

OPEN SPACE

Architectural Design Studio For Restoration of Complex Construction

Master Thesis in Building Architecture

Politecnico di Milano
School of Architecture Urban Planning Construction Engineering
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Abstract

The project, located in the Societa Umanitaria of Milan City(Via Solari and Viale Lombardia), designed by Giovanni Broglio, faces the problem of "OLD", the aim is to preserve the light machinery lab building and at the same time, rehabilitate it. Because of the needs of the users, light machinery lab has to improve the quality of the spaces by reorganizing the rooms while preserving the main facade and structure by adding new ones inside. According to the situation of the building, the functions should be reorganized and the structure needs to reinforce while the services system also need to be refreshed.

Not only the building itself need to be rehabilitate, but also the landscape should be redesigned, to provide a better connection of the buildings of Umanitaria. New internal and external access are given to the different parts of the site. People will have new feelings about the whole area.

Sommario

Il progetto, situato nella Società Umanitaria della città di Milano (Via Solari e Viale Lombardia), progettato da Giovanni Broglio, affronta il problema di "VECCHIO", lo scopo è quello di preservare l'edificio del laboratorio di macchinari leggeri e allo stesso tempo di riabilitarlo .

A causa delle esigenze degli utenti, il laboratorio di macchinari leggeri deve migliorare la qualità degli spazi riorganizzando gli ambienti preservando la facciata e la struttura principali aggiungendone di nuovi all'interno.

A seconda della situazione dell'edificio, le funzioni dovrebbero essere riorganizzate e la struttura deve essere rafforzata mentre anche il sistema dei servizi deve essere aggiornato.

Non solo l'edificio stesso deve essere riabilitato, ma anche il paesaggio dovrebbe essere ridisegnato, per fornire una migliore connessione degli edifici dell'Umanitaria. Un nuovo accesso interno ed esterno è dato alle diverse parti del sito. Le persone avranno nuovi sentimenti per l'intera area.

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HISTORY OF SOCIETA UMANITARIA

SOCIETÀ UMANITARIA

(FONDAZIONE LORIA)

MILANO - Via A. Manzoni 9 - MILANO

I SUOI SCOPI

La Società Umanitaria, fondata nel 1899 da Prospero Loria, ha lo scopo di mettere i diseredati, senza distinzione, in condizione di rilevarsi da sé stessi procurando loro lavoro, alloggio, istruzione (art. 5 dello Statuto), disposti di un capitale di 1.000 milioni di lire, con un reddito annuo di circa 200.000.000 lire.

COSA HA FATTO E COSA FA L'UMANITARIA.

La Società Umanitaria compie una duplice opera di prevenzione e di assistenza. Previene gli sprechi, i guasti, i danni della disoccupazione. E si occupa di assistere gli operai intorno alle fondazioni del movimento del lavoro, le società d'emigrazione, ecc. ecc.

L'Ufficio del Lavoro, che fornisce dati e notizie istruite, a regolarizzare quindi le dimissioni e le chieste di nuovo lavoro.

L'Ufficio di informazioni e traduzioni, che illustra sulle sue più importanti manifestazioni l'opera delle organizzazioni lavorative locali.

Le Scuole Professionali che aumentano e perfezionano la capacità tecnica degli operai e della disoccupazione, la quale laborisce più e orientando tra le file dei diseredati verso abilità professionali. Inoltre le Scuole preparano un maestro per scuola, allargano il campo delle iniziative industriali e detestano quindi un generale susseguirsi di imprese.

Le Scuole della Umanitaria sono:

1. Scuola del Libro per la sua attività libraria, tecnica, istruttiva, culturale e sociale, contro l'ignoranza e l'arretratezza, via Galvani 10.
2. Scuola di elettrotecnica - piazza Cavotti, presso il Politecnico.
3. Scuola per orologiai - via S. Donato 38.
4. Scuola per l'industria dei grani, saponi, profumi, ecc. ecc. - via S. Marco presso la Società d'Incoraggiamento.

Tutte le scuole dell'Umanitaria, create per gli operai, sono gratuite.

Di Istituti creati per l'assistenza immediata sono:

1. Ufficio industriale via Tre Alberghi 17, in accordo con l'Unione Femminile che si propone di aiutare ed indirizzare gli operai riciclati nel lavoro.
2. Ufficio di collocamento e di personale femminile e di servizi (via Tre Alberghi 17) costituito con una Scuola di cucina e un Laboratorio.
3. Ufficio di collocamento per gli operai - in servizio delle Industrie (via Manzoni 9 e via Grandino 13).
4. Casa di sussidio alle due querce, che cura i diseredati italiani sotto nome di sussidio delle rispettive organizzazioni.
5. Istituto di Credito per la Cooperazione - via Manzoni 9.
6. Laboratorio calcoli che fornisce i calcoli per il costo e il rendimento.

Il prossimo funzionamento:

1. Casa di lavoro per disoccupati - via Maestro Fieschi.
2. Scuola Agraria per disoccupati.

L'Umanitaria spende inoltre mezzi ed attività per la creazione di istituti intesi ad elevare il tenore di vita morale e materiale dei diseredati.

Tra questi sono:

1. Conservatorio delle Bambine Povere.
2. L'Asilo Popolare.

Milan, XX century

The city was experiencing a robust industrial development and its social-economic context reflected a remarkable demographic and productive expansion. But if from one side you can see a burgeoning industrial activity, on the other side you have a derelict fourth estate. The appalling view of beggars and tramps and the unfairness of both public and private charity inspired Prospero Moisè Loria, a Jewish entrepreneur, to conceive a new institution that would revolutionize the entire history of our country: the Società Umanitaria.

Helping the “underprivileged, without distinction” meant that Umanitaria would focus on a wider public rather than only the marginalized subjects who needed charitable intervention.

Work and education would always be combined as the cornerstone of this social action.

1892, depositato negli atti del ...
Sfondrini con rubrica a di lui rogito N. 21682, e
pubblicato il 29 ottobre 1892, e nominata sua ve-
de universale nel Preambolo stesso. -

II.

Scopo della Società Umanitaria è di mettere
e diseredati, senza distinzioni, in condizione di
rilevarsi da sé medesimi, procurando loro op-
-poggio, lavoro ed istruzione. -

III

Per conseguire il suo scopo la Società si propone:
a) d'istituire anzitutto in Milano una Casa di

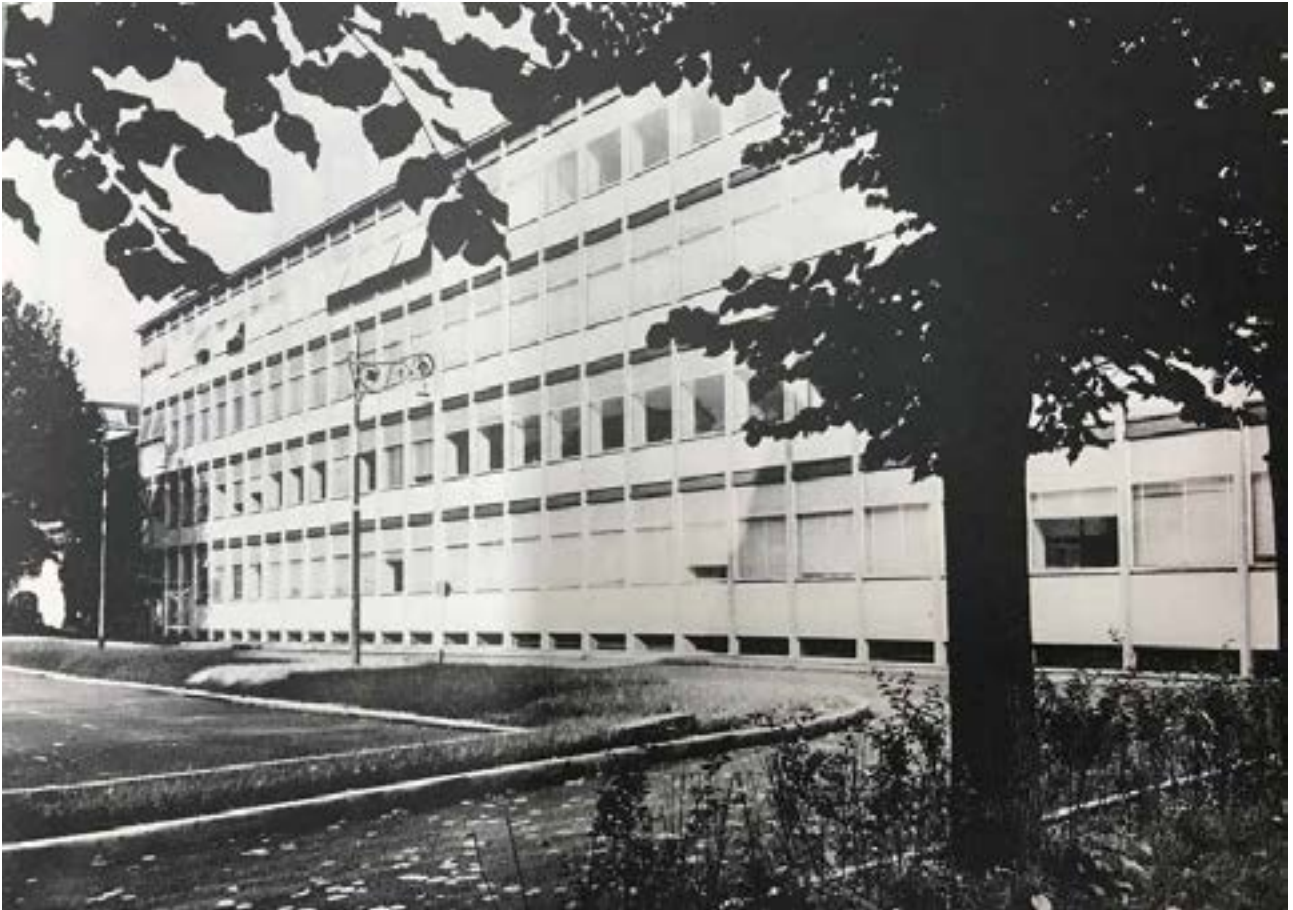
"Its goals would be to provide the underprivileged, without distinction, with support, work and education so that they may elevate themselves."

Societa Umanitaria

The Societa Umanitaria was founded in 1893.

Its goal is to "provide the underprivileged, without distinction, with support, work and education so that they may elevate themselves". The underprivileged will be provided with the instruments that would help them improve on their condition by receiving work and education instead of just a temporary support. Education was the Society's earliest concern. Based on the concept that "developing the worker's professional skills means protecting them from the threat of unemployment and increasing their economic wealth", it established a whole range of primary and secondary schools, all of them free of charge and more importantly, professional training schools. A first initiative led to the construction of two housing estates for working-class communities in Milan (Via Solari and Viale Lombardia), designed by Giovanni Broglio.

The bombings of August 1943 destroyed or damaged 80% of the central buildings and of the furniture and equipment of the schools, while further damage resulted from bad weather, looting and collapses later on. The new headquarters of the Societa Umanitaria designed by Giovanni Romano, had been completed in 1957, reconstructed on the site of the old facility destroyed by bombing in 1943.



The “Società Umanitaria” was configured as a large facility composed of parts that divided up the area. An entire block with a regular form in which the new buildings were clearly identified as part of a complex: classrooms, heavy laboratories, light laboratories, the scuola del libro, the administration and the boarding facilities, along with reconstructed surviving cloisters and the Chiesa della Pace, outside the property. The buildings, separated but connected by porticos and passages on the ground level, subdivided the proportions of the lot, gauging them in relation to the elements facing them. The project of reconstruction of the cloisters was signed by Giovanni Romano. A volume with two above-ground levels, formed by classrooms, fills out the remains of the portico with its thickness. In the section, the new building rests on the foundations of the old one, but it subdivides the new glazed elevations with pillars that are shifted outward by one meter, to form an external architectural order at the edge of the facade. This solution that was not implemented by combining the structure and the infill on the same plane, probably for economic reasons connected with the making of the reinforced concrete, avoiding a double foundation, is a forerunner of the solution later used for the southern facade of the new classrooms, ten years later, justified by the difference in exposure to sunlight.



Historic cartography





Milan, 1722
Catasto del Filippini



Milan, 1826
Carta del Brenna



Milan, 1884
Geoportale, Comune di Milano





Milan, 1910
PRG, Comune di Milano



Milan, 1930
CTC, Comune di Milano



Milan, 1946
CTC, Comune di Milano





Milan, 1956
PRG, Comune di Milano



Milan, 1965
PRG, Comune di Milano

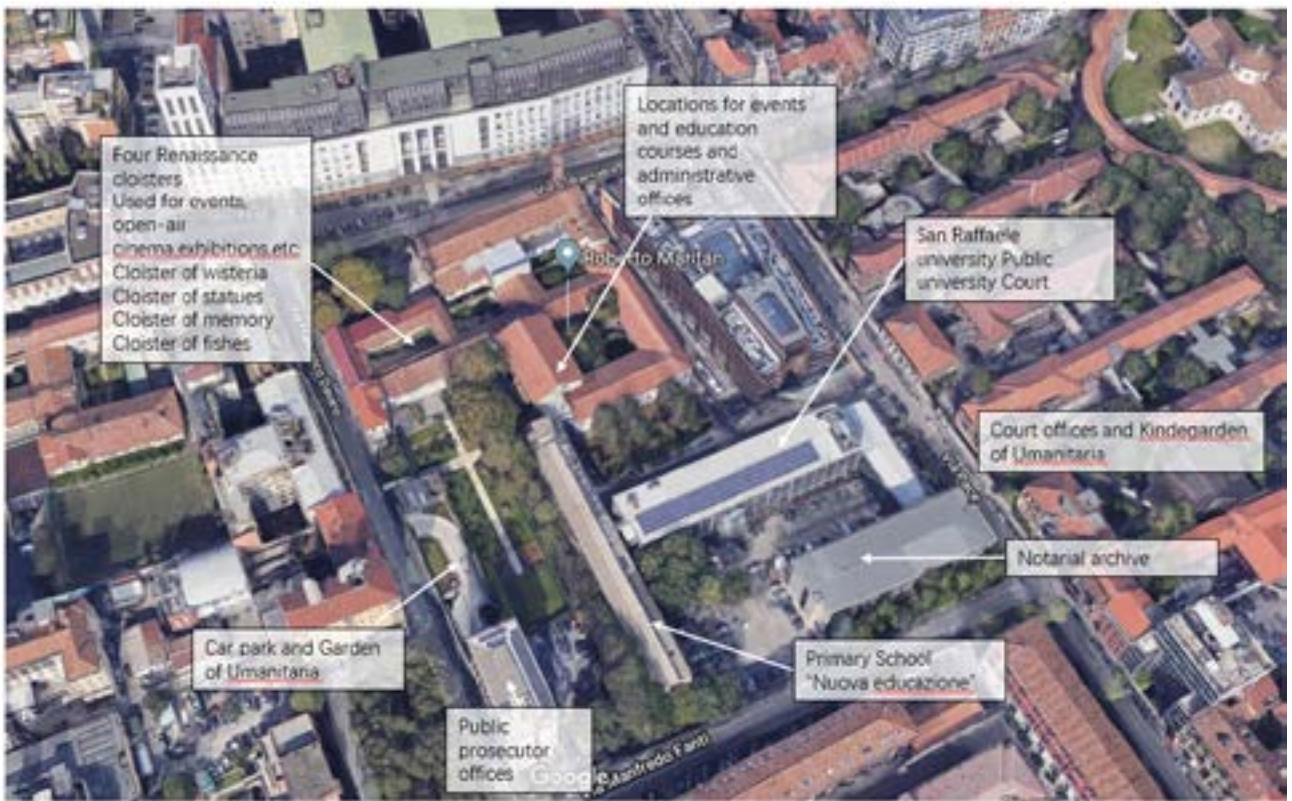


Milan, 1990
PRG, Comune di Milano

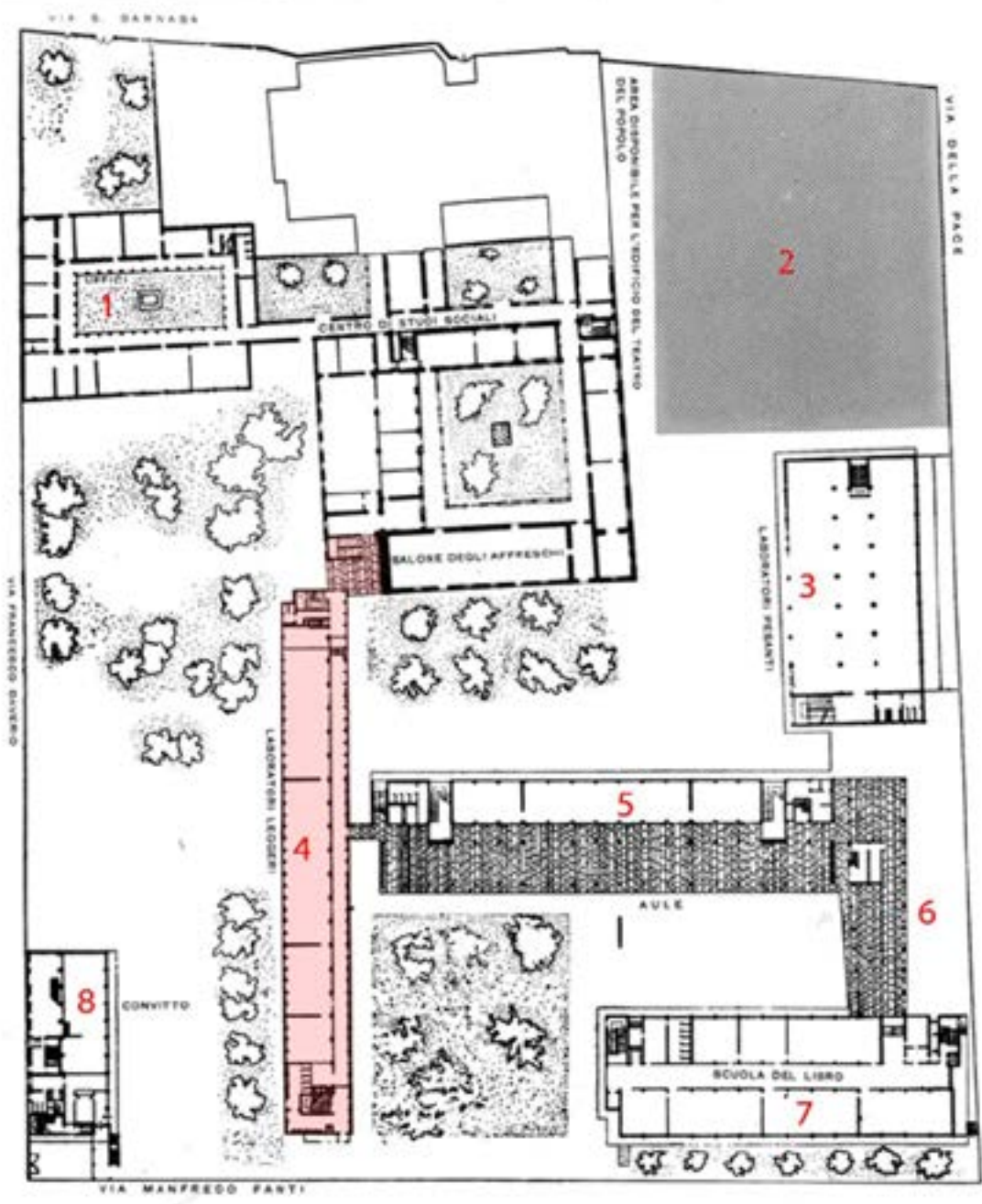
CURRENT STATE OF SOCIETA UMANITARIA



Google







“SOCIETA’ UMANITARIA”

Via Francesco D’Averio 7, Milano

General ground plan [1960]

1_Cloister, Monastery of the Peace

2_People’s Theatre

3_Heavy- machinery laboratories

4_Light- machinery laboratories

5_Classroom

6_Administrative

7_Book School

8_Student Housing

CURRENT STATE OF PROJECT AREA



Aerial view of light machinery laboratories[2018]



The light machinery lab has four plans. On the groundfloor there are seven rooms and one classroom for primary school. In the other floors there are offices and some rooms for handicraft labs.

Each floor has a corridor which is a serving space: it runs longitudinally throughout the building and the various rooms overlook on it.

Rooms and corridor are divided by eighteen curtain walls, which are made out of wood and glass.

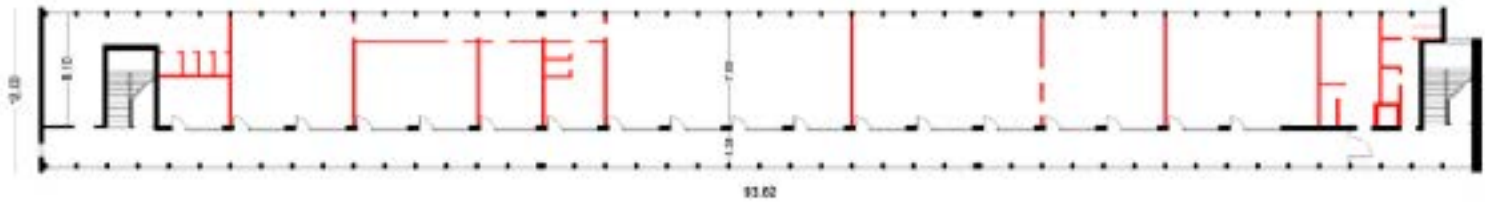
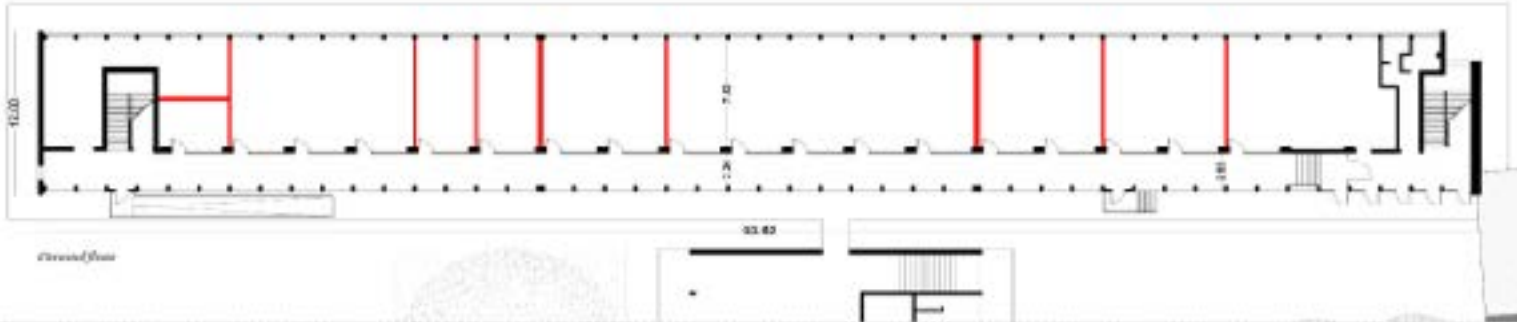
Existing Problems

- 1.The functional space of school is not enough. For example:Video room, Playground, Computer room, Infirmary , offices for teachers etc.
- 2.The space of light machinery is completely fixed and no rest space for individuals.
- 3.Lacking of daylight in educational part because of orientation and trees.
- 4.No façade insulation.
- 5.Parking area is too large that no space for children's outdoor activities.

The goals of what we want to achieve

SURVEY

Gemetrical survey_ground floor and typical floor



Typical floor

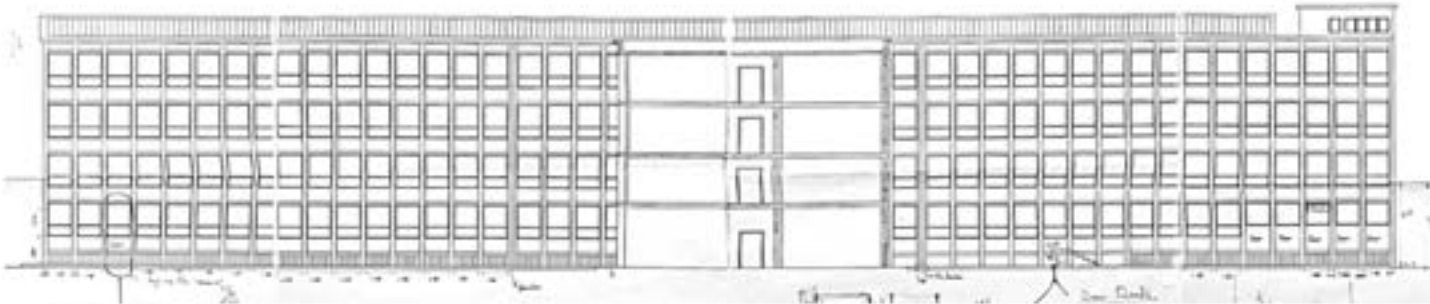
	<i>detected</i>	
	<i>not detected</i>	

The light machinery lab has four plans. On the groundfloor there are eight rooms and one classroom for primary school. In the other floors there are offices and some rooms for handcraft labs.

Each floor has a corridor which is a serving space: it runs longitudinally throughtout the building and the various rooms overlook on it.

Rooms and corridor are divided by eighteen curtain walls which are made out of wood and glass.

Gemetrical survey_east elevation



Sketch of east elevation



Points cloud of east elevation



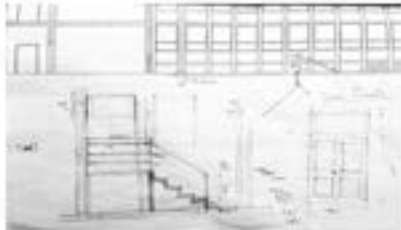
Points cloud of west elevation



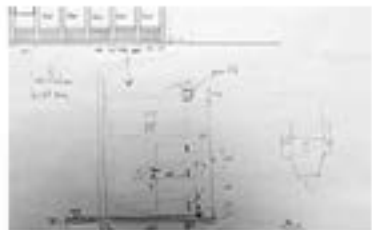
Details of ramp



Details of principal door

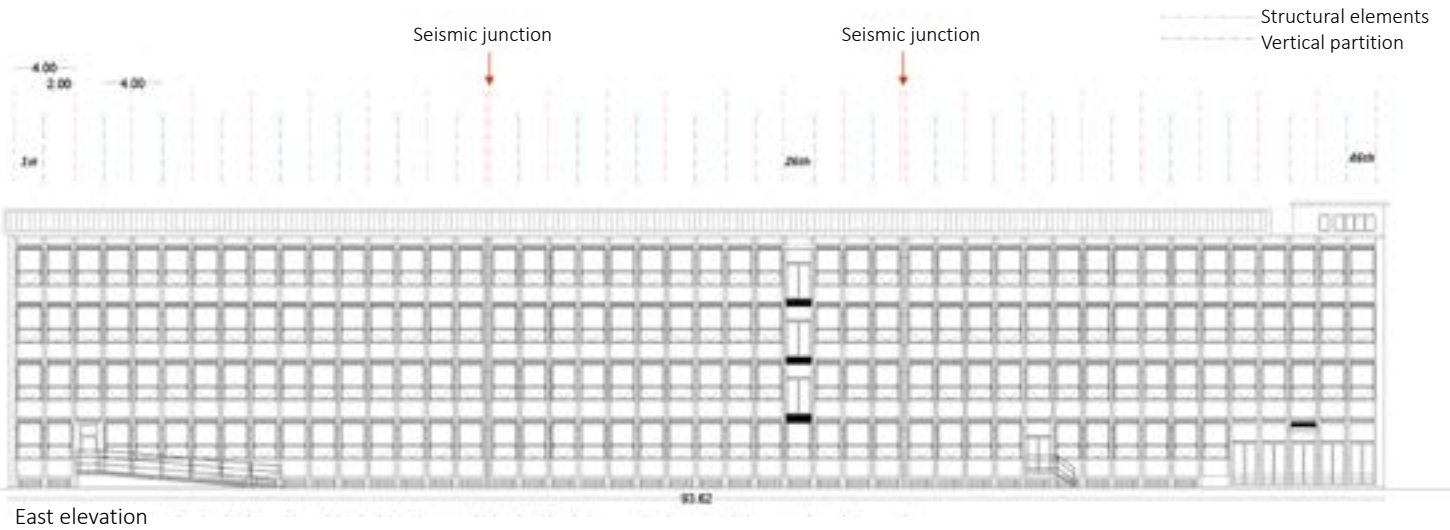


Details of door with stairs



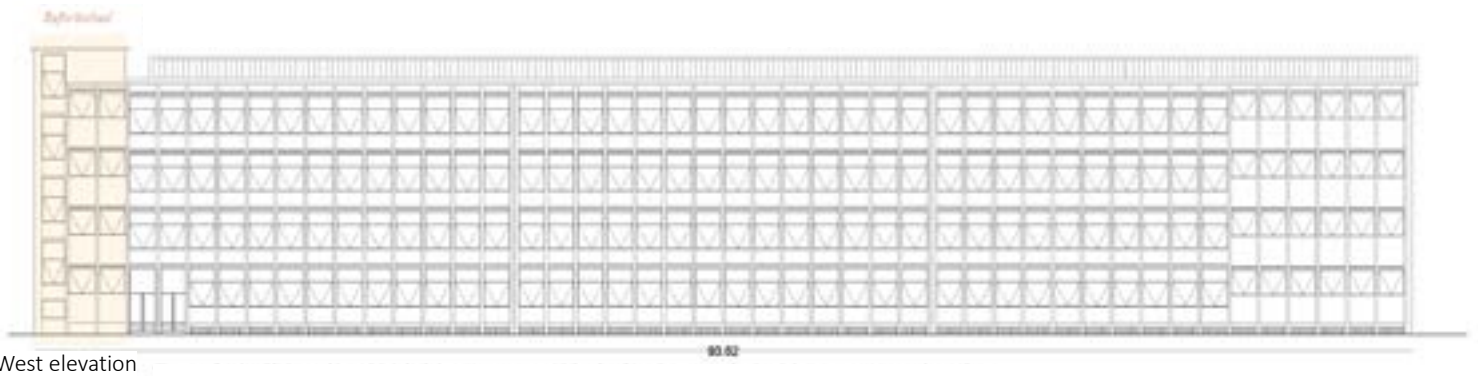
Details of door with

Geometrical survey_elevation



East elevation

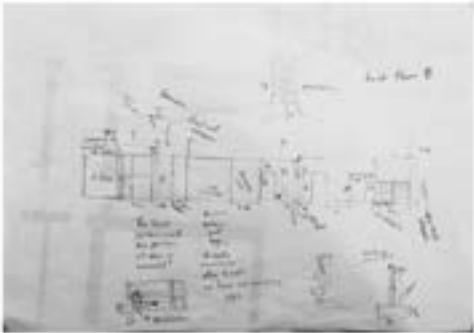
The east facade of light machinery lab is built by 46 spans, with length of 2 m between each other. At the 26th span we have the connection with the tribunale through three bridges except for the ground floor. It has five main entrances at the north-east corner of the buildings and an entrance for disabled people located on the third span by a ramp. It also have two junctions. The first one is between the 16th and 17th span while the other is about 27m further.



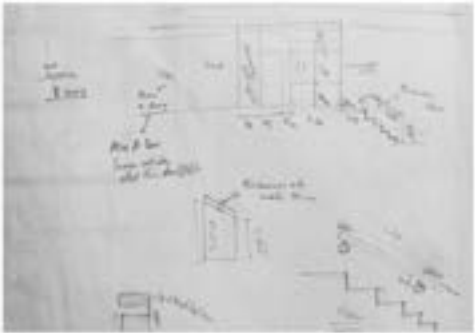
West elevation

The west facade of light machinery lab is built by 46 spans with length of 2m between each other. It has two entrances at the north-west corner of the building. But nowadays they are not used anymore. In the another facade, there are also two seismic junctions. Starting from the left , the building has three spans that are refurbished while all the others are not.

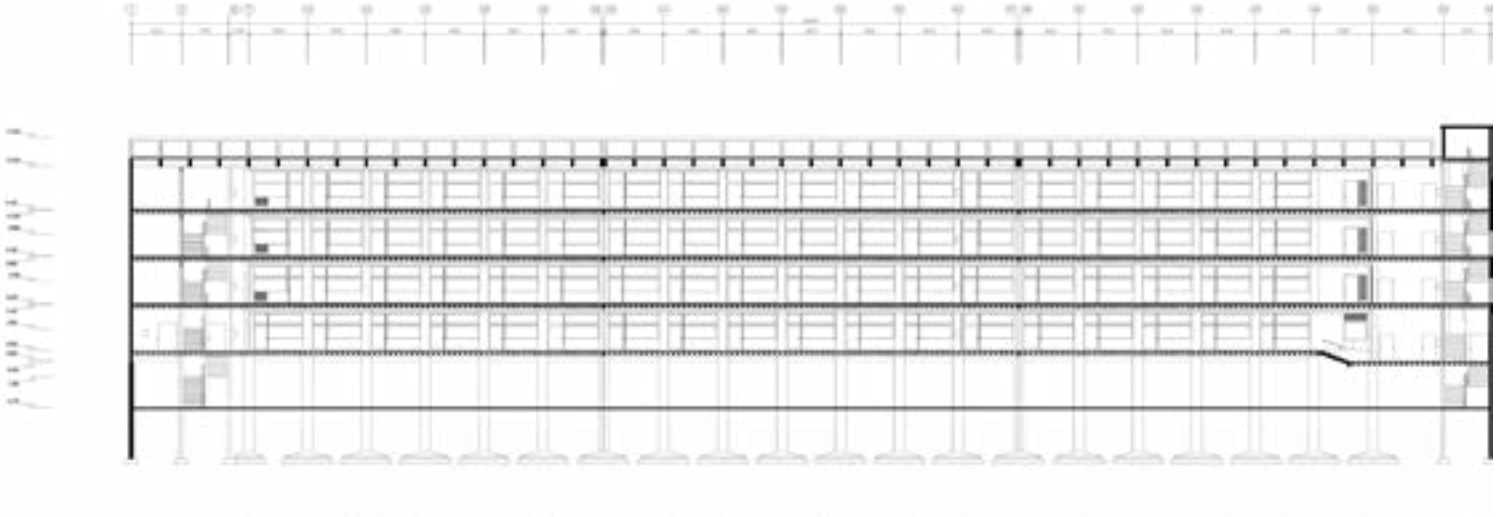
Gemetrical survey_longitudinal section



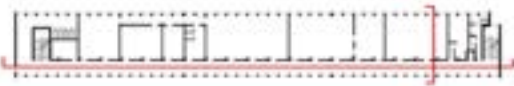
Preliminary sketch of longitudinal section



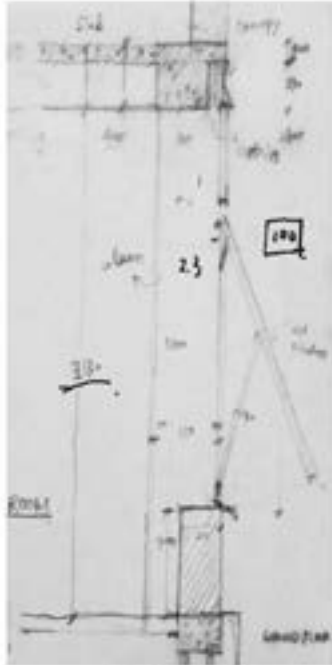
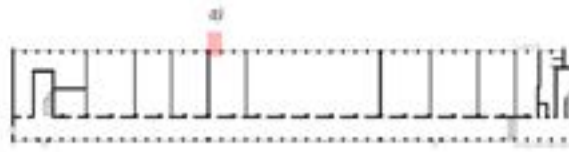
Details internal stairs inside the corridor



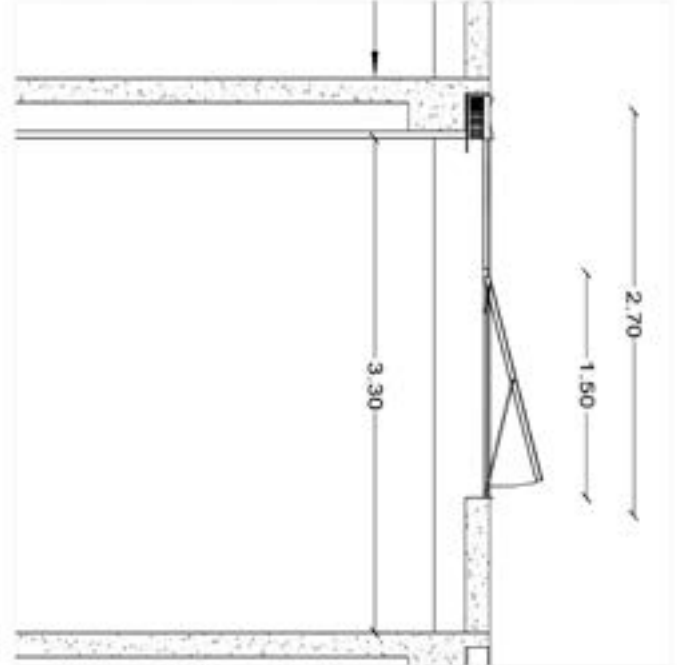
According to our survey, we draw a longitudinal section which is cut through the main corridor.
As we can see the typical curtain walls which are made out of wood , divide the space into areas which are used mainly as classrooms.
Curtain walls are situated between two columns with a step of 3.3m



Gemetrical survey_vertical sections west side

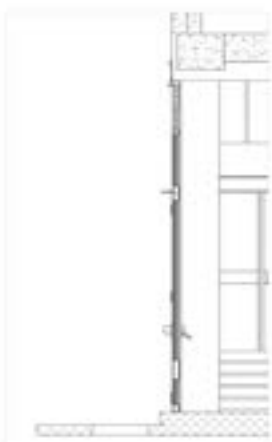
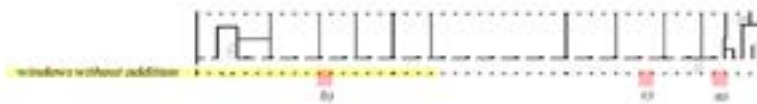


a) window in west elevation

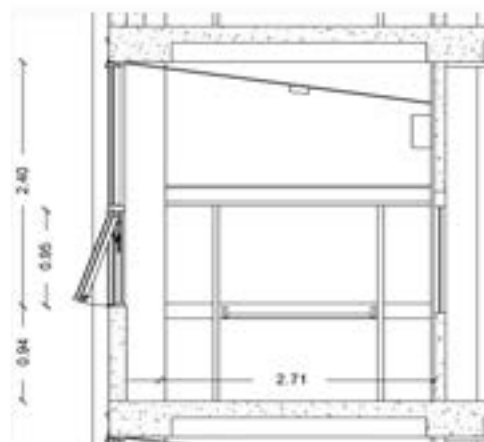


a) window in west elevation

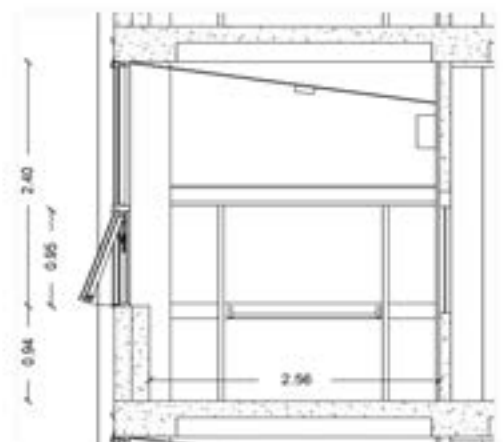
Gemetrical survey_vertical sections east side



a) main door in east elevation

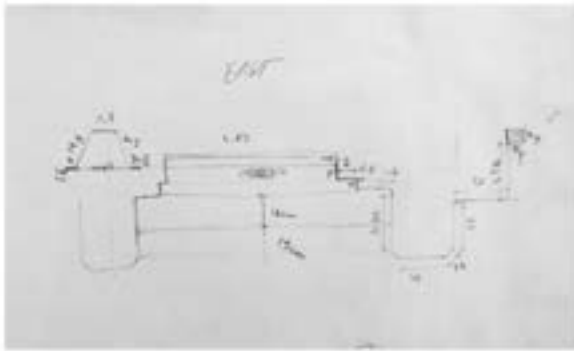


b) window in east elevation



c) window in east elevation with addition

Gemetrical survey_horizontal section east side



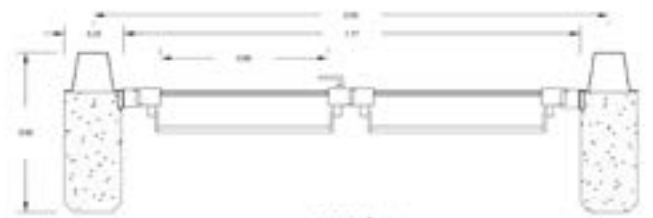
Horizontal section of a main window



b) main window with addition

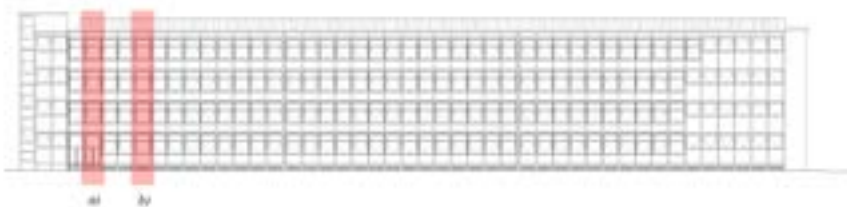


a) main window without addition



c) main door

Gemetrical survey_typical elements west side



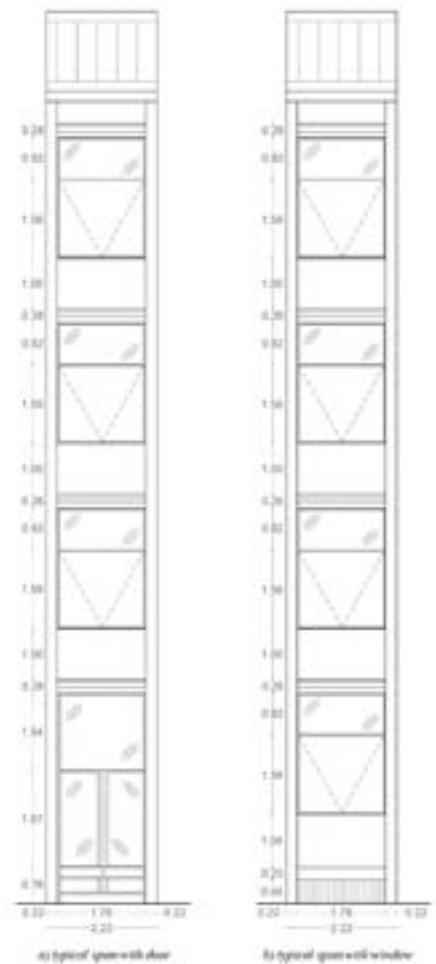
a1 b1



a) picture of a door



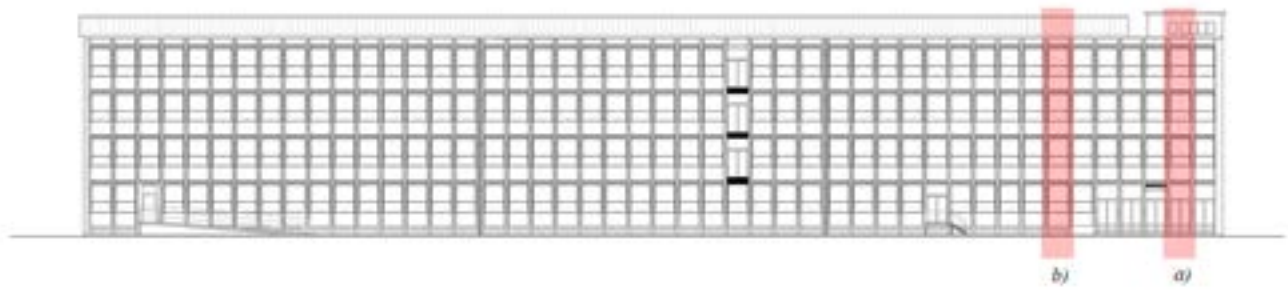
b) picture of a window



a) typical open with door

b) typical open with window

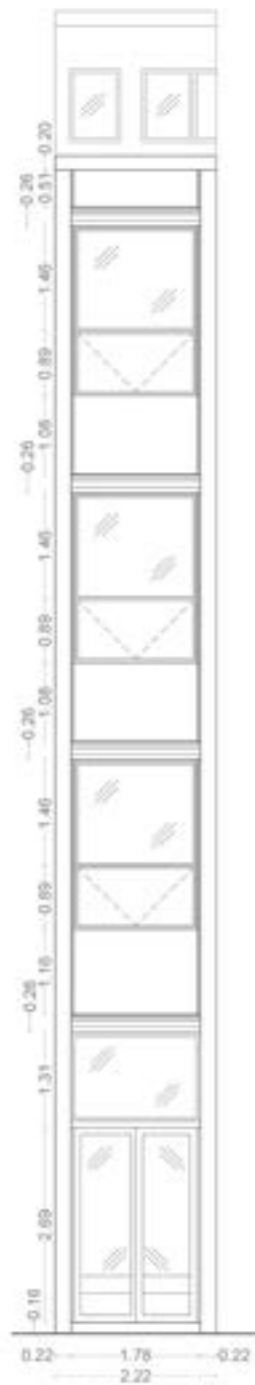
Geometrical survey_typical elements east side



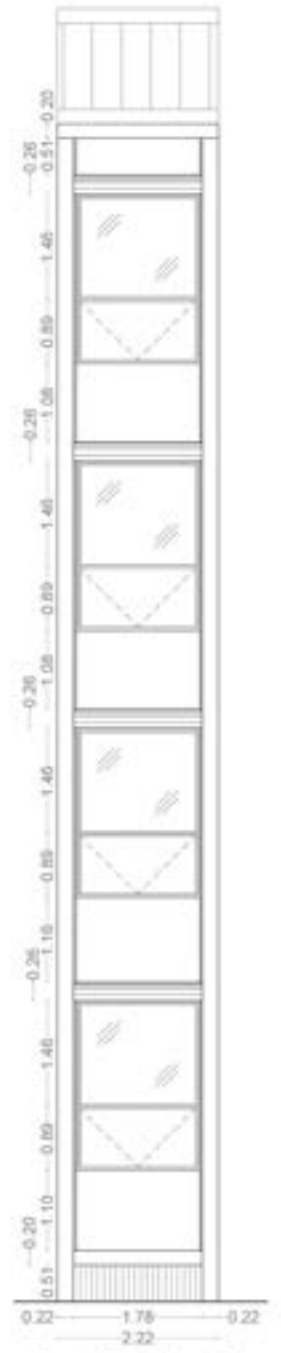
a) picture of a door



b) picture of a window



a) typical span with door



b) typical span with window

Geometrical survey_exploded axonometry

Geometrical survey_exploded axonometry



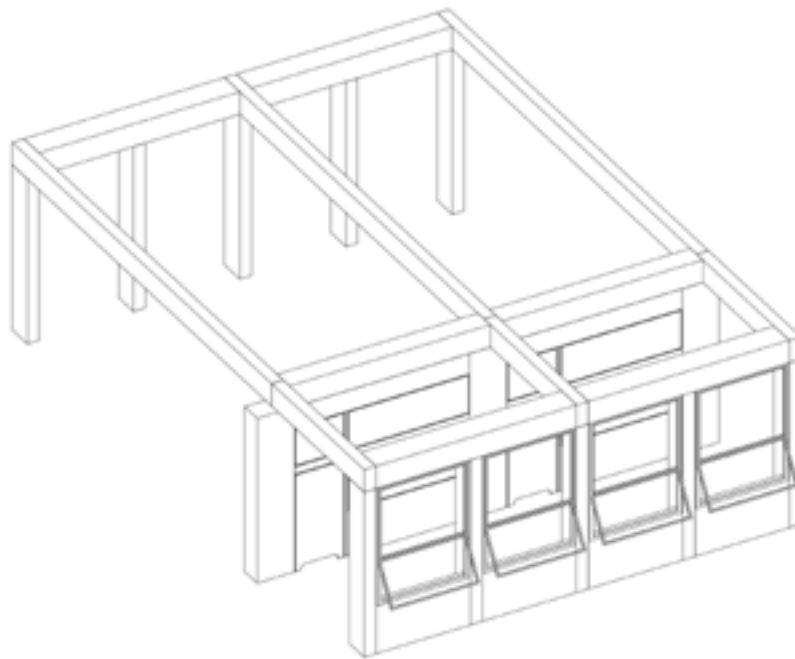
Building site in 1950s



Building site in 1950s



Exponents of the Italian Government visiting the building site site



Exploded axonometry

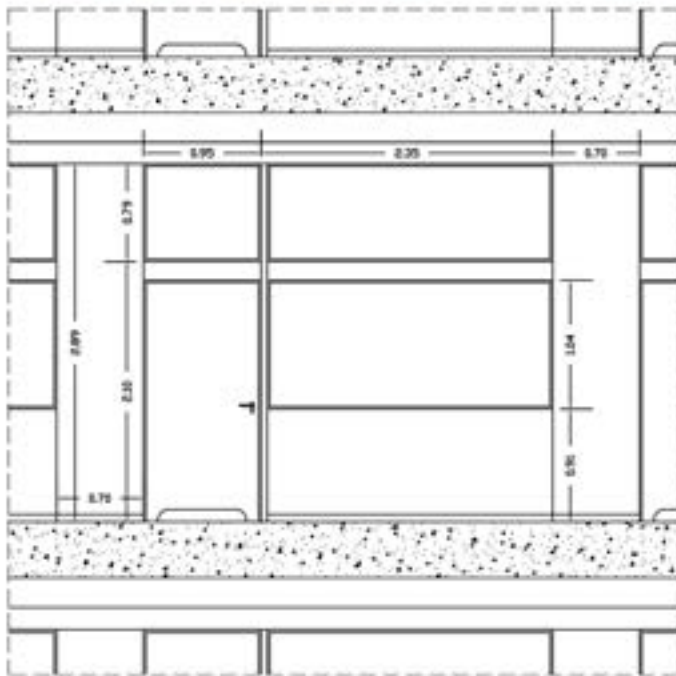
*0,50 x 0,45 m
beam in reinforced concrete*

*0,22 x 0,45 m
beam in reinforced concrete*

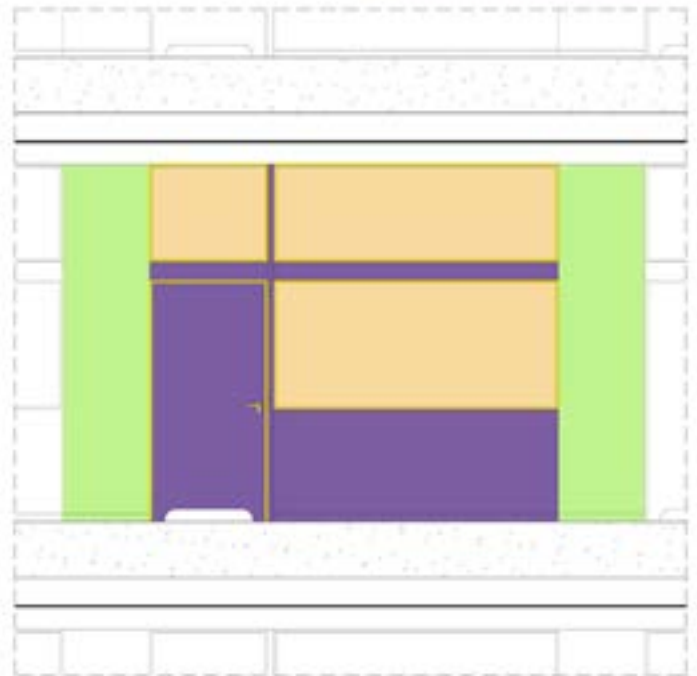
*0,70 x 0,40 m
column in reinforced concrete*

*0,22 x 0,50 m
column in reinforced concrete*

*1,78 x 1,10 x 0,20 m
panel in precast reinforced concrete*



typical curtain wall



curtain wall 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

Every 3.3m there is a column with dimensions of 0.7m*0.4m. Between two columns there is a curtain wall made out of wood and glass. On each floor there are eighteen curtain walls. Those curtain walls divide the classrooms from the corridor.

Material survey_east facade



view of east facade

48 pillars in the east elevation, in reinforced concrete, are covered by these zinc coated steel plates. They divide the facade into 46 typical spans. According to our photographic survey these panels are remodeled from the original RC one.





view of west facade

The facade in east elevation has been refurbished. The wall is made of reinforced concrete, covered by a cement plaster with pink painted coating layer while the pillars are overlaid by a zinc coated steel plate.



view of west facade

It is evident that west elevation of the building has not been renovated recently except the first two spans at the north side. The wall, in reinforced concrete, has a decadent painting orange layer with patially detached/cracked cement plaster layers.

Material survey_window



Typical window in east elevation



Typical window in west elevation



Detail of a window in east elevation



Detail of a window in west elevation

The materials that are used in the refurbished parts are aluminium for framings and steel awnings and flashings with painted coating while on the west side, the windows framings are made of steel, the awnings and flashing are made of copper.

As we observed, rather than the material, it is evident that the design of windows on each side of windows on each side of the building is different. On the east elevation, the windows framings are designed in a way that the big part of the windows are fixed while in the west facade it is exactly opposite.






The other factor that we have noticed is that the windows on west elevation have curtains while on the east elevation not. We assume that the reason is related to the function of the plans since the corridor situated on the east side while on the west part where the labs are located.

It is important to mention that the refurbished windows are double glazed while the other are single glazed. Also the glasses that are used in the curtain walls inside the building are reinforced.

Decay survey_decay mapping

Vertical elements decay

General state of vertical elements

Numbers	Mark	Condition
3		completely remained
1		completely preserved
2		partly remained
37		Base remained
6		completely removed

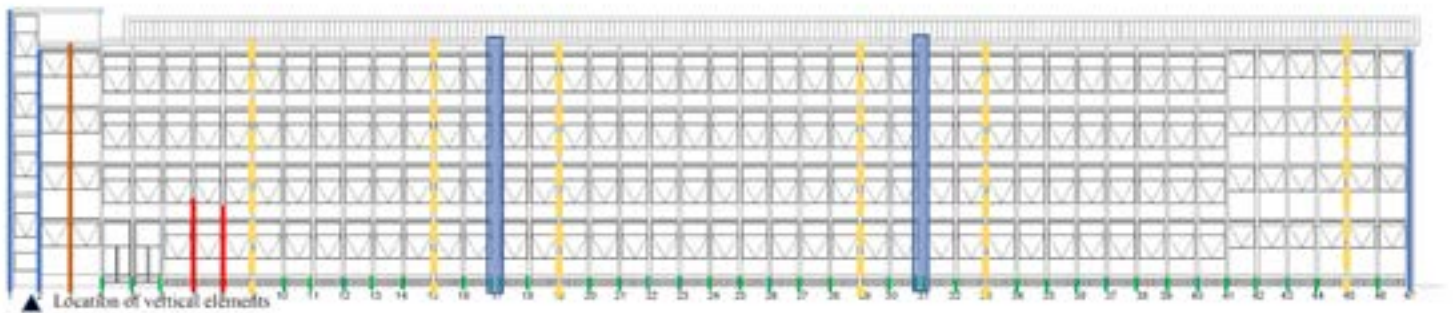


▲ Status photo



▲ Façade of convitto

▲ Preservation of the vertical elements



remained



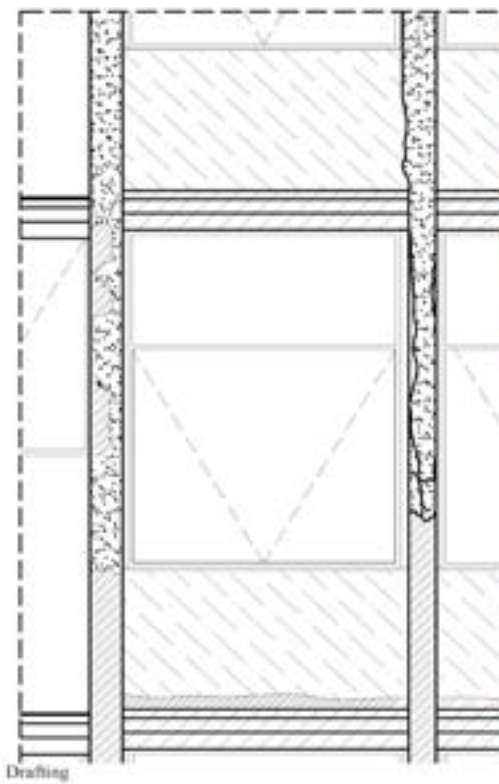
detached



removed

Decay survey_decay mapping

Missing part

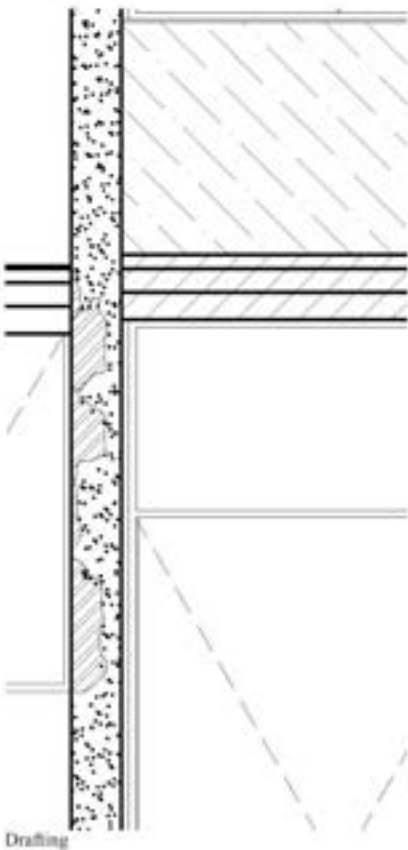


- missing part
- deposit
- integration

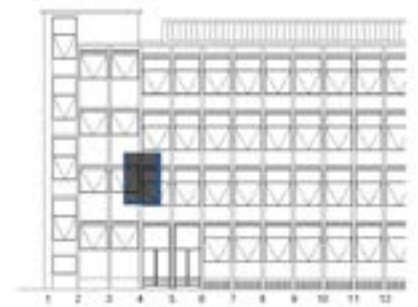
As the historical photo shows, there were vertical elements and almost all of them have been demolished. As a statistic, there were 49 vertical elements in total:

3 of them were the three edges of the facade. 1 of them were covered with alloy metal. 2 of them a large part were remained. 37 of them only a bottom were remained, the upper part were removed. 6 of them were completely removed and additional drainage pipes were embedded in it.

Among these vertical elements between 16th and 17th, 39th and 31st there are two expansion joints.



- discoloration
- missing part
- deposit
- integration

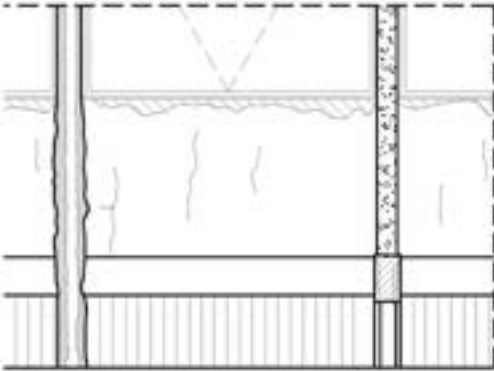


The decay of integration only happened where there is a replacement of the windows or other elements. The cement mortar was filled to cover the gap.

Decay survey_decay mapping
Biological colonization



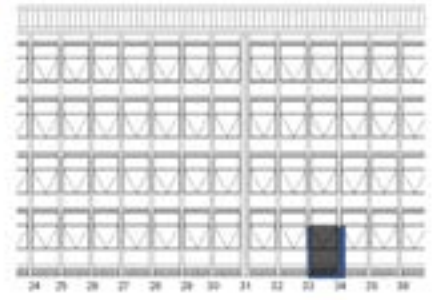
Status photo



Drafting



Amplification of the decay



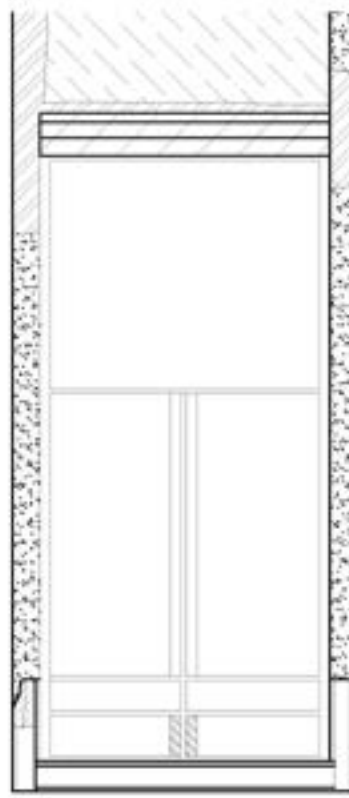
Location of the decay: it's localized in number(33) and number (34)

About the biological colonization: it happened along drainage pipe(33). As counted, there are only one drainage pipe of sum (6) pipes to which these kind of phenomenon happened.

Decay survey_decay mapping
Detachment



status photo



Drafting

-  discoloration
-  deposit
-  corrosion
-  missing part
-  intergration
-  detachment



Location of the decay: it's localized in number(5)and number(6)

Decay survey_decay mapping
 Detachment



Detachment of concrete of the base(photo from the front)

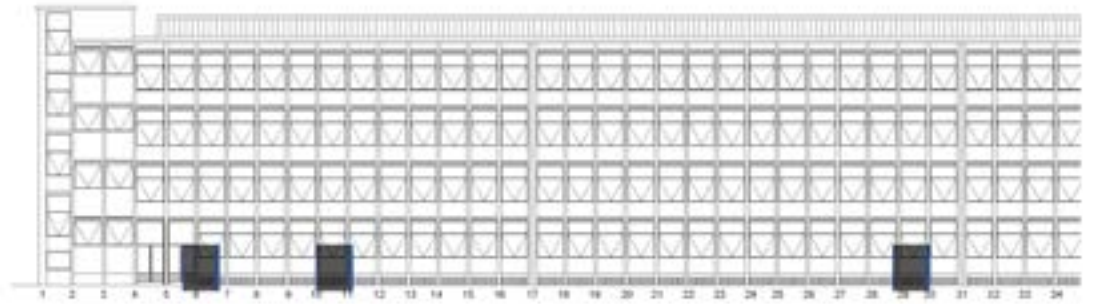


Detachment of concrete of the base(photo from the side)

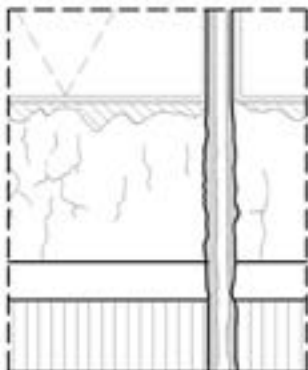
Decay survey_decay mapping
 Elements decay: finishing of the closure wall



status photo



Location of the closure wall: there're localized in span(29) (6) and (10)



Drafting of hair cracks (Position1)

- missing part
- biological colonization
- detachment
- hair crack
- moist area

A general state of the plaster of the closure walls: most of the faded in color, minor parts of them peeled off , meanwhile ,minor part of them there is a hair cracks happened.



Discoloration(position 2)



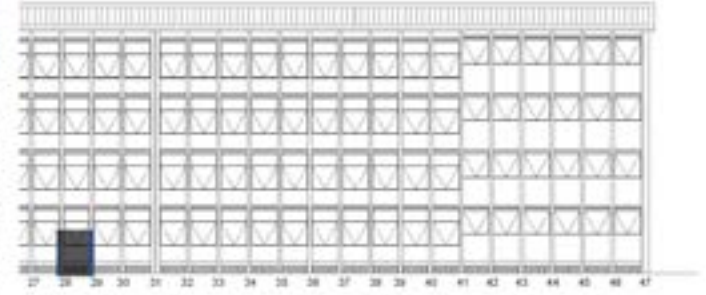
Peeling off (Position 3)

Decay survey

Elements decay: finishing of the base lintel



Finishing detached partly (photo from the front)



Location of the lintel: it's localized between vertical elements of number(28) and number(29)



Finishing detached partly (photo from the side)

Totally, there are 44 lintels. Most of them all covered in good condition. One of them on which detachments happened and another one of them the finishing completely detached.

Decay survey

Corrosion and discoloration



channel of the frame



corner of the frame



decay from the front



decay from the side

In west facade, there is only two doors in span(4) and (5): they are closed normally. From the frame inside stays well. Only a part of the bottom there is a corrosion. There are 225 windows in west facade:(14) are refurbished windows on the north part, the rest(211) windows are corroded with deposit on the flashing, discoloration on the copper profile and corrosion on the windows frame.

Decay survey

Elements decay:doors



status photo

In west facade, there is only two doors in span(4)and(5): they are closed normally. From the virtual observation, they are preserved well: on peeling happened to the door frame. So the frame inside stays well. Only a part of the bottom have a problem of corrosion which can be presumed by the color.



amplification of the decay

Decay survey

Painting detachment and corrosion of metals



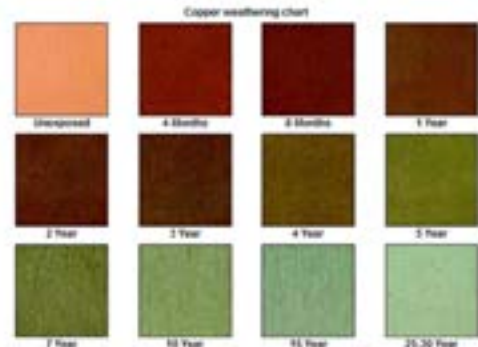
As we can see on the west elevation, the window frames, which are made of steel, are corroded because of direct contact with rainwater and oxygen due to the lack of a protective coating. We assume that the reason is due to the lack of maintenance, the painting on the framings are detached then the steel frames were in direct contact with water and air that has resulted in corrosion.



Decay survey Discoloration

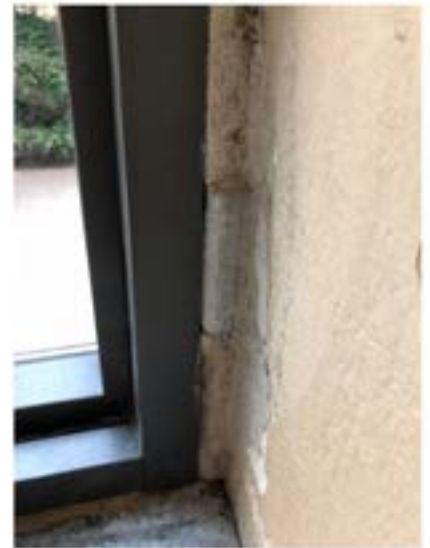


On the west elevation the flashings and awnings are made of copper that allow rainwater to fall down without contacting the facade in order to prevent damaging. Over time copper will naturally change colors-transformation from a shiny brown color to darker browns. Then blues and finally greens after a number of years. When exposed to the natural elements such as wind and rain, copper develops this "painting" which actually protects and preserves the metal underneath.



<https://www.standardscopper.com/for-lead-copper-lead-paint-test/>

Intervention



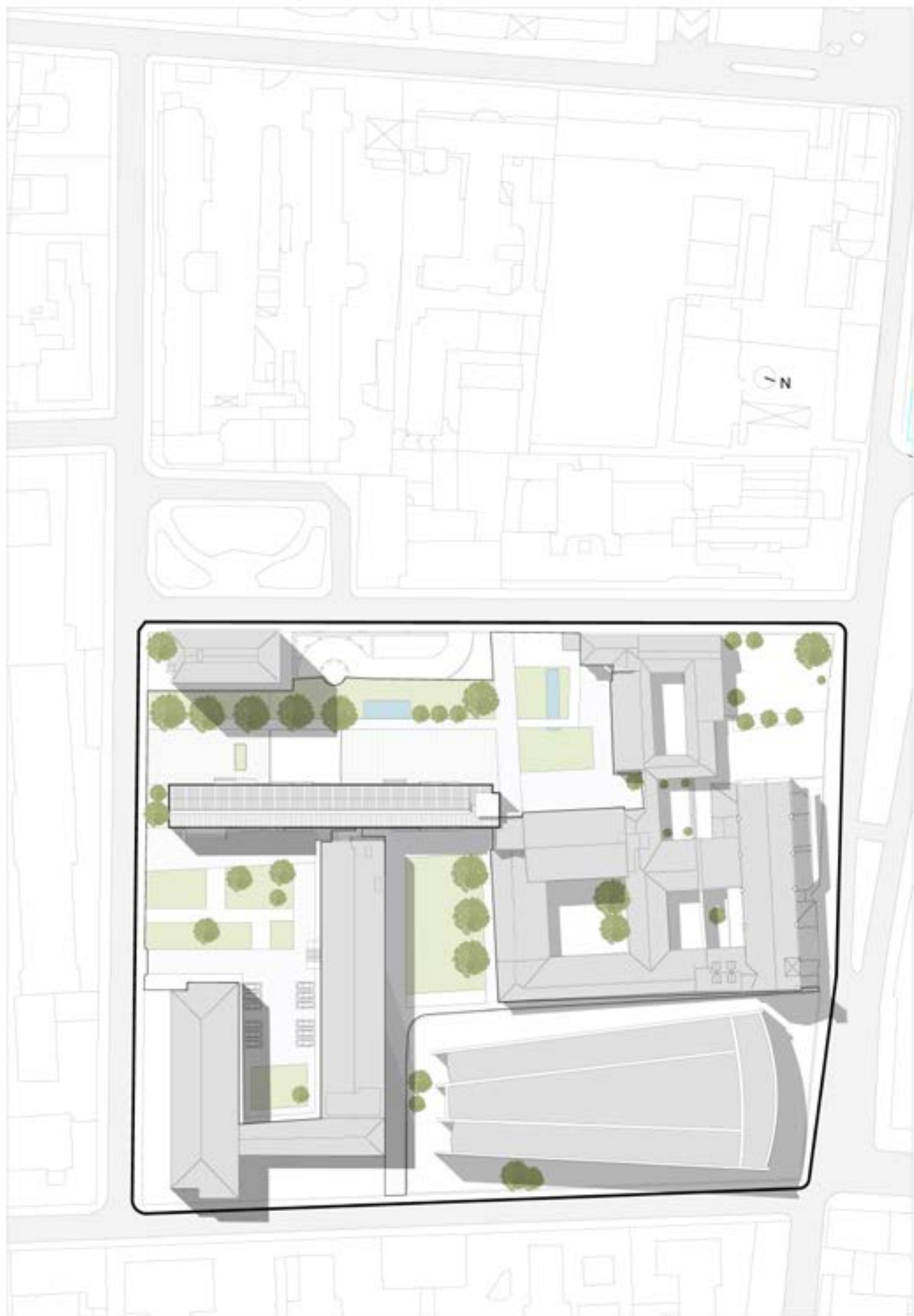
For assembling the sub-frames of doors and windows, the refurbishment is done in a very inappropriate way.

They have engraved the columns for connecting the subframes with walls. Then it is exposed and in some parts are covered by a layer of cement mortar in an inappropriate way.

ARCHITECTURAL DRAWINGS

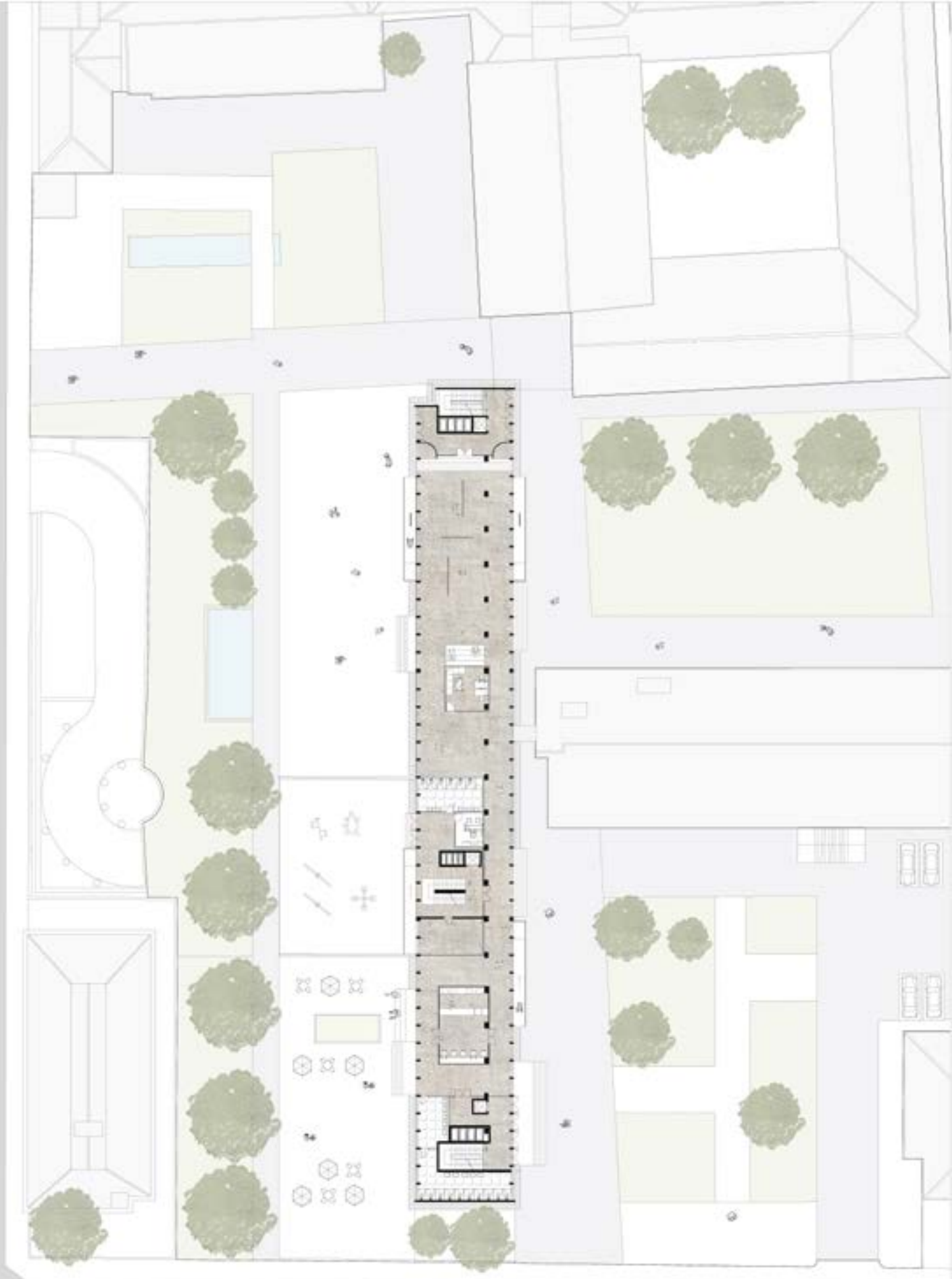






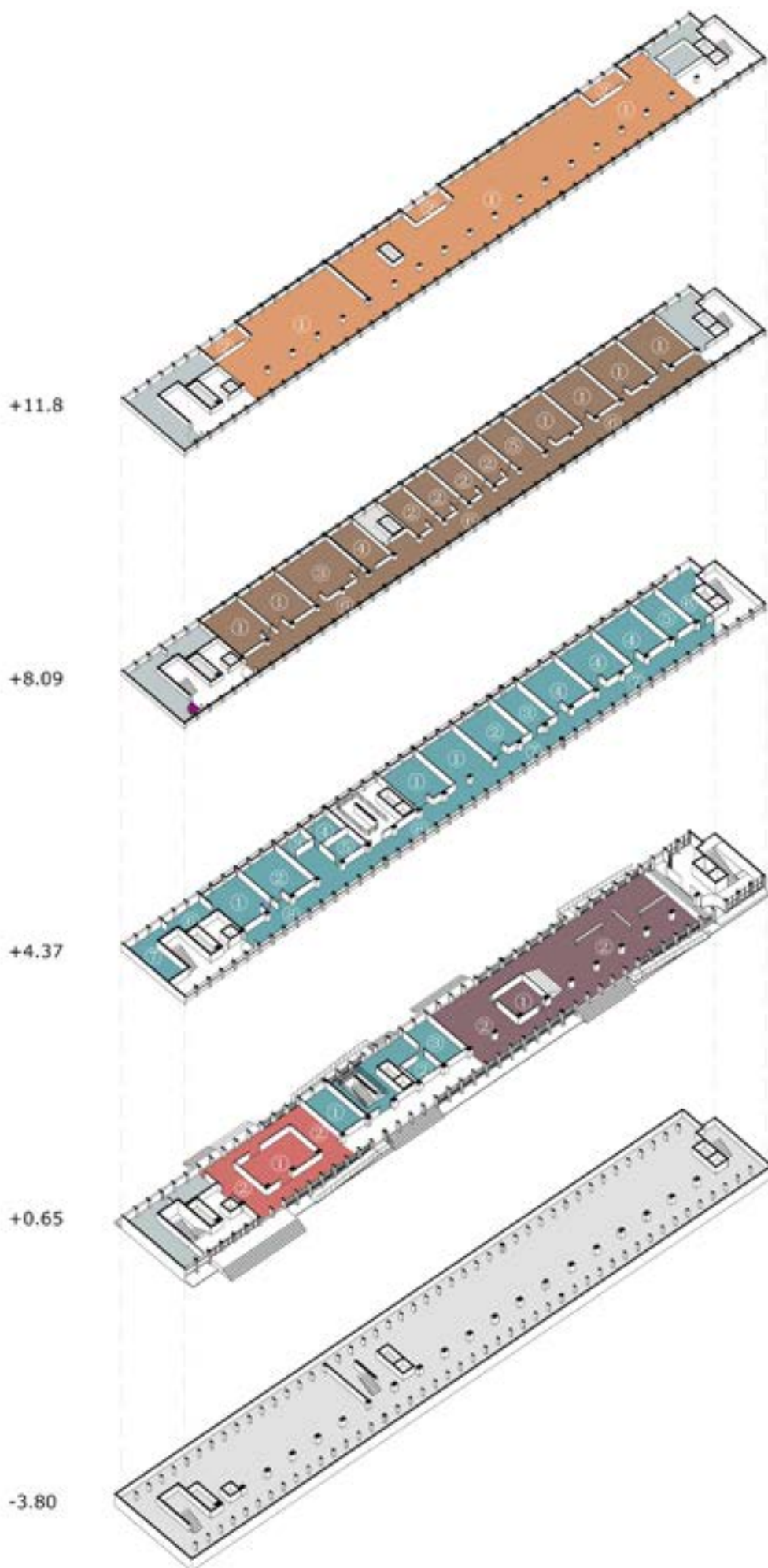
MASTERPLAN_SCALE 1:500





GROUND FLOOR PLAN _SCALE 1:200





Rented office

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

Rented classroom

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

School area

1. Equipment room for school	30 m ²
2. Reception	12 m ²
3. Toilet	29 m ²

Kindergarten

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

Primary school

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

Cafeteria

1. Cafe shop	42 m ²
2. Rest space	134 m ²

Exhibition area

1. Office	24 m ²
2. Exhibition area	361 m ²

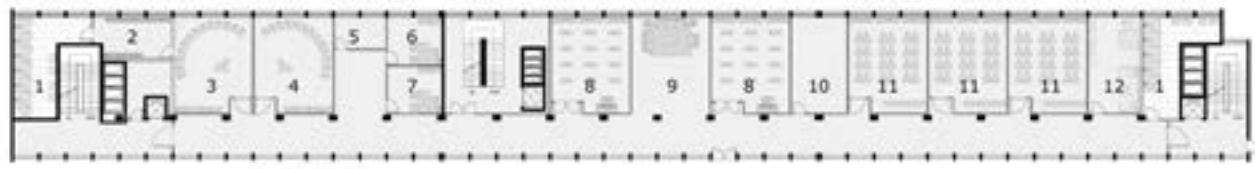
Technical area

1. Technical	1100 m ²
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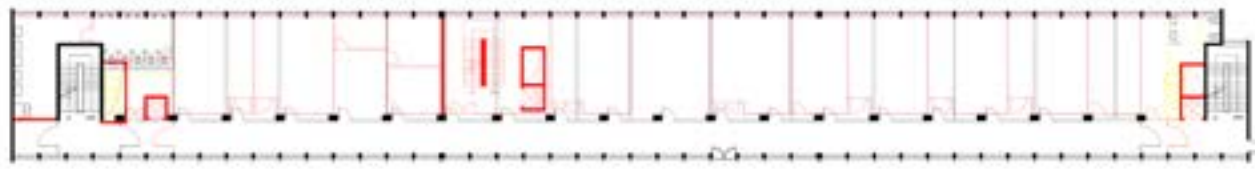
Toilet

1. Toilet	182 m ²
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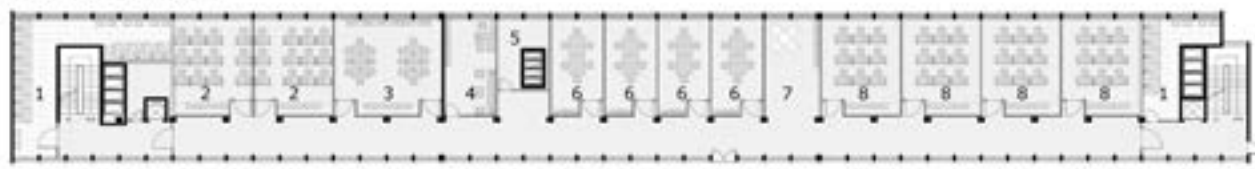
First Plan_Scale 1:200



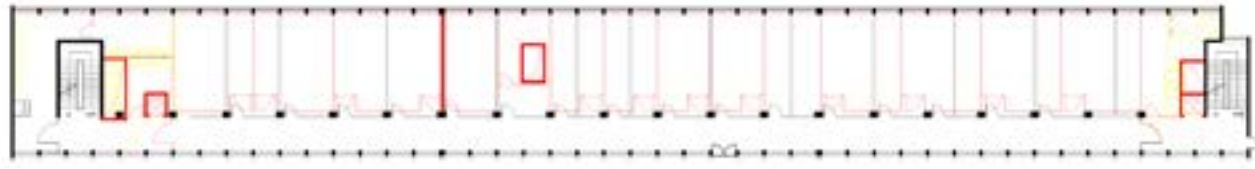
- 1 Toilet
- 2 Classroom
- 3 Activity room
- 4 Multi purpose room
- 5 Storage room
- 6 Office
- 7 Meeting check room
- 8 Activity room
- 9 School hall
- 10 Equipment
- 11 Class room
- 12 Teachers office



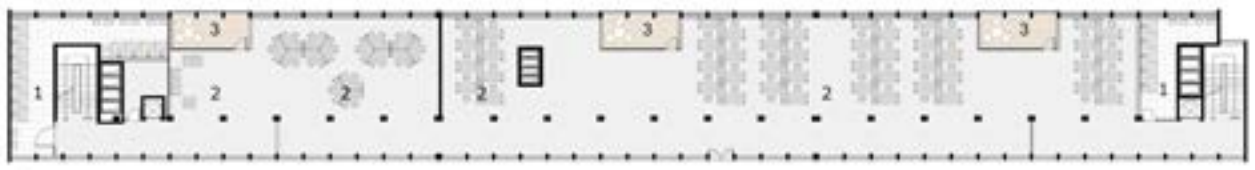
Second Plan_Scale 1:200



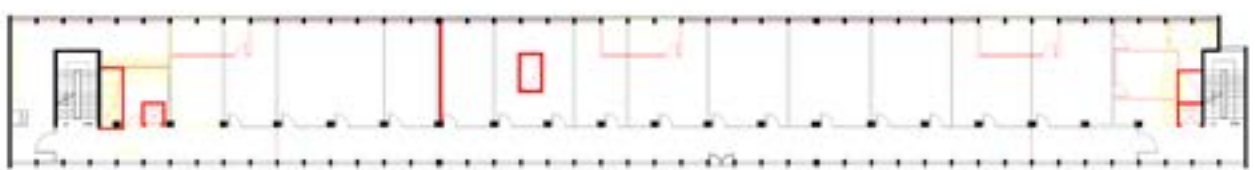
- 1 Toilet
- 2 Computer room
- 3 Activity room
- 4 Office
- 5 Storage room
- 6 Workshop
- 7 Rest space
- 8 Class room

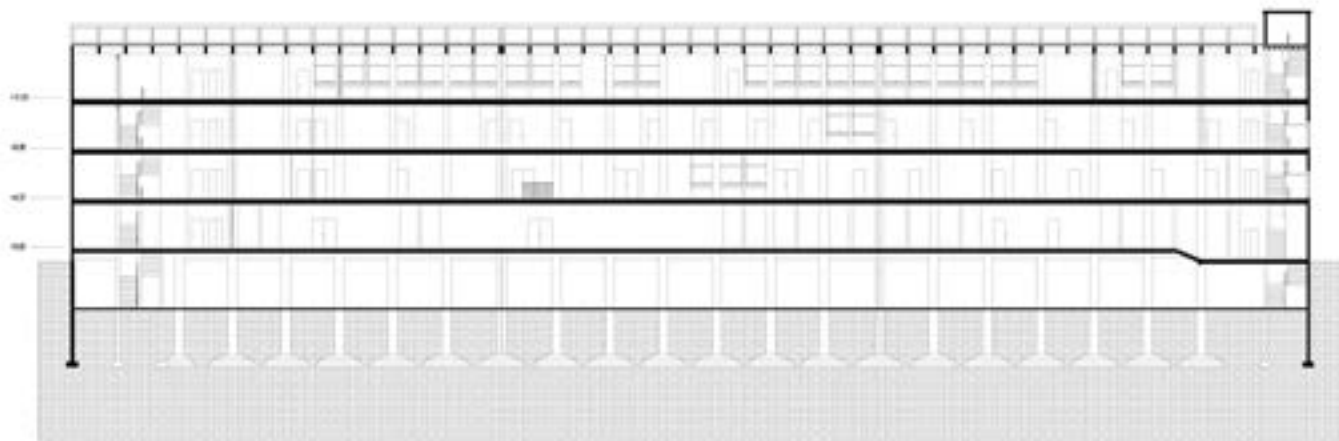


Third Plan_Scale 1:200



- 1 Toilet
- 2 Office
- 3 Library

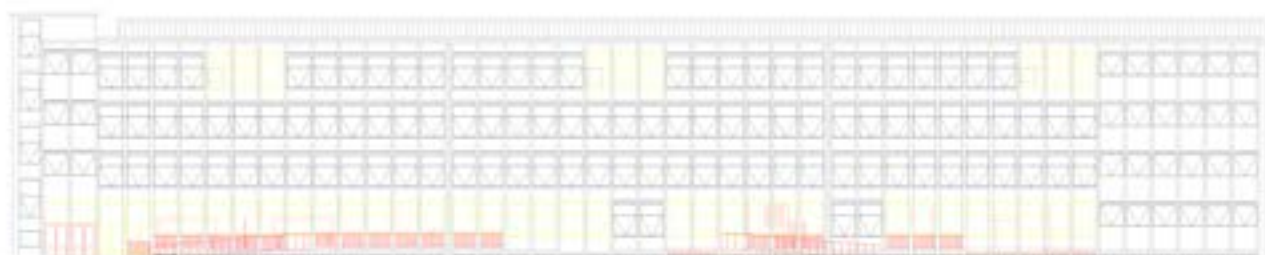




Section B-C Scale 1: 200



West Elevation Scale 1: 200



West Elevation Mapping Scale 1: 200



East Elevation Scale 1: 200



East Elevation Mapping Scale 1: 200

STRUCTURE

Structure

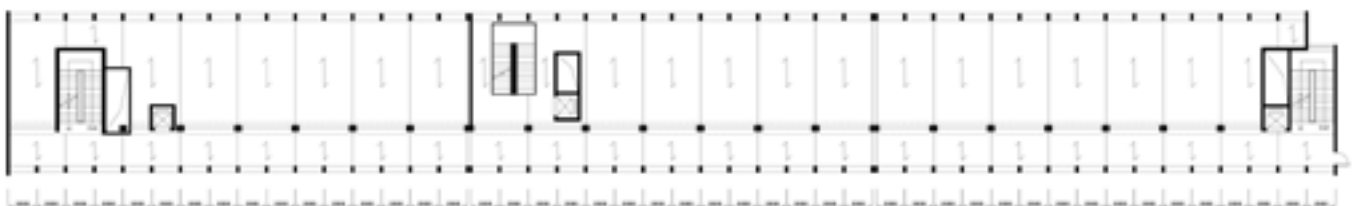
Floor load	Bulk density(kg/m ³)	Thickness(mm)	Weight per unit area(KN/m ²)
Dead load from slab(structural)	2300.00		2.76
Dead load from slab(no structural)			0.336
wood based subfloor	650	15	0.098
Waterproof-high density polyethylene	950	8	0.076
Cavity insulation	0	0	0
Waterproof-high density polyethylene	950	8	0.076
Gypsum Board	900	9.5	0.086
Live load			4

Floor (not include the struct	formula	number	unit
$Q1=(G1+G2+G3)1.3+1.5Q$			
G1: Self load of beam	$H1*B1*23KN/m^3$	1.15	KN/m
G2: Dead load from slab(structural)	$1.23*2.76KN/m^2$	3.39	KN/m
G3: Dead load from slab(non-struct)	$1.23*0.336KN/m^2$	0.41	KN/m
Q: live load	$1.23*4KN/m^2$	4.92	KN/m
Q1: factored total load on seconds	$Q2=(G1+G2)1.3+1.5Q$	13.83	KN/m

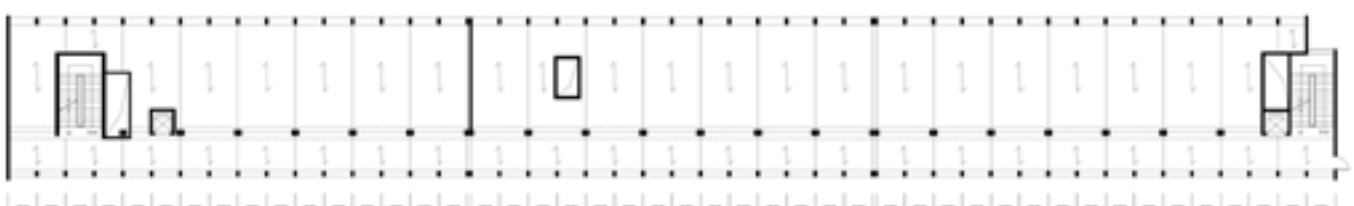
Check the Moment				
Med max	Max applied moment	$Med\ max=Q1*L^{1/8}$	52.28	KNm
Mrd max	Max moment without compression steel	$Mrd\ max=0.168*bd^2fck$	62.63	KNm
Mrd max > Med max				

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

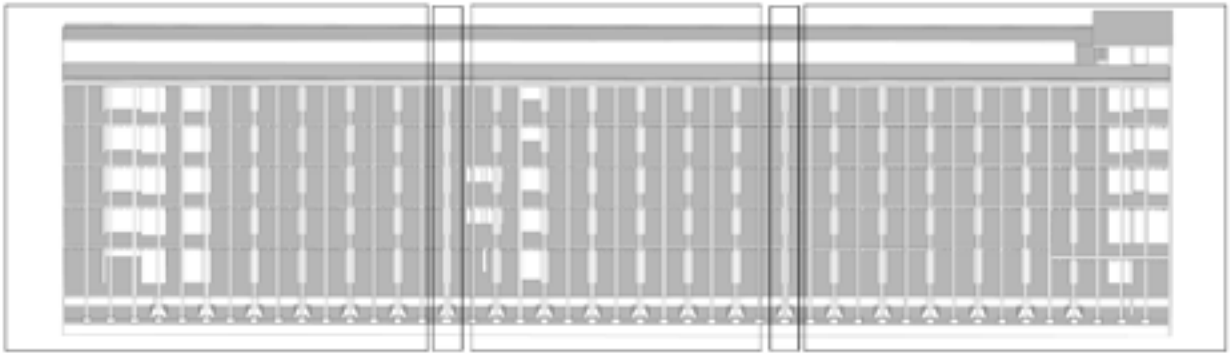
Beam information	number	unit
Floor		
L1: Length of beam	5.50	m
H1: height of beam	0.30	m
B1: width of beam	0.15	m
A1: area of beam	0.05	m ²



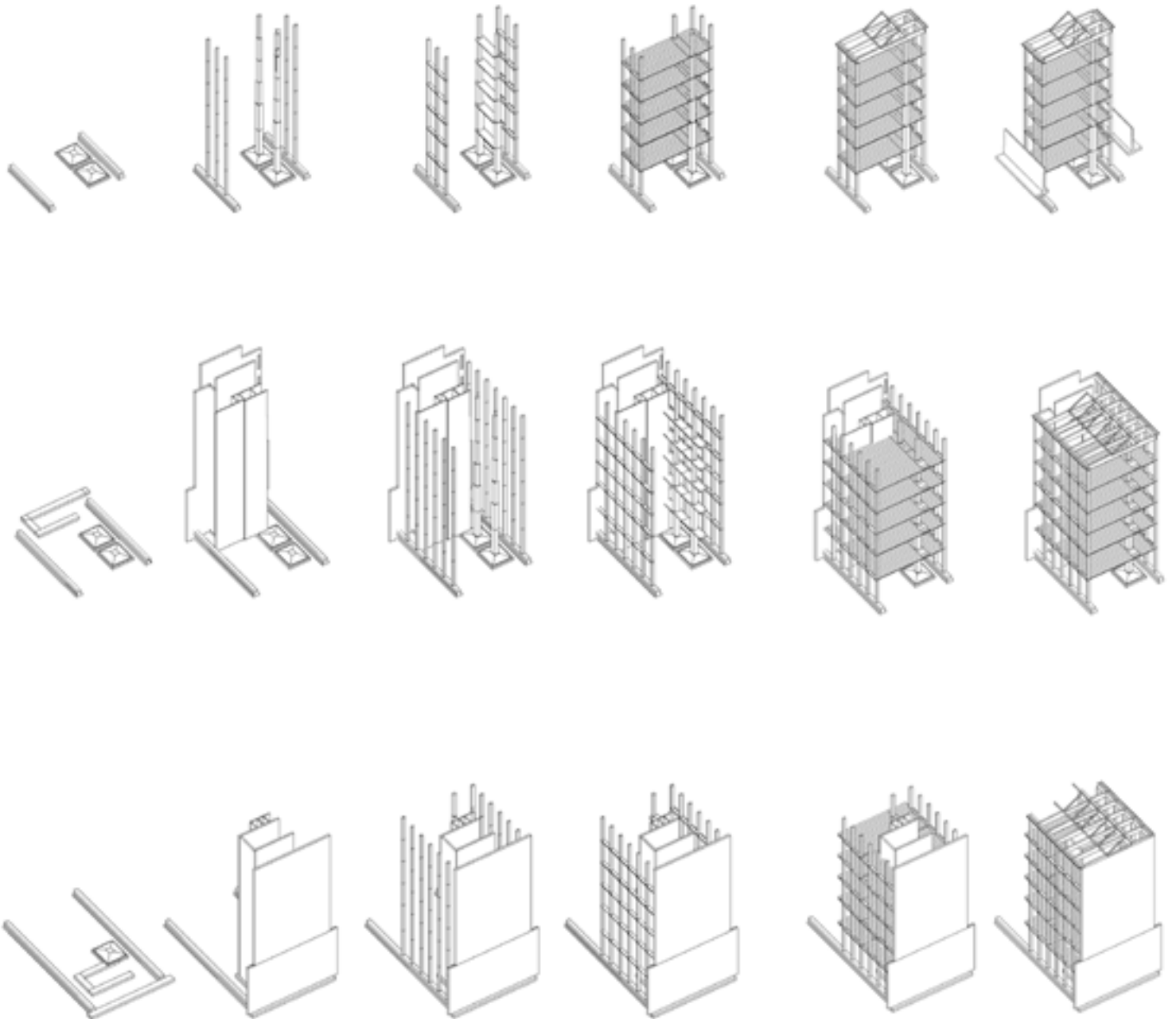
Groundfloor structure plan

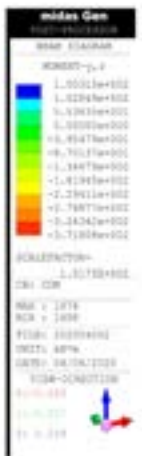
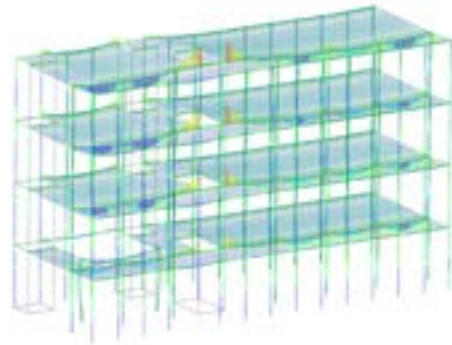
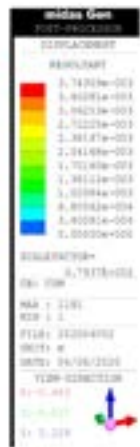
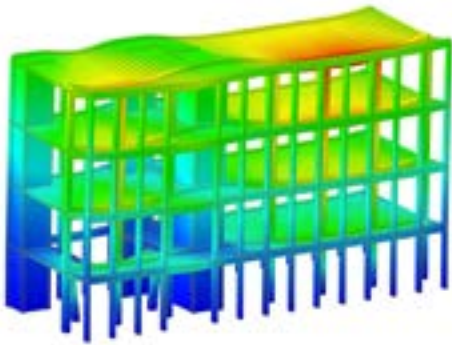
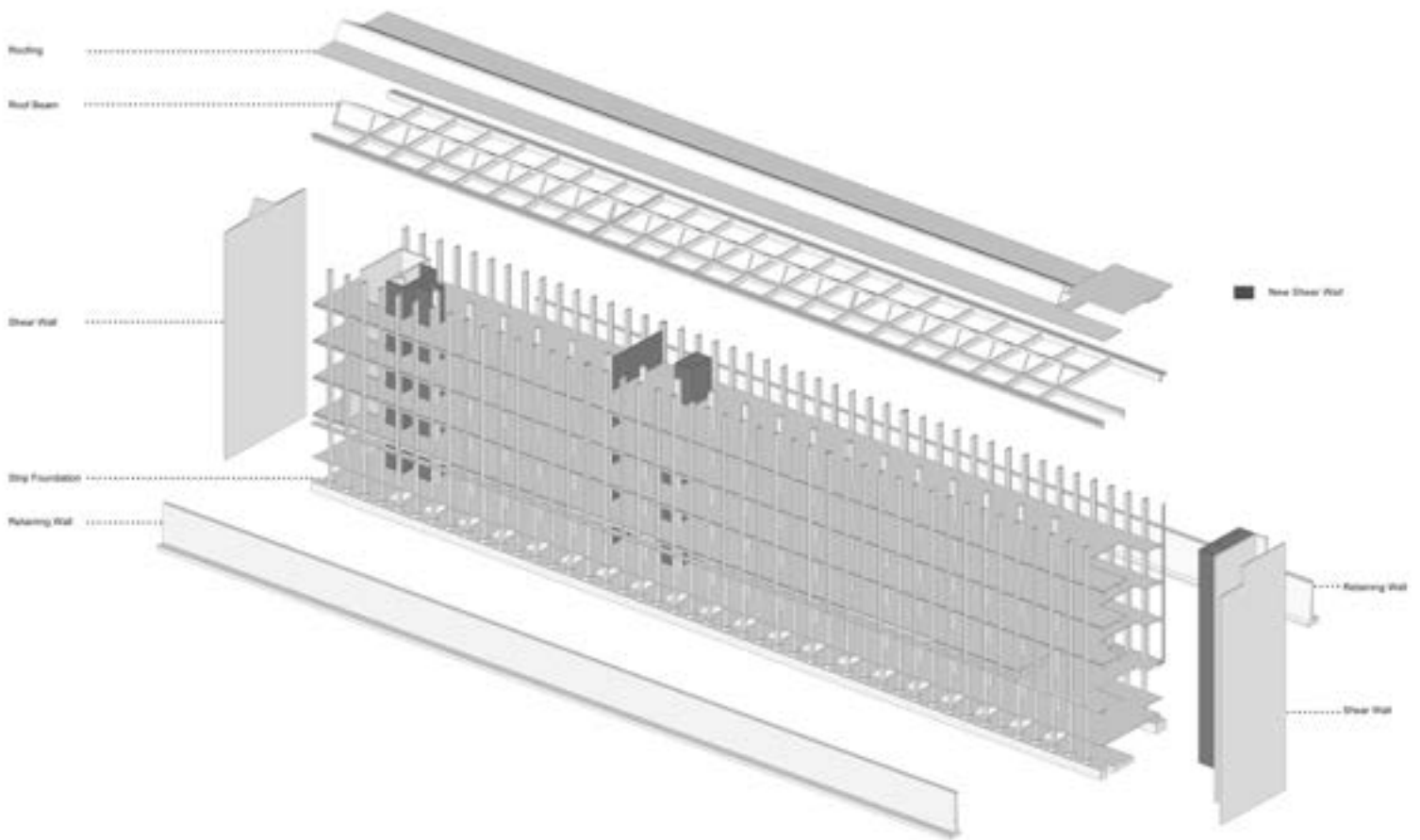


Upper floor structure plan



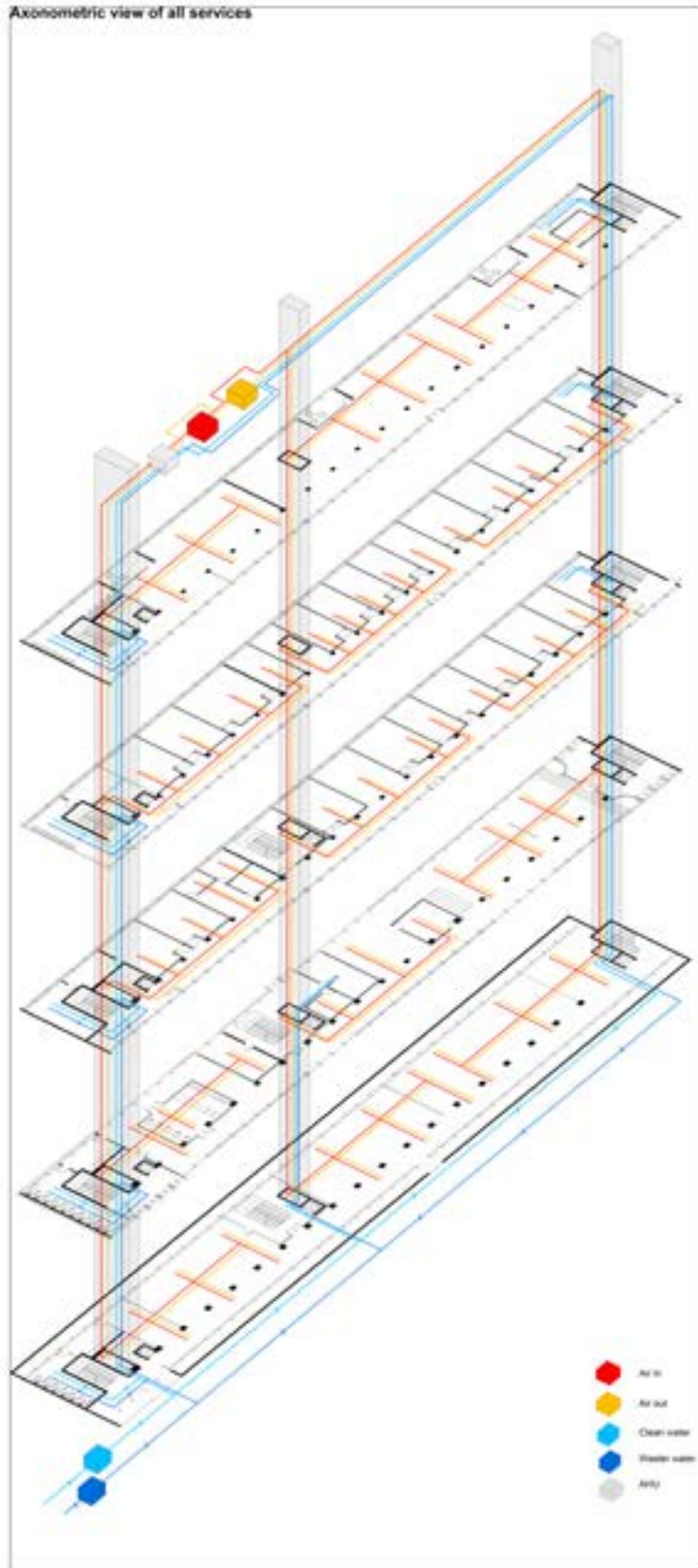
There are two junctions between the whole building. So, this building is like three separate buildings from structure view. However, there are only shear walls on both sides. The first thing we need to consider is to reinforce the middle part of the building.



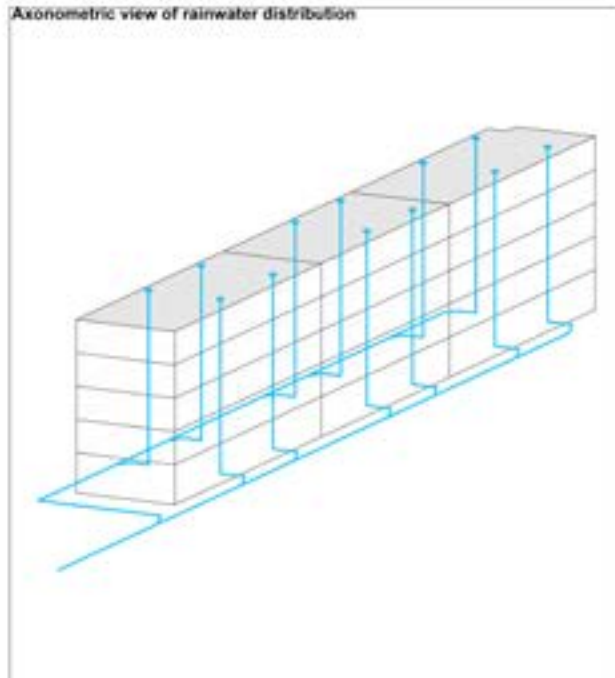


SERVICES

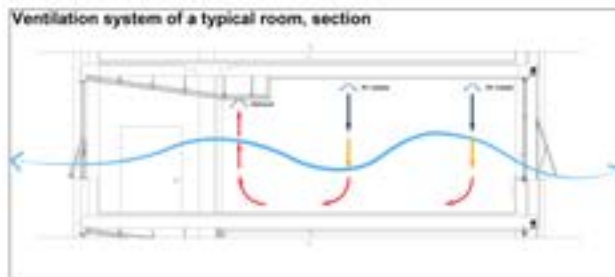
Axonomic view of all services



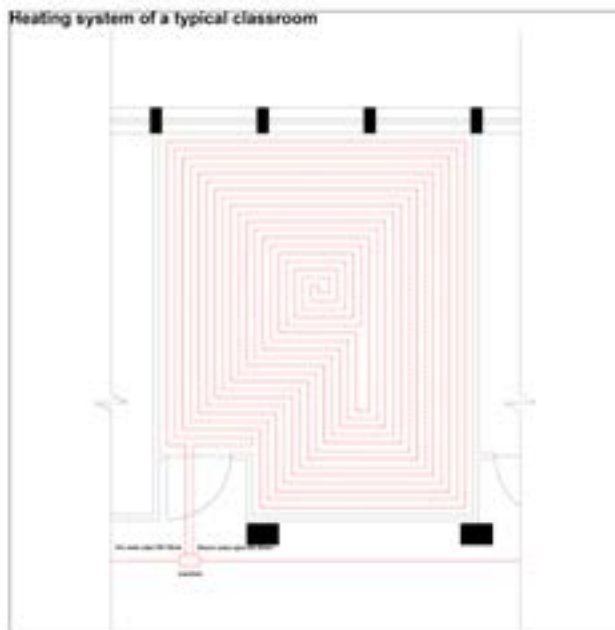
Axonomic view of rainwater distribution



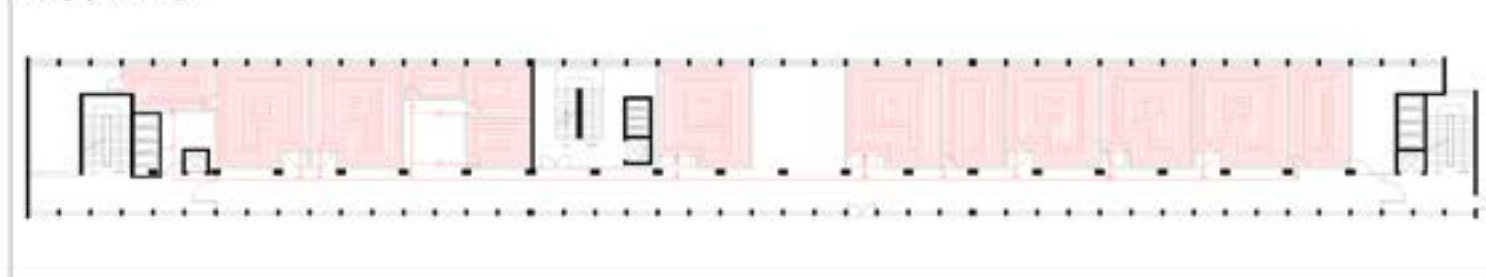
Ventilation system of a typical room, section



Heating system of a typical classroom



Heating system of a plan

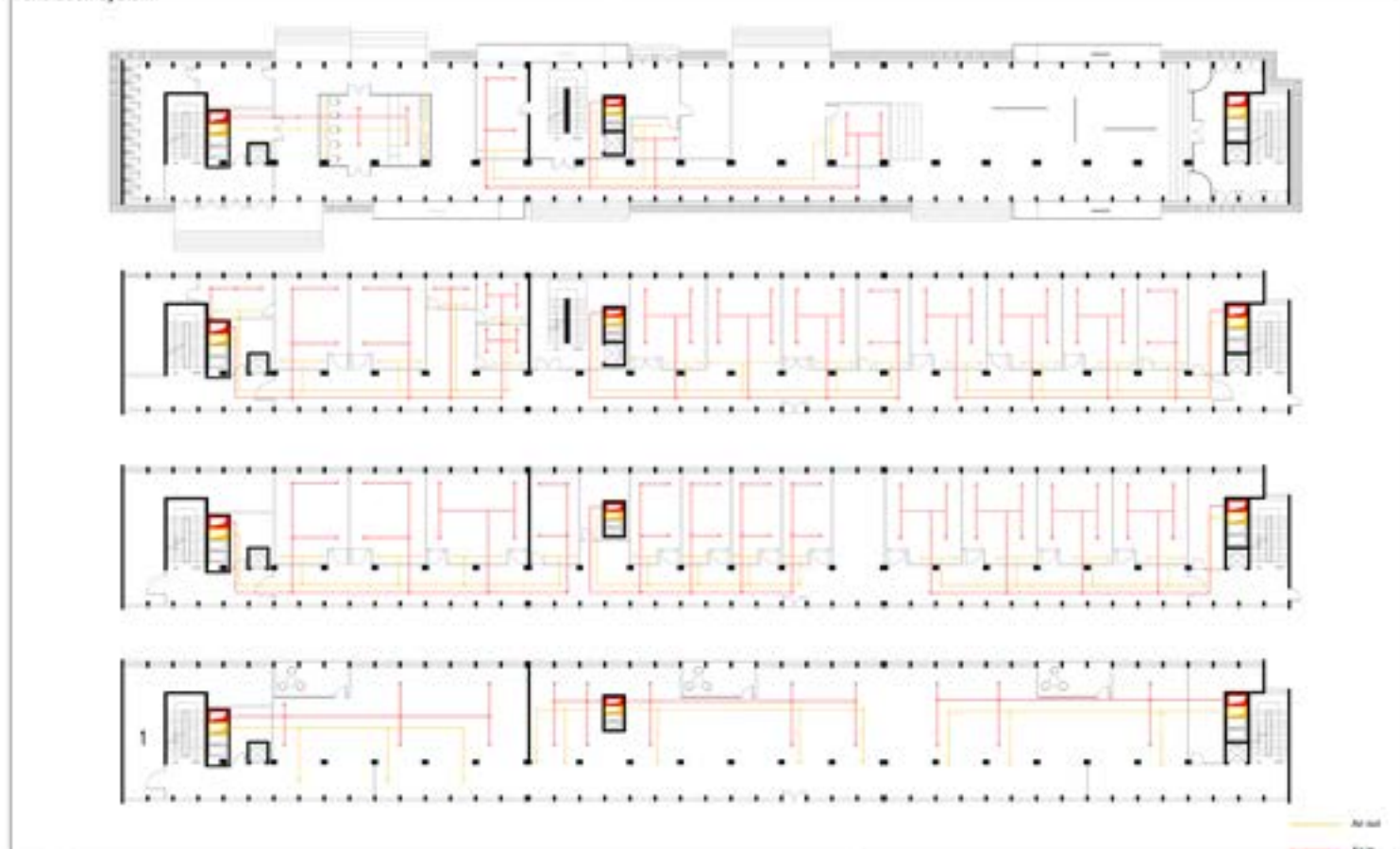


Water supply system

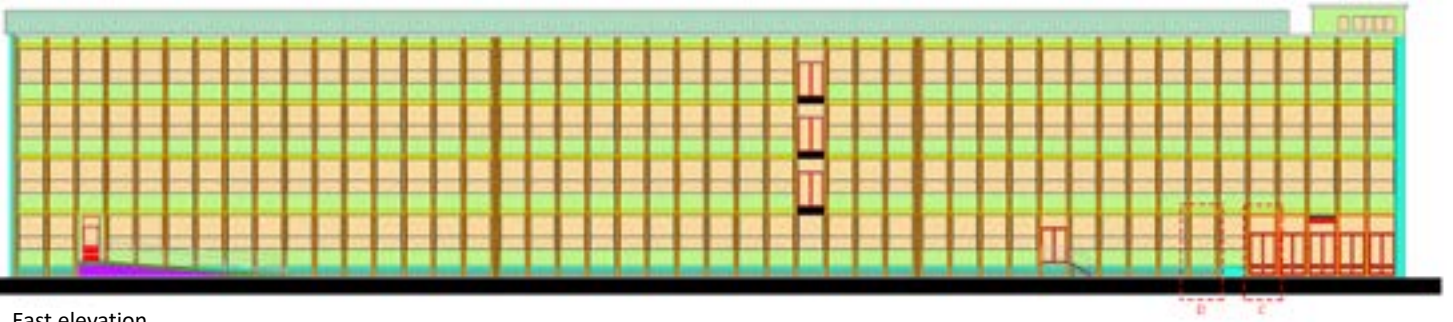
Discharge system



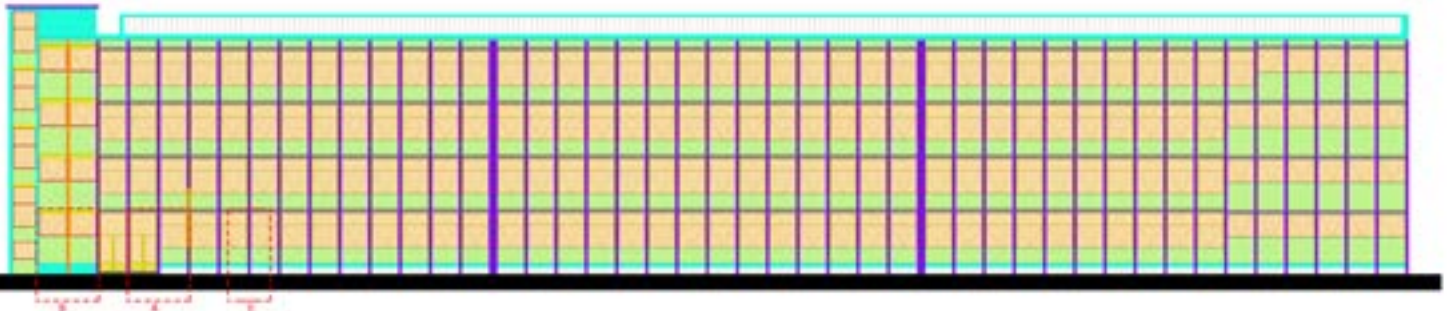
Ventilation system



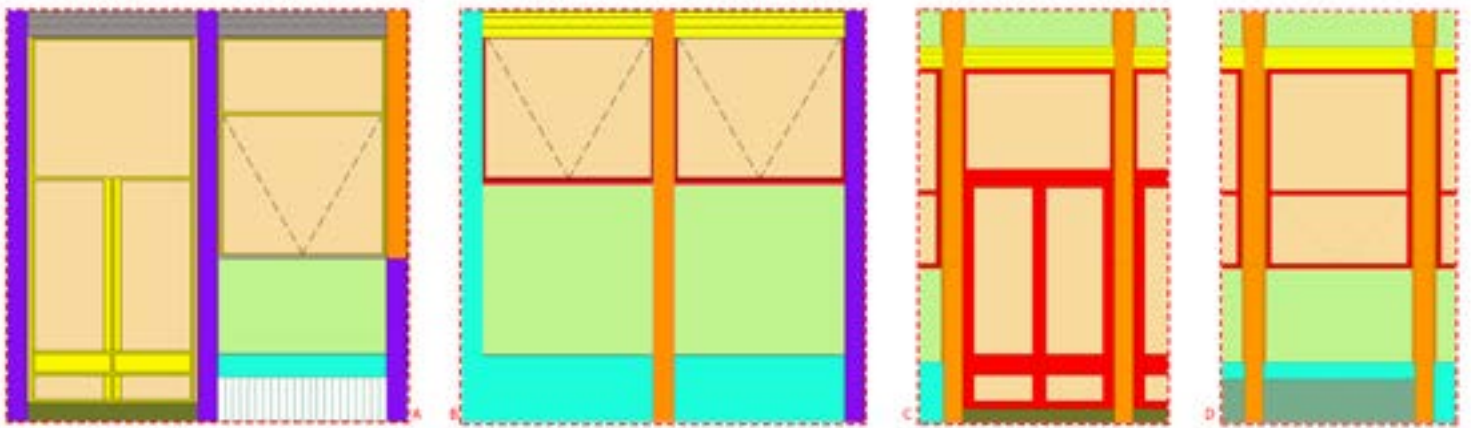
PRESERVATION



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

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 our surface 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.



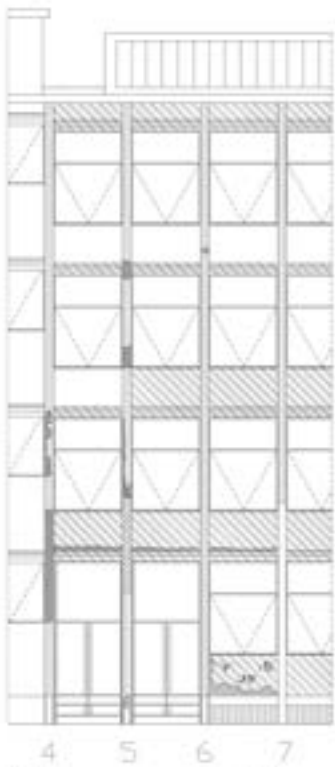
Expansion joints

Intervention

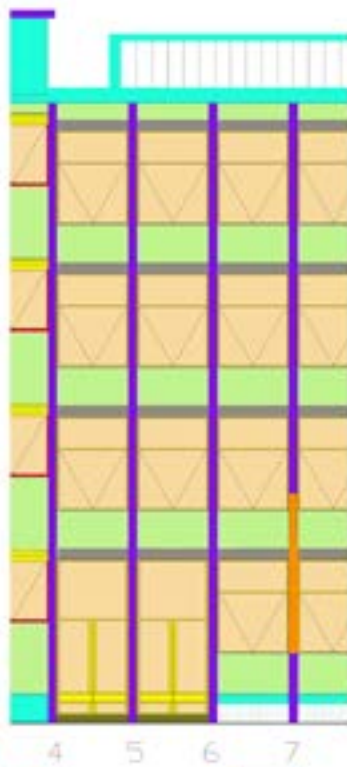
Removing of the cement mortars at these borders are needed then we can cover the gap with expansion joint system.



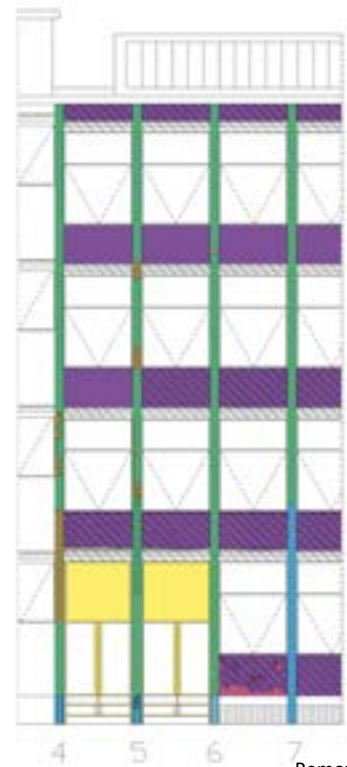
Material mapping and preservation detail



- | | | | |
|--|-------------------|--|----------------------------------|
| | Missing part | | Discoloration and depositsoiling |
| | Mechanical Damage | | Corrosion |
| | Detachment | | Hair Crack |
| | Dampness | | Detachment |



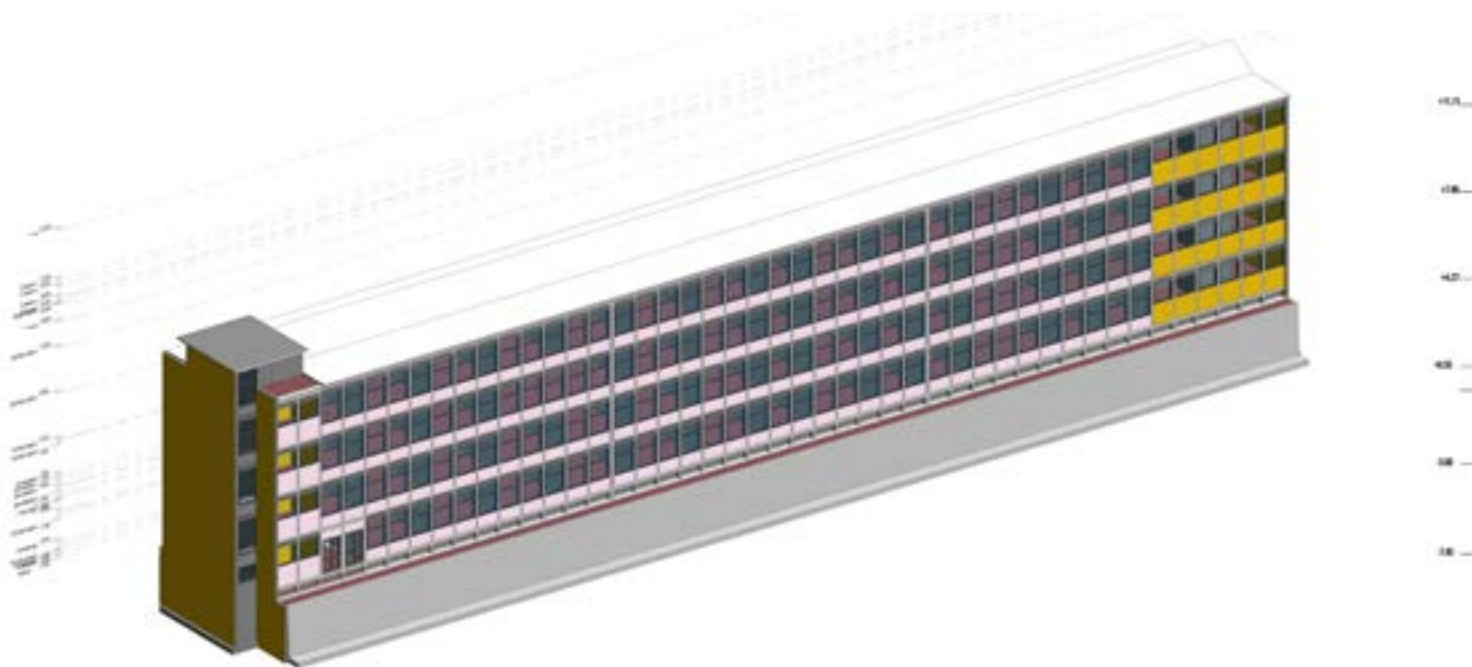
- | | | | |
|--|---------------------------------------|--|------------------------------|
| | Aluminium framings and flashings | | Zinc coated steel sheets |
| | Glass | | Cement mortar |
| | Steel framings and awnings | | Reinforced concrete |
| | Stone step pavings | | Copper awnings and flashings |
| | Cement plaster with painted finishing | | |



- | | | | |
|--|---|--|--|
| | Cleaning the deposit from the plaster mortar. | | Removing the remaining eroded vertical elements made of reinforced concrete. |
| | Grouting lime mortar on cracks and detached parts of the surface. | | Removal of inappropriate cement mortar from the surface. |
| | Adding aluminium vertical elements. | | Painting a new layer as coating for protection after cleaning |

BIM

Laser scanning





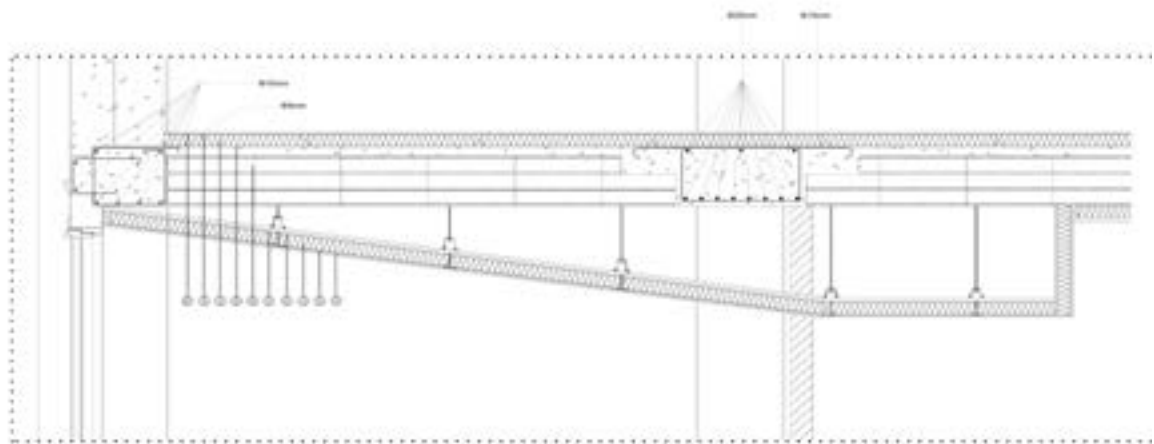
- ceiling 10'
- intermediate floor 10'
- first intermediate floor 10'
- second intermediate floor 10'
- third intermediate floor 10'
- fourth intermediate floor 10'
- ground floor 10'
- basement 10'
- sub-basement 10'



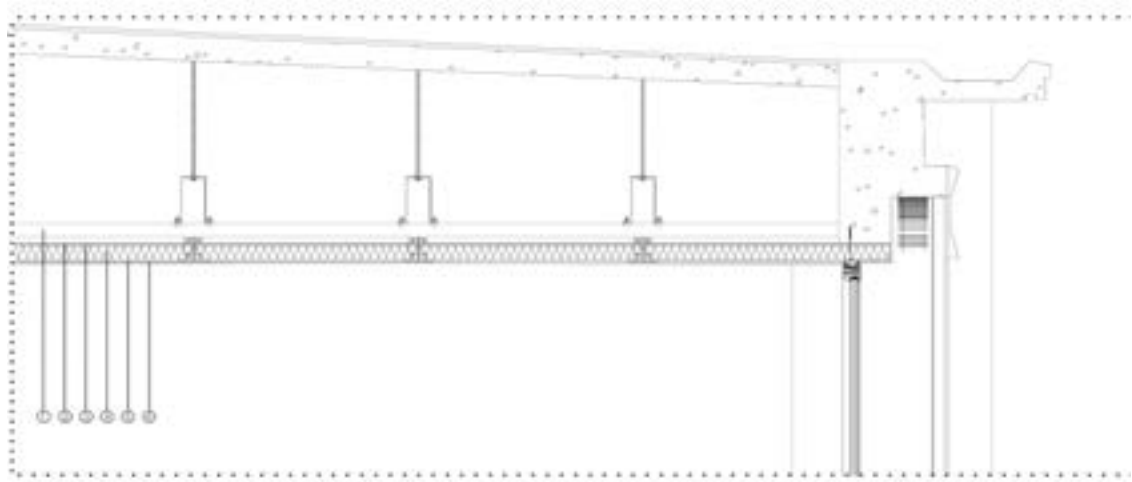
SECTION B-B SCALE 1/200



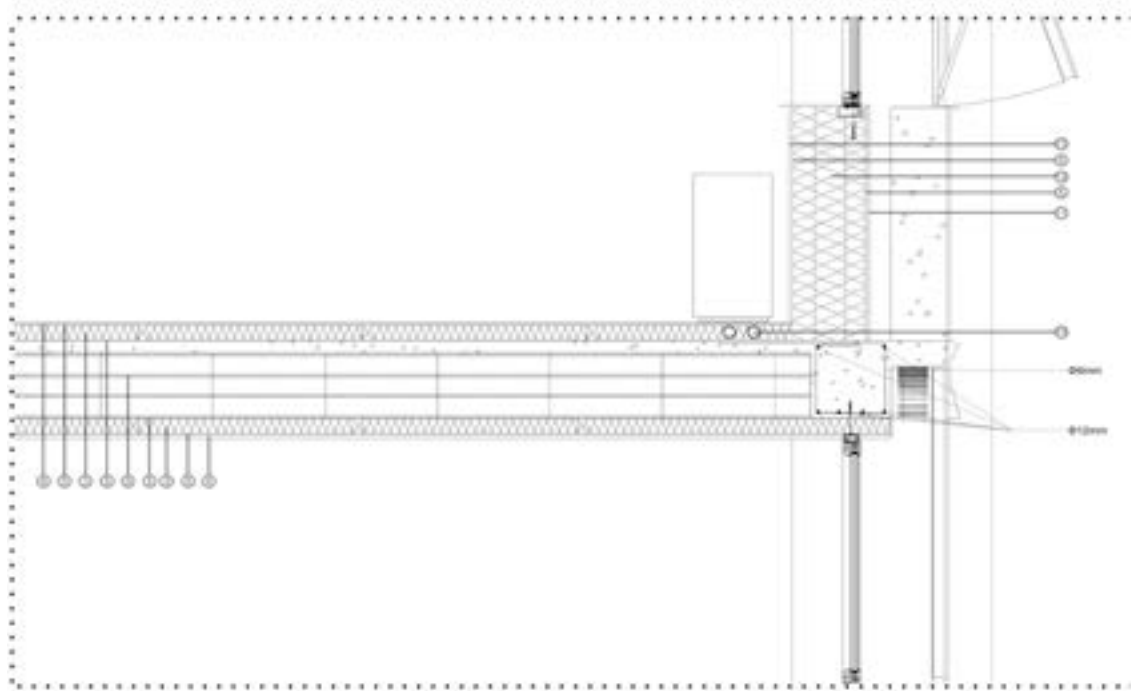
SECTION C-C SCALE 1/50



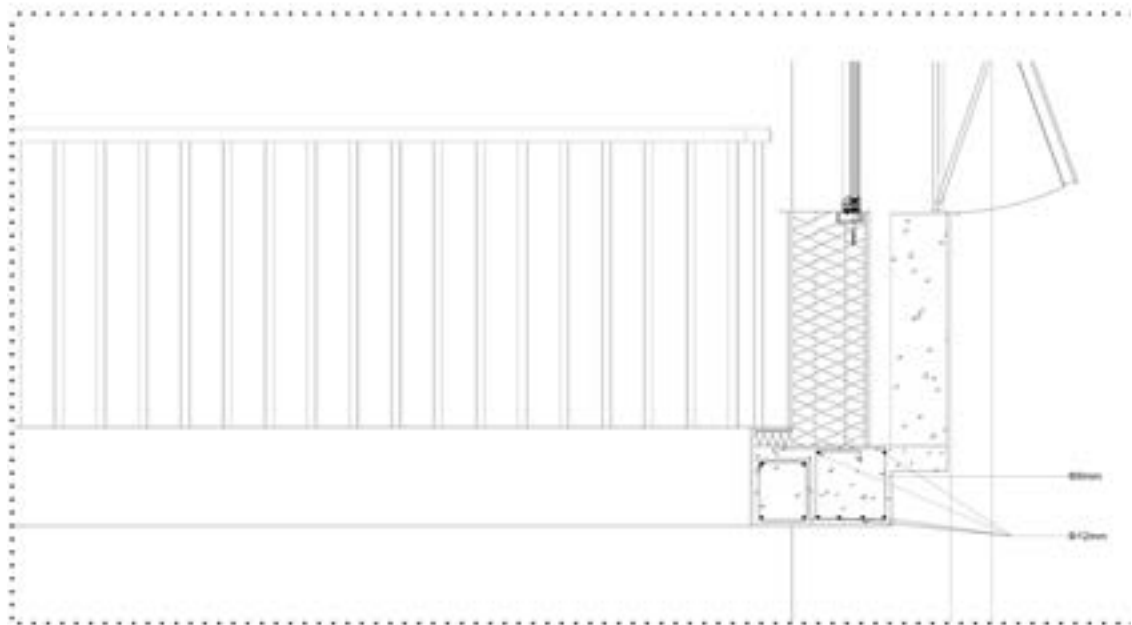
SECTION D-D SCALE 1/50



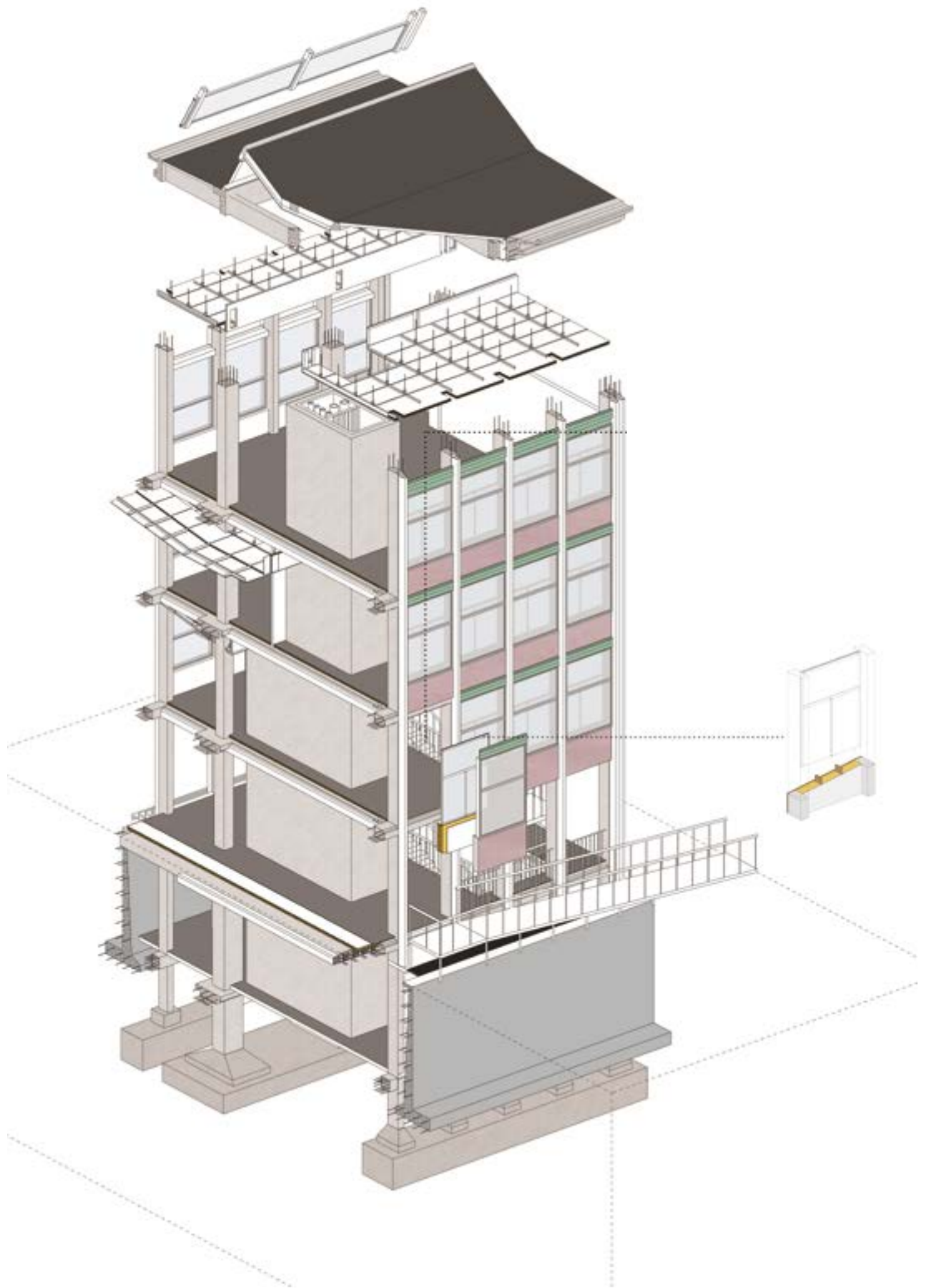
03 SCALE 1/10

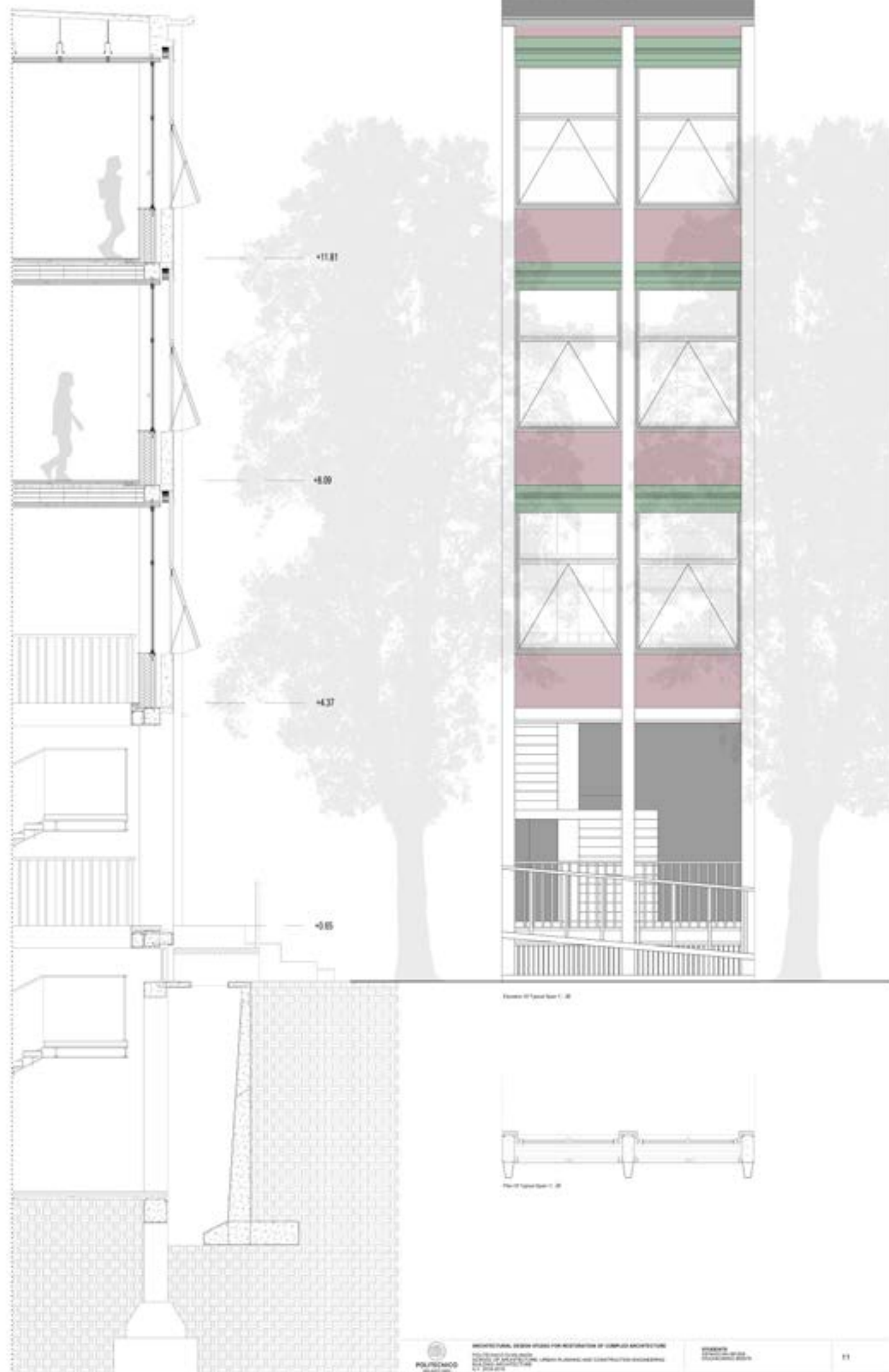


04 SCALE 1/10



05 SCALE 1/10





CONCLUSION

This thesis is about a preservation project for improving the situation of light machinery building which is located in the centre of SOCIETA' UMANITARIA. In order to get specific information of it. A geometric survey and functional analysis were done. After that, the concept shaped according to the existing problems.

This laboratory divides the site into two parts and these two parts were separated because of building blocks. It has a length of 93meters. On the north side, it is the most important historical buildings in the site. On the west side, light machinery is facing Convitto. On the east side, it is a huge building which has multiple functions in it and their connection is a corridor which occupied most of space of the gap. That is one reason why site is divided into separated parts.

Considering the streamline and function organization, we think rehabilitating the relationship between the lab and surrounding environment is most crucial part in our design concept. For this reason, we demolish most walls on the groundfloor to open the whole space and connect two separated parts. In this way, the site would be more flexible and transparent which is more suitable for modern society.

For the restoration, we remained most existing walls and structure and enhance the energy efficiency of the building by building a new wall layer which has insulation layer inside of existing walls. For structure part, the middle part is reinforced with core tube.

To conclude, the project is focusing on rehabilitation and improving of the light machinery building while preserving diagnosis and interventions were done for the maintenance of the building.

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