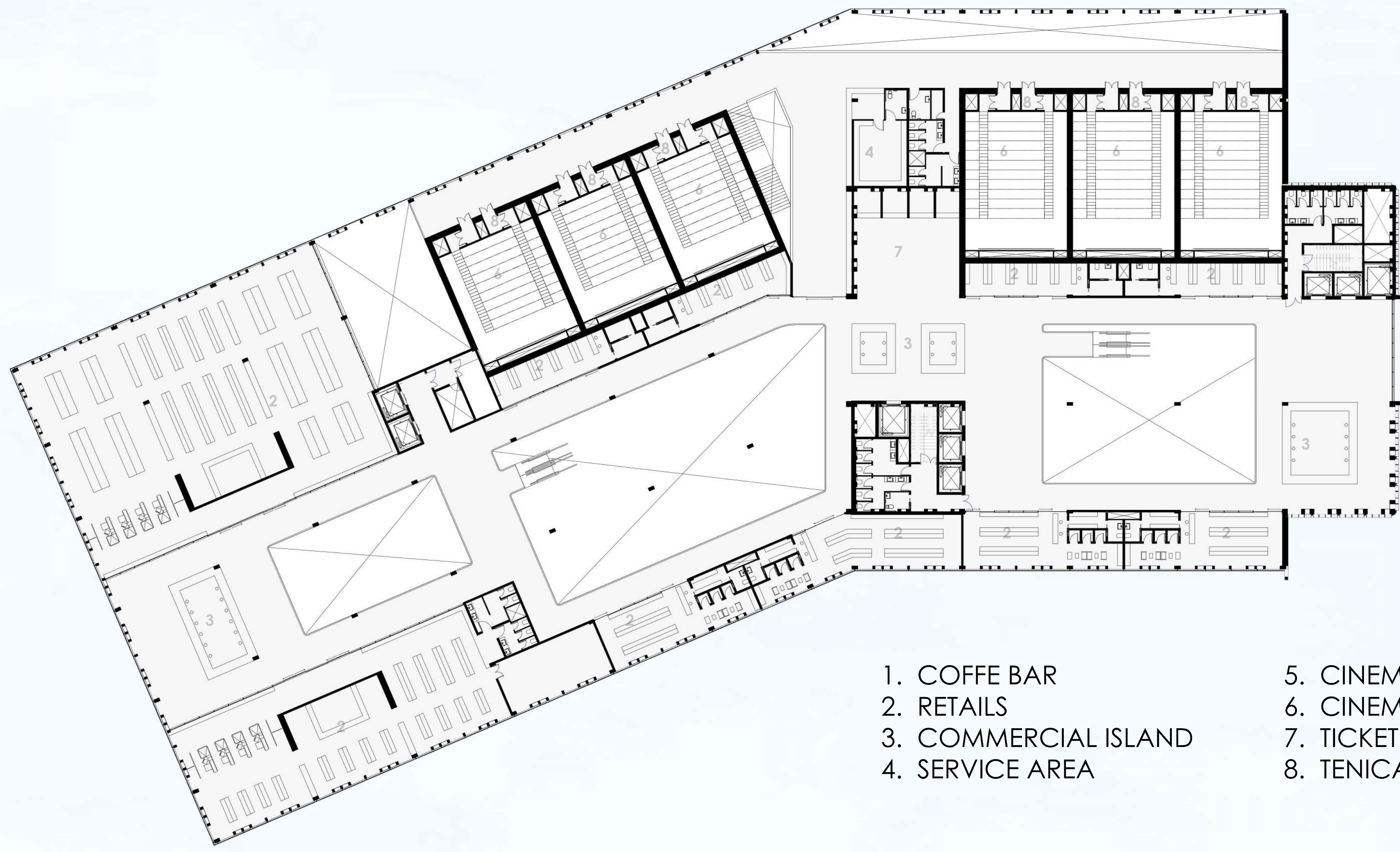


PODIUM  
AXONOMETRIC DRAWING



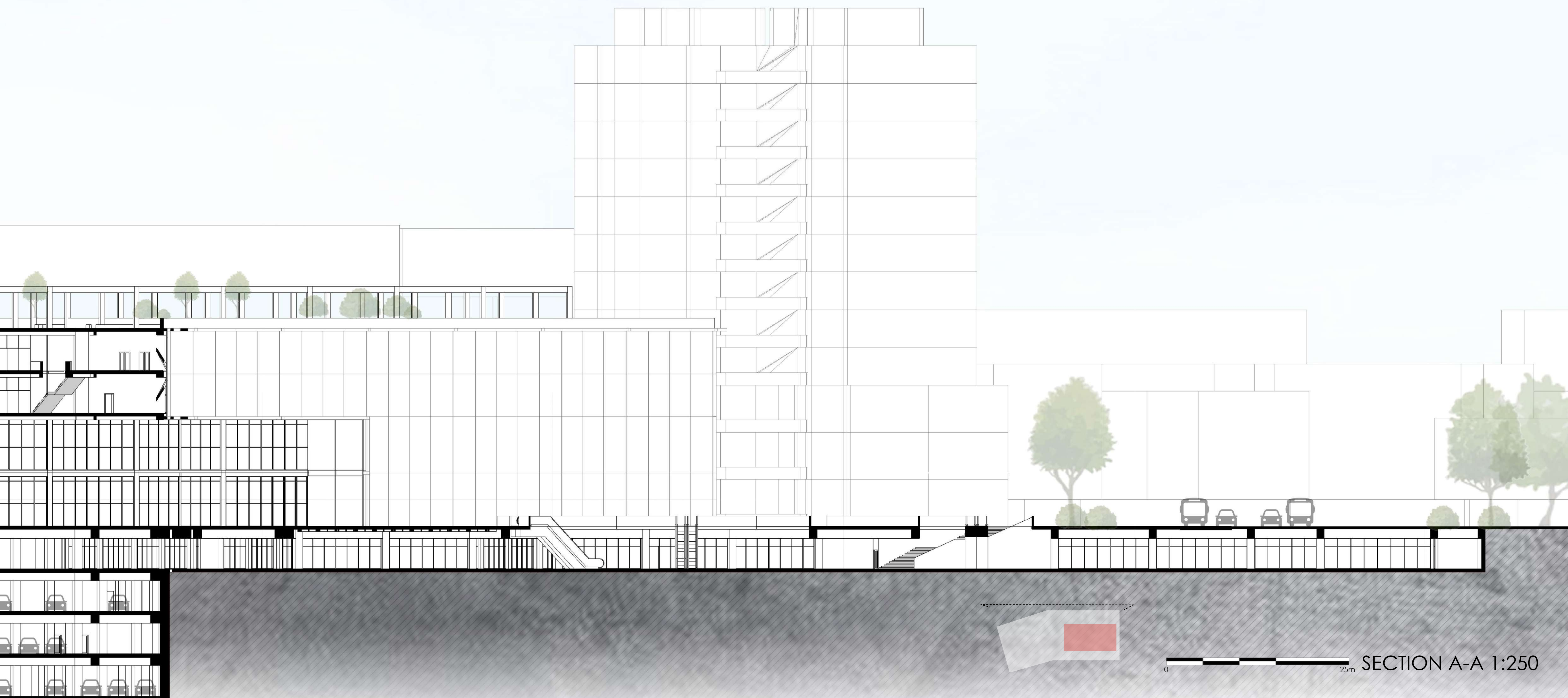


1 LEVEL 2 : +12M  
1:250

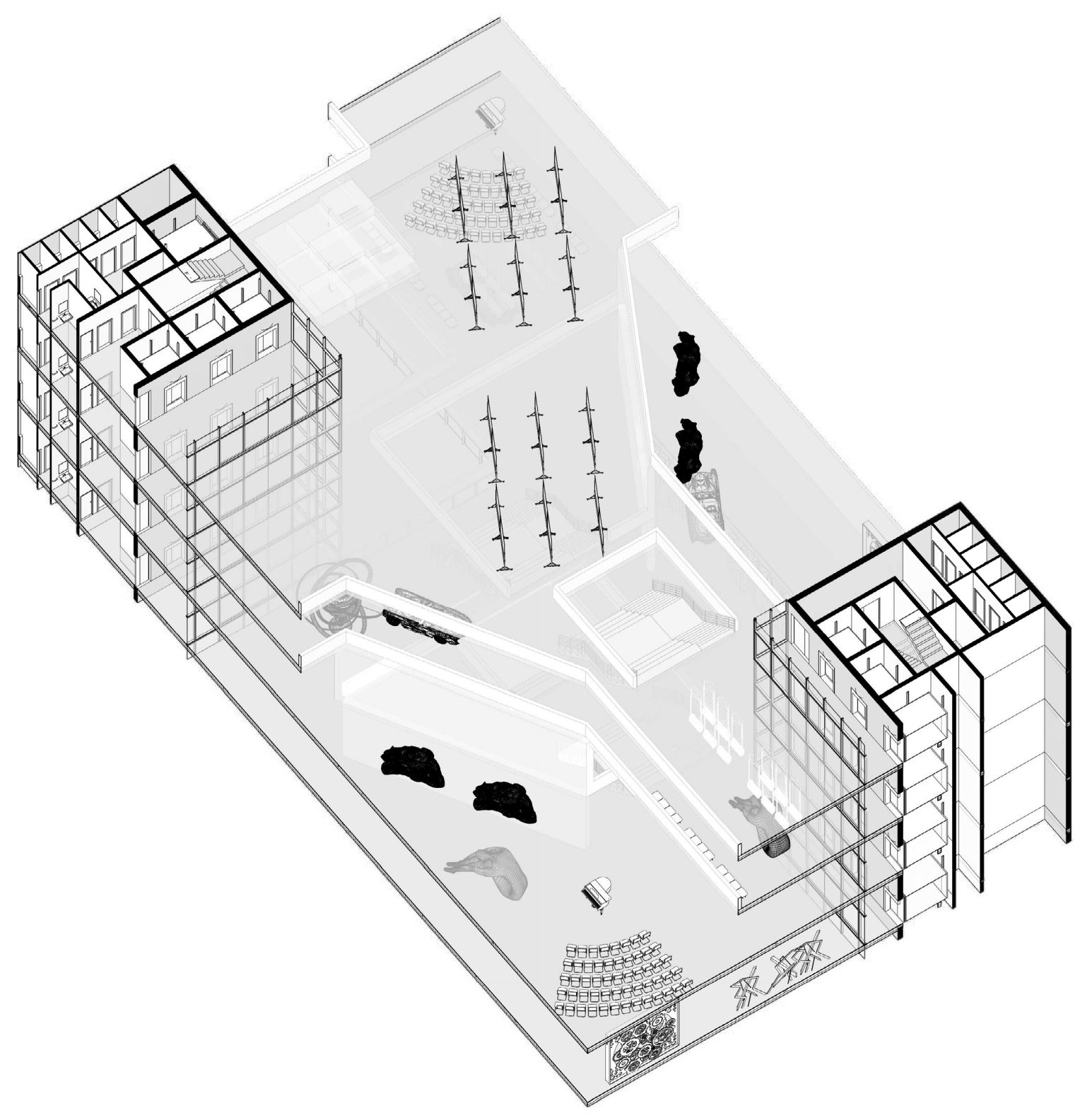


2 LEVEL 3 : +16.5M  
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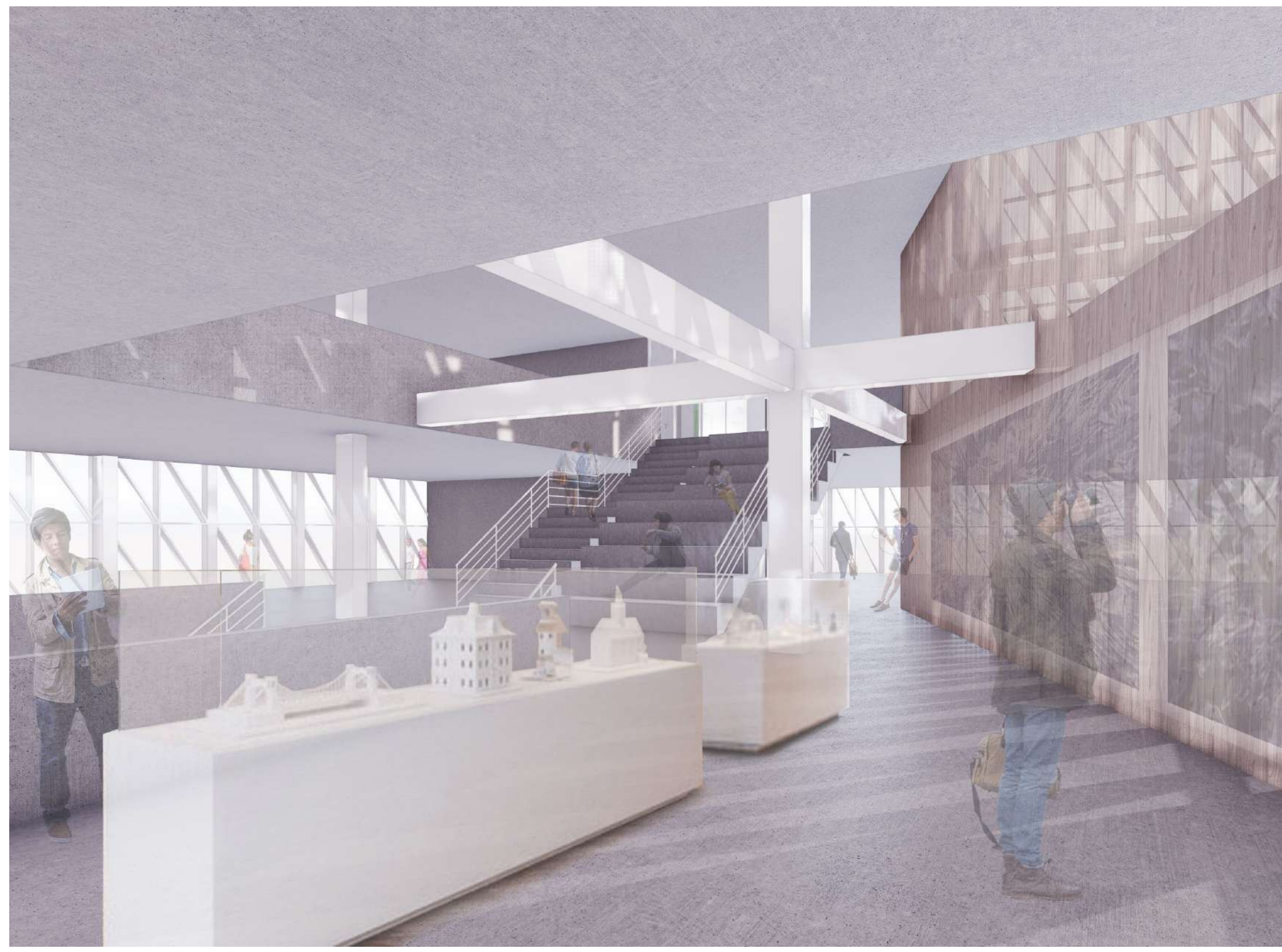
- 1. COFFE BAR
- 2. RETAILS
- 3. COMMERCIAL ISLAND
- 4. SERVICE AREA
- 5. CINEMA HALL
- 6. CINEMA
- 7. TICKET BOOTH
- 8. TENICAL ROOM



0 25m SECTION A-A 1:250



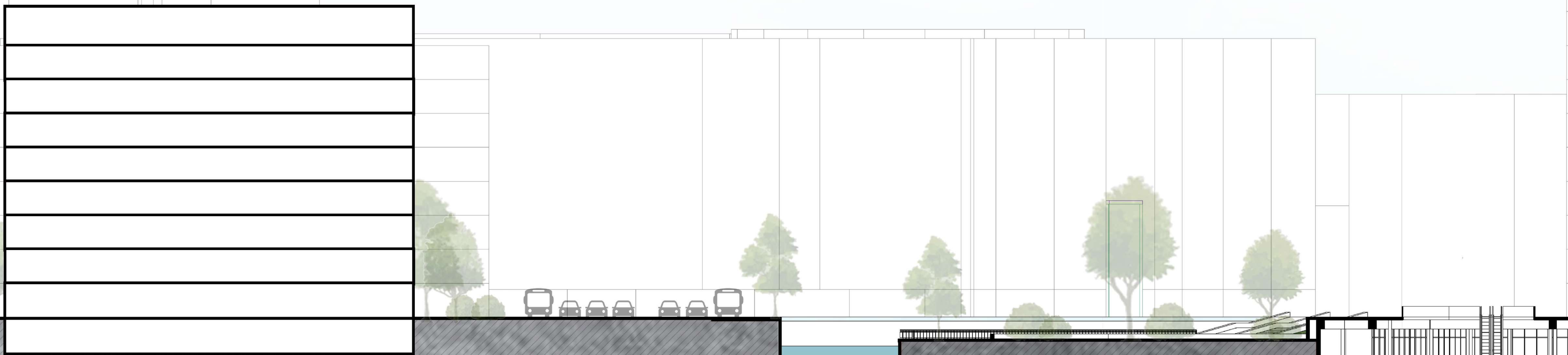
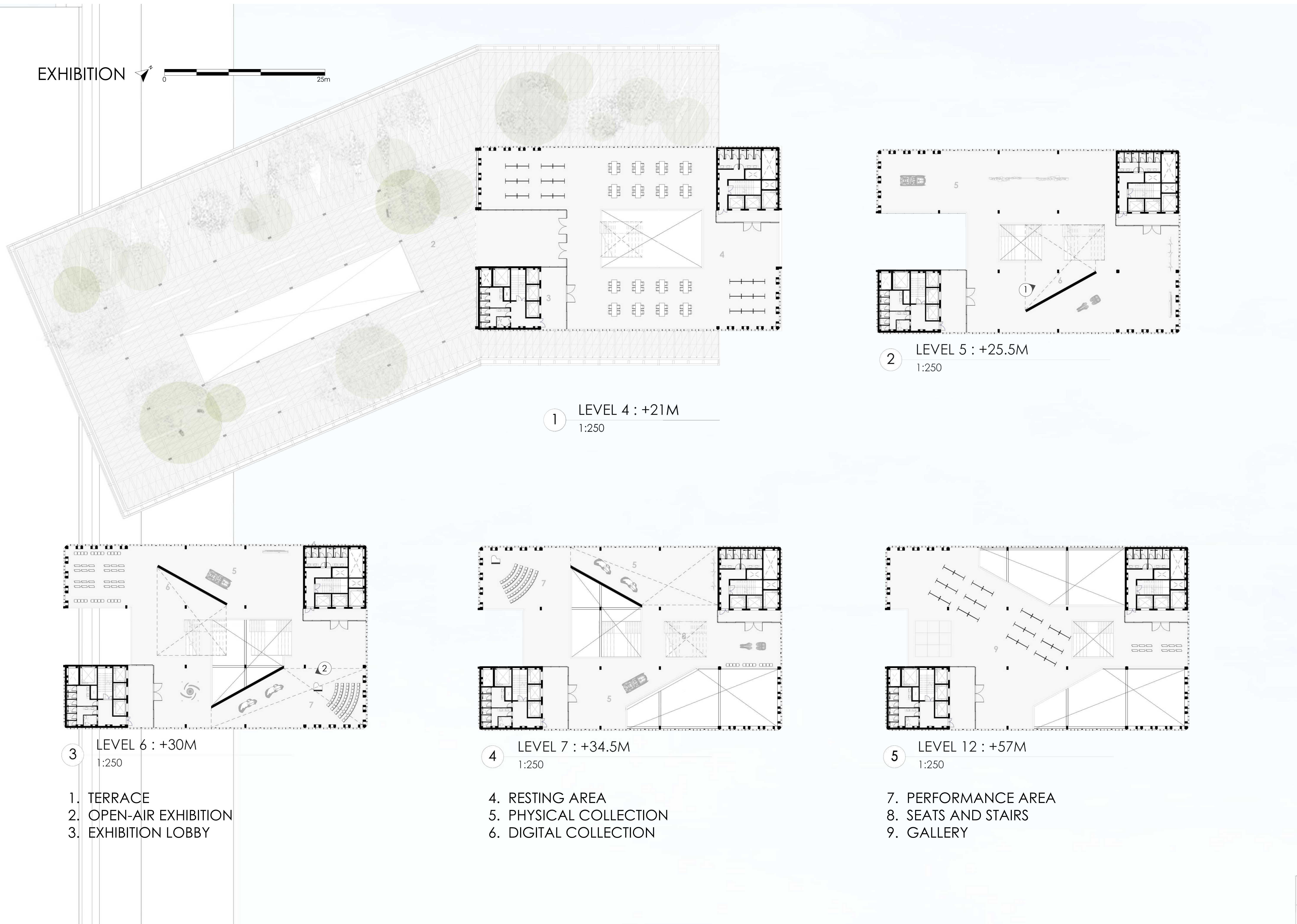
EXHIBITION AXONOMETRIC DRAWING

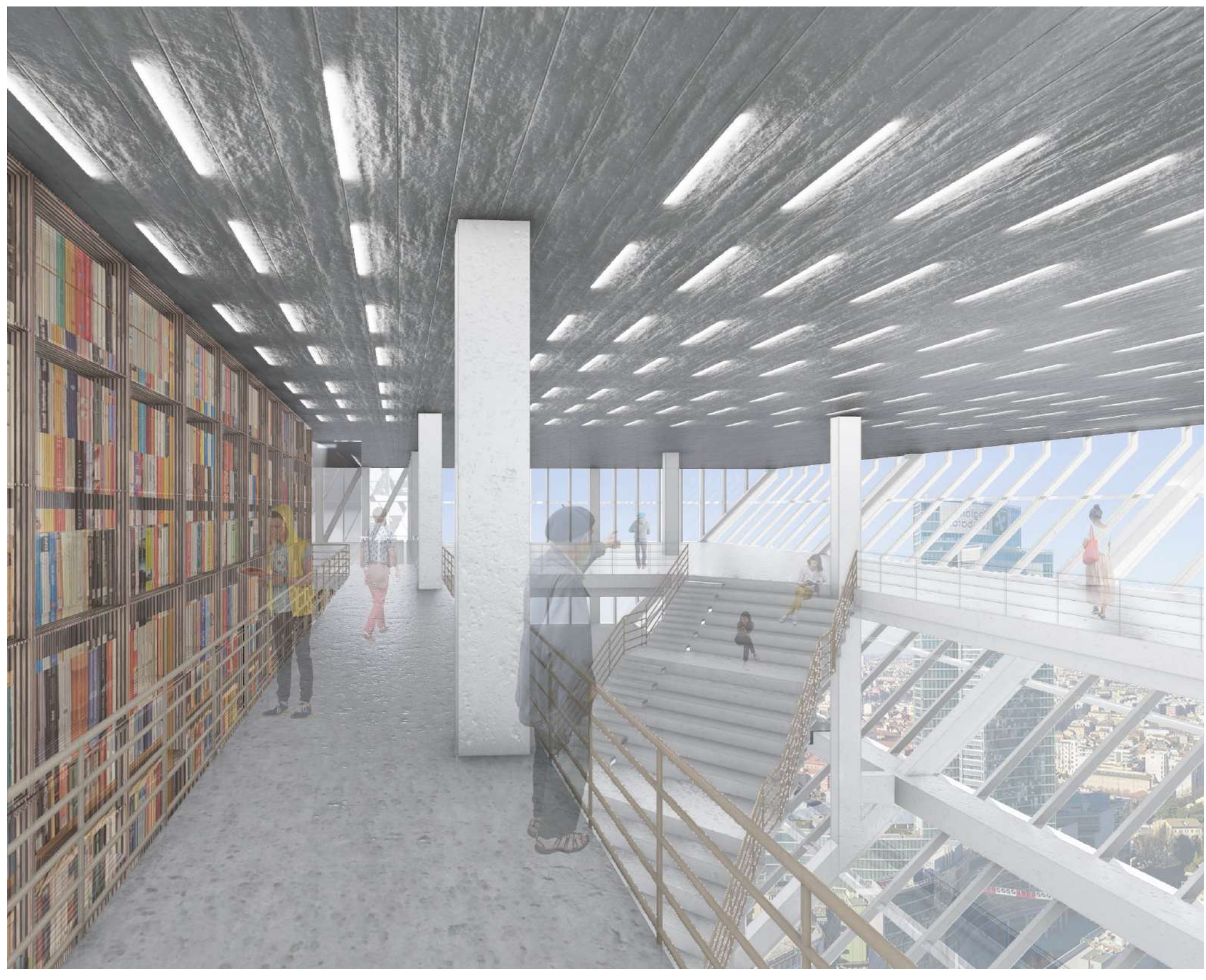


EXHIBITION VIEW 1



EXHIBITION VIEW 2

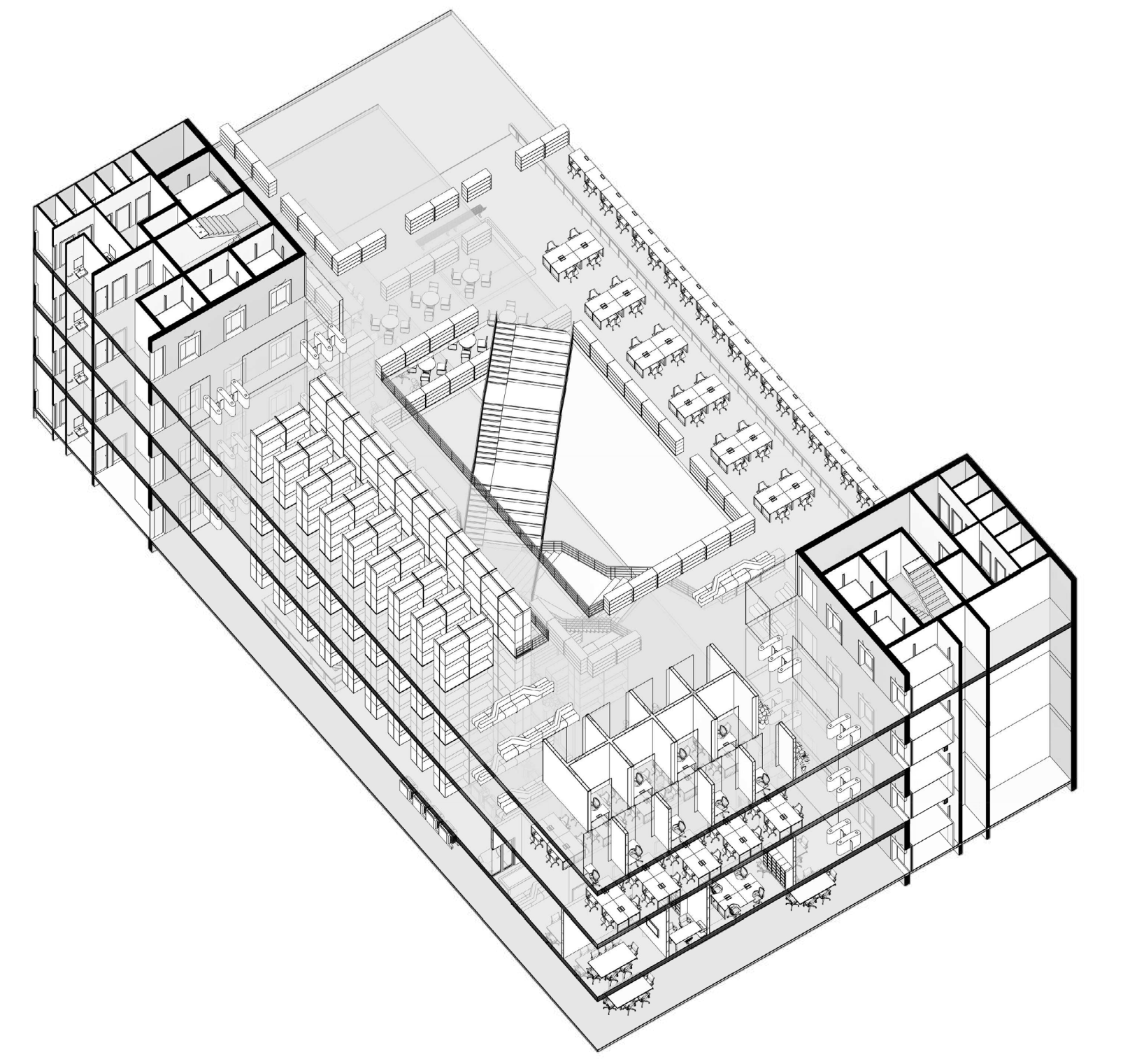




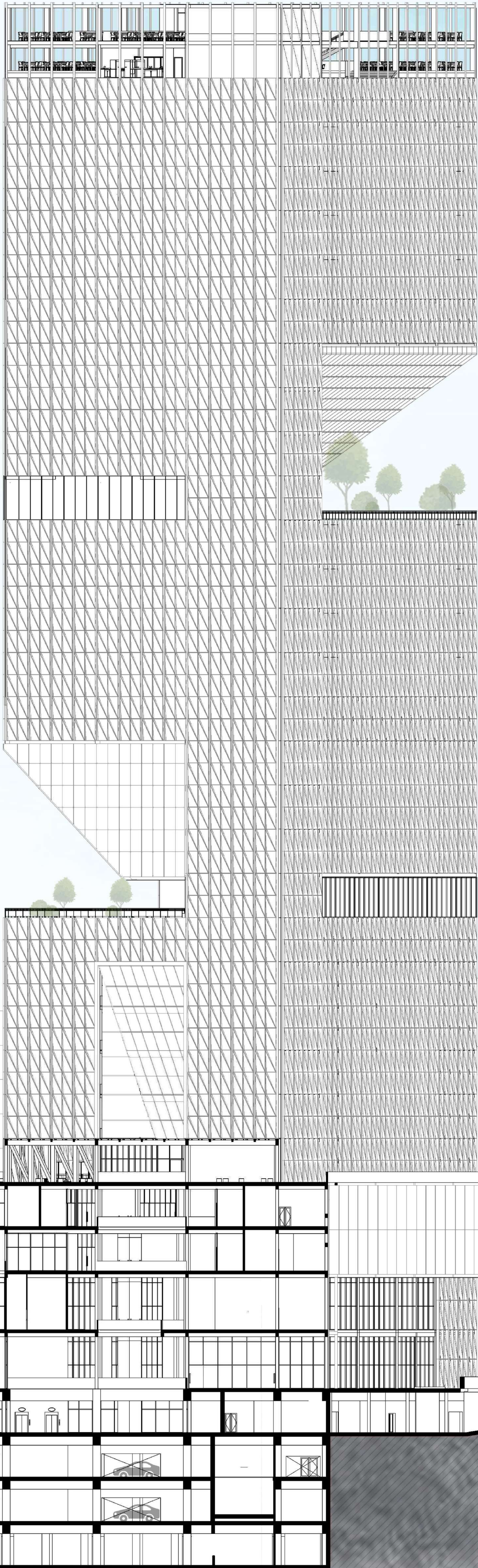
LIBRARY VIEW 1



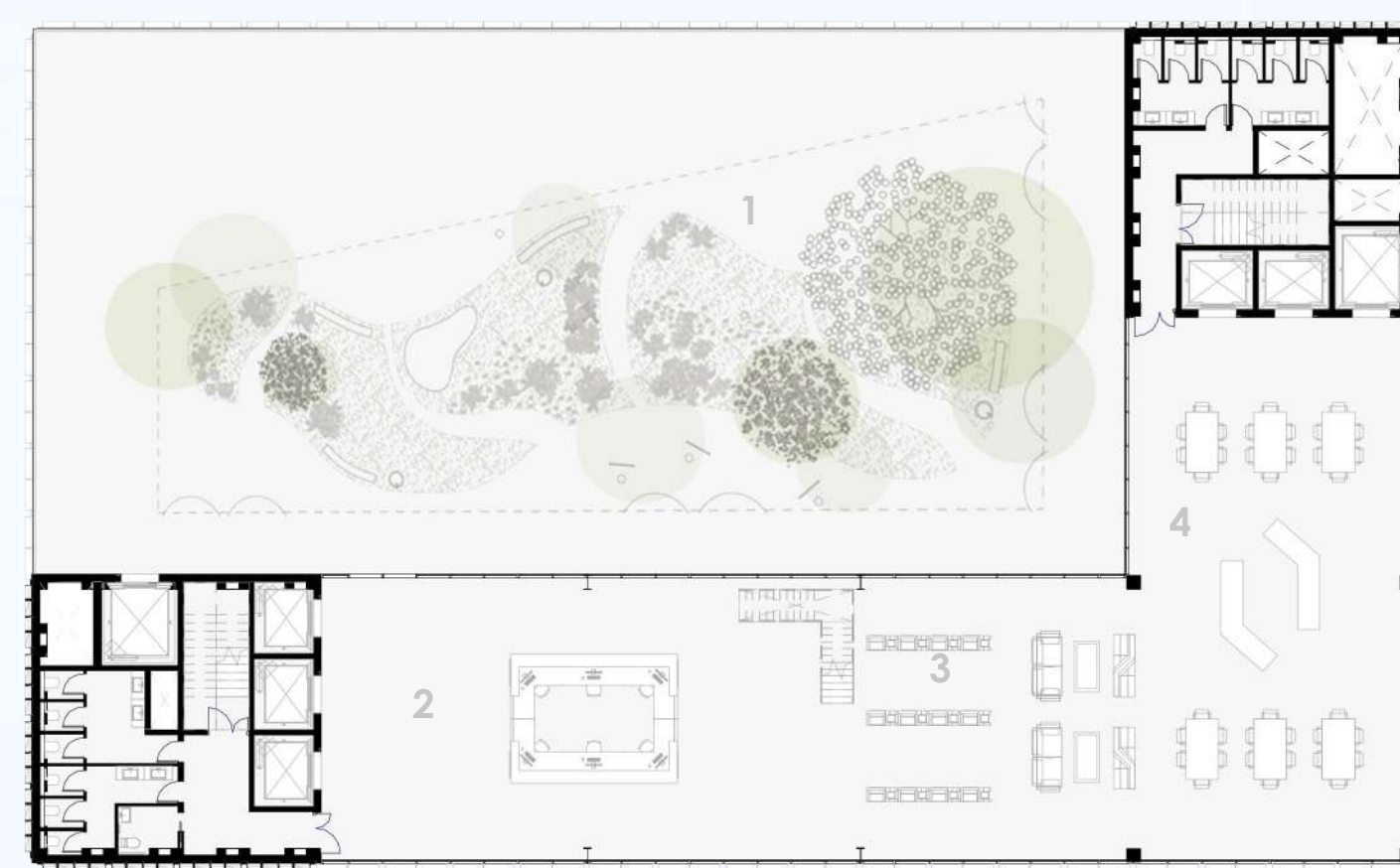
LIBRARY VIEW 2



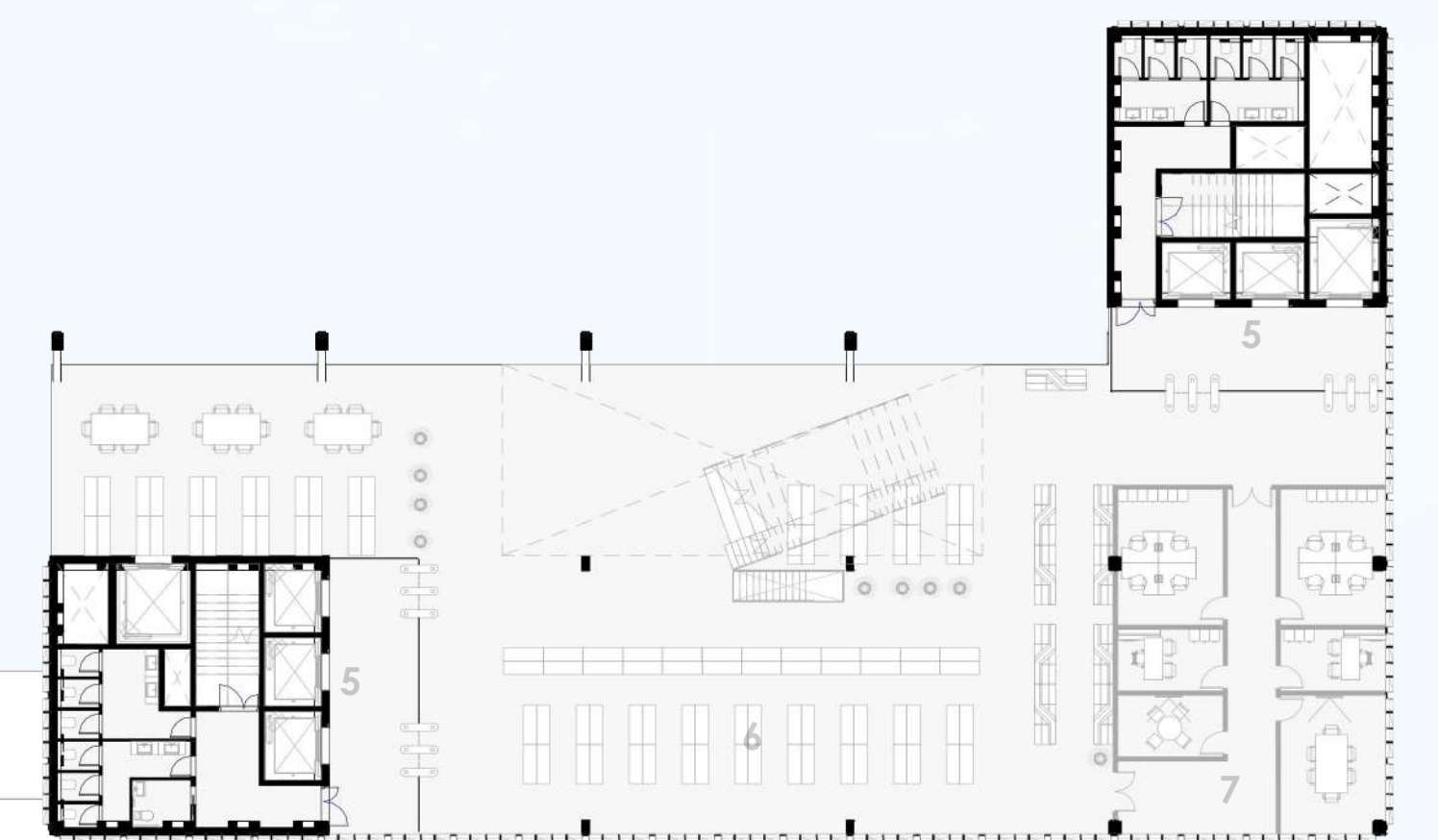
LIBRARY AXONOMETRIC DRAWING



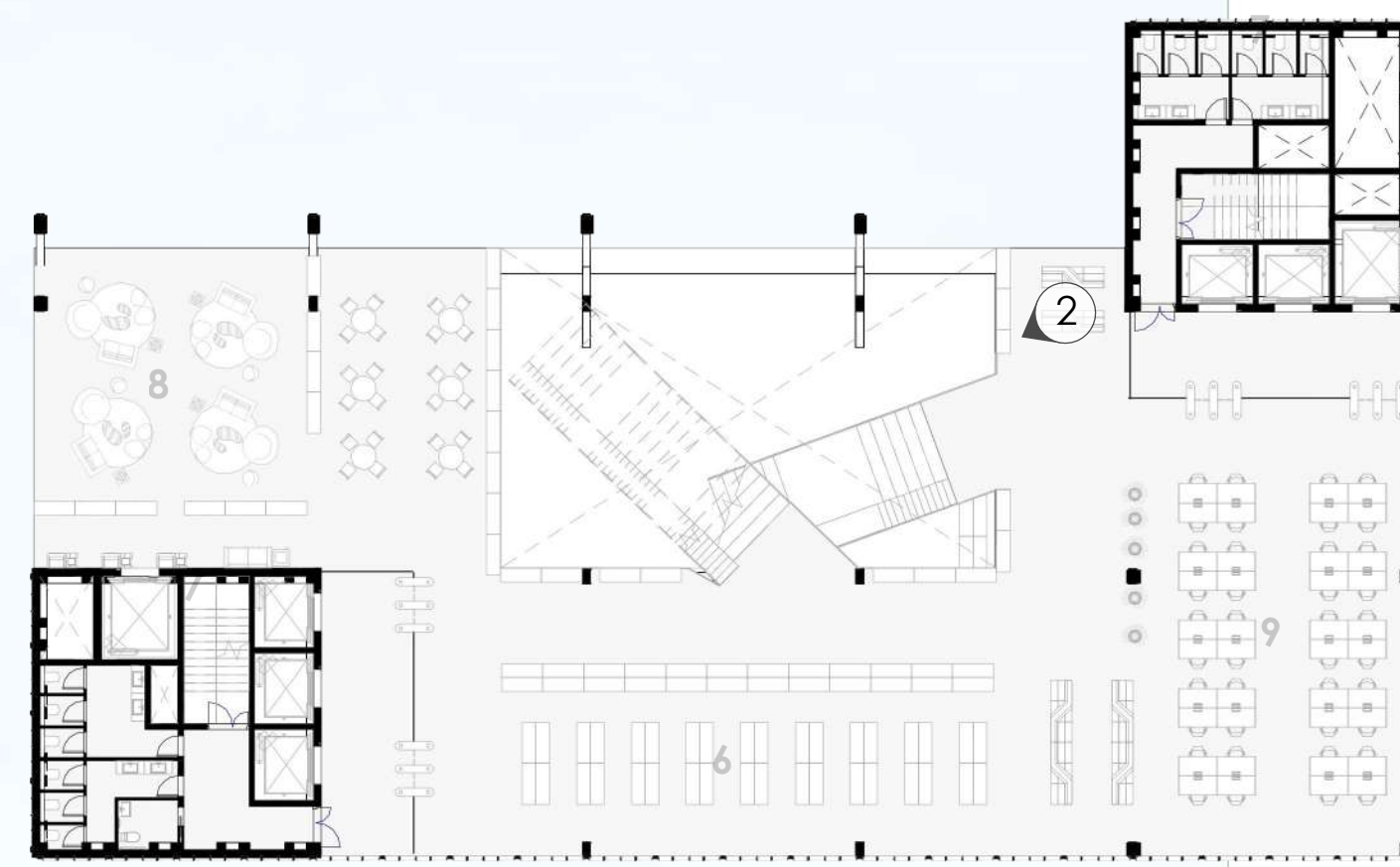
LIBRARY



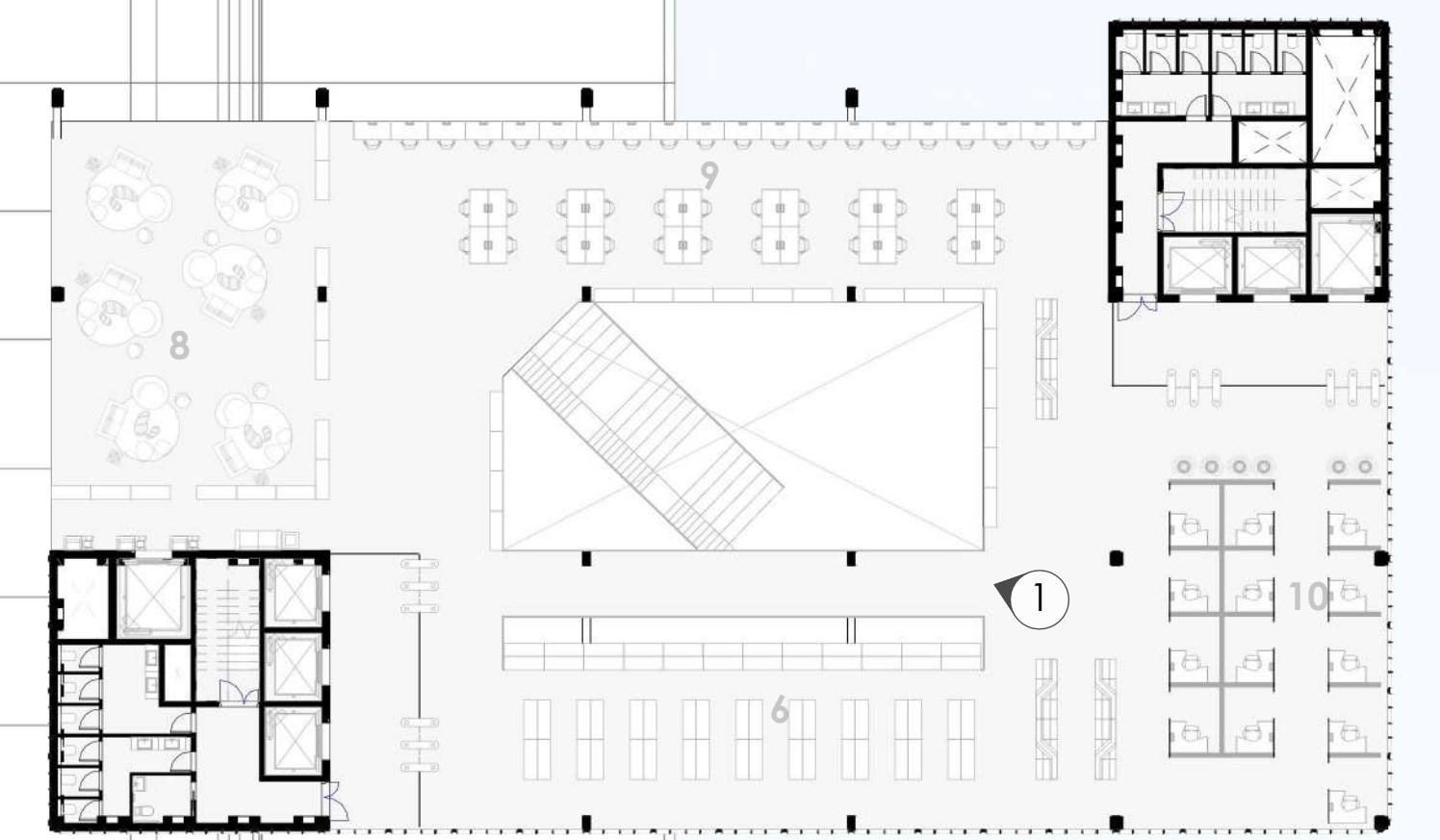
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1:250



2 LEVEL 11 : +52.5M  
1:250



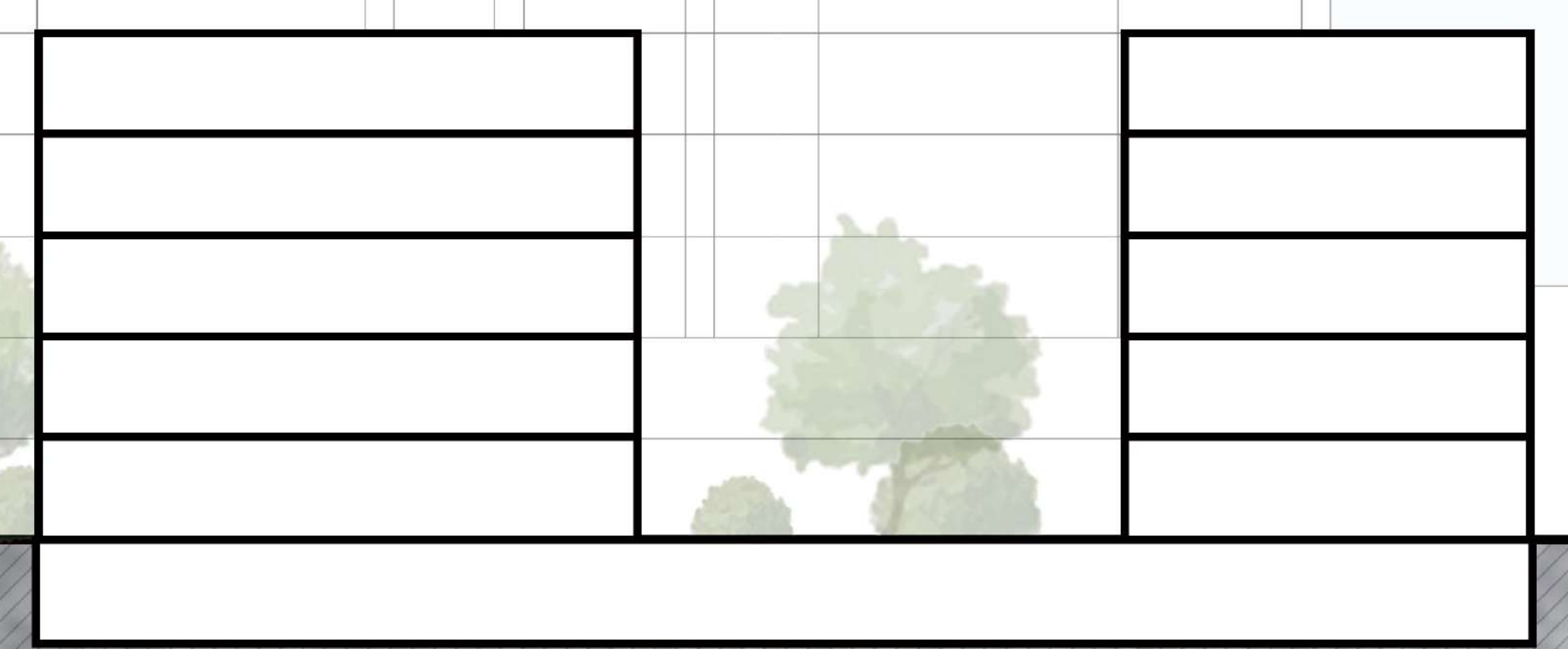
3 LEVEL 12 : +57M  
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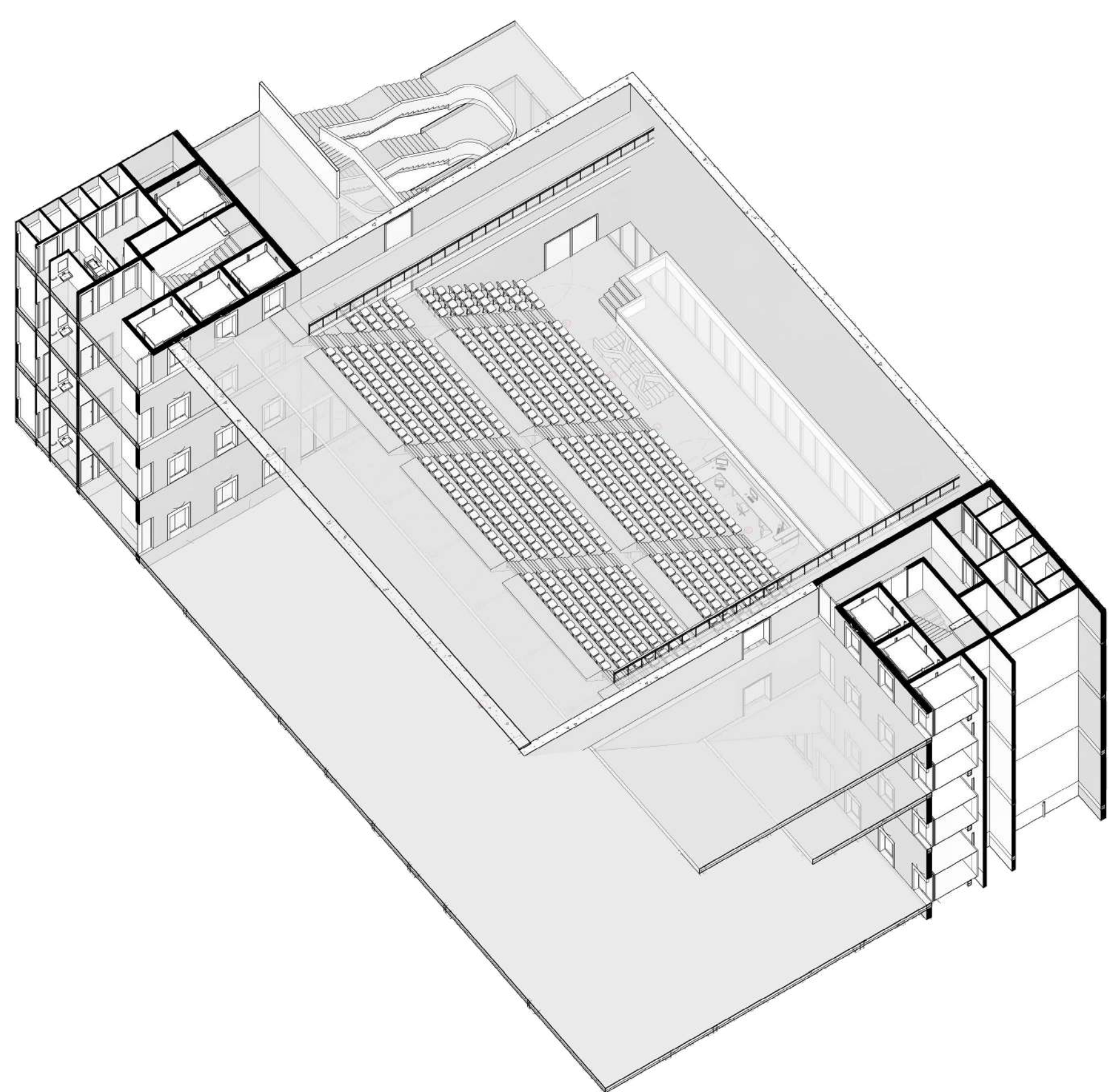
4 LEVEL 13 : +61.5M  
1:250

- 1. LIBRARY TERRACE
- 2. RECEPTION DESK
- 3. BOOK-LOAN MACHINE
- 4. RESTING AREA
- 5. CONTROL

- 6. BOOKSHELF
- 7. MANAGER OFFICE
- 8. DISCUSSING AREA
- 9. STUDY AREA
- 10. DIGITAL LIBRARY



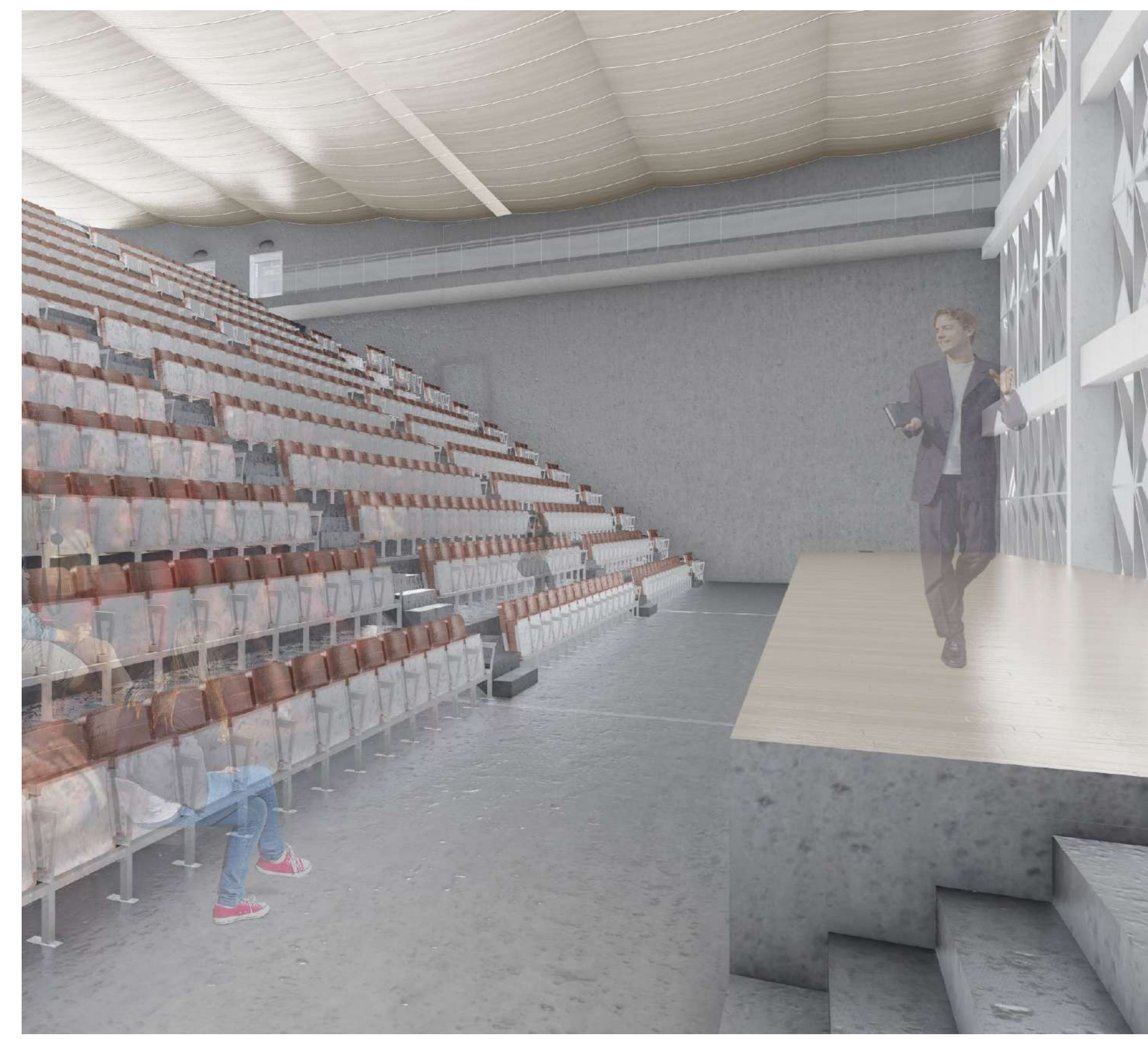
SECTION B-B 1:250



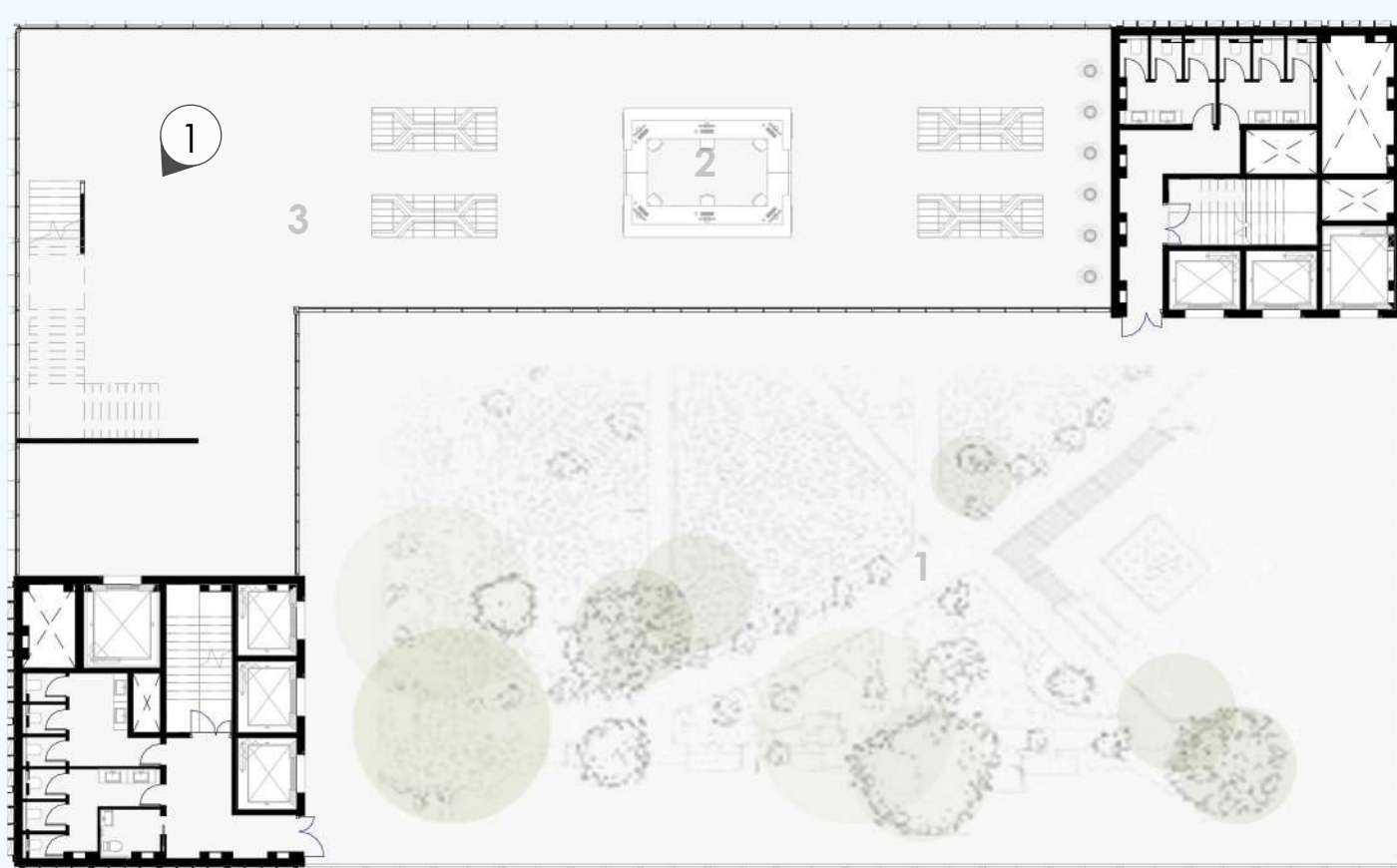
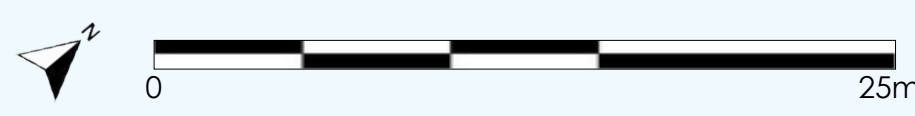
AUDITORIUM AXONOMETRIC DRAWING



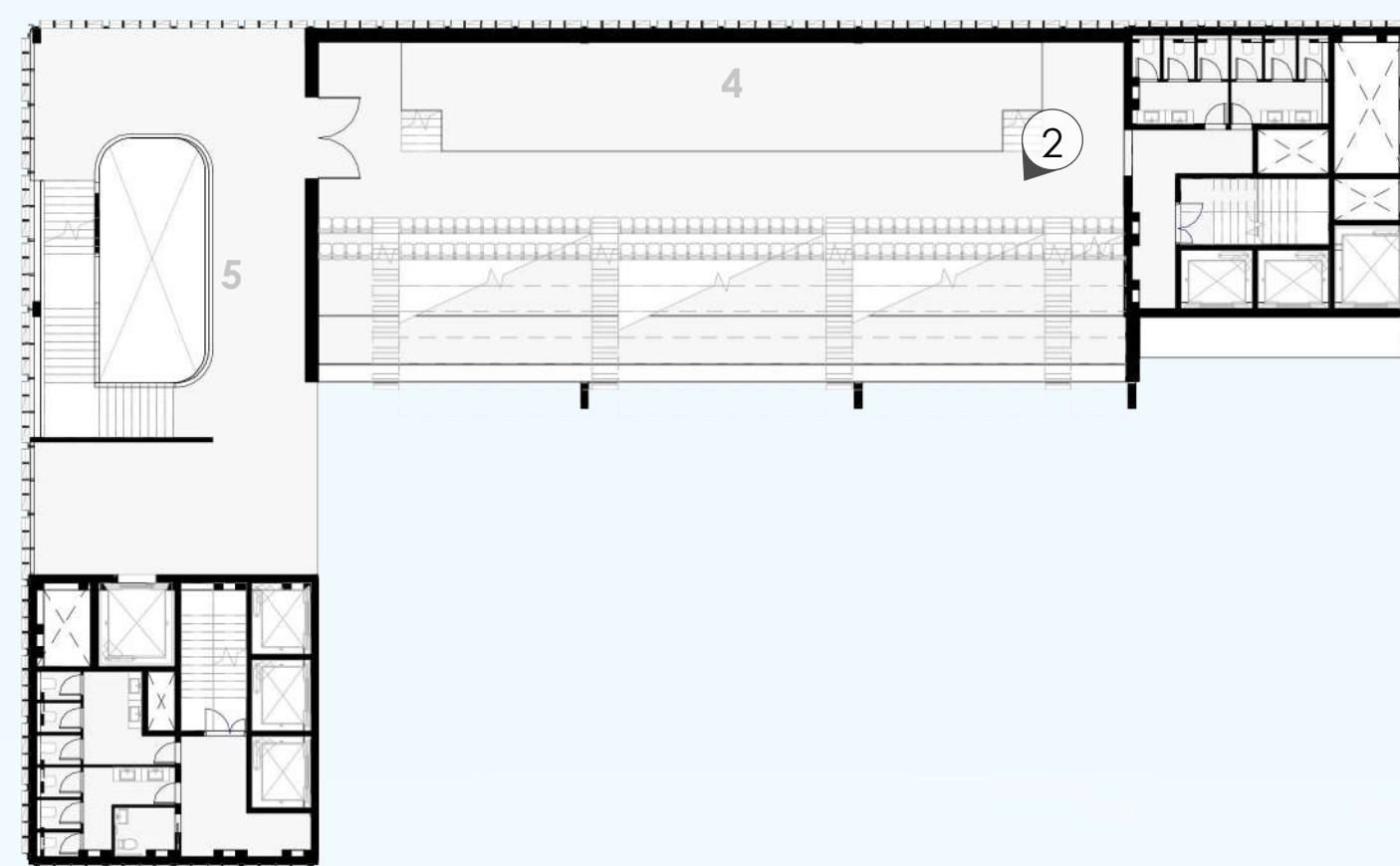
AUDITORIUM VIEW 1



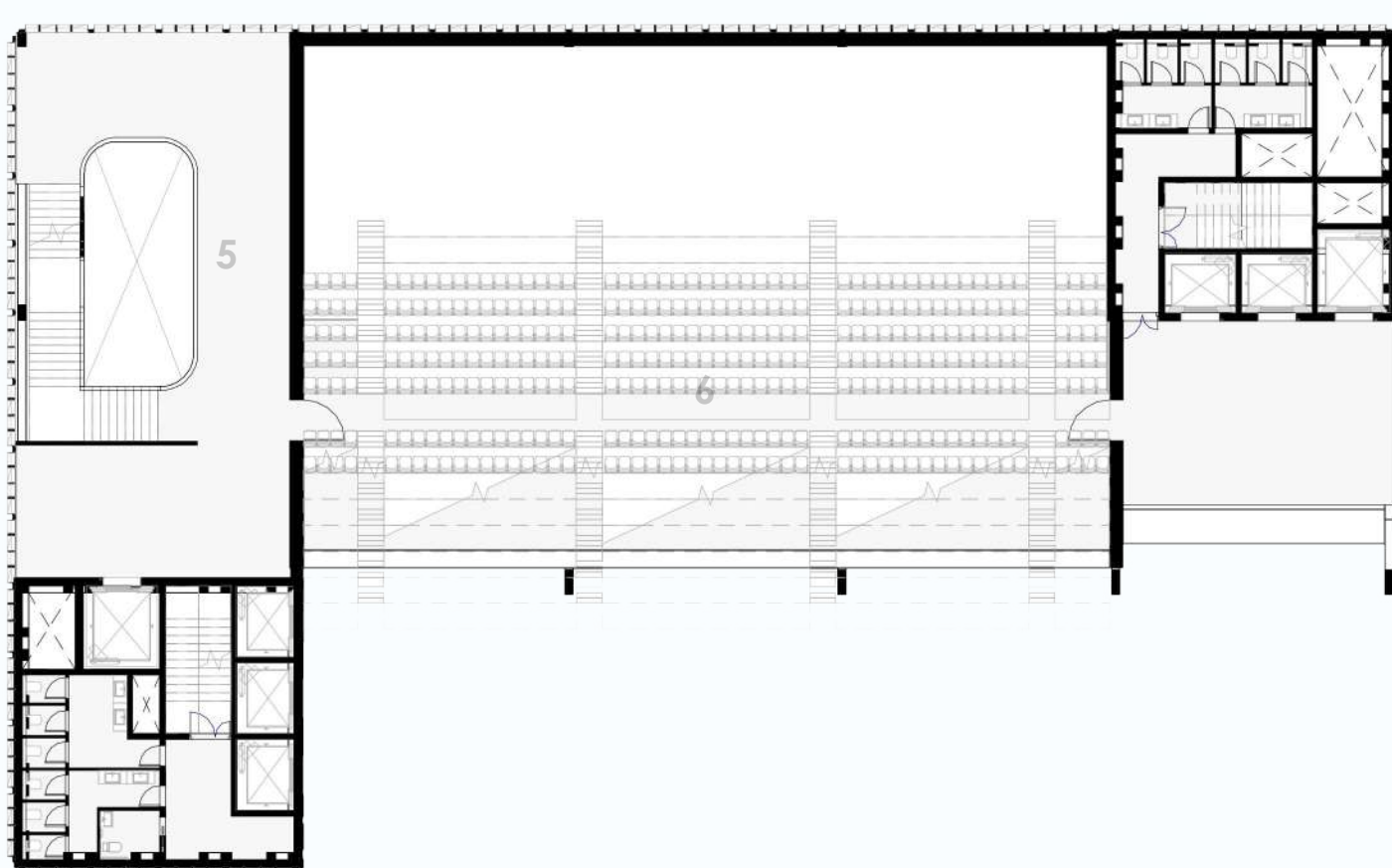
AUDITORIUM



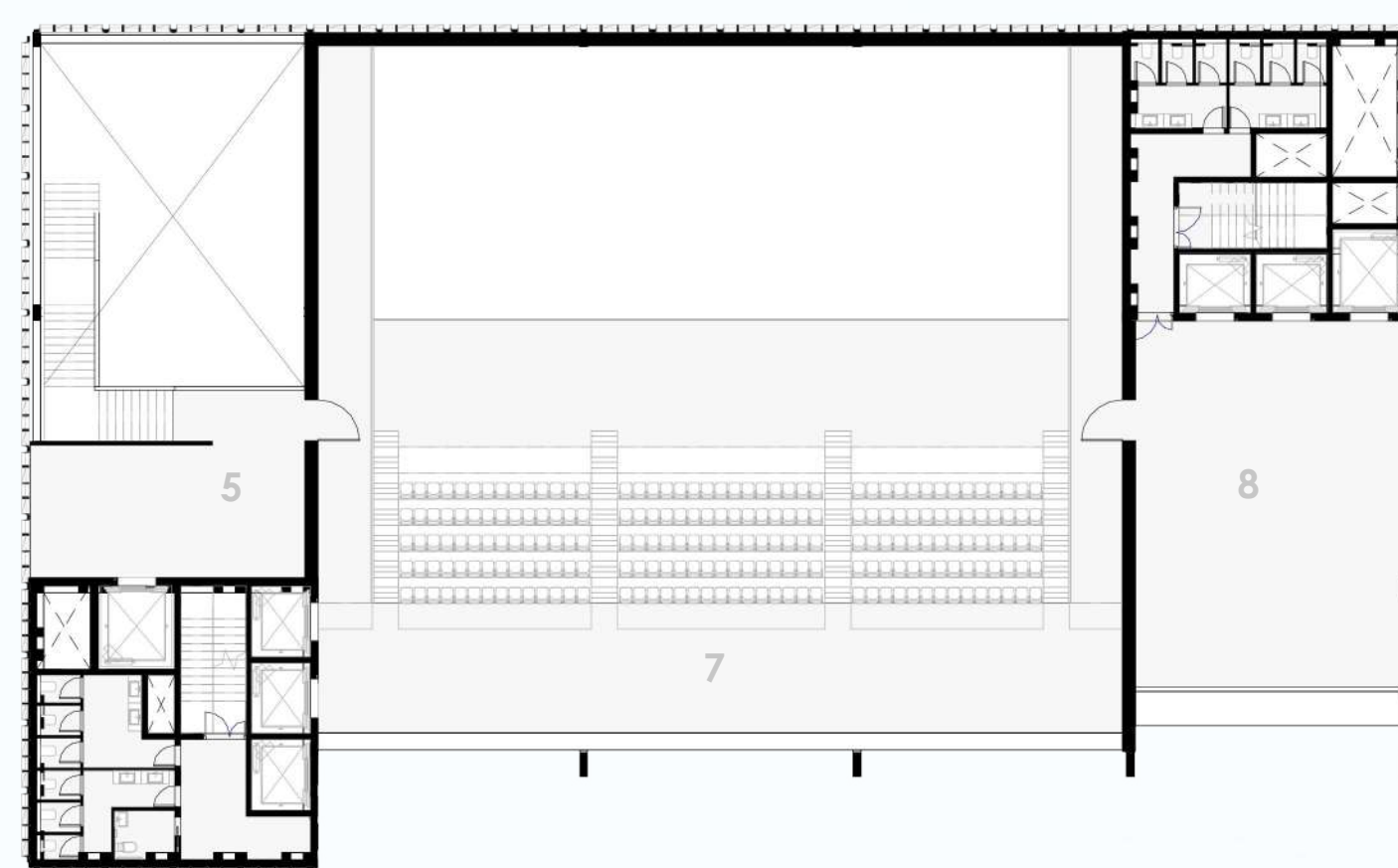
1 LEVEL 20 : +88.5M  
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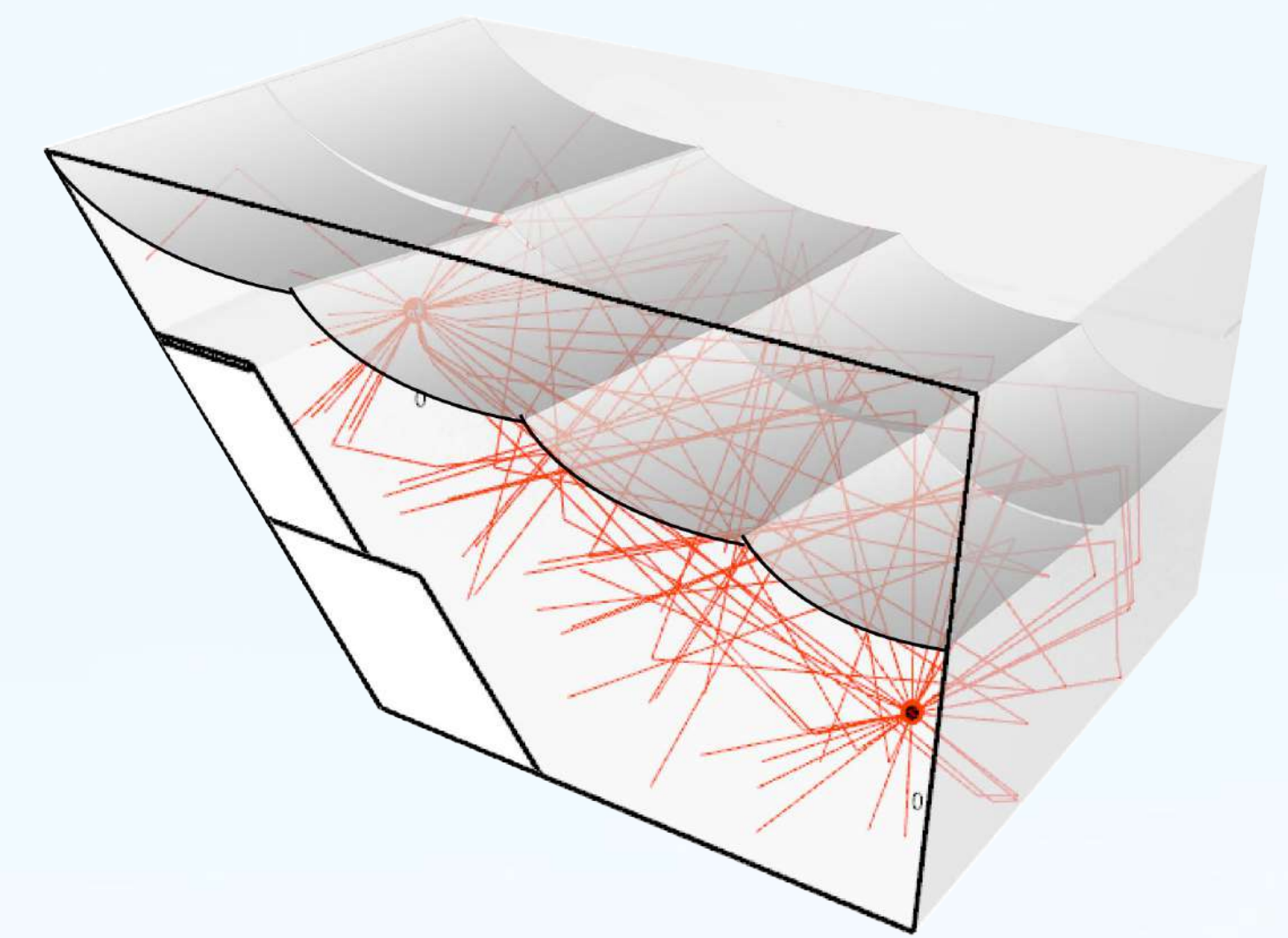
2 LEVEL 21 : +93M  
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3 LEVEL 22 : +97.5M  
1:250

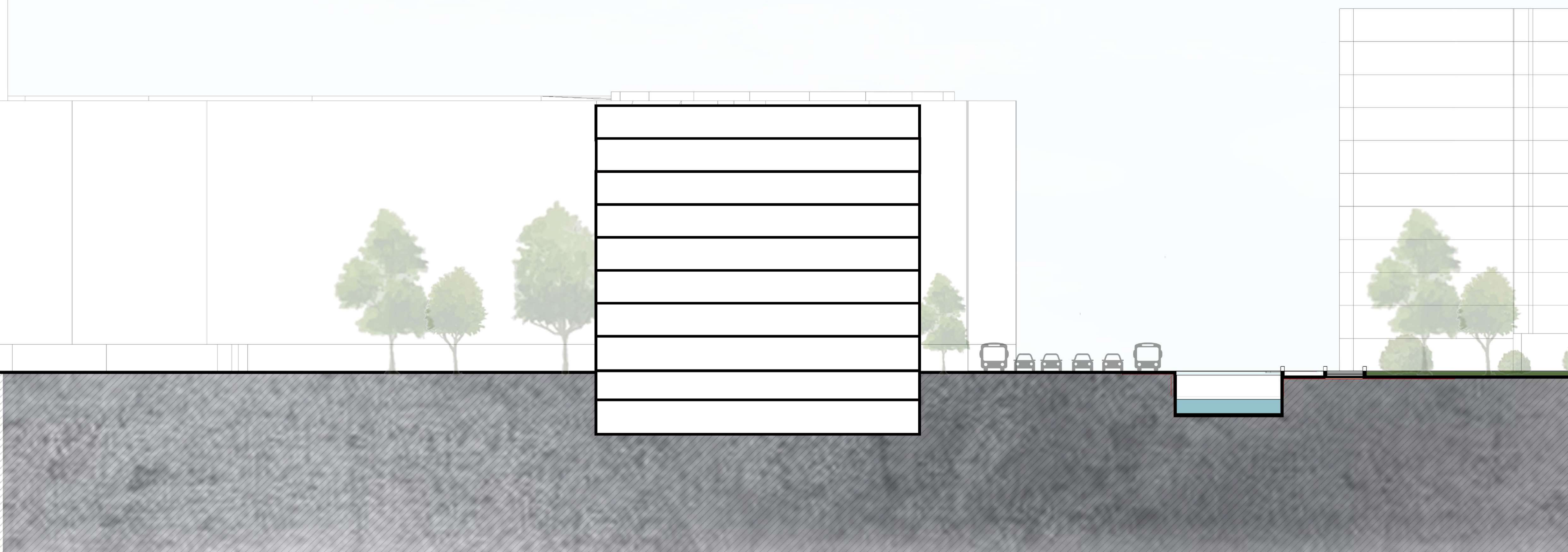


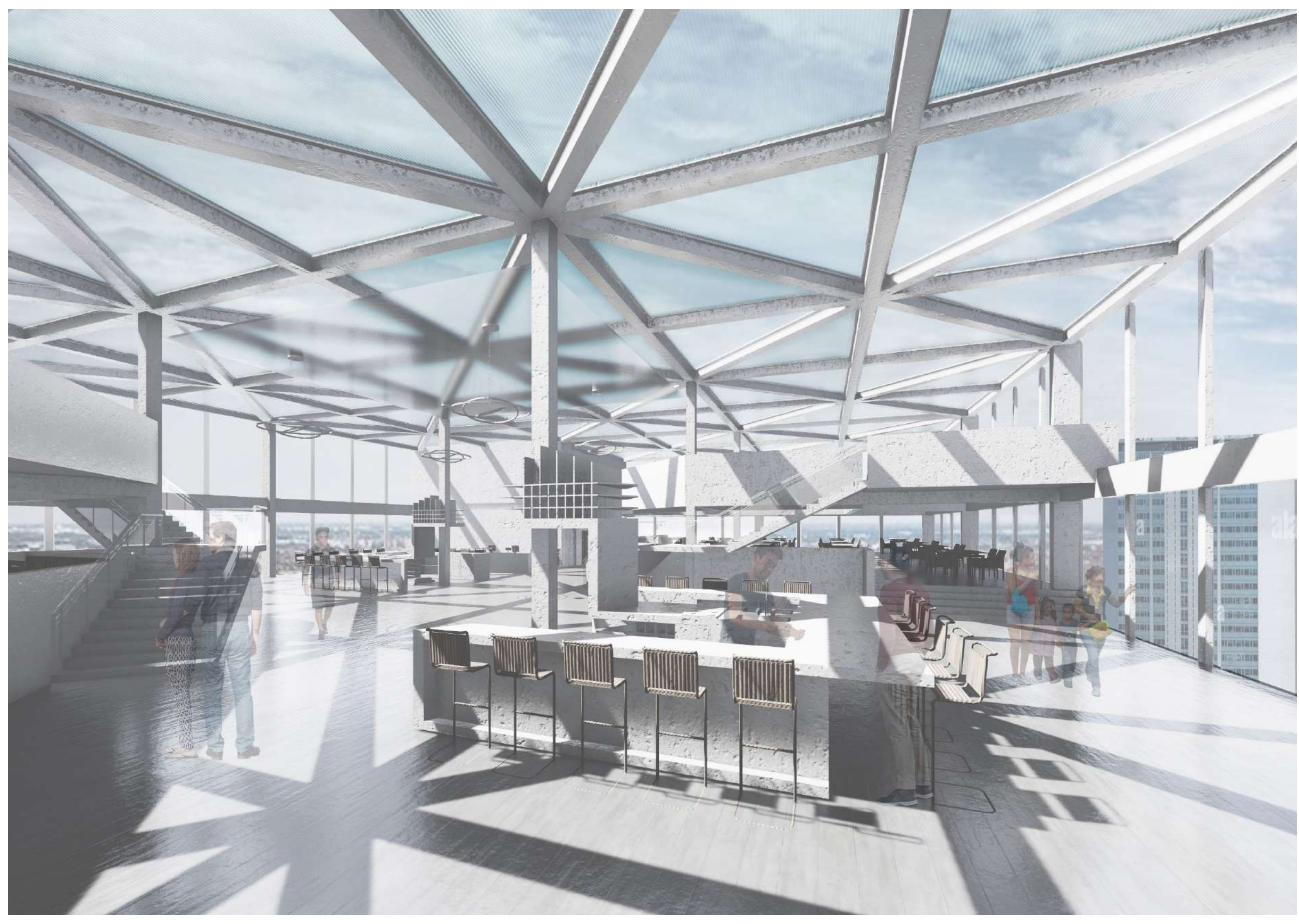
4 LEVEL 23 : +102M  
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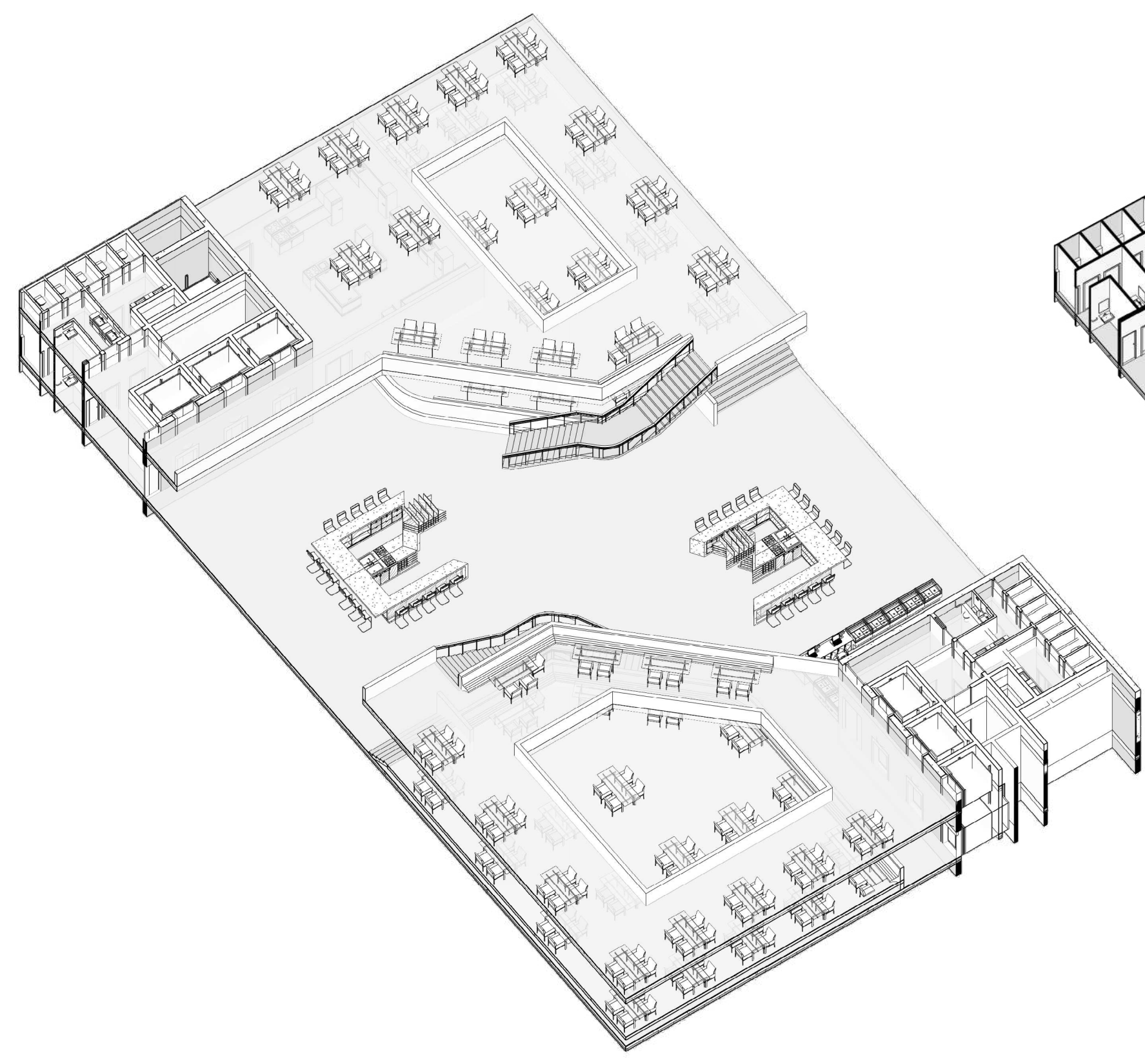
AUDITORIUM VOLUME AND SOUND PATH

- 1. TERRACE
- 2. TICKET BOOTH
- 3. LOBBY
- 4. AUDITORIUM STAGE
- 5. CORRIDOR
- 6. AUDITORIUM SEATS
- 7. AUDITORIUM CONTROL SPACE
- 8. EMERGENCY EXIT

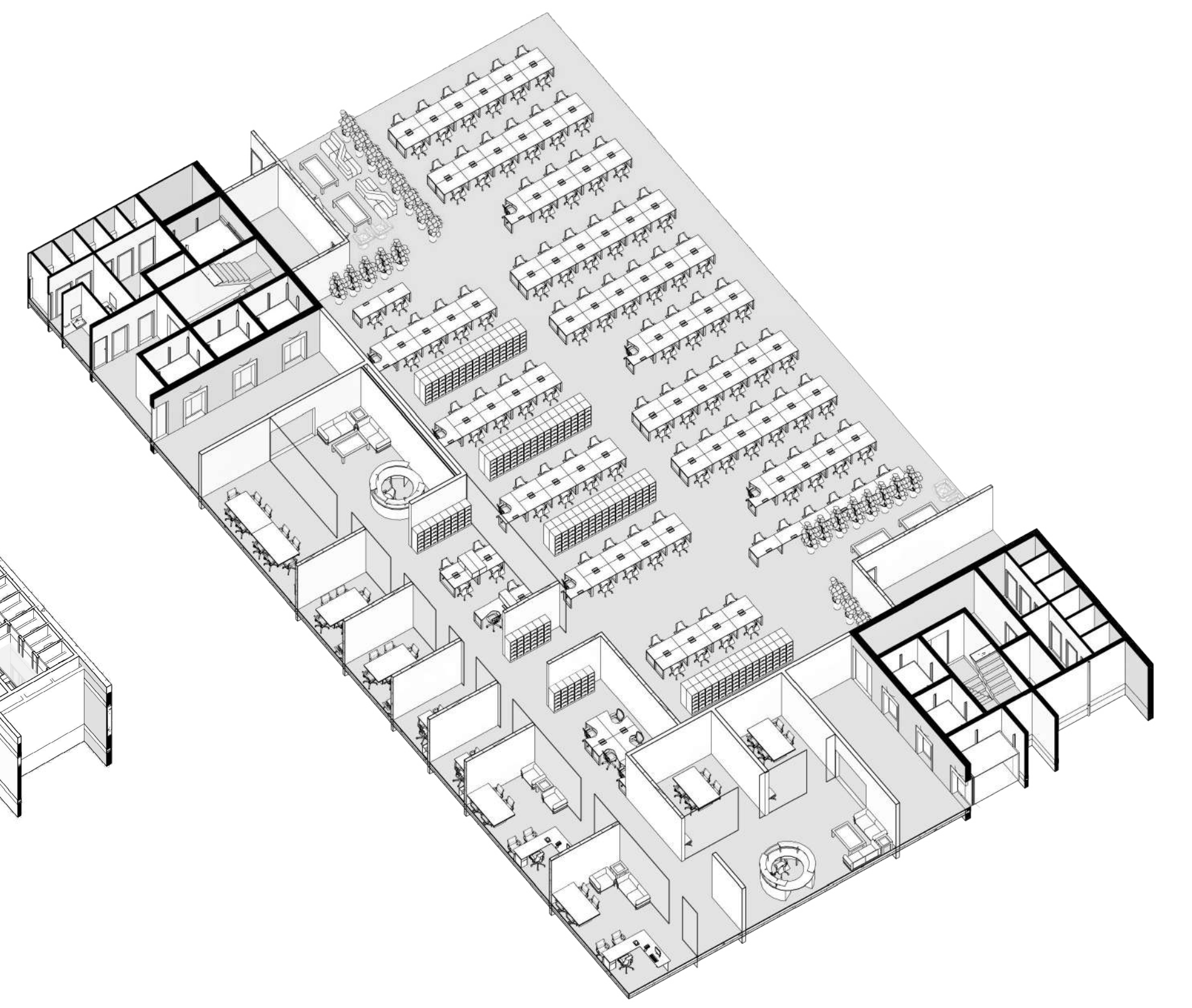




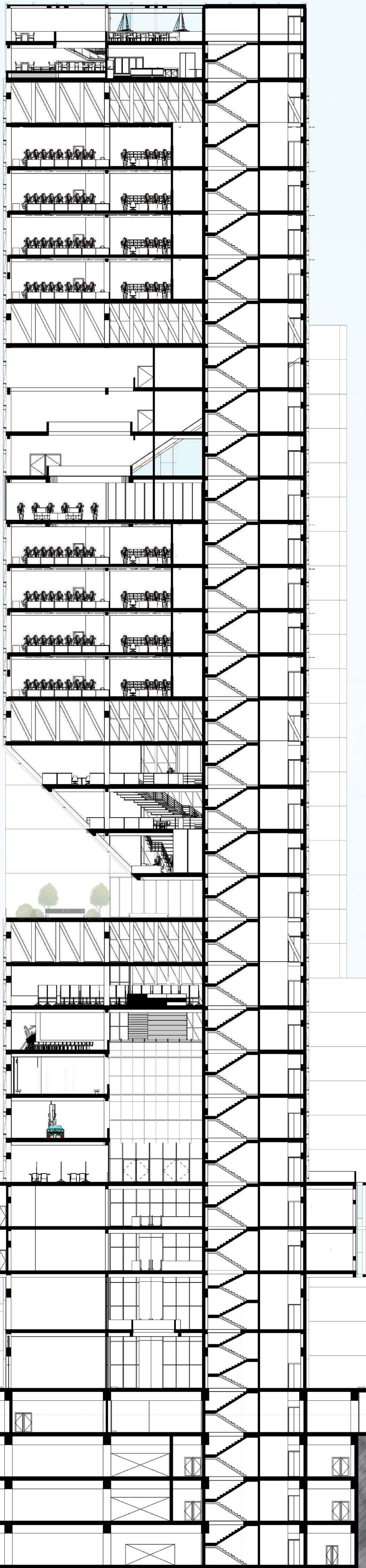
SKY BAR VIEW 1



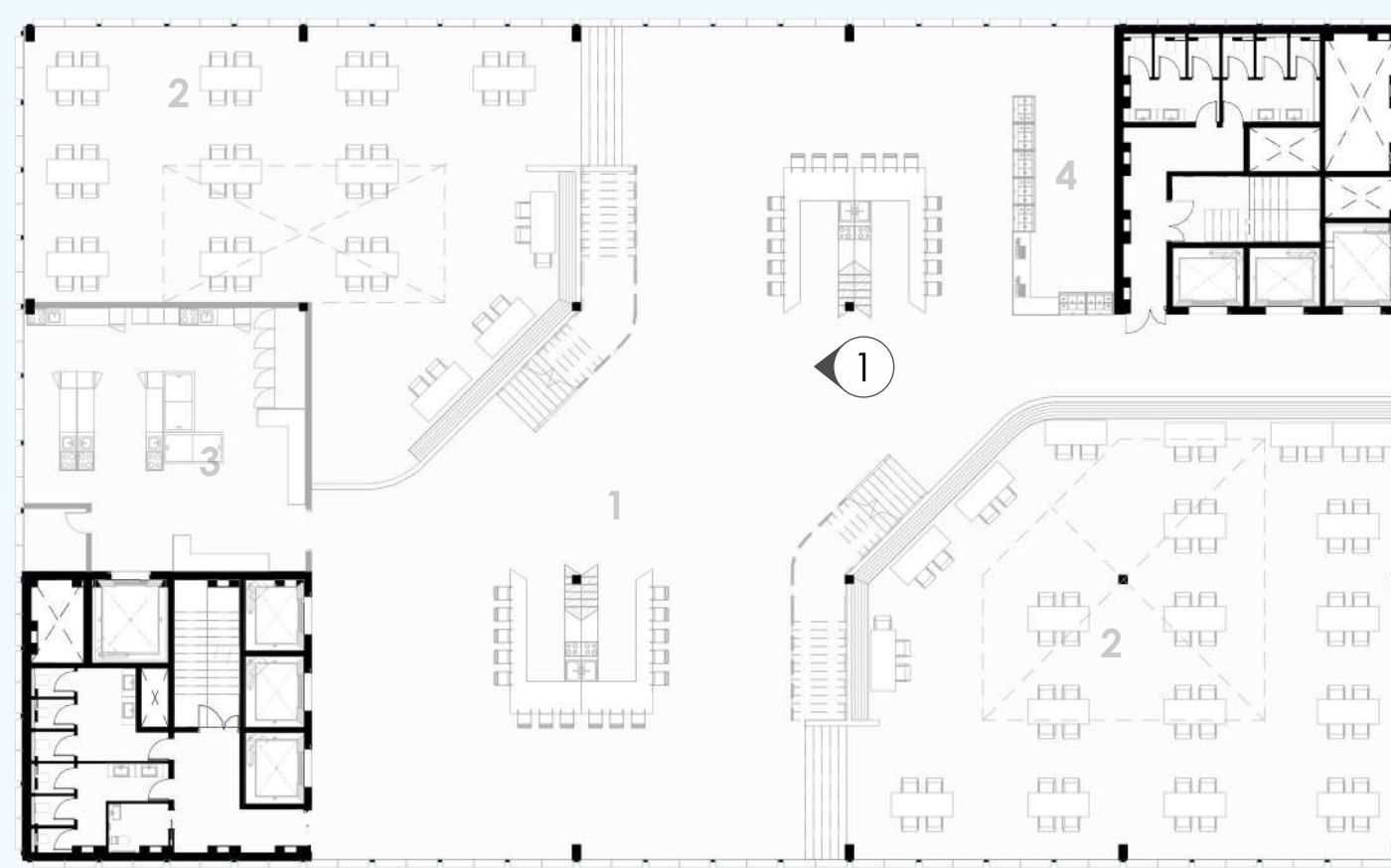
SKY BAR AXONOMETRIC DRAWING



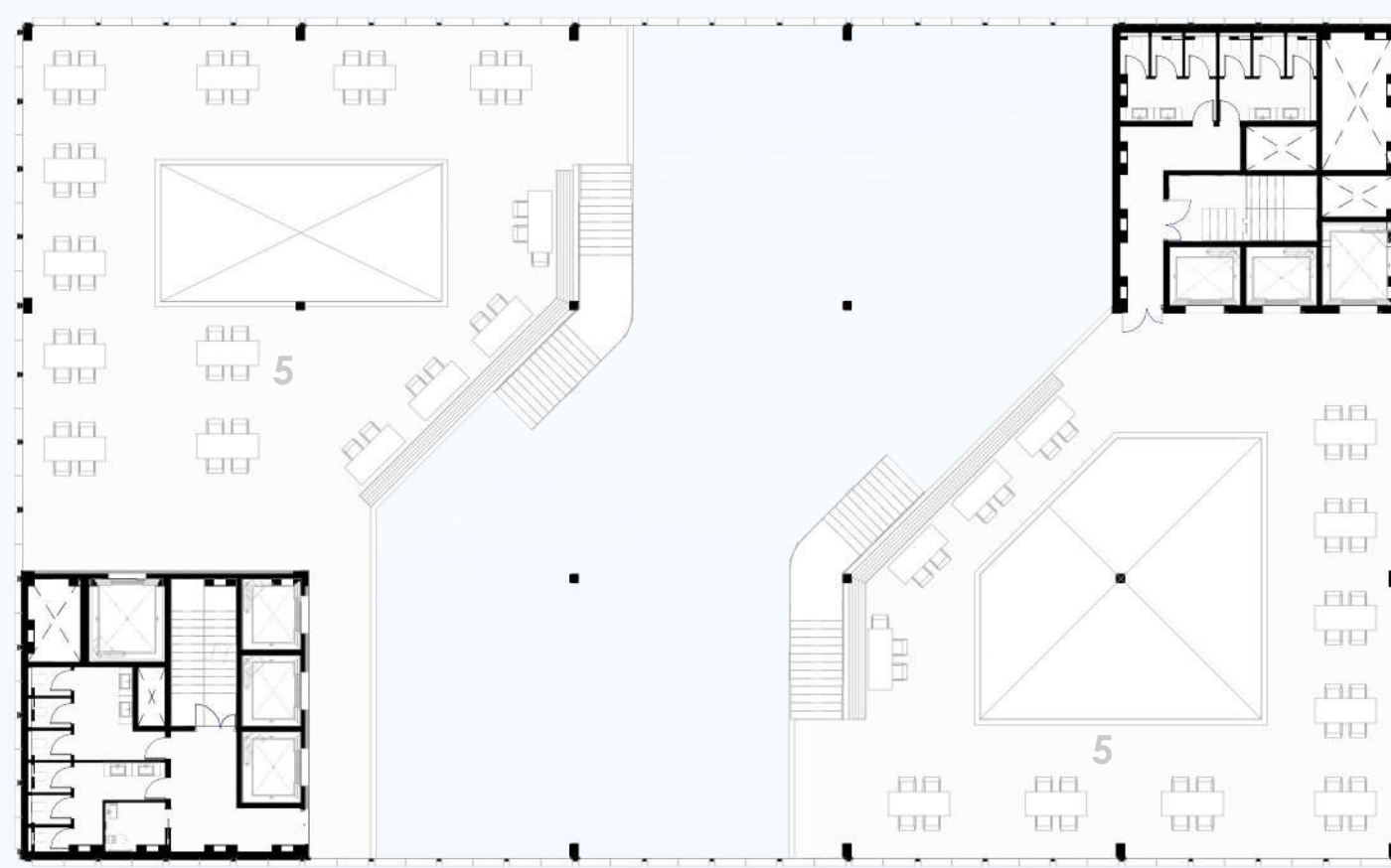
OFFICE AXONOMETRIC DRAWING



SKYBAR

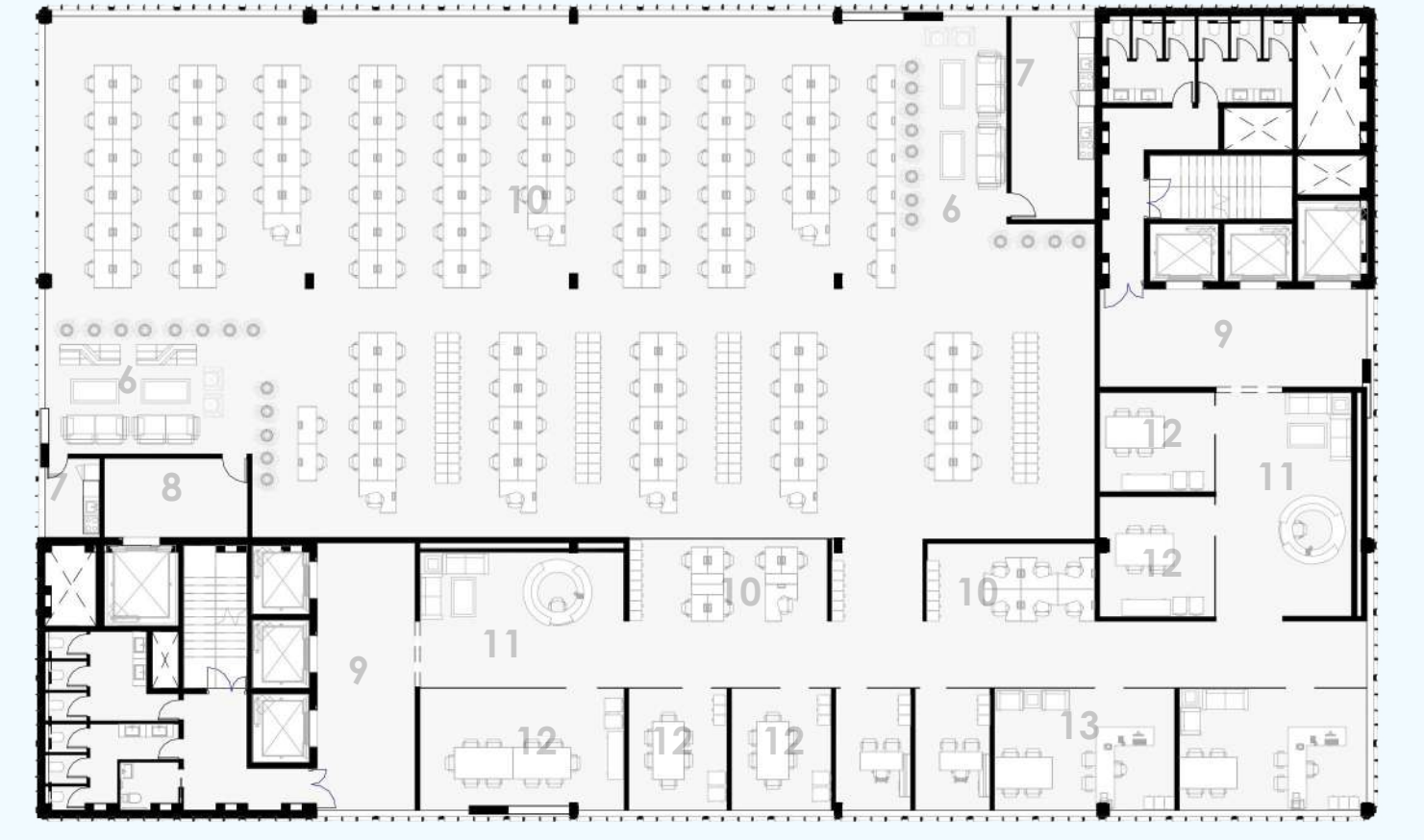


1 LEVEL 30 : +133.5M  
1:250



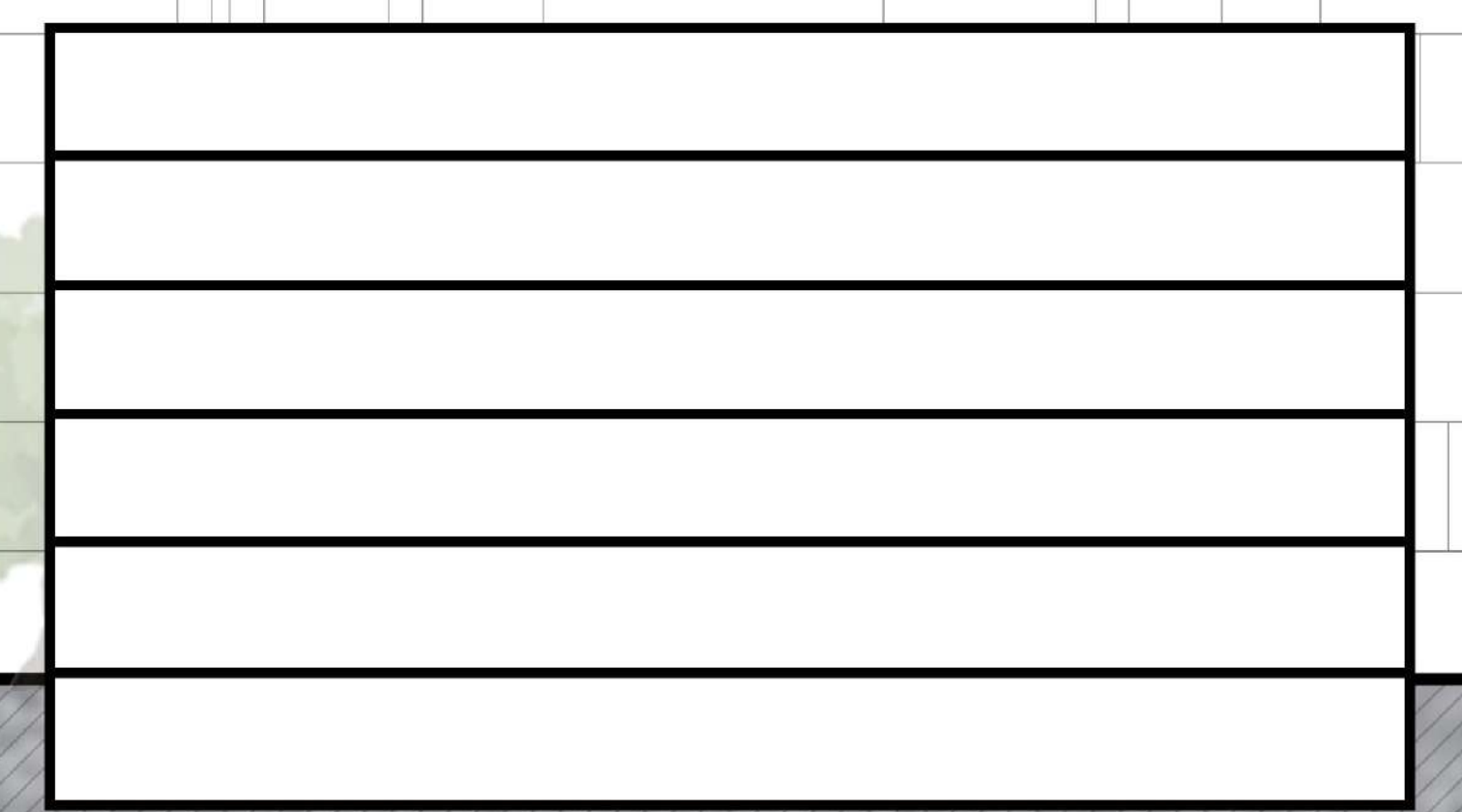
2 LEVEL 30 MEZANINE : +137.2M  
1:250

OFFICE



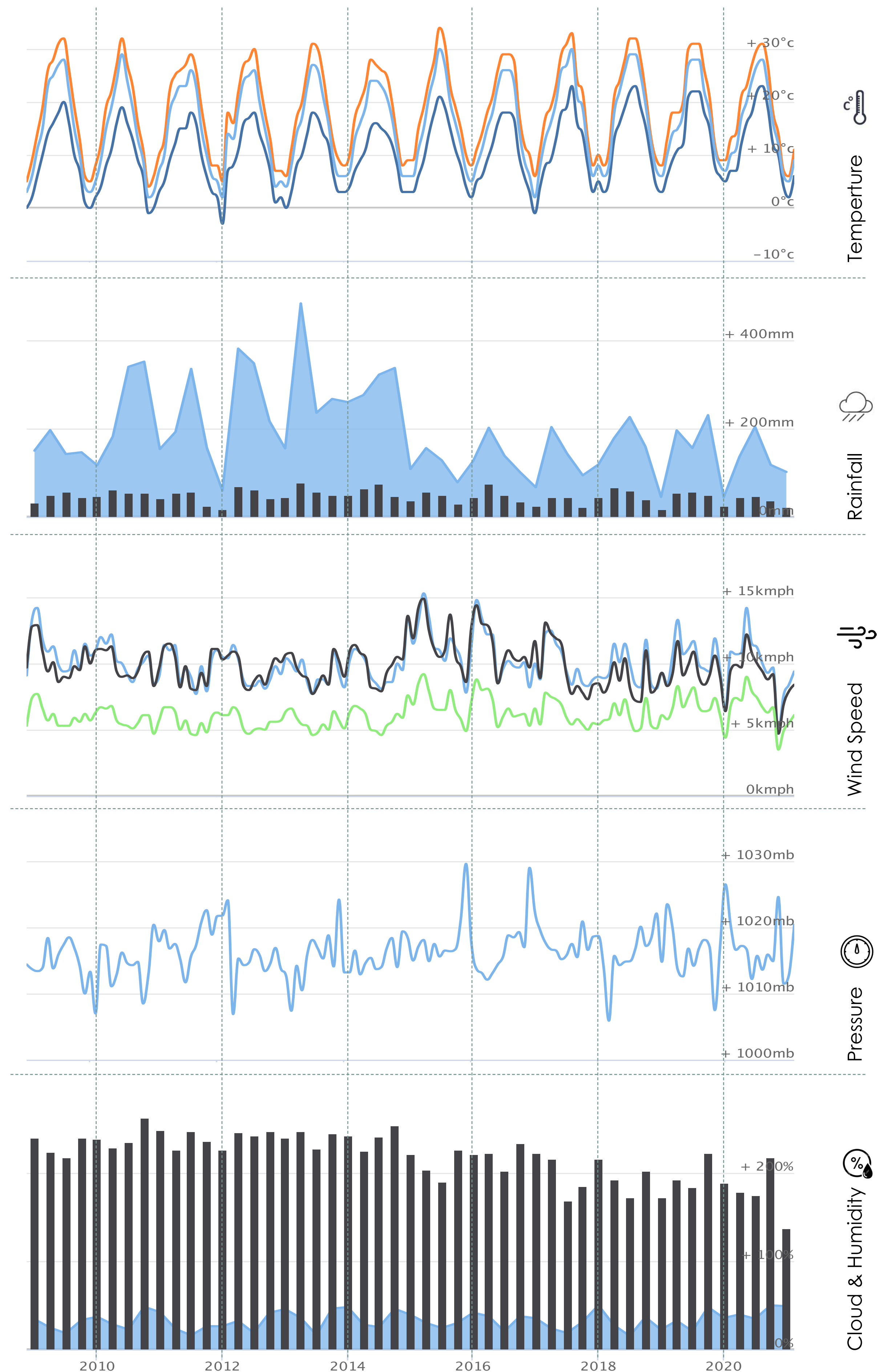
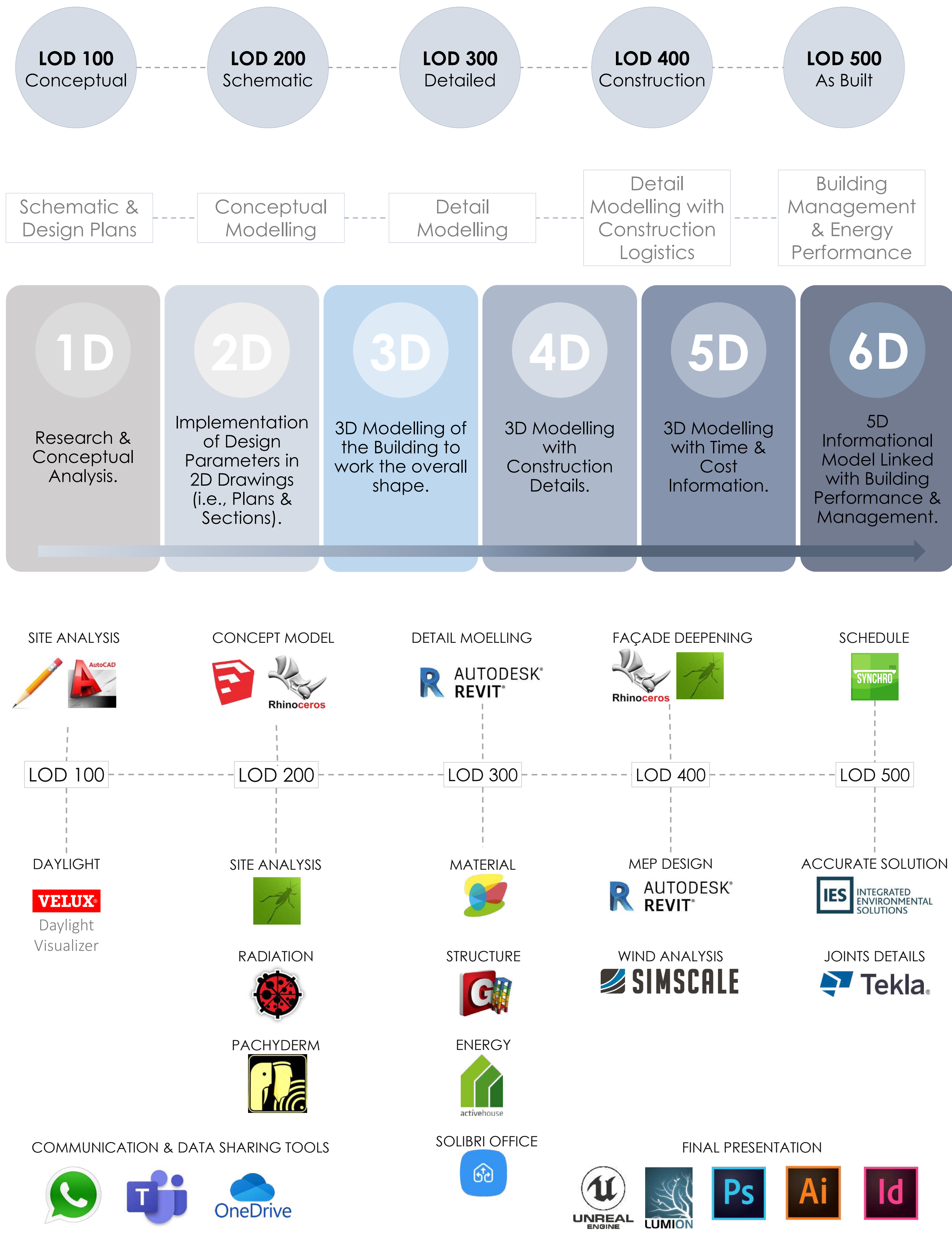
LEVEL 15-16-17-18 - 24 - 25 - 26 - 27  
1:250

1. BAR
2. OPEN LOBBY AND BAR AREA
3. KITCHEN
4. BAIN MARIE COUNTER
5. DINNING MEZZANINE
6. RECREATION SPACE
7. PANTRY
8. LOADING UNLOADING AREA
9. LOBBY
10. WORKSTATIONS
11. RECEPTION AND WAITING AREA
12. CONFERENCE ROOM
13. OFFICE CABINET

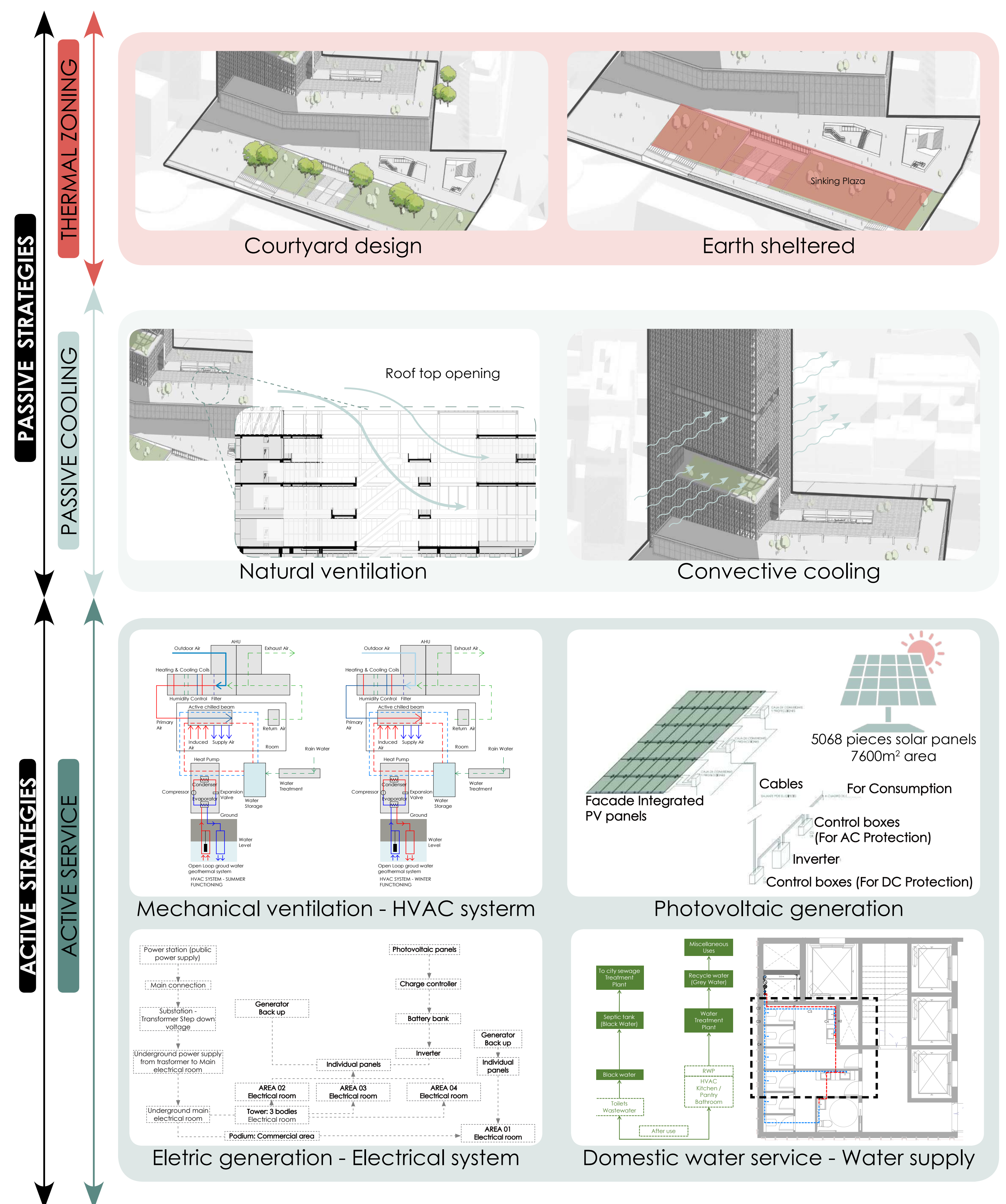
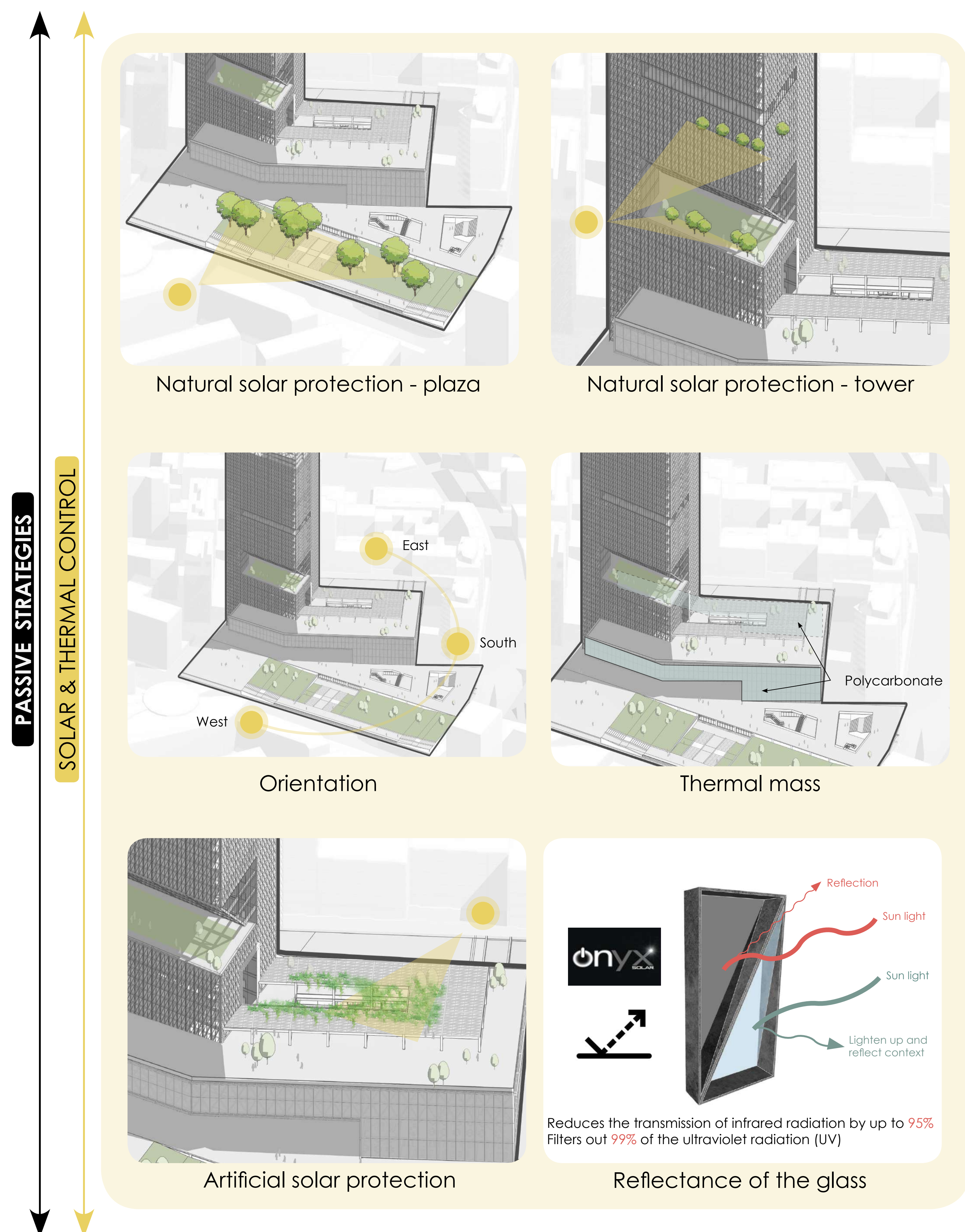


SECTION C-C 1:250

# BIM WORKFLOW AND SITE DATA COLLECTION

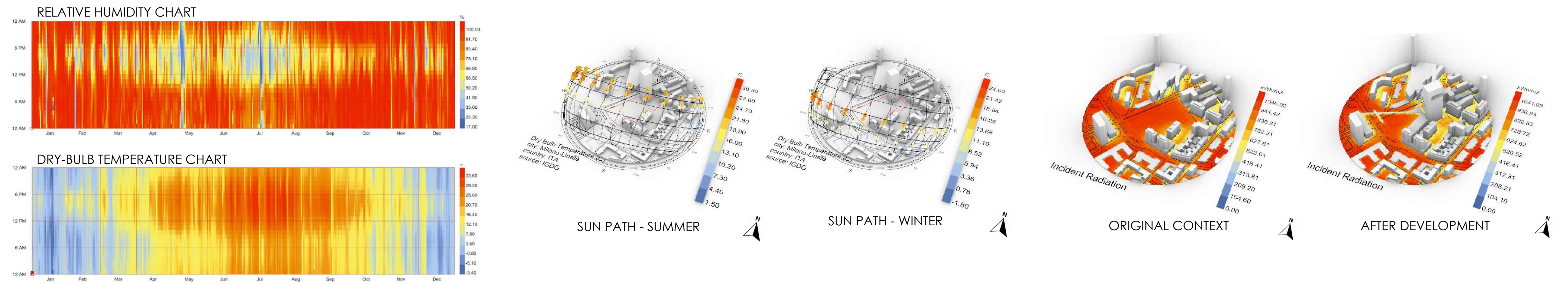


## NZEB STRATEGIES



## SUN RADIATION ANALYSIS - LADYBUG

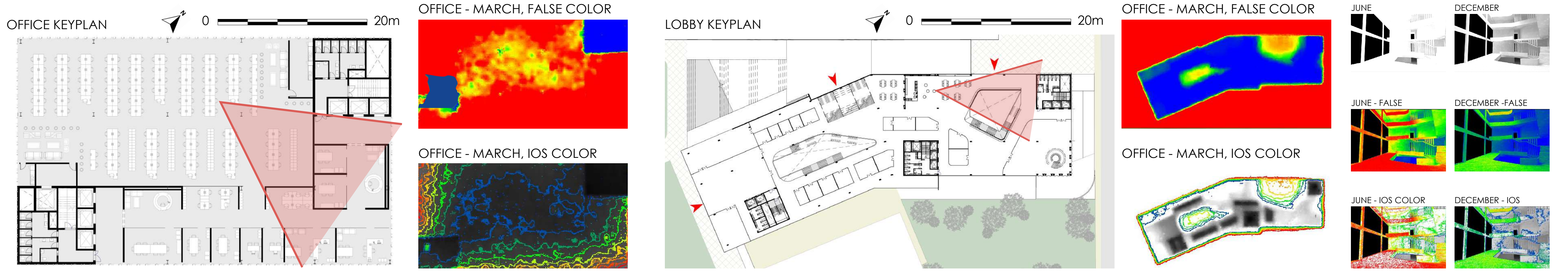
Environmental factors such as solar radiation, wind, temperature, sun path, humidity analyses are procured with grasshopper-ladybug plugin. Epw file is selected for Milan and applied on simplified simulation geometry. The results affected the design of the sun shading for windows in facade, the materials for facade, form and orientation of the building. The data of wind affected the building shape and orientation in the site.



## DAYLIGHT ANALYSIS - VELUX

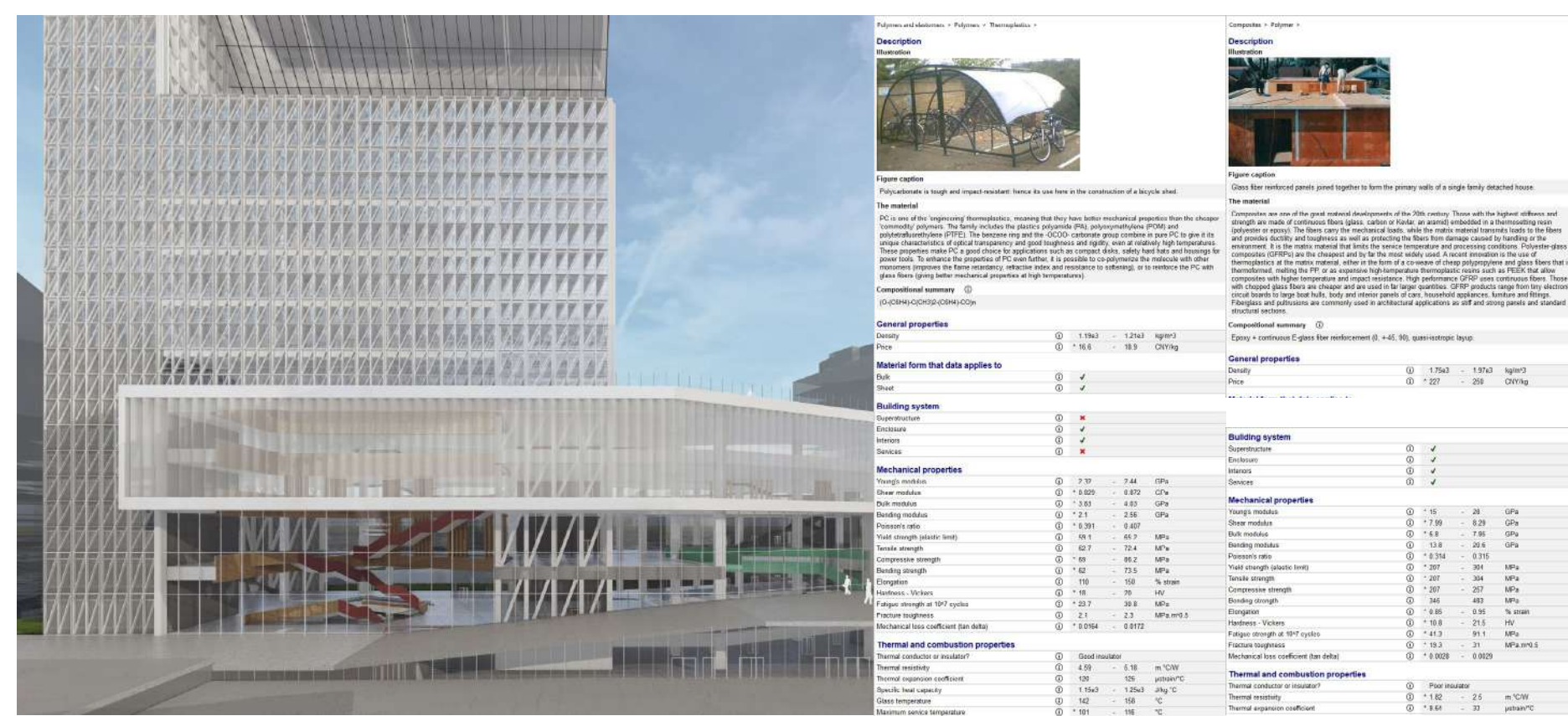
To behold and predict daylight levels and appearance of the interior spaces prior to the realization of the building, we took the merits of VELUX-Daylight Visualizer.

To fulfill the lighting simulations along the "BIM" process, we decided firstly to analyze two very different spatial configurations: the typical office floor with solar panel facade, and the lobby of the tower.



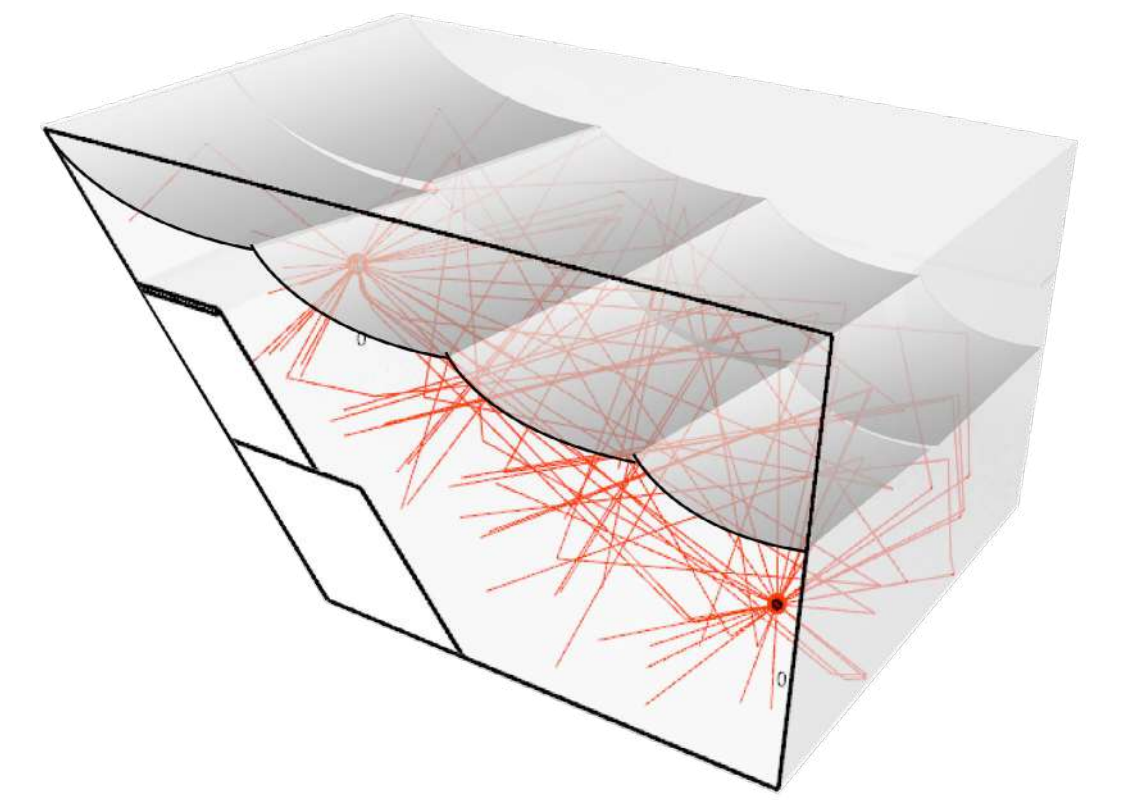
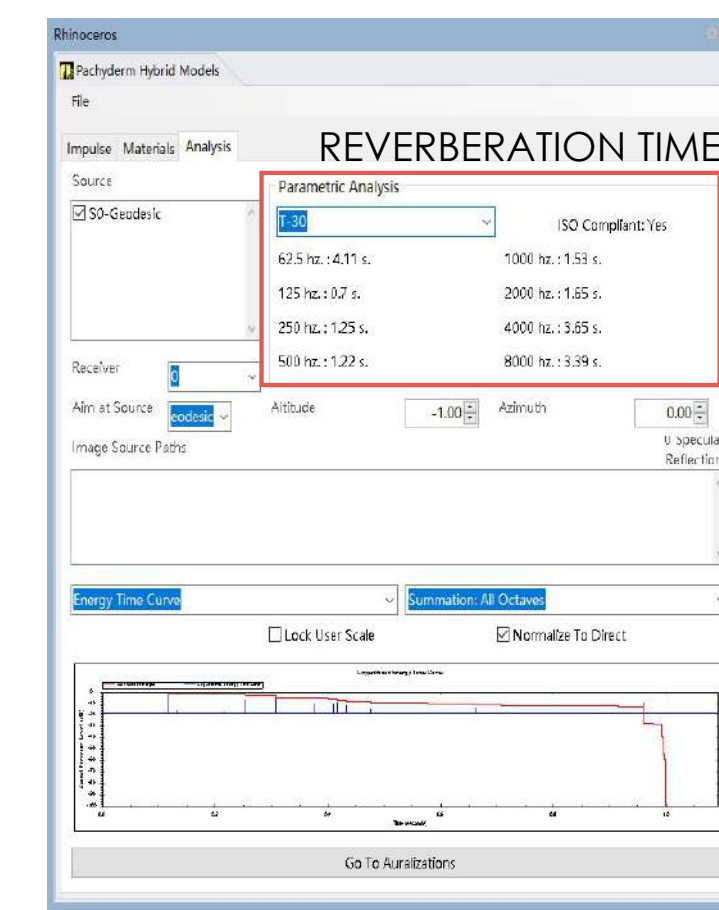
## MATERIAL PROPERTIES - CES EDUPACK | PACHYDERM

CES Edupack is a software selection of materials, including processes, joining and finishing. EduPack includes a database of materials and process information, materials selection tools and a range of supporting resources. Apart from seeing the material properties in this software, we can also get the embodied energy of the chosen material.



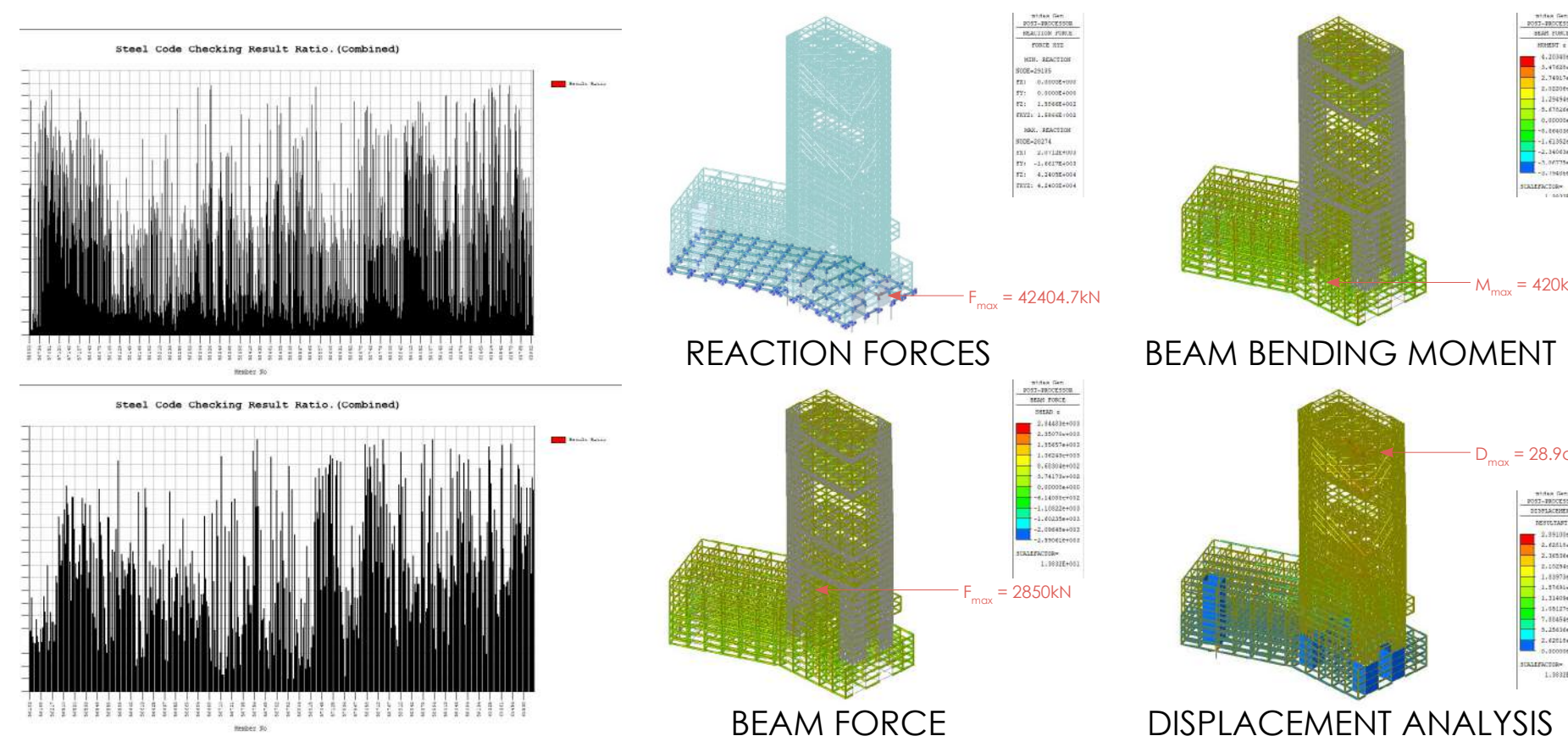
For the acoustic design of the auditorium, we adopted rhino and pachyderm plug-ins. This software helps us to better define the materials of the walls and acoustic board inside the auditorium.

For this space, we placed the sound source in the center of the stage, and each took the farthest audience position: the last row of seats in the second floor to test the reverberation and sound intensity of the sound.



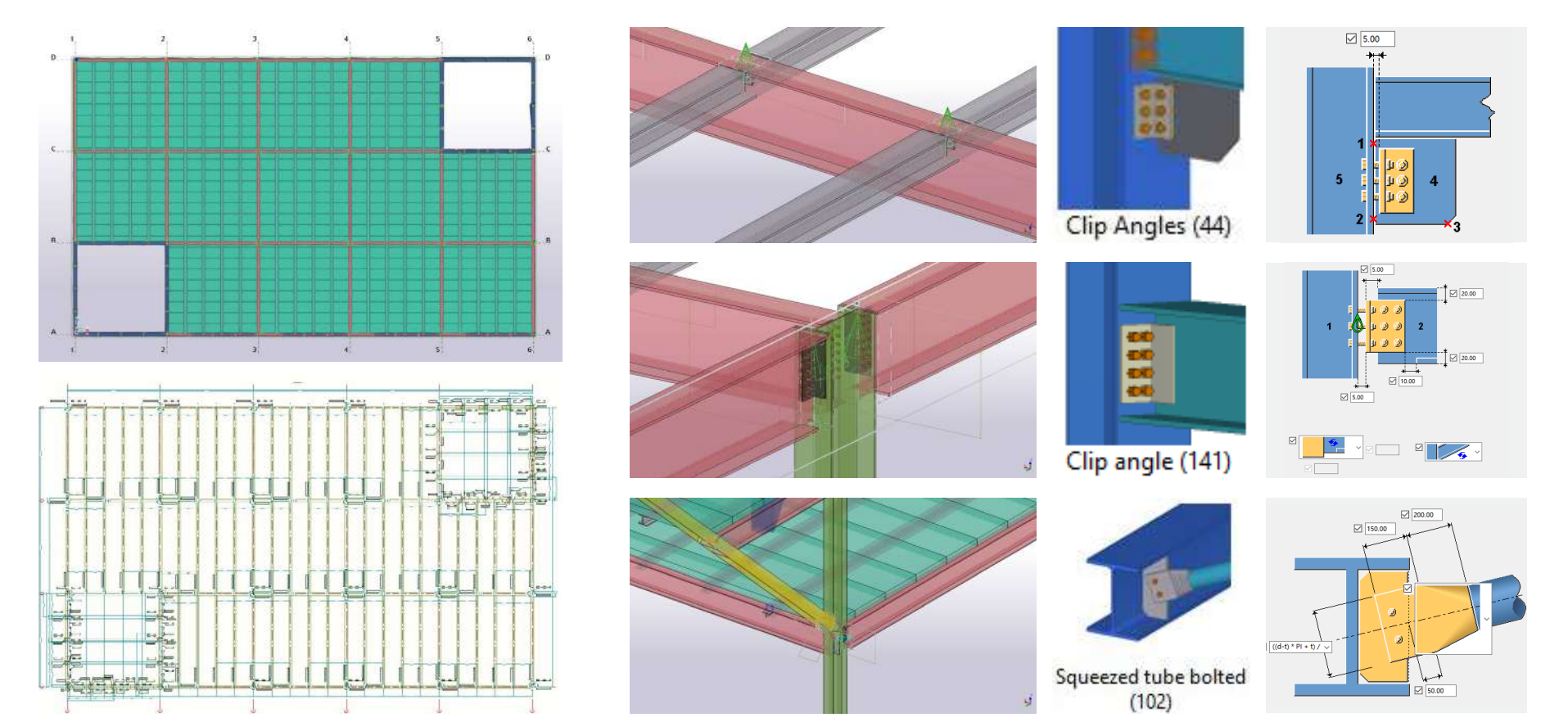
## STRUCTURE DESIGN - MIDAS | TEKLA

Midas Gen utilizes a diverse range of specialty finite element analysis functions as well as modern theories of structural analysis to render accurate and practical results. These features contribute to higher and unprecedented standards of convenience, efficiency, versatility and productivity for structural design.



Tekla Structures is a building information modeling software able to model structures that incorporate different kinds of building materials, including steel, concrete, timber and glass.

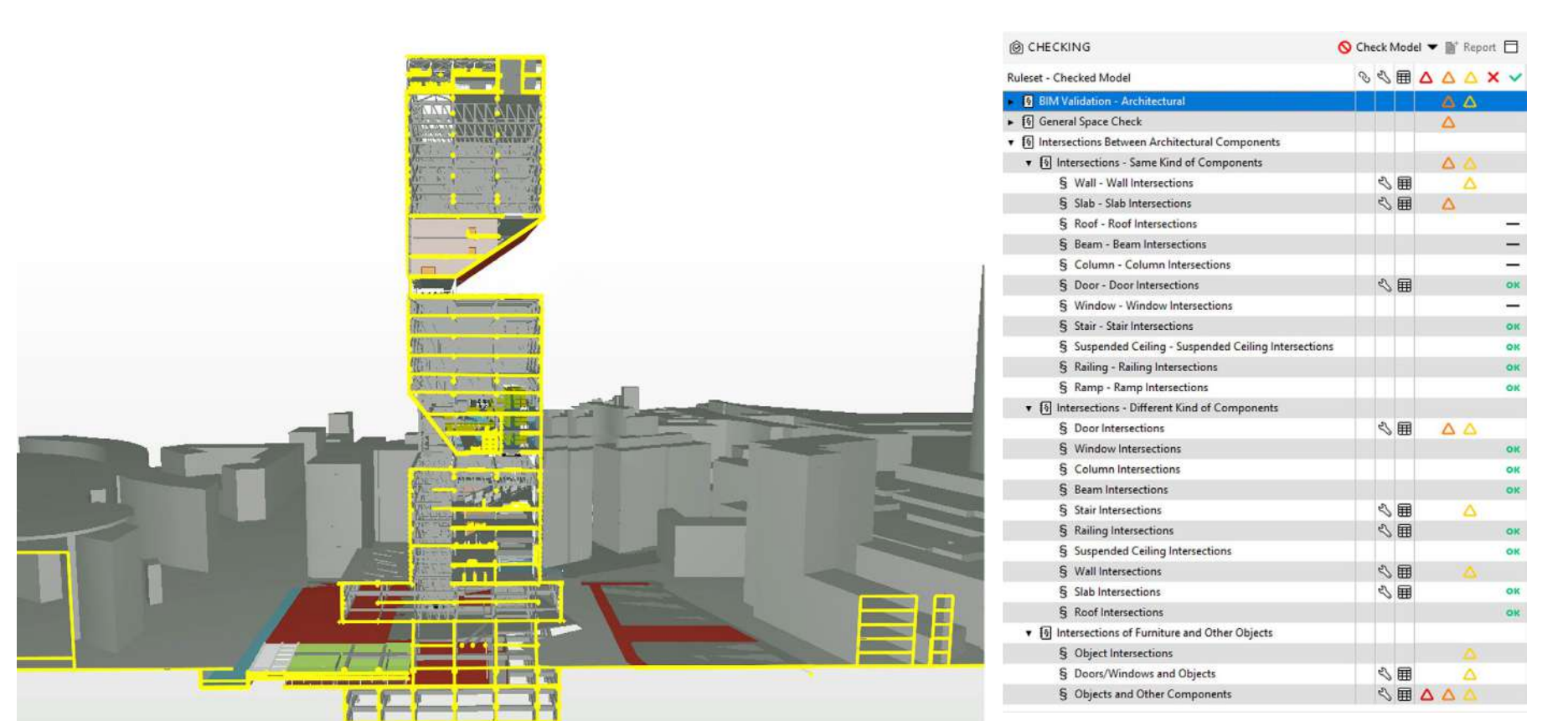
We use Tekla to define the joints of structural elements, which helps us to further define the details of the structure and understand the combination mode between the elements.



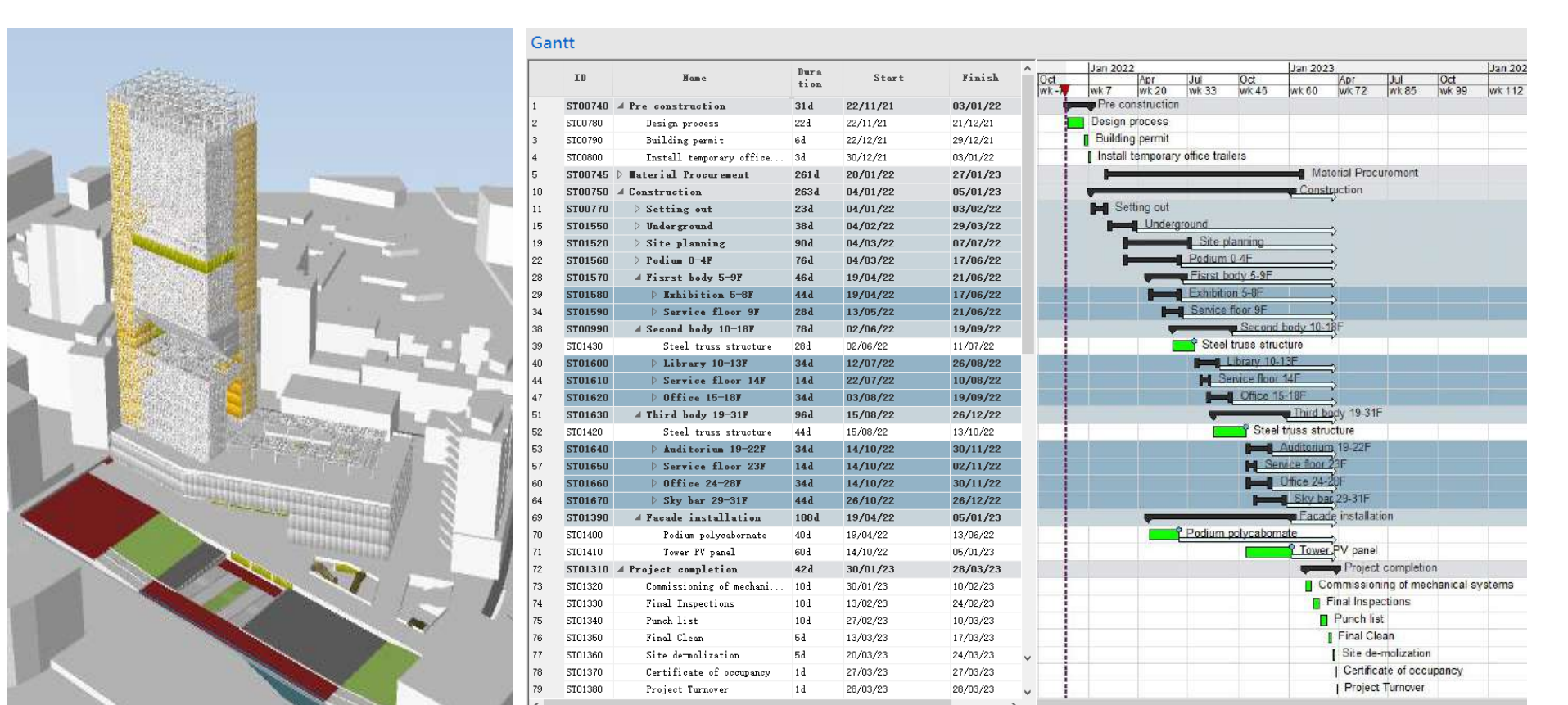
## BUILDING MANAGEMENT - SOLIBRI OFFICE | SYNCHRO PRO

Solibri is founded on the concept of Open BIM. Solibri Office can import building models from all major BIM software products by using the standardized IFC interface.

In our project, we applied Solibri office right after the 3D modelling finished, to make sure the model was without intersection. According to the result reports, we kept updating and modifying our Revit model, and arriving to the final version.



In the LOD500 stage, we use Synchro to evaluate the construction cycle of the project and seek a construction management plan that is faster and saves manpower, money, material resources and financial resources. According to the planning, the project will take 352 days to complete. Including 31 days for pre construction, 263 days for construction, and 42 days for project completion.

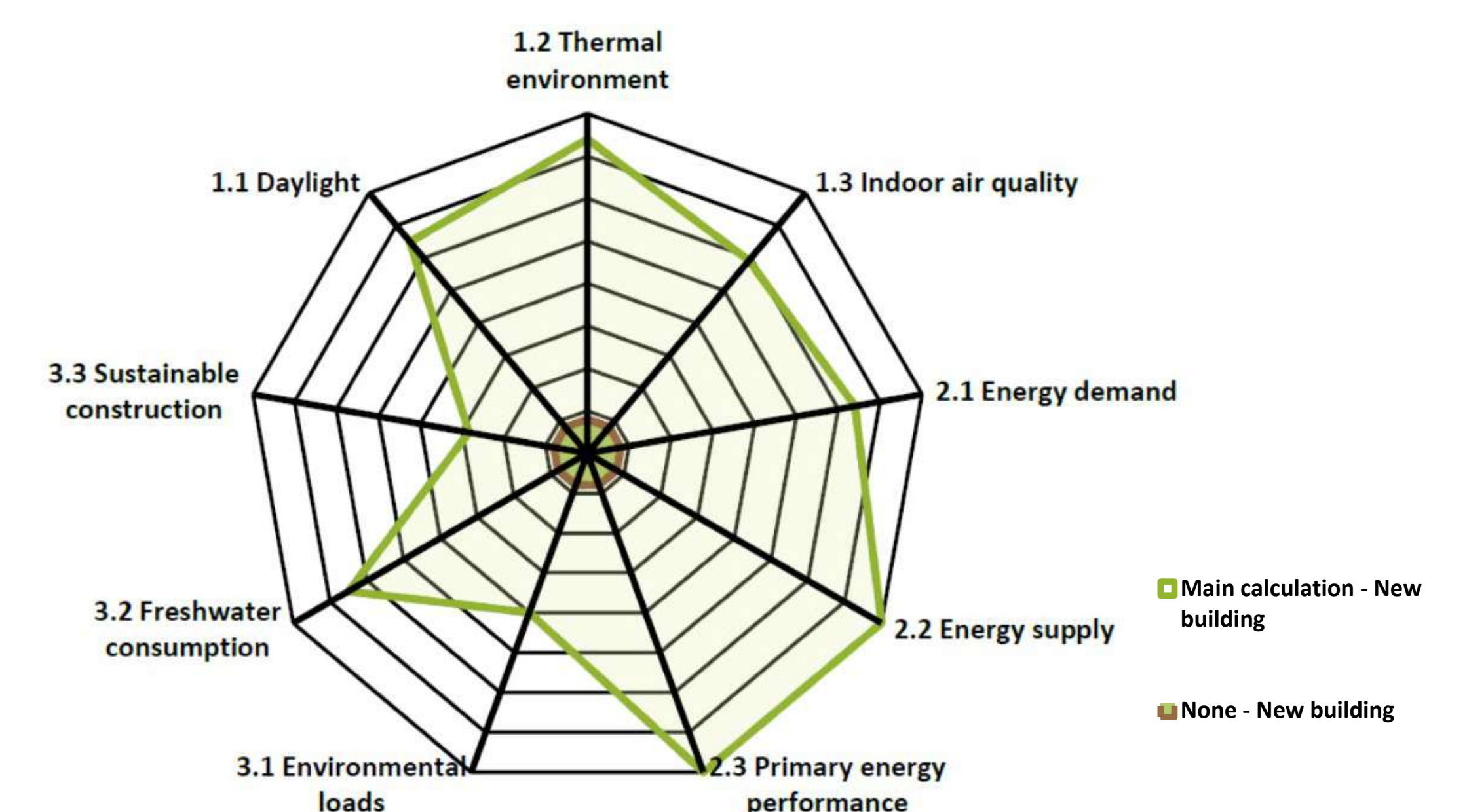


## ENERGY PERFORMANCE - ACTIVE HOUSE

ActiveHouse is a vision of how to create sustainable buildings anywhere in the world. These Specifications offer insight and knowledge needed to draw up the required technical specifications and design concept for an Active House. They include important issues to consider when creating an Active House. These issues can be qualitative or quantitative. The qualitative aspects describe aspects that influence the quality of a building or how it is being experienced by the user, but difficult to put a number on, such as having a view. The quantitative aspects form the basis for the Active House radar, that can be used as a communication instrument to display the quality of an Active House in an instant.

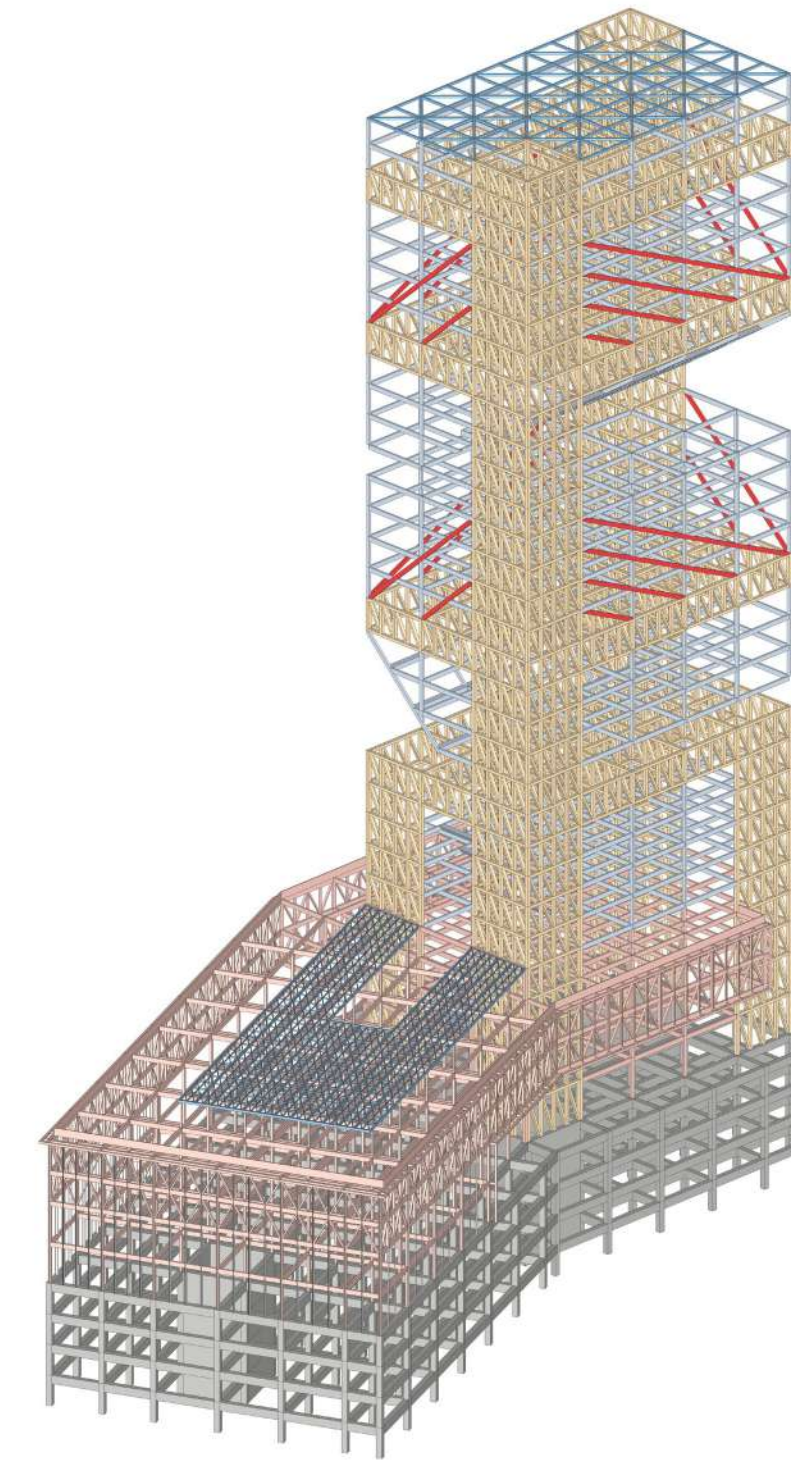
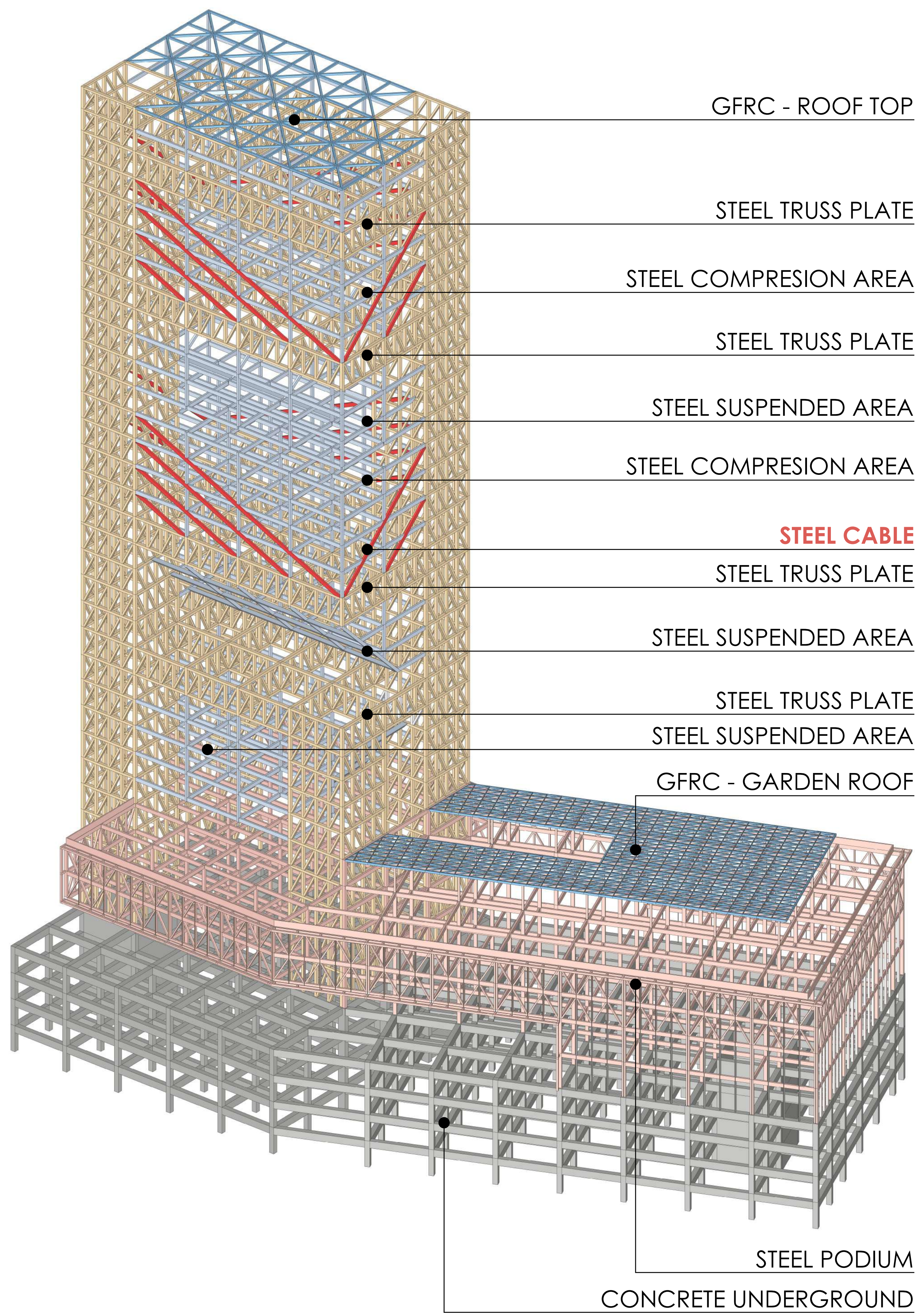
activehouse.INFO  
NETWORK AND KNOWLEDGE SHARING

Main calculation - New building		
<b>Comfort</b>	Value	Category
1.1 Daylight:	3.7 %	1.8
1.2 Thermal environment:	Better level	1.3
1.3 Indoor air quality:	≤ 1000 ppm	2.0
<b>Energy</b>	Value	Category
2.1 Energy demand:	56.0 kWh/m <sup>2</sup>	1.8
2.2 Energy supply:	153.0 kWh/m <sup>2</sup>	1.0
2.3 Primary energy:	-90.0 kWh/m <sup>2</sup>	1.0
<b>Environment</b>	Value	Category
3.1 Environmental loads:	Good level	3.0
3.2 Freshwater:	35 % savings	1.8
3.3 Sustainable construction:	Better level	3.6

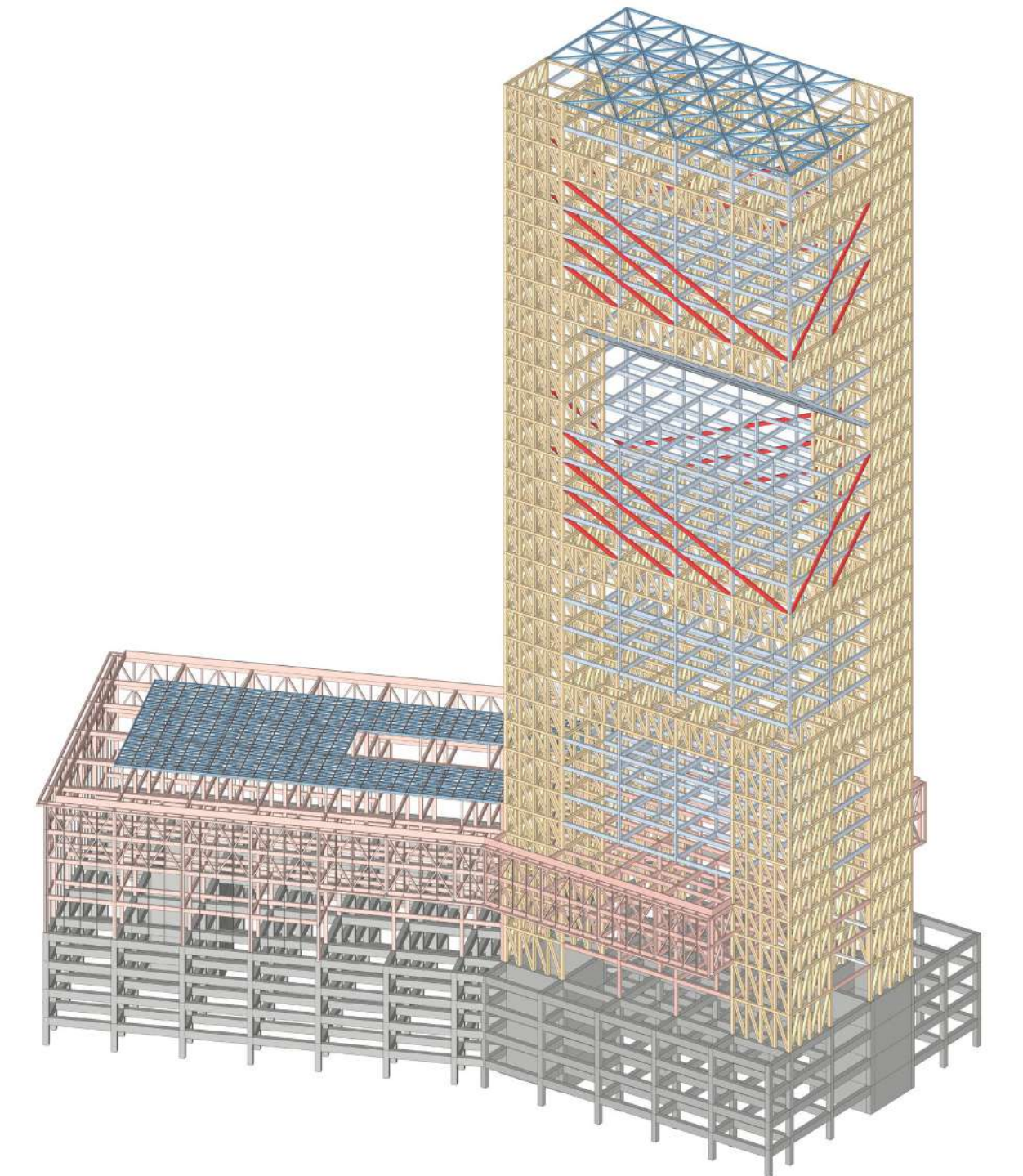




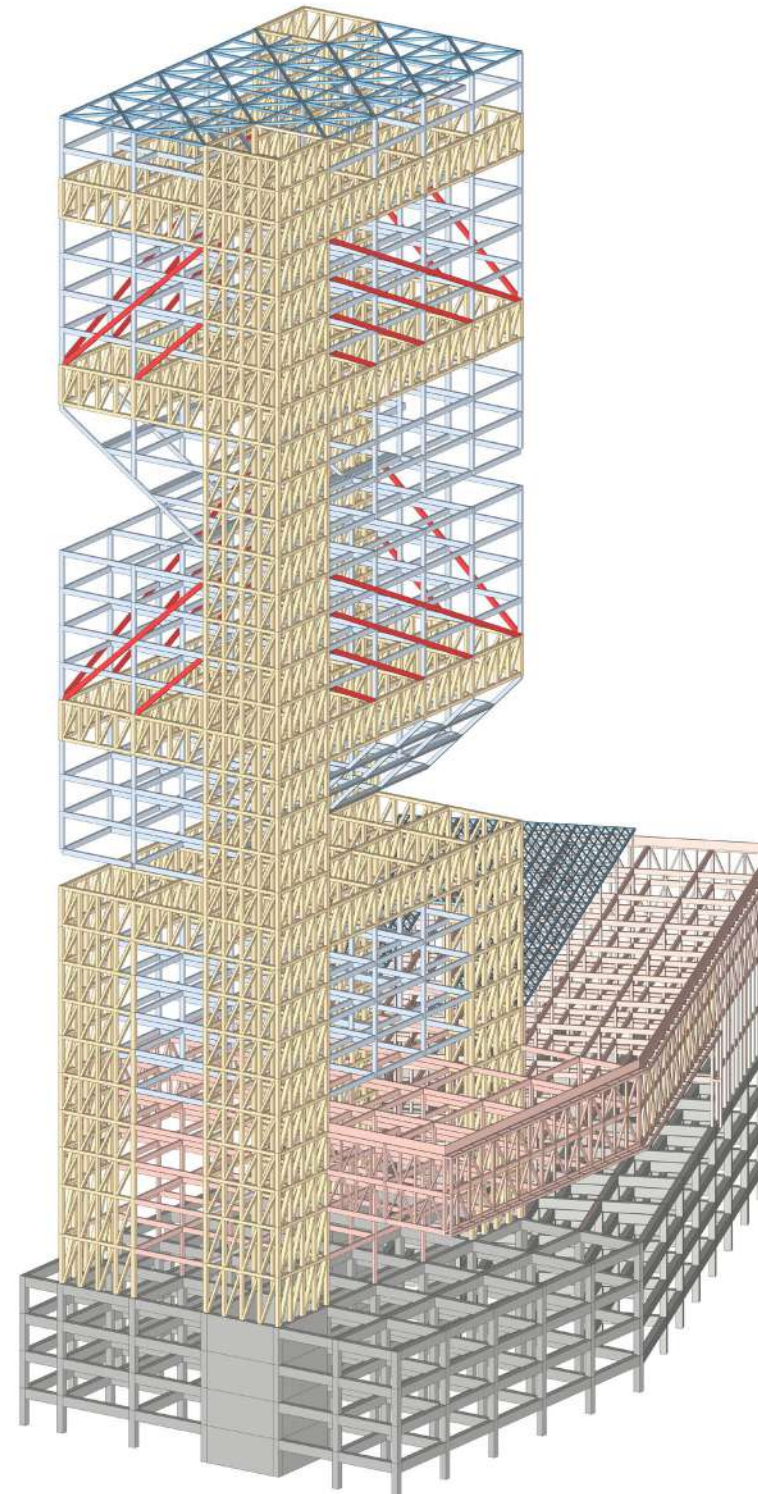
### 3D BEHAVIOR



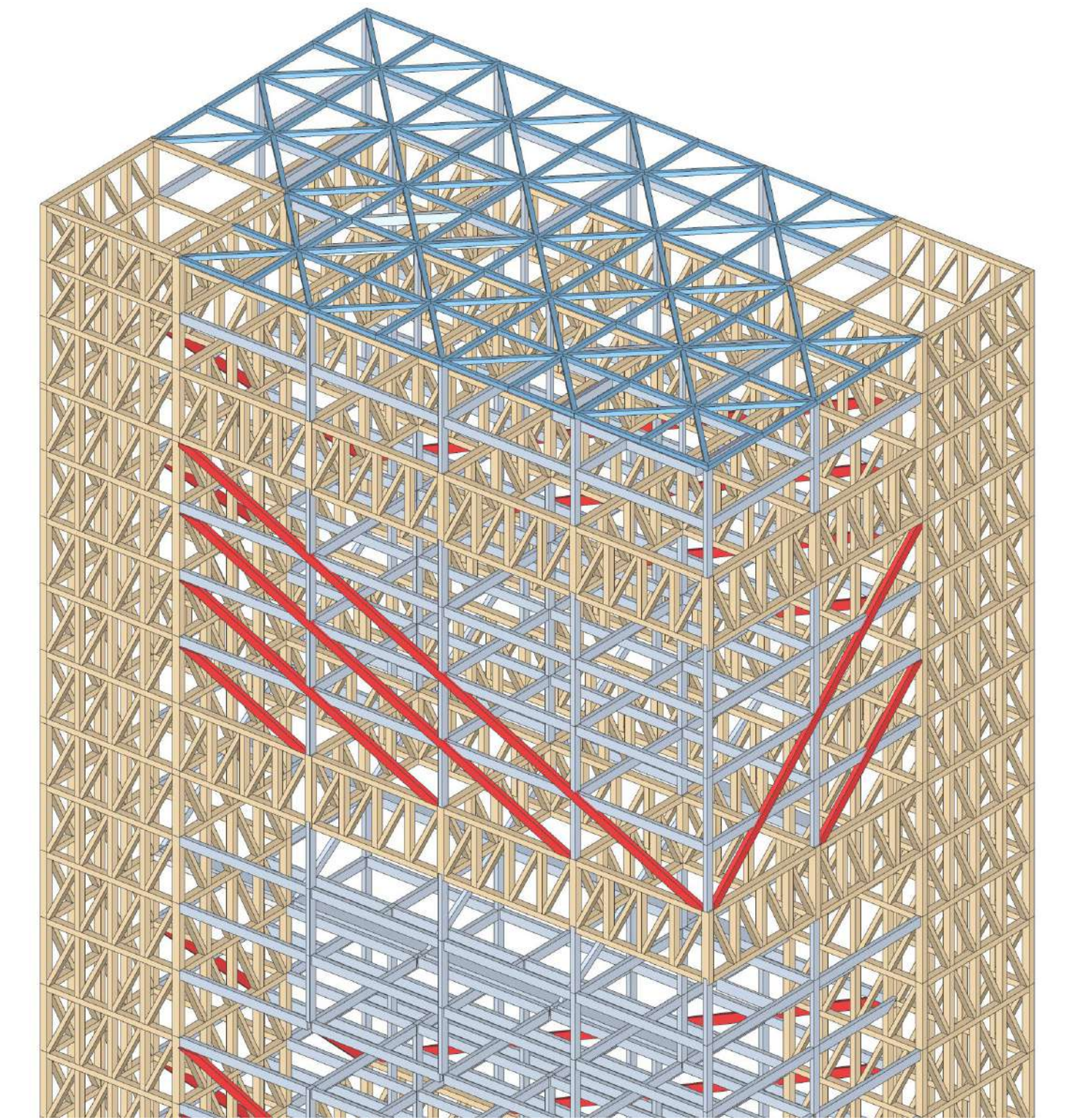
SOUTH OF STRUCTURE SCHEME



EAST OF STRUCTURE SCHEME



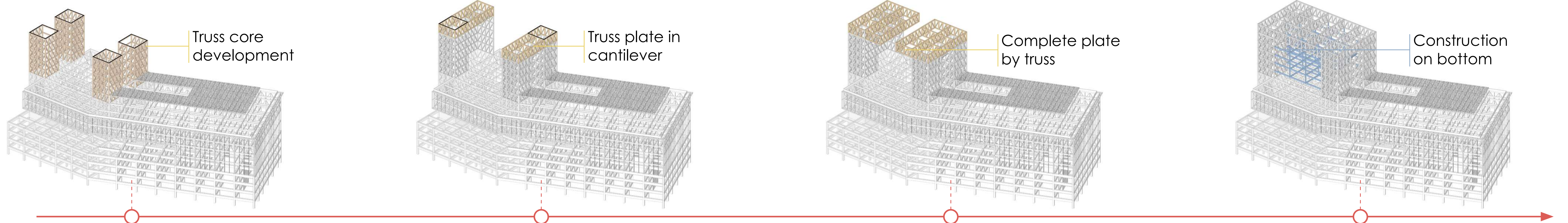
NORTH OF STRUCTURE SCHEME



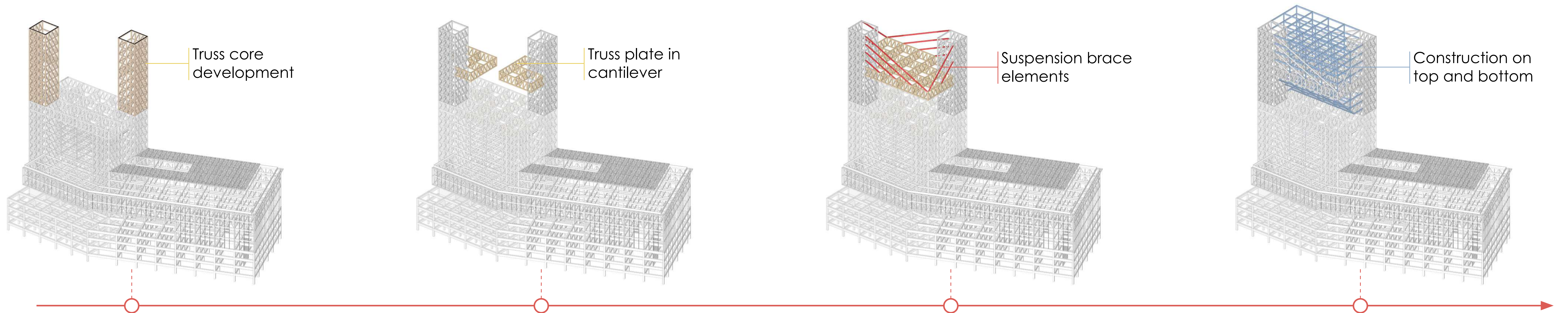
DETAIL OF STRUCTURE SCHEME

### CONSTRUCTION SEQUENCES

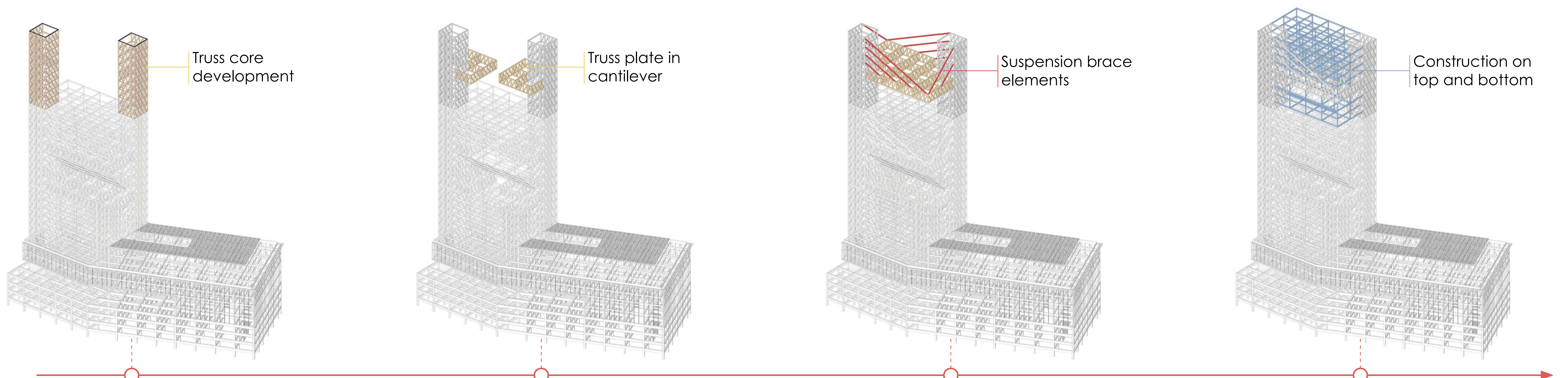
01  
BODY



02  
BODY

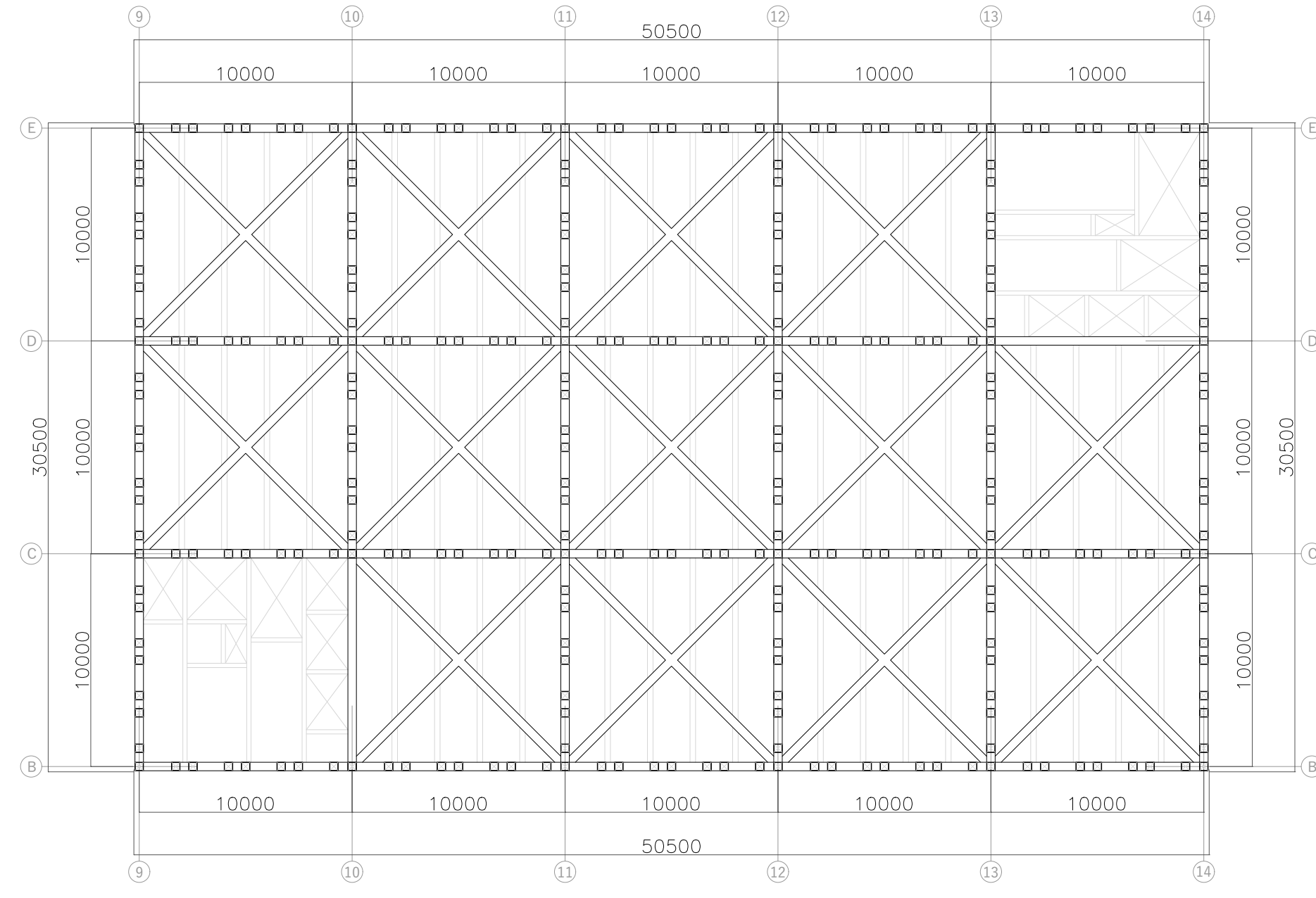
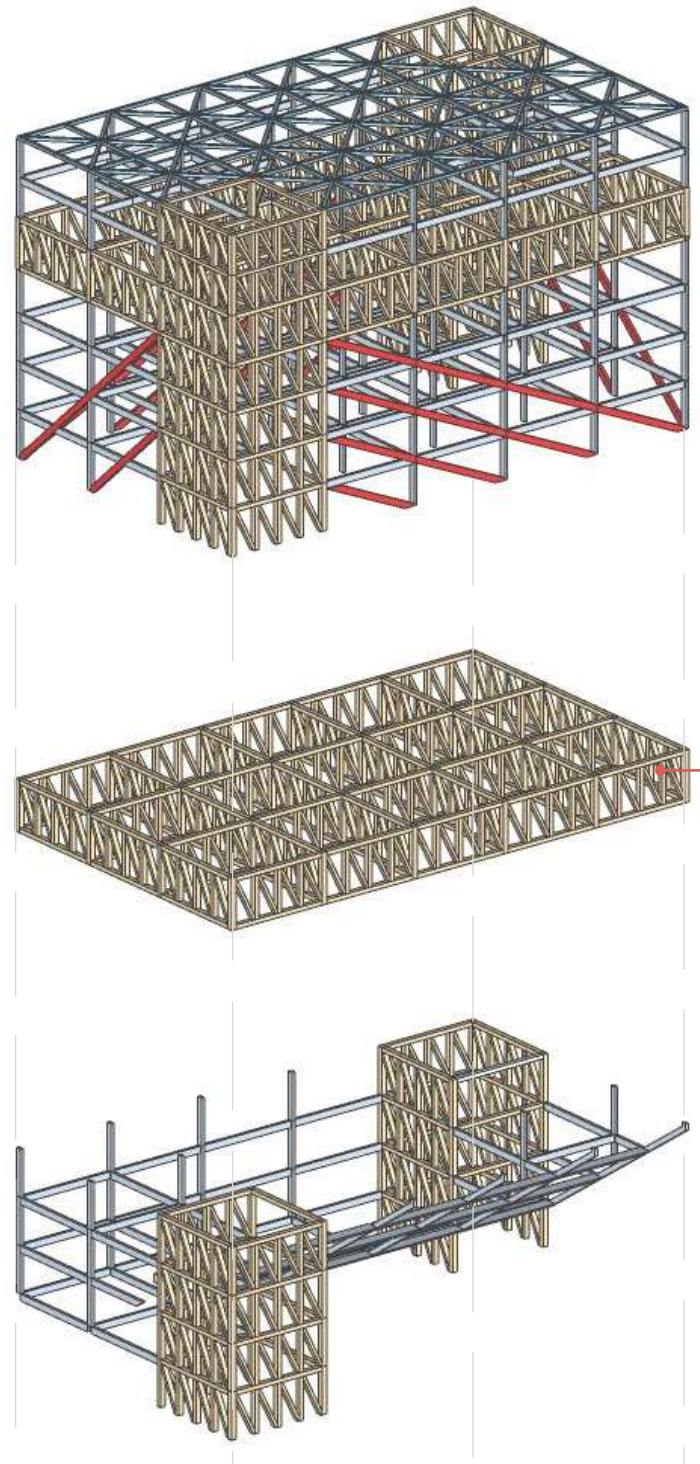


03  
BODY

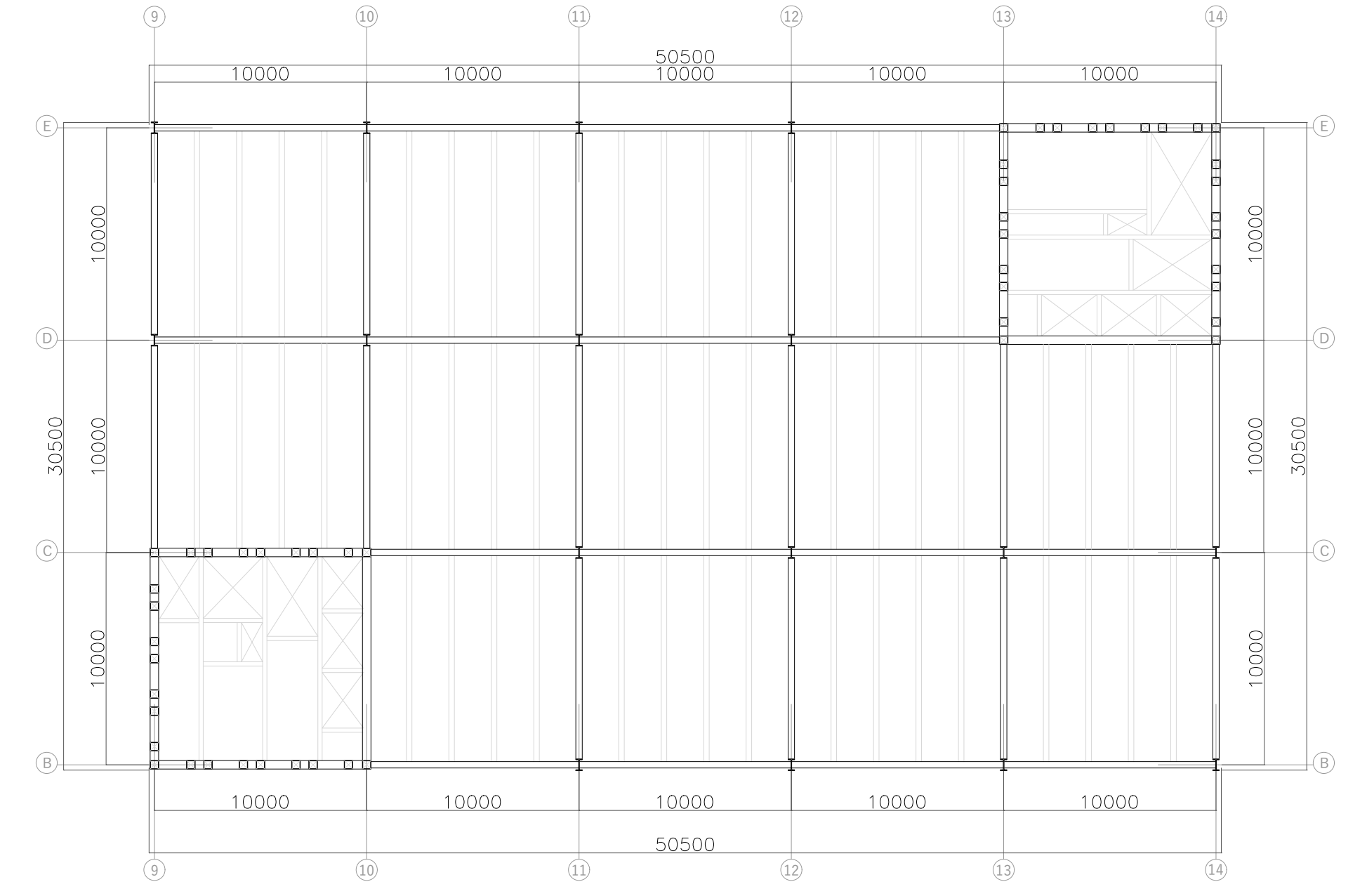


# STRUCTURE PLAN

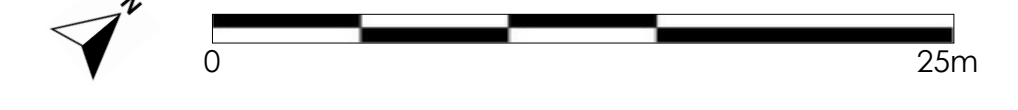
03  
BODY



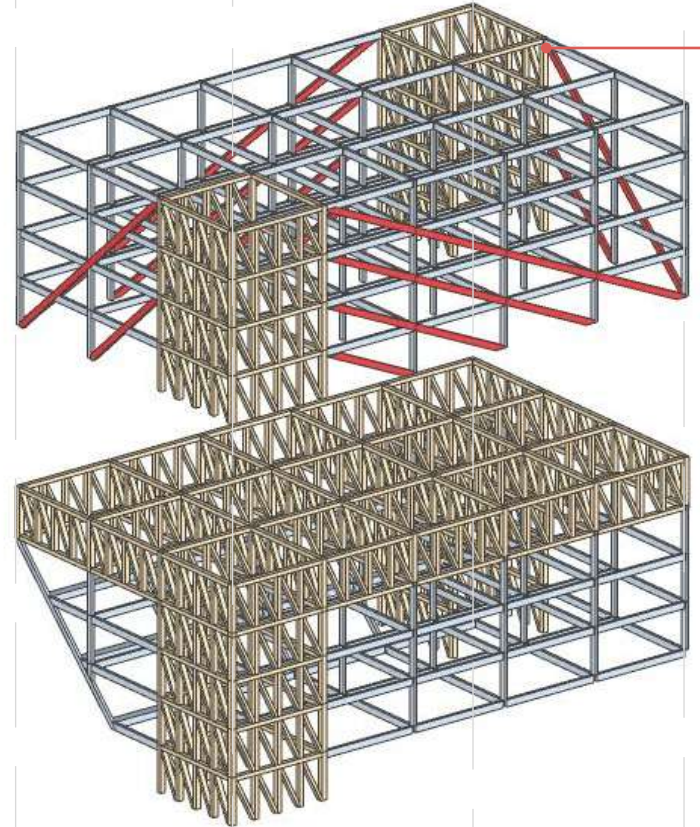
TOWER TRUSS PLATE STRUCTURAL LAYOUT 1:250



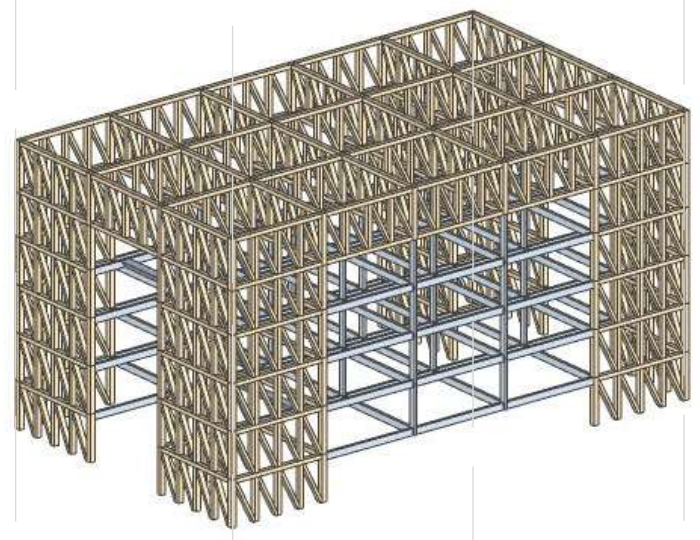
TOWER OFFICE FLOOR STRUCTURAL LAYOUT 1:250



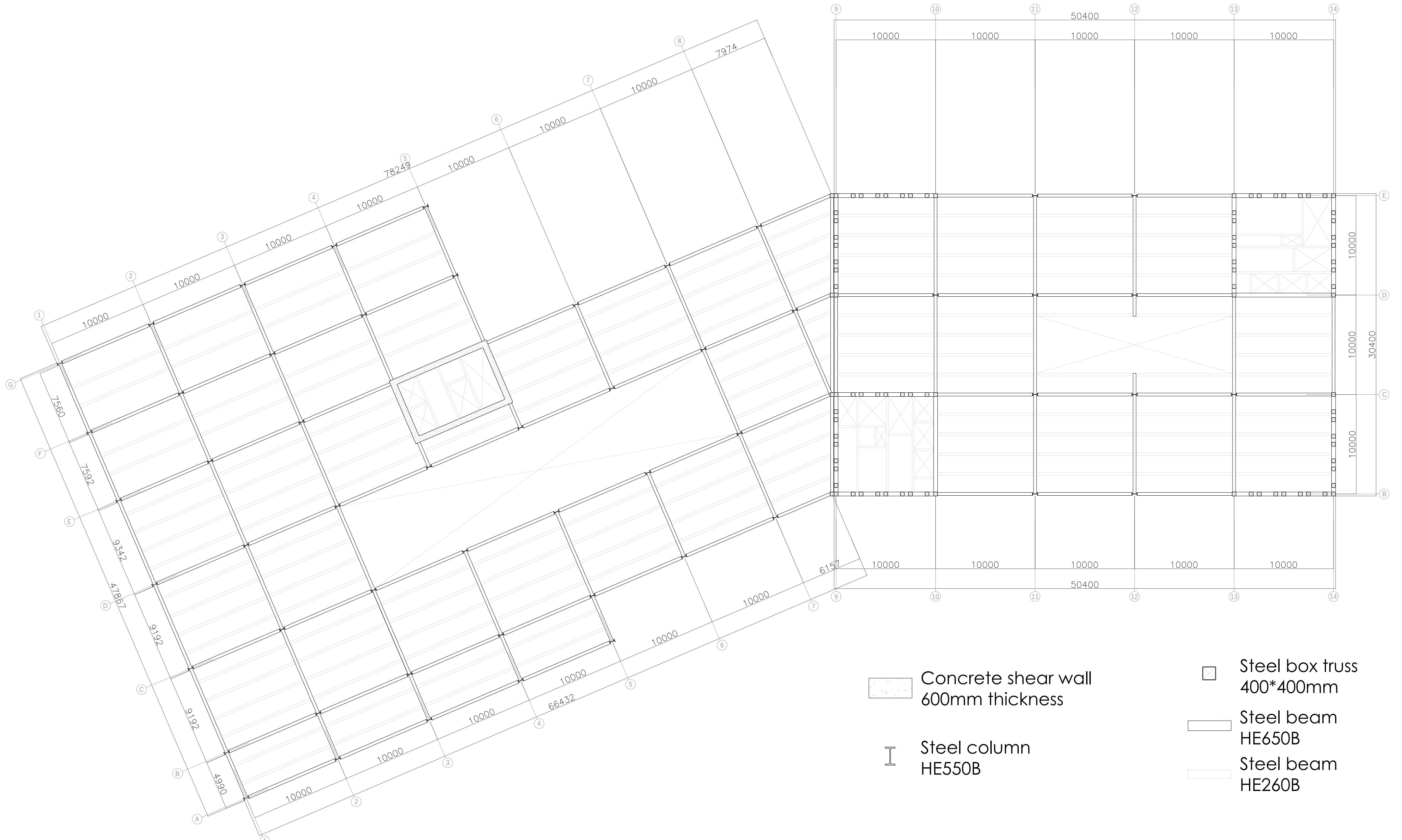
02  
BODY



01  
BODY



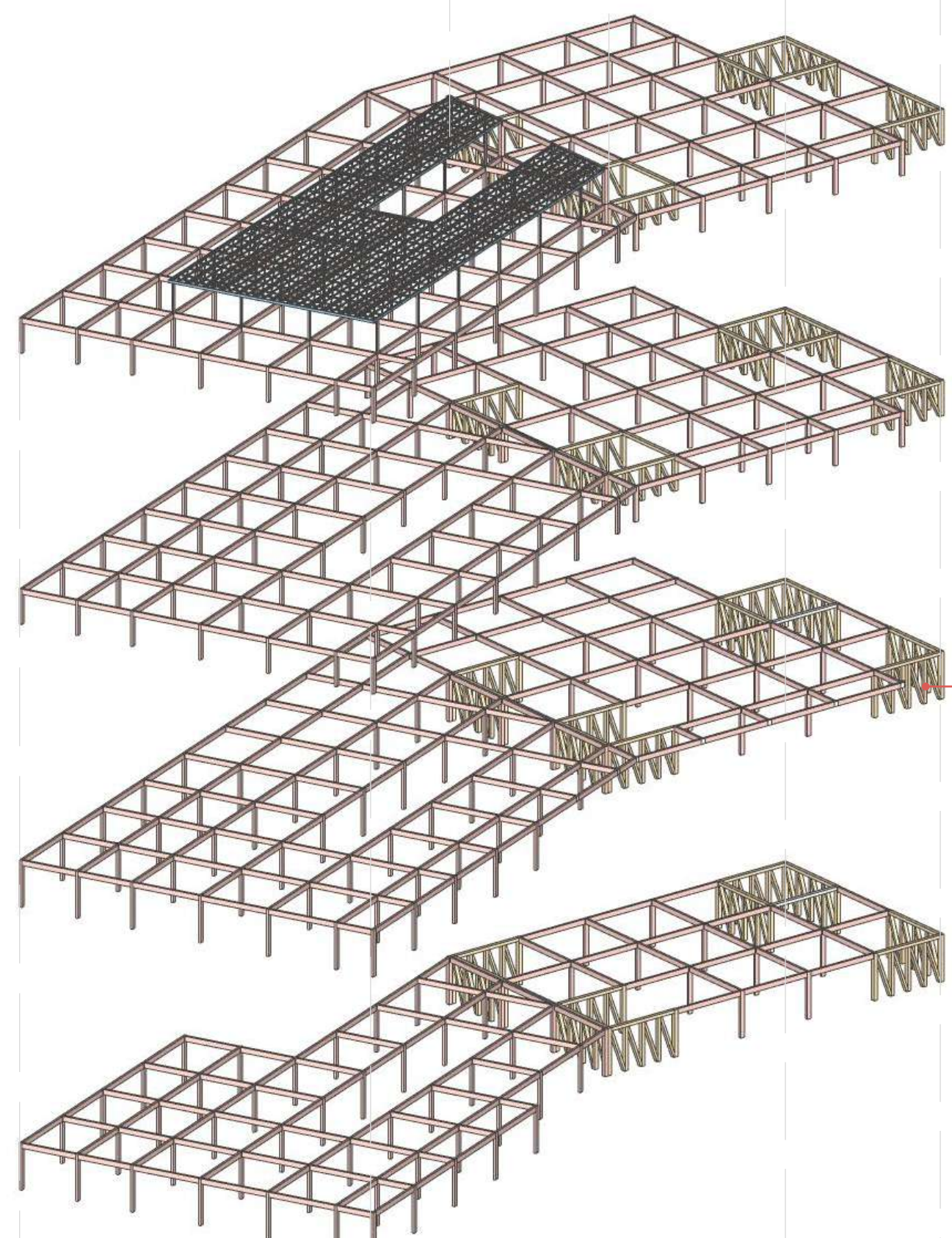
STEEL | TOWER



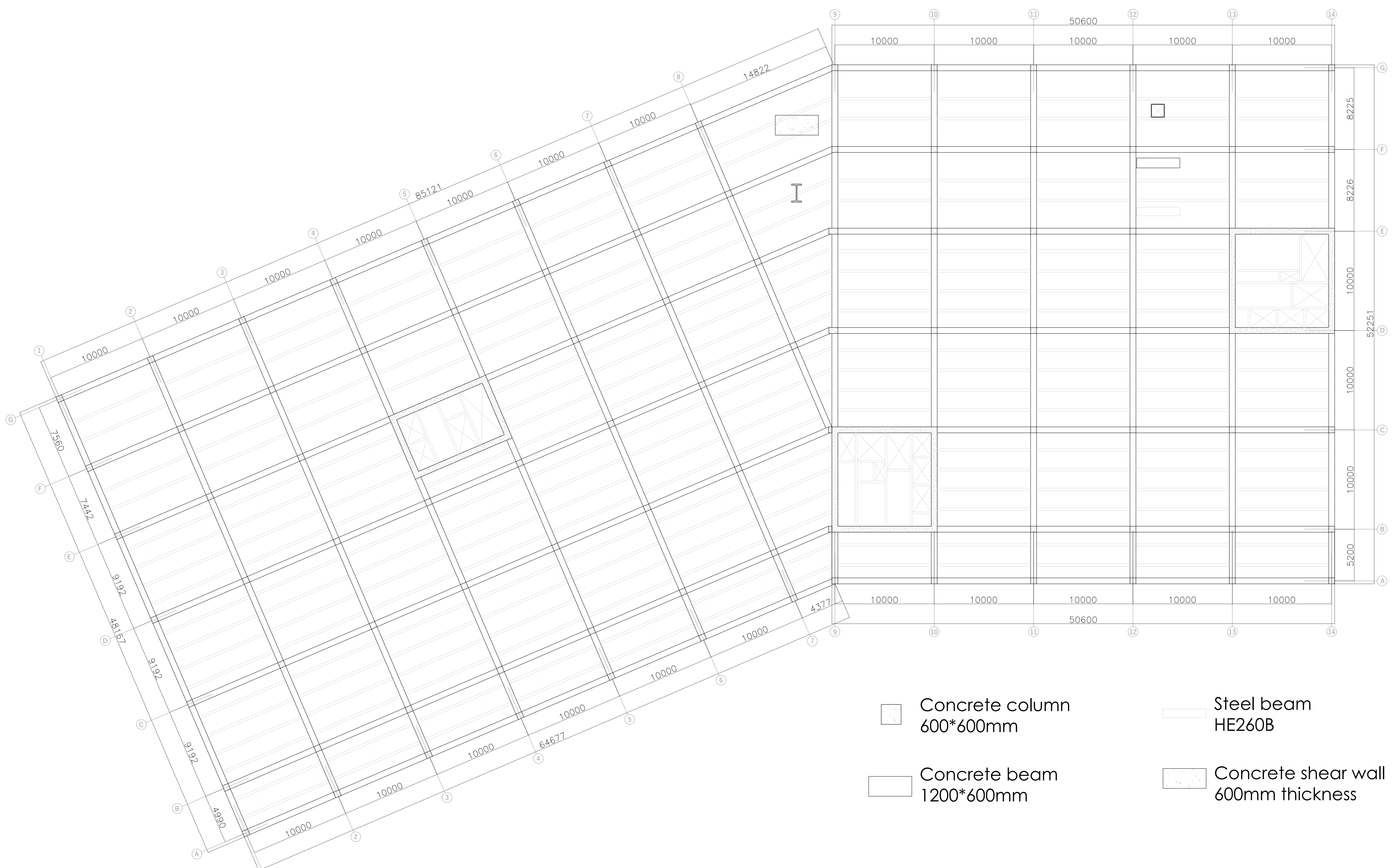
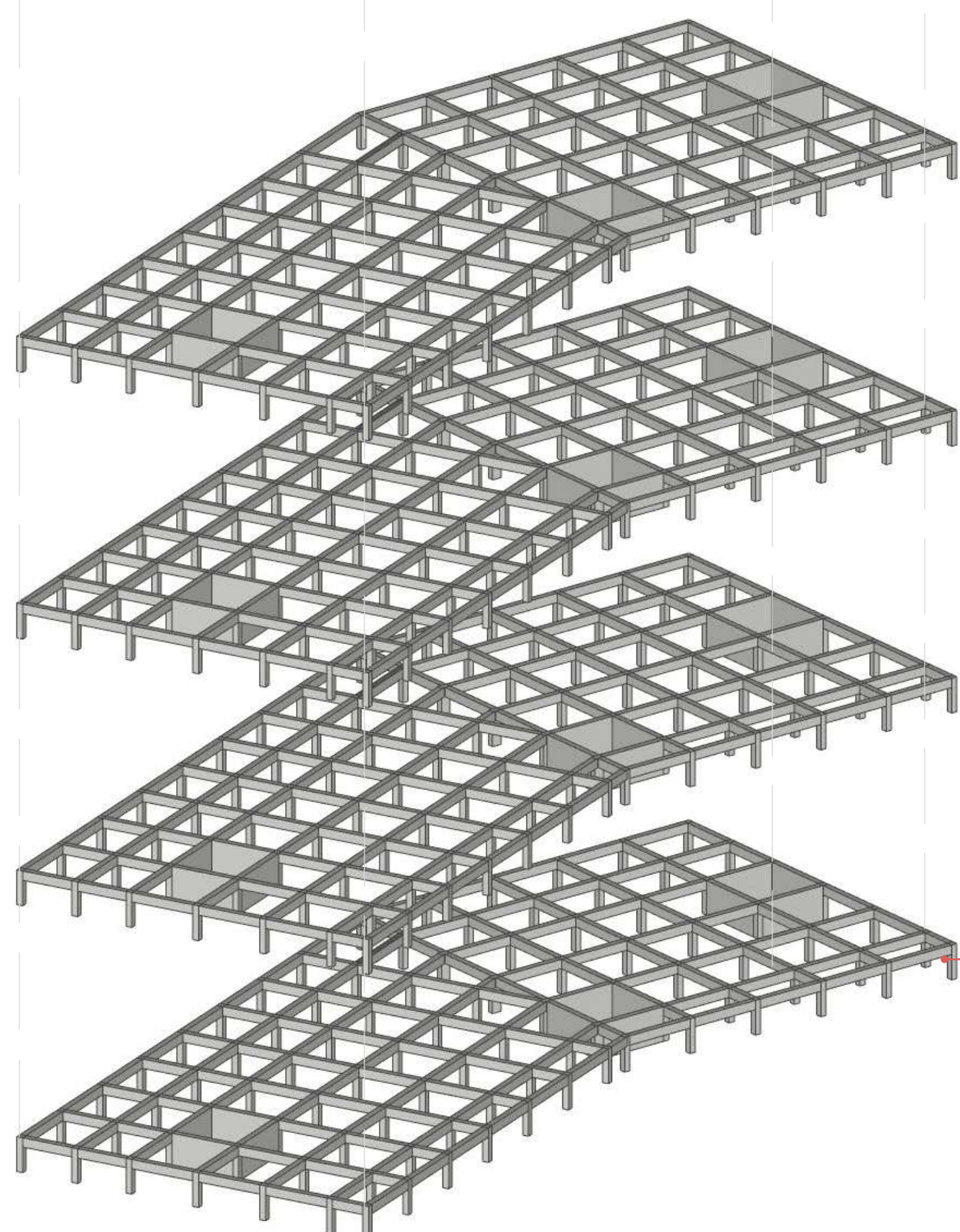
PODIUM STRUCTURAL LAYOUT 1:250



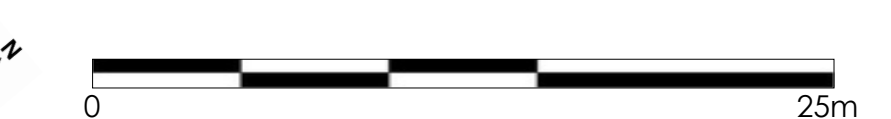
STEEL | PODIUM



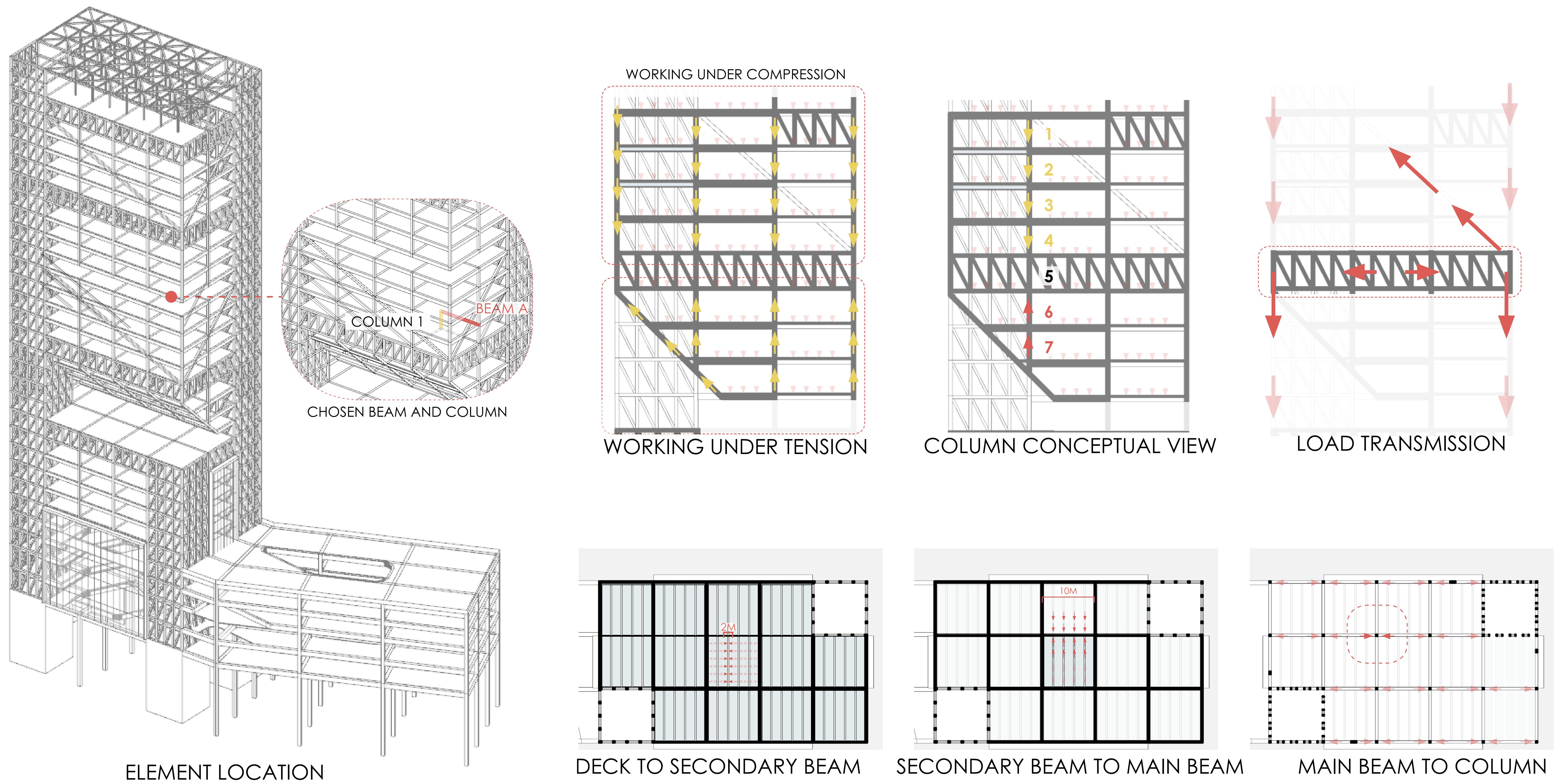
CONCRETE | UNDERGROUND PARKING



UNDERGROUND STRUCTURAL LAYOUT 1:250

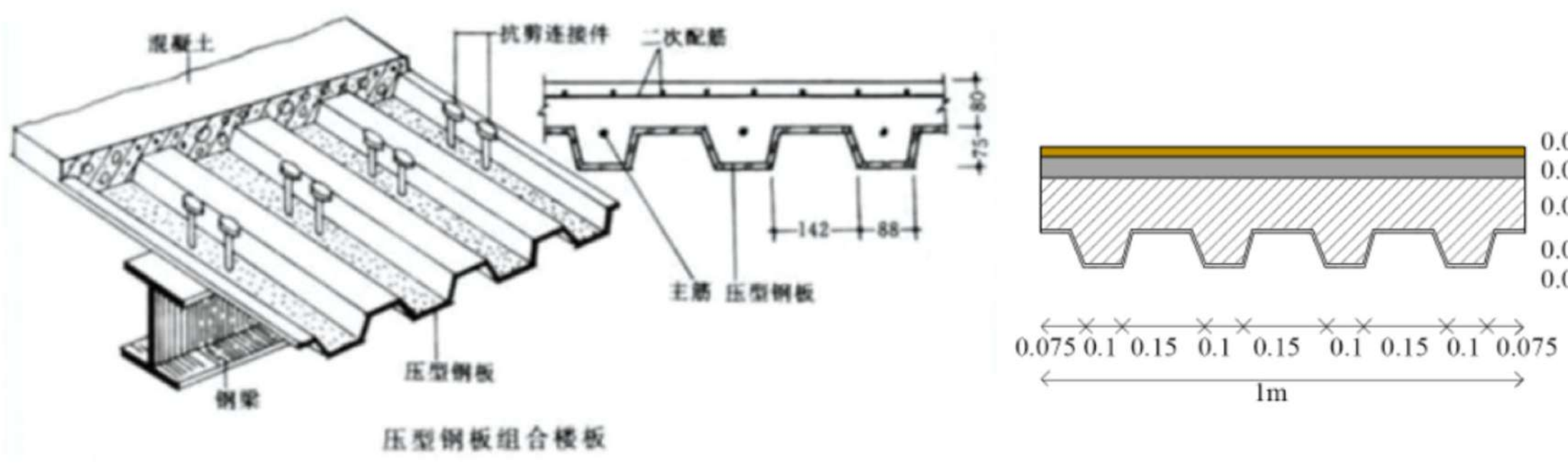


## STRUCTURE SCHEME



## STRUCTURE CALCULATION

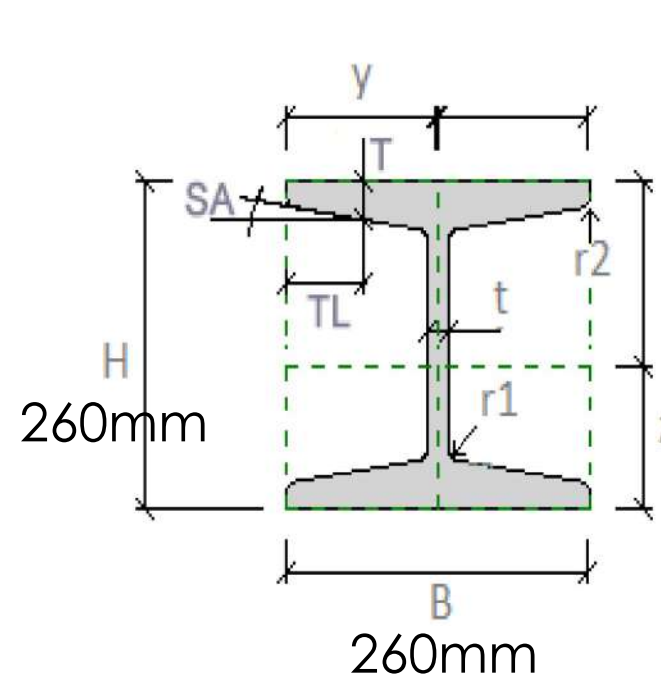
### SLAB SELECTION



Layer	Length	Width	Height	Volumetric weight	Weight
Ceramic	1.0 m	1.0 m	0.02 m	20 kN/m <sup>3</sup>	0.4 kN/m <sup>2</sup>
Levelling	1.0 m	1.0 m	0.02 m	20 kN/m <sup>3</sup>	0.4 kN/m <sup>2</sup>
Concrete layer	1.0 m	1.0 m	0.08 m	25 kN/m <sup>3</sup>	2.0 kN/m <sup>2</sup>
Concrete ribs	1.0 m	0.4 m	0.077 m	25 kN/m <sup>3</sup>	0.8 kN/m <sup>2</sup>
Steel	1.0 m	1.0 m	0.003 m	78.5 kN/m <sup>3</sup>	0.2 kN/m <sup>2</sup>
<b>Area load G2</b>			<b>0.2 m</b>		<b>3.8 kN/m<sup>2</sup></b>

SLAB COMBINATION: Pressed steel plate  
FLOOR SELF WEIGHT: G2=3.8kN/m<sup>2</sup>

### SECONDARY BEAM: HE 260B



<b>B</b>	<b>26 cm</b>	<b>0.26 m</b>
<b>H</b>	<b>26 cm</b>	<b>0.26 m</b>
<b>Linear weight</b>	<b>93 kg/m</b>	<b>0.93 kN/m</b>
<b>Linear load G1</b>		<b>0.9 kN/m</b>

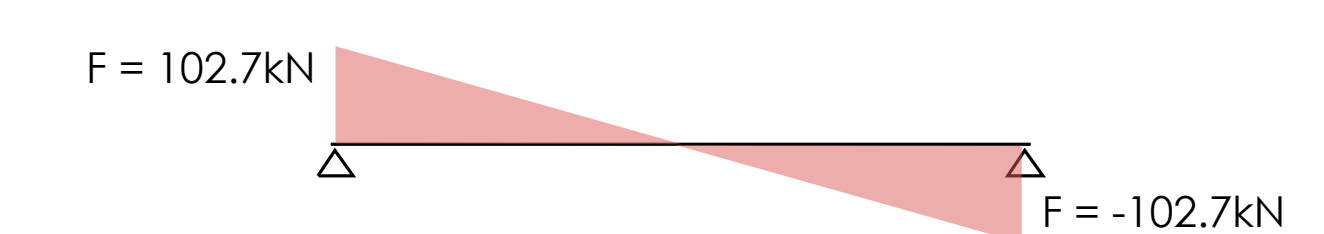
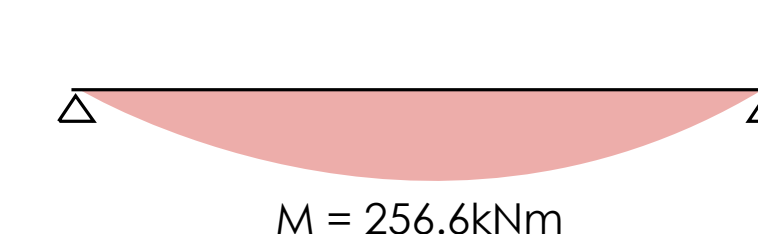
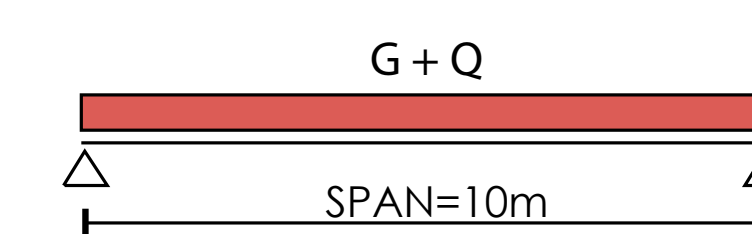
	G	I <sub>y</sub>	W <sub>el,y</sub>	W <sub>pl,y</sub>	i <sub>y</sub>	A <sub>cz</sub>
	kg/m	x 10 <sup>4</sup>	x 10 <sup>3</sup>	x 10 <sup>3</sup>	x 10	x 10 <sup>2</sup>
HE 260 AA	54,10	7 981	654,10	714,50	10,76	24,75
HE 260 A	68,20	10 450	836,40	919,80	10,97	28,76
HE 260 B	93	14 920	1 148	1 283	11,22	37,59
HE 260 M	172	31 310	2 159	2 524	11,94	66,89

BEAM TYPE: HE 260 B  
BEAM LINEAR LOAD: g1=0.9kN/m

1. LOAD COMBINATION  
BEAM LENGTH: L=10m  
LOAD COMBINATION ULS = 20.5kN/m

2. EXTERNAL BENDING MOMENT  
 $M_{ed} = Q_{uls} L^2/8 = 256.6kNm$

3. SHEAR FORCE  
 $F = Q_{uls} L/2 = 102.7kN$

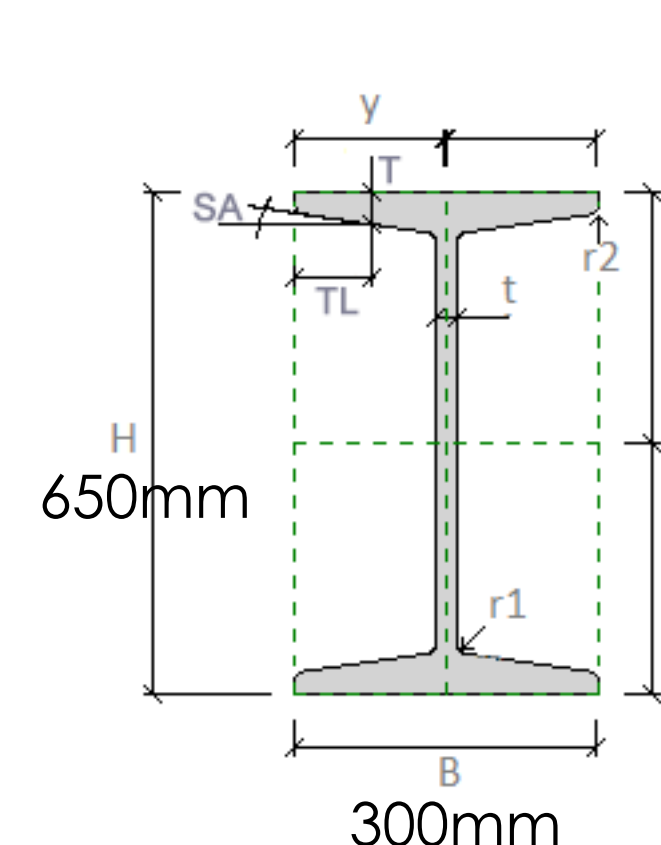


4. ULS - VARIFICATION  
 $W_{pl} = 1256 \cdot 10^3 mm^3 < W_{max} = 1383 \cdot 10^3 mm^3$   
**VERIFIED**

5. SLS - DEFORMATION  
 $\Delta_{TOT} = 7mm < \Delta_{TOT}max = 40mm$   
**VERIFIED**

$\Delta_{LIVE} = 3mm < \Delta_{LIVE}max = 33mm$   
**VERIFIED**

### PRIMARY BEAM: HE 650B



<b>B</b>	<b>30 cm</b>	<b>0.3 m</b>
<b>H</b>	<b>65 cm</b>	<b>0.65 m</b>
<b>Linear weight</b>	<b>225 kg/m</b>	<b>2.25 kN/m</b>
<b>Linear load G1</b>		<b>2.3 kN/m</b>

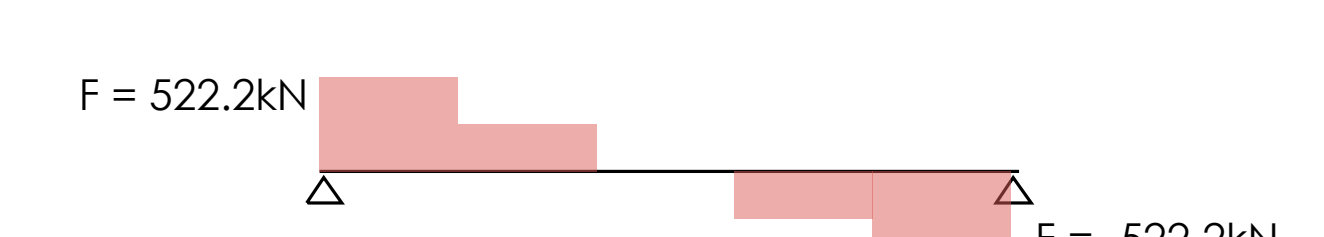
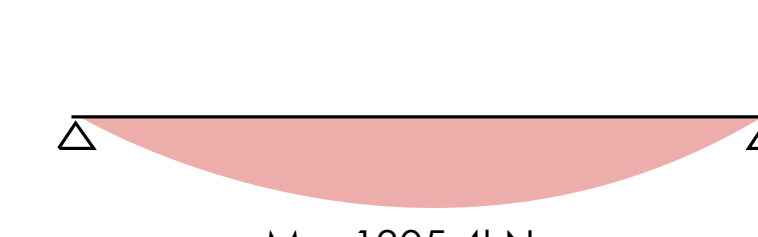
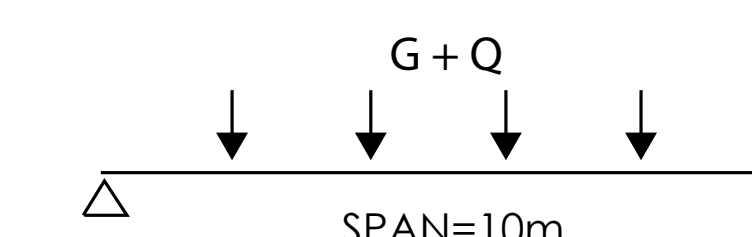
	G	I <sub>y</sub>	W <sub>el,y</sub>	W <sub>pl,y</sub>	i <sub>y</sub>	A <sub>cz</sub>
	kg/m	x 10 <sup>4</sup>	x 10 <sup>3</sup>	x 10 <sup>3</sup>	x 10	x 10 <sup>2</sup>
HE 600 AA	129	91 900	3 218	3 623	23,66	81,29
HE 600 A	178	141 200	4 787	5 350	24,97	93,21
HE 600 B	212	171 000	5 701	6 425	25,17	110,80
HE 600 M	285	237 400	7 660	8 772	25,55	149,70

BEAM TYPE: HE 650 B  
BEAM LINEAR LOAD: G1=2.3kN/m

1. LOAD COMBINATION  
BEAM LENGTH: L=10m  
LOAD COMBINATION ULS = 104.4kN/m

2. EXTERNAL BENDING MOMENT  
 $M_{ed} = Q_{uls} L^2/8 = 1305.4kNm$

3. SHEAR FORCE  
 $F = Q_{uls} L/2 = 522.2kN$

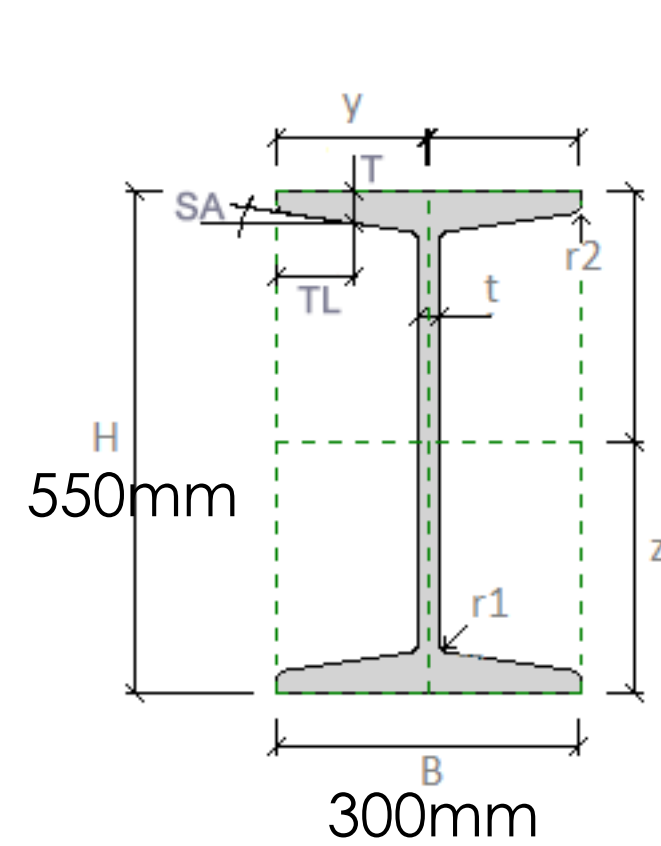


4. ULS - VARIFICATION  
 $W_{pl} = 6388 \cdot 10^3 mm^3 < W_{max} = 7320 \cdot 10^3 mm^3$   
**VERIFIED**

5. SLS - DEFORMATION  
 $\Delta_{TOT} = 6mm < \Delta_{TOT}max = 40mm$   
**VERIFIED**

$\Delta_{LIVE} = 2mm < \Delta_{LIVE}max = 33mm$   
**VERIFIED**

### COLUMN: HE 550B



<b>Pillar Base dimension a</b>	<b>0.55 m</b>
<b>Pillar Base dimension b</b>	<b>0.30 m</b>
<b>Pillar Height H</b>	<b>4.50 m</b>
<b>PILLAR SELF-WEIGHT Puls,self</b>	<b>9.0 kN</b>
<b>Number of pillars</b>	<b>4</b>
<b>Total load self weigth pillars</b>	<b>35.8 kN</b>

COLUMN TYPE: HE 550 B  
TOTAL COLUMN SELF WEIGHT: G = 35.8kN/m

1. AREA OF SELECTED PROFILE  
CHOSEN PROFILE: HE 550B

AREA: A=25410mm<sup>2</sup>

$i_{min} = 71.7mm$

2. λ CALCULATION  
PILLAR LENGTH: l = 4.5m

LENGTH REDUCTION FACTOR: k = 0.65

$l_0 = l/k = 2925mm$

$\lambda = l_0/i_{min} = 40.8 < 150$ . **VERIFIED**

3. BUCKLING CURVE CALCULATION  
 $\alpha = b = 0.34$

$\Phi = 0.5[1 + \alpha \cdot (\bar{\lambda} - 0.2) + \bar{\lambda}^2] = 0.63$

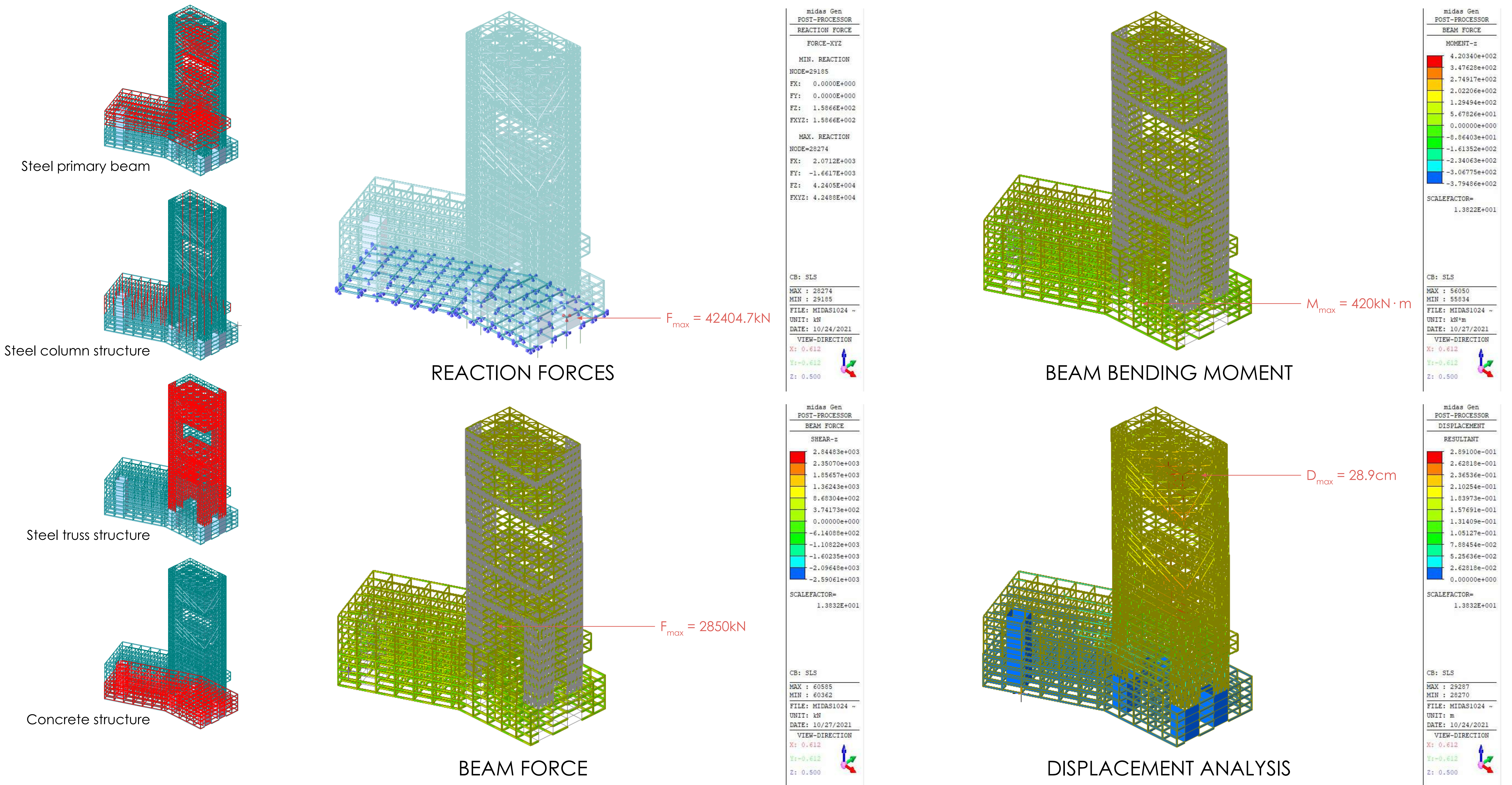
$\chi = \frac{1}{\sqrt{\Phi + \sqrt{\Phi^2 + \bar{\lambda}^2}}} = 0.844$

4. COMPARISON

$N_{ed} = 4213.2kN < N_{rd} = 4652kN$

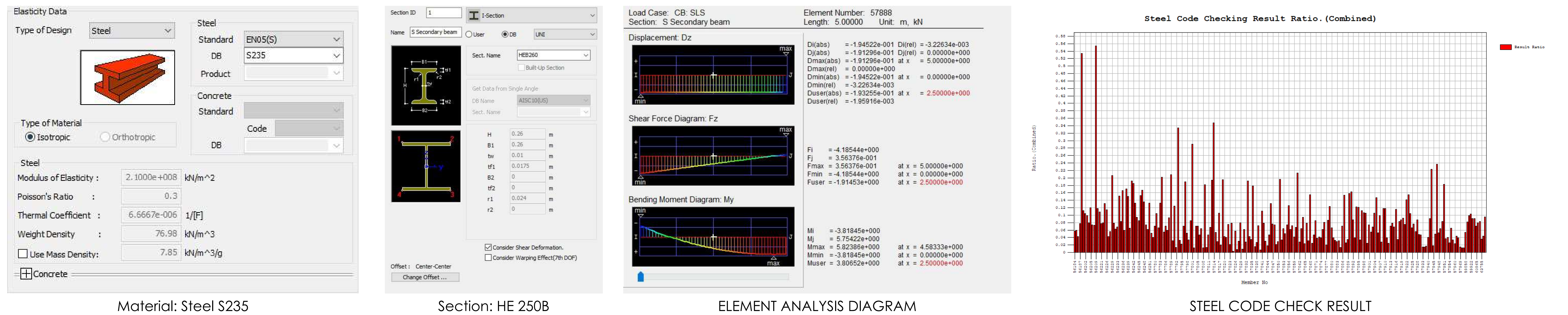
**BUCKLING VERIFIED**

# MIDAS ANALYSIS RESULT

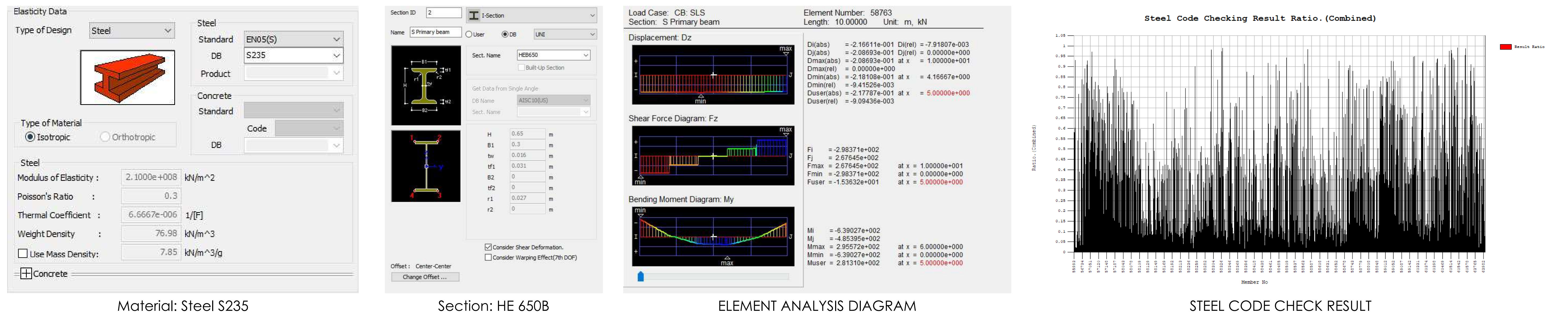


# MIDAS ELEMENTS CHECKING

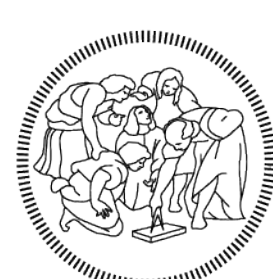
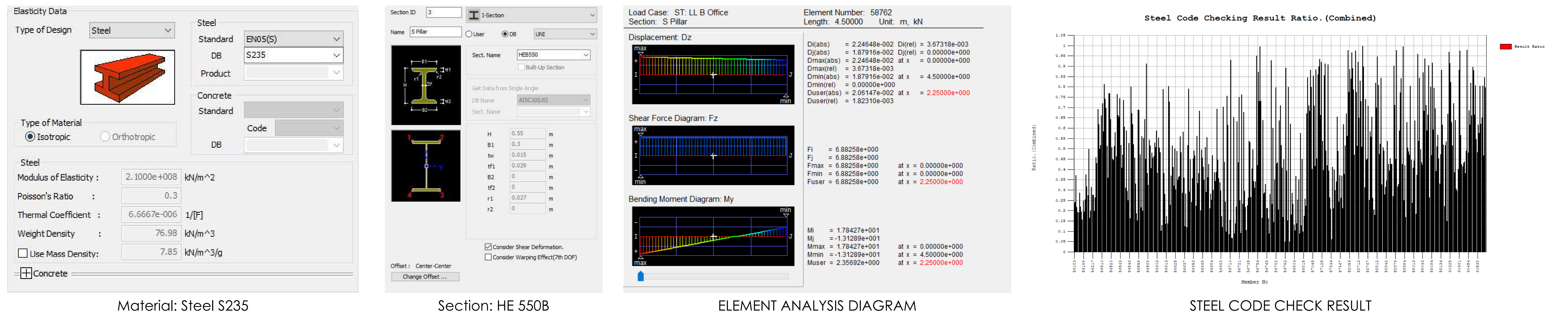
## SECONDARY BEAM: HE 260B



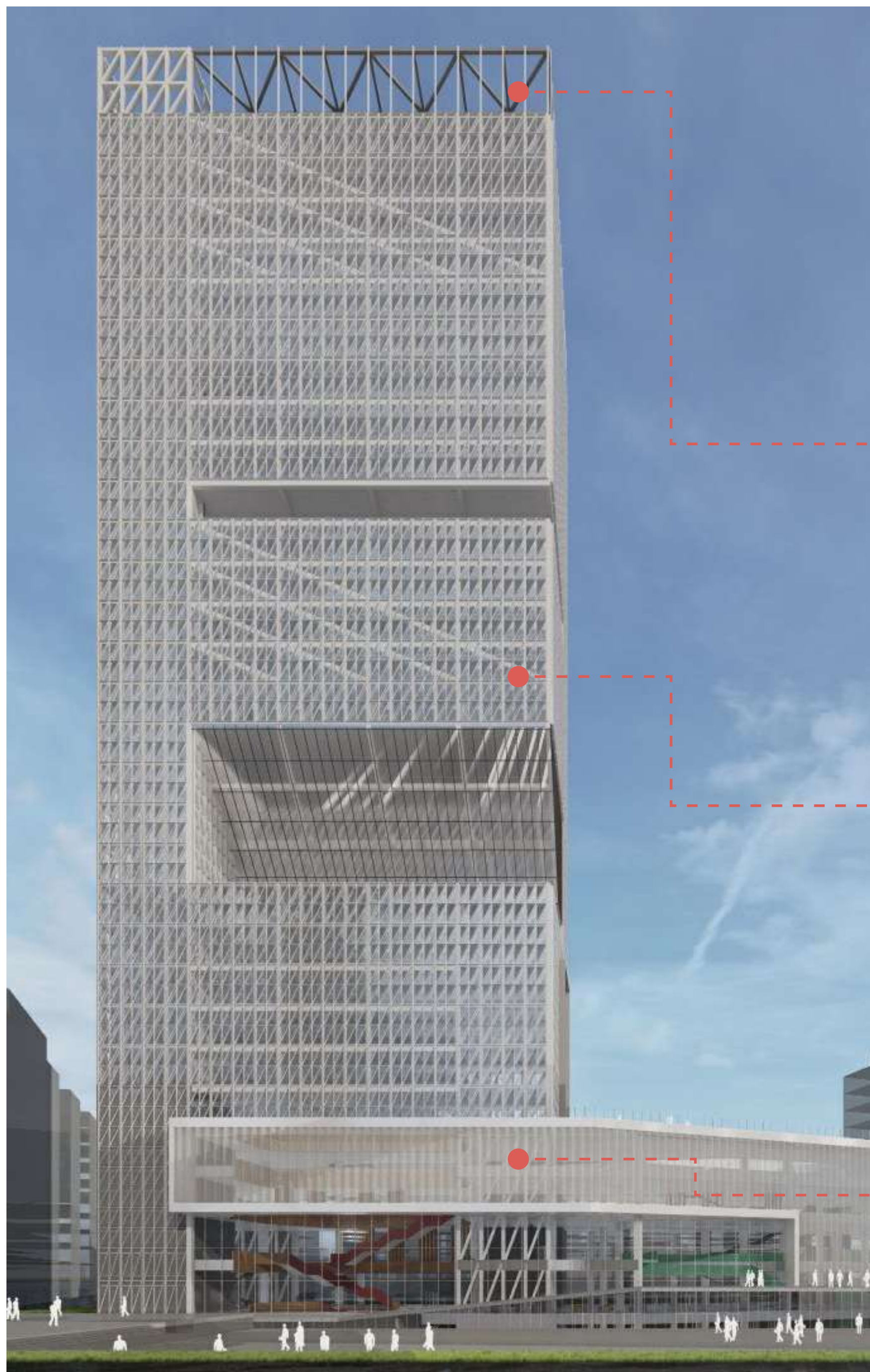
## PRIMARY BEAM: HE 650B



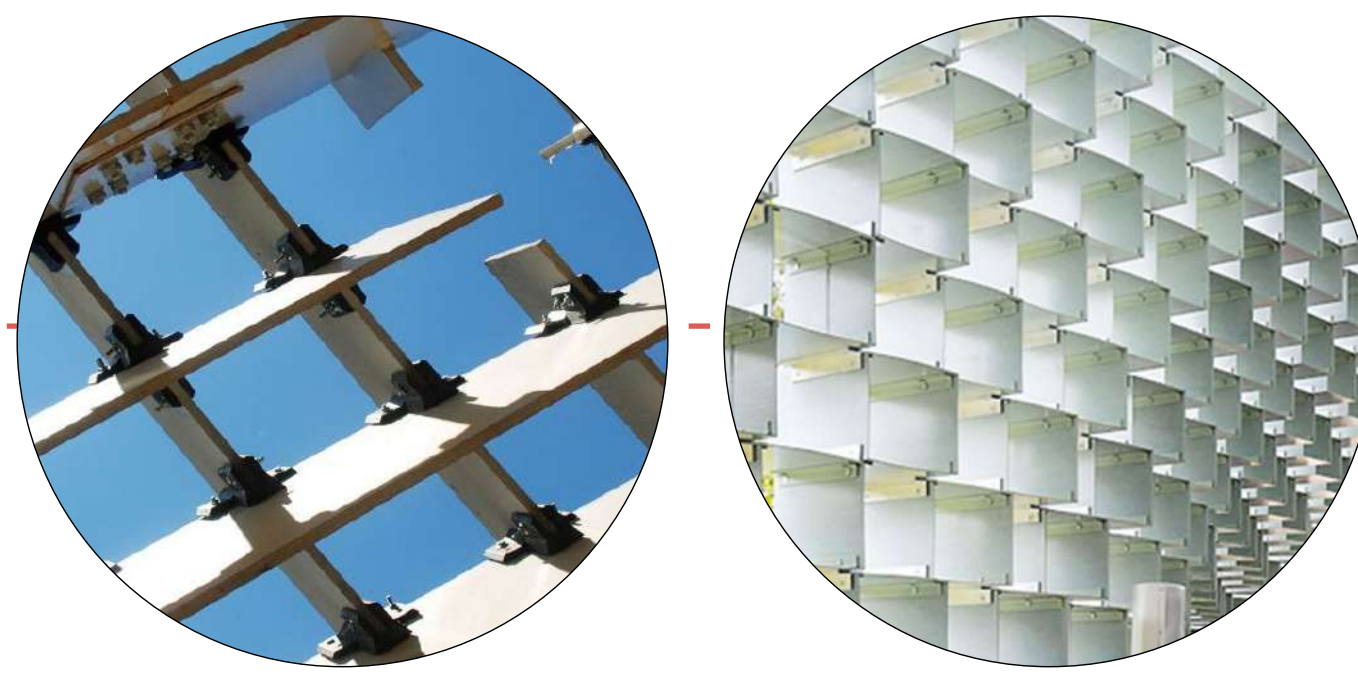
## STEEL COLUMN IN TOWER: HE 550B



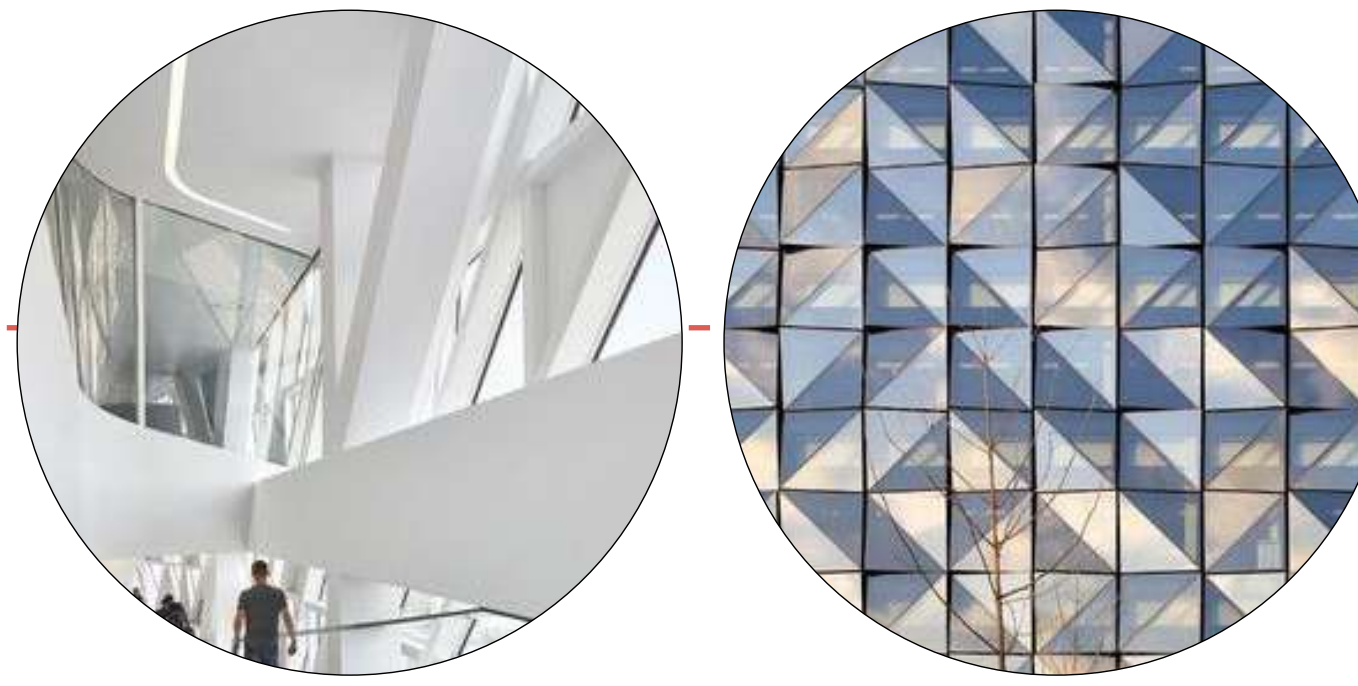
## EXTERIAL MATERIAL OVERVIEW



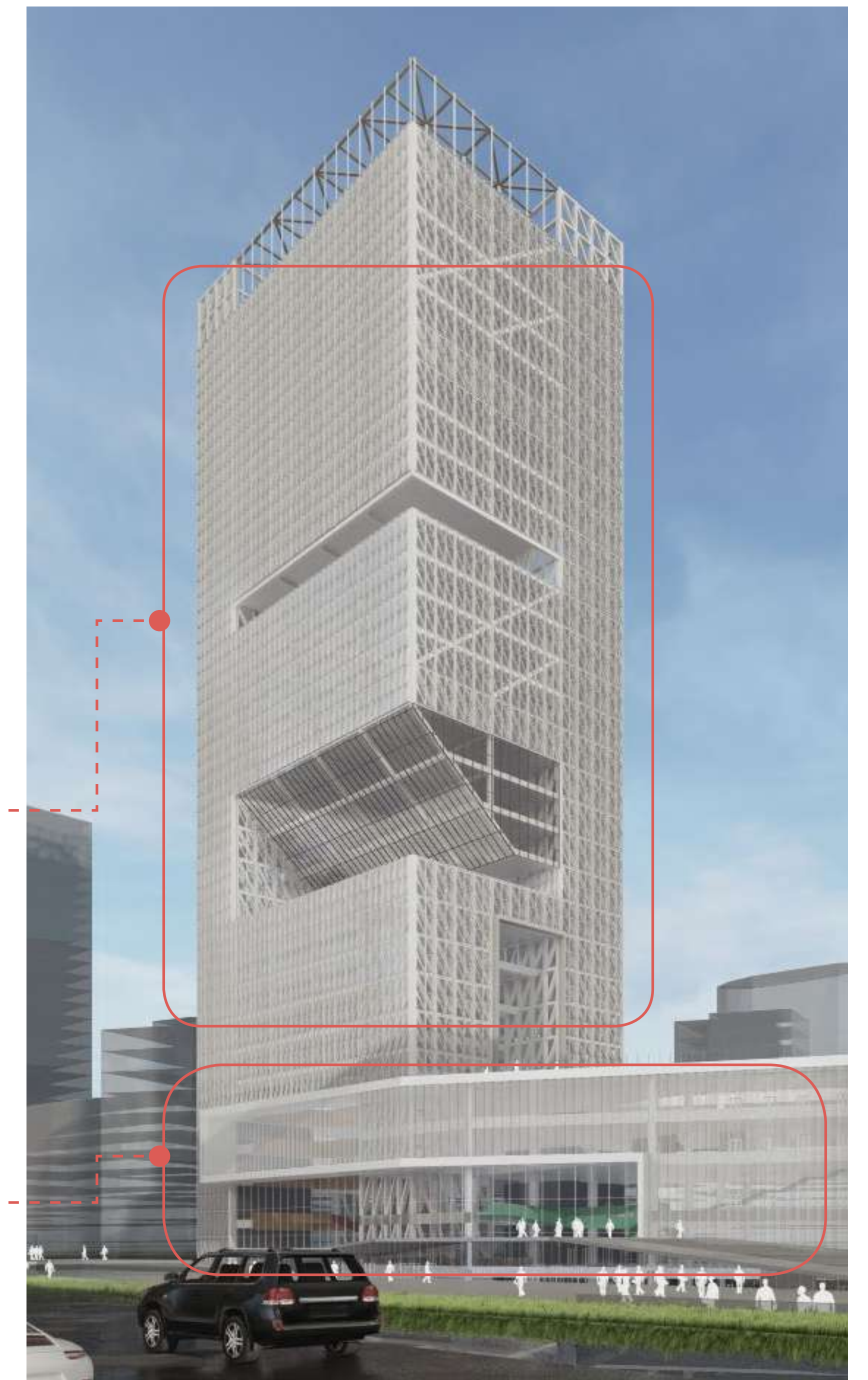
**SKY BAR**  
GLASS FIBER  
REINFORCED  
CONCRETE



**TOWER FACADE**  
GLASS AND SOLAR  
PANEL



**PODIUM FACADE**  
POLYCARBONATE



## PODIUM FACADE MATERIAL - POLYCARBONATE



**Manufacturer - Polycarbonate panel**  
DOTT. GALLINA



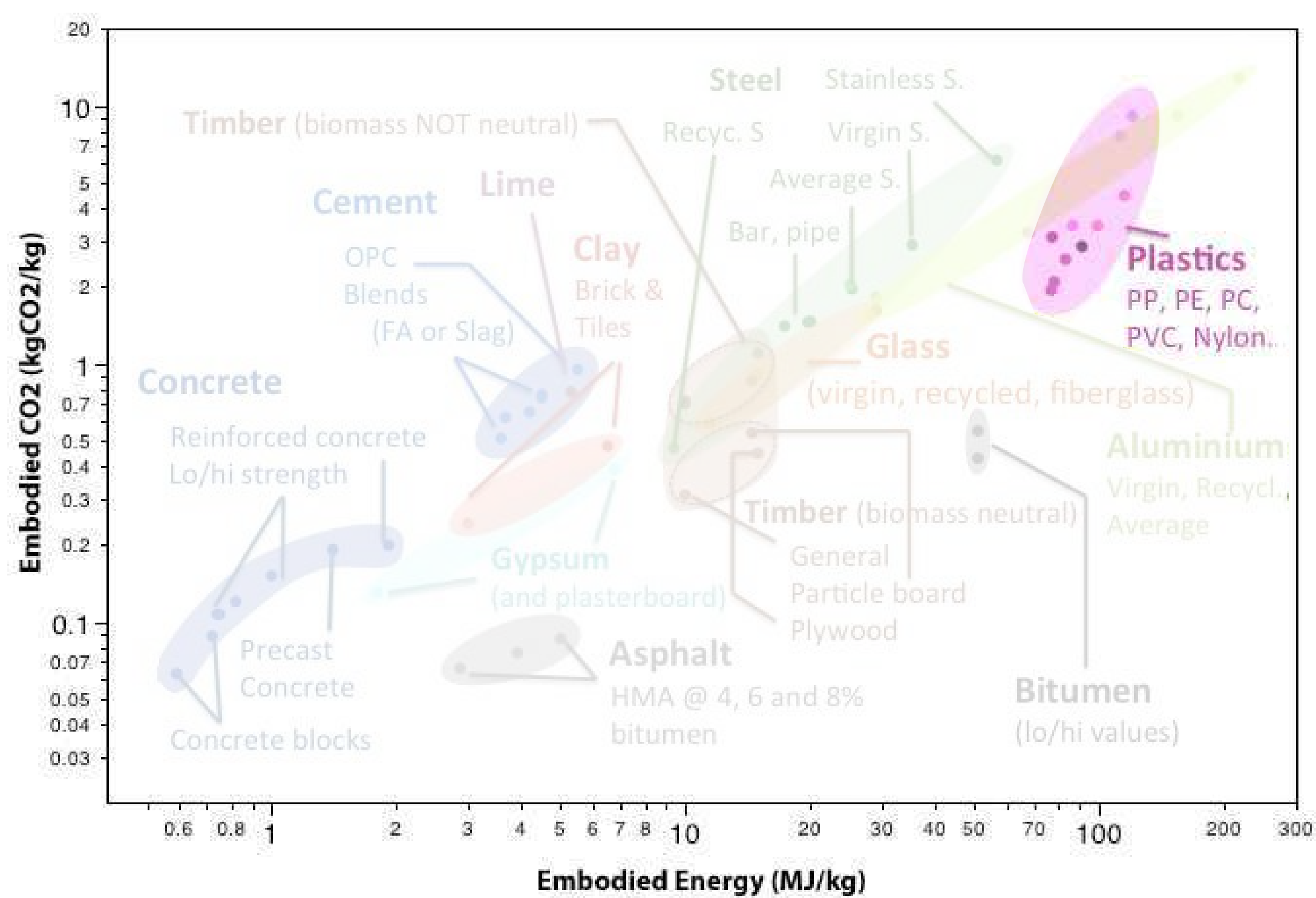
ALUCOBOND

POLYCARBONATE



ACOUSTIC GLASS

GLASS RAILING



### Production standards

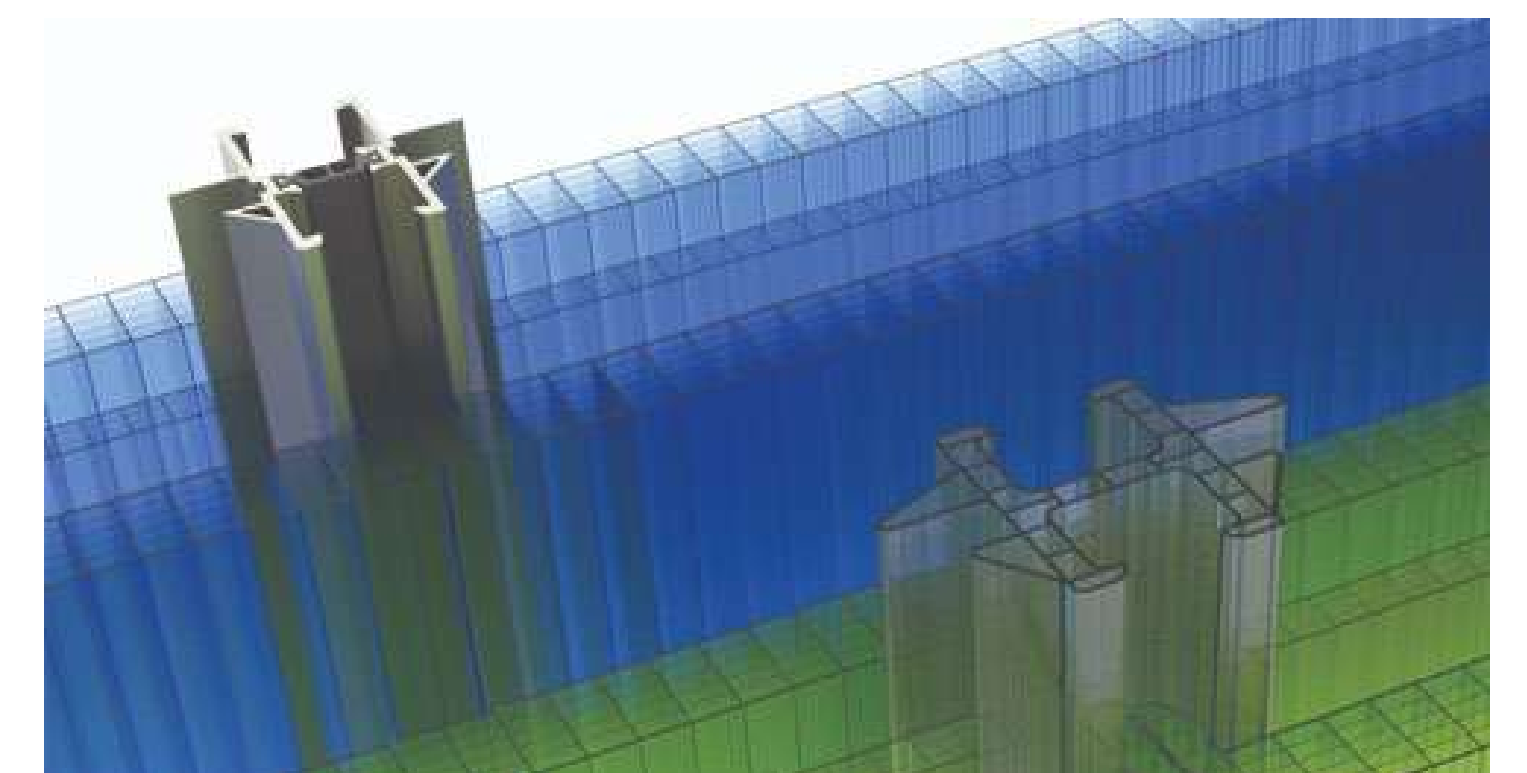
arcoPlus®	626	9287	9327	5410
Panel thickness (mm)	20	20	32	40
System thickness (mm)	90	90	114	130
Module width (mm)	600	900	900	600
Structure (walls)	6	7	7	10
Thermal transmittance	0.62	0.64	0.51	0.40
Acoustic insulation	26	26	27	-
Light transmission	39	34	31	26

### Special treatments



### Features

Linear thermal expansion	0,065mm/m°C
Temperature range	-40°C +120 °C
U.V. rays protection	Coextrusion su 2 lati
Fire reaction EN 13501-1	EuroClass B-s1,d0



### Material properties

- 1 AESTHETIC DESIGN SOLUTION:** The special multi-joints profile "double connector" allows to build a unique wall consisting of 3 layers of paneling, which can be customized by choosing the most suitable arcoPlus® panel in order to give the most suitable coloring or to apply the appropriate surface treatment.
- 2 EASY AND LOW-COST INSTALLATION:** The hollow spaces between the three vertical layers allow a complete natural recirculation of air throughout all seasons, bringing benefits for the health of the environments and for **reducing heating/cooling costs**.
- 3 THERMAL INSULATION:** ArcoPlus® DB connect system has been developed to offer, thanks to its **triple layer composition**, the highest performance in terms of thermal insulation and energy sustainability with the purpose of carry out imposing translucent continuous facades
- 4 RESISTANCE TO UV RAYS AND TO HAIL:** Special connector system made with polycarbonate multiwall panels **UV protected**.

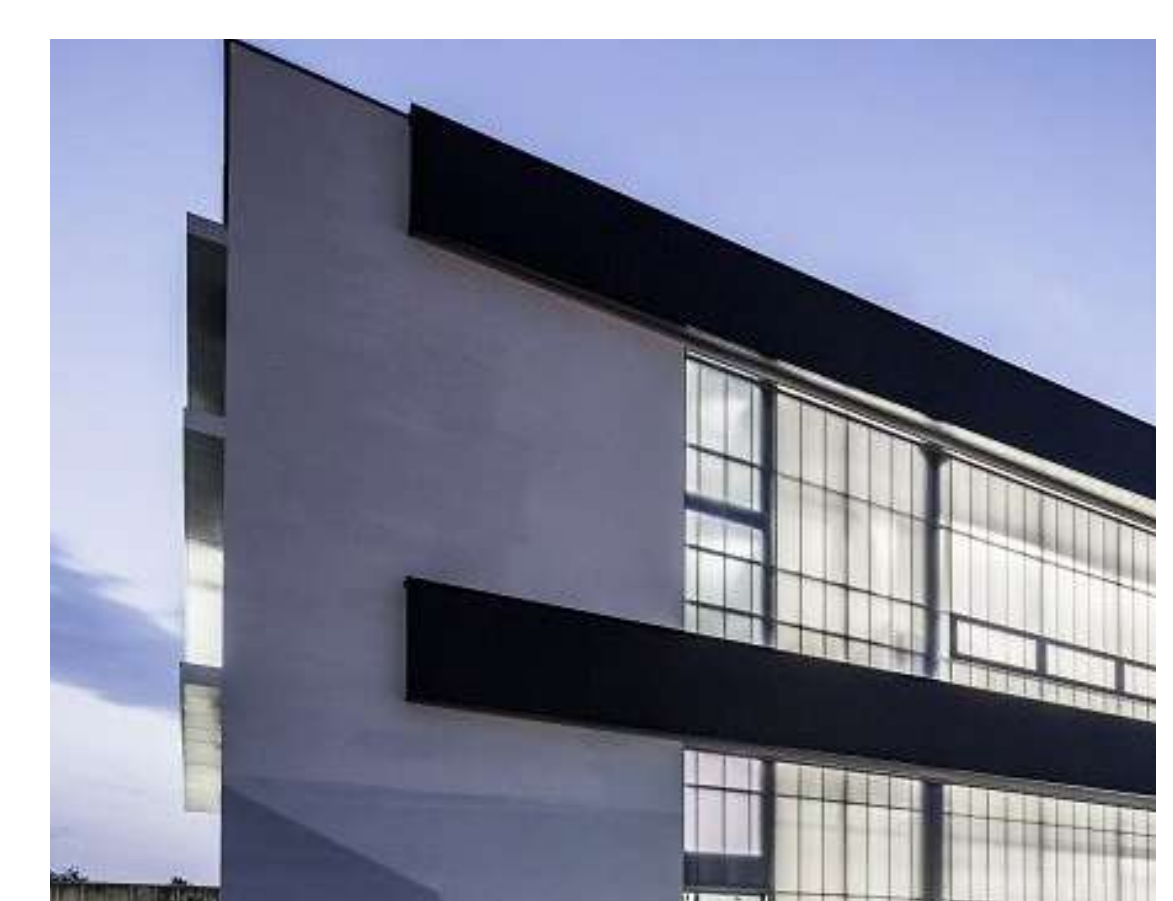
### Previous projects



Pavillon Arena - Svezia



Scuola di Saint Plourin - Francia



Protoshop Lamborghini - Sant'Agata Bolognese



**POLITECNICO**  
MILANO 1863

MEASURE:

Building Architecture  
AY 2020/21

PROFESSOR:

ARCHITECTURE DESIGN Prof. Maria Frazia Folli  
STRUCTURAL DESIGN Prof. Corrado Pecora  
INNOVATIVE MATERIALS Prof. Giovanni Dotelli  
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MEMBERS:

GROUP 3 IN TALL BUILDING  
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Gino André Segura D'Angelo 10706875  
Yiqi Lai 10703809

CAPTION:

EXTERIOR MATERIAL

PAGES:

21

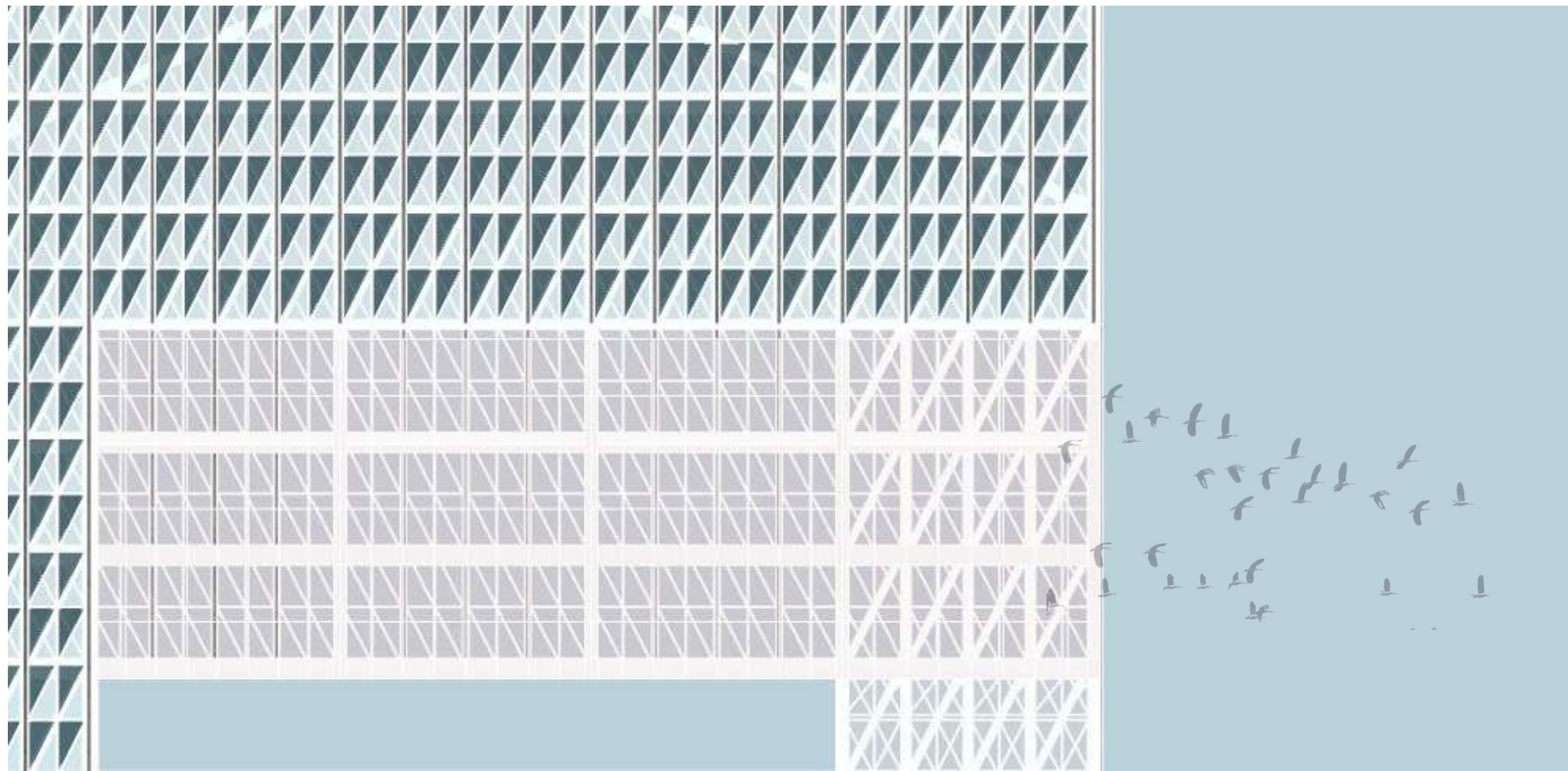
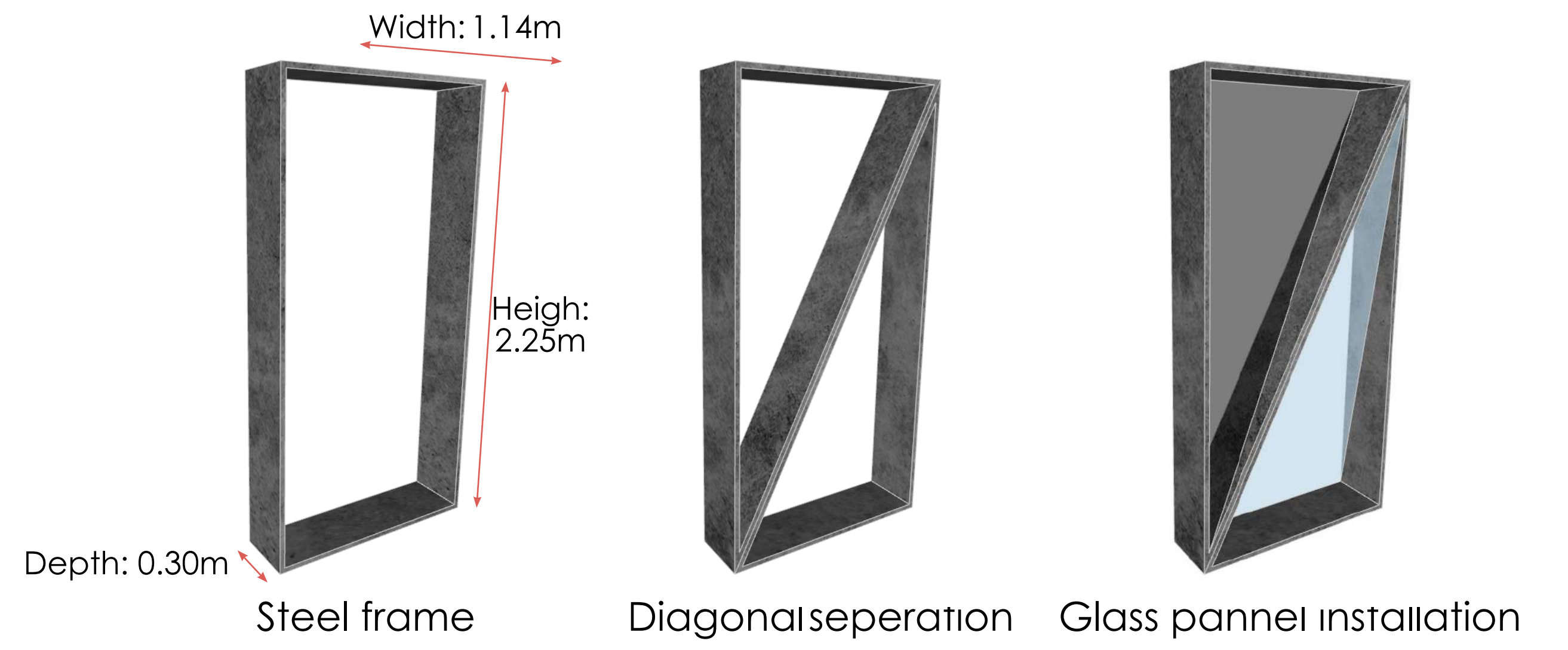
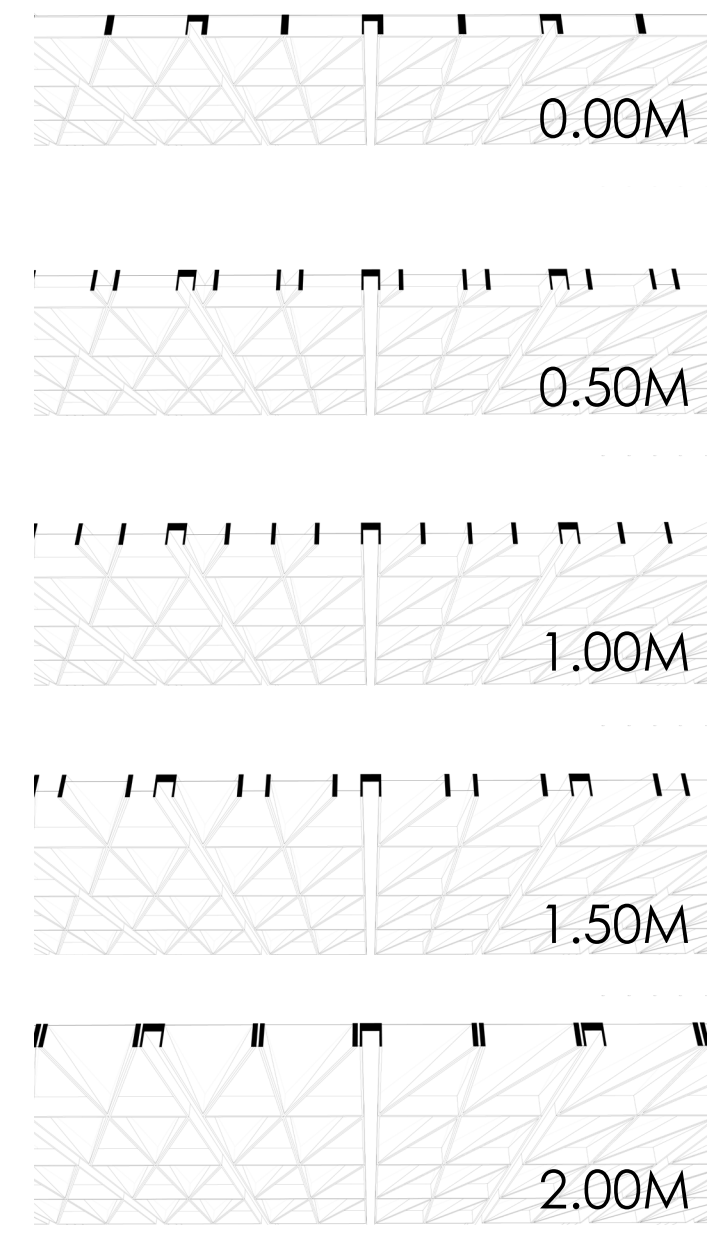
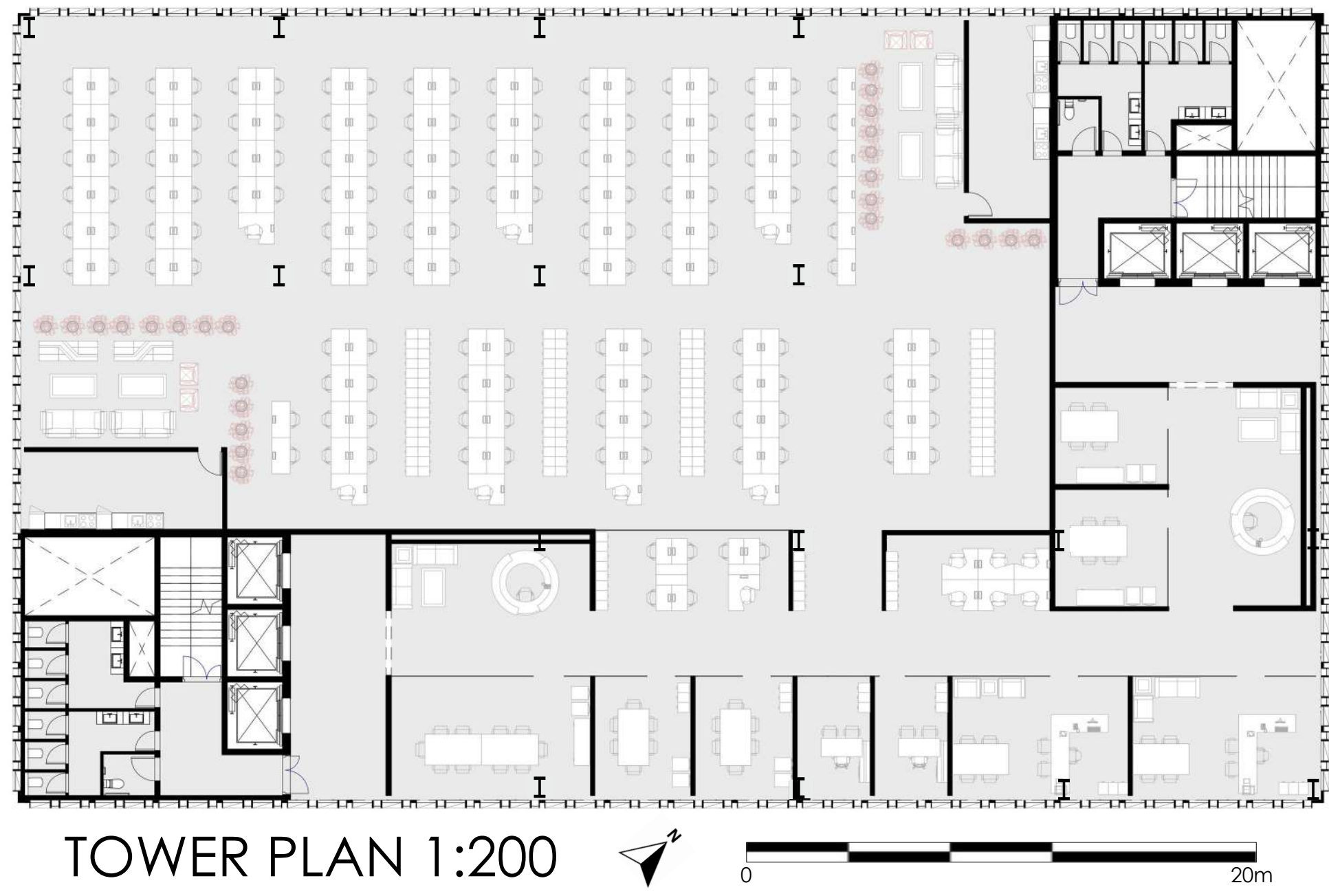
SCALE:

ORIENTATION:

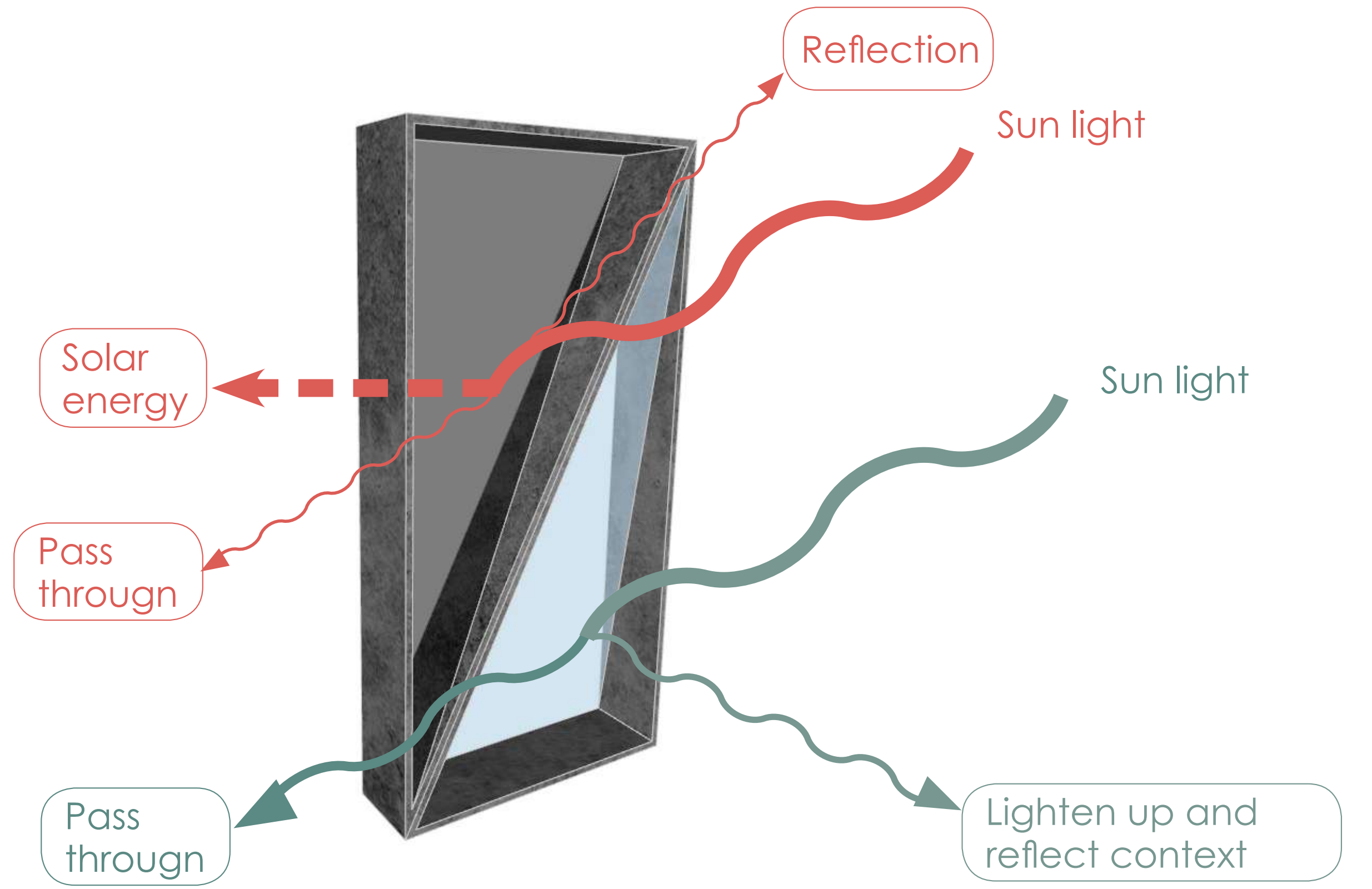
LEVEL:

DATES: 25/11/2021

## TOWER FACADE STRATEGY

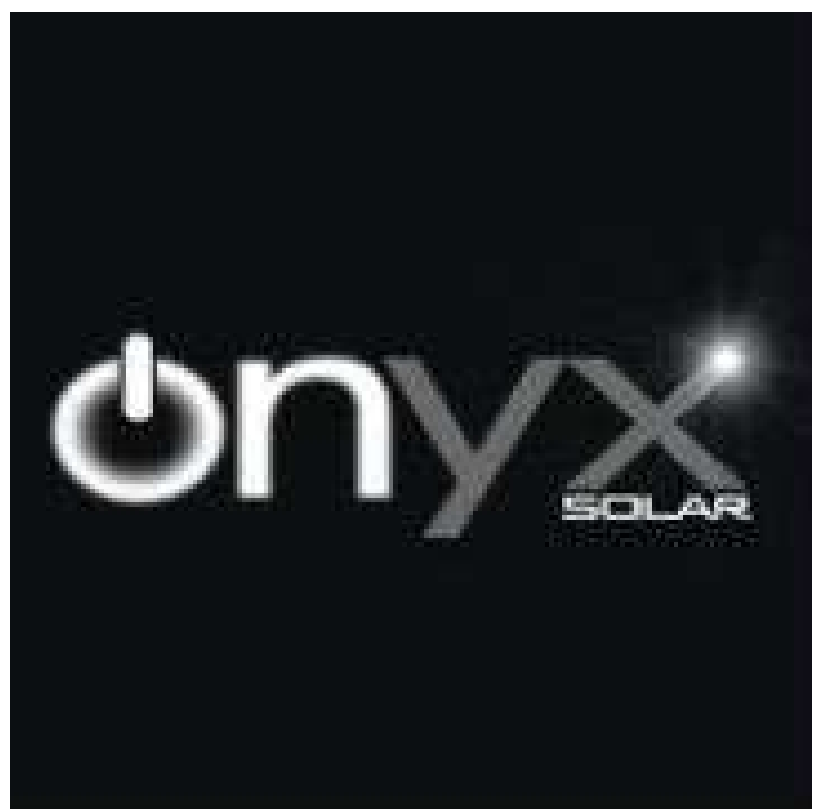


GEOMETRY DETAILS

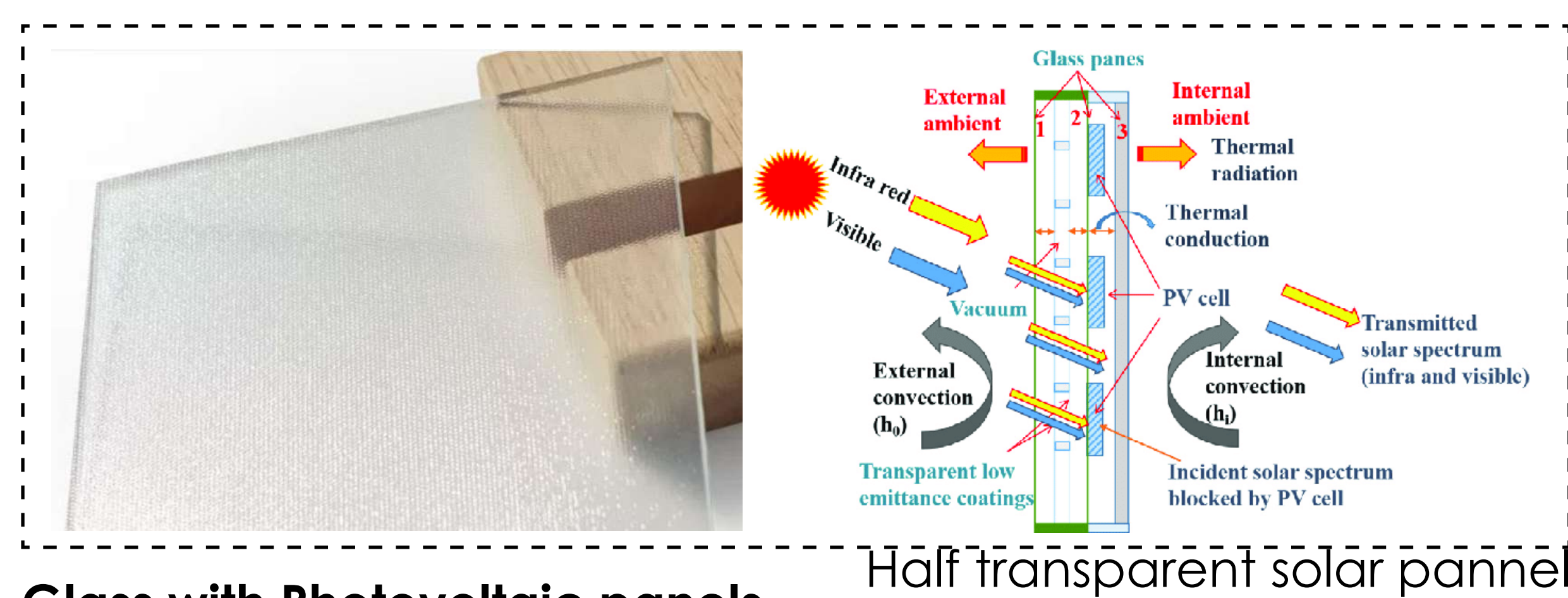
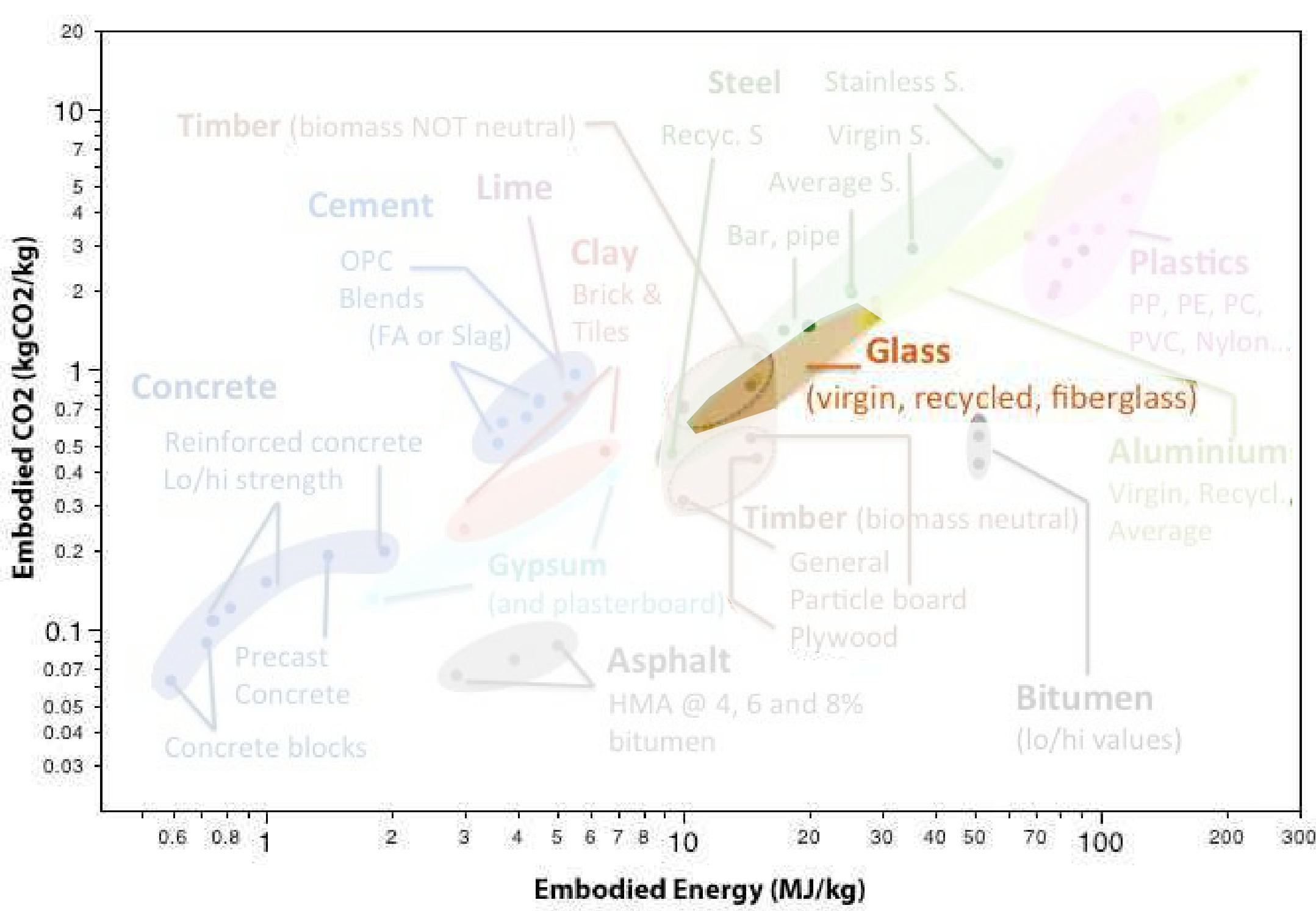
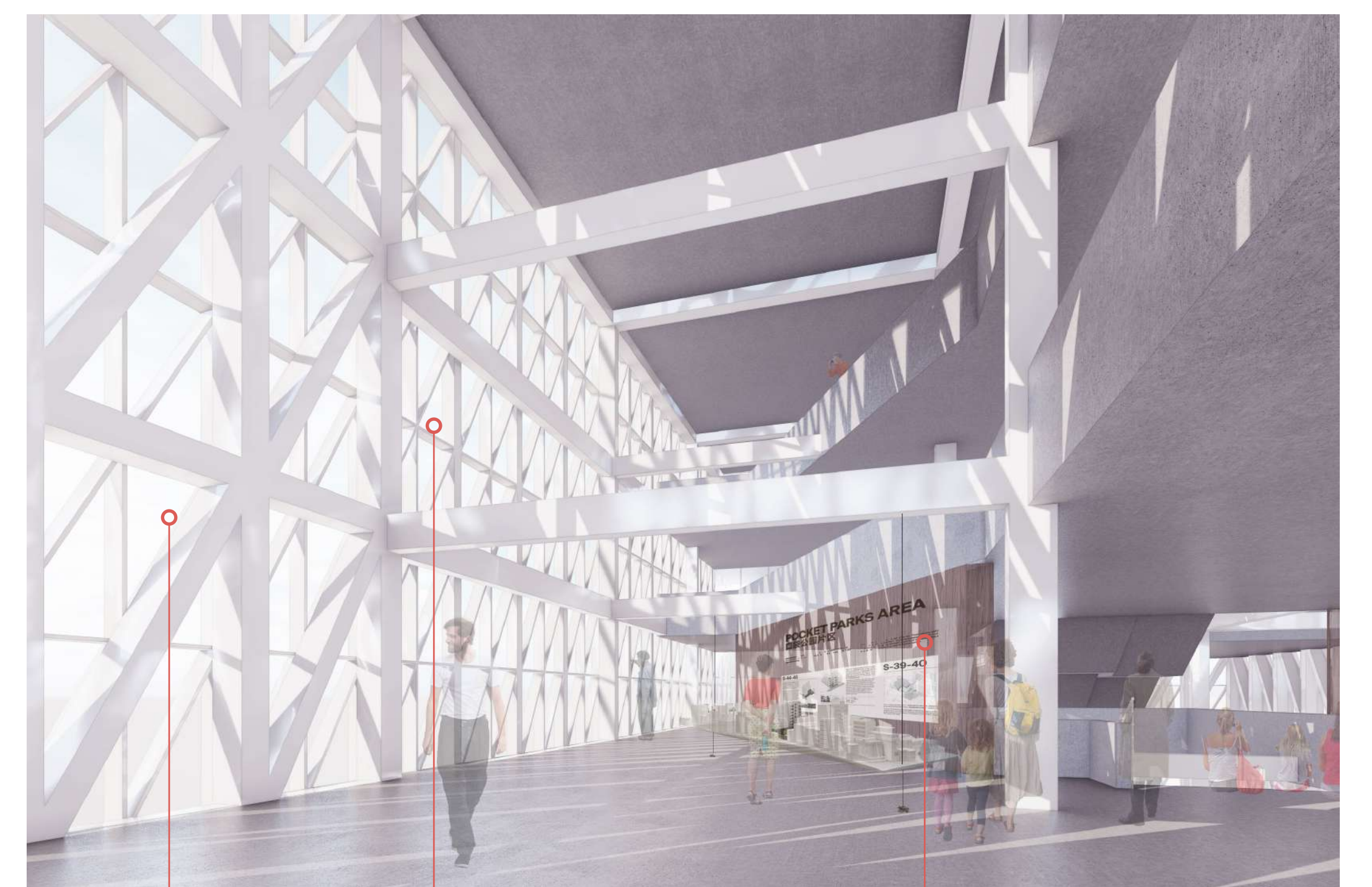
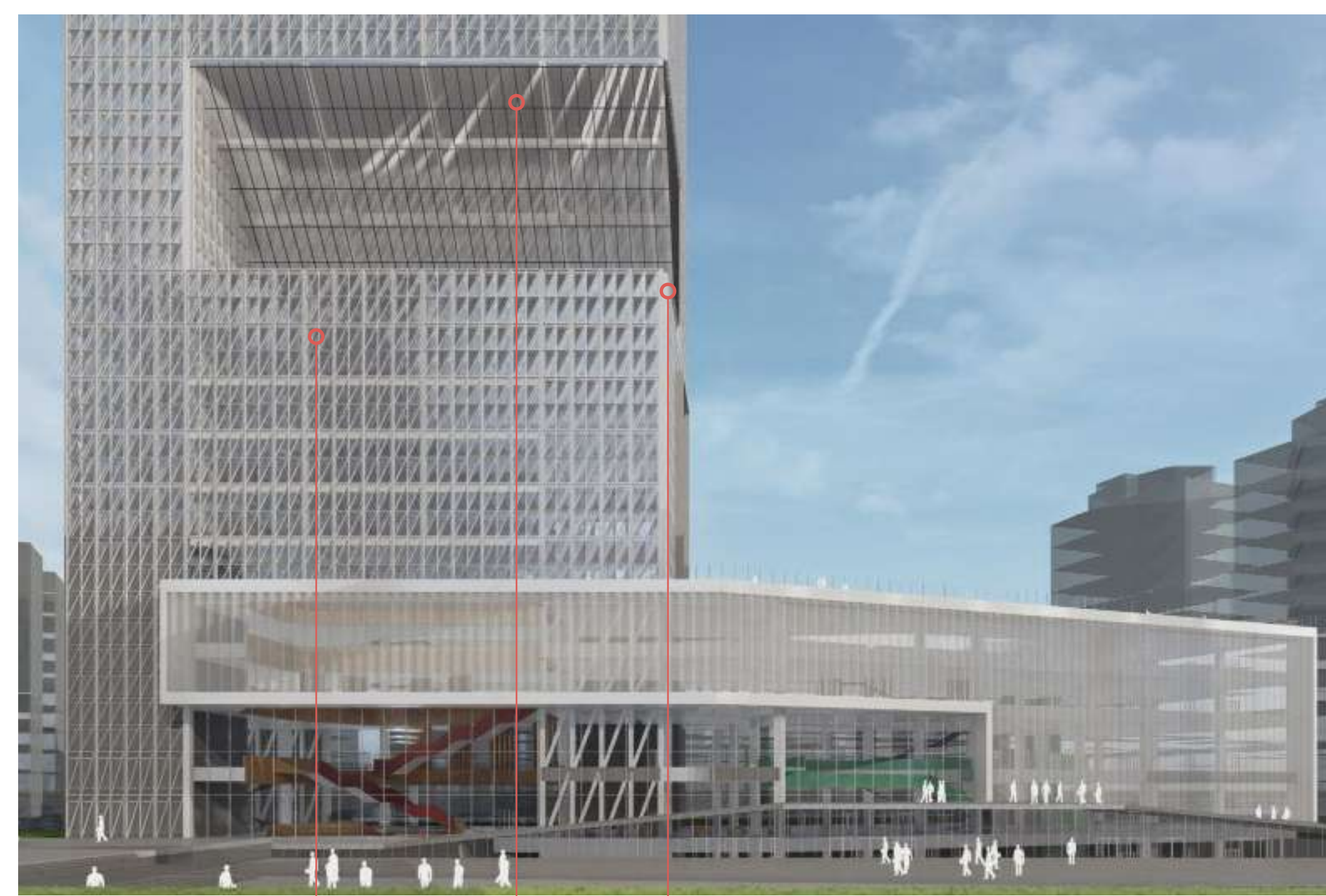


FACADE CONCEPT

## TOWER FACADE MATERIAL - PV PANEL



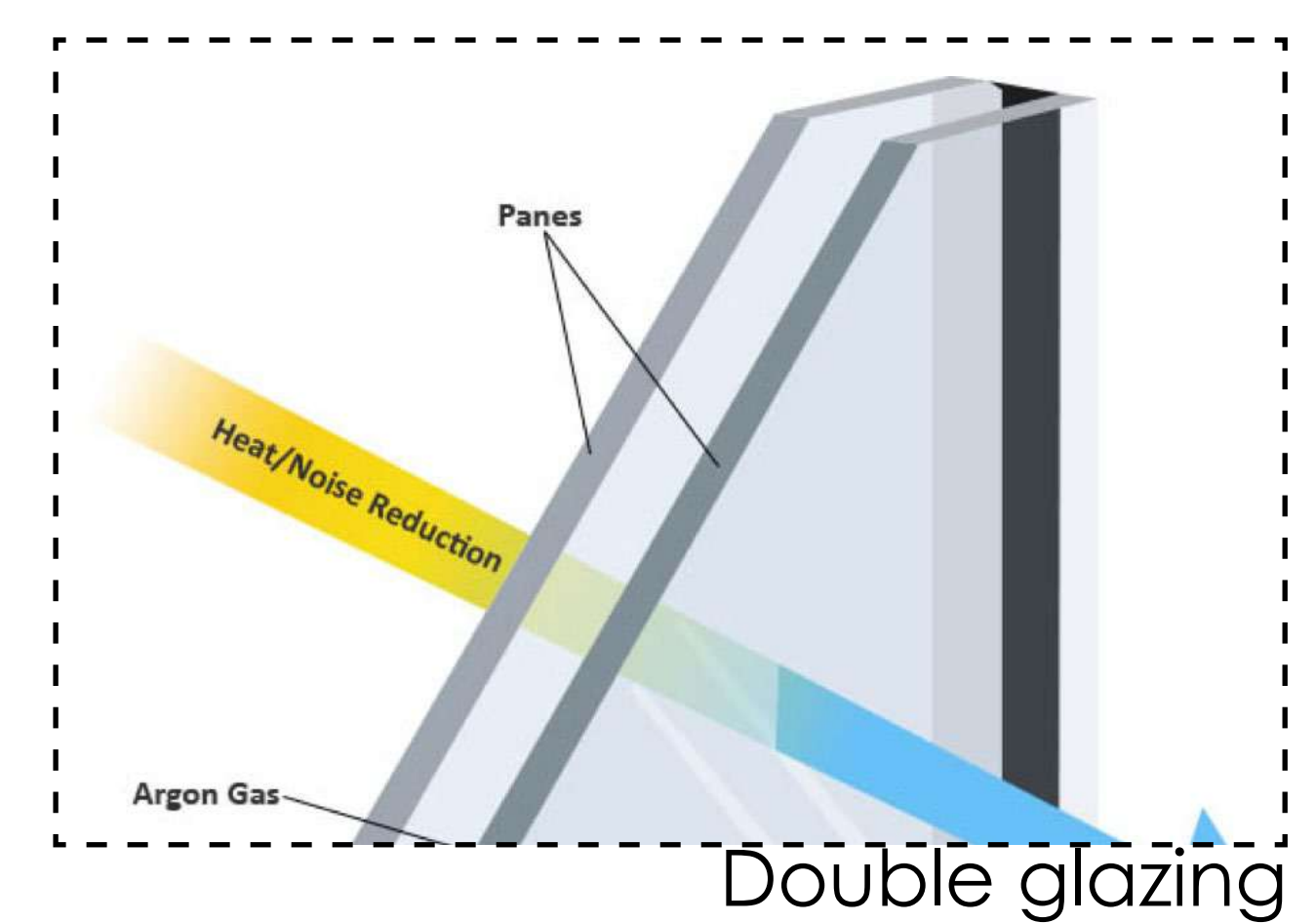
Manufacturer - PV Panel  
ONYX SOLAR GLASS



Glass with Photovoltaic panels

- 1 TRANSMITTANCE: Transparent- efficiency 5%
- Half transparent - efficiency 7.5%
- Opaque - efficiency 15%

2 EFFICIENT: Choice with the added benefit of minimising noise. The sealed air gap between the two panes acts as an added layer of insulation.

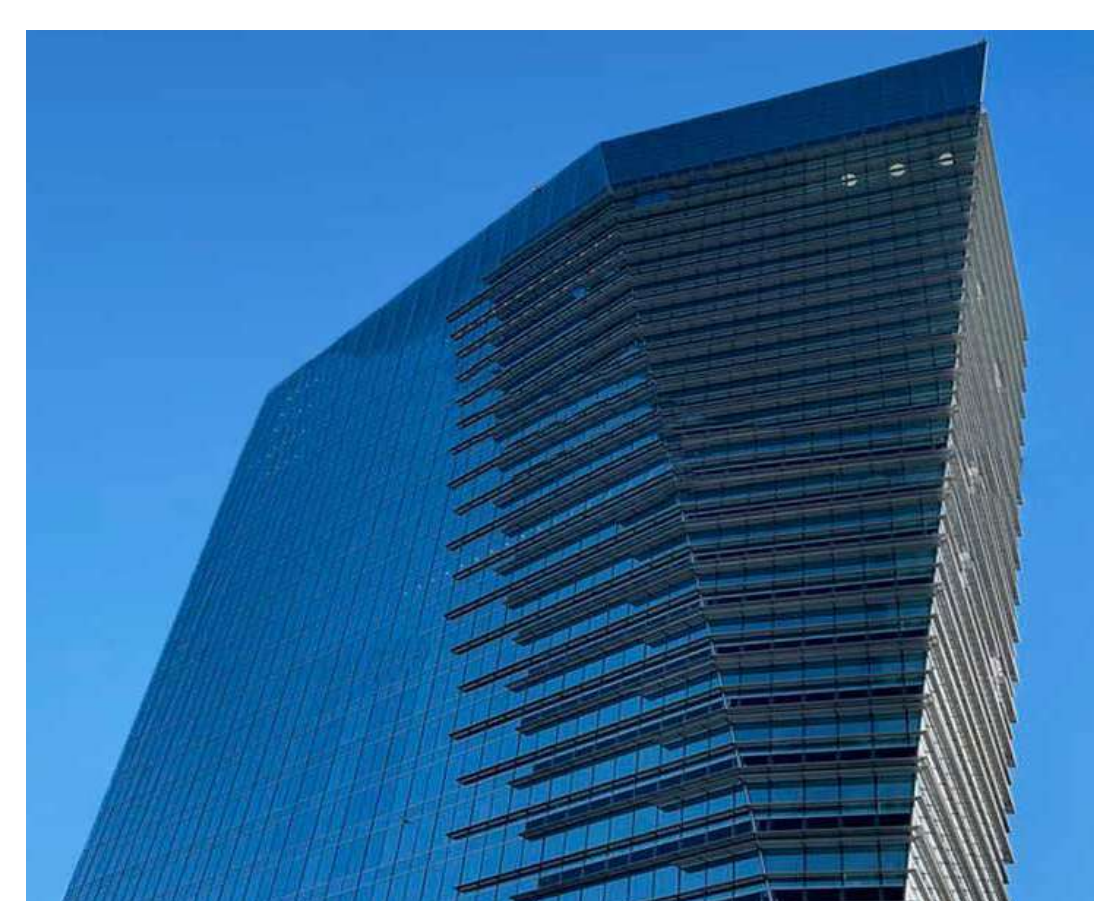


Double glazing

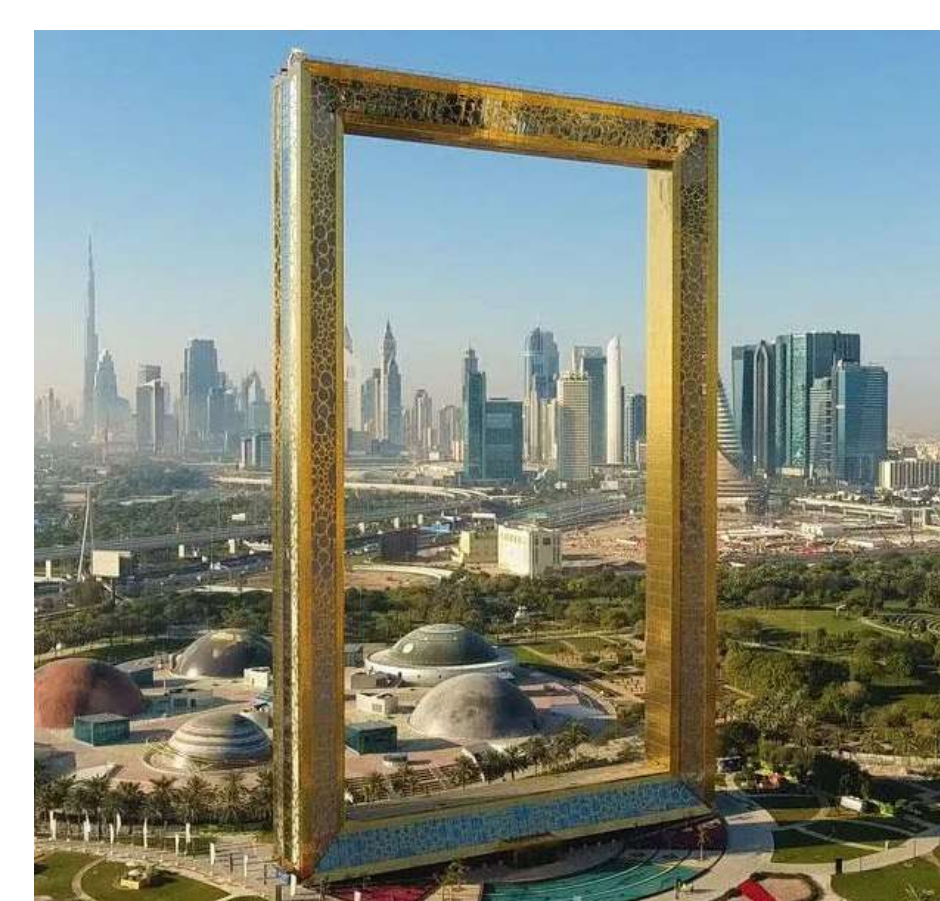
### Material properties

- INSULATION PROPERTIES:** The "U-value" measures the amount of heat that passes through the glazing when there is a difference in temperature between its two sides. The lower this value is, the higher the thermal insulation. Onyx Solar's PV glass offers values up to **0.18 BTU/SqFk**, which ties to the highest performing glass products in the market.
- OPTIMIZED SOLAR FACTOR:** Onyx Solar's glass offers a solar factor between **10% to 40%**, which makes it an ideal element to improve indoor comfort.
- HARMFUL RADIATION FILTER:** The architectural PV glass developed by Onyx Solar reduces the transmission of infrared radiation by up to 95% compared to a conventional laminated glass; it also filters out 99% of the ultraviolet radiation (UV), which accelerates interior ageing.
- NATURAL LIGHT:** Onyx Solar's PV Glass has been designed to provide natural light in a diffuse manner. Rather than having your windows covered with blinds, PV Glass allows for you to enjoy unobstructed views, enjoy natural light and to avoid glare.

### Previous projects



Gioia 22 - Milan



Dubai frame - Dubai



University of Washington - Washington D.C.



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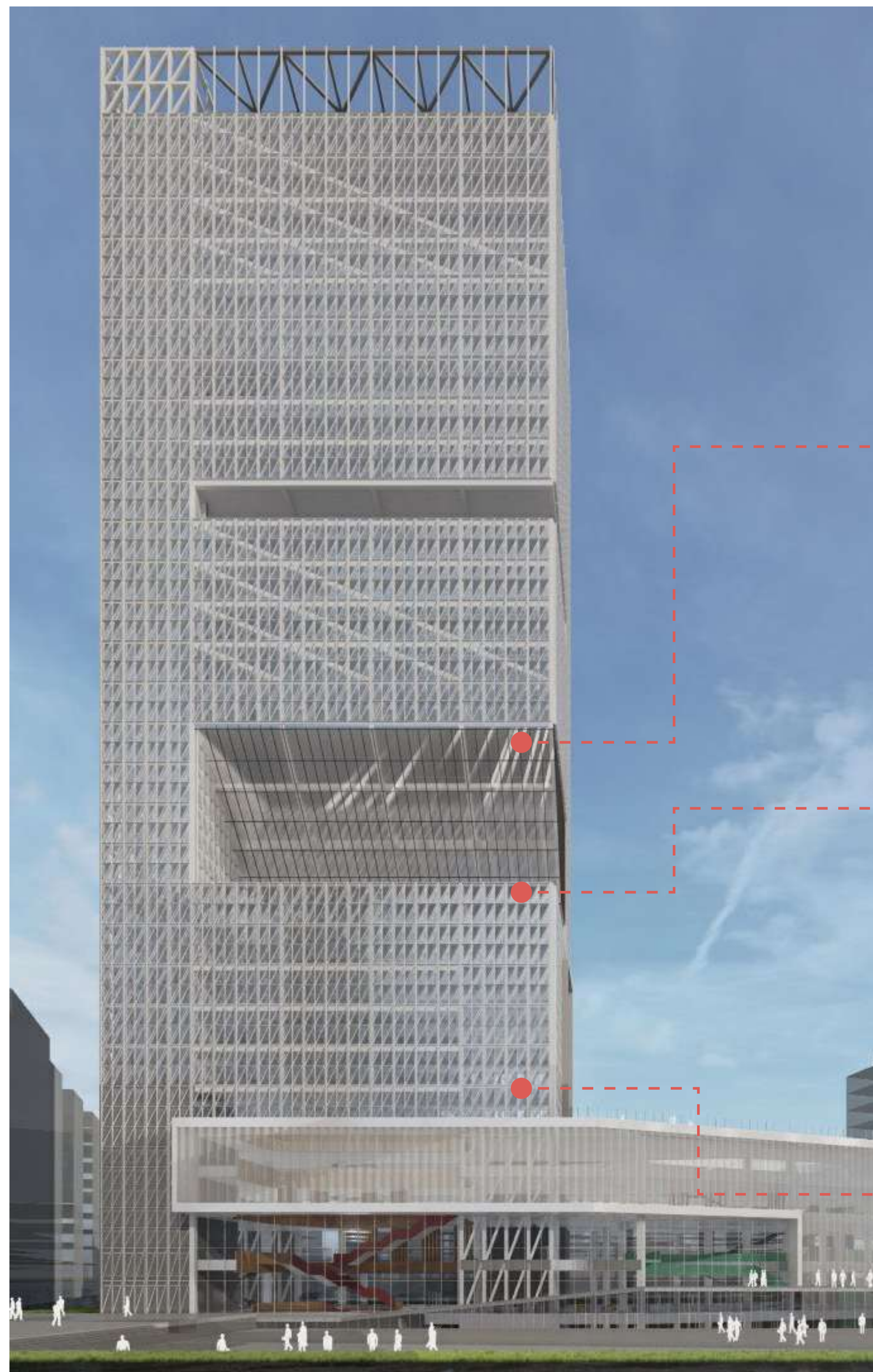
SCALE:

ORIENTATION:

LEVEL:

DATES: 25/11/2021

## INTERIOR MATERIAL OVERVIEW



AUDITORIUM  
ACOUSTIC GLASS



LIBRARY  
STAMPED CONCRETE



EXHIBITION  
TRANSLUCENT WOOD



## EXHIBITION MATERIAL - TRANSLUCENT WOOD

# WOODOO

augmented wood

Manufacturer - Translucent Wood  
WOODOO



CONCRETE

STEEL STRUCTURE

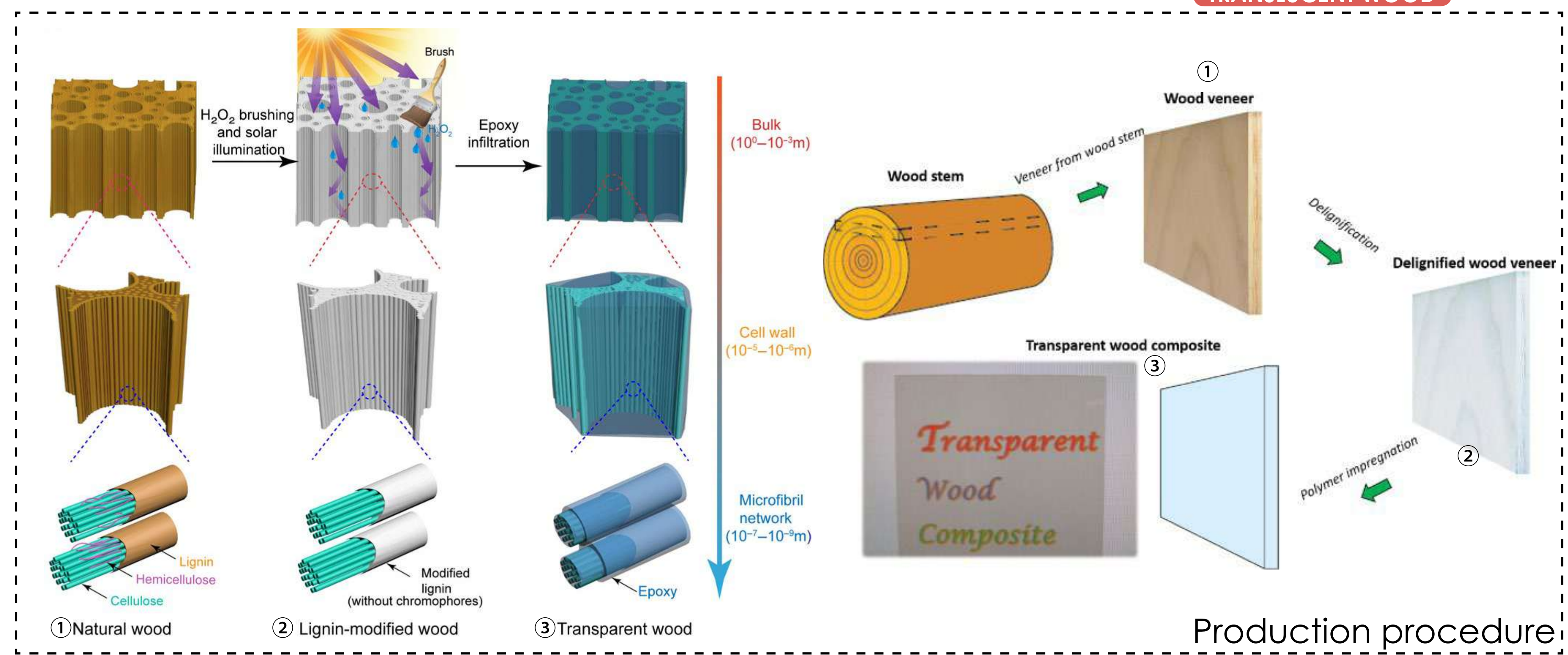
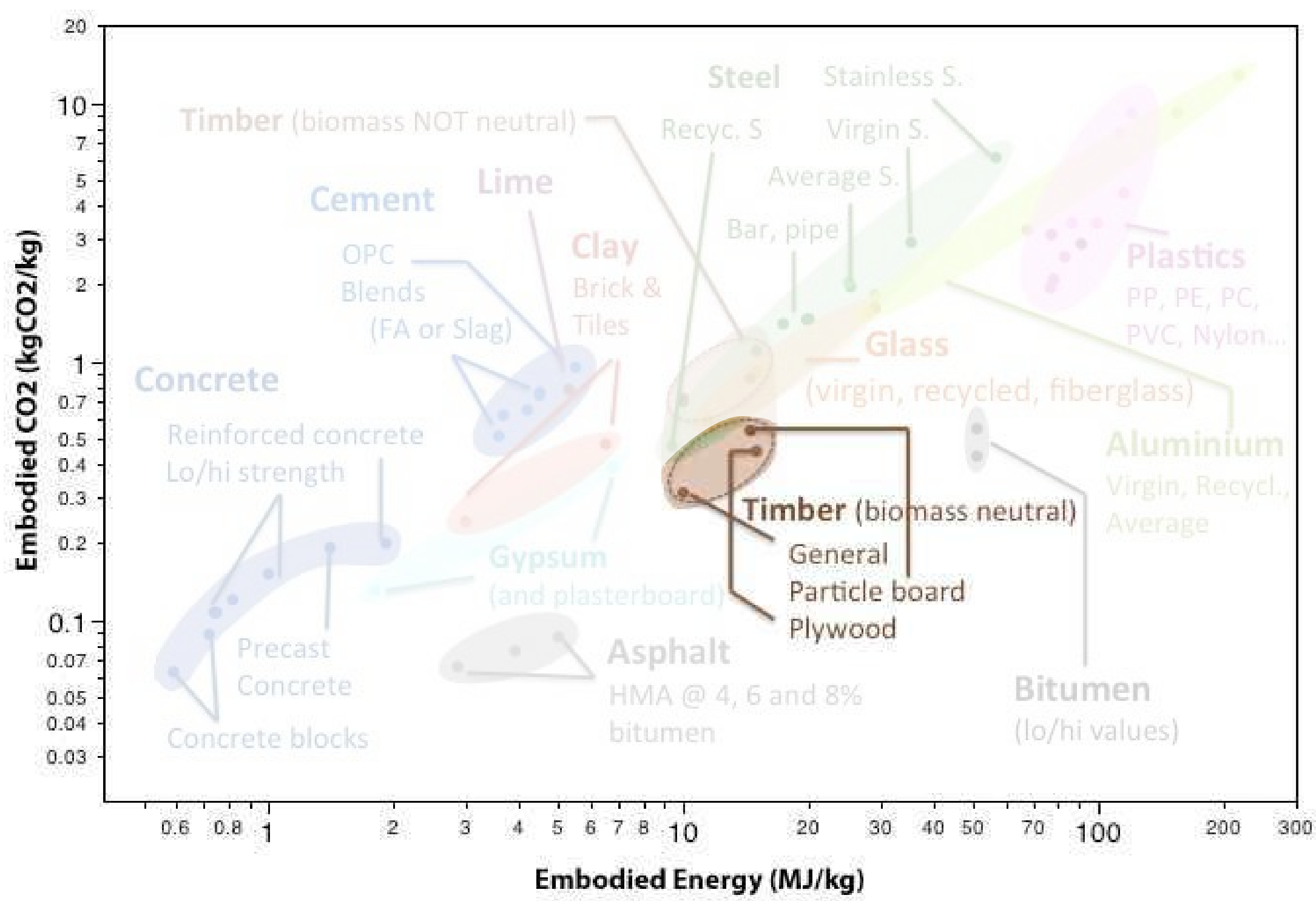
TRANSLUCENT WOOD



SOLAR PANEL

IMITATION CEMENT

TRANSLUCENT WOOD



### Material properties

- 1 LOW DENSITY COMPARED TO GLASS: From 1200 kg/m<sup>3</sup>
- 2 HIGH OPTICAL TRANSMITTANCE: Transparent wood (thickness about 1mm) shows high light transmittance (> 90%), high haze (> 60%) and excellent light guiding effect in the visible wavelength range.
- 3 LOW THERMAL CONDUCTIVITY: Excellent UV blocking ability and low thermal conductivity (0.24 W m<sup>-1</sup>K<sup>-1</sup>)
- 4 OUTSTANDING TOUGHNESS: The rapid manufacturing process and mechanical strength of translucent wood (high longitudinal tensile strength of 91.95 MPa and toughness of 2.73 MJ m<sup>-3</sup>) are conducive to the enlargement of the production scale (320mm×170mm×0.6mm) while saving a lot of time and energy.
- 5 ENVIRONMENTAL FRIENDLY: Translucent wood can reduce energy cost by lowering the usage of artificial lights inside homes and other buildings. Nowadays, urban architecture depends heavily on the use of glass and steel.

### Previous projects



Cabrini Hospital - Australia



Digital Wood Panel - France



Table Design - Japan



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SCALE:

-

ORIENTATION:

-

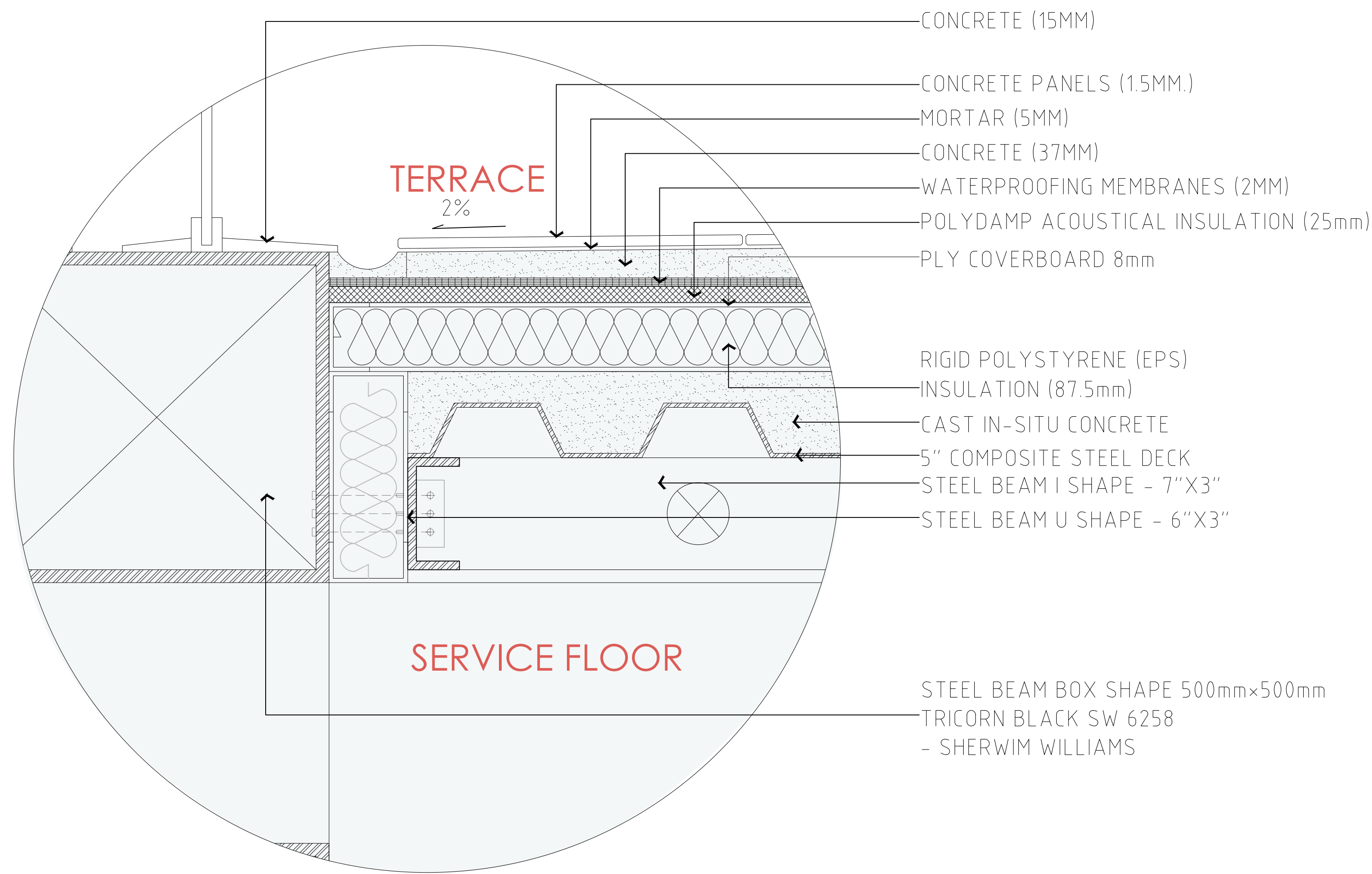
LEVEL:

-

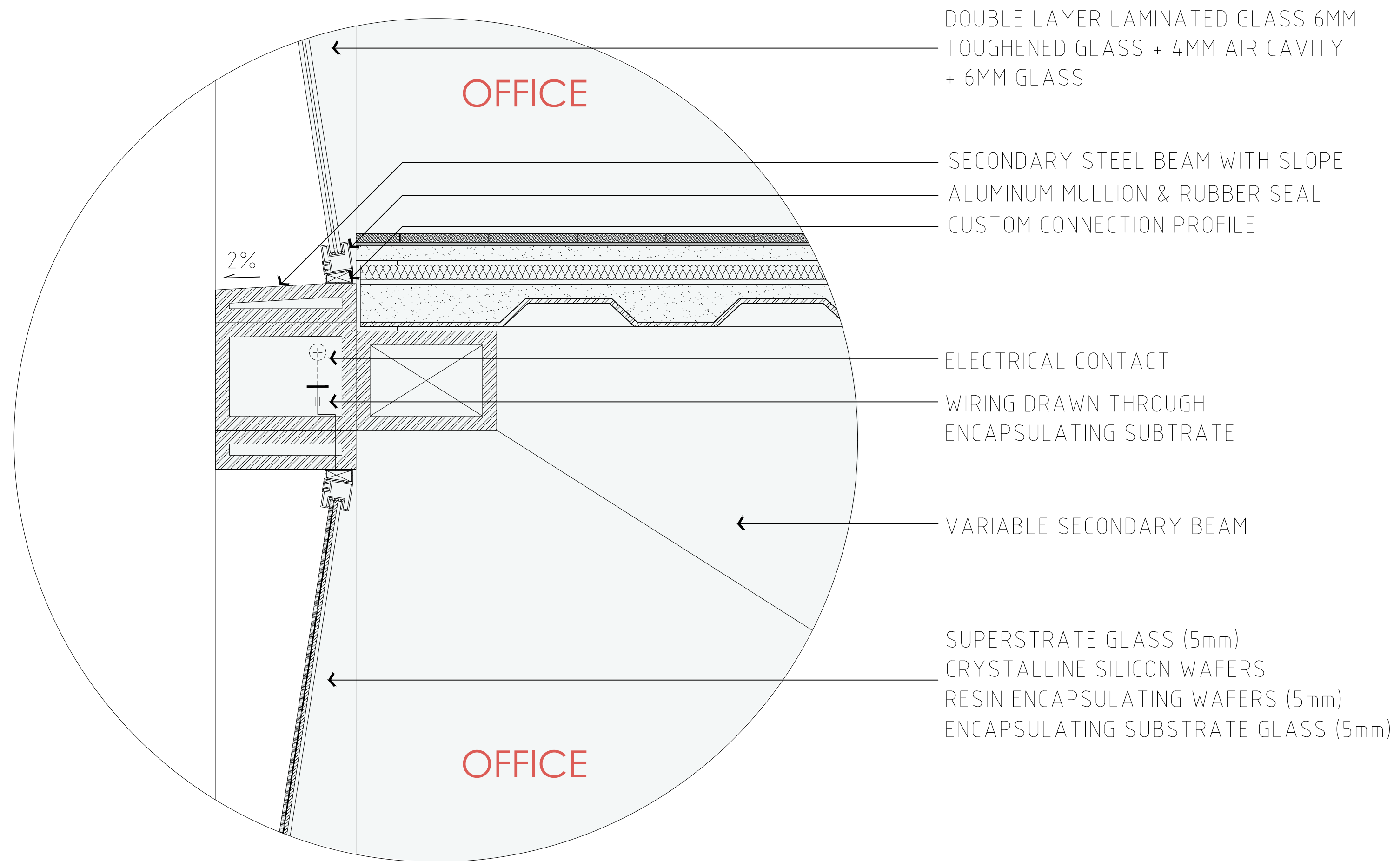
DATES:

25/11/2021

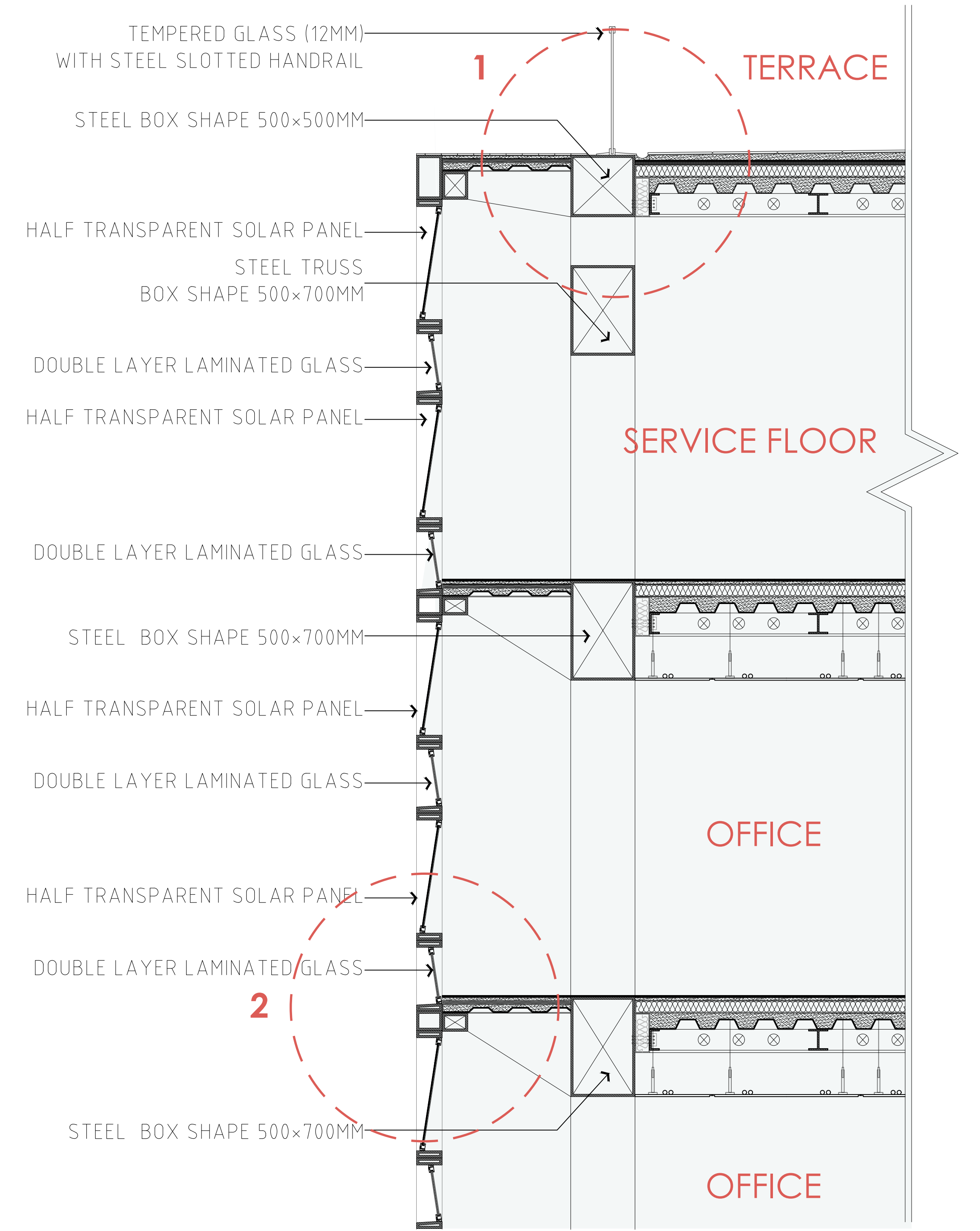
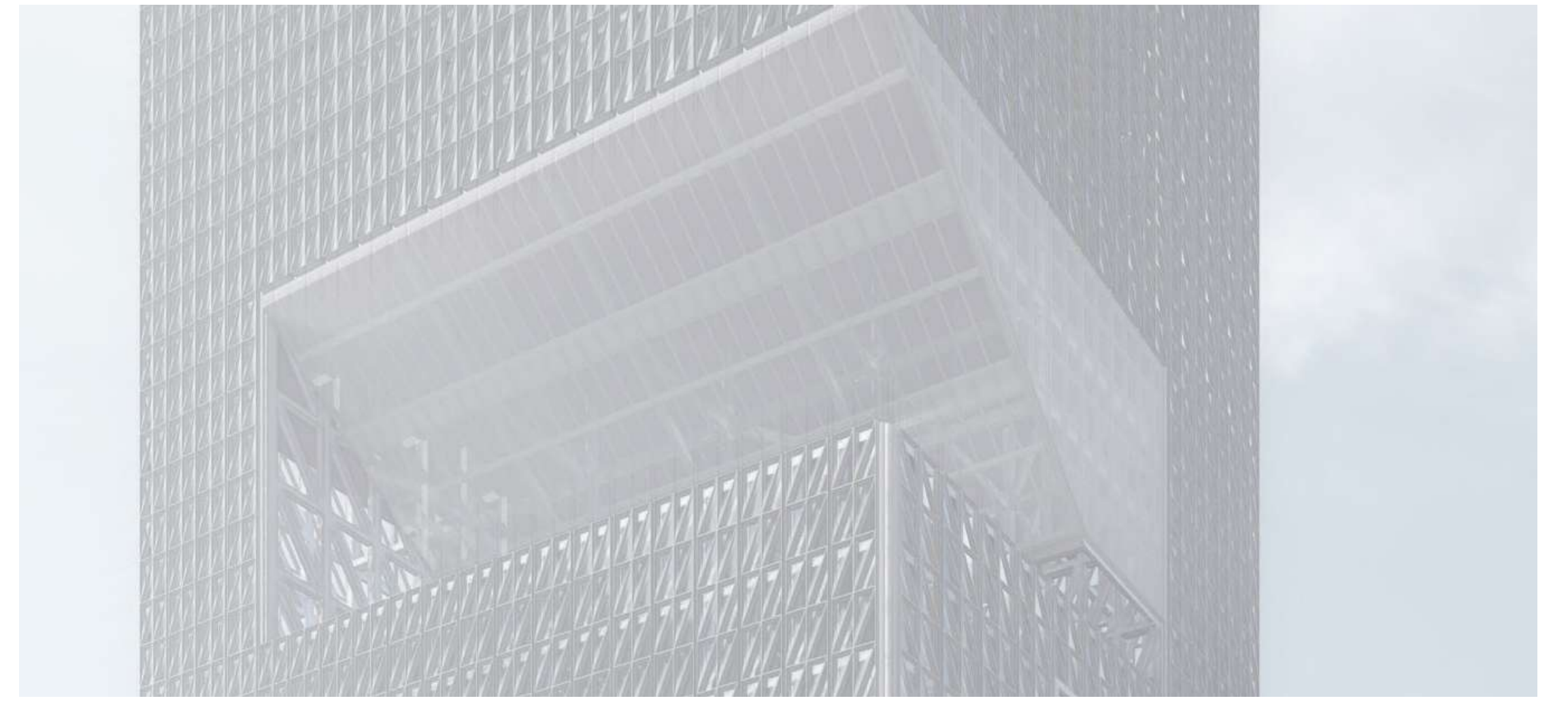
# CONSTRUCTION DETAIL



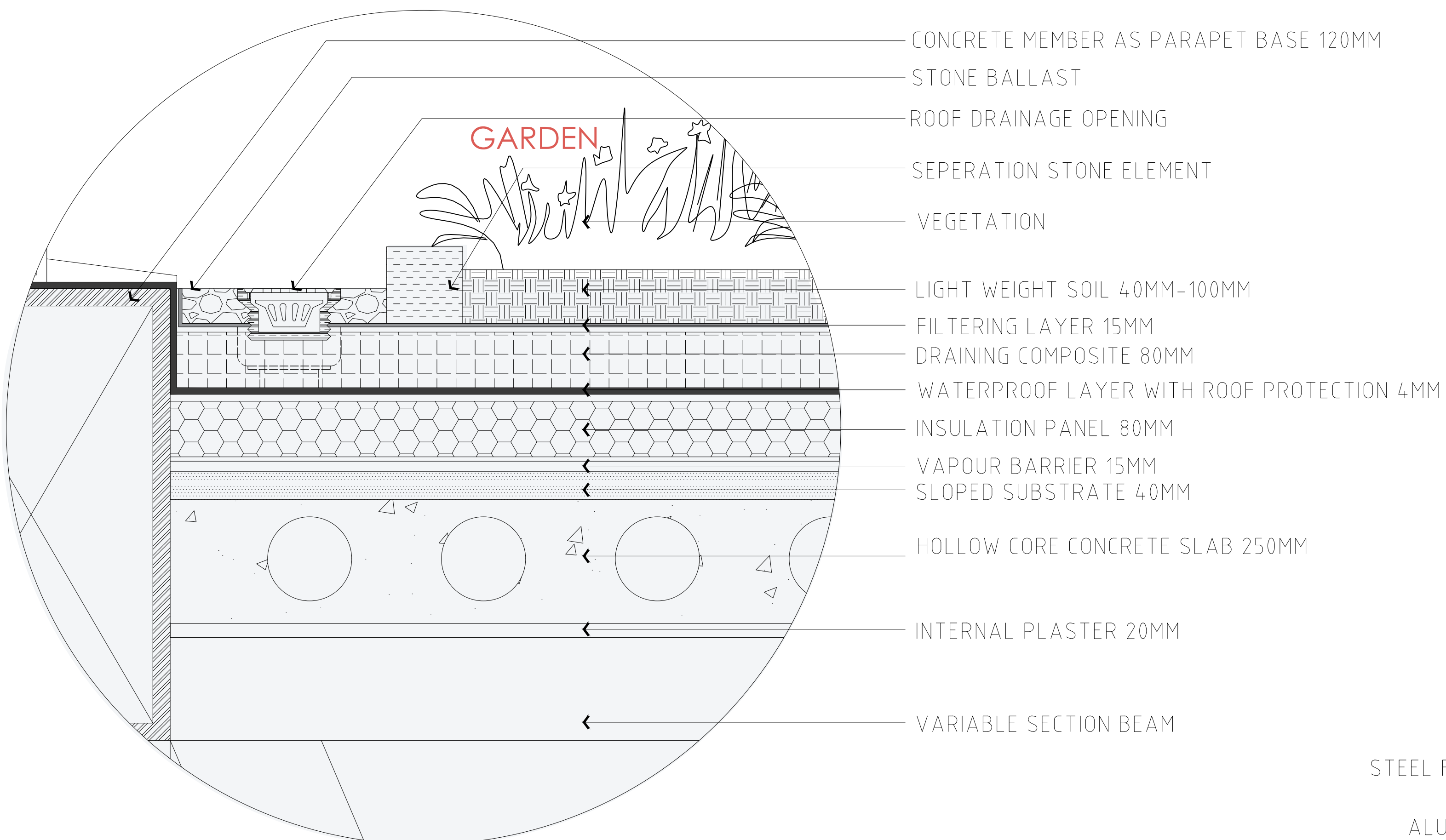
1 TOWER TERRACE DETAIL 1:5



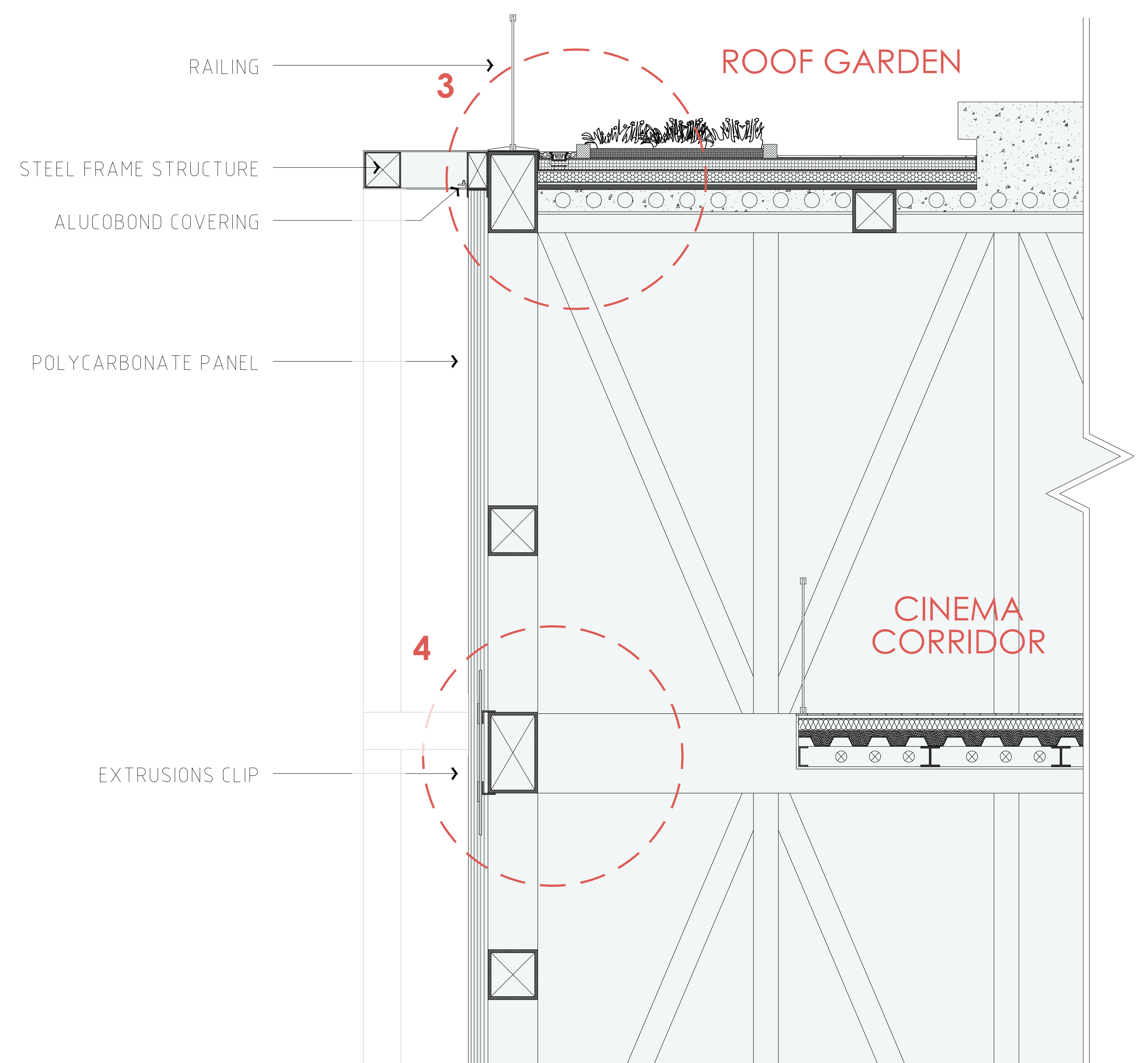
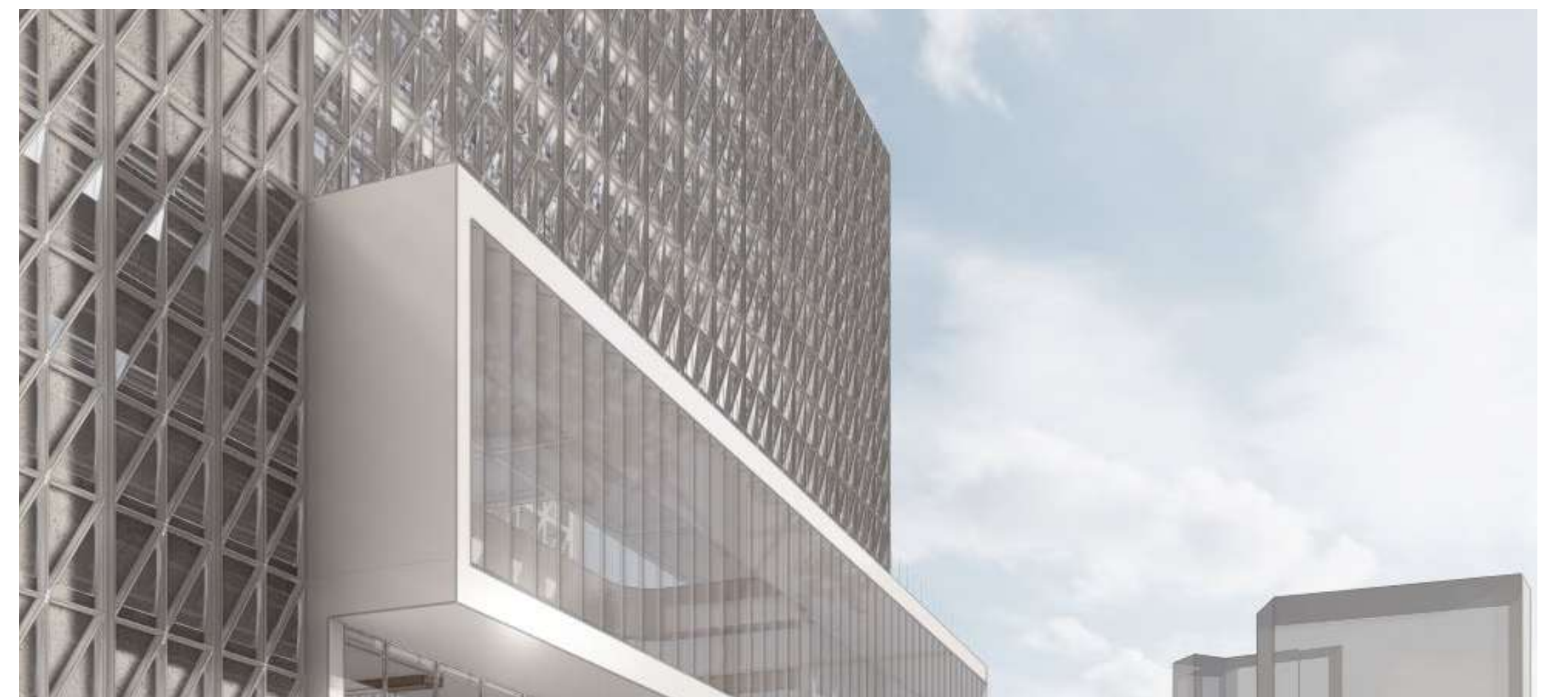
2 TOWER FACADE DETAIL 1:5



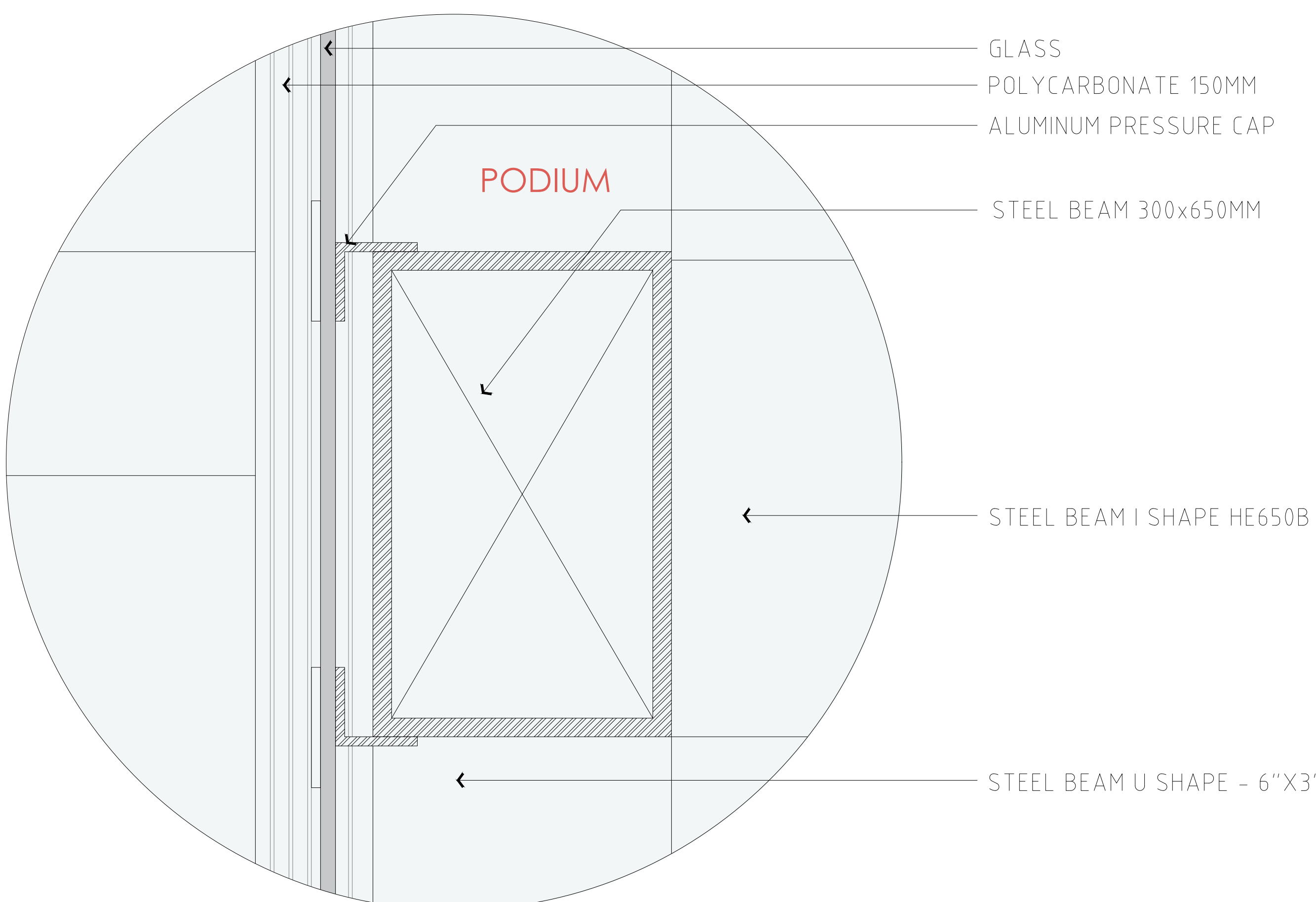
TOWER FACADE DETAIL 1:25



3 ROOF GARDEN DETAIL 1:5

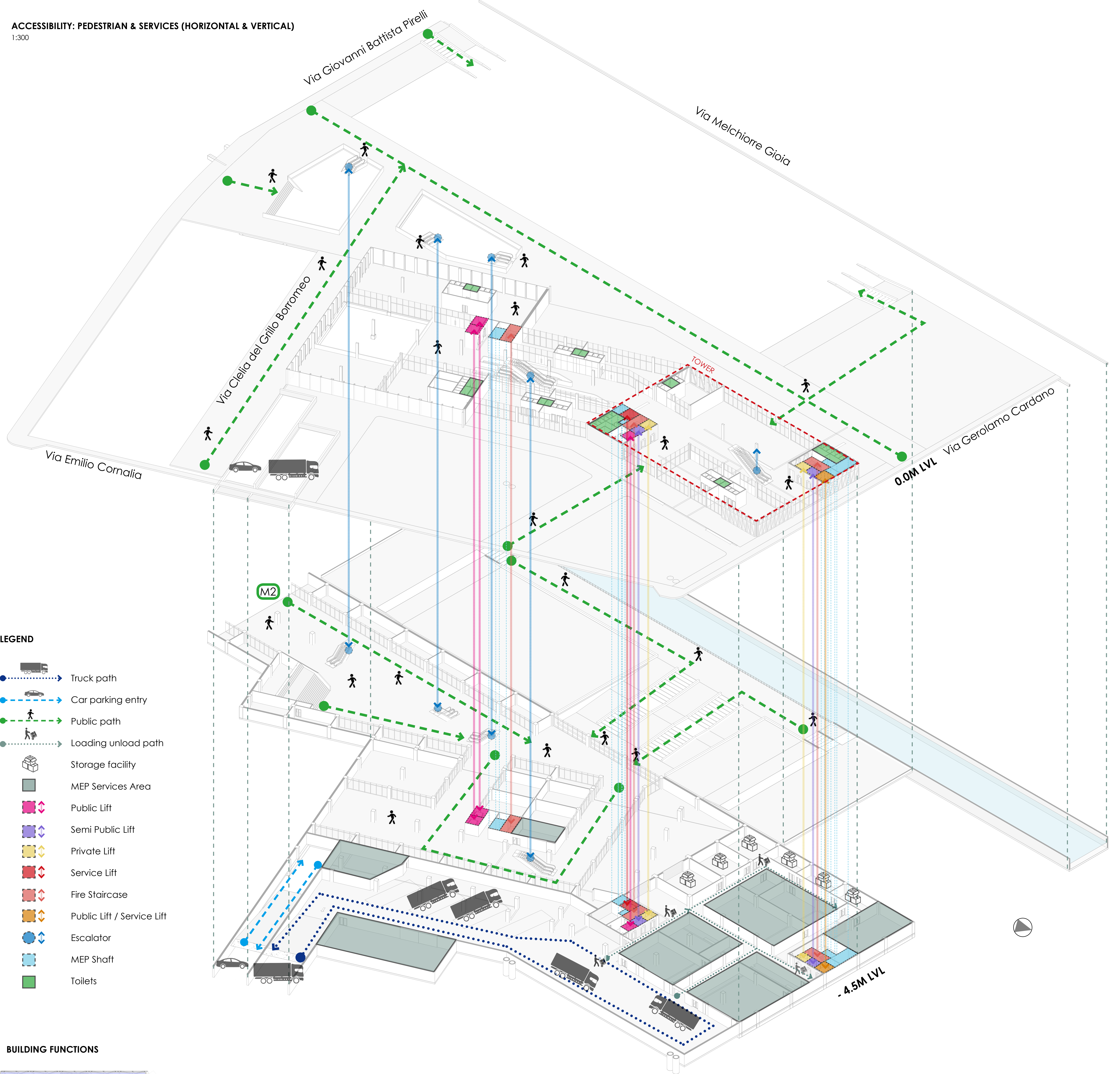


PODIUM FACADE DETAIL 1:25



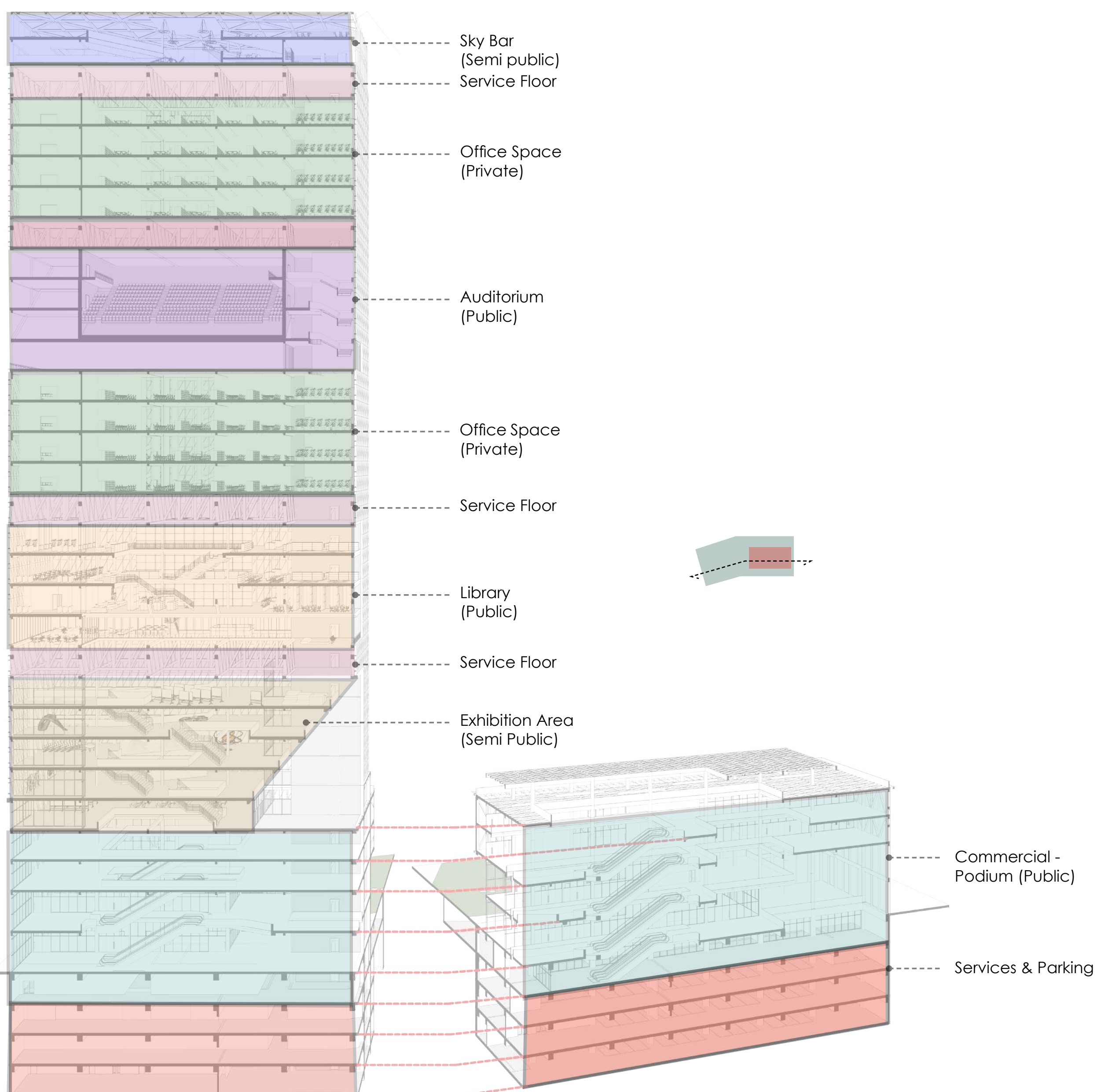
4 PODIUM FACADE DETAIL 1:5





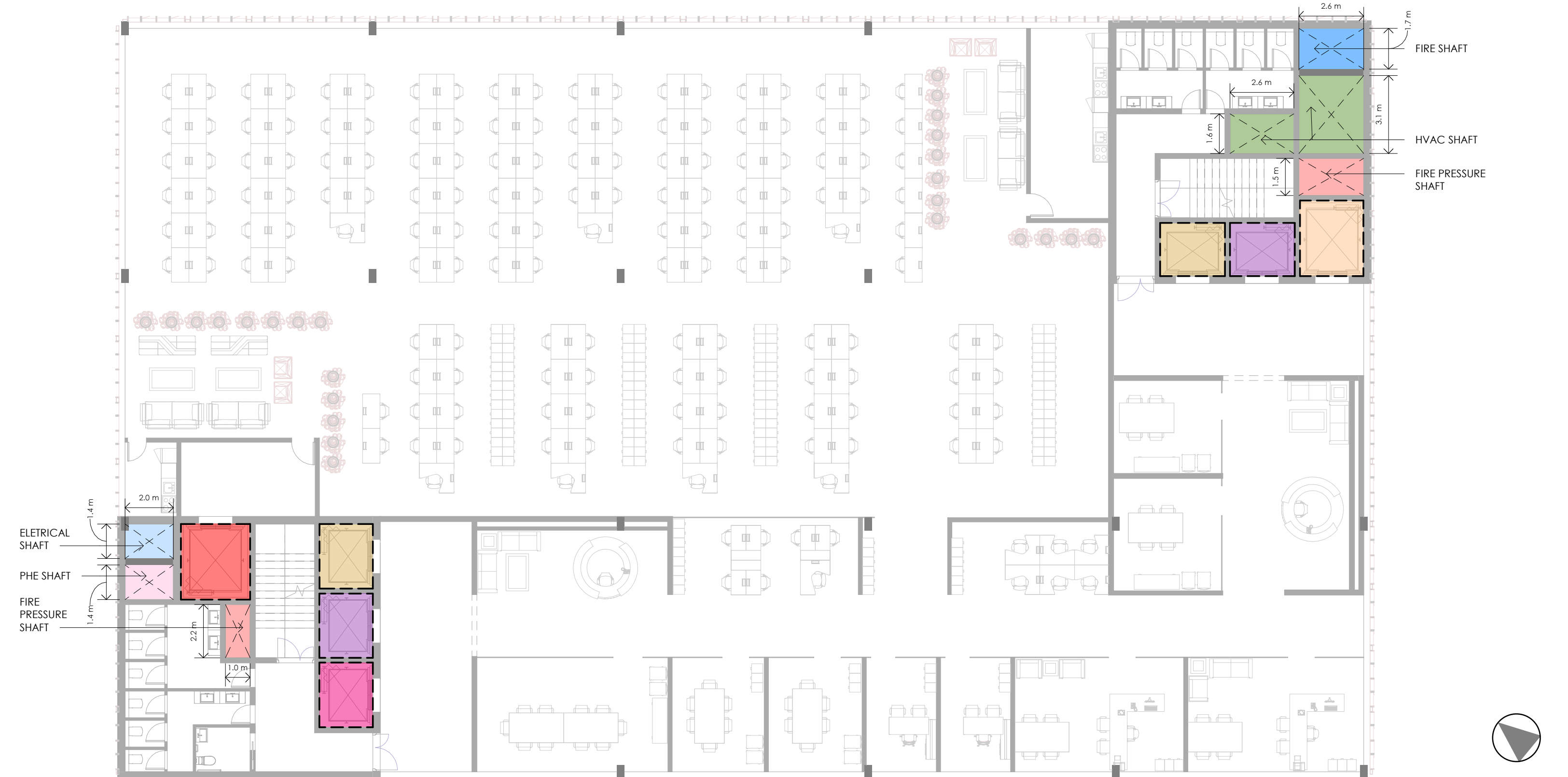
- LEGEND**
- Truck path
  - Car parking entry
  - Public path
  - Loading/unload path
  - Storage facility
  - MEP Services Area
  - Public Lift
  - Semi Public Lift
  - Private Lift
  - Service Lift
  - Fire Staircase
  - Public Lift / Service Lift
  - Escalator
  - MEP Shaft
  - Toilets

**BUILDING FUNCTIONS**



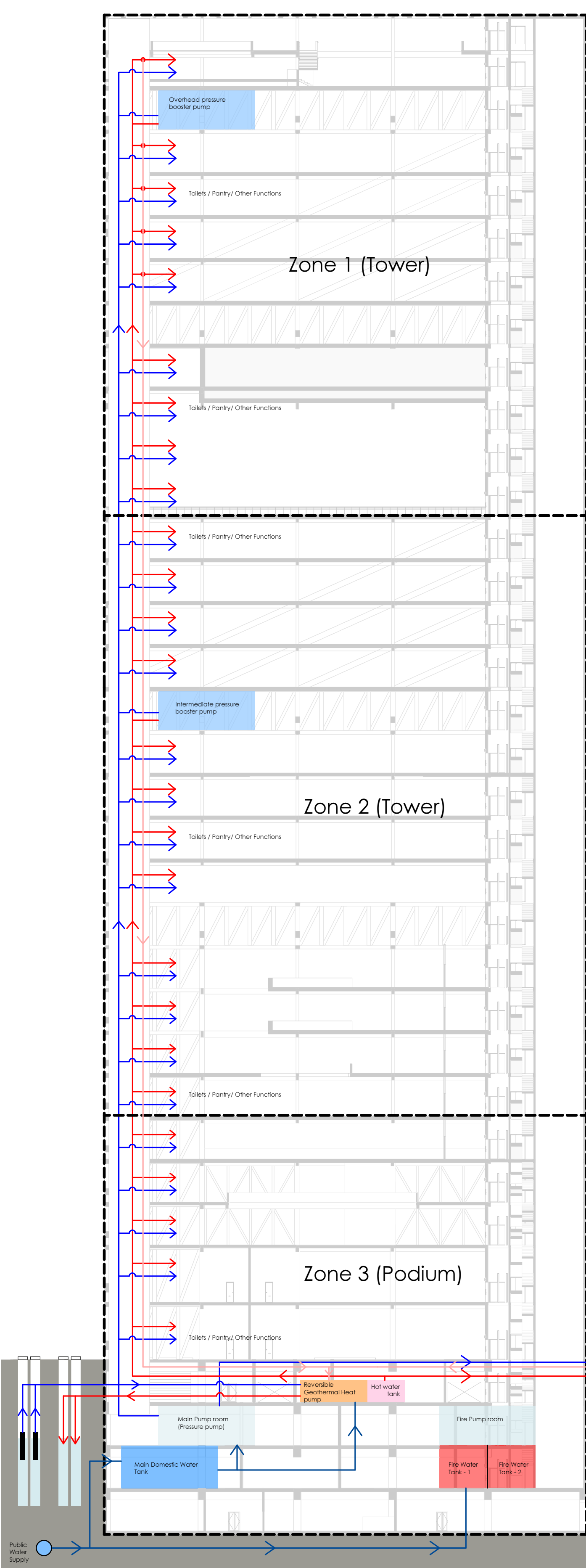
**SERVICE SHAFT DETAILS - TOWER**

1:150



**LEGEND**

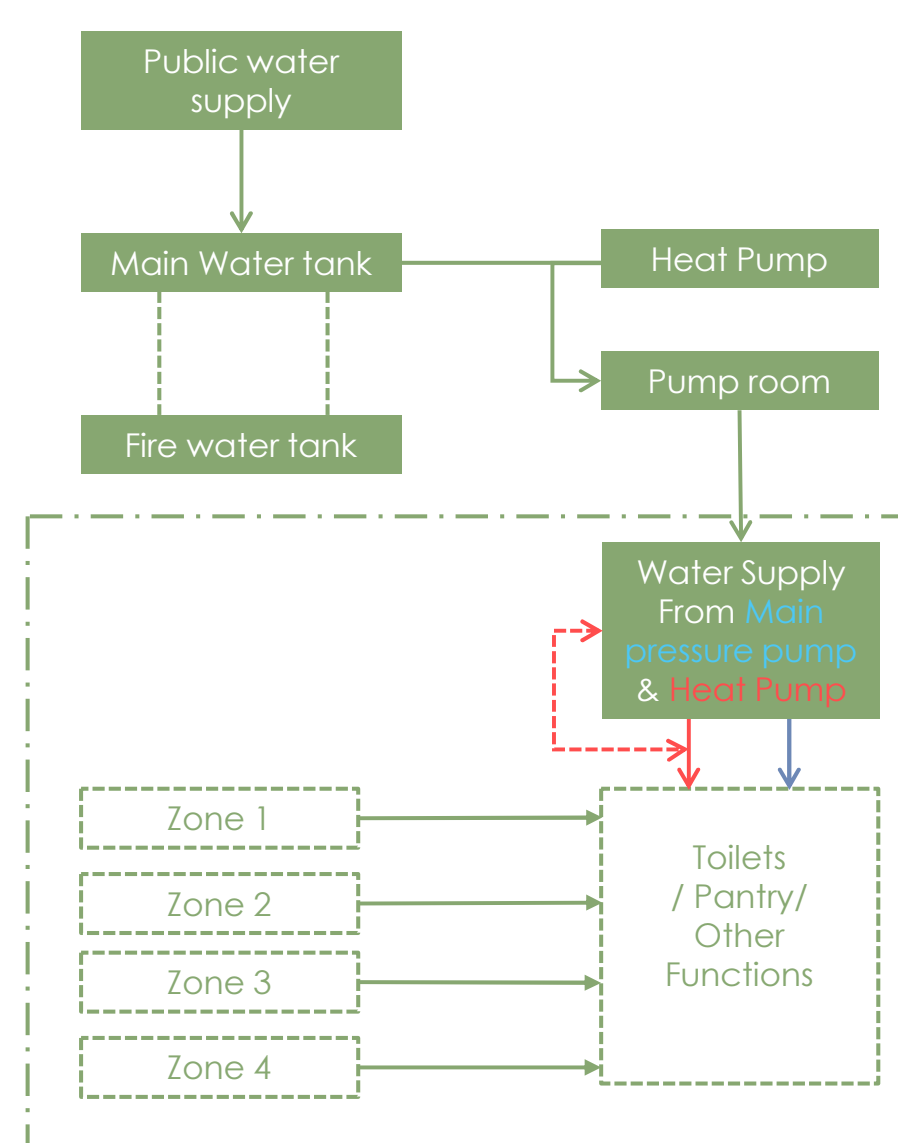
- Public Lift
- Semi Public Lift
- Private Lift
- Service Lift
- Public Lift / Service Lift



**LEGEND**

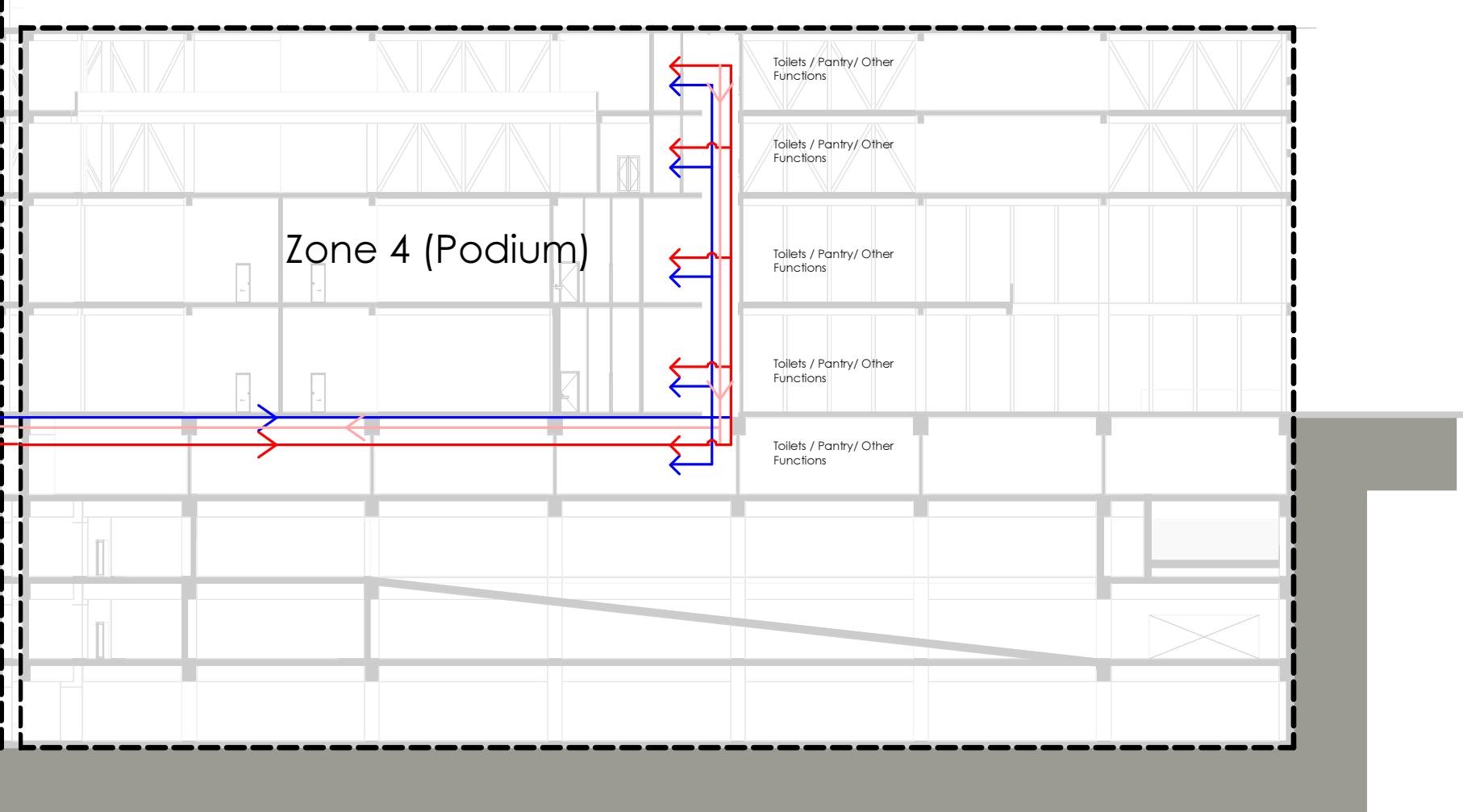
- Main Water Supply
- Hot Water Supply
- Cold Water Supply
- Hot water recirculation
- Fire Water Tank
- Domestic Water Tank
- Hot Water Tank
- Main Pump Room
- Reversible Geothermal Heat Pump
- Pressure Booster Pump

**WATER SUPPLY SCHEME**



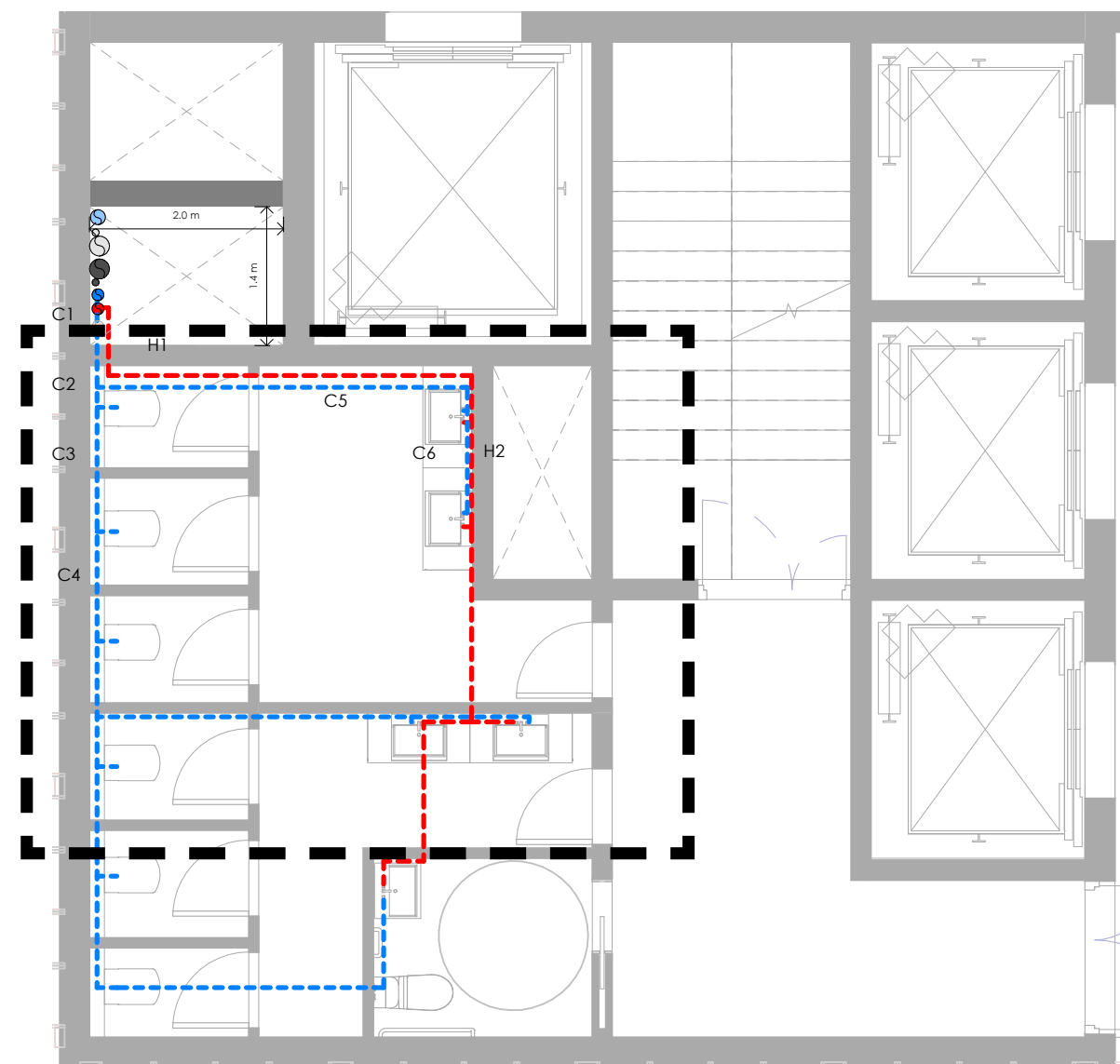
**WATER SUPPLY SCHEME SECTION**

1:300



**WATER SUPPLY PLAN**

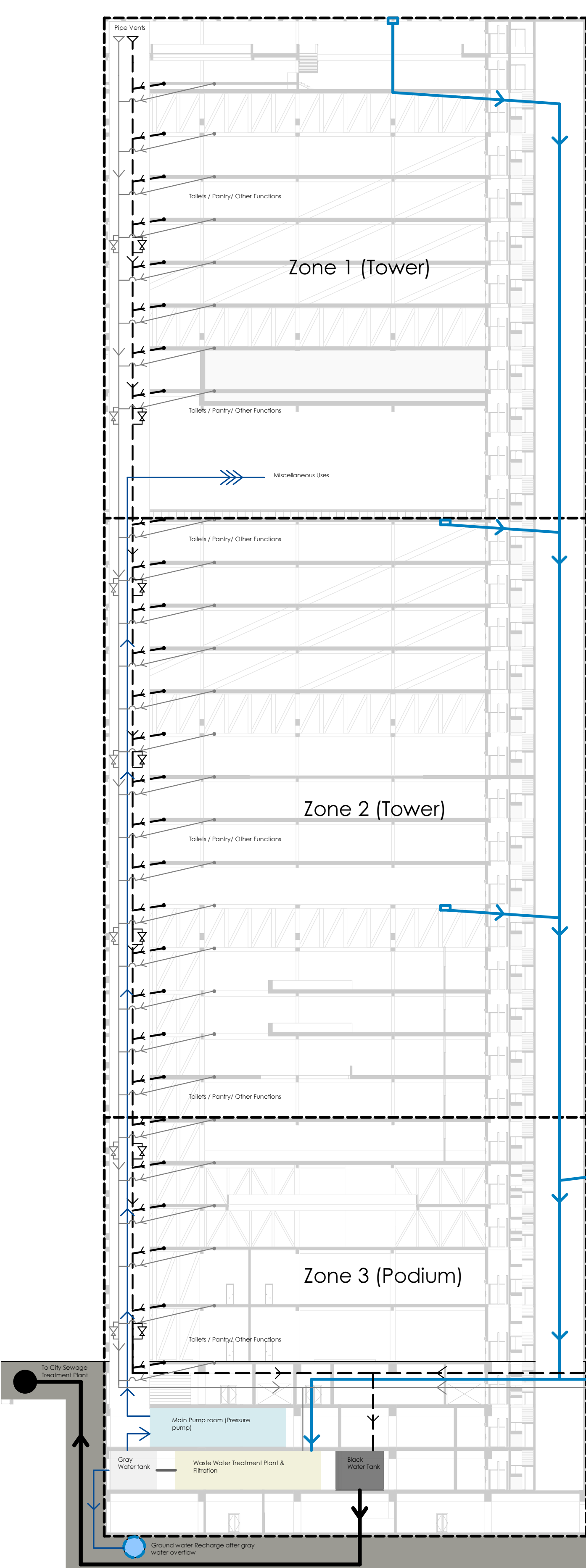
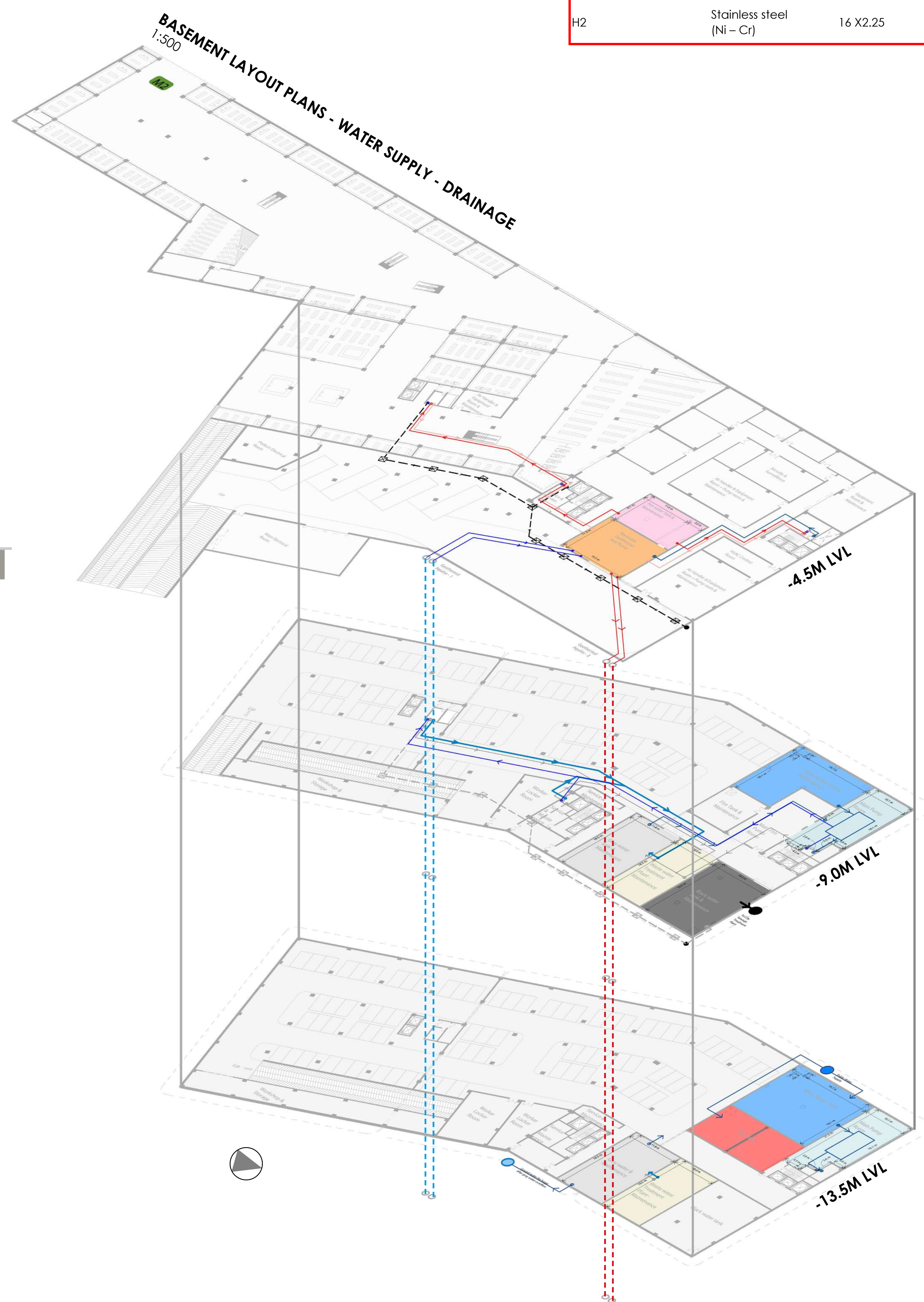
1:50



Note : Calculation details mention in Technical Report

**WATER SUPPLY PLAN LEGEND**

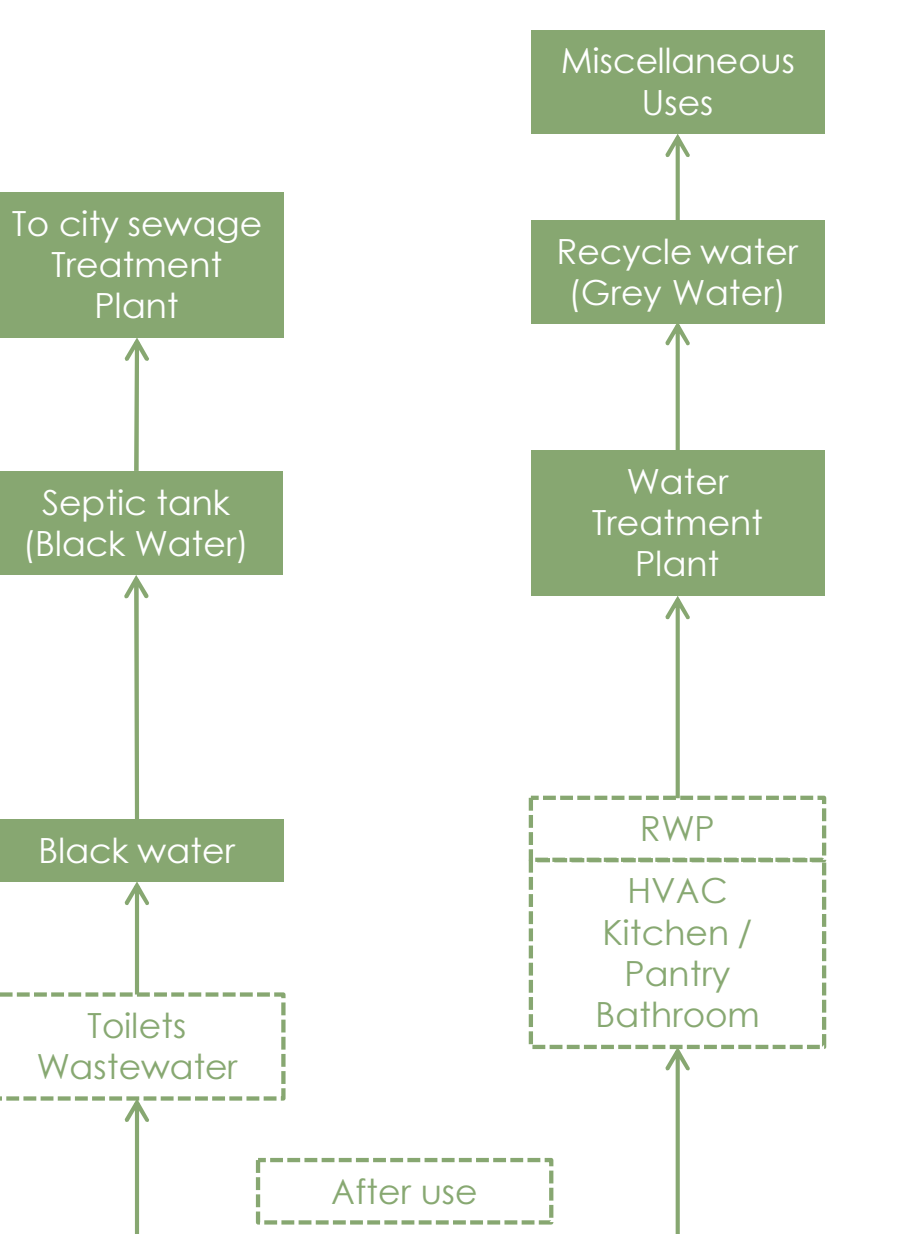
Pipe No.	Pipe Material	Pipe Size
<b>Cold Water</b>		
Main Cold Water Supply Pipe	Stainless steel (Ni - Cr)	40 X 3.5
C1	Stainless steel (Ni - Cr)	18 X2.0
C2	Stainless steel (Ni - Cr)	16 X2.25
C3	Stainless steel (Ni - Cr)	16 X2.25
C4	Stainless steel (Ni - Cr)	16 X2.25
C5	Stainless steel (Ni - Cr)	16 X2.25
C6	Stainless steel (Ni - Cr)	16 X2.25
<b>Hot Water</b>		
Main Hot Water Supply Pipe	Stainless steel (Ni - Cr)	40 X 3.5
H1	Stainless steel (Ni - Cr)	16 X2.25
H2	Stainless steel (Ni - Cr)	16 X2.25



**LEGEND**

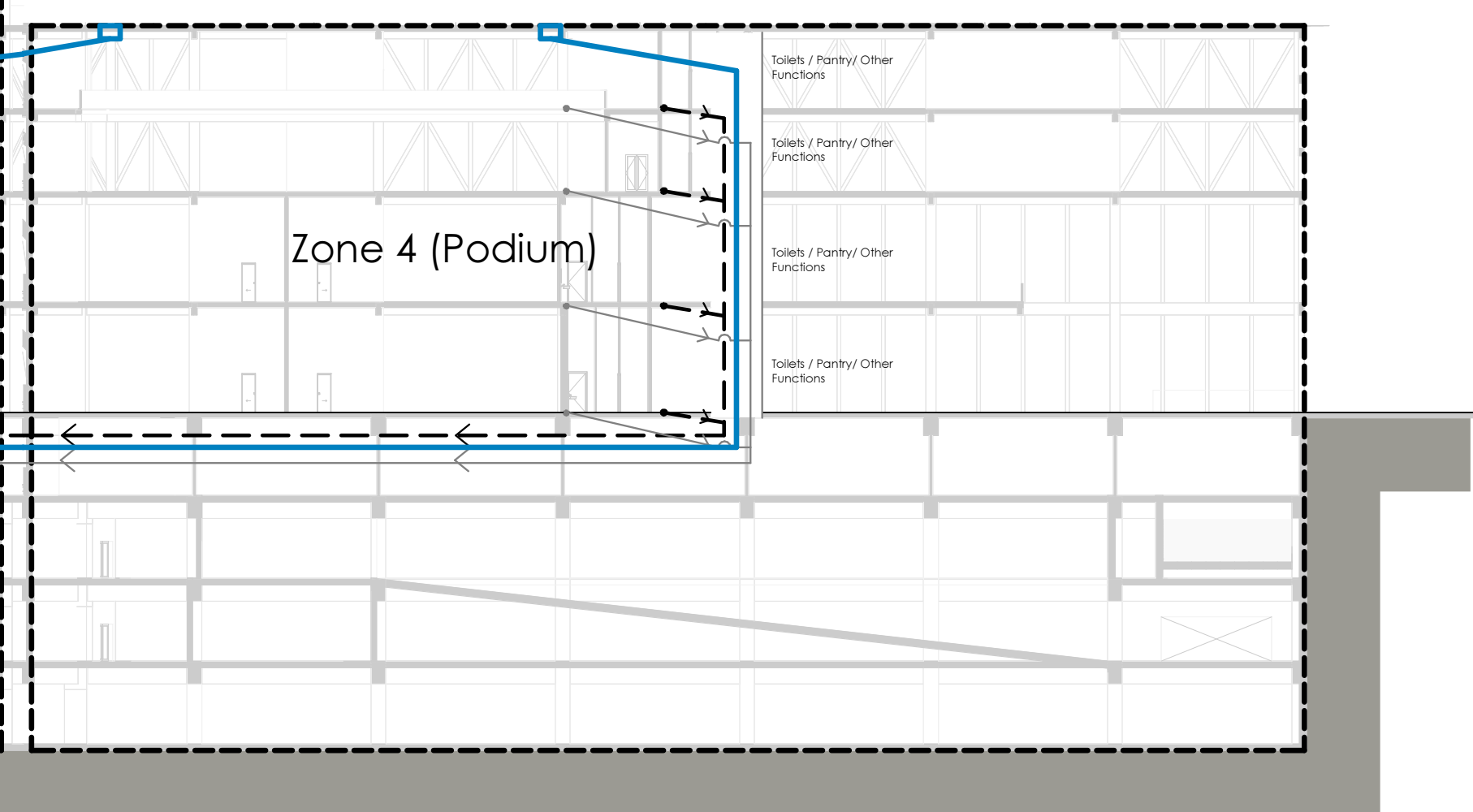
- Miscellaneous Uses
- To City Sewage Treatment Plant
- Gray Water Pipe
- Black Water Pipe
- Rain Water Pipe
- Sewage Treatment Plant line
- Ground Water recharge
- WWTP & Filtration Room
- Main Pump Room
- Black Water Tank
- Gray Water Tank

**DRAINAGE SCHEME**



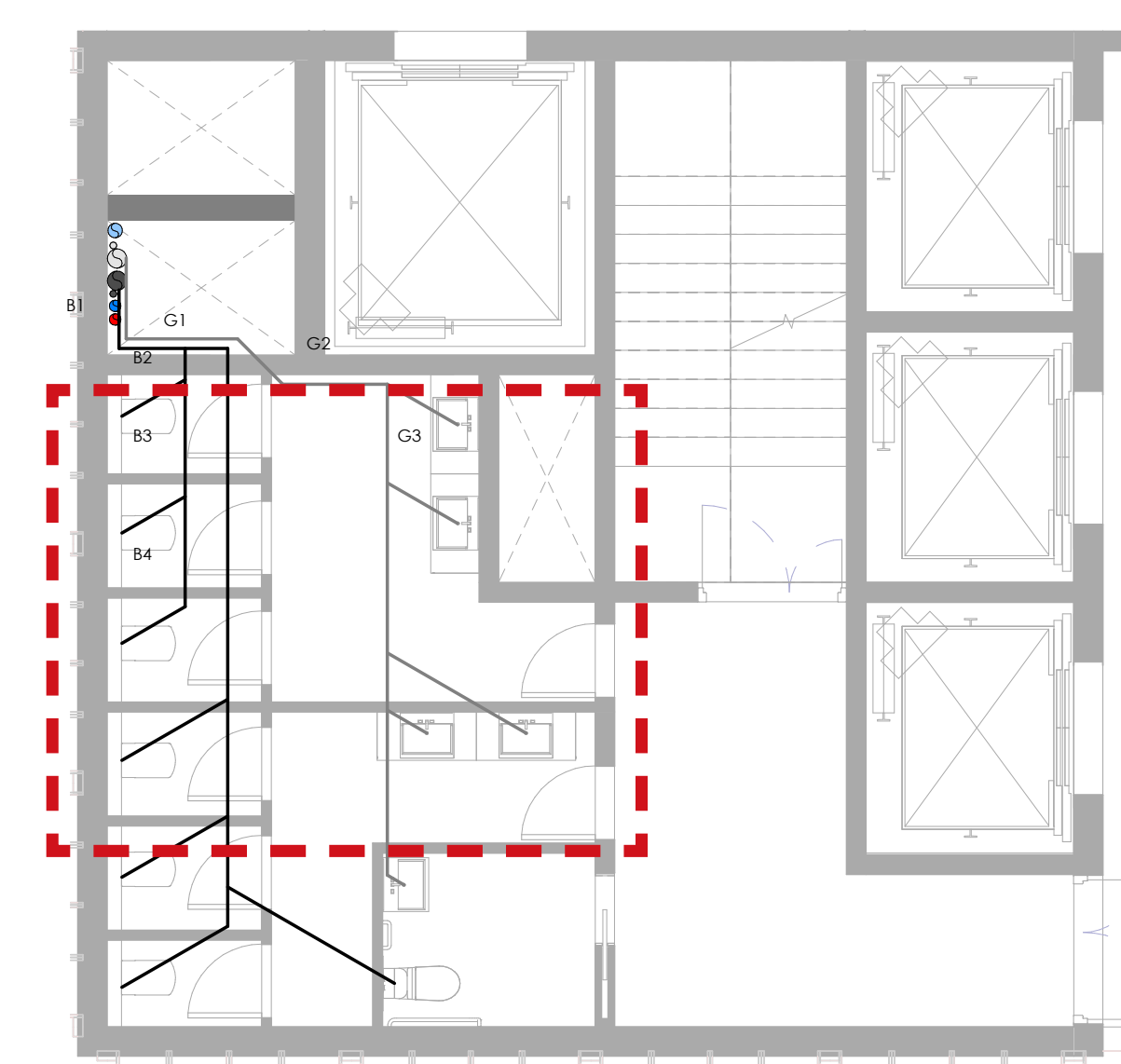
**DRAINAGE SCHEME SECTION**

1:300



**BLACK WATER DRAINAGE PLAN**

1:50



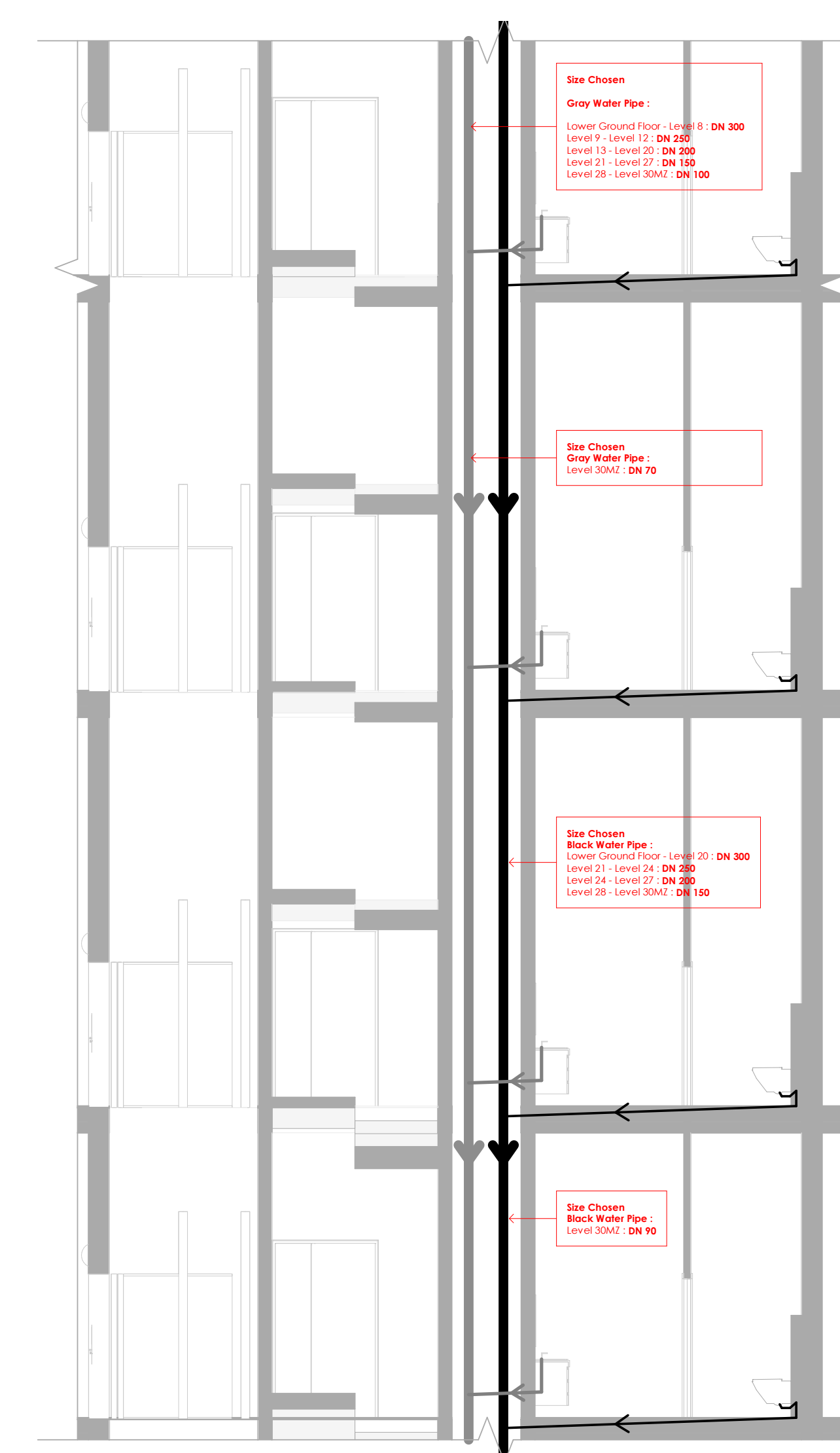
**DRAINAGE PLAN LEGEND**

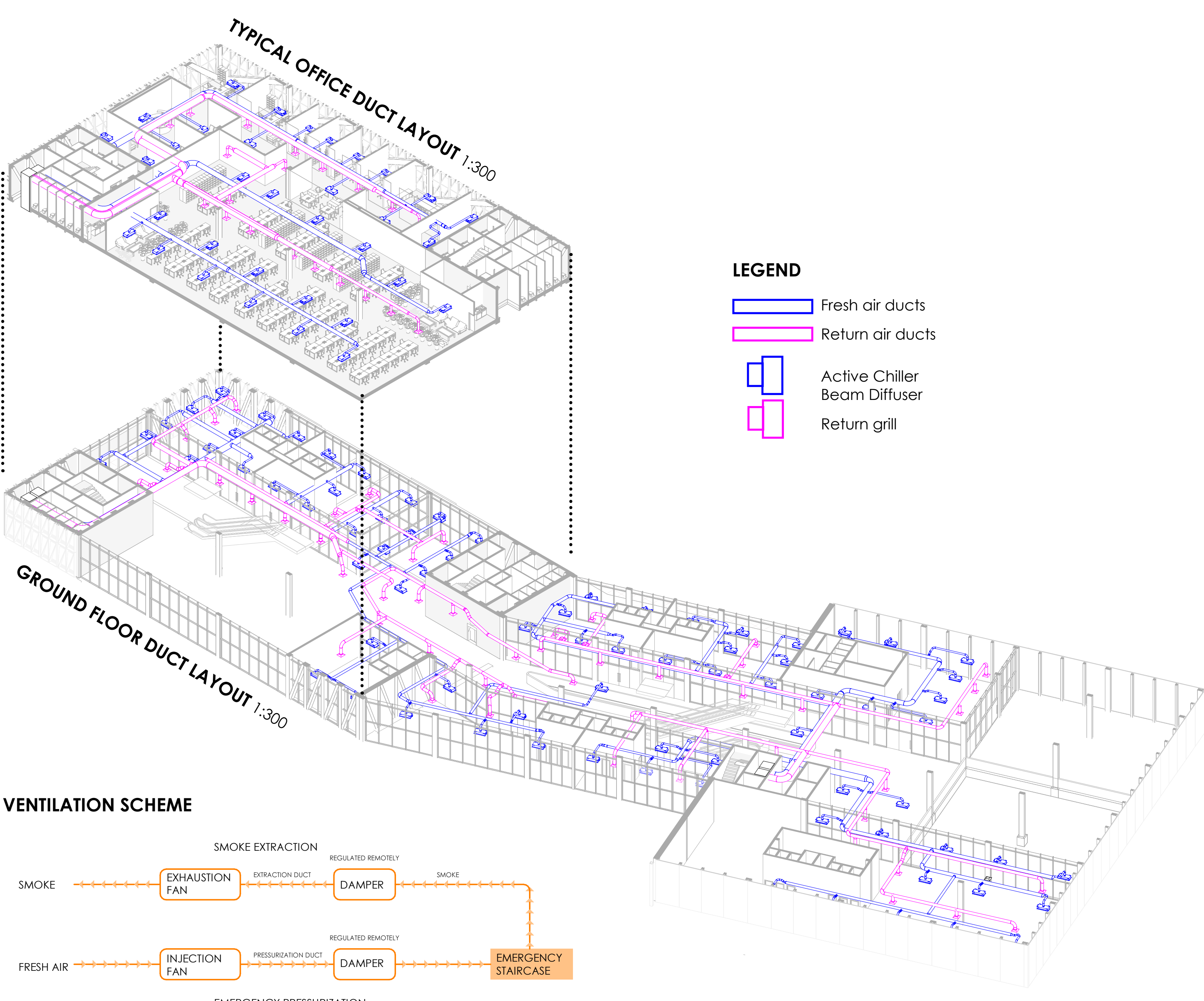
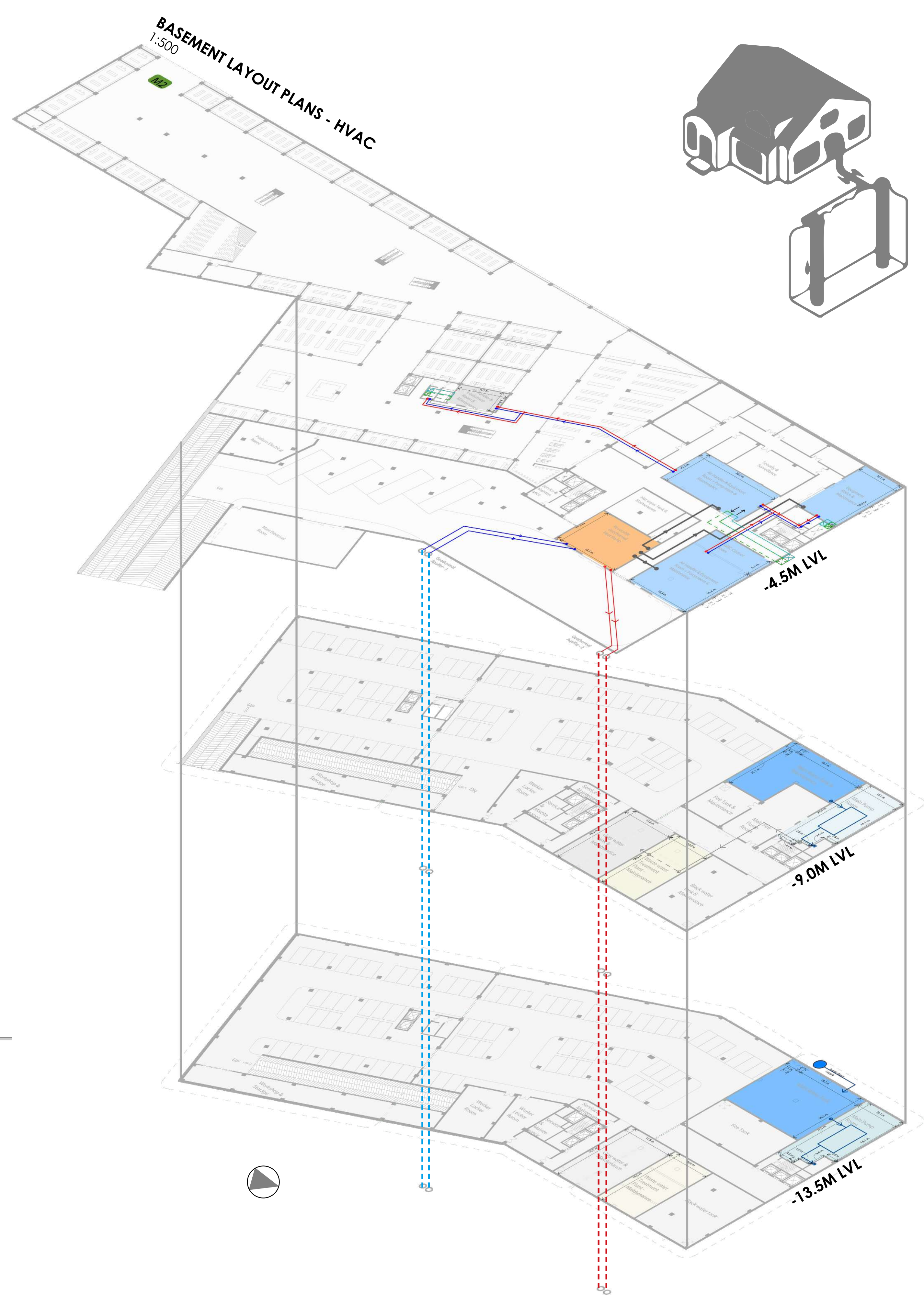
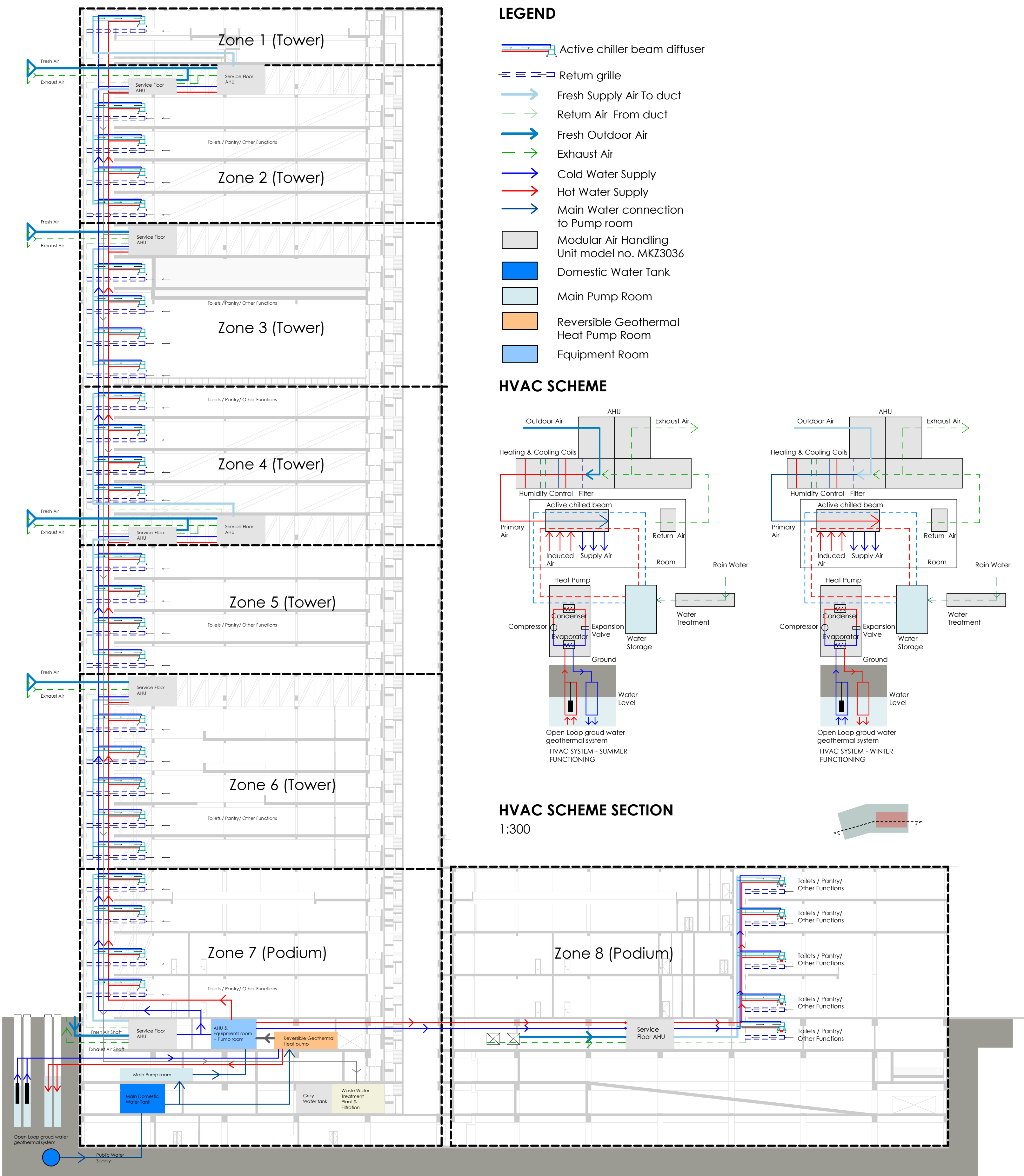
Pipe No.	Pipe Material	Pipe Size
<b>Gray Water</b>		
Main Gray Water Pipe	PVC	DN 60
G1	PVC	DN 30
G2	PVC	DN 30
G3	PVC	DN 30
<b>Black Water</b>		
Main Black Water Pipe	PVC	DN 100
B1	PVC	DN 60
B2	PVC	DN 60
B3	PVC	DN 50
B4	PVC	DN 50

Note : Calculation details mention in Technical Report

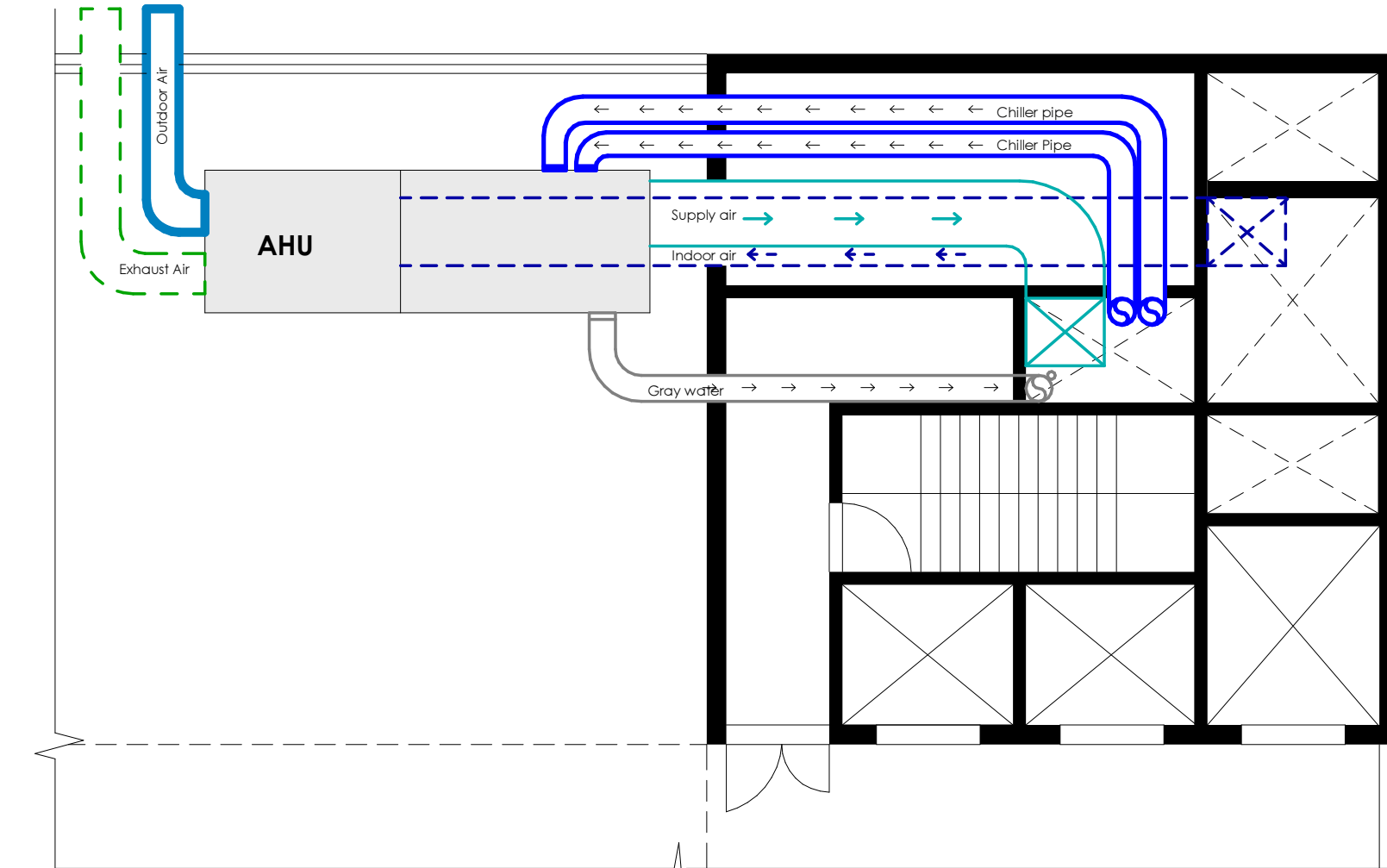
**DISCHARGE STACK SECTION**

1:50

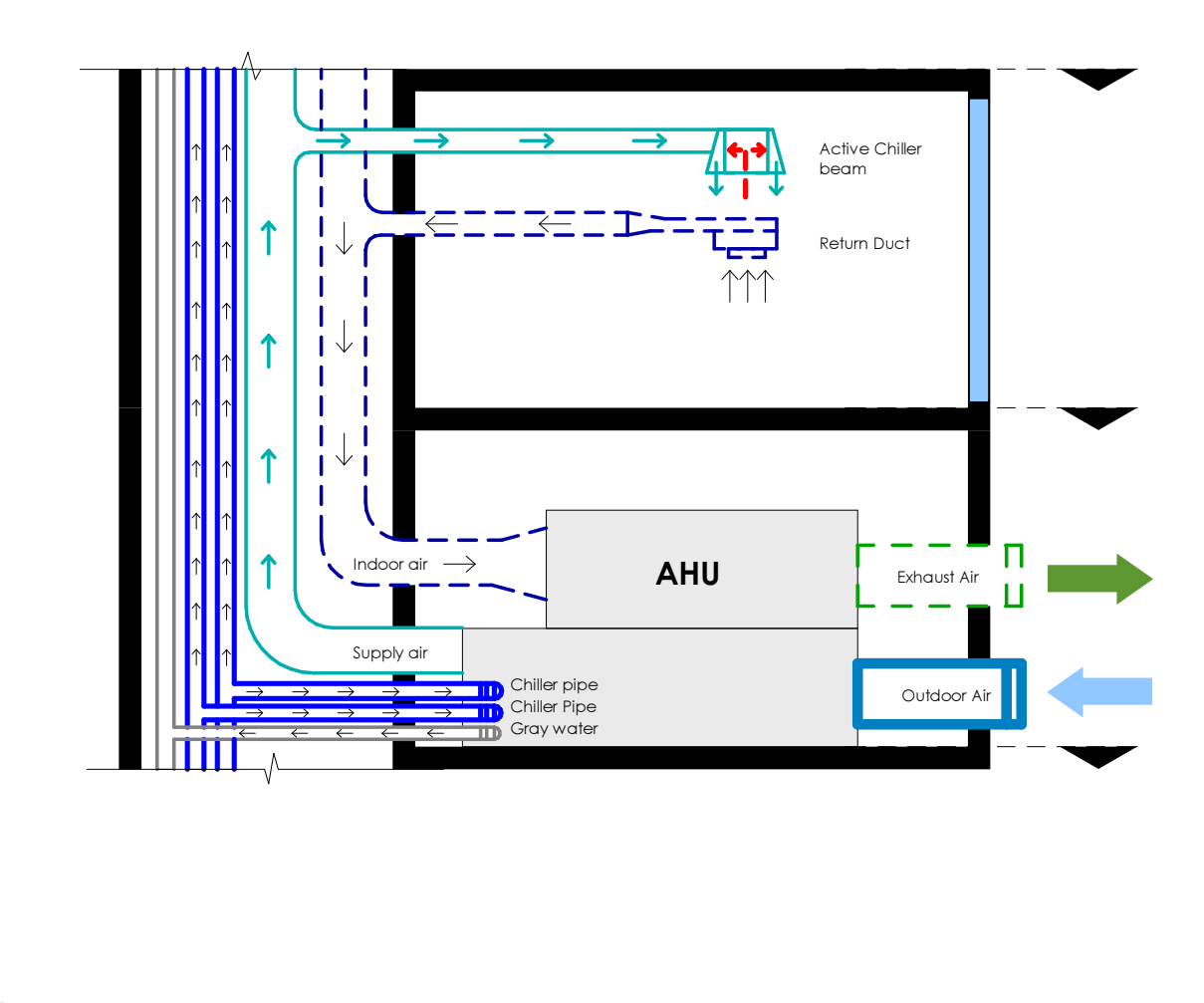




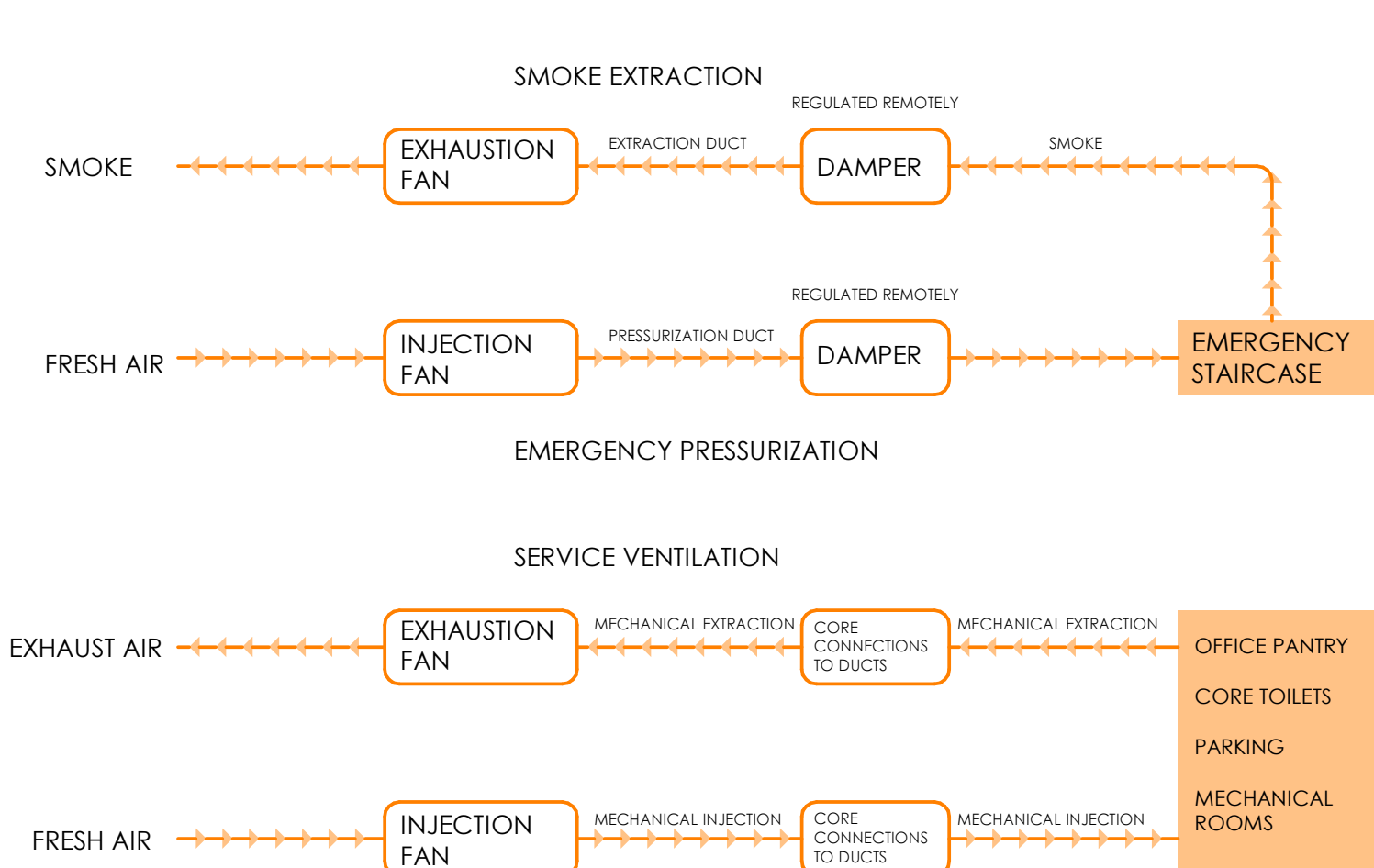
**AHU DUCTS LAYOUT - PLAN**  
1:100



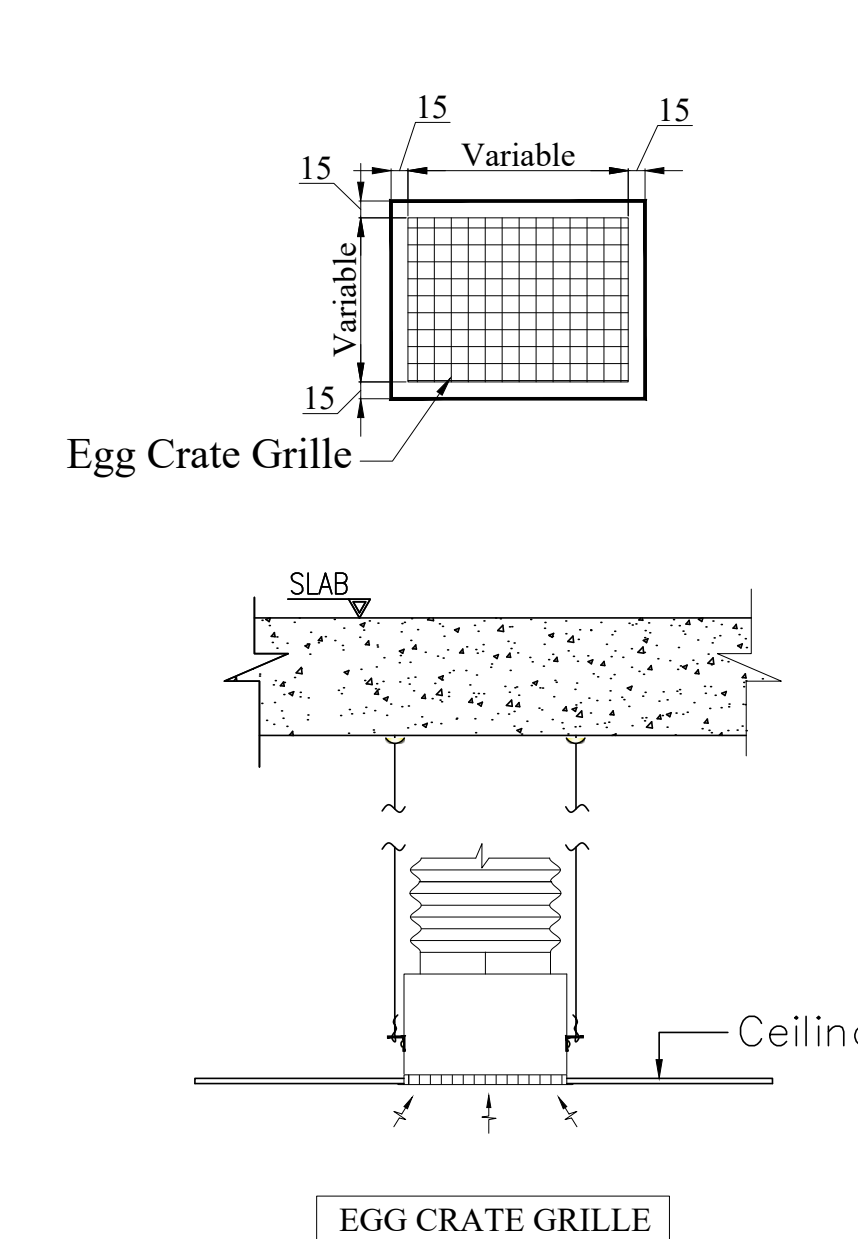
**AHU DUCTS LAYOUT - SECTION**  
1:100



**VENTILATION SCHEME**



**RETURN AIR GRILLE DETAIL (NTS)**



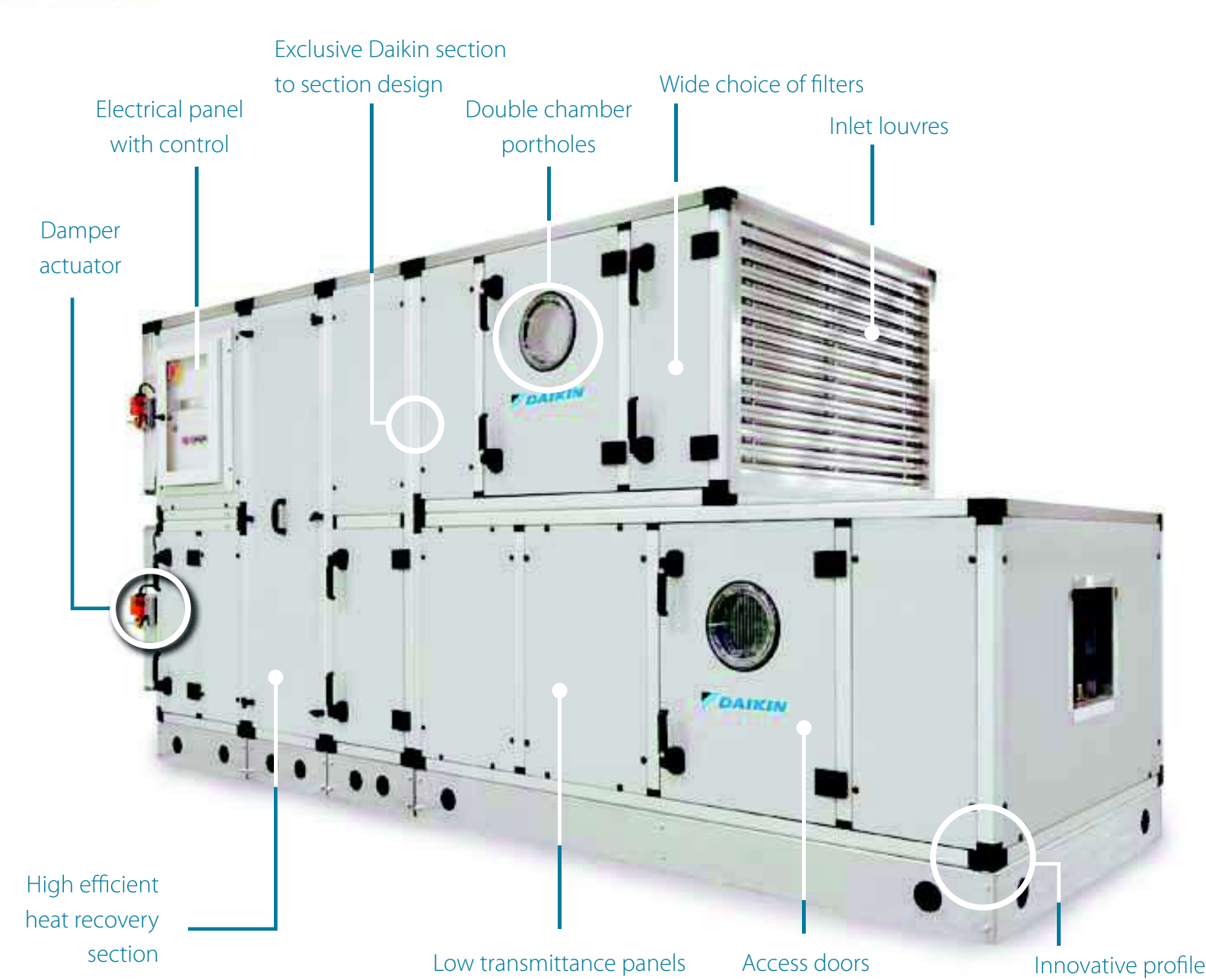
**REFERENCE - Active chilled beam Unit - ACB20 - Dadanco catalogue**

**CEILING MOUNTED ACB CASSETTE**  
(VERTICAL COILS AND DRAIN PANS)

**PERFORMANCE CHARACTERISTICS**

SIZE	TYPICAL CAPACITY	SOUND LEVEL			
Width	Height	Cooling (RTU4)	Heating (RTU4)	Primary Airflow (CFM)	NC15-NC24
26"	11.2"	1,500 - 10,000	13,000	12 - 180	NC15-NC24

**DAIKIN Air Handling Unit D-AHU Professional**



Flexible design Daikin Professional air handlers are tailored to your needs, optimizing always the unit for the most cost-effective selection and manufacturing standardization.

» Air flow from 500 m³/h up to 144,000 m³/h.

» All the units can be modularly designed to facilitate the transport and the assembly on site.

Airflow (m³/h)	Airflow per zone (m³/h)	Unit Size (m)	Height (mm)	Width (mm)	Face Velocity (m/s)
1,24,447	1,555.85	1.57 X 2.19	1570	2190	3.5

**TOTAL HEAT LOAD CALCULATIONS -**

Maximum Summer Heat Load -

<b>MAXIMUM SENSITIVE LOAD</b>	<b>1872229.16 W</b>
<b>MAXIMUM LATENT LOAD</b>	<b>922924.83 W</b>

Maximum Heat Load -

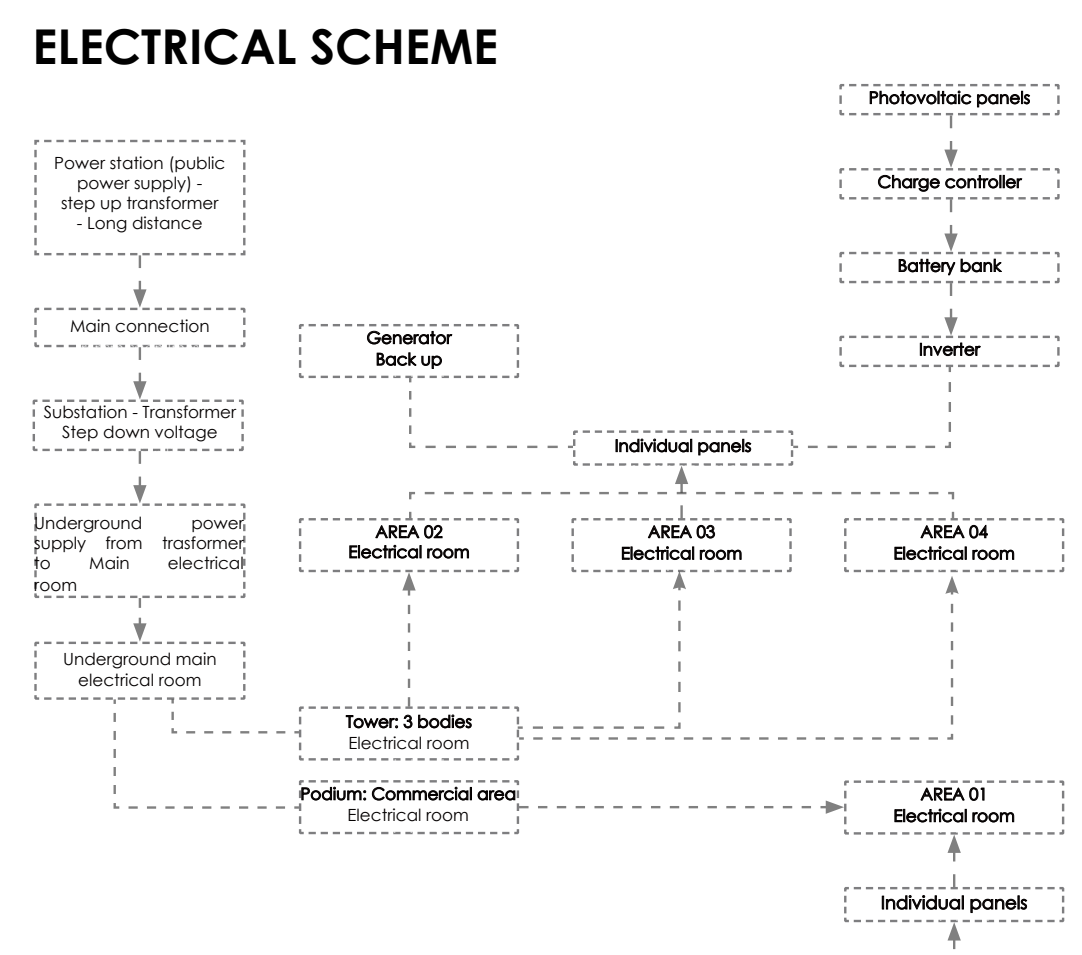
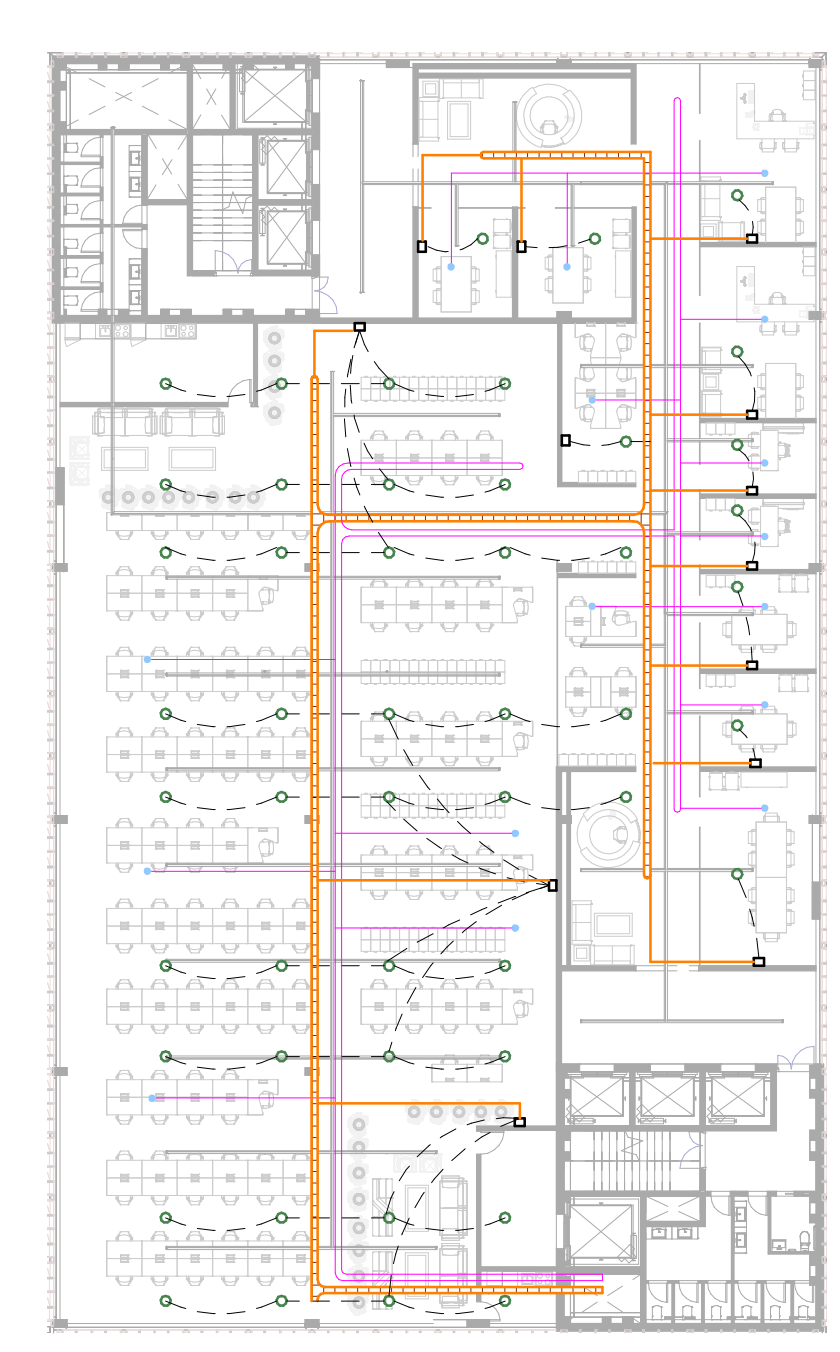
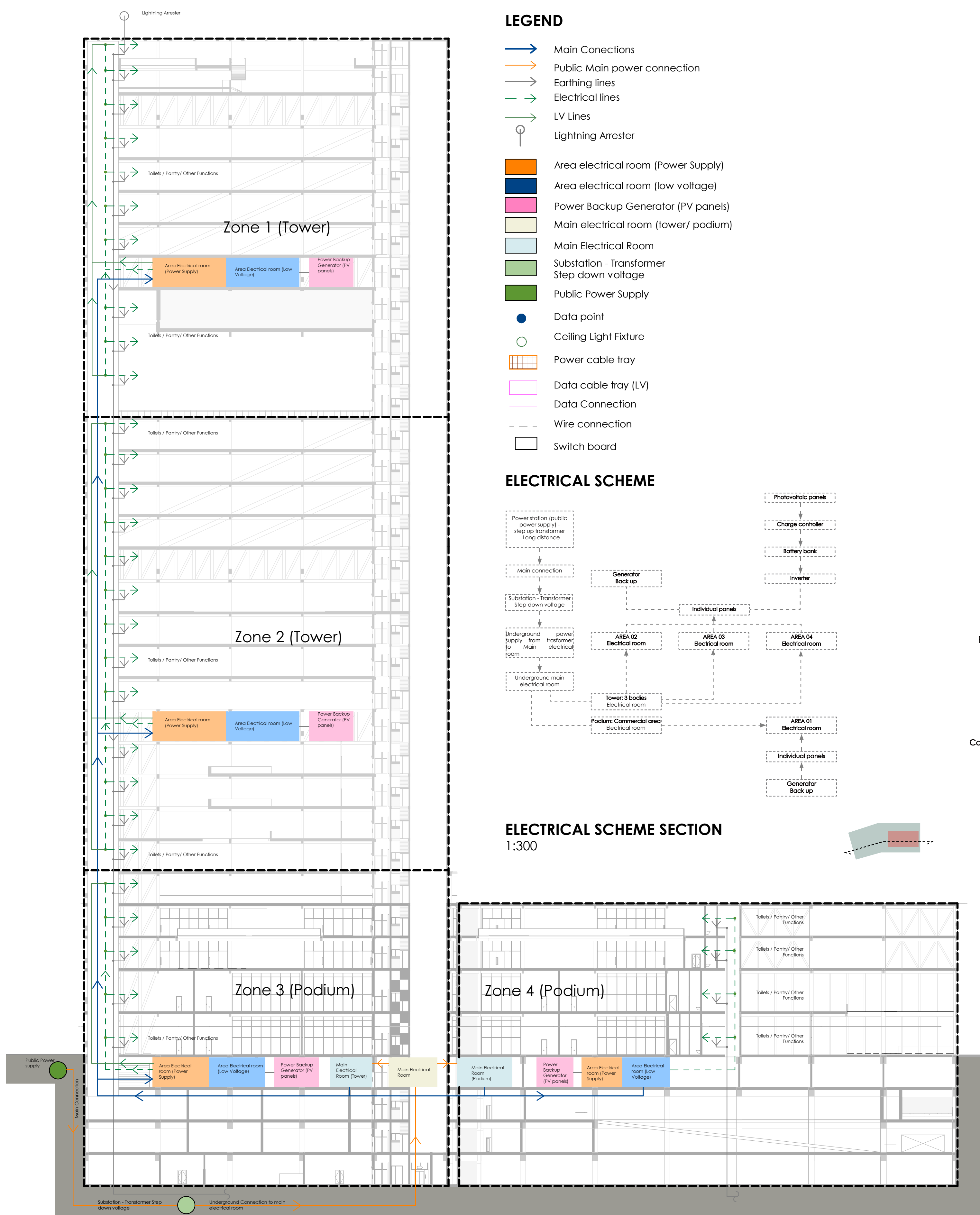
<b>Total Winter heat load</b>	<b>kW</b>	<b>3411.0</b>
<b>Total Summer heat load</b>	<b>kW</b>	<b>2795.2</b>
<b>Total heat load</b>	<b>W</b>	<b>6206134.2</b>

**CROSS SECTION CALCULATIONS -**

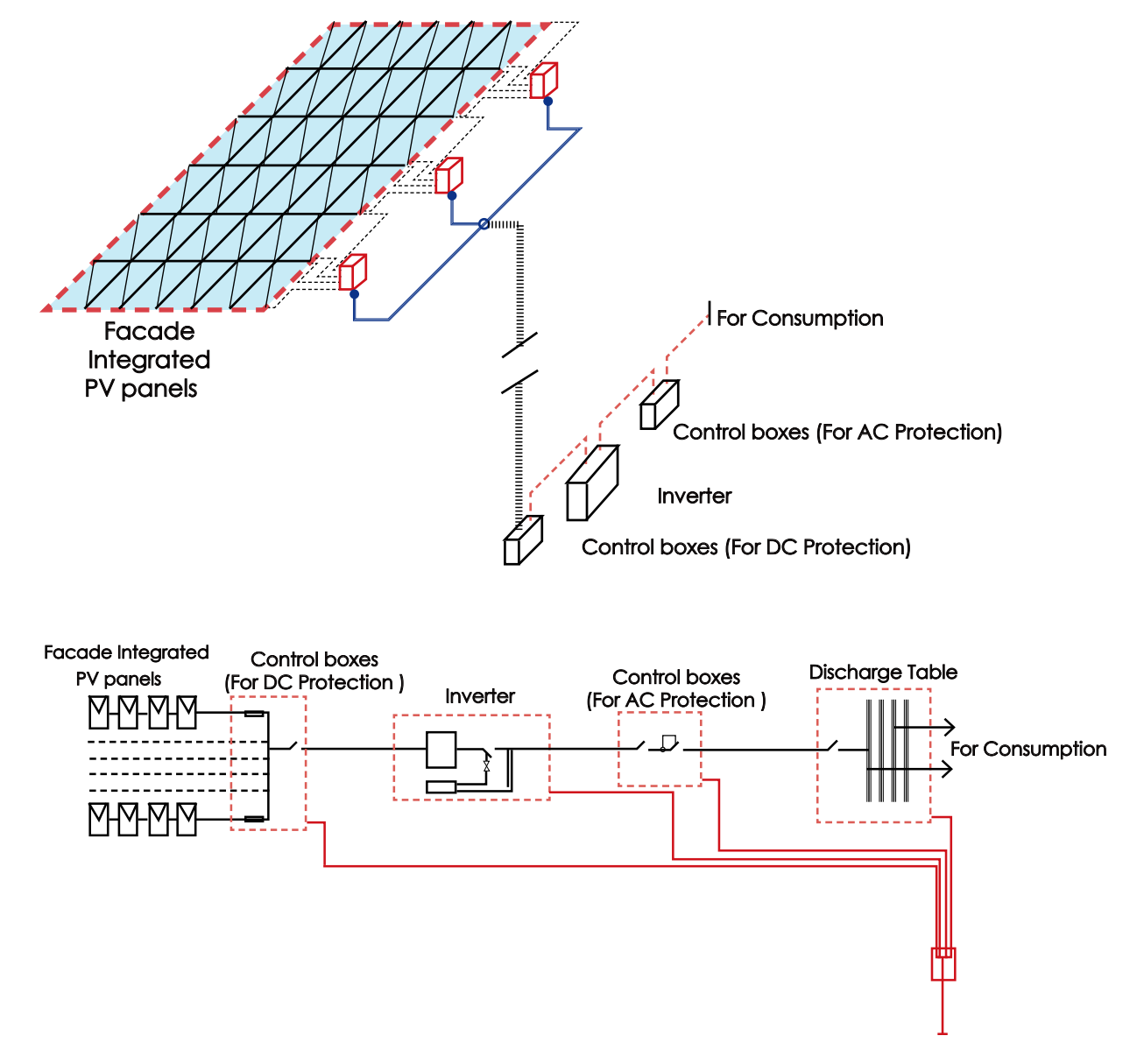
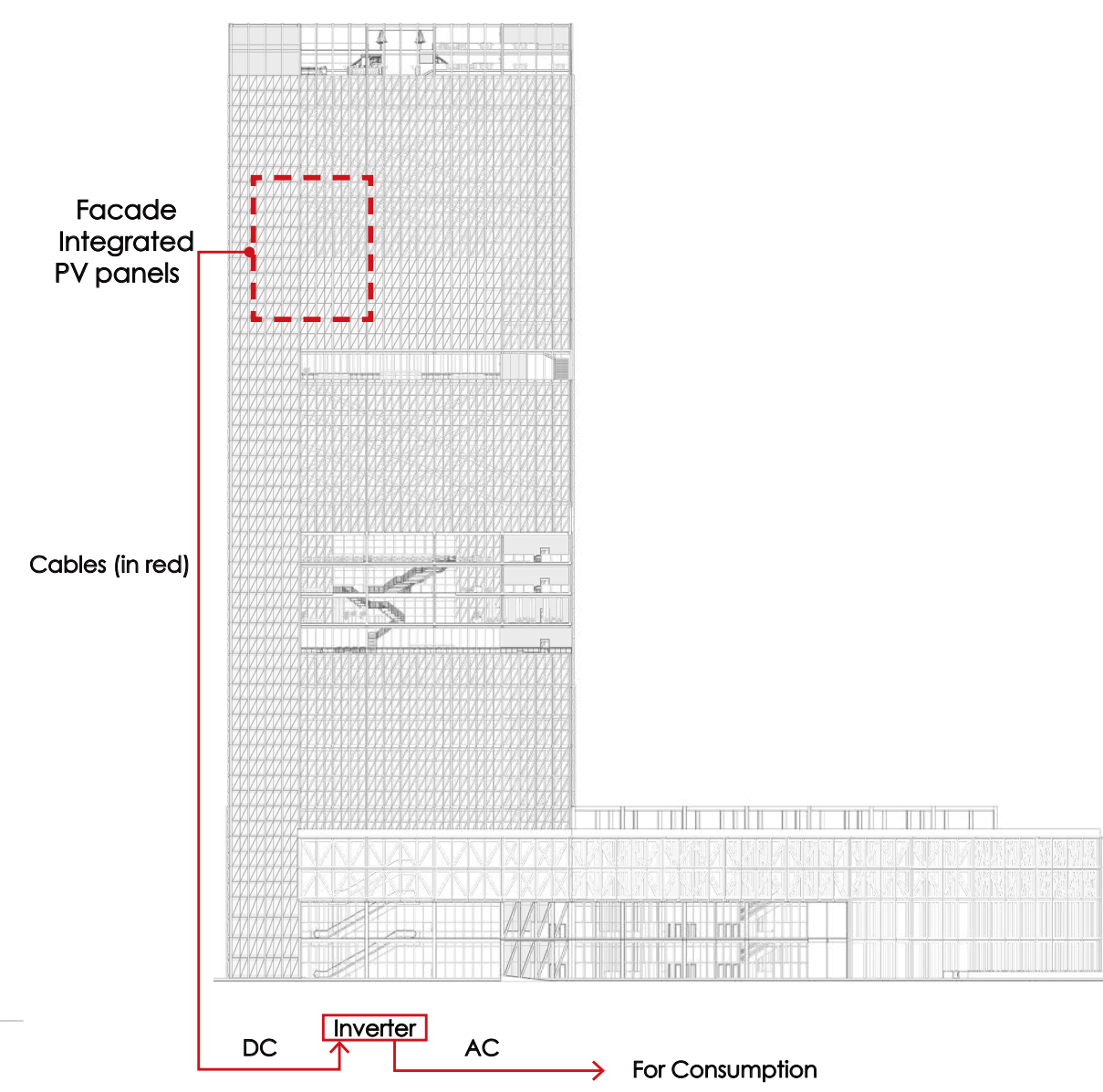
Qsensible (W)	m air (kg/s)	Airflow rate (m³/s)	c p,air	T air,amb.sp	T air,in	Air speed (m/s)	Cross section (m²)
18,72,229	41	34.6	1000	27	40.7	3.5	9.88

Size of ducts: **1.2m X 1m** (Cross section of required duct / no. of ducts in AHU - 8 units)

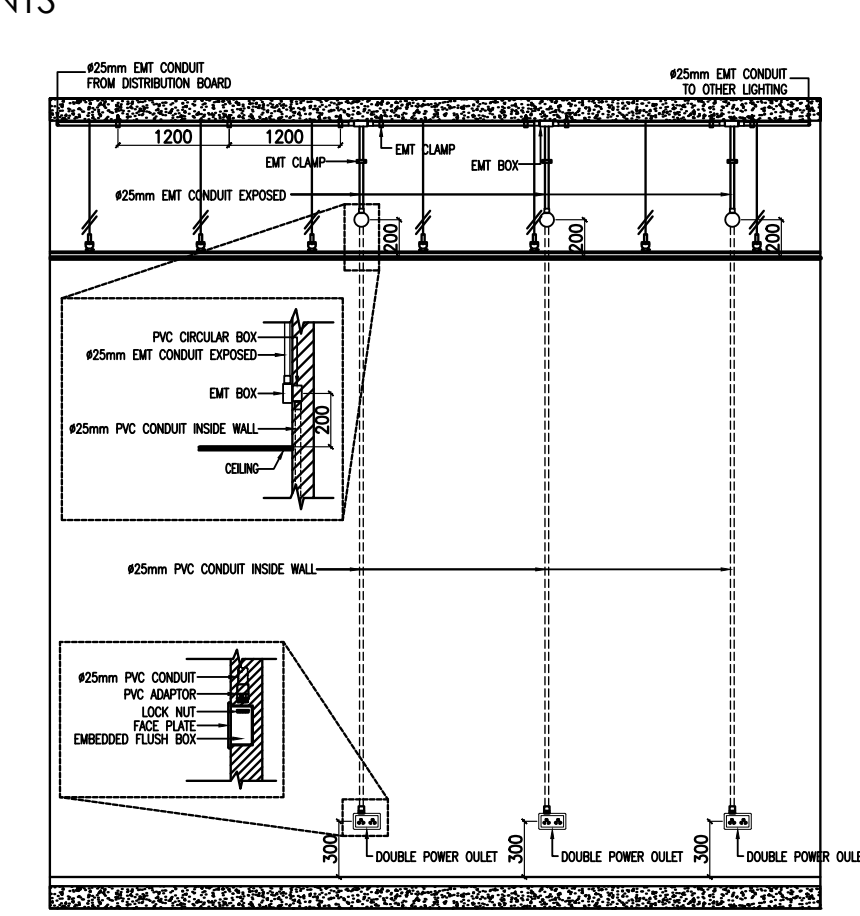
Note : Calculation details mention in Technical Report



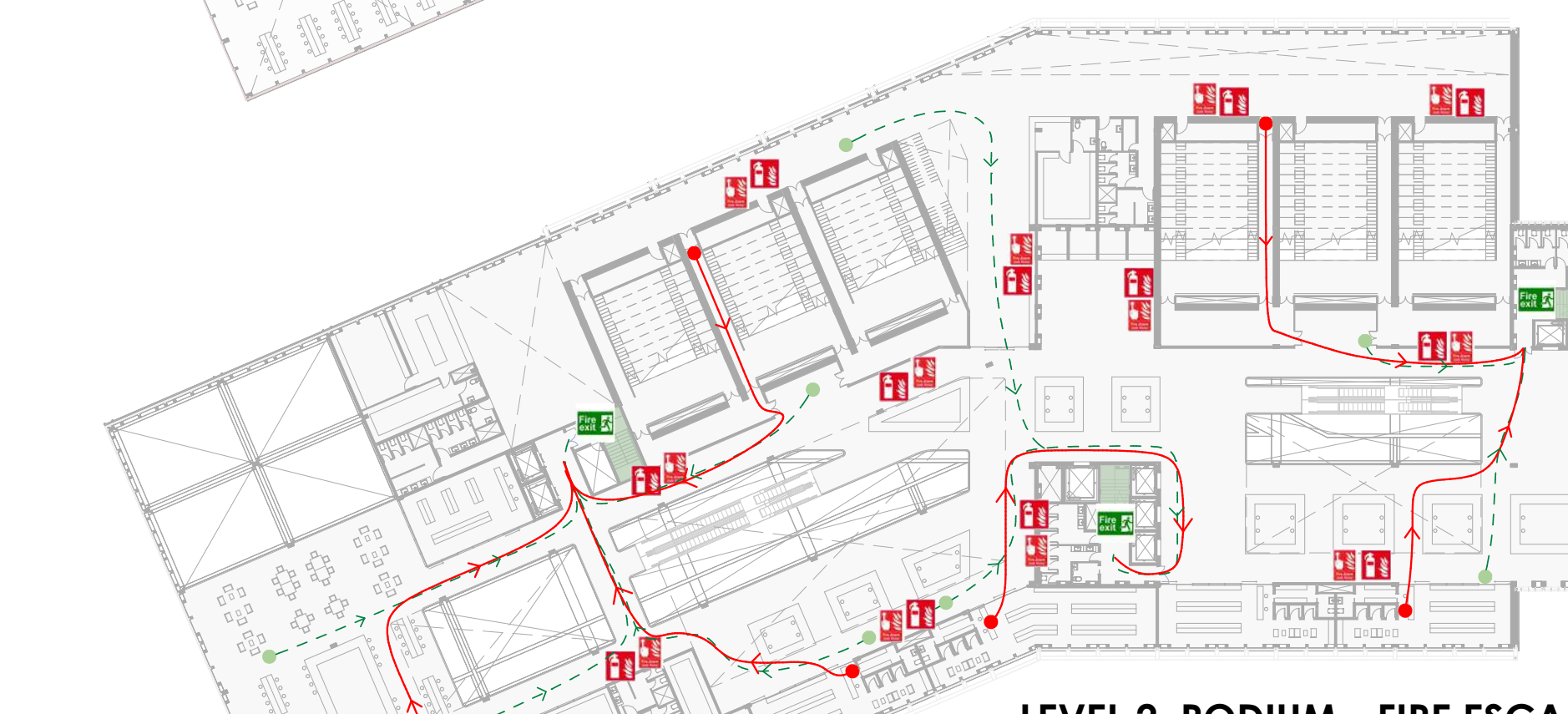
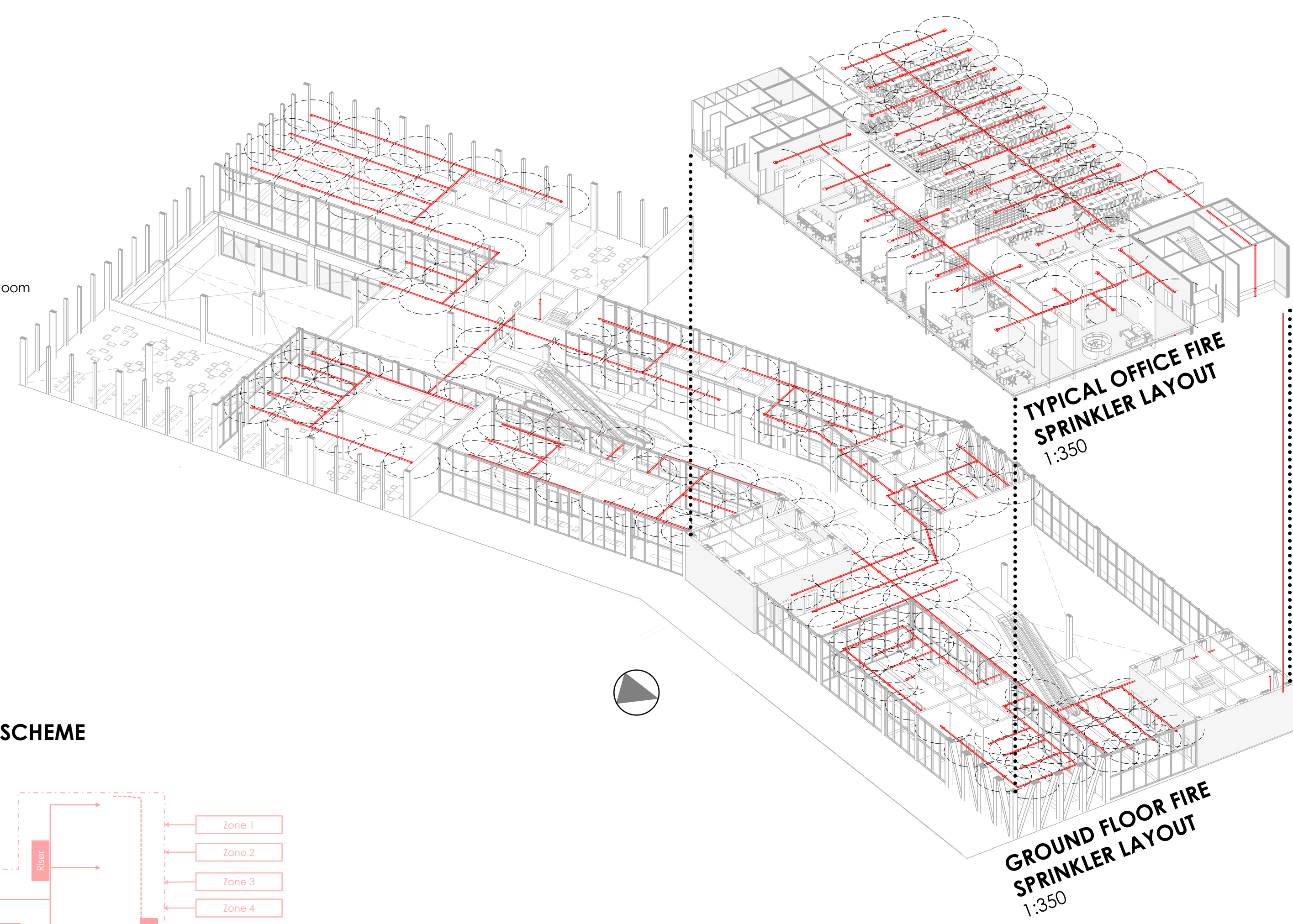
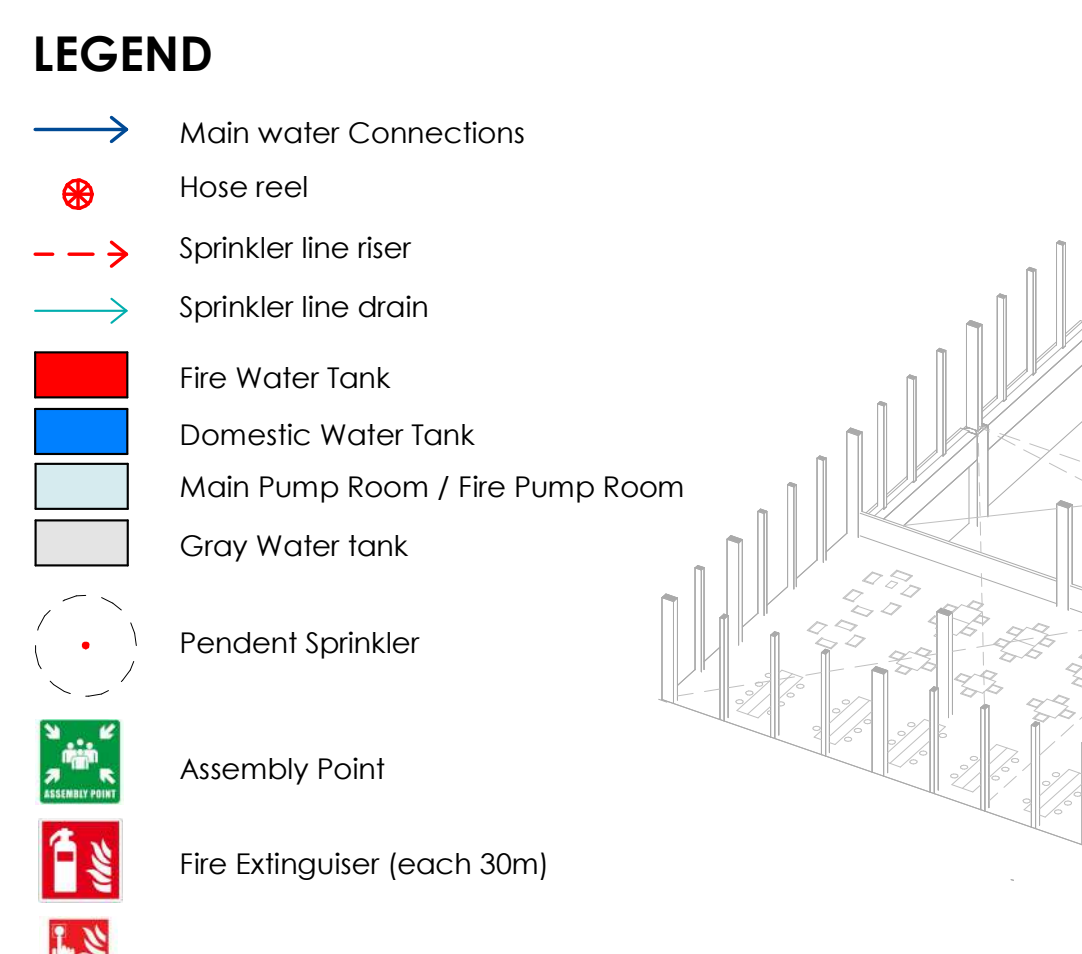
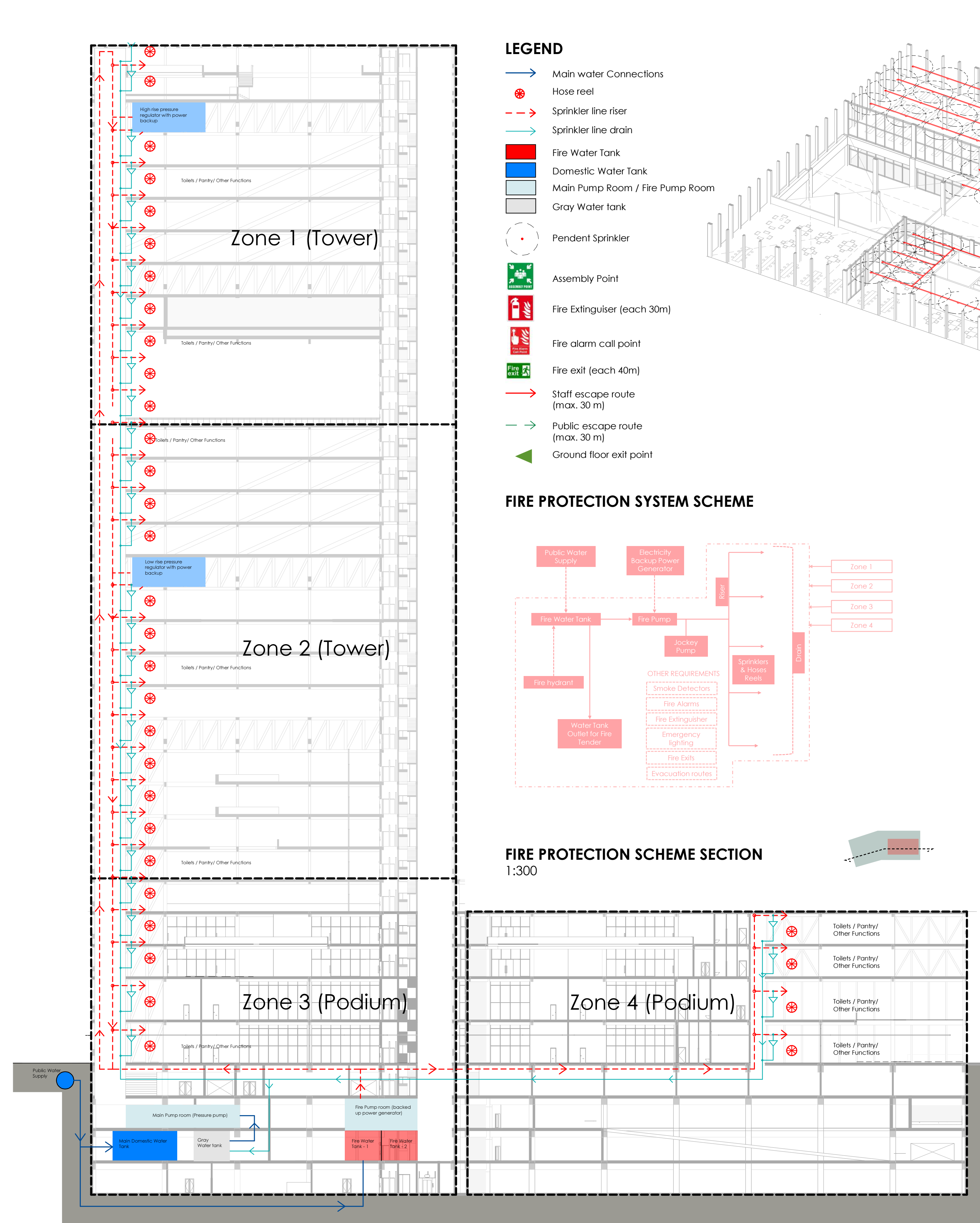
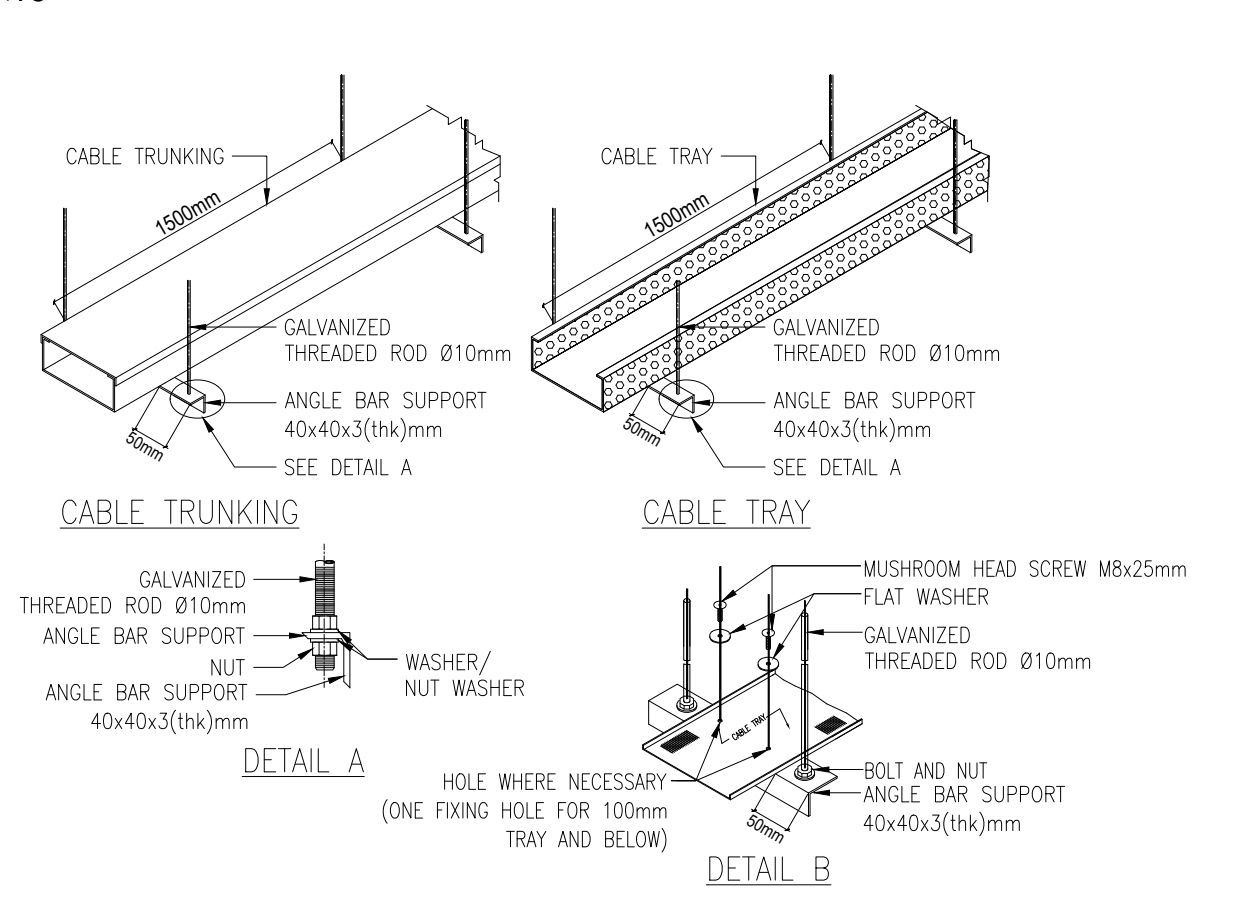
FACADE INTEGRATED WITH PHOTOVOLTAIC PANEL



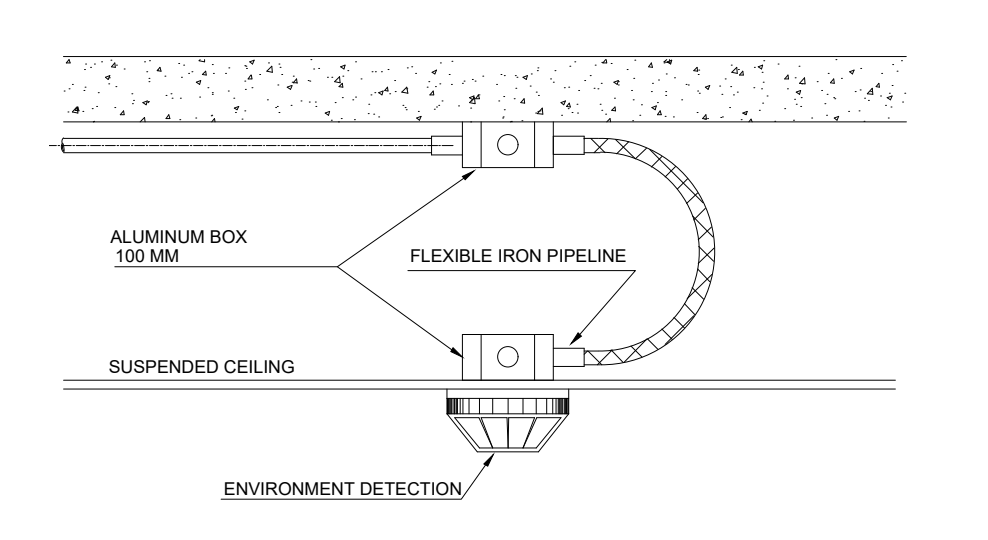
TYPICAL INSTALLATION DETAIL FOR POWER OUTLET (CEILING AREA)  
NTS



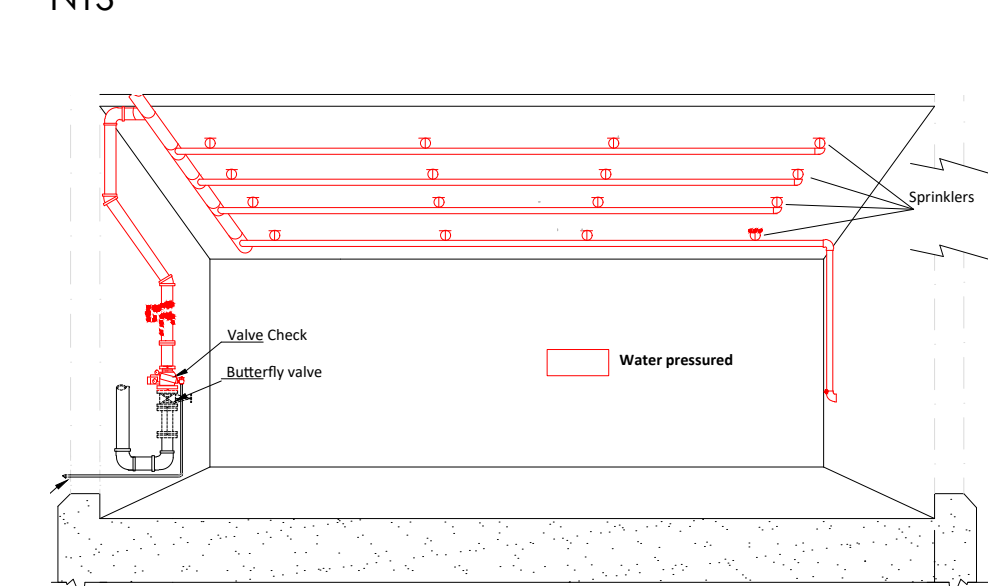
INSTALLATION OF CABLE TRAY/TRUNKING AND HANGER, SUPPORT  
NTS



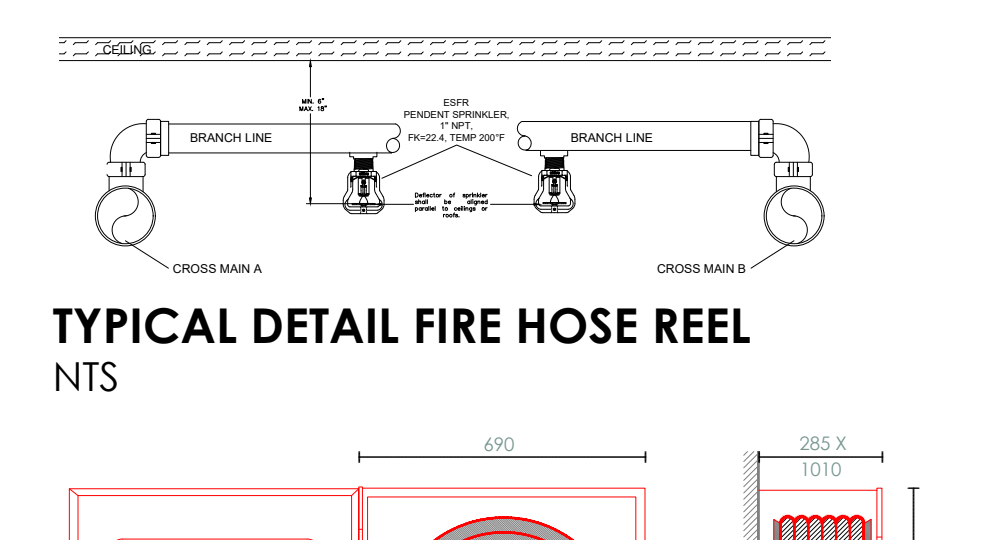
SMOKE DETECTOR INSTALLATION DETAILS  
NTS



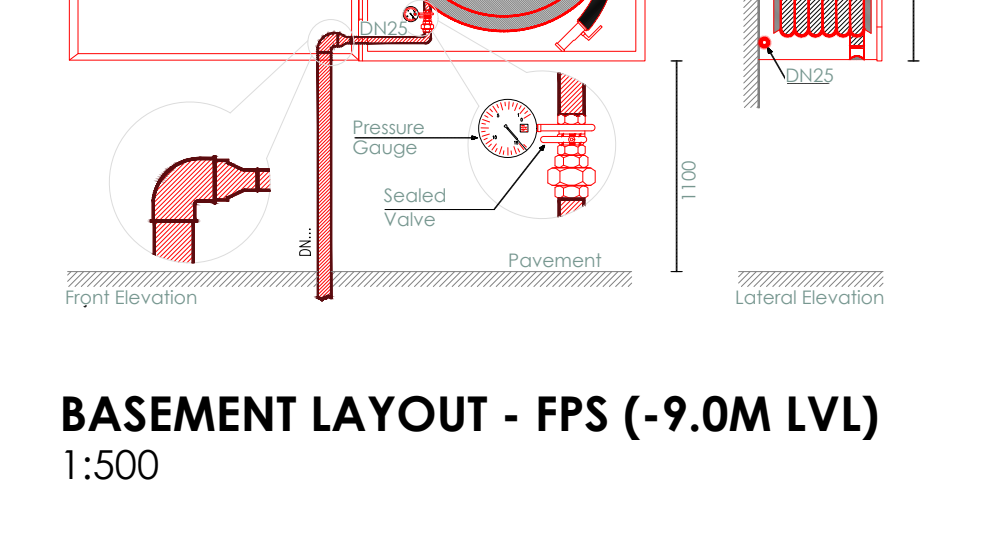
TYPICAL SPRINKLER LINE DISTRIBUTION  
NTS



TYPICAL SPRINKLER DETAIL  
NTS



TYPICAL DETAIL FIRE HOSE REEL  
NTS



BASEMENT LAYOUT - FPS (-9.0M LVL)  
1:500

