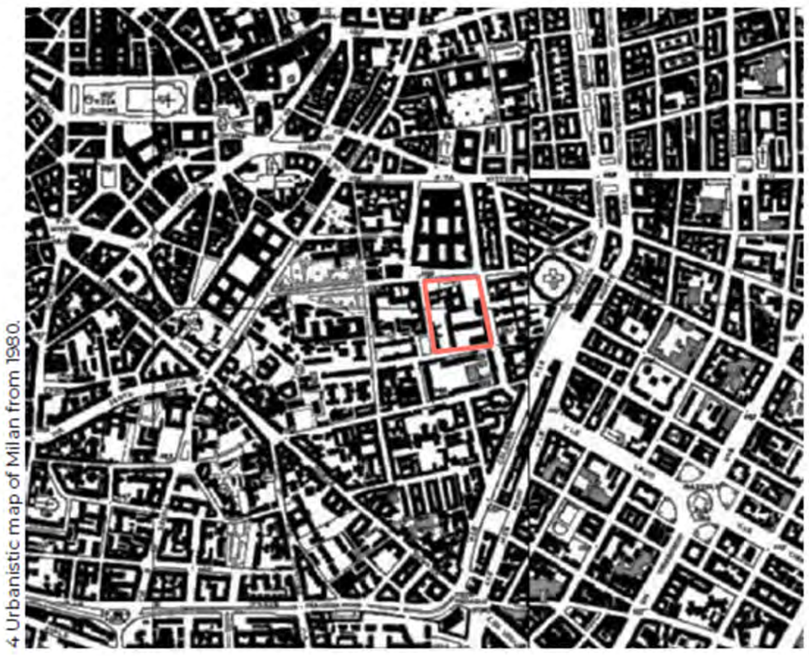
2 Urbanistic map of Milan from 1888.

1888.

3 Urbanistic map of Milan from 1936.

1936.



4 Urbanistic map of Milan from 1980.

1980.

SITE AXONOMETRIC

ARCHITECTURAL DESIGN STUDIO FOR RESTORATION OF COMPLEX ARCHITECTURE

Giulio M. Barazzetta Architectural Design
Angela Pavesi Technology Design in BIM environment
Rossana Gabaglio Restoration
Lucia Toniolo Materials for preservation
Mauro E. Giuliani Structural Design
Luca Piterà Building services Design

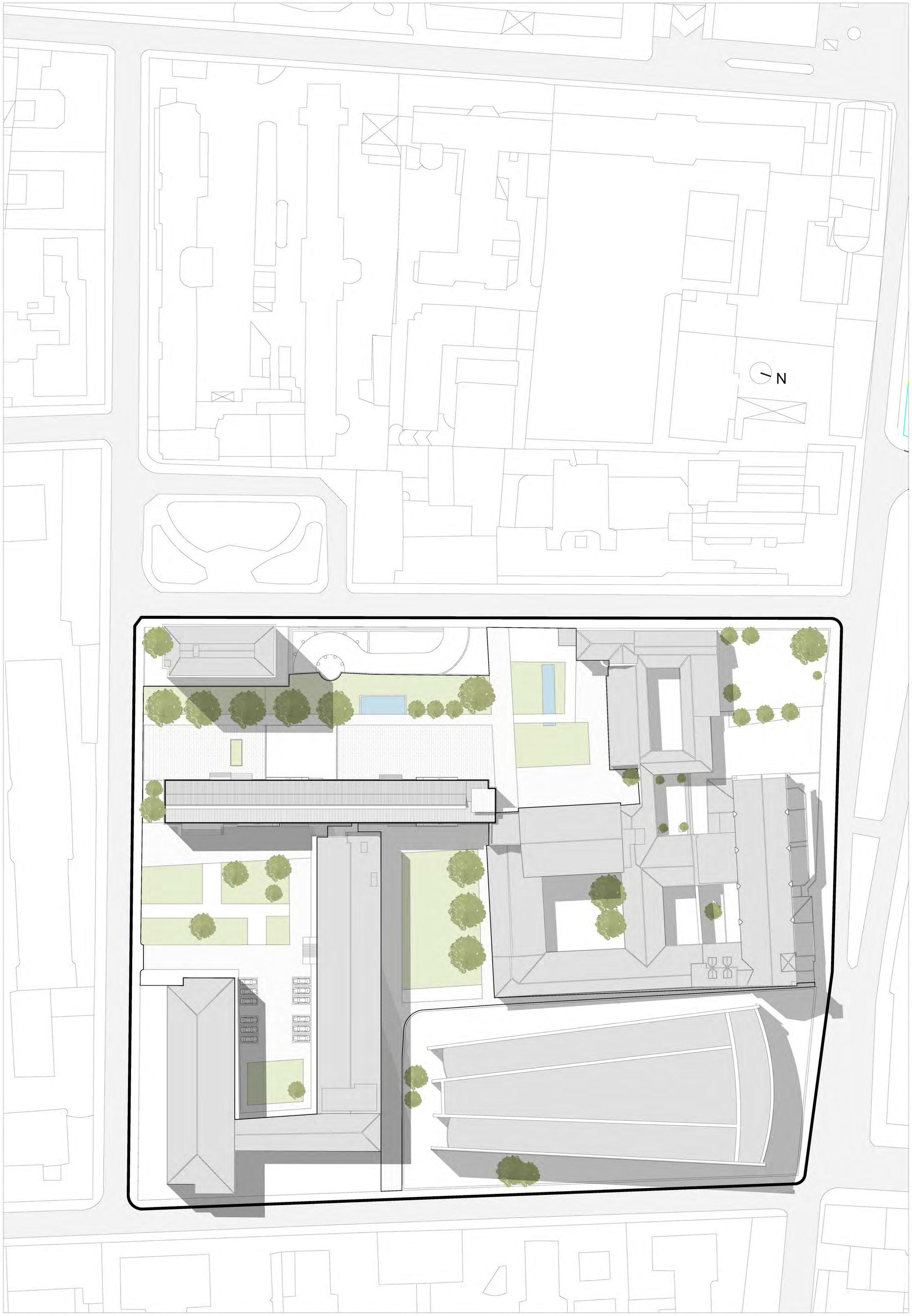
Conceptual Design Proposal:
Our start of design point is to create new space that could reflect the trend of the times and society. So, we tend to draw out some parts of floor to create double high space.
As a result, more communication could happen between two different floor. At the same time, in order to keep connection between the existing building and new construction, we would remain the main structure.

The second point is to reinforce structure. In order to solve the problem, we choose to add some braces between columns. At the same time, we have reorganised function.
It could fix new structural system well (we can see in the diagram). The brace would be steel and it will be connected with beam and column by screw.

For convenient regulation and better space organisation, we put all educational parts into one side and add some missing functions such as video room, computer room， infirmary ,offices for teachers etc.

And then, we move the majority of parking area from ground to underground. As a result, there are more space for children's daily activities.

In addition, we add a layer of insulation for saving energy. To some extent, it is a most remarkable element that could tell the difference between old buildings and modern buildings. Because we want to have a new appearance for the building, we would reconstruct external walls and at the same time, insulation could be a very important part we need to focus on.



MASTERPLAN _SCALE 1:500

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DOUHAOMING 893079

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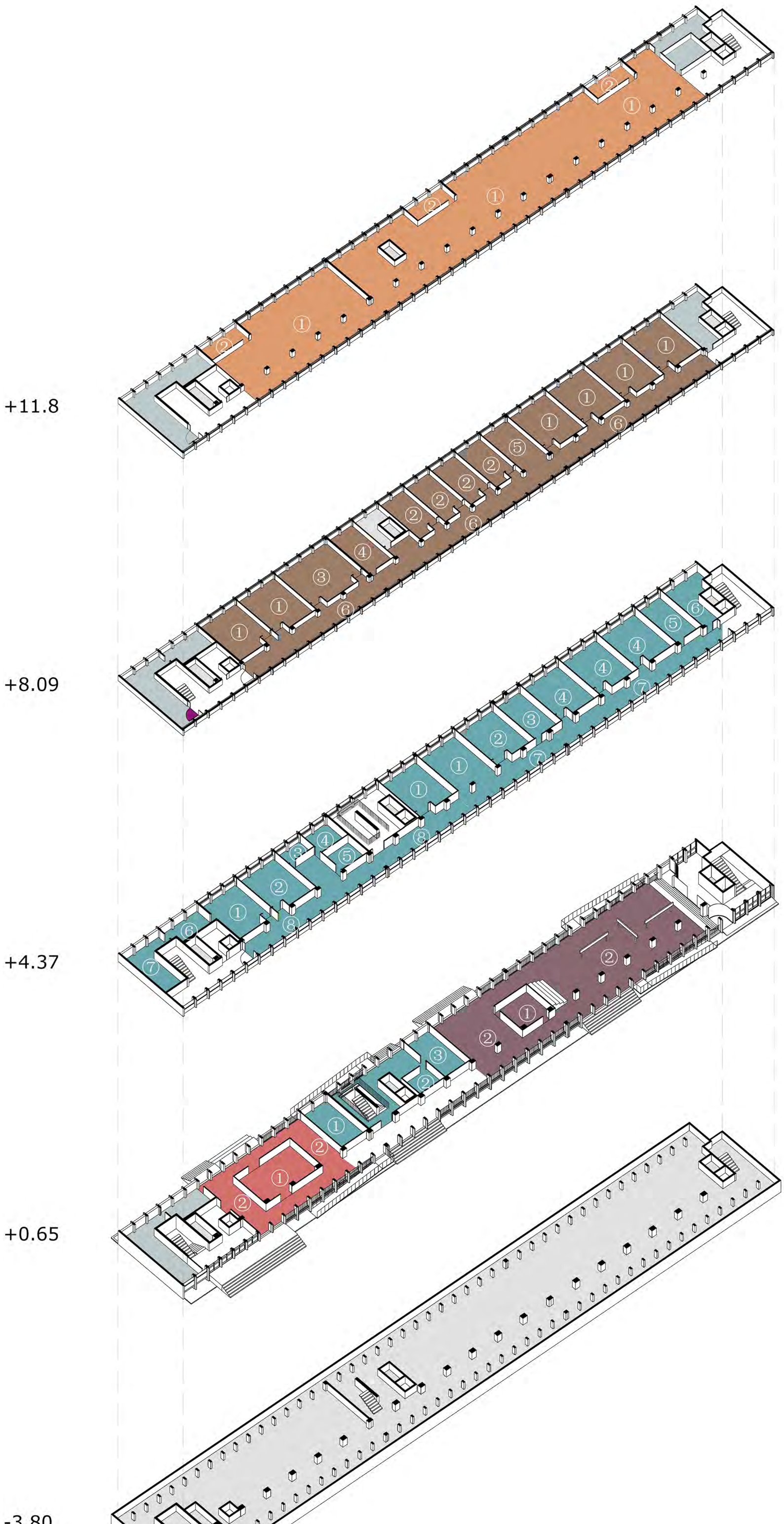


Rented office

1.Office area	696 ㎡
2.Balcony x 3	50 ㎡

Rented classroom

1.Classroom x 6	265 ㎡
2.Workshop x 4	118 ㎡
3.Activity room	60 ㎡
4.Office	31 ㎡
5.Rest space	31 ㎡
6.Corridor	223 ㎡

School area

1.Equipment room for school	30㎡
2.Reception	12 ㎡
3.Toilt	29 ㎡

Kindergarten

1.Activity room x 2	88 ㎡
2.Multi purpose room	44 ㎡
3.Storage room	10 ㎡
4.Office	14 ㎡
5.Morning checkroom	14 ㎡
6.Cloakroom	18 ㎡
7.Toilt	29 ㎡
8.Corridor	106 ㎡

Primary school

1.Rest space	42 ㎡
2.Activity room	42 ㎡
3.Equipment room	28 ㎡
4.Classroom x 3	126 ㎡
5.Teachers' office	28 ㎡
6.Toilt	29 ㎡
7.Corridor	117 ㎡

Cafeteria

1.Cafe shop	42 ㎡
2.Rest space	134 ㎡

Exhibition area

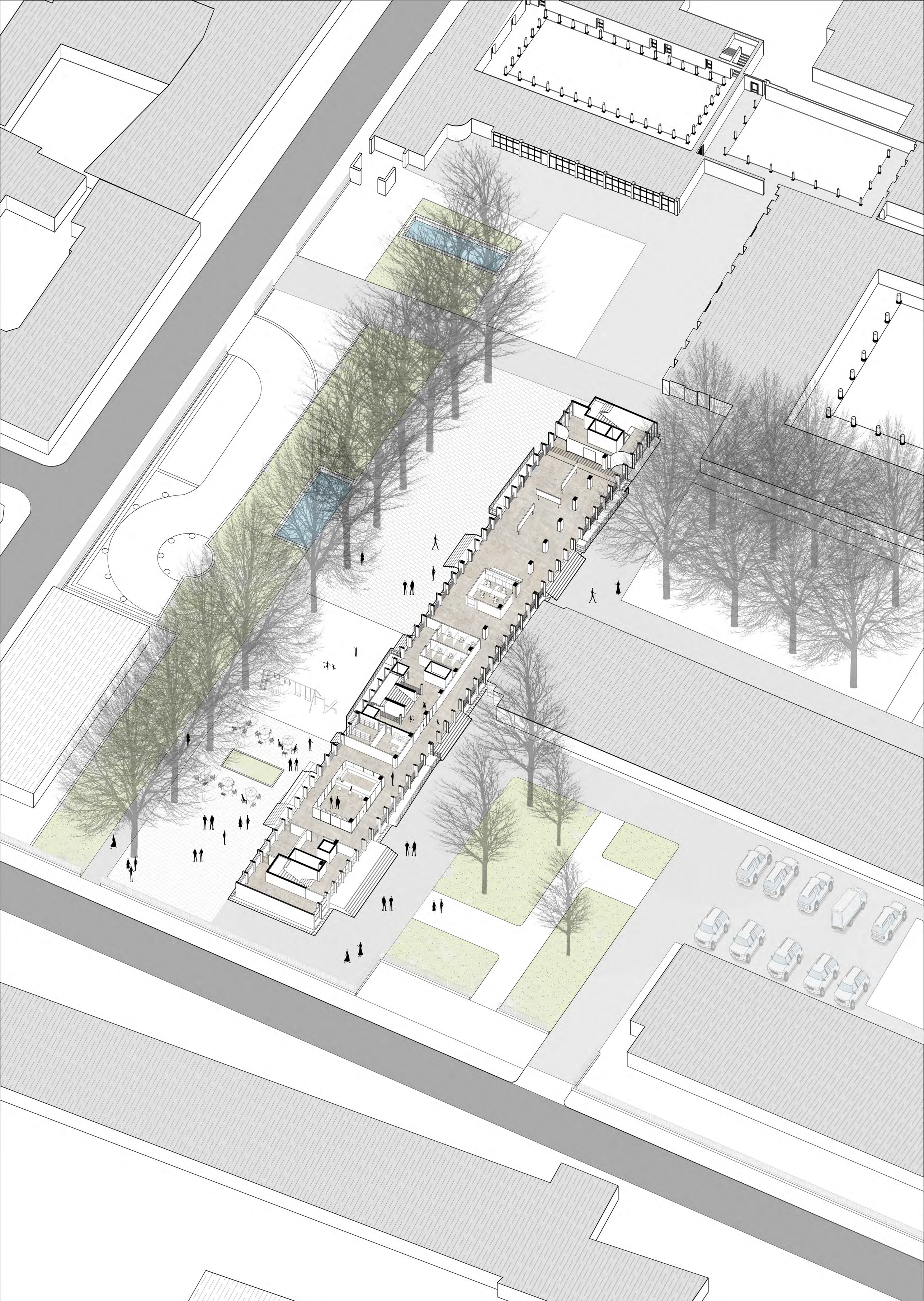
1.Office	24 ㎡
2.Exhibition area	361 ㎡

Technical area

1.Technical	1100 ㎡

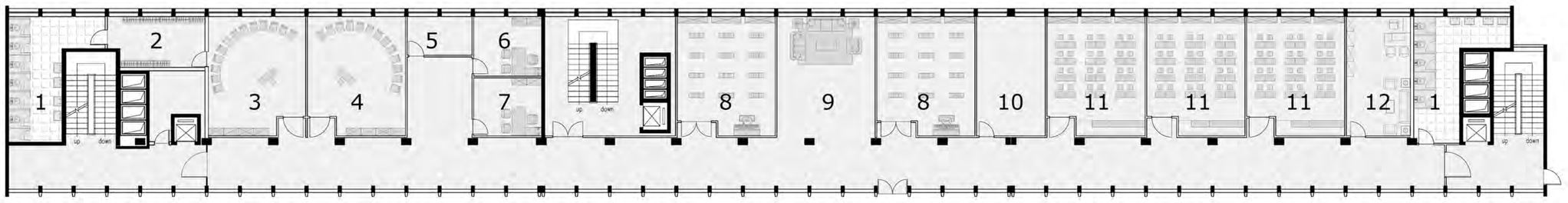
Toilet

1.Toilet	182 ㎡

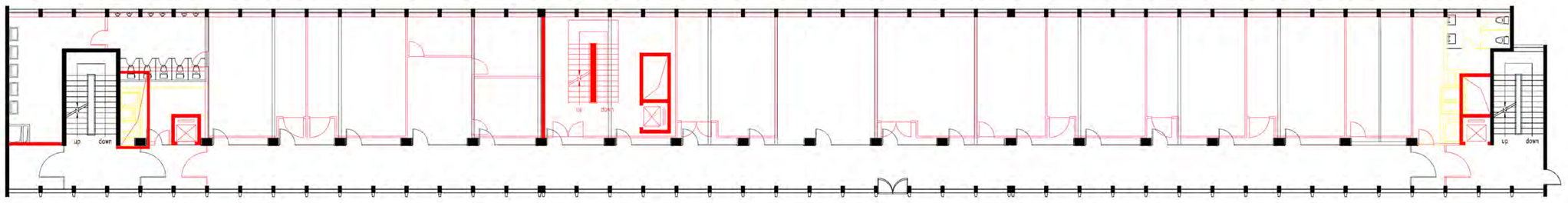


GROUNDFLOORPLAN _SCALE 1:200

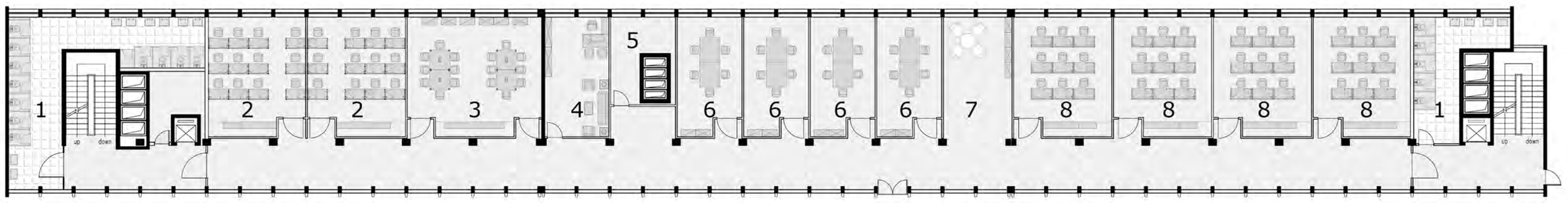
First Plan_Scale 1:200



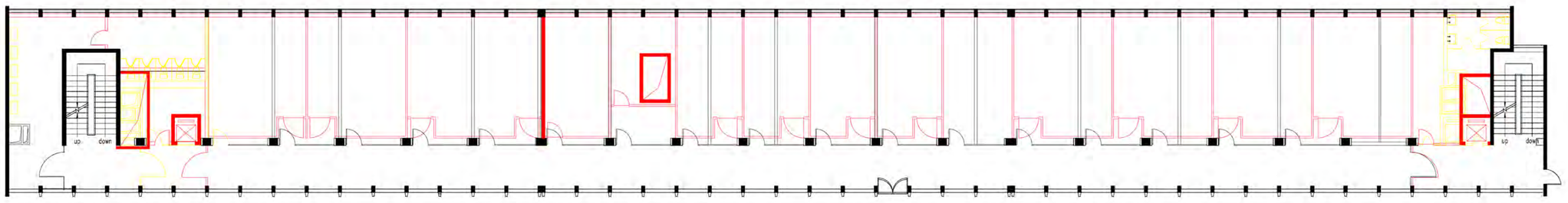
1.Toilet
2.Cloakroom
3.Activity room
4.Multi purpose room
5.Storage room
6.Office
7.Morning check room
8.Activity room
9.School hall
10.Equipment
11.Class room
12. Teachers' office



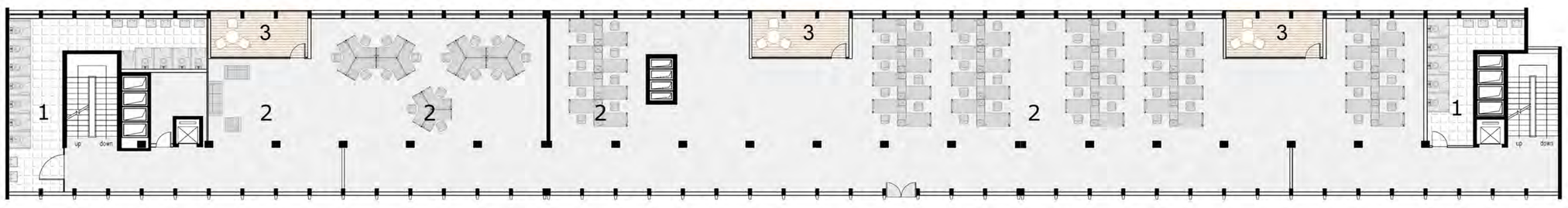
Second Plan_Scale 1:200



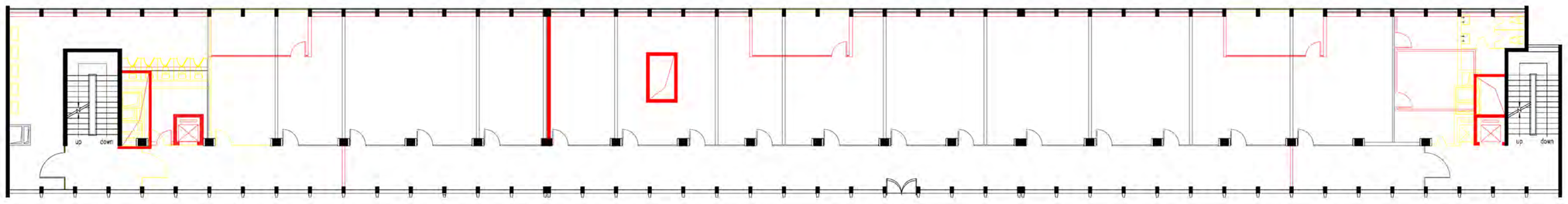
1.Toilet
2.Computer room
3.Activity room
4.Office
5.Storage room
6.Workshop
7.Rest space
8.Class room



Third Plan_Scale 1:200



1.Toilet
2.Office
3.Balcony



6m
2m
10m

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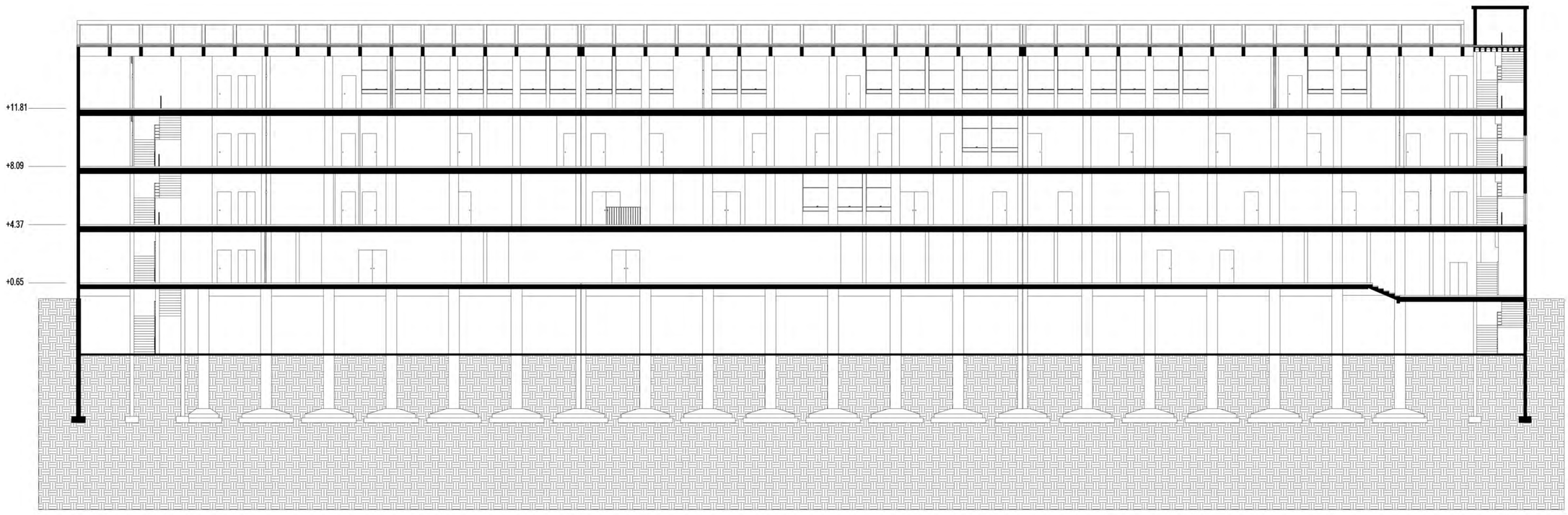
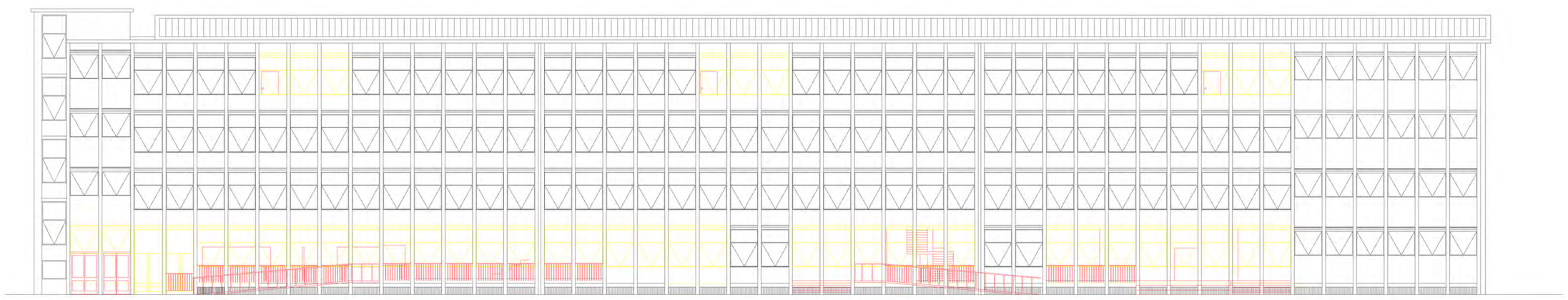


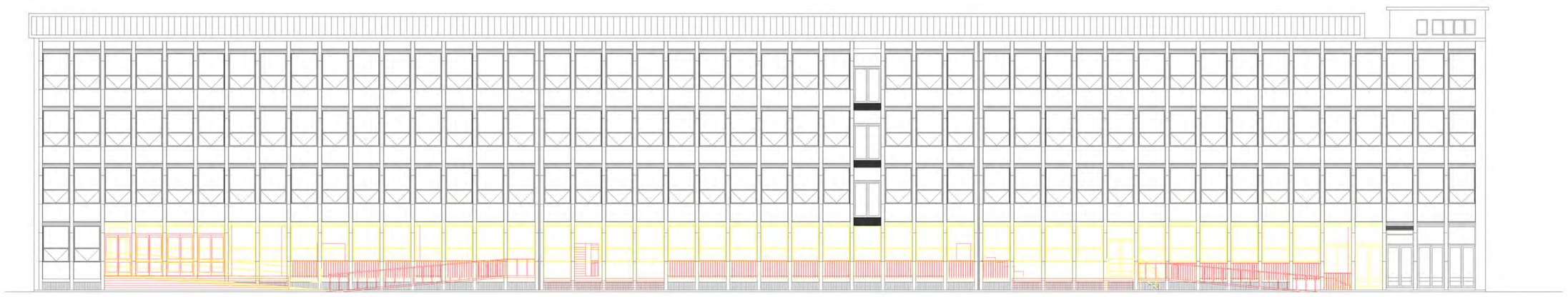
Section B-B Scale 1：200

West Elevation Scale 1:200



West Elevation Mapping Scale 1:200

East Elevation Scale 1:200



East Elevation Mapping Scale 1:200

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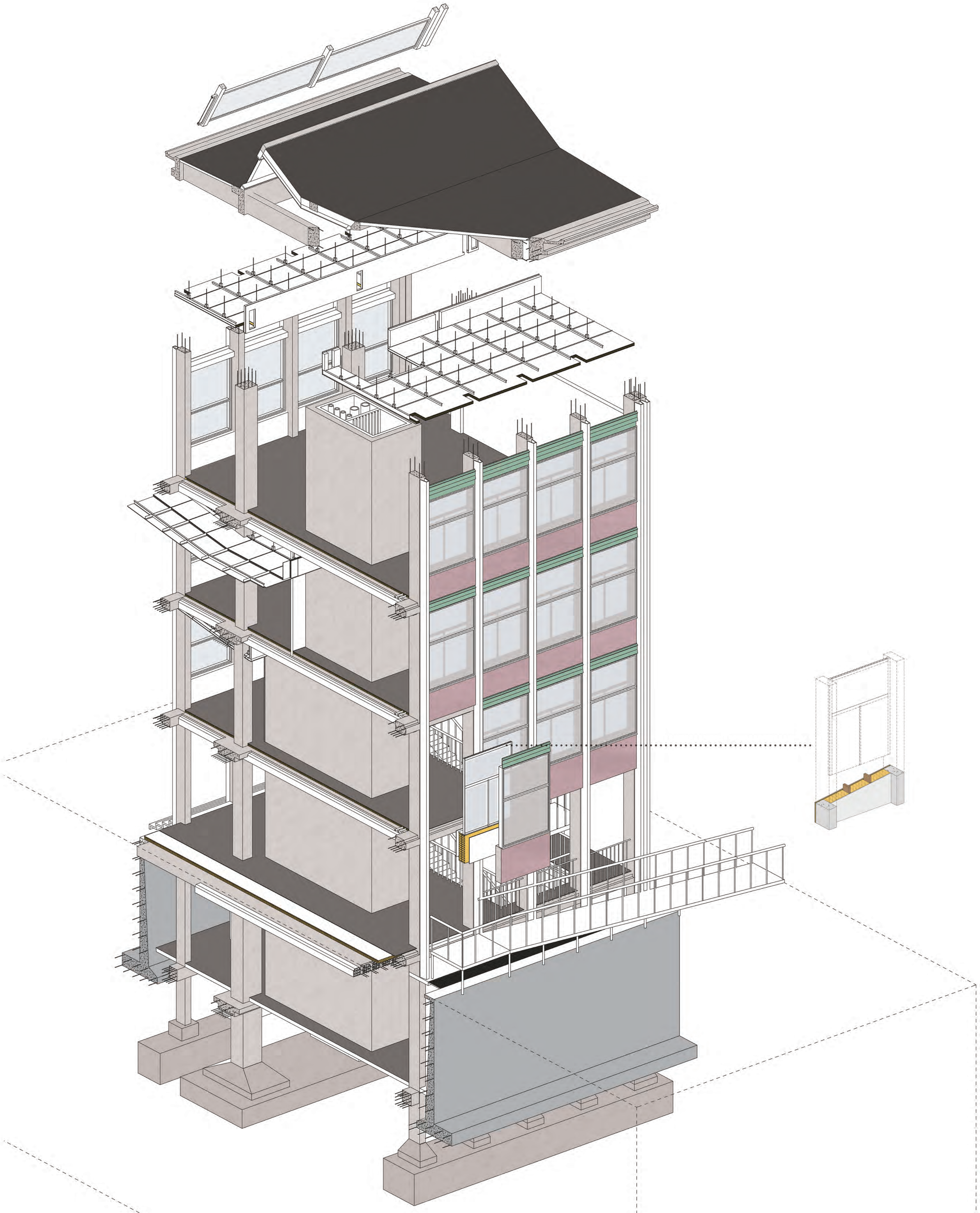

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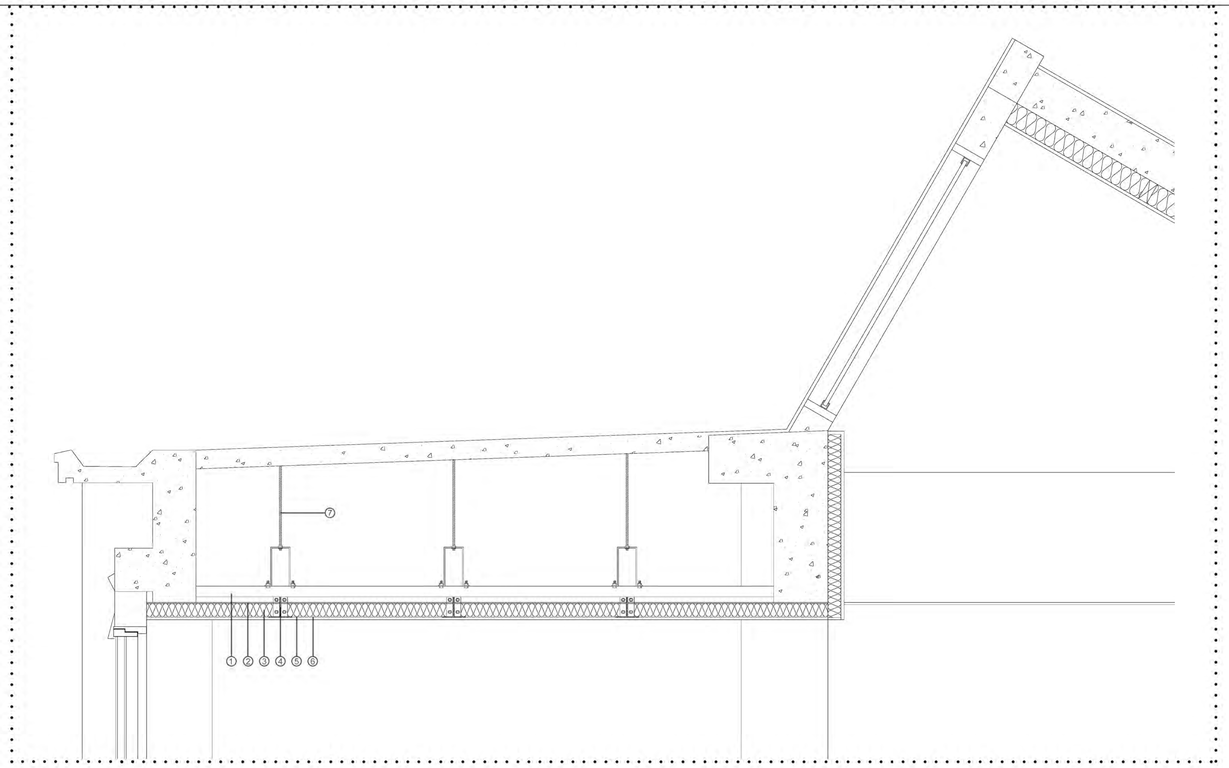
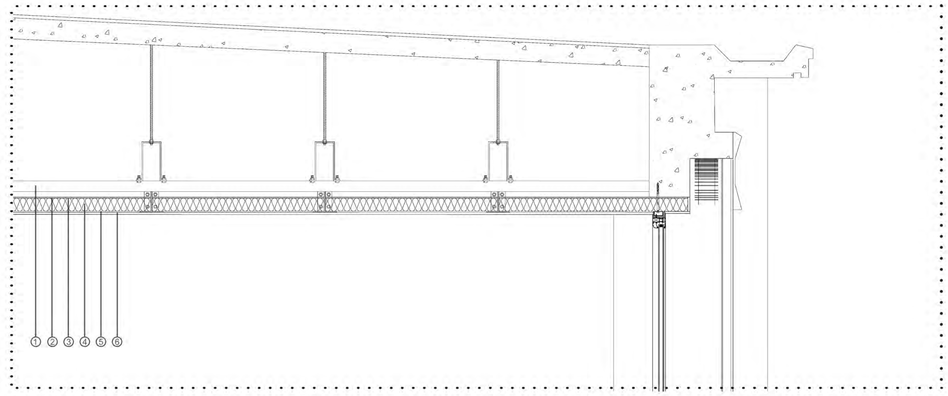
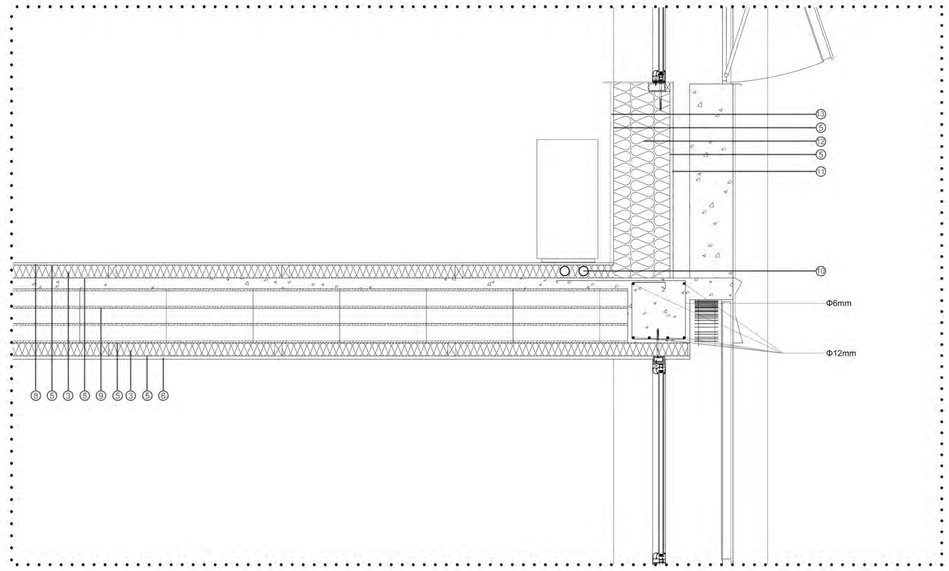


D1 SCALE 1:10

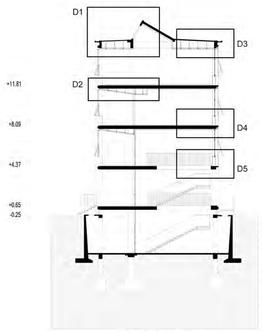


D3 SCALE1:10

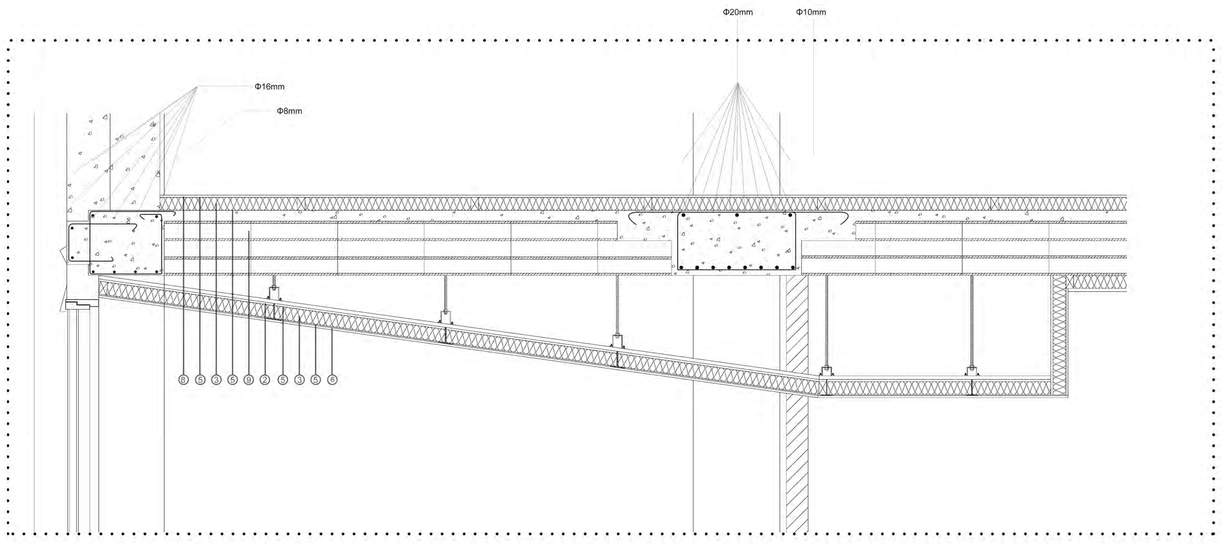


D4 SCALE1:10

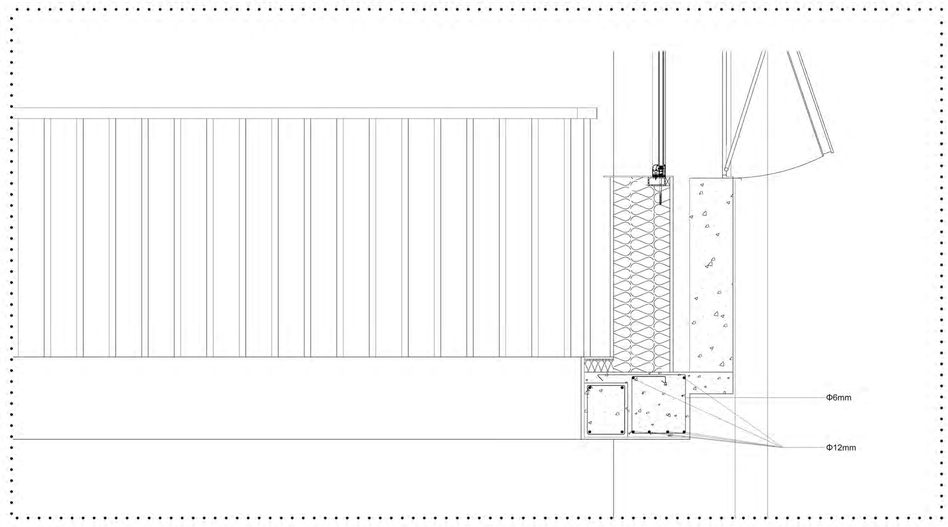
1. Ceiling Suspension Frame (main frame)
2. Wooden Panel 5mm
3. Cavity Insulation 60mm
4. Ceiling Suspension Frame (secondary frame)
5. Water Proofing
6. Gypsum Board 9.5mm
7. Threaded Rod
8. Wood-Based Subfloor 15mm
9. Brick-concrete Slab
10. Pipeline For Heating System
11. Aluminium Panel
12. Cavity Insulation 260mm
13. Single-layer Glued Plaster Interior Surface



SECTION A-A 1:200

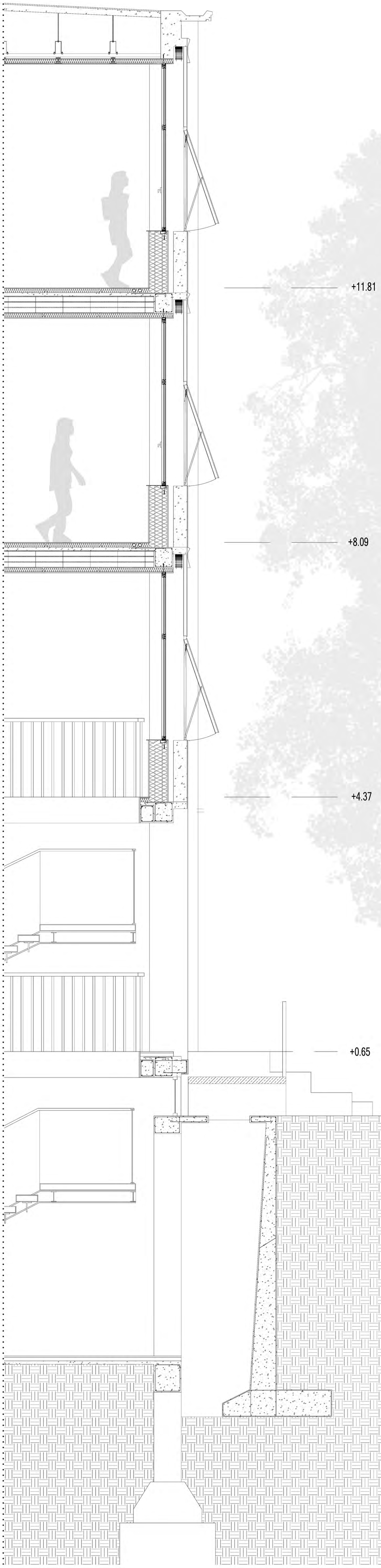


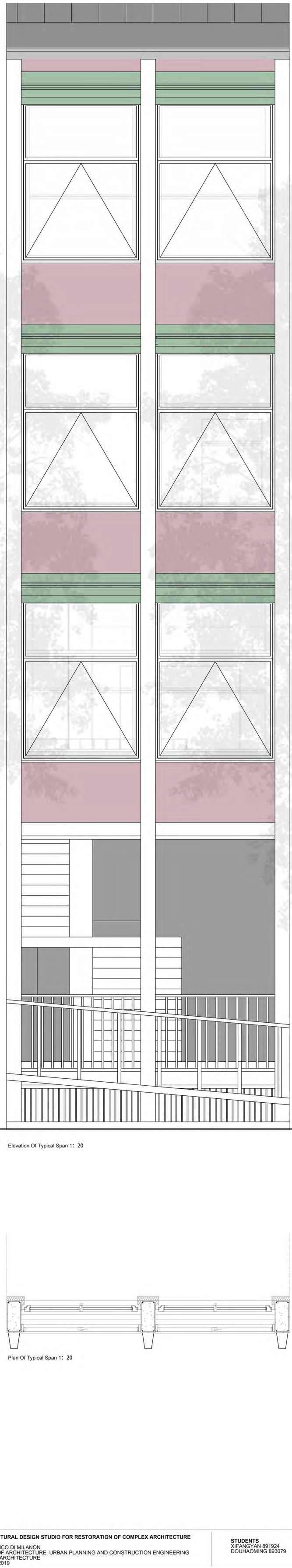
D2 SCALE 1:10



D5 SCALE1:10

Section Of Typical Span 1：20





Elevation Of Typical Span 1：20

Plan Of Typical Span 1：20

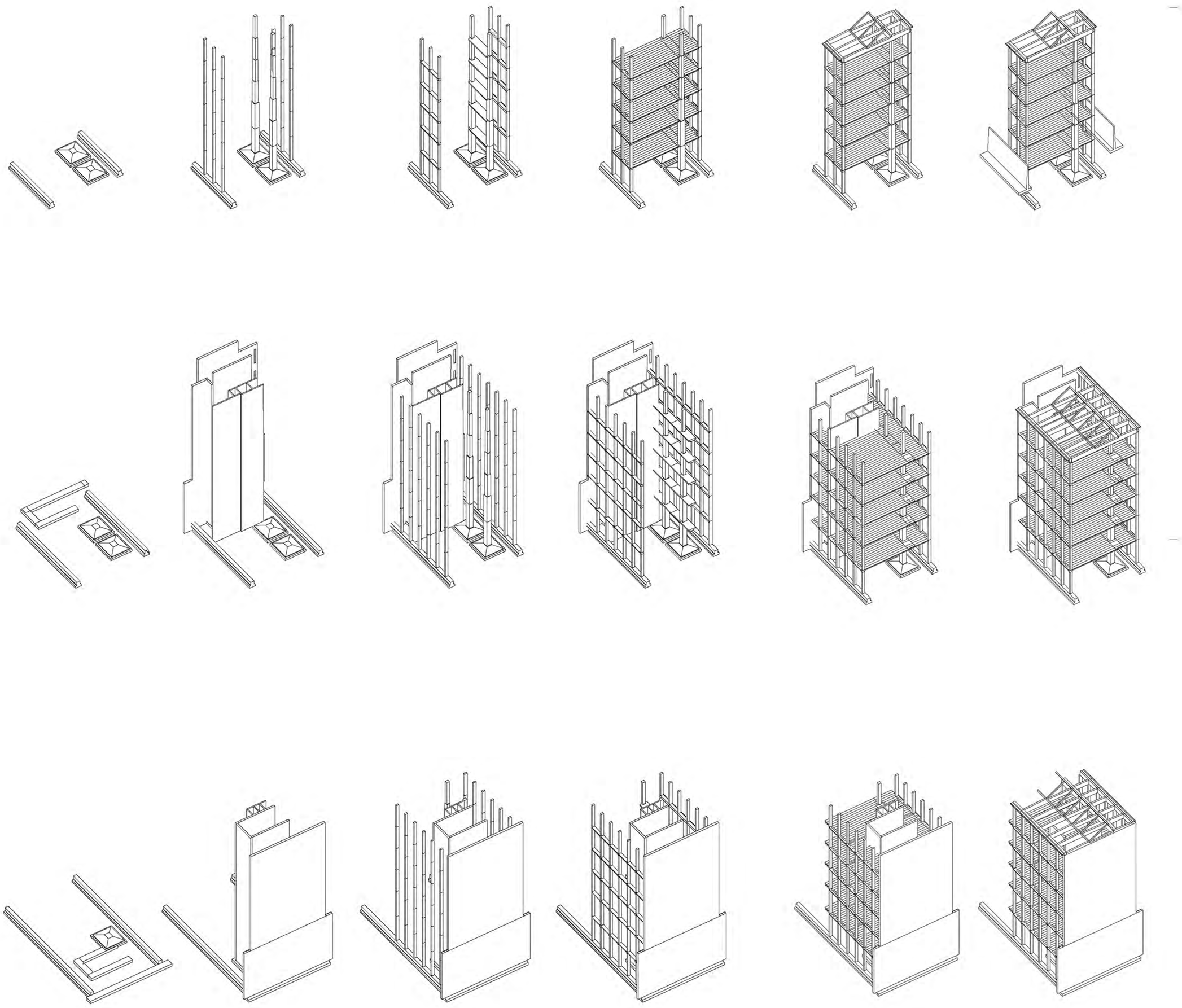
Floor load	Bulk density(kg/m³)	Thickness(mm)	Weight per unit area(KN/m²)
Dead load from slab(structural)	2300.00		**2.76**
Dead load from slab(no structural)			**0.336**
wood based subfloor	650	15	0.098
Waterproof-high density polyethylene	950	8	0.076
Cavity insulation	0	0	0
Waterproof-high density polyethylene	950	8	0.076
Gypsum Board	900	9.5	0.086
Live load			**4**

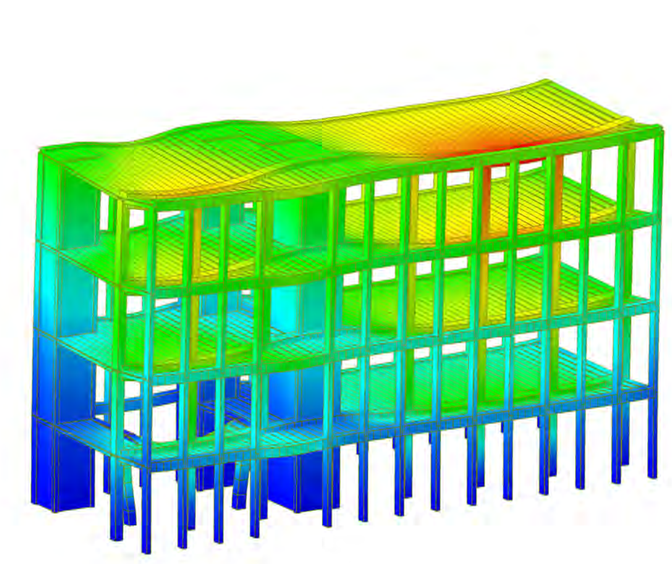
Floor（not include the struct Q1=(G1+G2+G3)1.3+1.5Q	formula	number	unit
G1: Self load of beam	H1*B1*23KN/m³	1.15	KN/m
G2: Dead load from slab(structura	1.23*2.76KN/m³	3.39	KN/m
G3: Dead load from slab(non-stru	1.23*0.336KN/m²	0.41	KN/m
Q: live load	1.23*4KN/m²	4.92	KN/m
Q1: factored total load on seconda	Q2=(G1+G2)1.3+1.5Q	13.83	KN/m

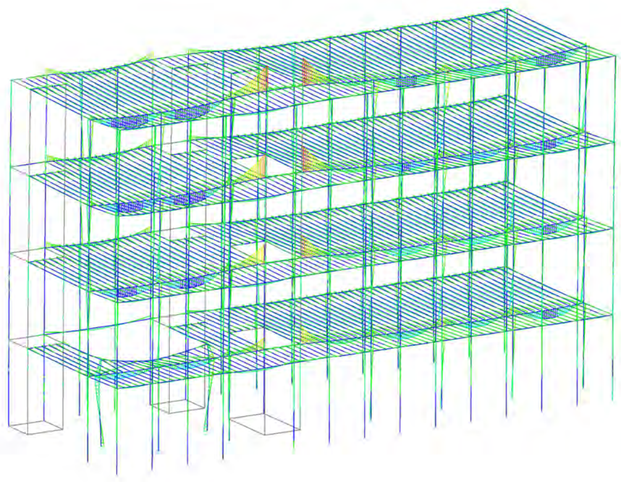
Check the Moment				
Med max	Max applied moment	Med max=Q1*L1²/8	52.28	KNm
Mrd max	Max moment without compression steel	Mrd max=0.168*bd²fck	62.63	KNm
			Mrd max>Med max	

Check the shear	formula	number	unit
l	L1/2	2.75	m
d	B1/2	0.08	m
Vmax		38.03	KN
Ved	Ved=(L-d)/L*Vmax	36.99	KN
Vn=Vc+Vs			
	Vc=2*fck^-2bwd	47.20	KN
			Vc>Ved

Beam information	number	unit
Floor		
L1: Length of beam	5.50	m
H1：height of beam	0.30	m
B1：width of beam	0.15	m
A1: area of beam	0.05	m²







midas Gen
POST-PROCESSOR
DISPLACEMENT
RESULTANT
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3.40281e-003
3.06253e-003
2.72225e-003
2.38197e-003
2.04168e-003
1.70140e-003
1.36112e-003
1.02084e-003
6.80562e-004
3.40281e-004
0.00000e+000
SCALEFACTOR=
3.7937E+002
CB: COM
MAX : 1181
MIN : 1
FILE: 202004052
UNIT: m
DATE: 04/06/2020
VIEW-DIRECTION
X:-0.483
Z: 0.259

midas Gen
POST-PROCESSOR
BEAM DIAGRAM
MOMENT-y,z
1.50315e+002
1.02849e+002
5.53835e+001
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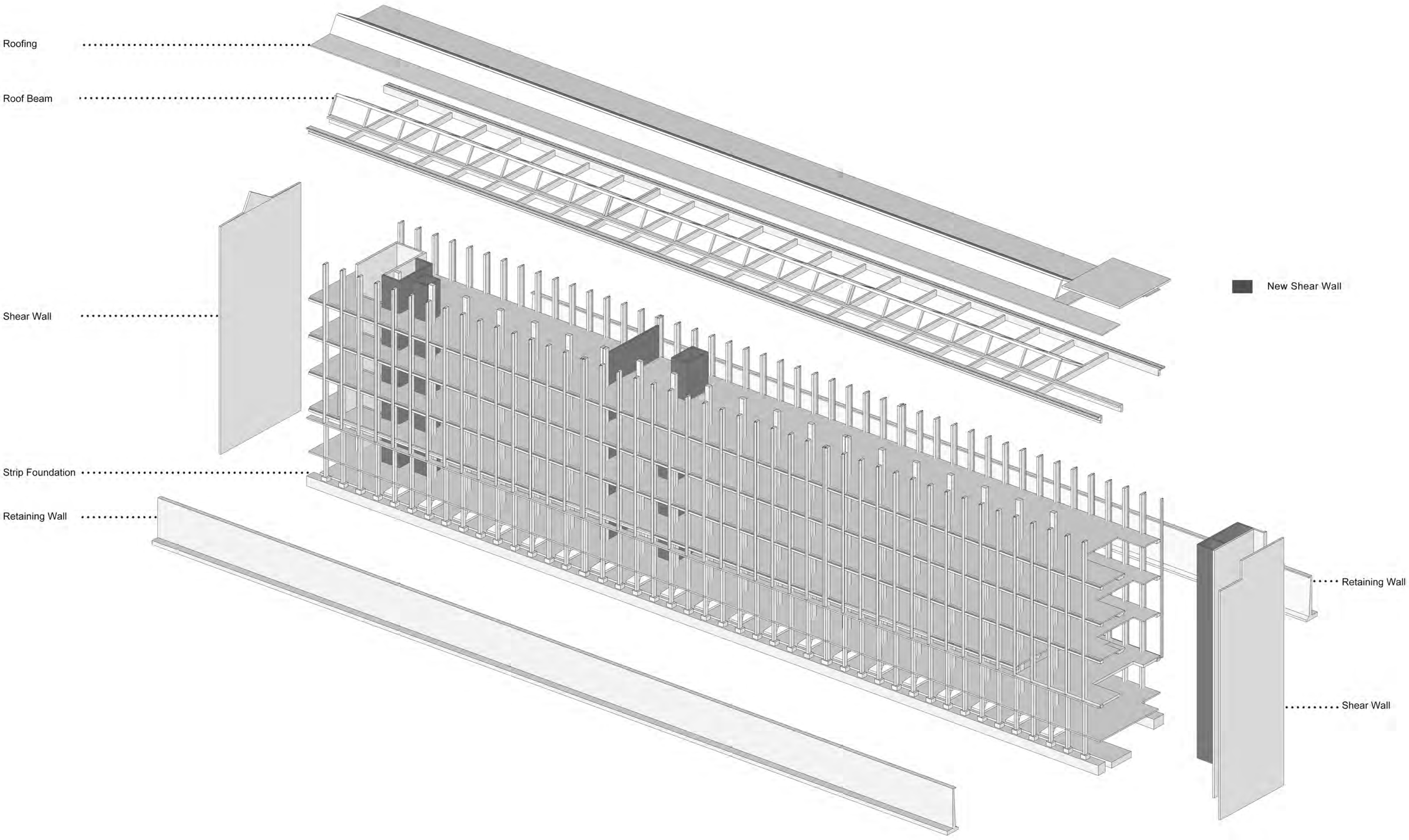
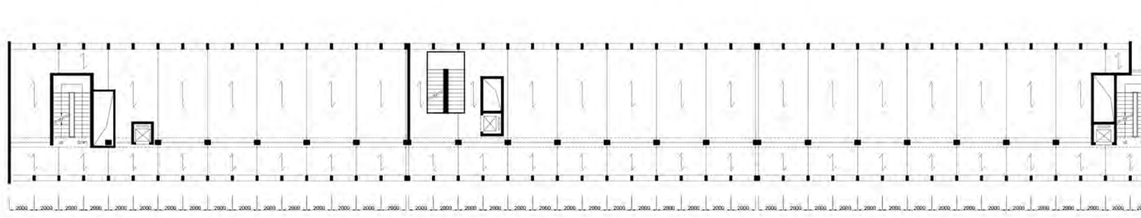
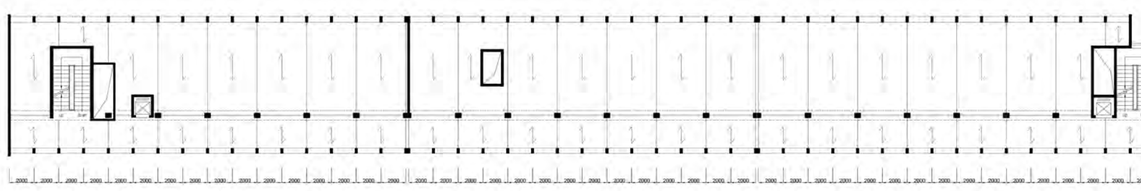
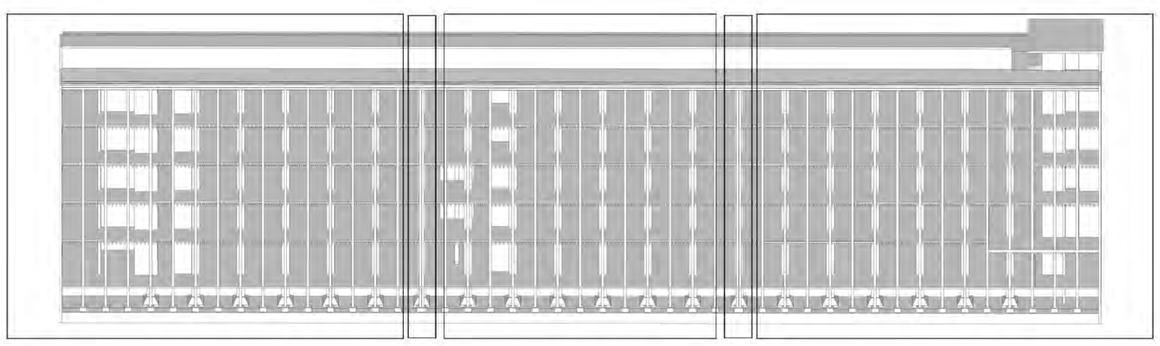




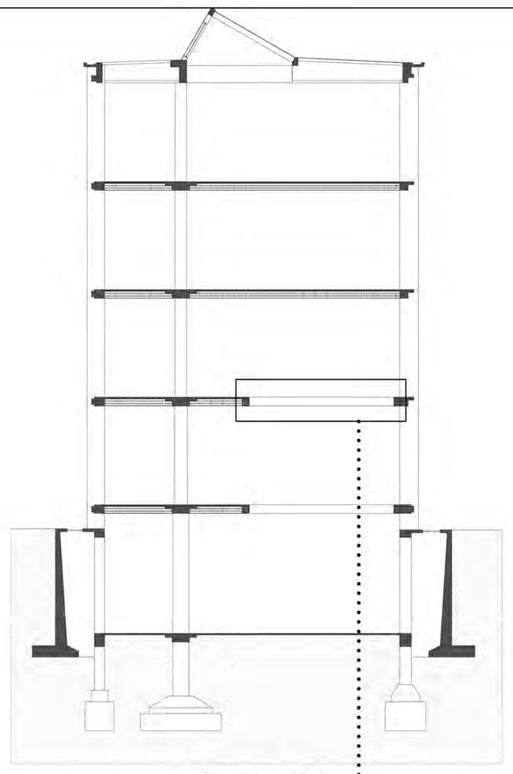
Underground Floor and Ground Floor Floor Strcuture Plan



Second Floor and Third Floor Strcuture Plan



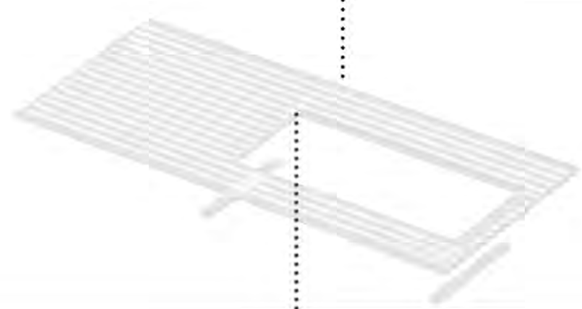
There are two junctions between the whole building. So,this building is like three separate buildings from structure view.
However, there are only shear walls on both sides. The first thing we need to consider is to reinforce the middle part of the
building.

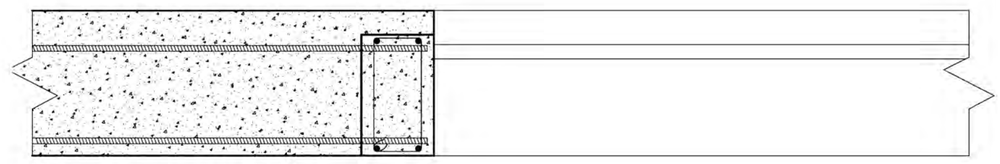


Structure Section

In order to build the middle staircase, you need to make a hole in the existing floor.

After the hole is finished, two reinforced concrete beams are placed in the lateral direction of the U-shaped floor to reinforce the floor.





Section of additional beam

When the hole was cut, some part were also taken away and exposured internal rebar of beam. And then, the new secondary beams were put there and connect with existing beam to reinforce the slab.

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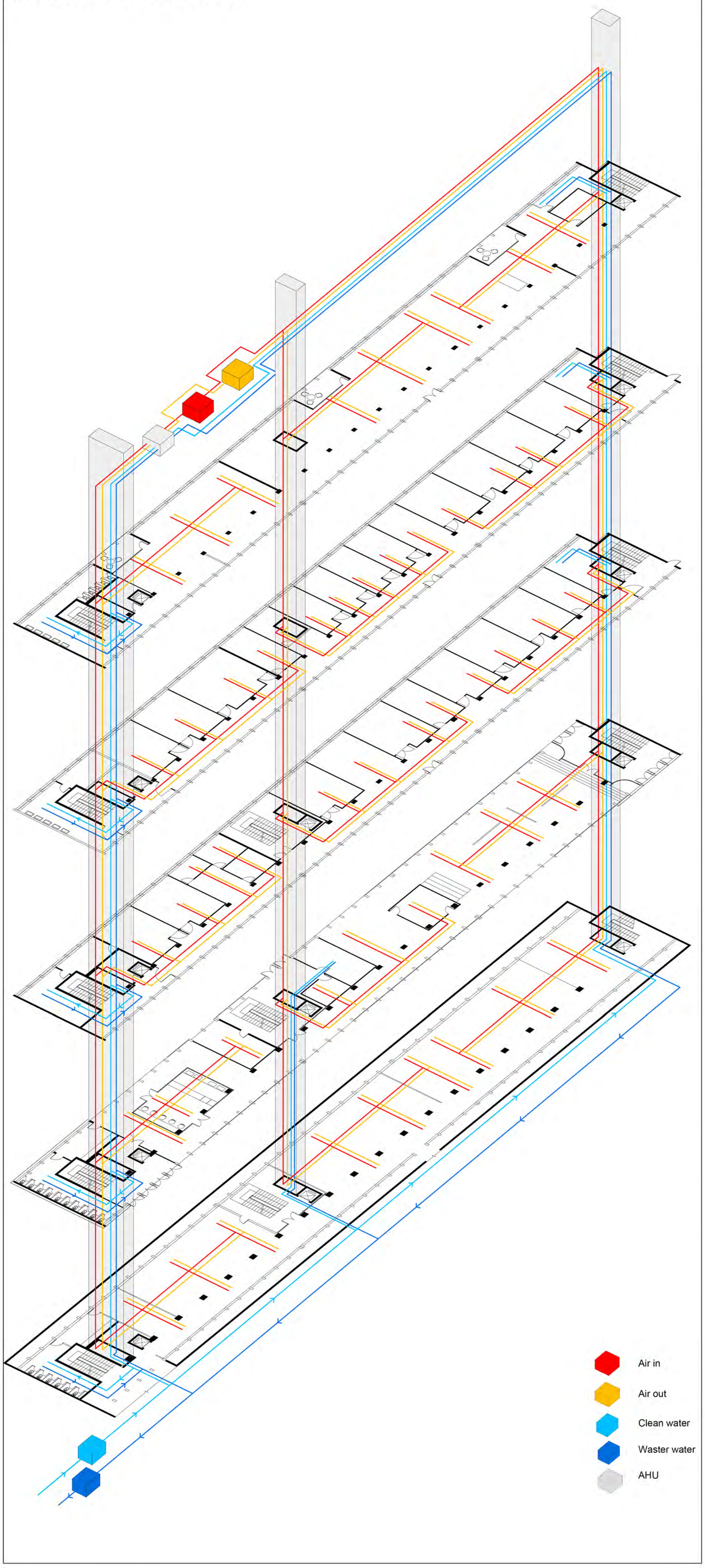
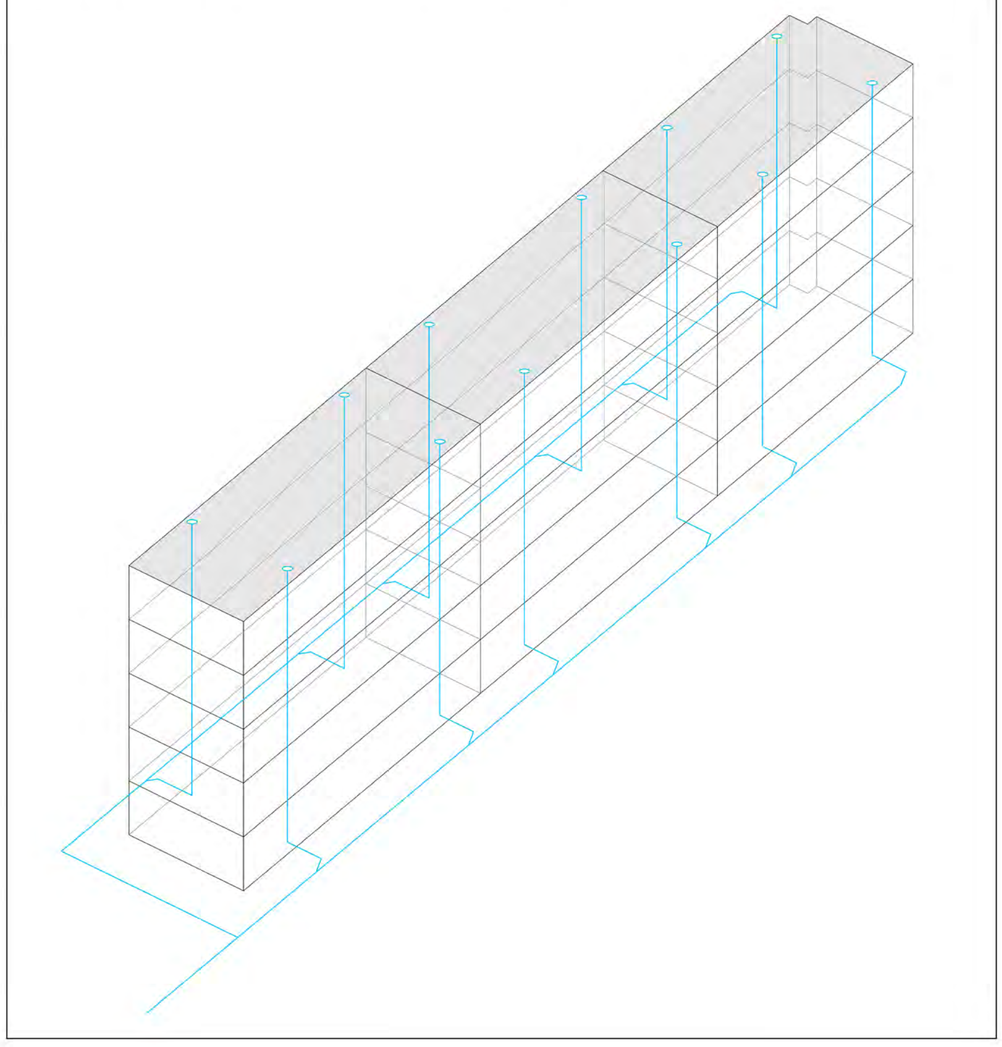
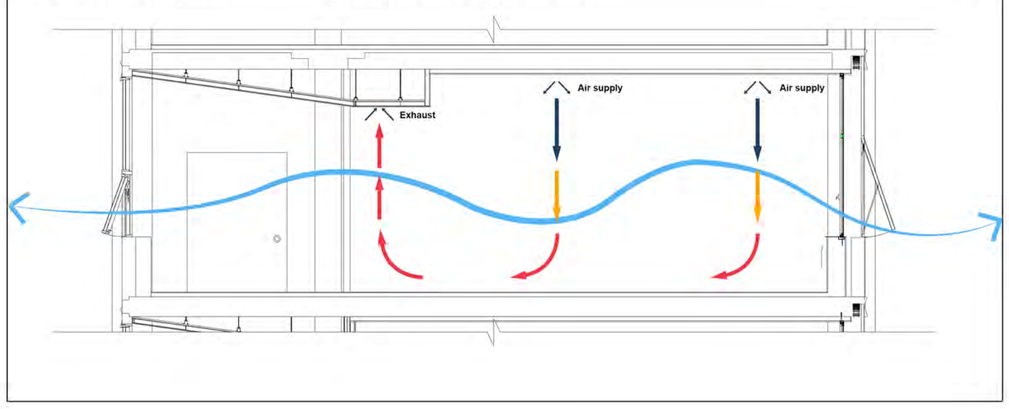
Axonometric view of all services



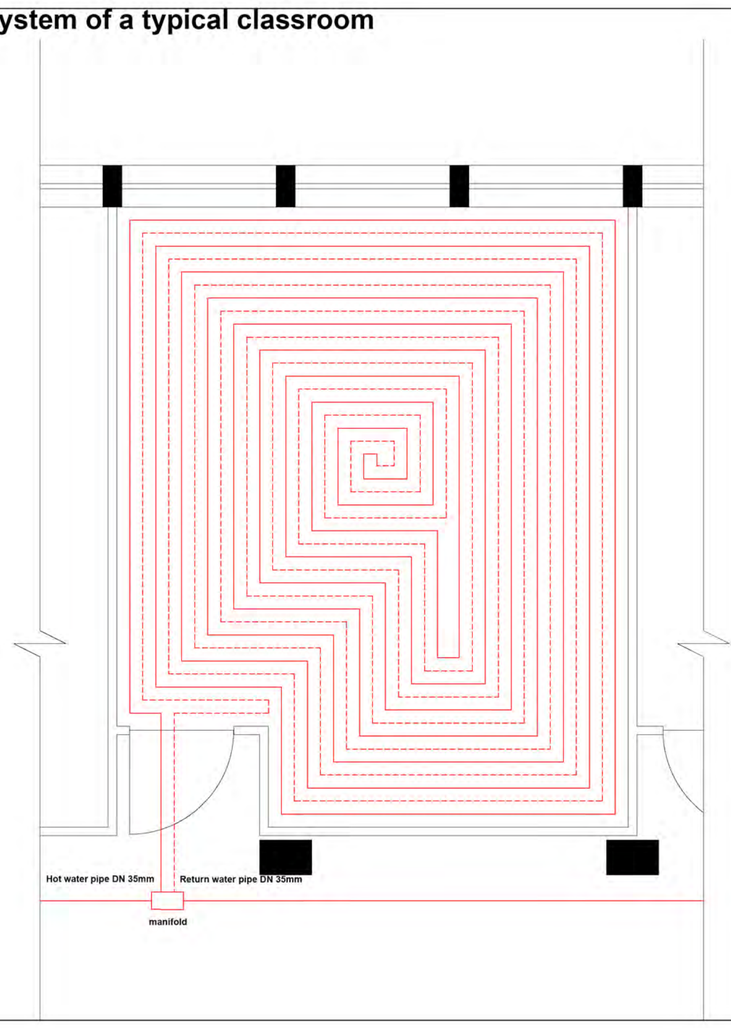
Axonometric view of rainwater distribution



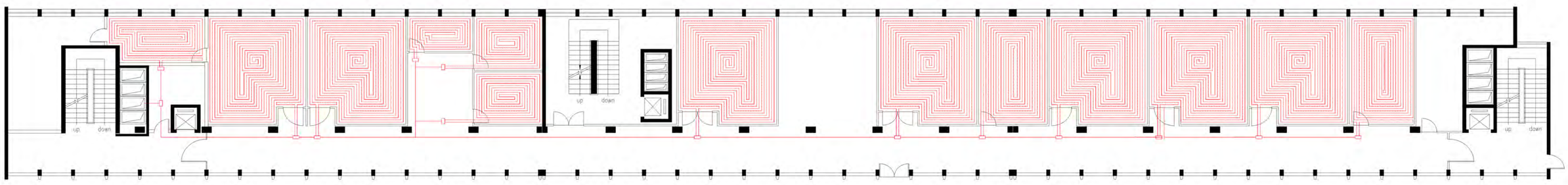
Ventilation system of a typical room, section



Heating system of a typical classroom



Heating system of a plan



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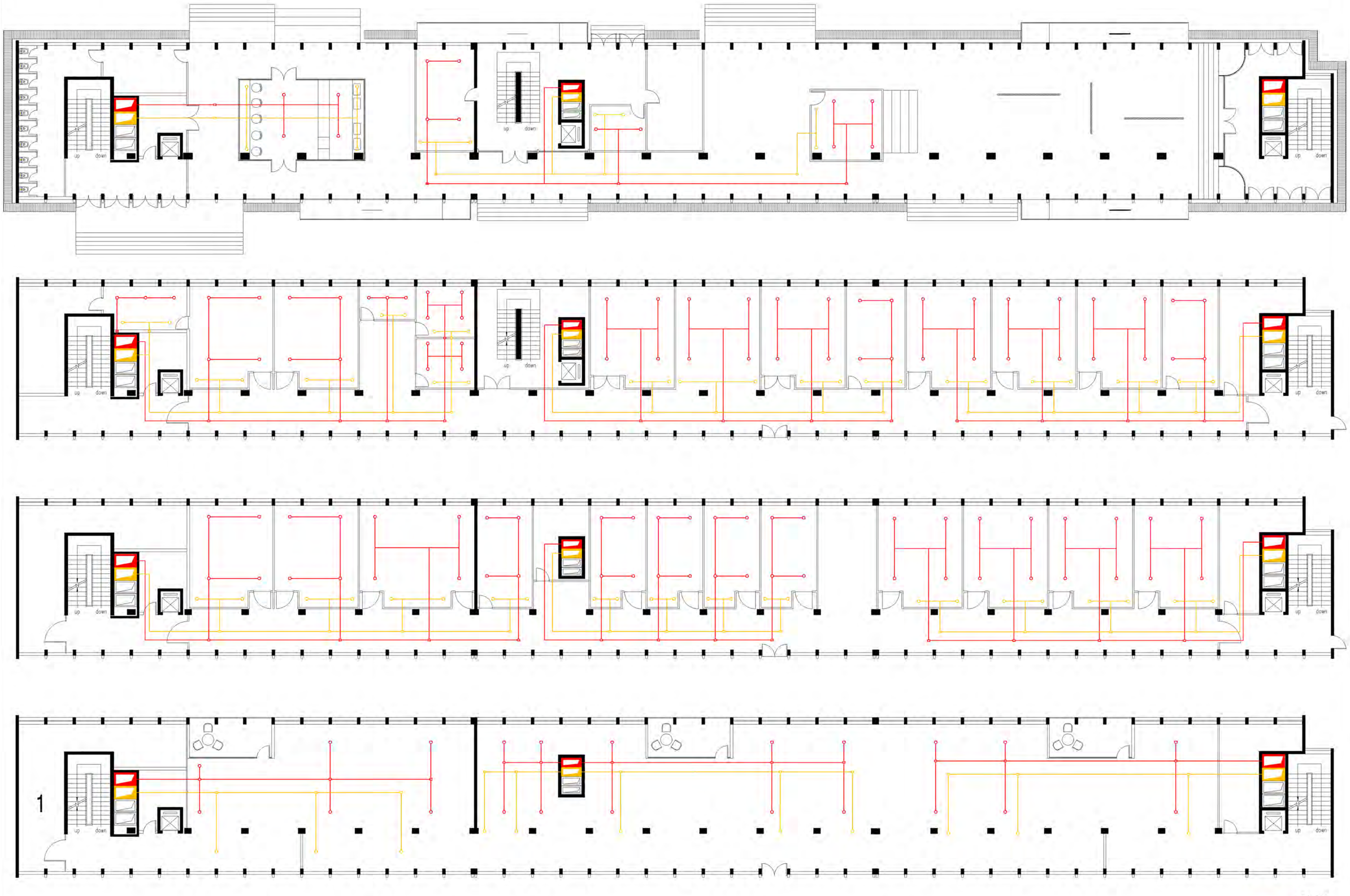
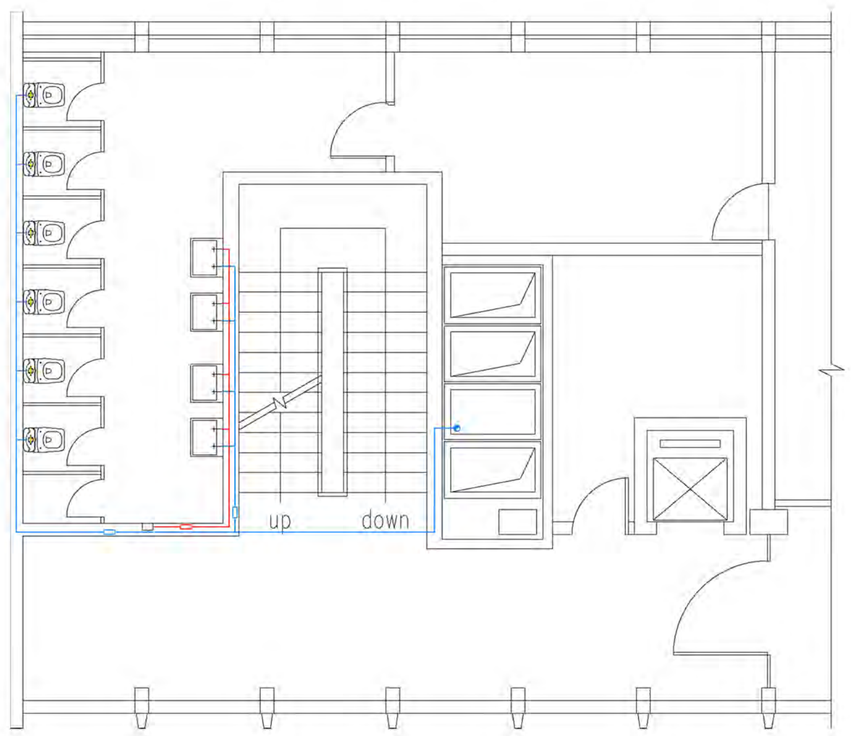
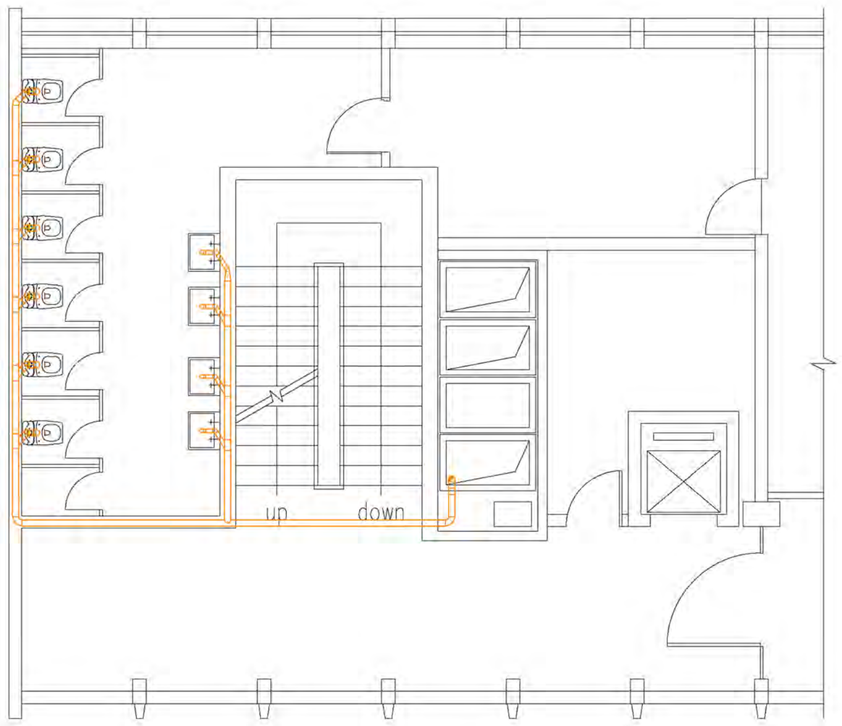
Ventilation system

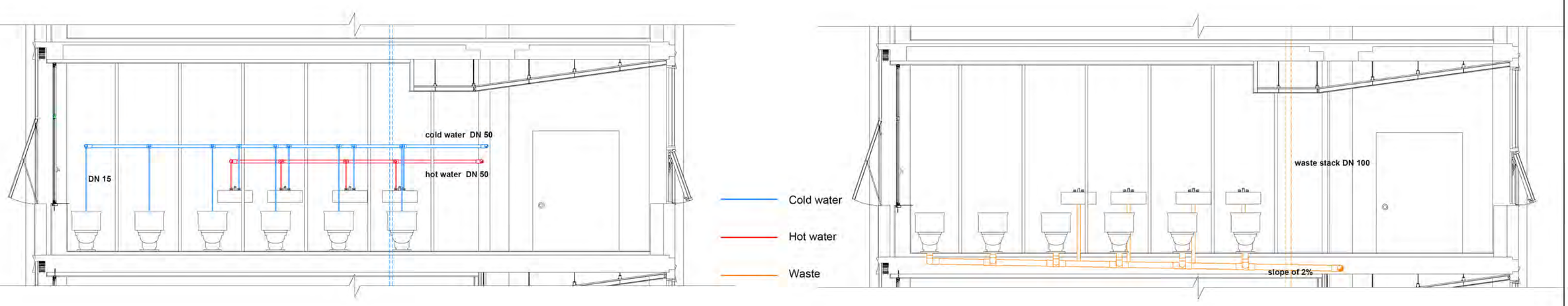


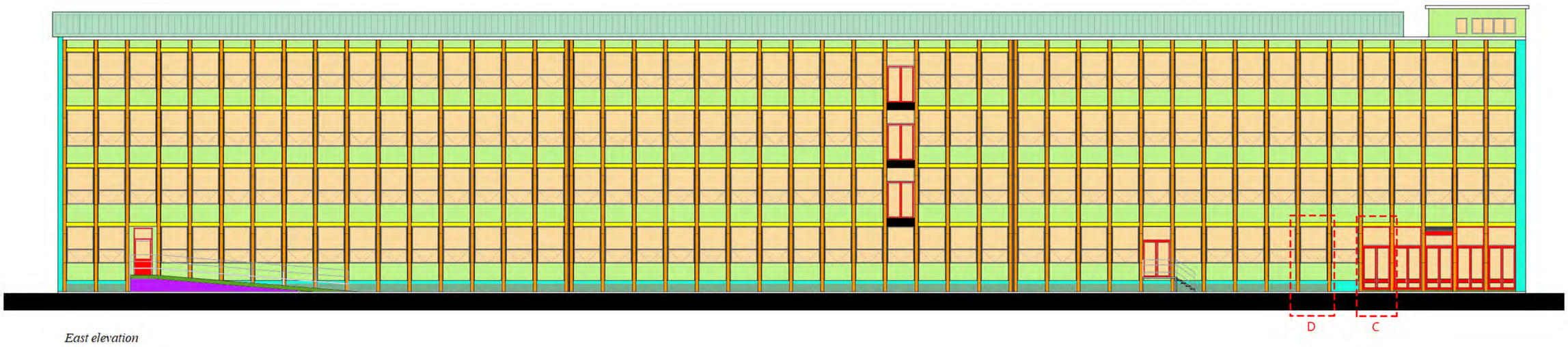
Water supply system



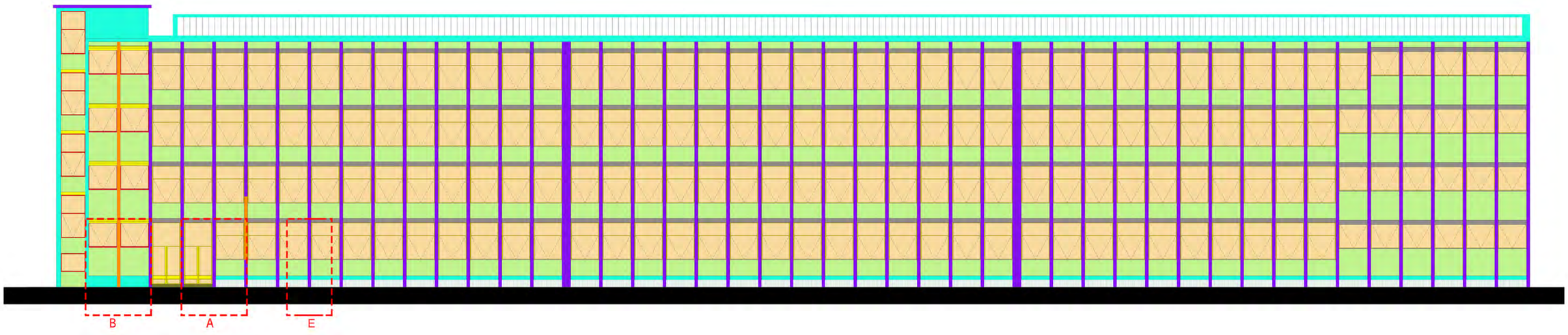
Discharrge system







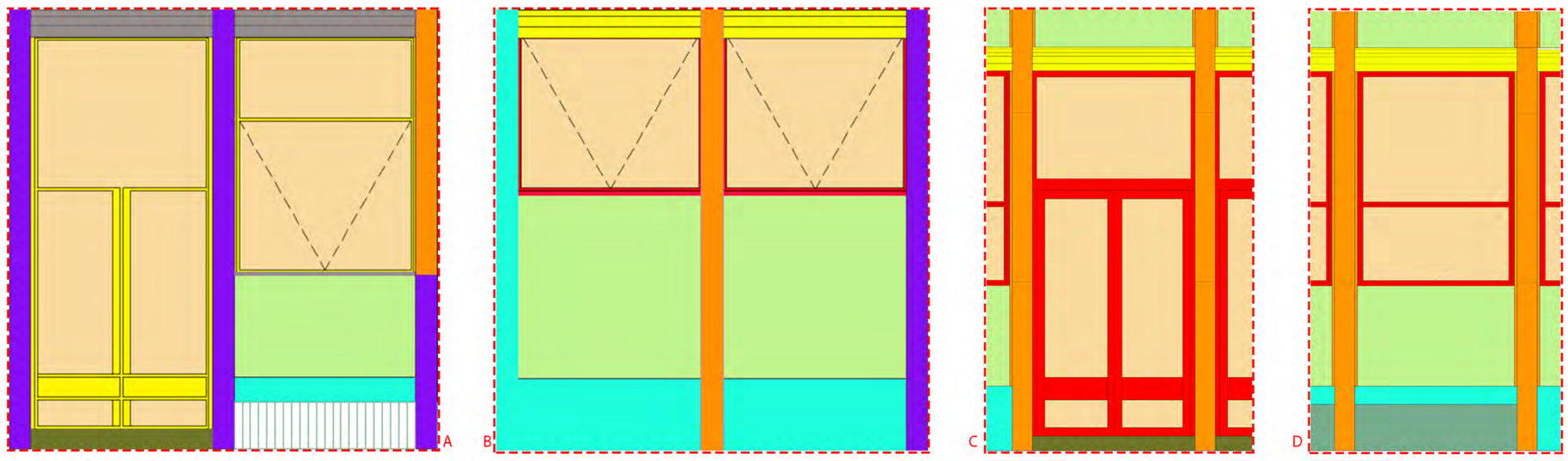
East elevation

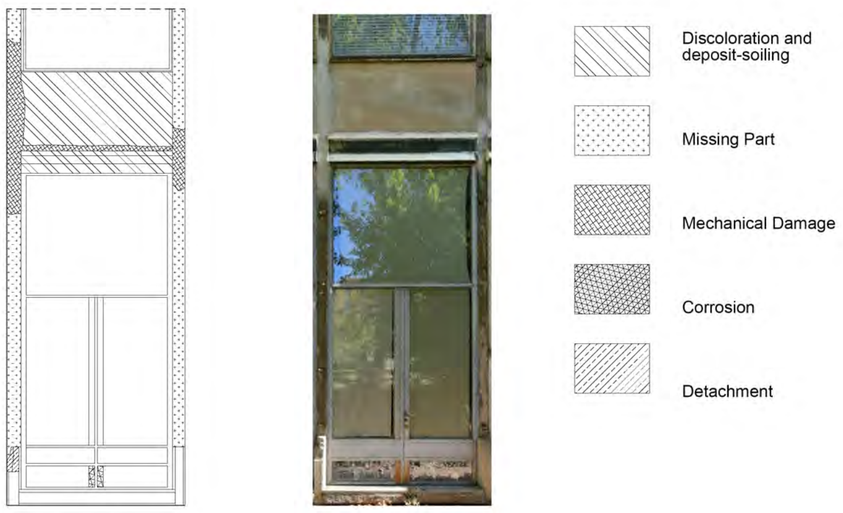


West elevation

MATERIAL MAPPING LEGEND

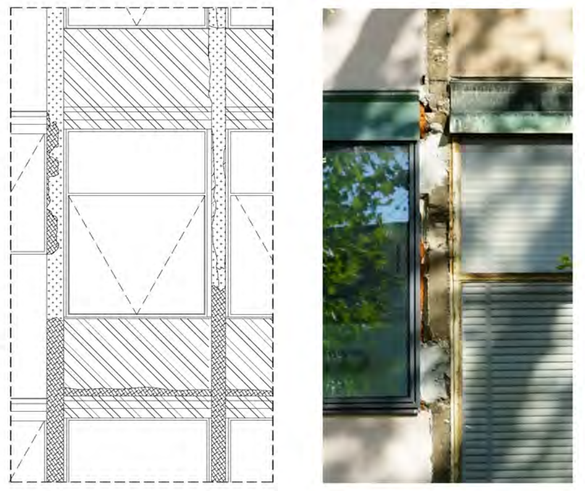
- Aluminium framings and flashings
- Zinc coated steel sheets
- Glass
- Metal panel
- Steel grids
- Cement mortar
- Steel framings and awnings
- Reinforced concrete
- Stone step pavings
- Brick curb of ramp
- Cement plaster with painted finishing
- Copper awnings and flashings
- Wood with painted coating
- PVC framings
- Tiled surface





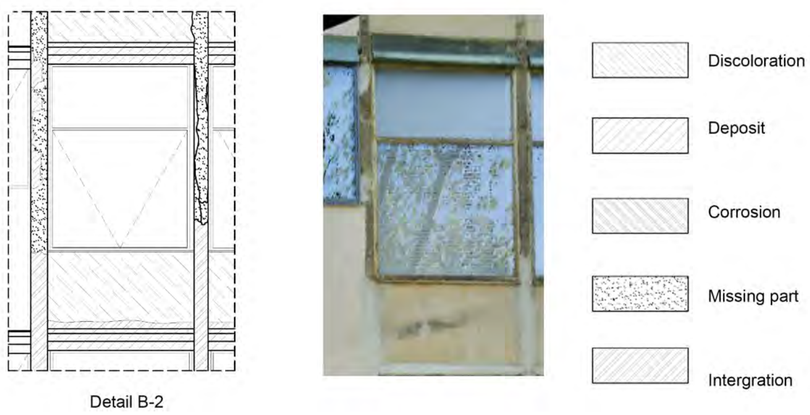
Detail A

- Discoloration and deposit-soiling
- Missing Part
- Mechanical Damage
- Corrosion
- Detachment



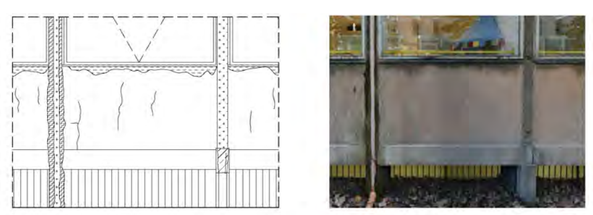
Detail B-1

- Missing Part
- Discoloration and Deposit-Soiling
- Mechnical Damage



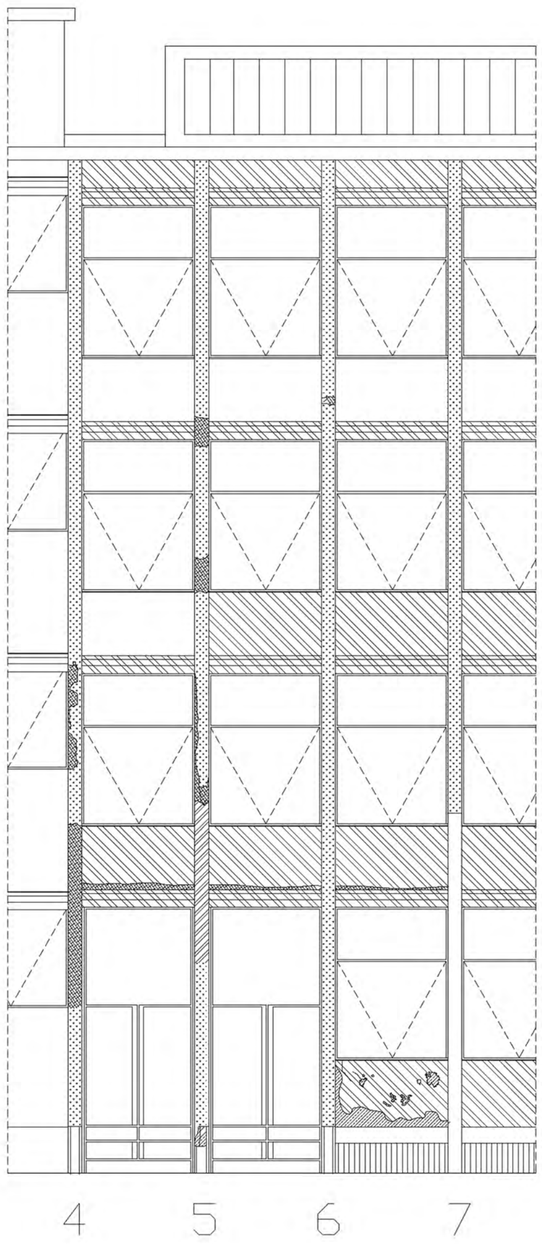
Detail B-2

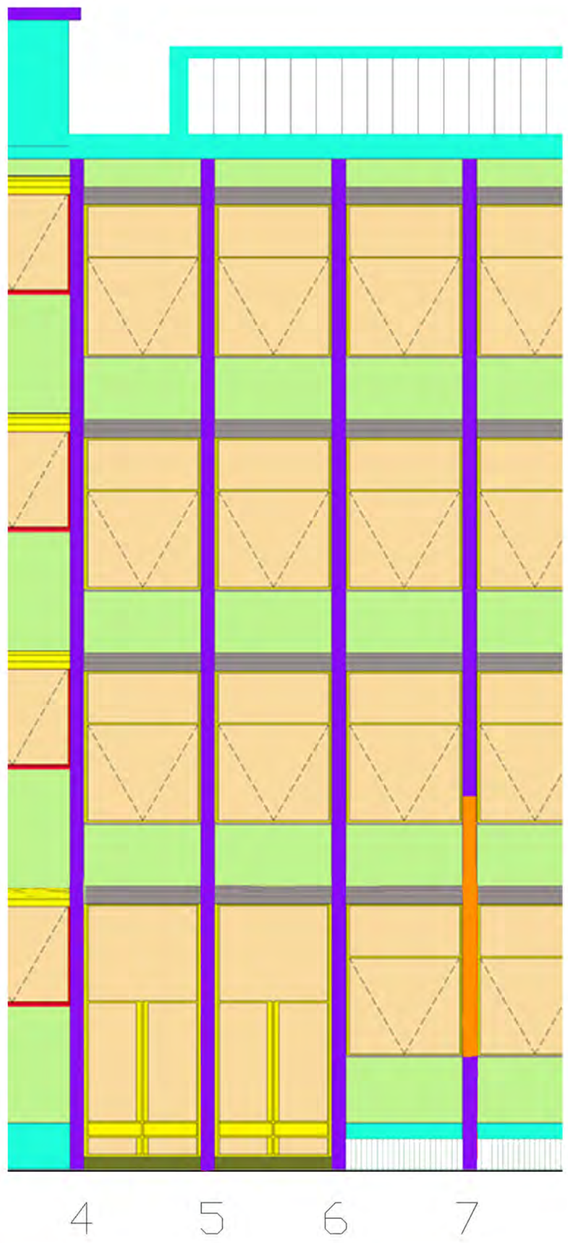
- Discoloration
- Deposit
- Corrosion
- Missing part
- Intergration

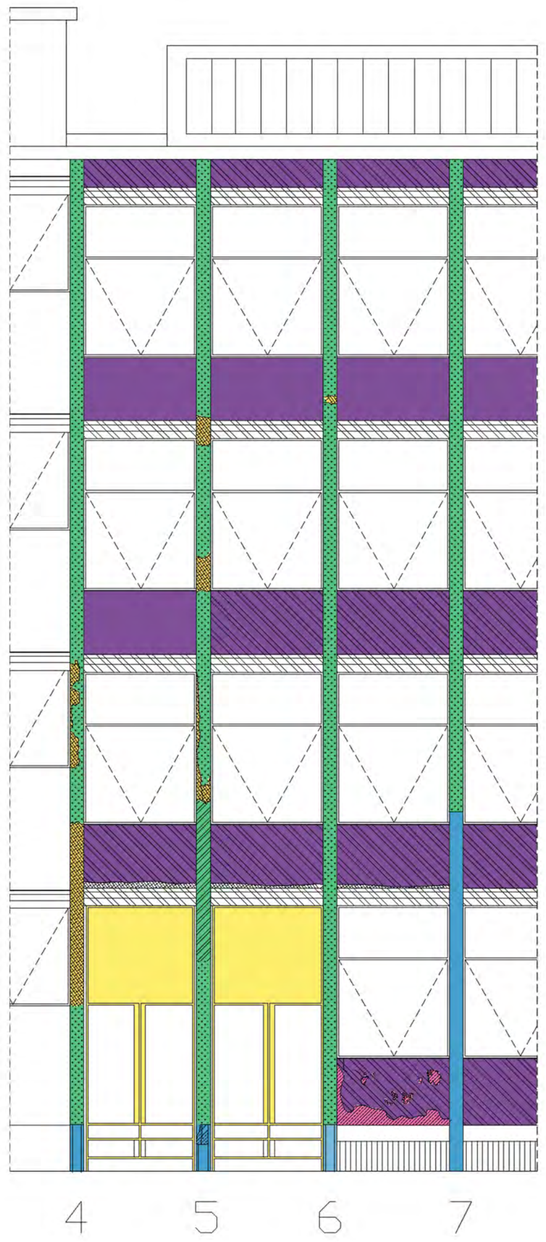


Detail E

- Missing Part
- Biological Colonisation
- Hair Crack
- Dampness
- Detachment







Missing part

Discoloration and Depositsoiling

Mechanical Damage

Corrosion

Detachment

Hair Crack

Dampness

Detachment

Aluminium framings and flashings

Zinc coated steel sheets

Glass

Cement mortar

Steel framings and awnings

Reinforced concrete

Stone step pavings

Copper awnings and flashings

Cement plaster with painted finishing

Cleaning the deposit from the plaster mortar.

Removing the remaining eroded vertical elements made out of reinforced concrete.

Grouting lime mortar on cracks and detached parts of the surface matchin with existing.

Removal of inappropriate cement mortar from the surface.

Adding aluminum vertical elements.

Painting a new layer as coating for protection after cleaning the rust to avoid corrosion.

Guidelines for the conservation:

At the ground floor, we remove most of existing wall to open the space for public and at other floors, we remain all exterior wall to keep spirit of this light machinery building.
On the east side, we do few things about exterior walls because these walls have been repaired once and it works well.
On the west side, we add new windows and walls behind existing windows and walls. Because some parts have peeled off from existing walls, in order to improve the existing walls, we choose add a layer of mortar. For windows, we will remain it and paint them.
For inside space, we choose new floor construction that have inside insulation to replace existing floor. At the same time, indoor walls would be removed and new walls with insulation would be chosen.

Details of conservation

Mortars detachment and cracks of facade

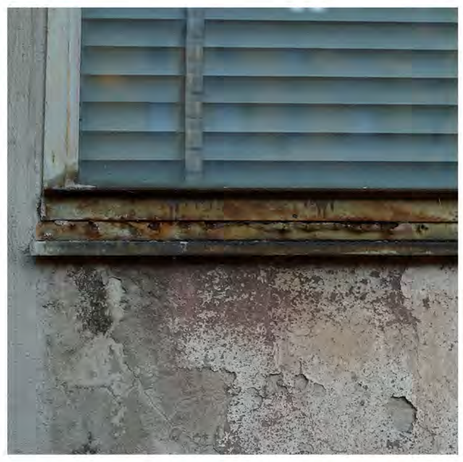
Intervention

Cleaning and removing some parts and then adding the replacement with same materials and color. At first, we can remove and clean the deposits on oursurface by brushing. Then the solution is grouting of missing parts, detached and removed parts bay using lime mortar, added with natural pigments in order to acquire the same color with the existing ones on our surface. We can also fill the cracks with lime mortar.

Windows and doors framings, flashings, windowsills

Intervention

Cleaning by hand is the best way to remove thick corrosion layers, working with fine hand-tools and with the aid of a low power microscope.
Chemical cleaning maybe is not the best way because it cannot easily be controlled and some chemicals may remain on the object.
We have to remove the rust from the steel framings.



Vertical elements

Intervention

Adding the vertical elements with the same material as the refurbished elements. After that, we could follow the original form.It could hide drainage pipes. Also it can help avoid our columns from erosion so it works as a protection.

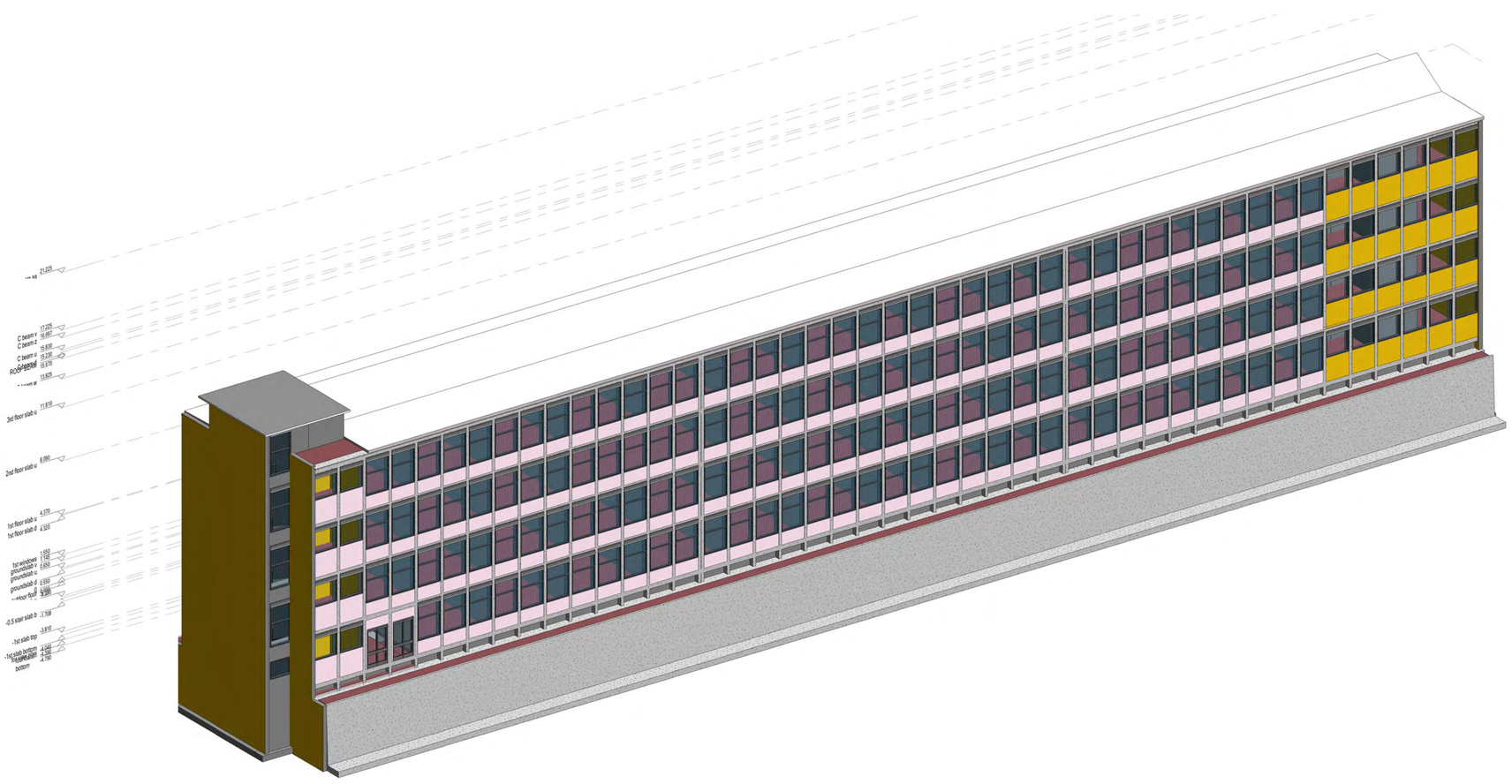
Expansion joints

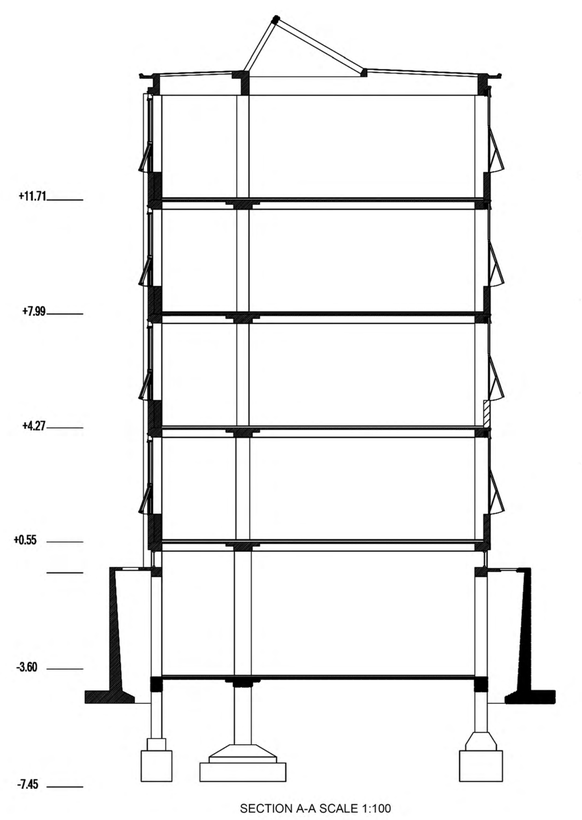
Intervention

Removing of the cement mortars at these borders are needed then we can cover the gap with expansion joint system.

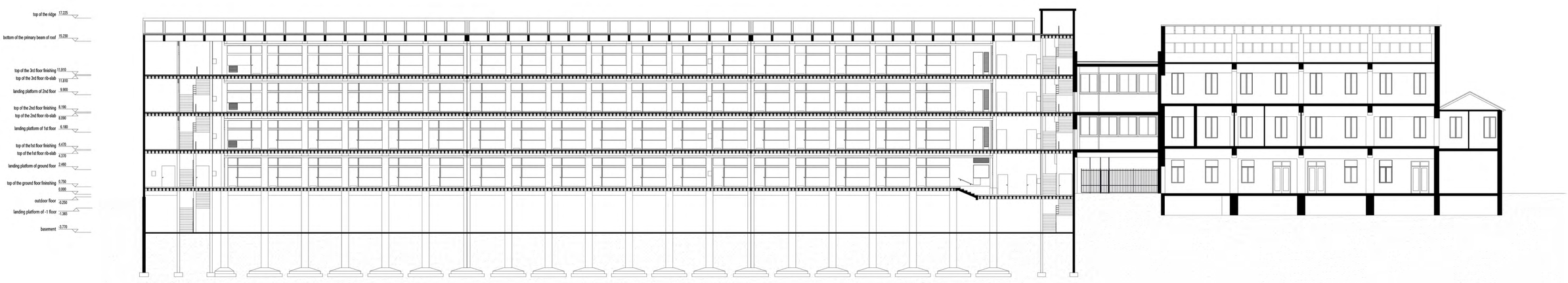
Survey-laser scanning

0 5 10 15 m





SECTION A-A SCALE 1:100



SECTION B-B SCALE 1:200