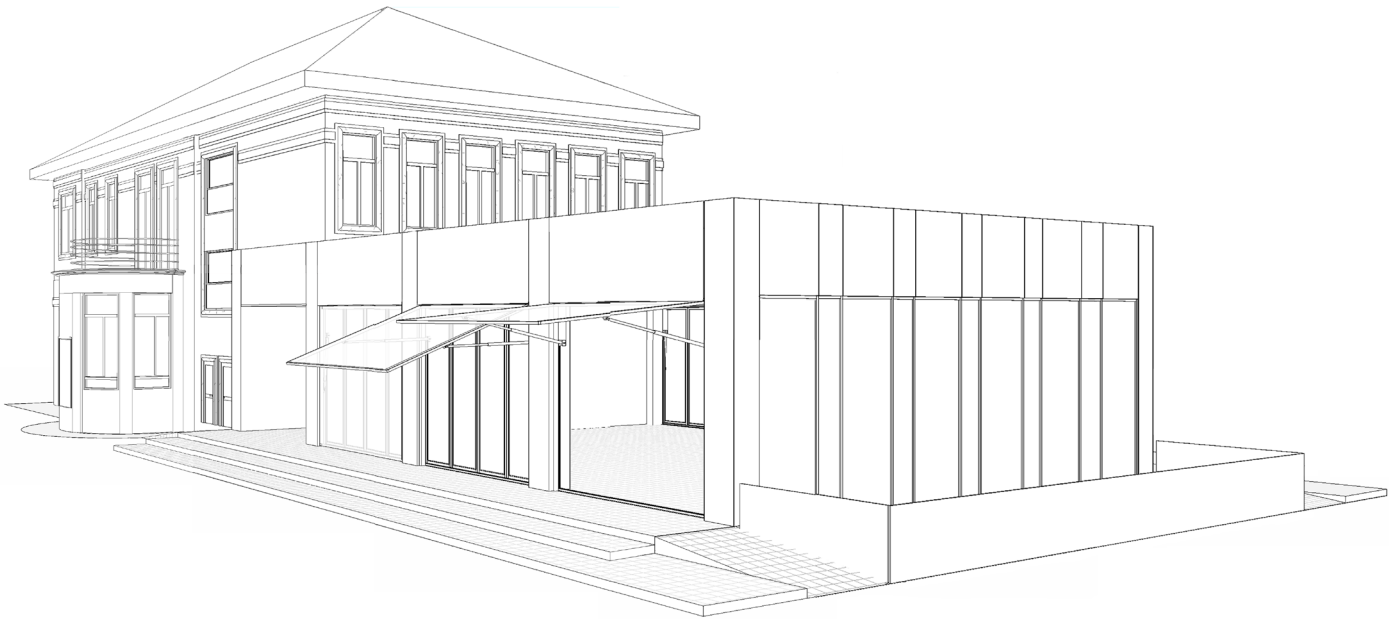
I N T E G R I T Y

in the center of Veterinaria Campus



Integrity

/ɪnˈteg.rə.ti/
noun

1- the quality of being whole and complete
2- the quality of being honest and having strong moral principles
3- wholeness and unity

The project aims to extend the central building of the campus, creating a dialogue between the old and new with a conservative transformation approach.
The addition consists of main entrance hall, multifunctional classroom and underground extension, working with the existing building. The use of different materials gives the new addition recognizability.
‘Integrity’ express my purpose of preserving the wholeness of the space in the central point of the campus and integration between new and old.

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Abstract

The area considered in the project is the Veterinaria Campus in the Citta Studi district of Milan. A district with many academic institutions, Citta Studi has evolved over time since its planning in the early 1900s, contributing the past century Milanese urban development.
The study is directed towards a survey and knowledge process of the Veterinaria Campus. While carrying out this thesis project, my primary goal was to preserve and transform the Veterinaria Campus and central building 22090, respecting their historical heritage.
In accordance with the original state of the building, new addition volume was added towards the north on the ground floor and underground floor extensioned towards the north and south. The new addition on the ground floor consists of a multifunctional classroom. Also, the main entrance hall transformed by removing of classroom that was incompatible to the original building and raising of the ground floor to act as a connection point between the old and new building.
Moreover, I proposed to strengthen and organise the original parts of the building in order to adapt them to the functions of the new research center of the campus. The technical approach includes overviews on the structural, environmental, and services levels. In particular, the connection between different structures and materials studied, integration of old and new buildings in the same environment provided.
The outcome is a definitive project respect to the historical significance, able to respond to the required needs, extend the life of the existing building, add value to the existing building and increase the quality of campus thanks to the new addition.

Keywords

Extension, Addition, Integration, Connection, Transformation, Recognizability, Durability, Authenticity, Compatibility

Introduction

Post-War Architecture in Milan

Milan 1945, the Reconstruction

In this conservation and transformation project which is in a post-war campus district in Milan, I aimed to introduce the fundamental background of post-war architecture development and relative case study.
In the aftermath of World War II, in 1945, Milan was largely destroyed. Monuments and houses, parks and transportation systems – in effect, the whole city and its center – were heavily damaged. The age of reco struction was faced with a host of problems that posed important architectural and theoretical questions: the loss of a great number of monuments that represented the identity of the city, the destruction of many historical residential blocks and the large need for housing – a pre-war concern – that would increase in the following two decades due to industrial development. Tackling these problems led to a renewal of architecture and the city.
During this period, an important school of architects was forming in Milan – at the time, one of the most vital cities in Italy for its cultural and economic activities – together with a group of intellectuals, philosophers, poets and artists. The head of this group of architects working in both Milan and Venice (Albini, Gardella, Figini e Pollini, Bottoni) was Ernesto Rogers, the director of Casabella Continuità, the leading architectural magazine at the time. In the meantime, scientific studies on the city, its structure and its architecture took root: the research on the relationships between typology and morphology originated from this interest to better understand historical cities in order that each one's history may continue.
The transformational possibilities of the North Italian metropolis were palpably present in post-war Milan: architects looked to the future, projecting an ideal city onto the pre-existing one that had been heavily damaged during World War II, while also looking back at modern architecture's relatively young tradition in Italy, simultaneously reordering its narratives. Concentrating on three major elements of the new city – skyscrapers, housing and city planning.

... «Continuity» could be one of the keywords of the italian postwar period, in spite of the condition of strong changes that carachterized Italy from 1944 to 1960s...

Luca Molinari in 2G Italian Postwar Architecture 2000

Milano, World War II aerial view (Italy, 1944)

Case Study - 1

Complex for Houses, Offices and Shops
Via Melchiorre Gioia, Milan
Pietro Lingeri

The house in via Melchiorre Gioia, from 1949-1952, is one of the buildings that best represents the model of re-construction and modernization of Milan, which took place through detailed plans of parts of the city. Generally, the condominiums of Lingeri are characterized by some personal invariants : building components, finishing materials, facade compositional solutions and - despite the constraints determined by the characteristics of the lot and subsequently by the Milanese regulatory plan - plano-volumetric schemes. The building was built on the head of the Martesana, where the canal, now buried, entered the immaculate basin of Via S. Marco. The complex consists of a tower on Via Gioia and a lower condominium and a body on a lower road, used for services and shops, which stretch out onto a secondary road. Although considered by critics as a mere scholastic exercise on the themes of modernism of reconstruction, it stands out for the solutions adopted in the articulations between the volumes built.

Historical Timeline

Pietro Lingeri

1926 (..-60s)
Rationalism: “..between logic and rationality”

1934 - 35
Several housing projects in Milan with Giuseppe Terragni:
Casa Rustici, Casa Ghiringhelli, Rustici-Comolli Residential Building

1942
Via M. Gioia 1 in Milan city map: classic building block

1945 - 46
Lingeri is part of the consulting committee for the new city plan of Milan and Movimento di Studi per l’Architettura

1947 (..-60s)
Post-war Milan urban evolution: Lingeri designs numerous architectural complexes

Post-War Urban Program
Porta Nuova Zone as Commercial District

1949 - 51
Residential and commercial complex in Via M. Gioia is constructed

1962
The canal of Martesana is closed

30s and Rationalism
Italian rationalism has started with the “group 7” formation that has composed by several important architects of that time including Giuseppe Terragni. The association that had ran between 1920s until 40s by Lingeri and Terragni produced numerous projects in rationalist style.
The basic principles of Rationalism is that going back to the classical style that show the basic geometry (circles, triangles, squares..) as rejection of ornaments and Baroque style. The main idea was to create a honest architecture.

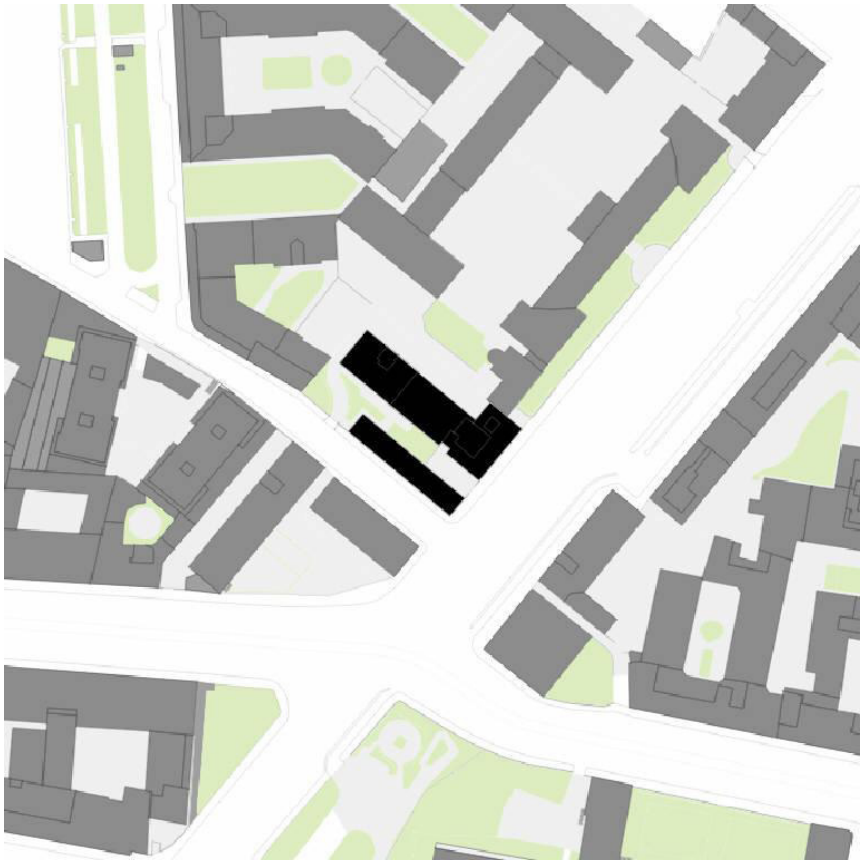
- Priority of urban planning on the architectural project
- The need for an increasing number of houses to solve the housing problem
- The rigorous rationality of forms
- The systematic approach to industrial technology and standardization
- The conception of architecture as a key determinant of social progress

Casa Rustici

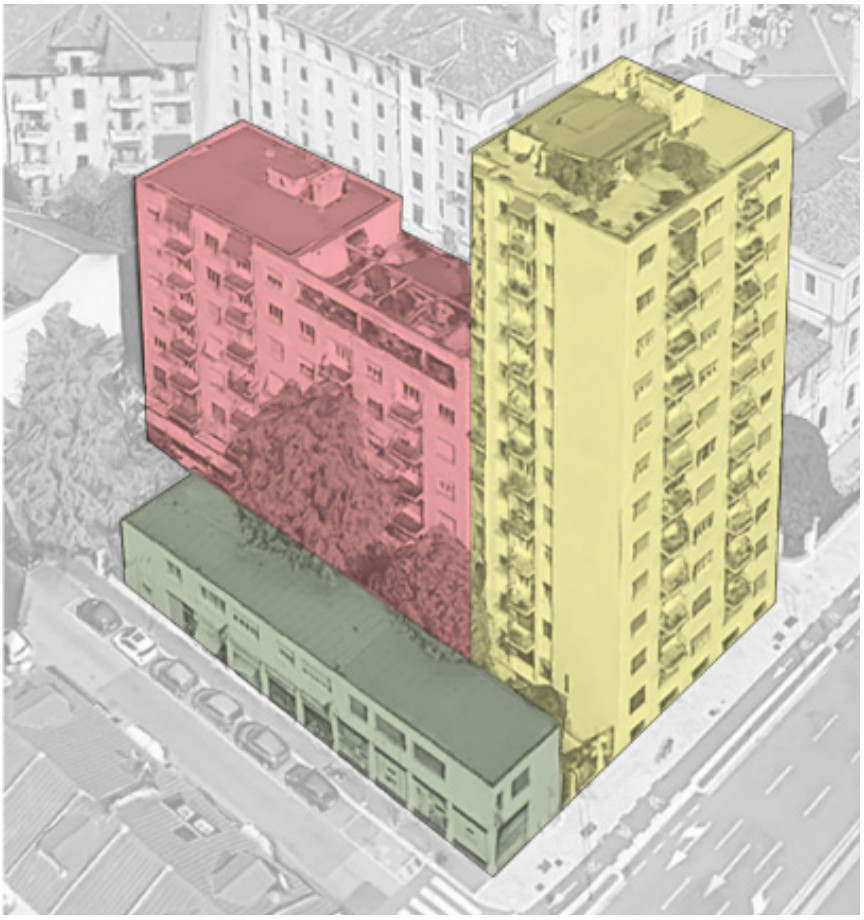
Rustici Comolli - residential building

Casa Ghiringhelli

Master Plan



Building Functions

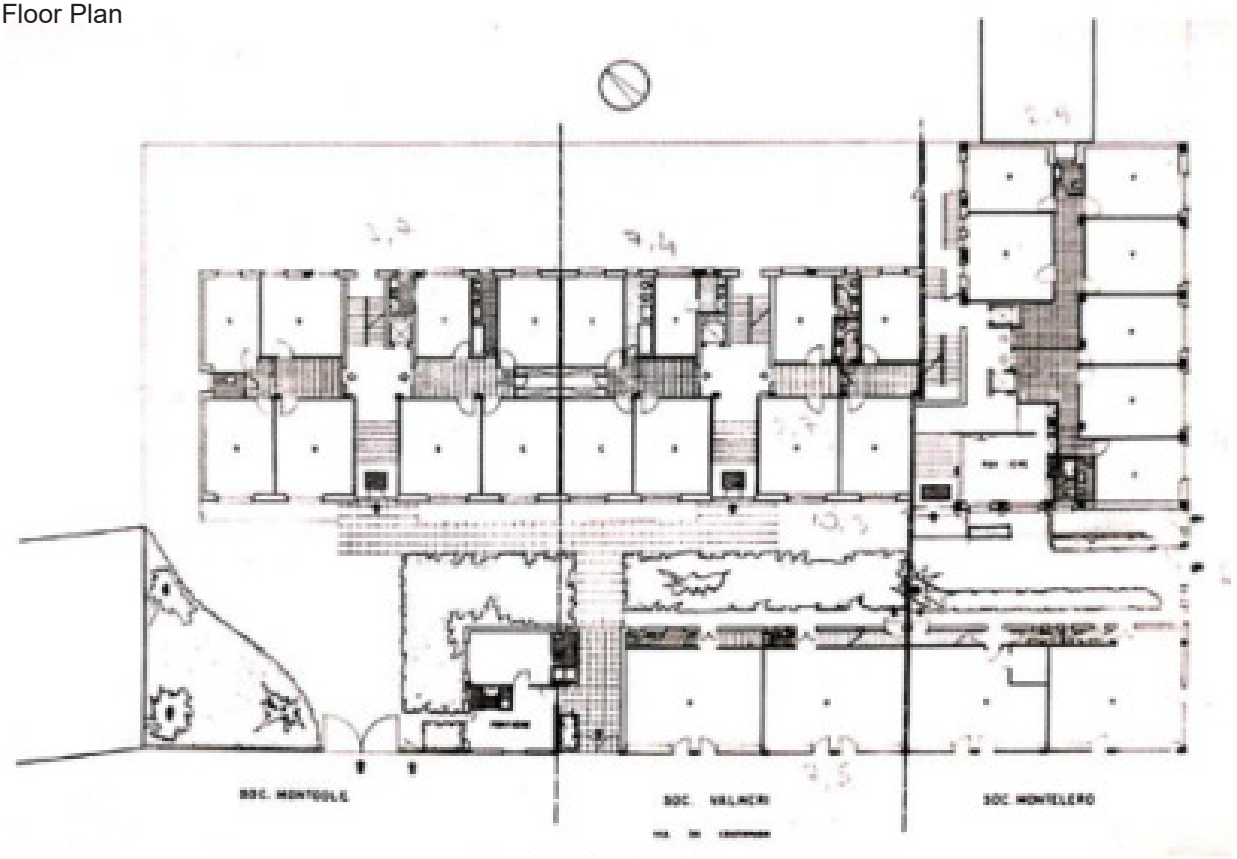


residential block 1

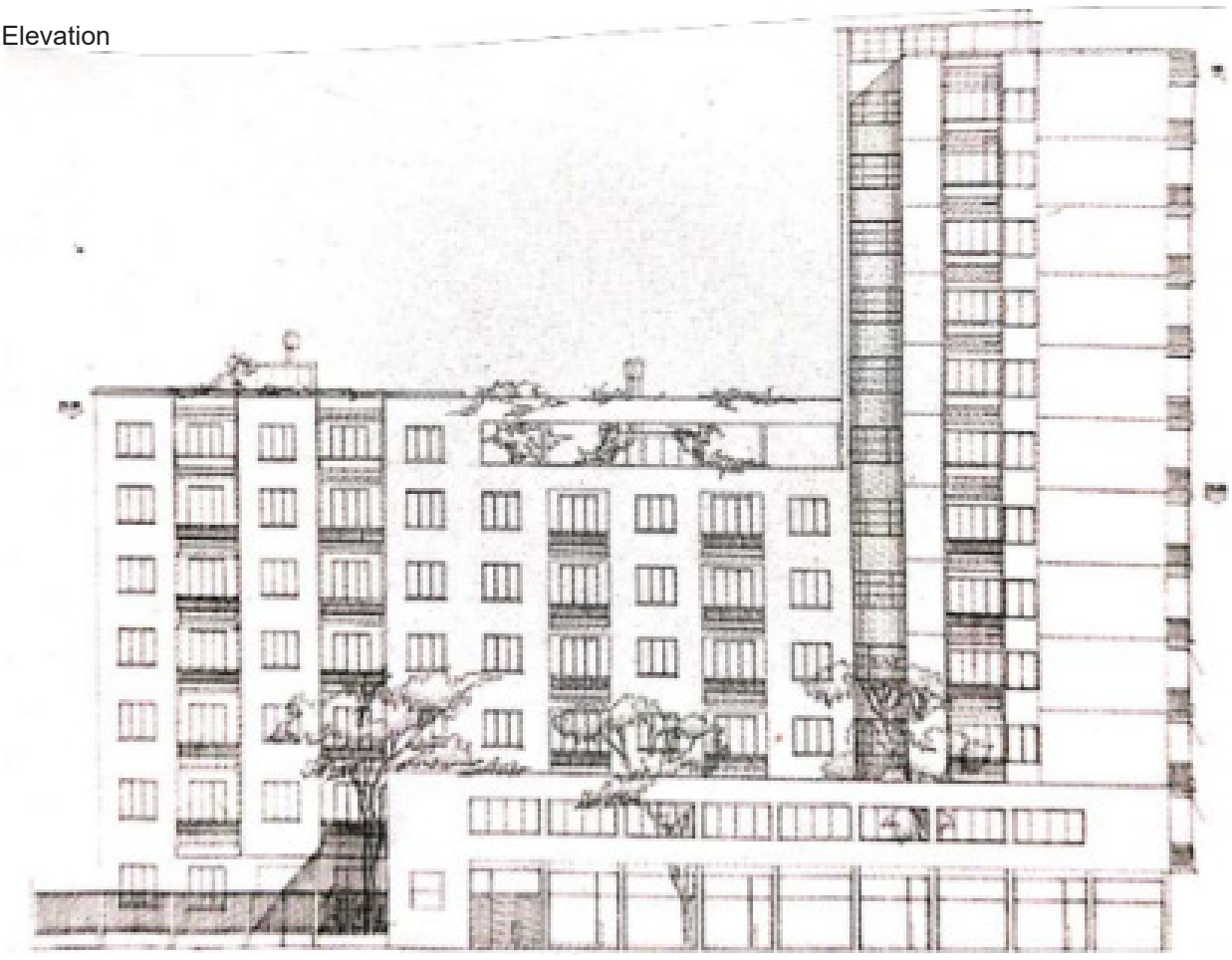
residential block 2

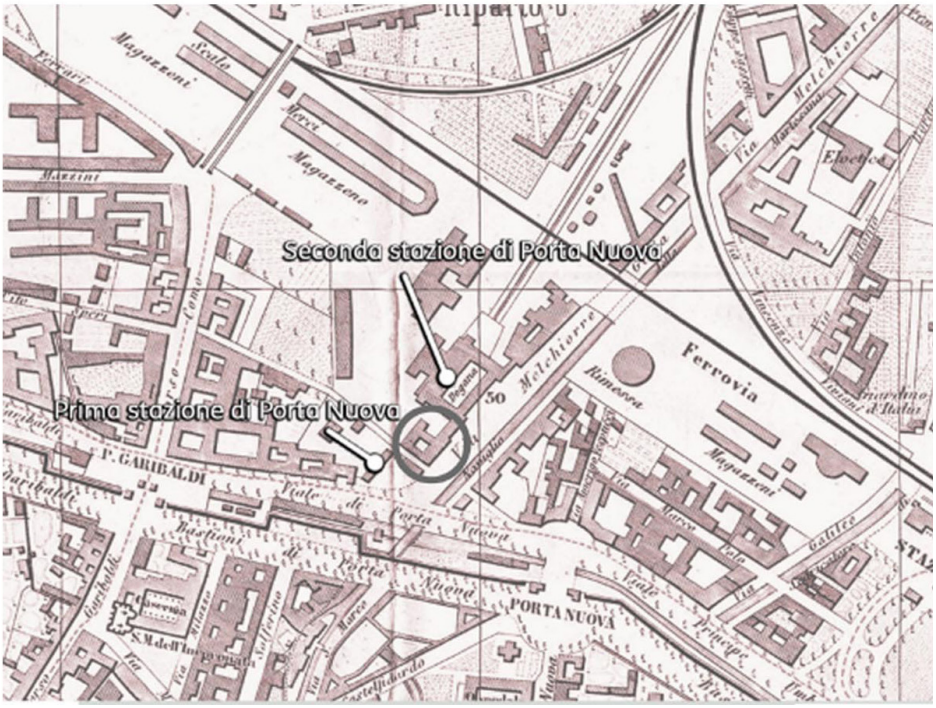
commercial

Floor Plan



Elevation





1850s, map showing the train stations of Milan


1887

1942, Milan city map

1962, closure of the canal

Current Views

Materials

This image is from the connection between ground floor and upper floors of the building as you see on the right small key picture. Stone was used as the material on the ground floor of the building. Perhaps this stone is marble, we can understand it due to the texture inside of the stone. And plaster was used on the upper floors. It has its own texture.

This image is from the lower commercial building as I marked on the right key image. According to our research it is litoceramica. The mosaic, with ceramic and glass based mixtures worked into small pieces of different geometry and colors to be applied with mortar. This cladding material was used in the residential especially in Milan and Rome in the fiftys as modern architecture.

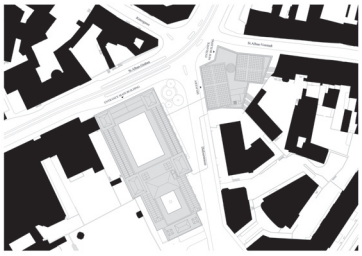
Case Study - 2

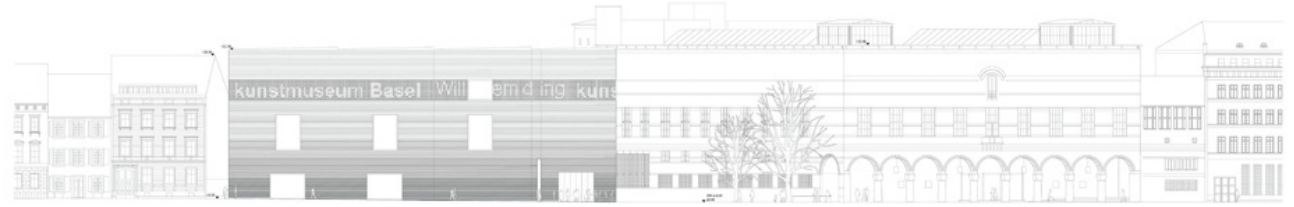
Extension of Kunstmuseum Basel
2010 - 2016
Christ&Gantenbein

“We wanted the new building to speak the same language as the existing structure with its mighty walls and distinctive horizontal stripes. At the same time, however, we wanted to tell a completely distinct, new story.”
Christ & Gantenbein

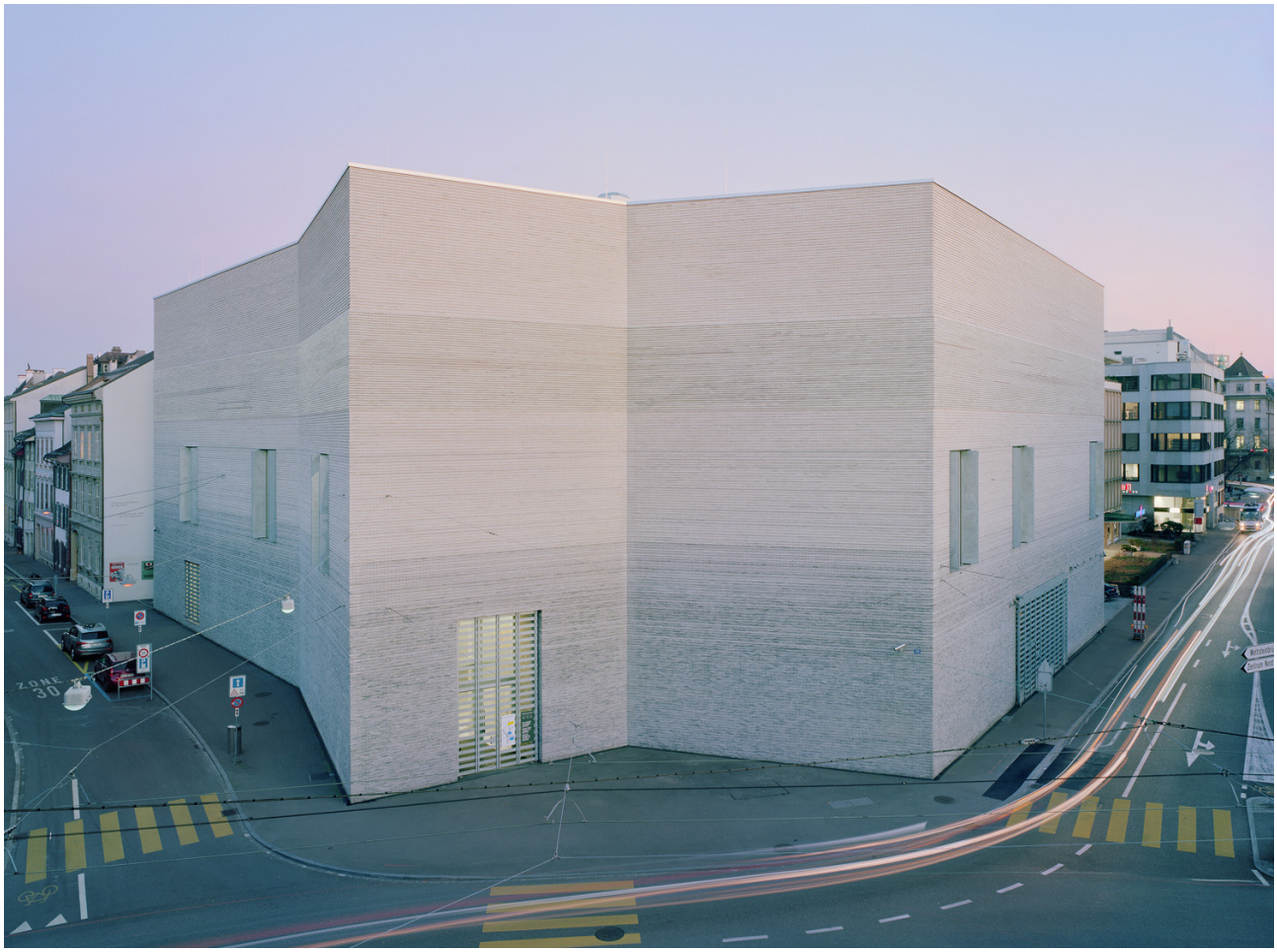
The new and enlarged museum consists of two buildings that together form a unified presence in the urban space. They are in direct communication with each other across the street that runs between them. Architects designed the building to be contemporary, but to also “speak the same language” as the main 1930s building, which is located across the street. To achieve this, the architects developed a design that mimics the scale and proportions of its neighbour.

In terms of the master plan, the addition part has a completely different shape from the existing one, which is a whole irregularity volume compared to the existing classical typology. The direct entry to the new building facing the street is formed by the extension of the existing arcades of the Kunstmuseum and is marked by the drawn-in corner of the front facade. A “subterranean alley” provides views to a garden foyer of the lower courtyard.





The roof level is identical, window heights match, and the grey brickwork complements the monochrome stonework.
The differences are in the details. Instead of a decorative arcade, a simple glazed wall forms the entrance. And while windows on the main building form an ordered grid, on the new building they are added more sparingly.
Different shades of grey break up the monotony of the brickwork, forming a soft graduation from dark to light. These self-supporting walls integrate strips of LED lights, sunken into a series of grooves, which can be used to spell out the names of current exhibitions.
The openings of the facade are arranged to give scale and proportion to the building structure. The closed wall of the top floor where the special shows are taking place, the upright windows of the first floor and the pragmatically placed openings in the ground level mark the vertical organization of the building.



The façades are gray brick walls that exude the timeless and archaic air of an ancient ruin. They were designed to be self-supporting and monolithic, and their emphatic horizontality, with elongated bricks that are just four centimeters high, heightens their presence. The striking pattern of shadows cast by the alternately projecting and receding layers of brick amplifies this impression. Like the main building's façades, those of the new building hint at classical architecture's standard tripartite order of base, middle, and capital. This order is visualized through the brickwork's different shades of gray as well as a frieze executed as a delicate relief.

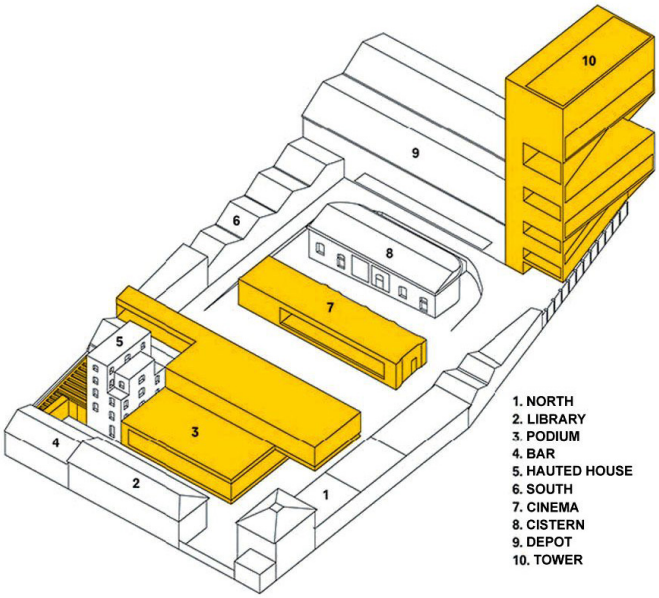
Case Study - 3

Fondazione Prada
2008-18
OMA-Rem Koolhaas

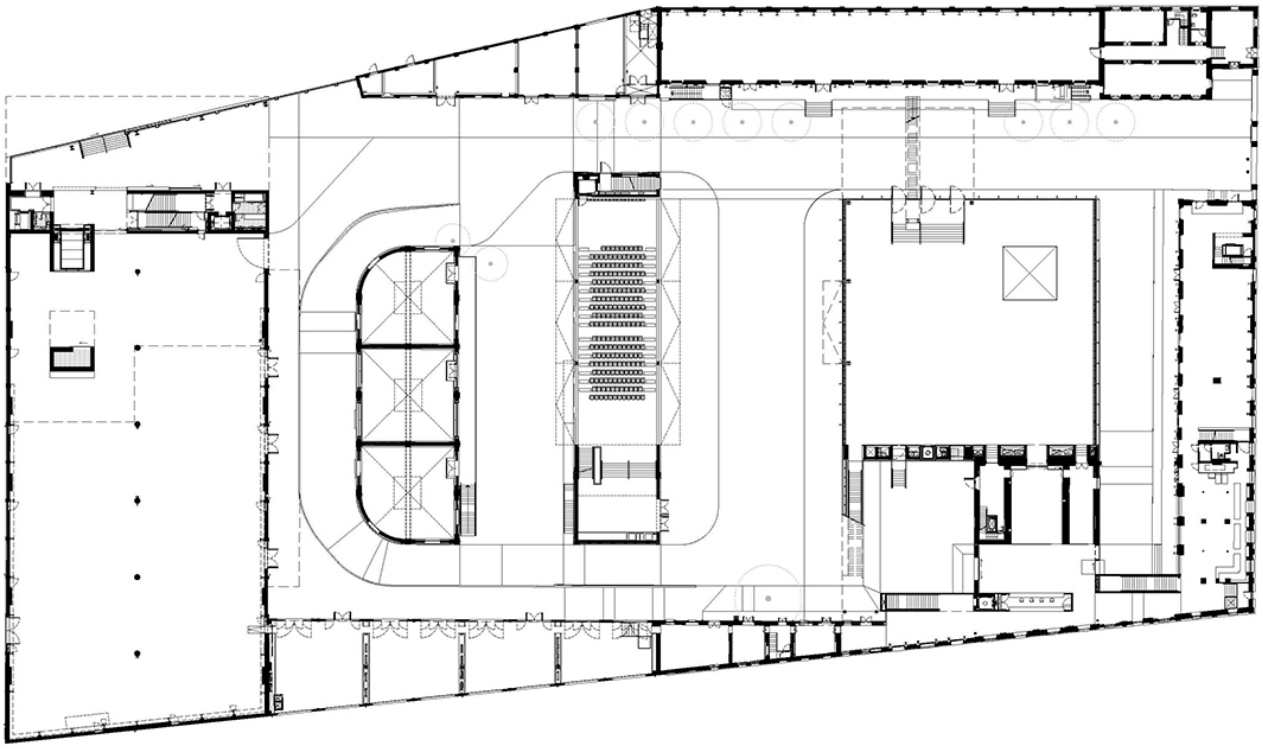
“We worked on a respect for what was existing,”
“We didn’t work with contrast but on the contrary, we tried to create a situation where old and new can work very seamlessly together and are sometimes actually merged together so that you cannot tell at any one moment whether you are in a new or an old situation,”

Rem Koolhaas

Located in a former gin distillery dating from 1910 in the Largo Isarco industrial complex on the southern edge of Milan, the new home of Fondazione Prada is a coexistence of new and regenerated buildings including warehouses, laboratories and brewing silos, as well as new buildings surrounding a large courtyard.
The complex aims to expand the repertoire of spatial typologies in which art can be exhibited. The project consists of seven existing buildings, and three new structures: Podium, a space for temporary exhibitions; Cinema, a multimedia auditorium; and Torre, a nine-story permanent exhibition space for displaying the foundation’s collection and activities.
Within the perimeter of the Largo Isarco complex existed two freestanding structures: one flat and square and the second more vertical. On close inspection, the square building did not offer attractive possibilities and was demolished, enabling the courtyard to become a significant element for open-air use.
The Fondazione is not a preservation project and not a new architecture. Two conditions that are usually kept separate here confront each other in a state of permanent interaction – offering an ensemble of fragments that will not congeal into a single image, or allow any part to dominate the others.
New, old, horizontal, vertical, wide, narrow, white, black, open, enclosed -- all these contrasts establish the range of oppositions that define the new Fondazione. By introducing so many spatial variables, the complexity of the architecture will promote an unstable, open programming, where art and architecture will benefit from each other’s challenges.

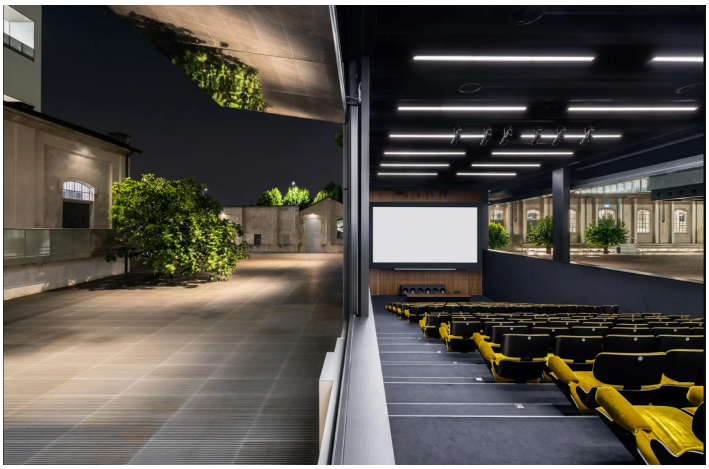


1. NORTH
2. LIBRARY
3. PODIUM
4. BAR
5. HAUTED HOUSE
6. SOUTH
7. CINEMA
8. CISTERN
9. DEPOT
10. TOWER



Cinema building as a reference of my design project

The Cinema acts as an autonomous cell within the compound. With large bi-fold doors, it can be instantly connected to the courtyard. Inside, the raked seating can be converted into a flat floor, allowing the space to be used for staging outdoor events or as additional, covered gallery space.



Materials

Concrete surfaces

The existing masonry facades have been renewed with a skim coat of light-colored cement, manufactured by an Italian concrete company. Aggregates of white Carrara marble were added to the cement mixture, giving these timeworn structures a subtle sparkle.

Mirrored stainless steel

Opposite the Podium and Haunted House is a 200-seat auditorium clad in highly-polished stainless steel. The center panels are affixed to massive, bi-folding doors which, when opened, enable performances to spill out into the courtyard. When closed, these mirrored panels cause the building to become invisible, disappearing into its context.

3d aluminum foam

At the heart of the complex is a contemporary gallery, dubbed the Podium. Its façades, soffits, interior walls and ceilings are all clad in Alusion, a metallic foam created by injecting air into molten aluminum. Although typically used by the military to protect against explosions, the foam's flame-resistant, sound-absorbing surface makes it surprisingly suitable for museum applications.

Curtain walls

Unlike the original masonry buildings, which are solid with few fenestrations, the Podium is open and inviting, featuring long expanses of high-purity glazing. In a playful nod to Milan's classical architecture, these glass façades are supported by deep, colonnade-like mullions with their doorways recessed beneath aluminum arches.

Gold Leaf

Adjacent to the Podium is the Haunted House, a gallery dedicated to site-specific artworks. Its entire exterior, including gutters and window mullions, was refinished in 24-karat gold leaf. "We discovered that gold is actually a cheap cladding material compared to traditional claddings like marble and even paint," said Koolhaas, "What I love is the way it contaminates the walls around it… The environment needed a little color."

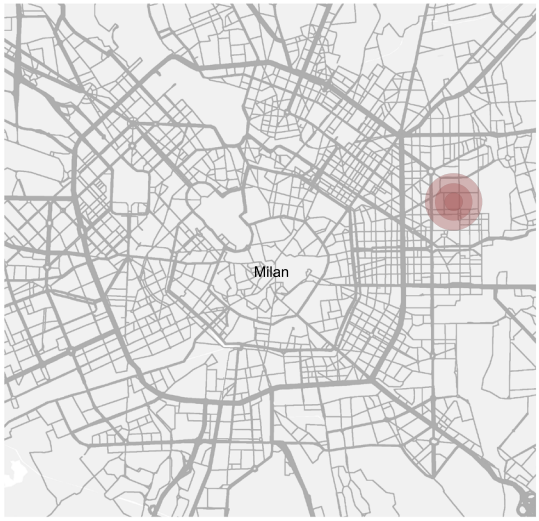
Hardwood pavers

In addition to granite cobblestones, the plaza and pathways have been repaved with oak setts, fabricated from salvaged railroad ties. Although uncommon today, these wooden pavers were popular in 19th century Europe as they were more comfortable than stone and less noisy under horse-drawn carriages.

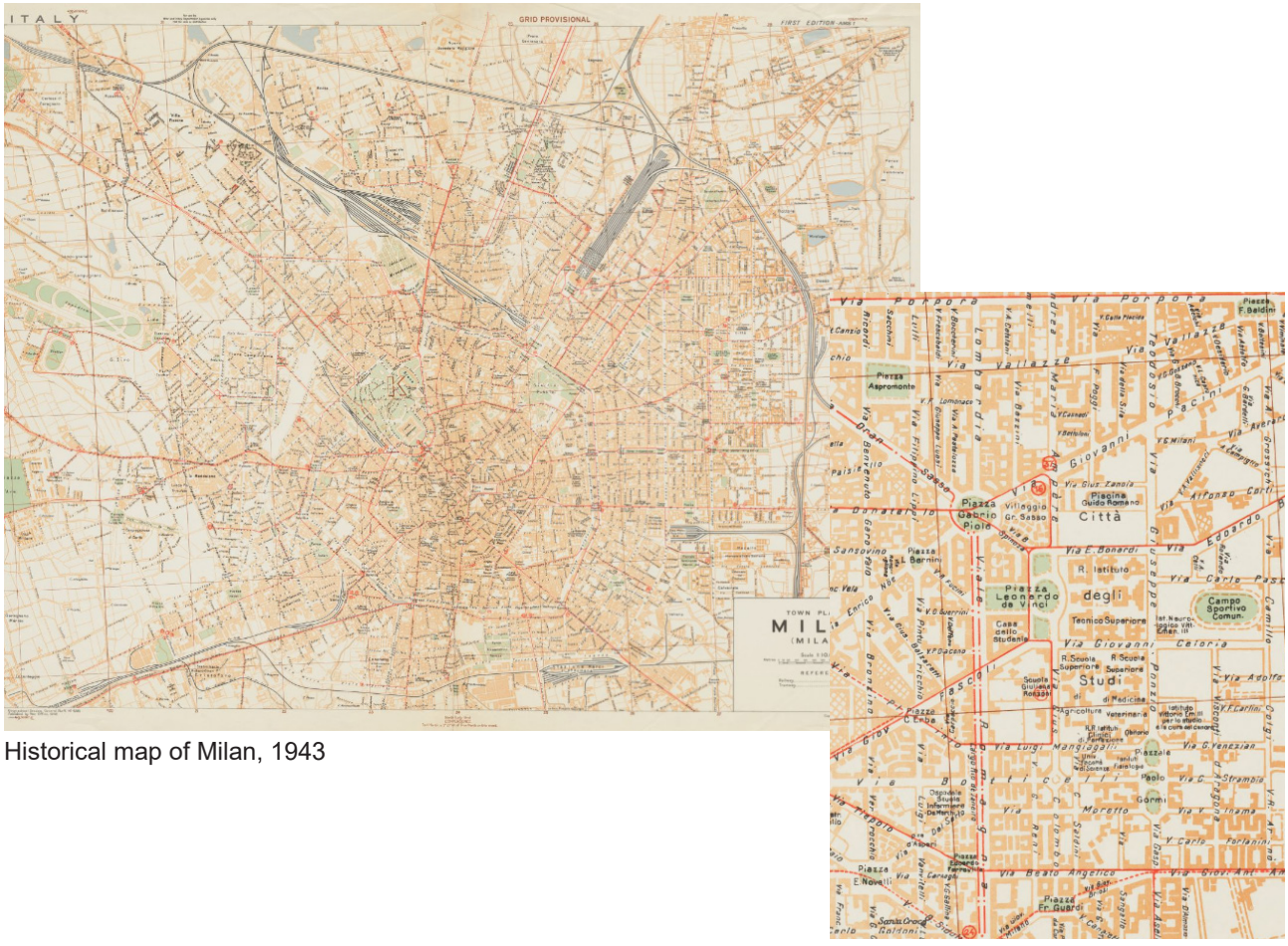
The Context

Urban Development of Citta Studi

Citta Studi (literally, “studies city”) is a district (“quartiere”) of Milan, Italy, located within the Zone 3 administrative division. Its name comes from the fact that the Politecnico technical university, as well as most technical and scientific branches of the University of Milan, are based in this area. The area also houses several prominent hospitals of Milan. Citta Studi was developed in the early 20th century as a response to the need for expanded higher education opportunities in Milan.

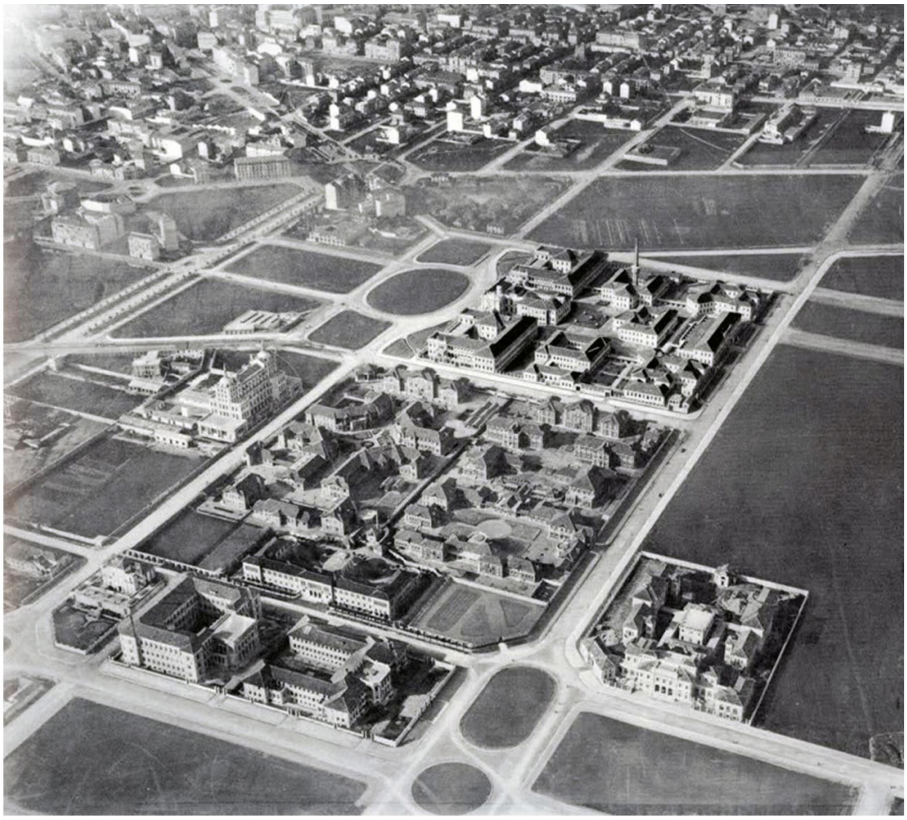


The history of Citta Studi begins in 1912, when Milan zoning plan designed by the engineers Pavia and Masera recognized the area as buildable with the idea of moving there and unify in a unique complex all the higher education institutions of the city. The aim of Pavia and Masera was to continue what already started by engineer Beruto in 1889 with the previous zoning plan, that is answering to the needs of a city under expansion due to the prominent role it gained in the industrial and commercial fields since the unification of Italy. The public spirit of this part of the city was definitively confirmed in 1927 with the transformation of the area of the Cascine Doppie (now Piazza Leonardo da Vinci) into the new Città degli Studi (City of Education) organized as a series of pavilions to host the Departments of Medicine, Agriculture and Veterinary Medicine and the Politecnico di Milano. During world war II, Citta Studi suffered significant damage from bombing, but the institutions in the area continued to grow and expand after the war. In the postwar period, Citta Studi became a center for technological innovation and research, particularly in the fields of engineering and science.



Historical map of Milan, 1943

Information on the history of the area shows that the master plan of the Citta Studi started in the 1920s. And after almost 100 years of history, the main function of the district is still university education, with complementary medical and sporting functions and abundant greenery. At the beginning of 20th century, outline of Citta Studi area were almost same as today. The fact that fundamental buildings were completed in general could be confirmed.

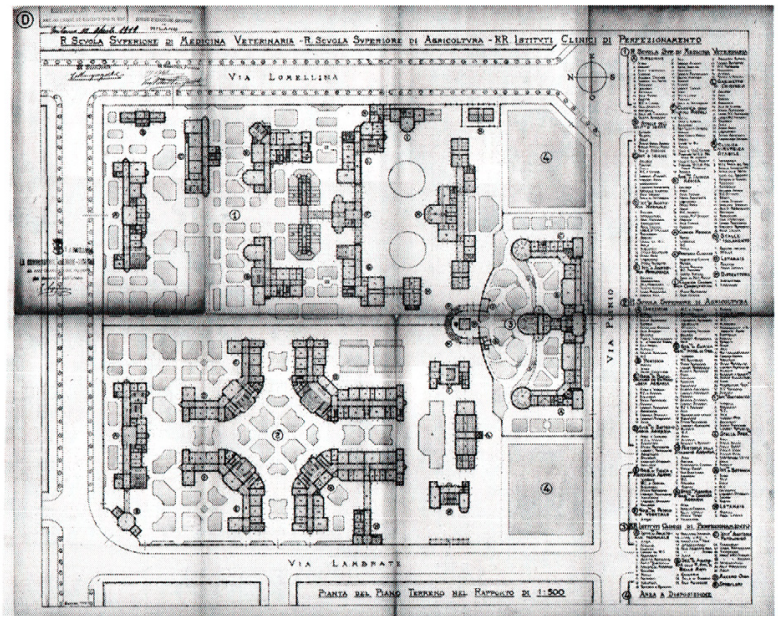


Aerial photo of Citta Studi, 1930s

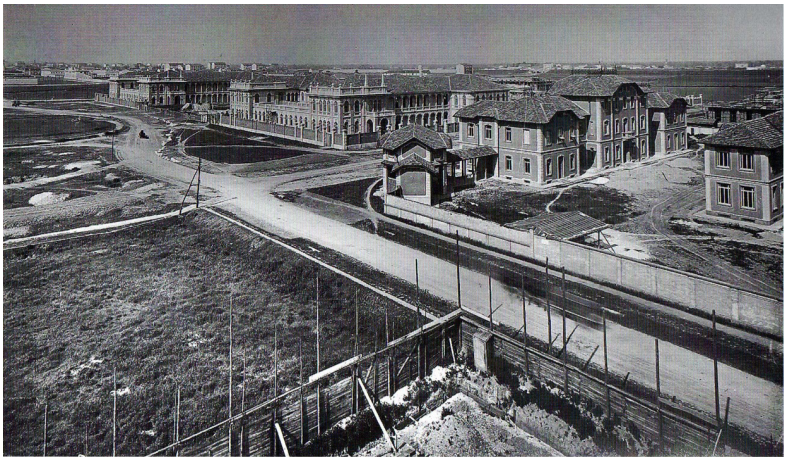
Aerial photo of Citta Studi, 2020s

The Site

Over 100 years' development on this campus, architectural style changed together with the functional transformation. The site as Veterinary Campus in Citta Studi has three main periods: firstly planning in 1910 with function of Agriculture and Animal clinic, then planned as biologic campus and the latest renovation as a multi-functional university.
The intervention that is the subject of this feasibility study is linked to the opportunity to recover the spaces located in Via Celoria 10 previously intended for the Veterinary Faculty, now in the process of definitive transfer to the new location in Lodi, for new use. The buildings constitute a unique compendium of fine architecture and important historical and testimonial value. The buildings covered by this report were conceived as the headquarters of the Veterinary Faculty built in the 1920s. The seat of the Faculty was already outlined with the overall construction of the Città degli Studi di Milano complex already developed with the Milan Masera Pavia Town Plan of 1912. These buildings on 19 August 2011 were subjected to the protection of Law 42 of 22 January 2004 with a specific decree of the Regional Directorate for Cultural and Landscape Heritage of Lombardy. The complex, with entrance from via Celoria, is made up of several buildings and is organized around a beautiful tree-lined garden that still bears traces of the original design probably due to the handling of the animals that found shelter in the same faculty. The architectural features of the buildings in question are strongly inspired by that eclectic Liberty.

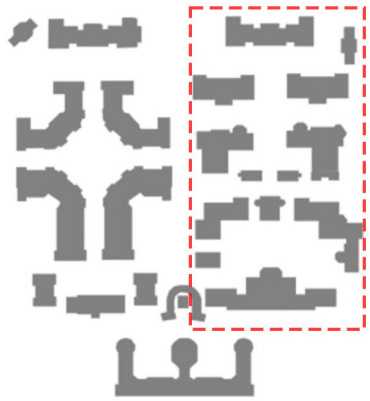


General plan of Faculty of Agriculture and Veterinaria in 1919


View of the Construction Site in 1924

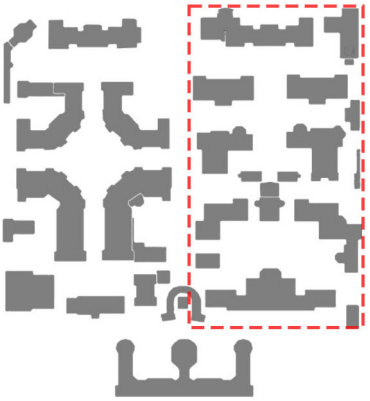
The Site

Changes in the Campus Over the Years



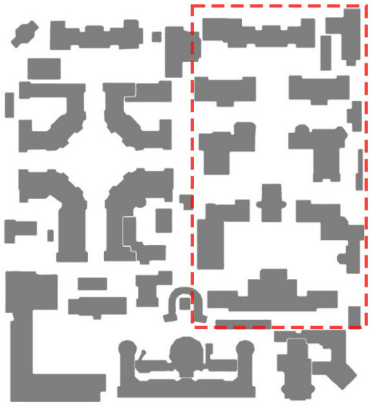
1910 - Development of Agriculture and Animal Clinic

Development of Agriculture and Animal Clinic completed around 1910 associated with obvious geometrical and symmetrical characteristics on planning and building design.



1949 - Planned as a Biologic Campus

In the renovation after WWII, this district was planned as a biologic campus which preserved some features of previous function, therefore some addtions on existing buildings were gradually constructed while not have certain architectural style.

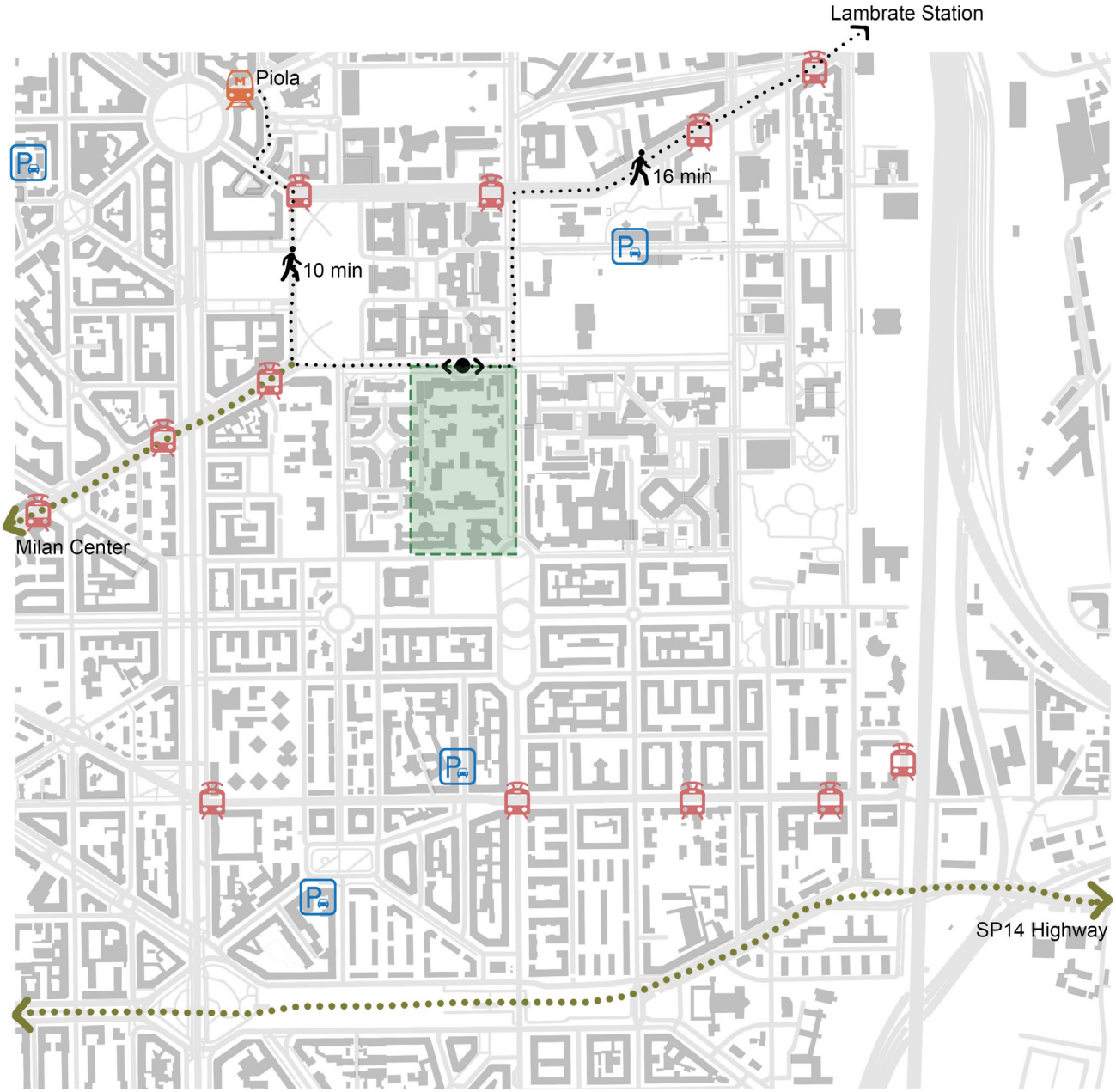


1949 - 2020s Development and Construction of Campus

Coming to the modern age, this campus continued to developed and transformed into more advanced and comprehensive university with more research centers and laboratories focusing on academic studies.

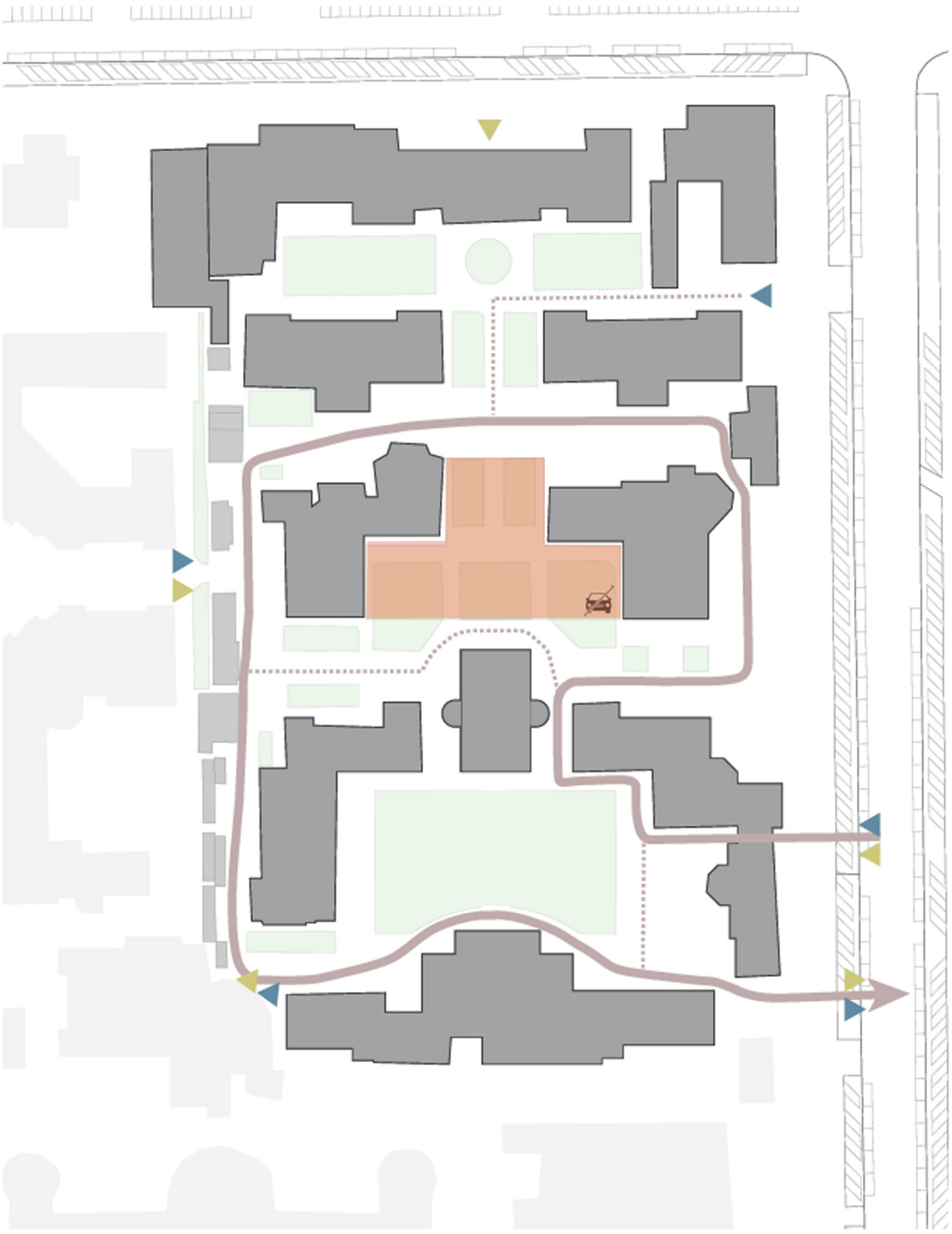
The Site

Accessibility to the Veterinaria Campus



The Site

Accessibility in the Veterinaria Campus

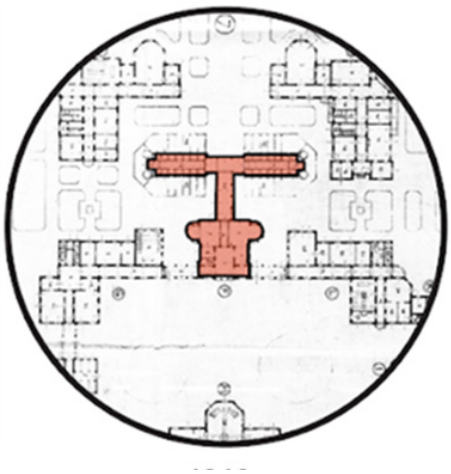


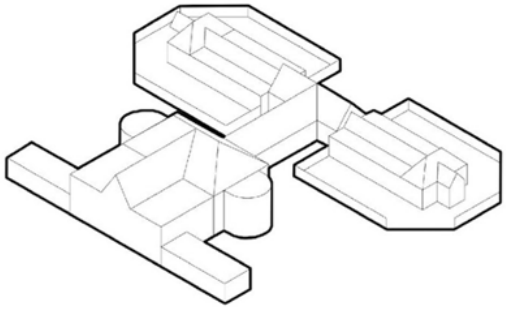
area without vehicle
primary way of vehicle
secondary way of vehicle
vehicle entrance
pedestrian entrance

The Existing Building

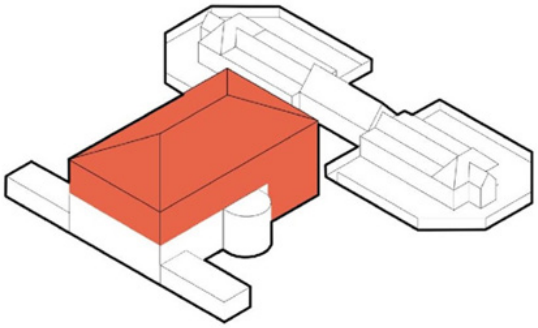
Transformation of Building 22090

1910

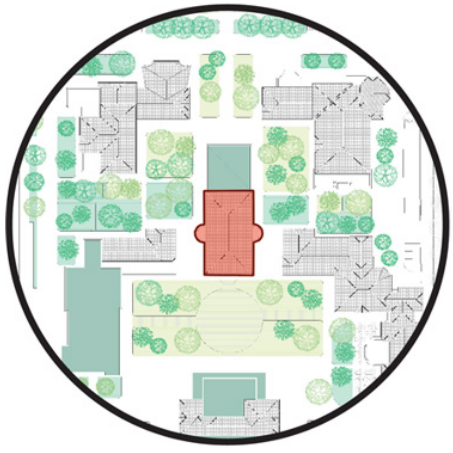


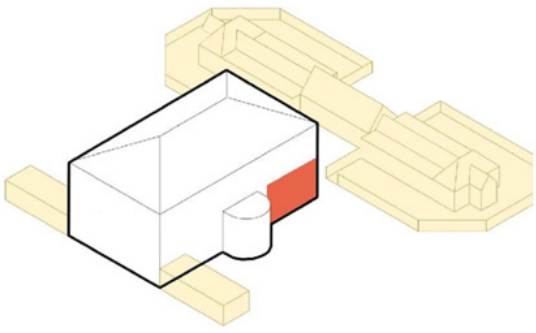


1949

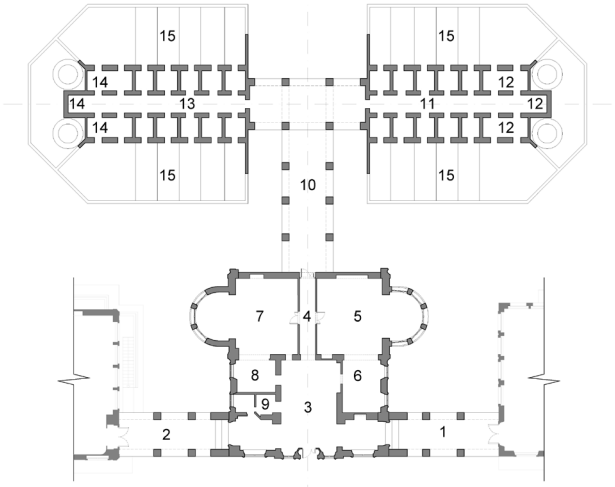


1949 - 2022



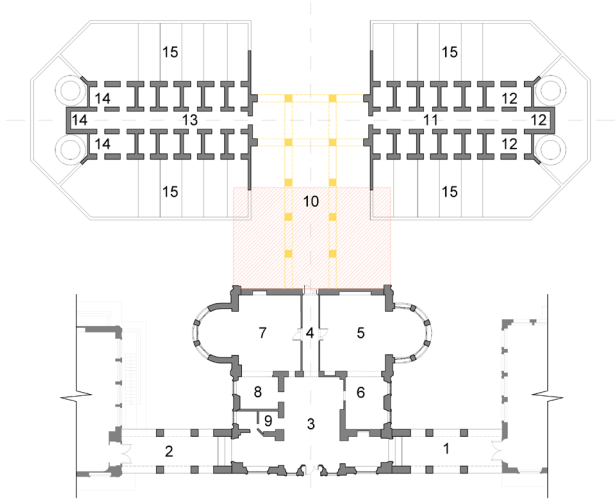


In the first construction of 1910, the single-storey building was made of brick as a peak animal clinic, but after about 1943 till 1949, the north part was extended therefore this building was symmetrical in two directions with the function of obstetrics and kennels. In the latest transformation, the south corridor and two north volumes were removed, and the main function was totally transformed into an educational building including labs and classrooms.



SMALL ANIMAL CLINIC

1. Porch
2. Porch
3. Waiting room
4. Disengagement
5. Surgic clinic Room
6. Service
7. Medical clinic room
8. Service
9. WC
10. Porch
11. Surgic clinic cells
12. Health institute of anatomy
13. Medical clinic cells
14. Health institute of normal anatomy
15. Paddock



SMALL ANIMAL CLINIC

1. Porch
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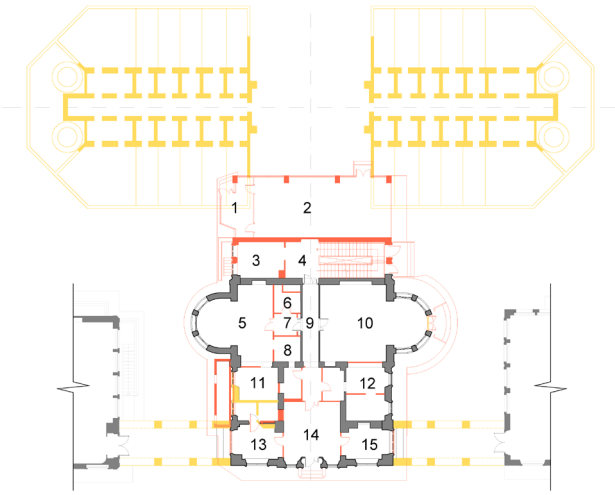
15. Paddock



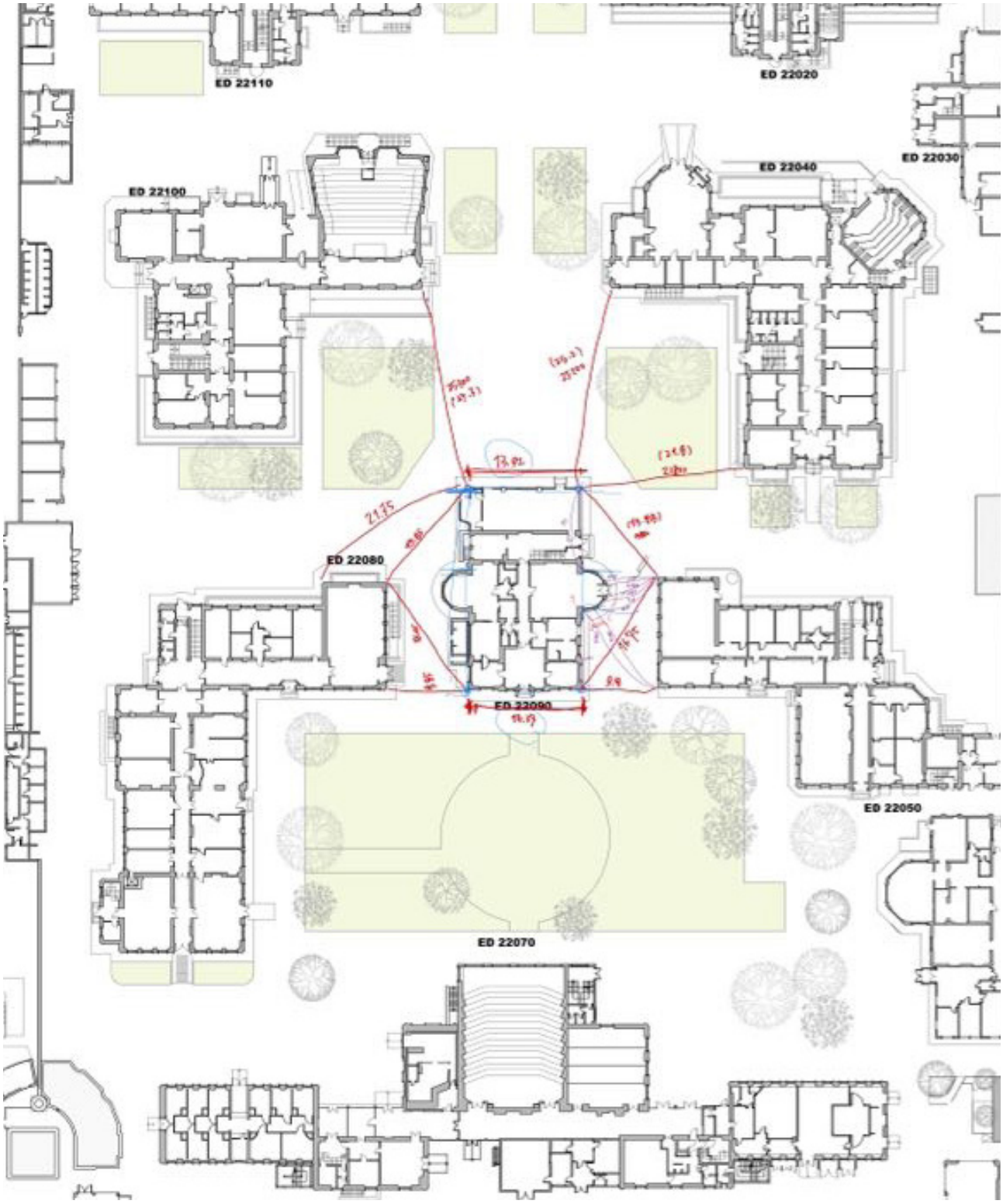
SMALL ANIMAL CLINIC

1. Hall Classroom
2. Classroom
3. Office
4. Hall
5. Lab 1
6. Storage
7. Hall
8. Toilet
9. Corridor
10. Office
11. Lab
12. Shared Office
13. Office
14. Hall / Entrance
15. Office

Geometrical Survey

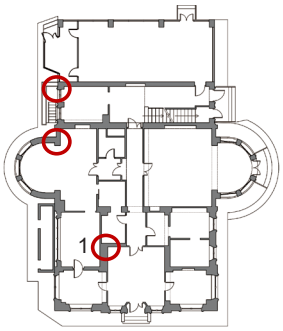
Site Survey

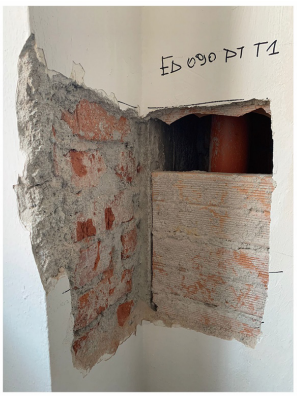
We used three methods for the site survey as team building 22090:
1- Polygonal survey of position on site
2- Dimension survey of outlines of the building
3- Survey of position of trees and plants

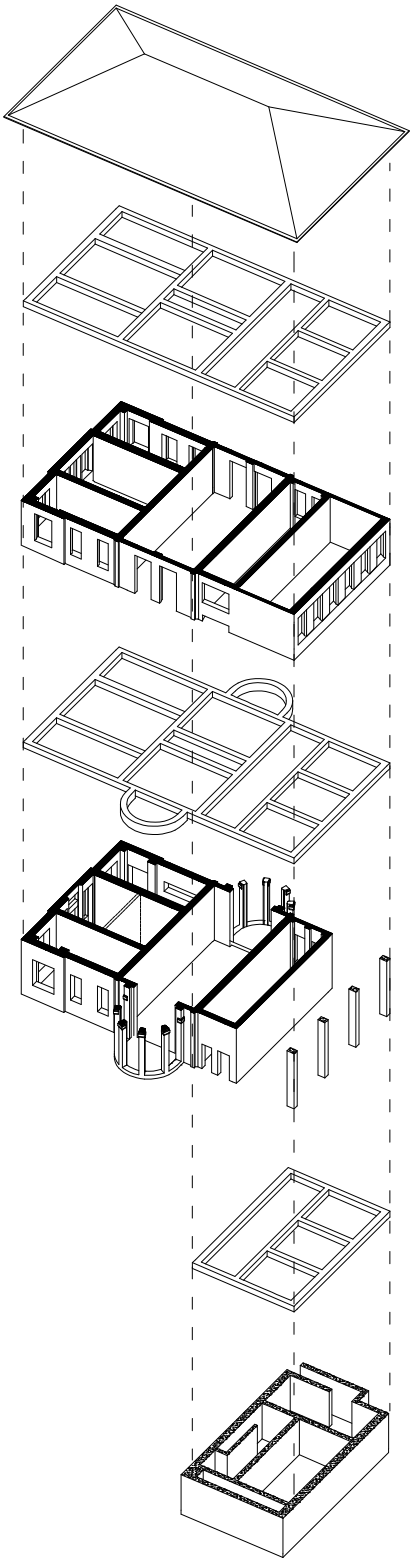


Structural Assumption

For the older part that does not have basement, which was built around 1949s, based on the historic technical drawings of the campus and the interior survey, we assumed it as brick walls and concrete beams structure, which is most popular since post-war construction in architecture. What's more, we discovered enough beams on the brick walls in interior survey, from the plan, it is obvious for brick walls and concrete beams as main structure for the whole building.
For the other part of the building that including a small basement constructed for technical and heating equipment which is also visible from interior and exterior (4 concrete columns) as reinforcement concrete structure in the next decades renovation of the two-storey building.







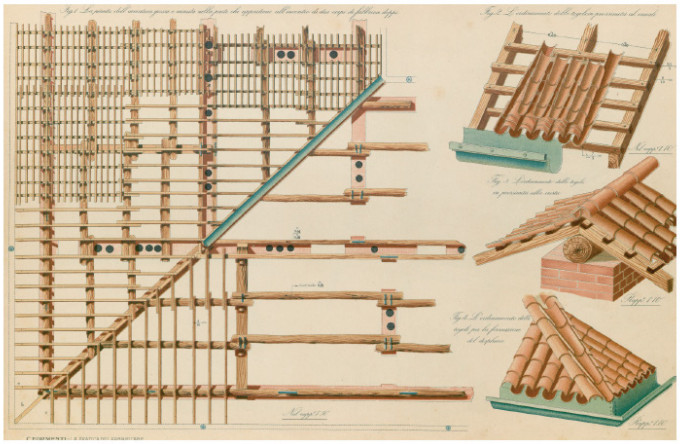
Building References

Brick detail

Refering to details of standard size of bircks (12cm*25cm*5.5cm) and hollow clay bricks (16cm*26cm*16cm), we compared with real dimensions of bricks at site and confirmed the basic dimensions as well as assumed this brick structure and hollow pot slab on concrete beam.

Foundation detail

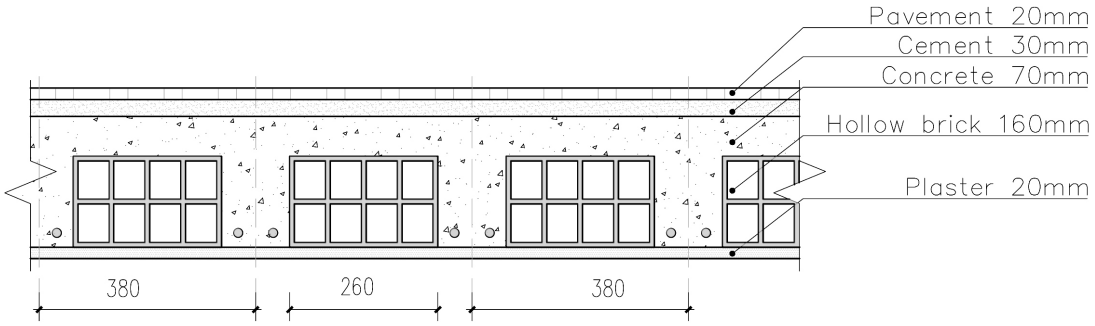
As for foundation part which we could not survey on site, in previous structure hypothesis and technical drawings of the campus, the reference with brick and concrete foundation detail would be more close to our assumption. And the thickness of mansory wall that connects with foundation is the same as reference.



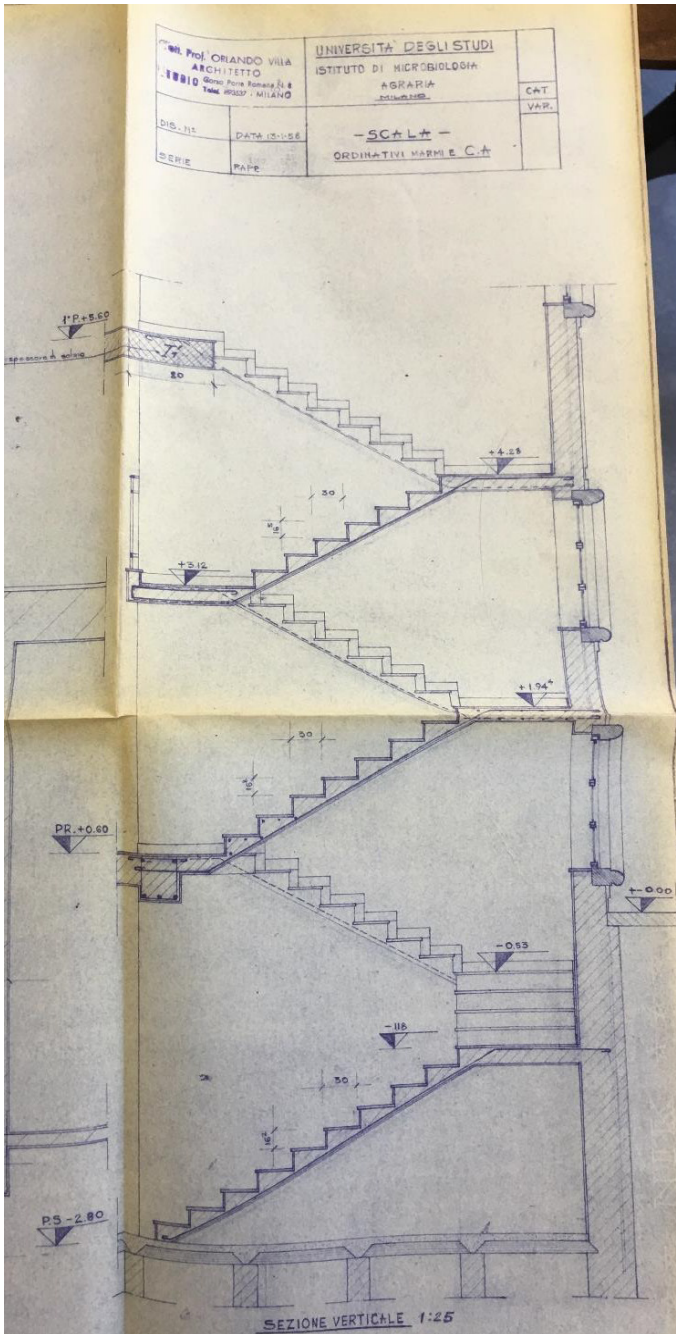
Roof detail

Roof with timber structure of existed building is another invisible part in the survey, which has a series of exact standard tradition including timber skeleton, two layers of tiles on the surface and metal drainage system that could be seen from exterior of the facades.

Building References



Slab detail

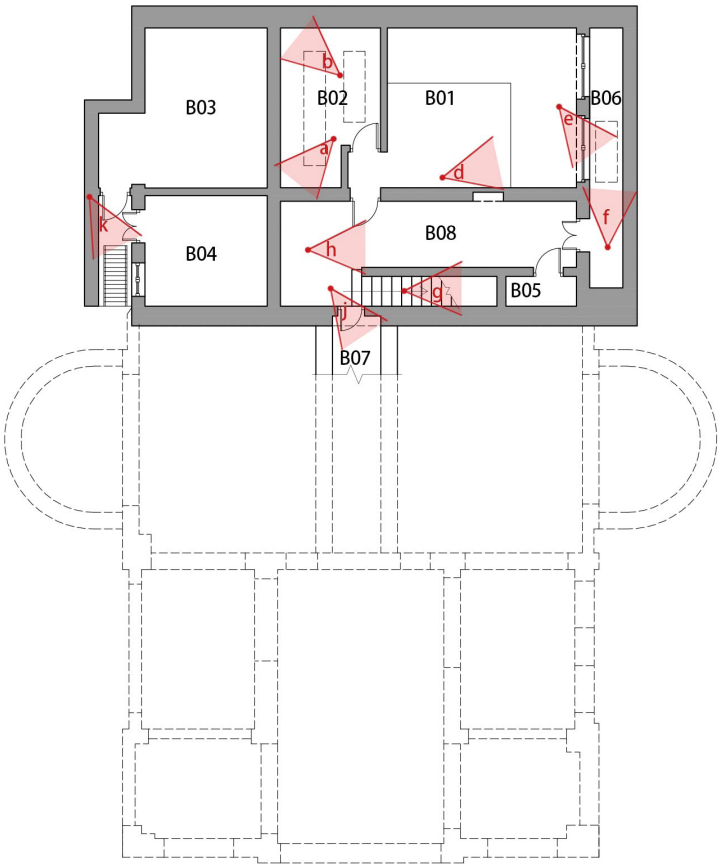


Staircase detail

In the reference, we found similar constructive technical drawings compared with photos of interior survey. This is a drawing of Agraria Campus which is the same construction techniques and building period with the building 22090. This reference is a clue for the survey section drawings.

Functional Brief

Underground Floor

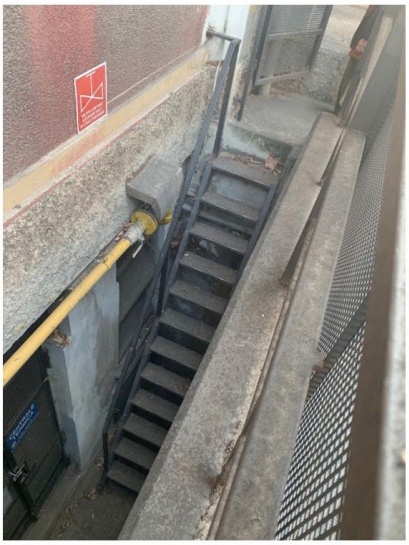


Room Name	Room Code	Function	Area (m2)
Room 1	B01	Machine Room	29,6
Room 2	B02	Machine Room	13,1
Room 3	B03	Technical Room	20,85
Room 4	B04	Thermal Power Station	12,6
Room 5	B05	Storage	1,9
Room 6	B06	Ventilation	8,65
Room 7	B07	Other	-
Corridor	B08	Transit space	20,5

Functional Brief

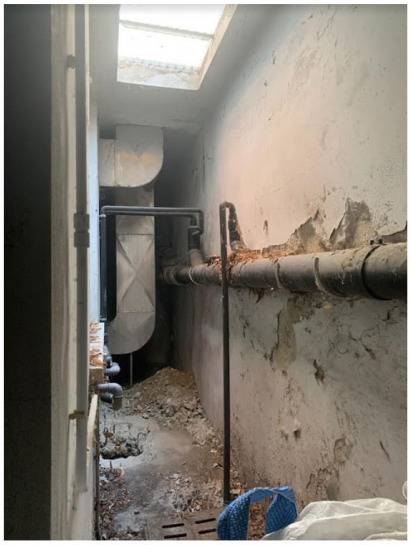
Underground Floor Photos

d. B01



k. Stairs

a. B02



f. B06

e. B06

h. B08

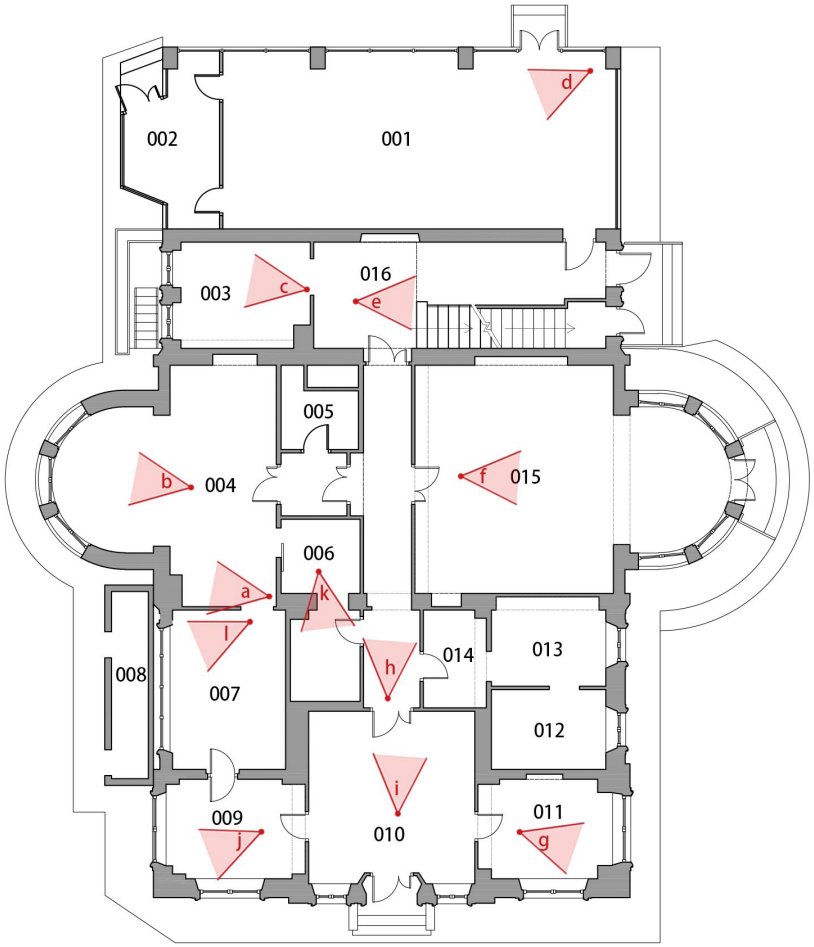
b. B02

j. B07

g. Stairs

Functional Brief

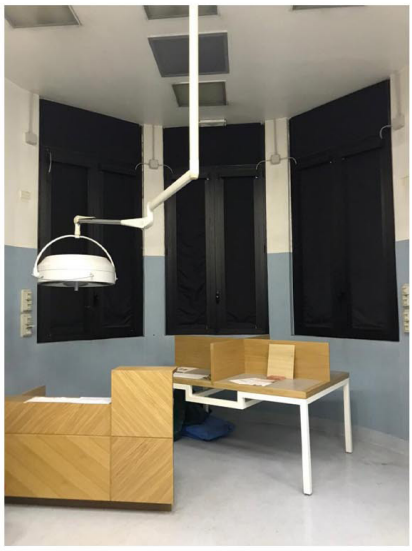
Ground Floor



Room Name	Room Code	Function	Area (m2)
Room 1	001	Classroom	62,25
Room 2	002	Hall	11,7
Room 3	003	Office	12,5
Room 4	004	Laboratory	35,9
Room 5	005	Storage	5,8
Room 6	006	Toilet	11,4
Room 7	007	Laboratory	16,6
Room 8	008	Technical Room	6,25
Room 9	009	Office	12,7
Room 10	010	Hall & Reception	26,05
Room 11	011	Office	12,5
Room 12	012	Shared Office	8,45
Room 13	013	Shared Office	9,6
Room 14	014	Storage	5,5
Room 15	015	Shared Office	53,85
Corridor	016	Transit space	48,75

Functional Brief

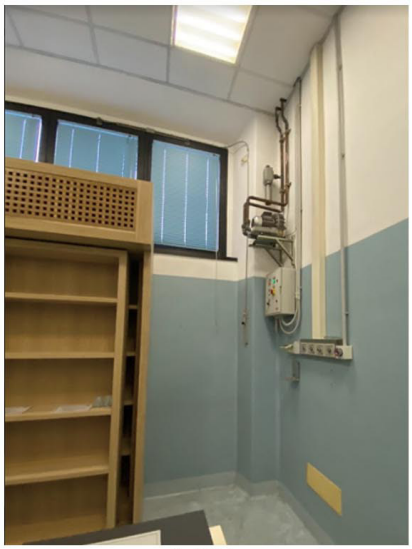
Ground Floor Photos



b. 004

d. 001

e.Stairs



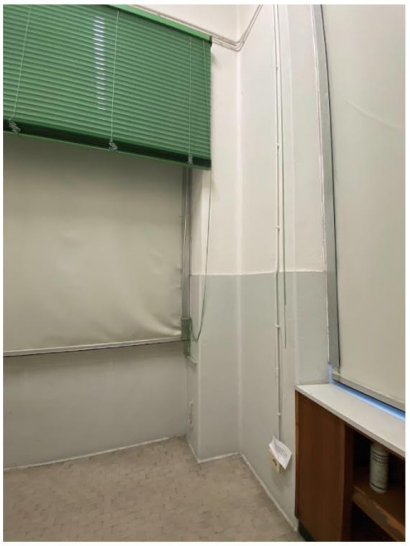
l. 007

c. 003

f. 015

i. 010

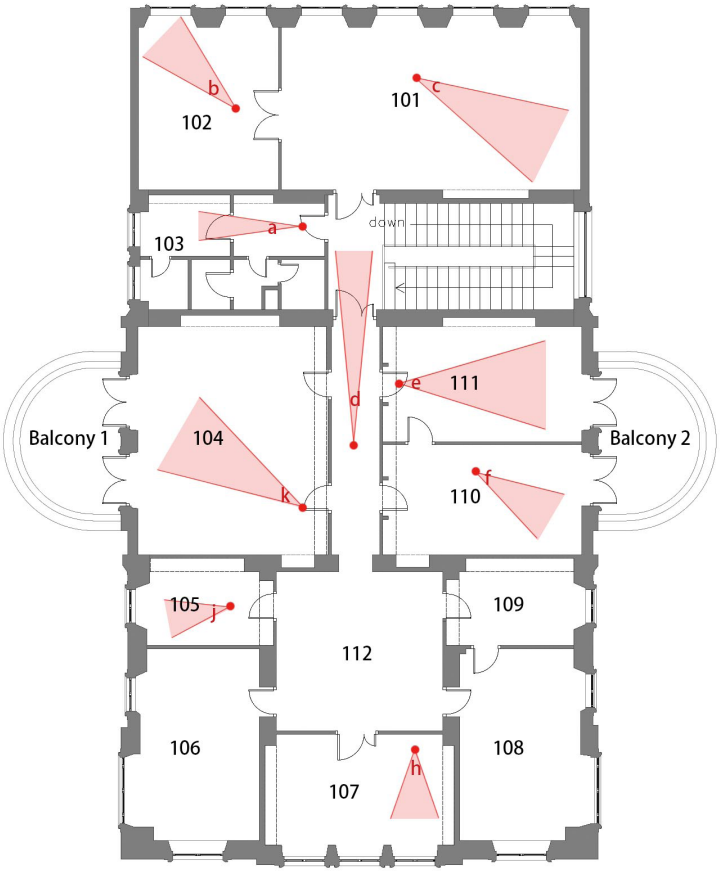
h. 016



g. 011

Functional Brief

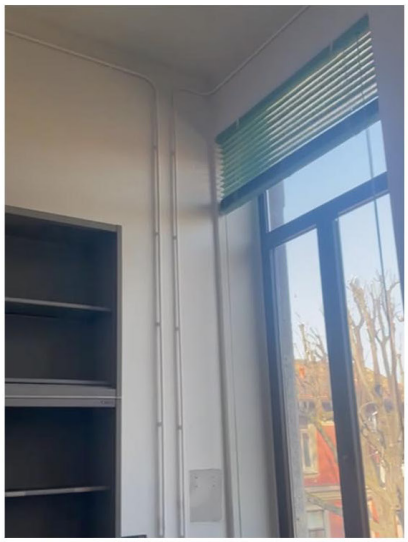
First Floor



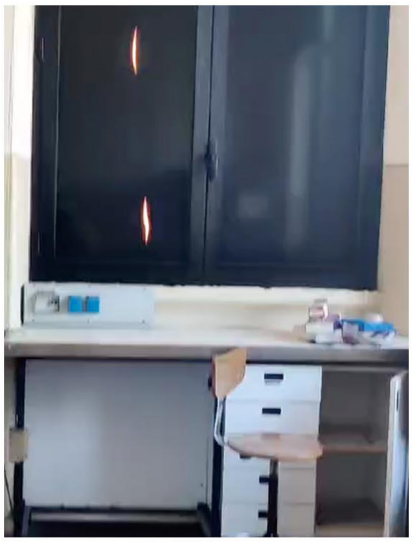
Room Name	Room Code	Function	Area (m2)
Room 1	101	Laboratory	46,75
Room 2	102	Laboratory	22,25
Room 3	103	Toilet	18,6
Room 4	104	Laboratory	41,4
Room 5	105	Office	9,85
Room 6	106	Laboratory	22,15
Room 7	107	Laboratory	20,23
Room 8	108	Shared Office	21,75
Room 9	109	Office	10,19
Room 10	110	Office	19,78
Room 11	111	Main Office	20,7
Balcony 1	112	Balcony	15,7
Balcony 2	113	Balcony	15,7
Corridor	114	Transit space	42

Functional Brief

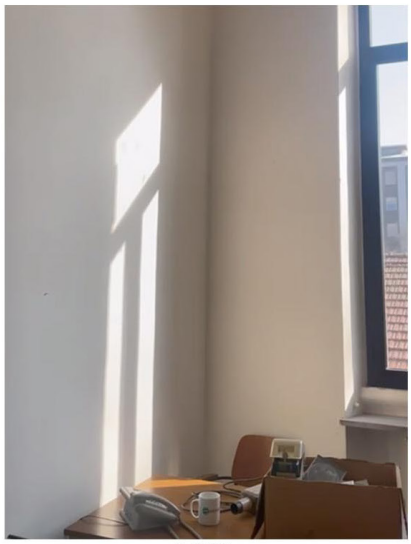
First Floor Photos



b. 102

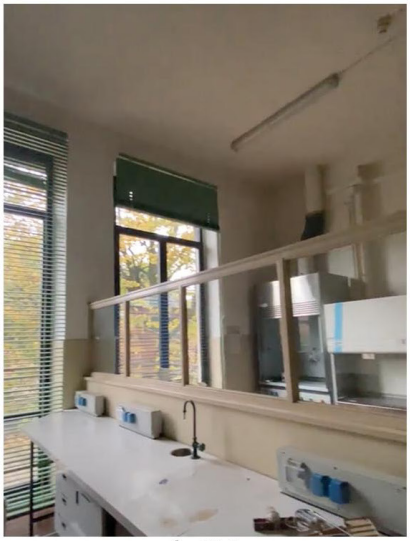


h. 107

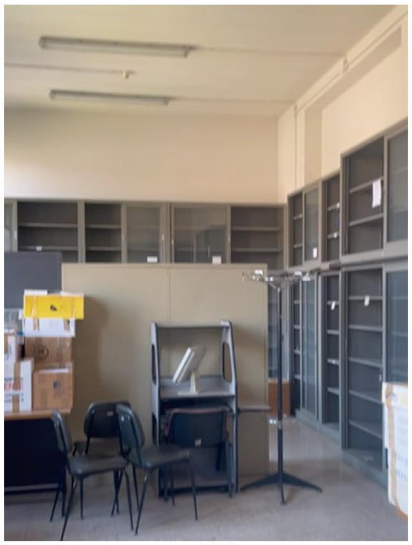


j. 105

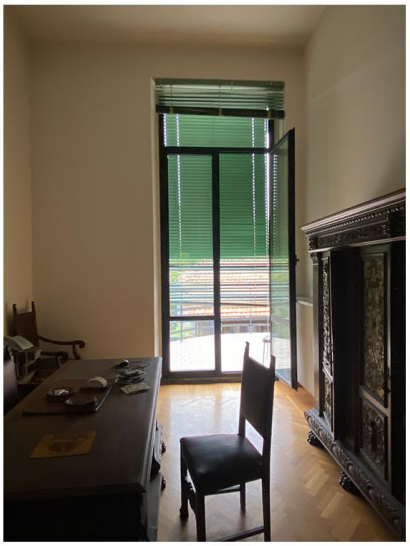
a. 103



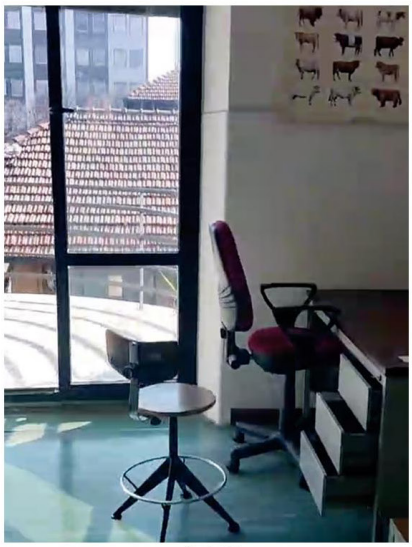
k. 104



c. 101



e. 111



f. 110

d. 112

Material and Deterioration

Material: plaster with red pigment
Decay type: discolouration
Decay reason: It is mainly caused by high humidity in atmosphere, especially in rainy days water would bring tiny dirt and color painting on the surface of plaster.

Material: decorative cement
Decay type: deposit
Decay reason: This decay could be caused by a series of complex mixtures, such as rainfall and dirt from air, tiny material losses from very surface of the cement.

Material: concrete
Decay type: biological colonization
Decay reason: This deterioration mainly caused by high humidity of environment and floating seeds in the air, lichen and mould are possible grow at same time and position.

Material: copper
Decay type: corrosion and oxidation
Decay reason: Metal corrodes when it reacts with another substance such as oxygen, hydrogen, an electrical current or even dirt and bacteria.

Material: artificial stone
Decay type: disintegration of artificial stone
Decay reason: Alternate wetting by rain and drying by sun causes internal stresses in the stones and consequent disintegration.

Material: mortar and plaster
Decay type: mechanical damage
Decay reason: This deterioration caused by renovation of ventilation or other equipment installment.

Material: mortar
Decay type: incompatible intervention (white painting)
Decay reason: This is human activities on the existing surface and the reason could be difficult to analysis, we can just assumed it ever experienced some dirty on the surface.

Material: mortar
Decay type: crack
Decay reason: Crack can caused by sudden temperature change and high humidity in air, gap between different materials during long periods after construction.

Material and Deterioration Survey

South Facade

North Facade

Materials

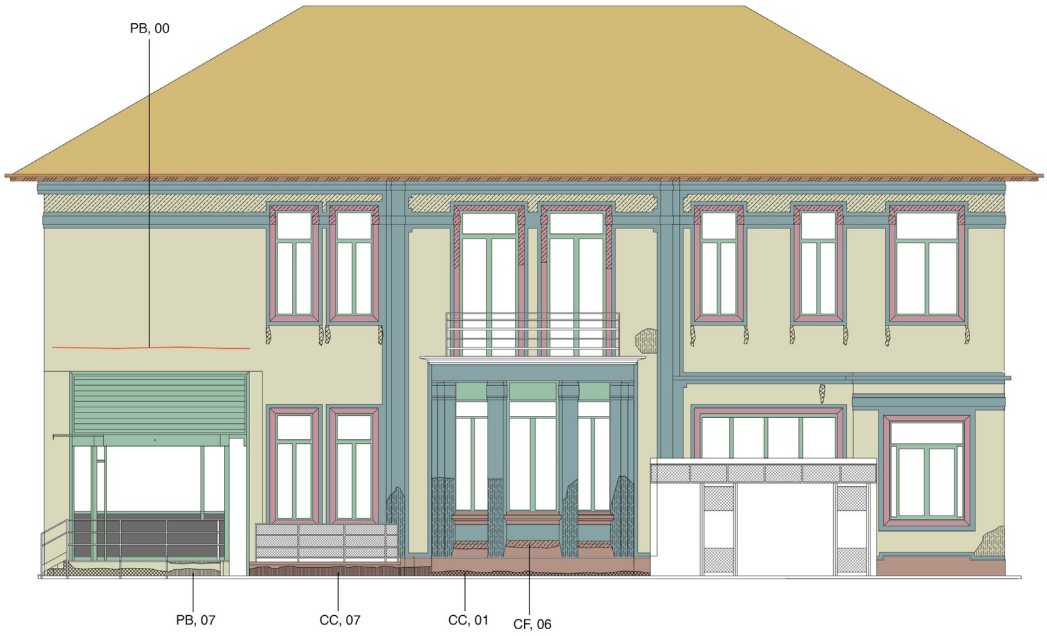
- G - glass
- S - stone steps
- B - brick tiles
- W - wood
- P - PVC
- PA - decorative plaster
- PB - plaster with red pigment
- C - decorative cement
- MA - metal (copper)
- A - metal (aluminum)
- CC - artificial stone (conglomerate)

Decays

- 00 - crack
- 01 - erosion
- 02 - disintegration
- 03 - peeling
- 04 - discoloration
- 05 - corrosion and oxidation
- 06 - deposit
- 07 - biological colonization
- 08 - incompatible intervention (white painting and cement)

Material and Deterioration Survey

West Facade



Materials

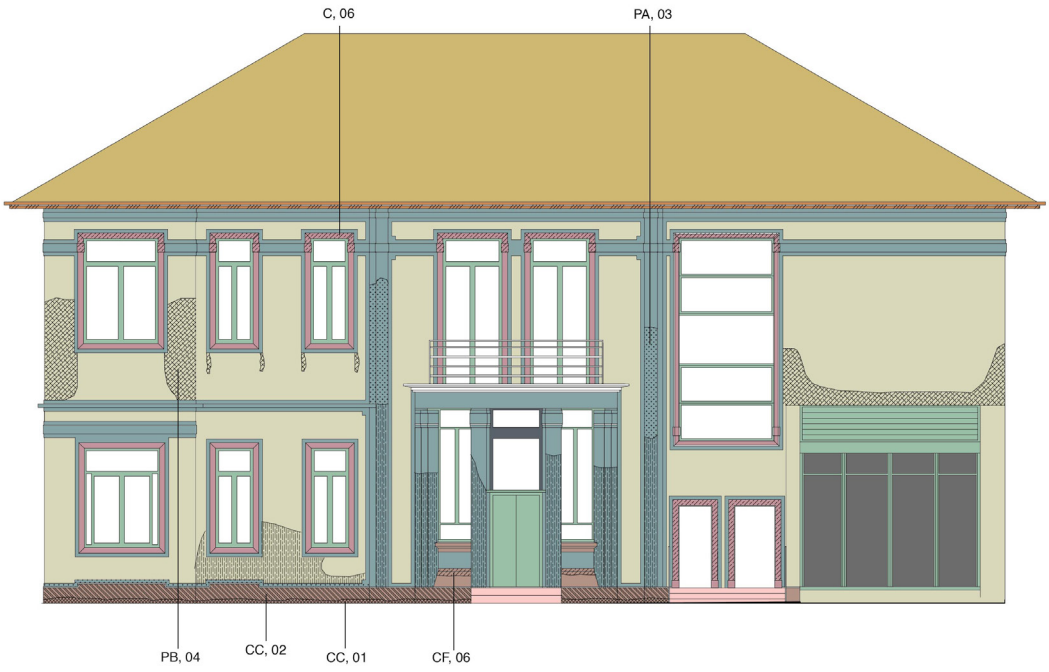
- G - glass
- S - stone steps
- B - brick tiles
- W - wood
- P - PVC
- PA - decorative plaster
- PB - plaster with red pigment
- C - decorative cement
- MA - metal (copper)
- A - metal (aluminum)
- CC - artificial stone (conglomerate)

Decays

- 00 - crack
- 01 - erosion
- 02 - disintegration
- 03 - peeling
- 04 - discoloration
- 05 - corrosion and oxidation
- 06 - deposit
- 07 - biological colonization
- 08 - incompatible intervention (white painting and cement)

Material and Deterioration Survey

East Facade



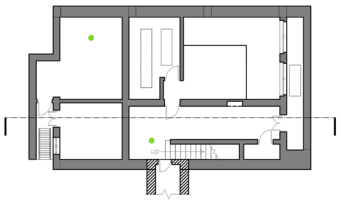
Materials

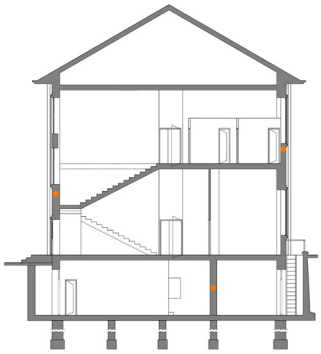
- G - glass
- S - stone steps
- B - brick tiles
- W - wood
- P - PVC
- PA - decorative plaster
- PB - plaster with red pigment
- C - decorative cement
- MA - metal (copper)
- A - metal (aluminum)
- CC - artificial stone (conglomerate)

Decays

- 00 - crack
- 01 - erosion
- 02 - disintegration
- 03 - peeling
- 04 - discoloration
- 05 - corrosion and oxidation
- 06 - deposit
- 07 - biological colonization
- 08 - incompatible intervention (white painting and cement)

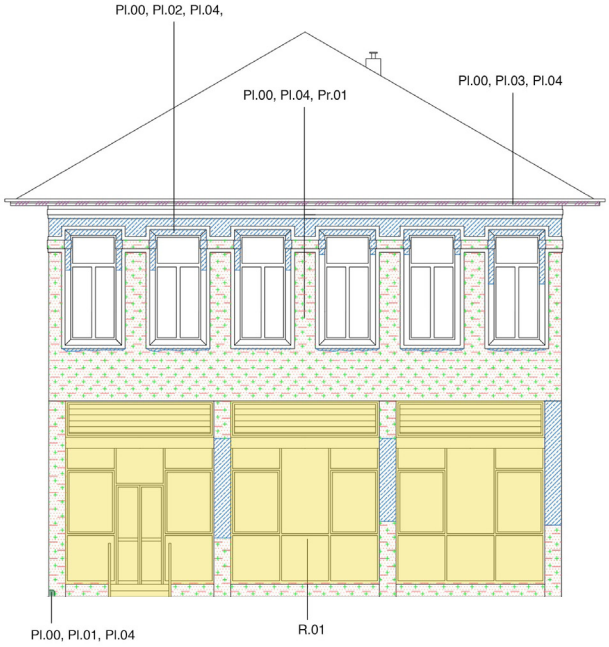
The Design





Diagnostic

- stratigraphy of the plaster
- test of the plaster composition
- georadar of the foundation
- endoscopy of the masonry walls



Conservation

PHASE 1

Removal

- R.01 - demolitions

Cleaning

- Pl.00 - dry cleaning
- Pl.01 - cleaning with bioxide products
- Pl.02 - cleaning with wrap of absorbent clay
- Pl.03 - cleaning with chemical products

PHASE 2

- Pl.04 - cleaning with deionized nebulized water at low pressure

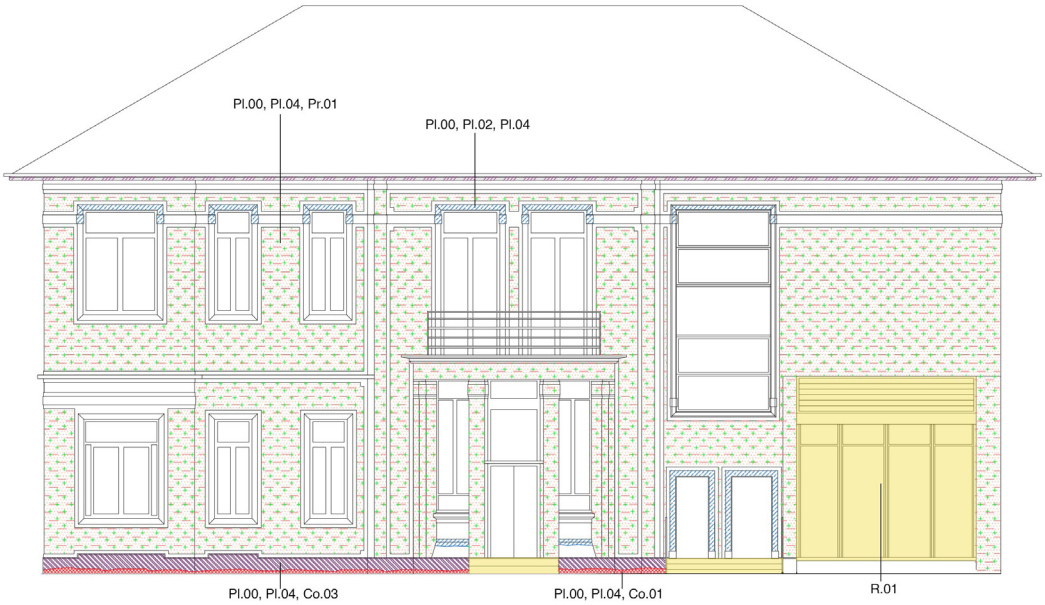
Consolidation

- Co.01 - consolidation with ethyl silicate
- Co.02 - micro surface consolidation
- Co.03 - addition - integration of the missing parts

Protection

- Pr.01 - final finishing to reduce chromatic differences

Conservation Project



Conservation

PHASE 1

Removal

- R.01 - demolitions

Cleaning

- Pl.00 - dry cleaning
- Pl.01 - cleaning with bioxide products
- Pl.02 - cleaning with wrap of absorbent clay
- Pl.03 - cleaning with chemical products

PHASE 2

- Pl.04 - cleaning with deionized nebulized water at low pressure

Consolidation

- Co.01 - consolidation with ethyl silicate
- Co.02 - micro surface consolidation
- Co.03 - addition - integration of the missing parts

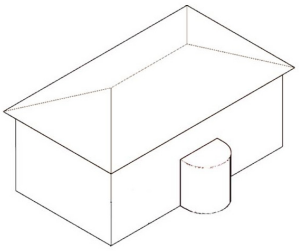
Protection

- Pr.01 - final finishing to reduce chromatic differences

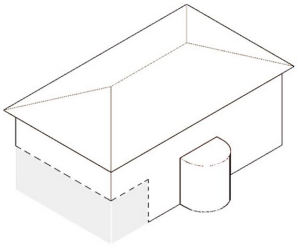
Concept

Massing Diagram

1 Existing state



2 Demolition of incompatible intervention



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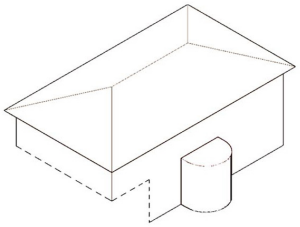
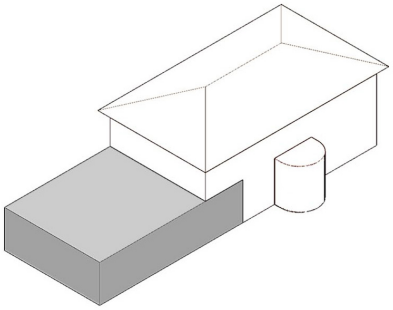
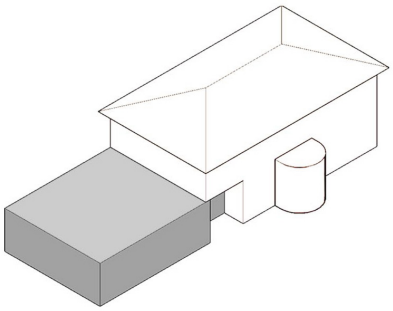


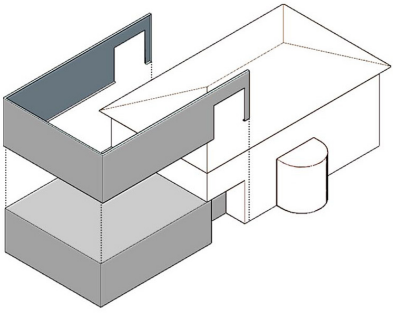
4 New addition



5 Pushing back the main entrances at the intersection of old and new buildings



6 The skin of the new addition



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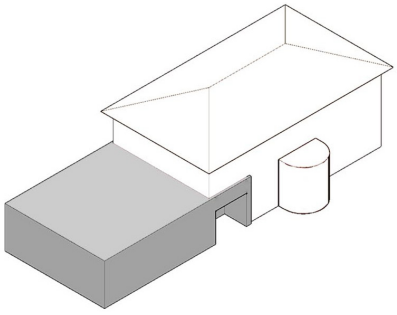
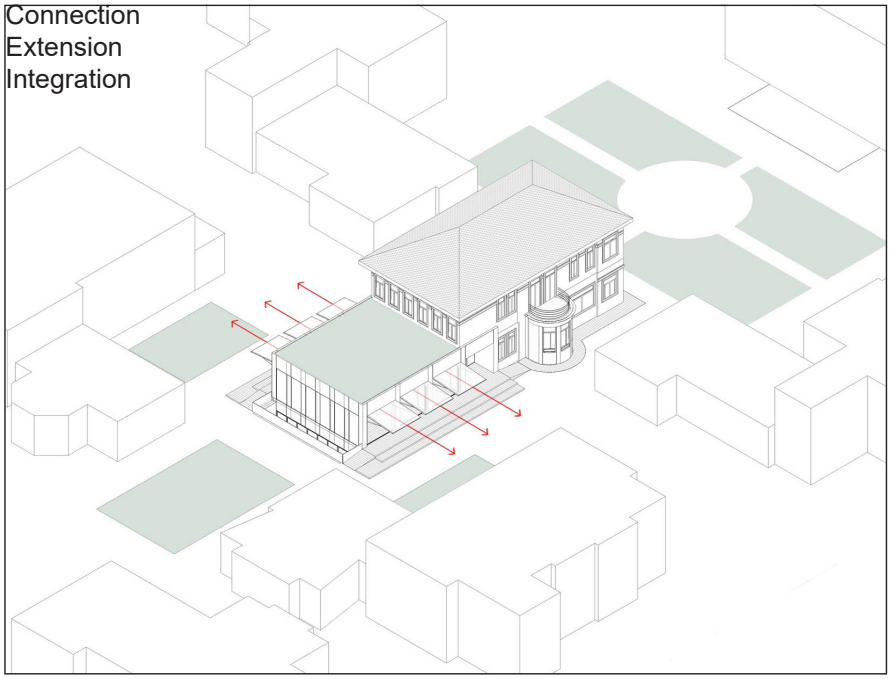
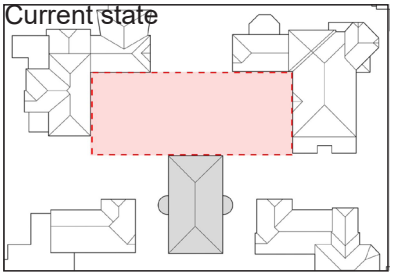
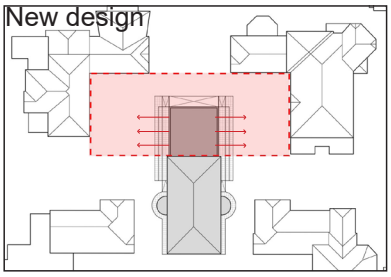


Concept





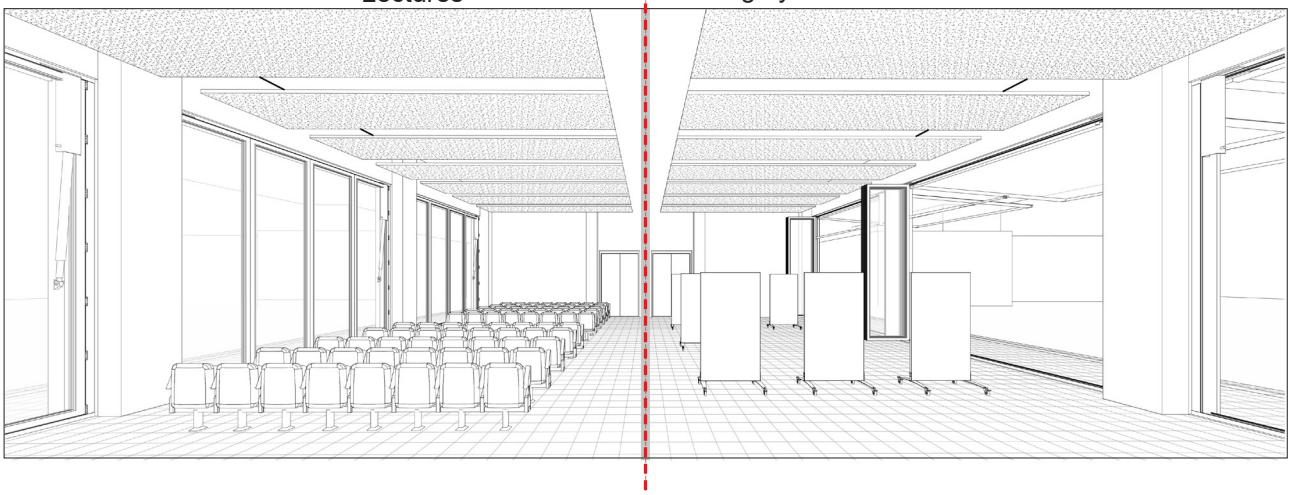
Preserving the integrity of the square in the center of the campus



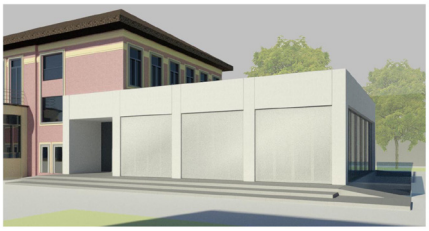
Multifunctional Space

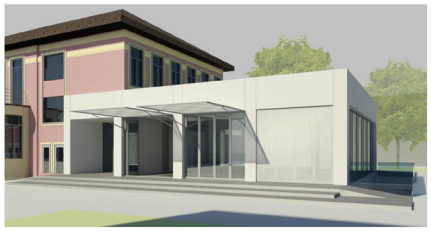
Ordinary functions:
Lecture hall
Lessons
Lectures

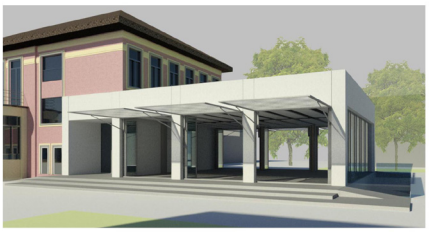
Other functions:
Exhibition hall
Seminars
Campus events
Research presentations
Integrity with the exterior



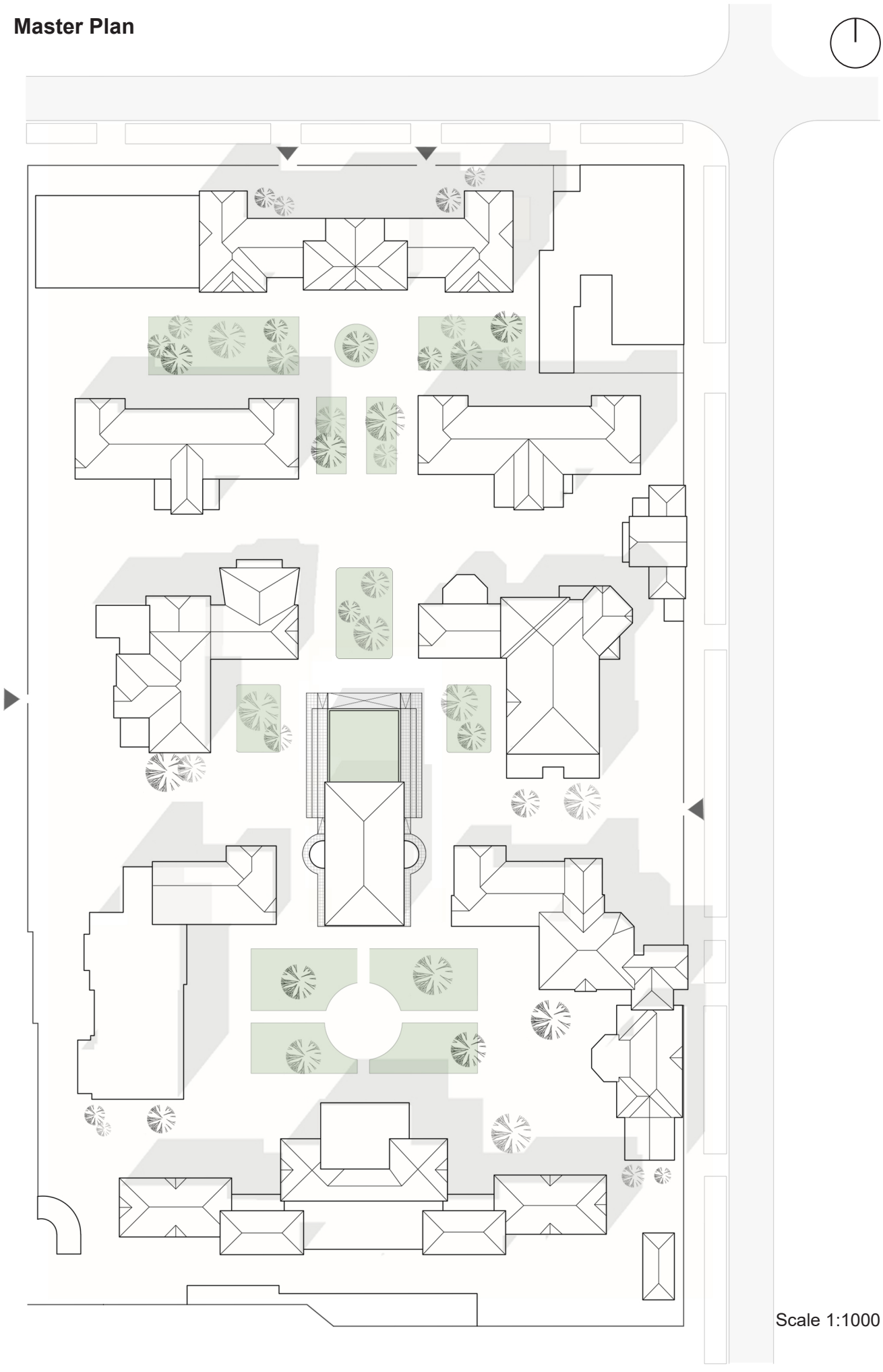
Different States





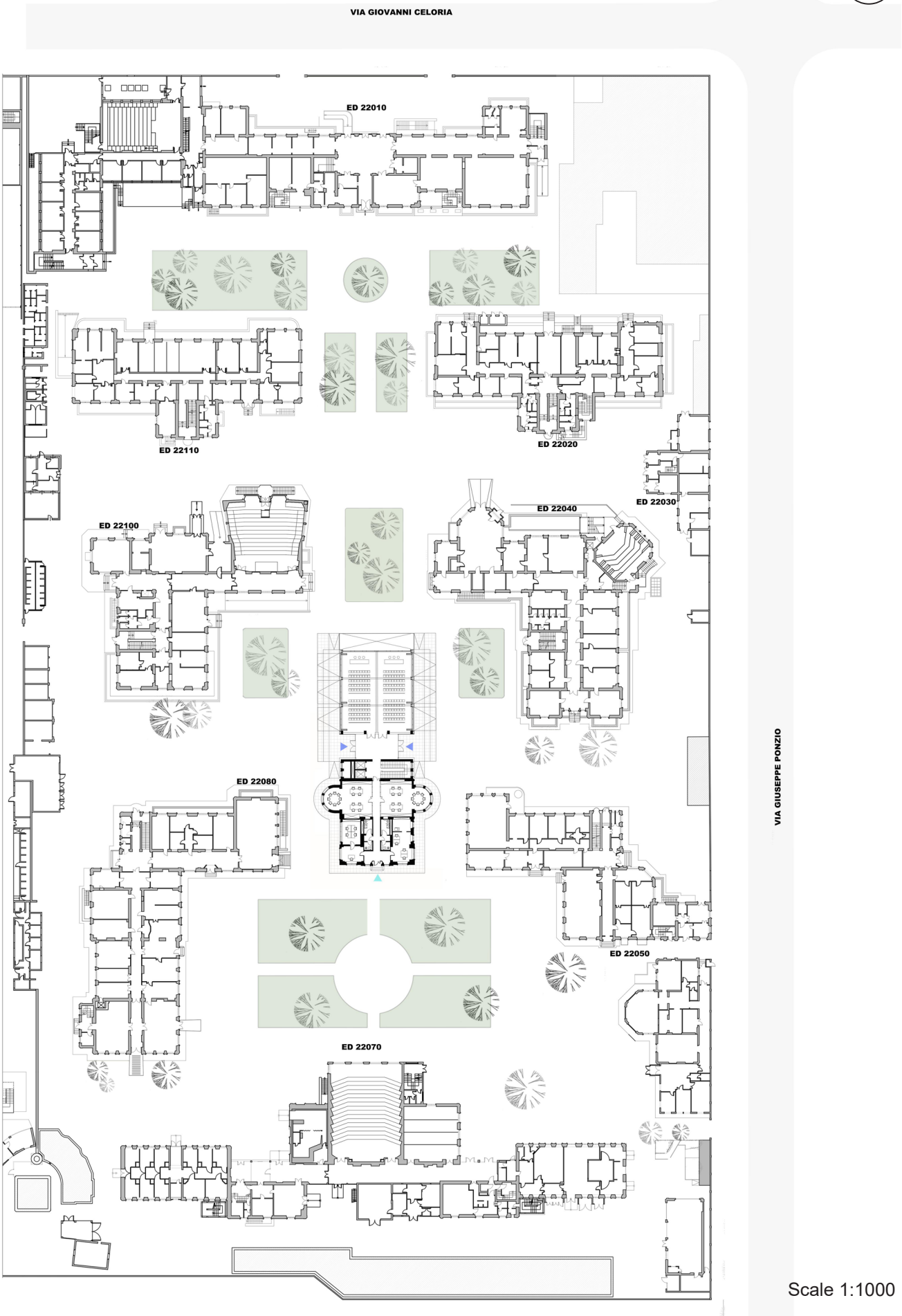


Master Plan



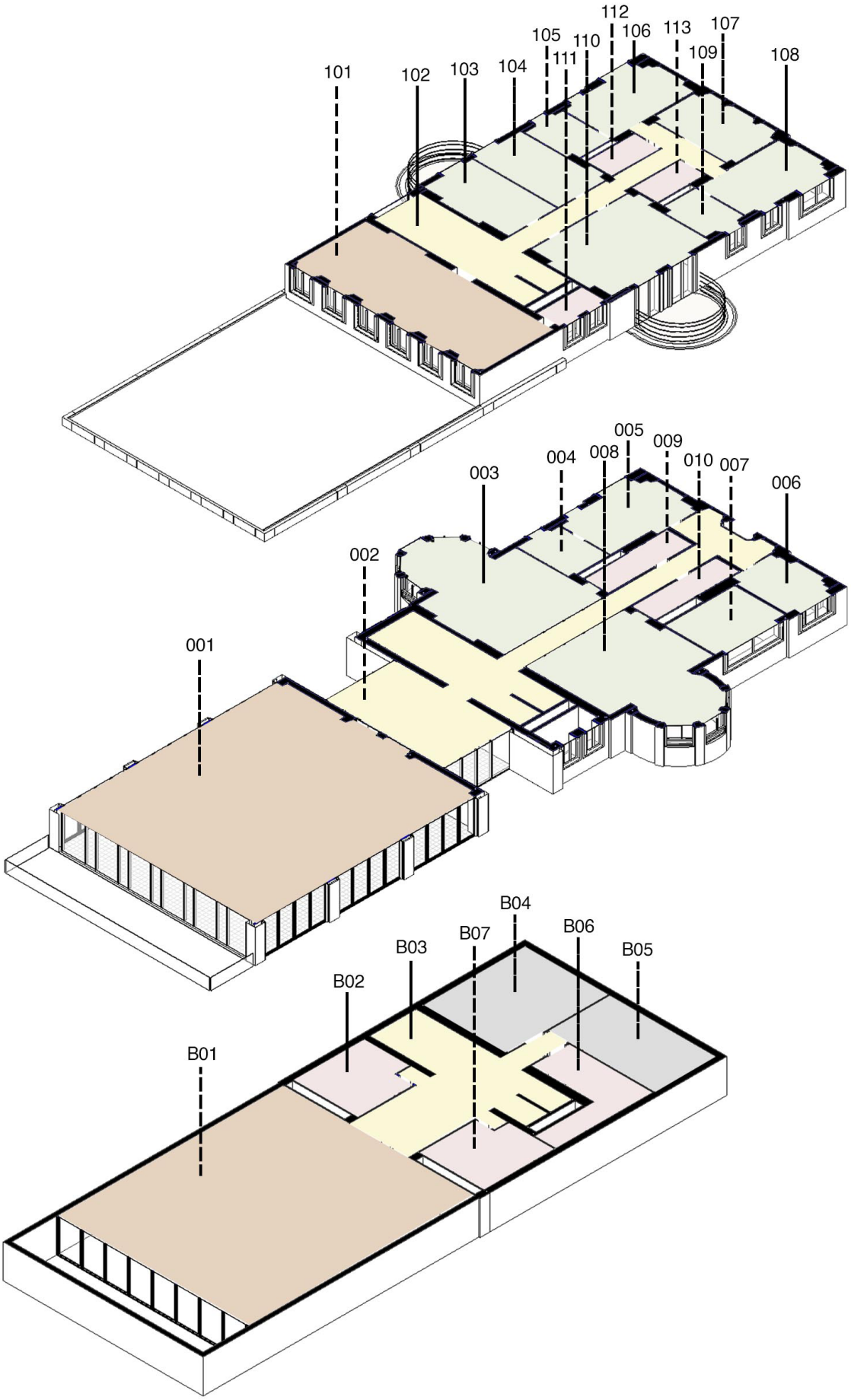
Scale 1:1000

Groundfloor Plan



Scale 1:1000

Functional Distribution

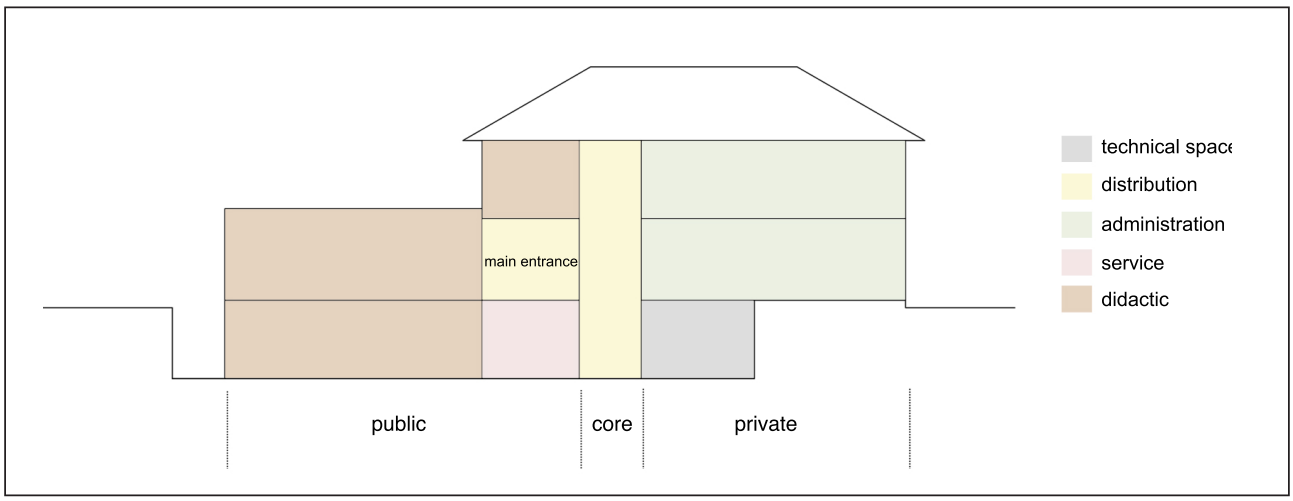


Functional Distribution

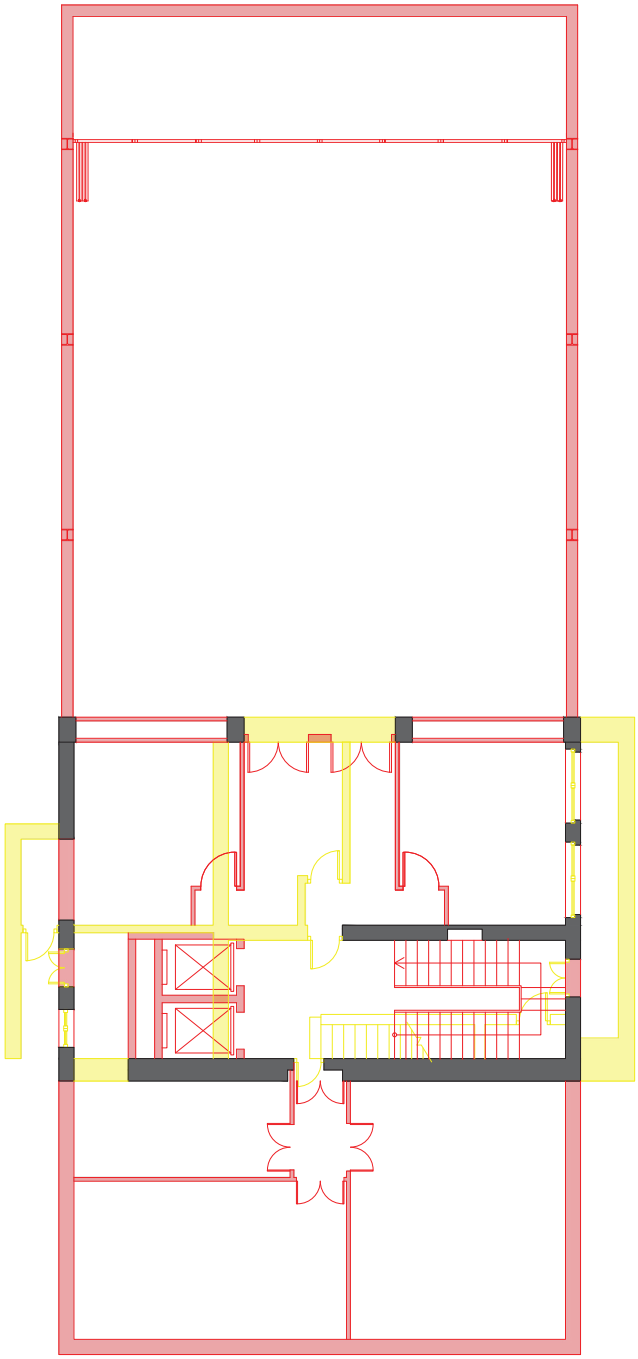
The areas on the ground floor and on the underground floor were designed according to the square meters requested in the program. While planning the functional distribution, I paid attention to the distinction between public and private. While the public areas are open to the use of students, I designed the private areas for the use of professors, researchers and staff. Between public and private areas, I preserved the existing staircase and added two elevators.

Level	Department	Area (m2)
Basement		
	Didactic	198
	Service space	59.85
	Technical space	68.55
	Distribution	61.1
	Total area	**387.5**
Ground floor		
	Didactic	210
	Service space	18.6
	Administration	162.78
	Distribution	103.77
	Total area	**495.15**
First floor		
	Didactic	68.8
	Service space	17.12
	Administration	164.54
	Distribution	55.1
	Total area	**305.56**

Room code	Function	Area (m2)
101	Laboratory	68.8
102	Distribution	55.1
103	Office	21.27
104	Office	21.27
105	Print room	9.24
106	Office	21.36
107	Office	20.38
108	Office	20.95
109	Print room	9.1
110	Office	40.97
111	Storage	5.2
112	Wc	5.96
113	Wc	5.96
001	Classroom	210
002	Distribution	103.77
003	Office	52.7
004	Print room	7.9
005	Office	20.84
006	Office	12.34
007	Office	16.3
008	Office	52.7
009	Wc	9.3
010	Wc	9.3
B01	Classroom	198
B02	Wc	19.8
B03	Distribution	61.1
B04	Technical room	38.8
B05	Technical room	29.75
B06	Storage	20.25
B07	Wc	19.8

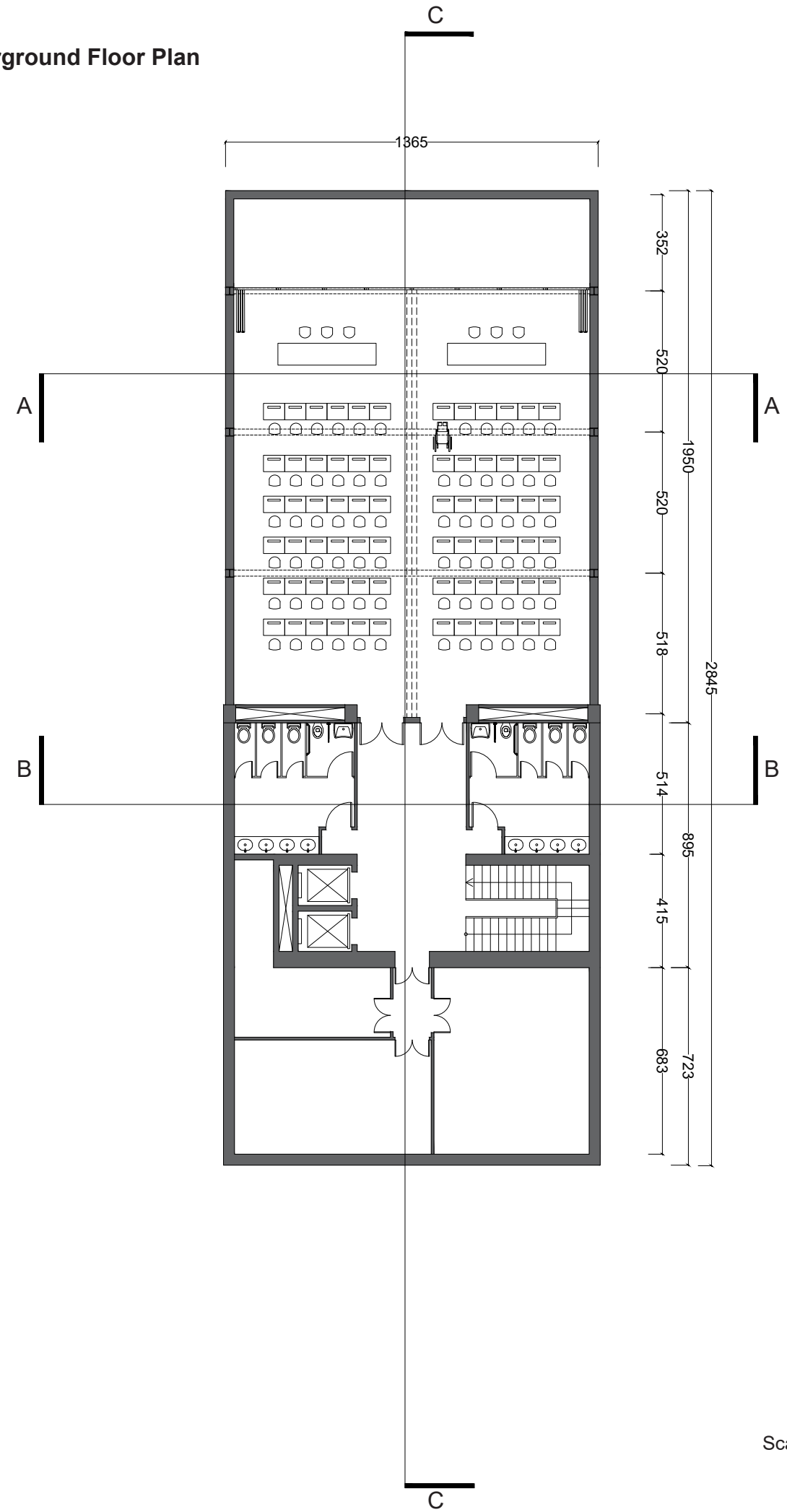


Underground Floor Plan



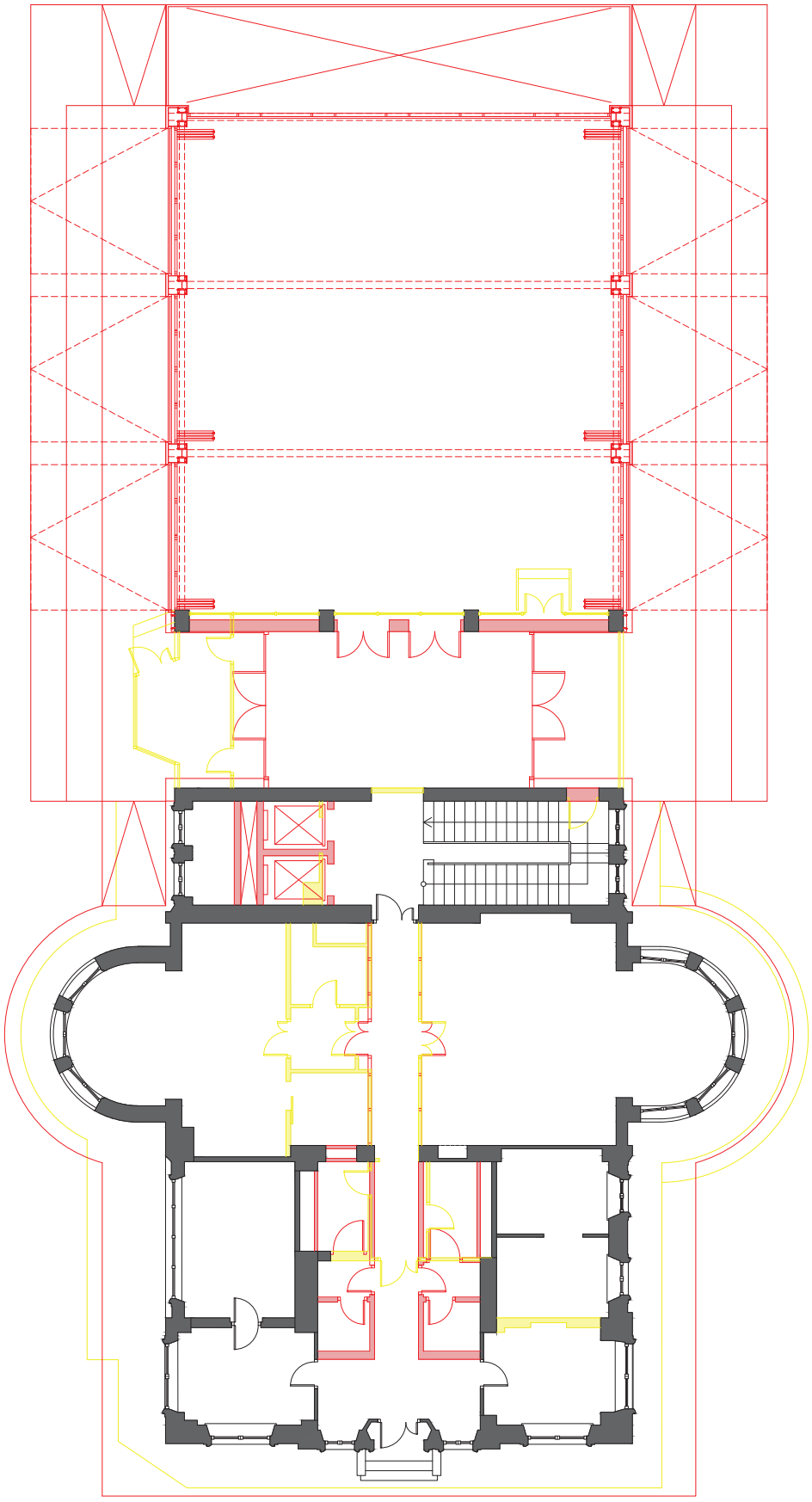
Scale 1:200

Underground Floor Plan



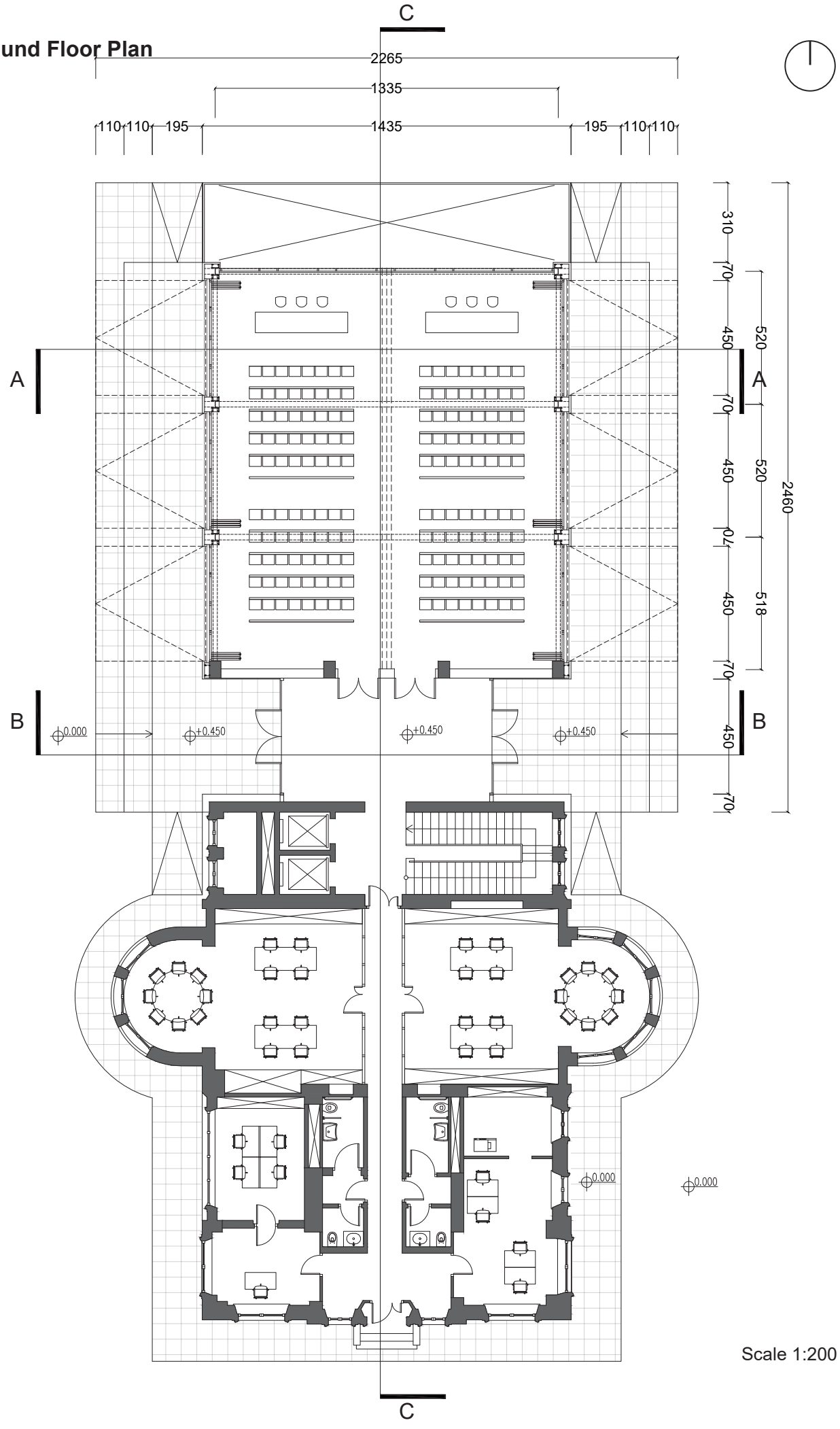
Scale 1:200

Ground Floor Plan



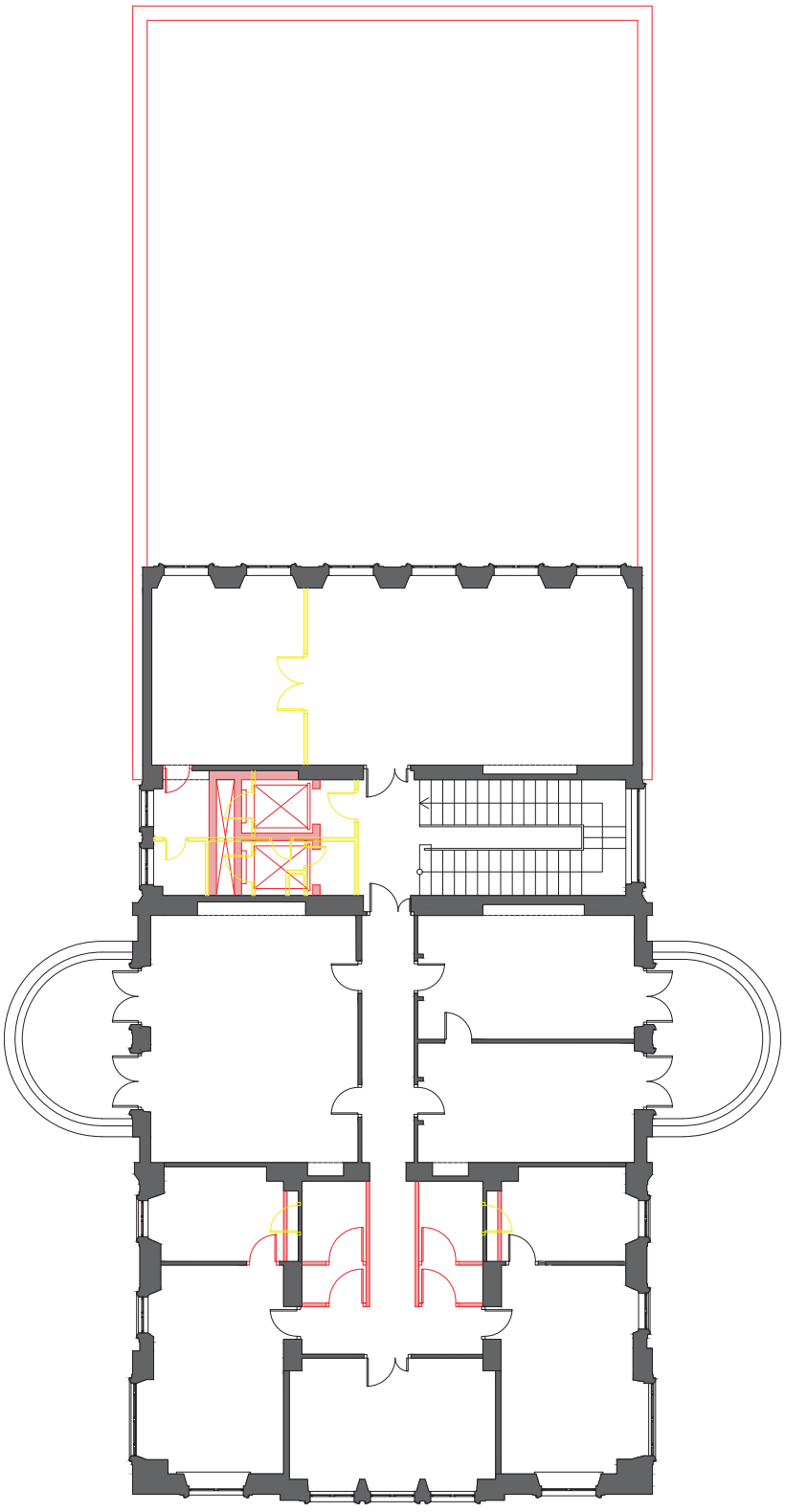
Scale 1:200

Ground Floor Plan



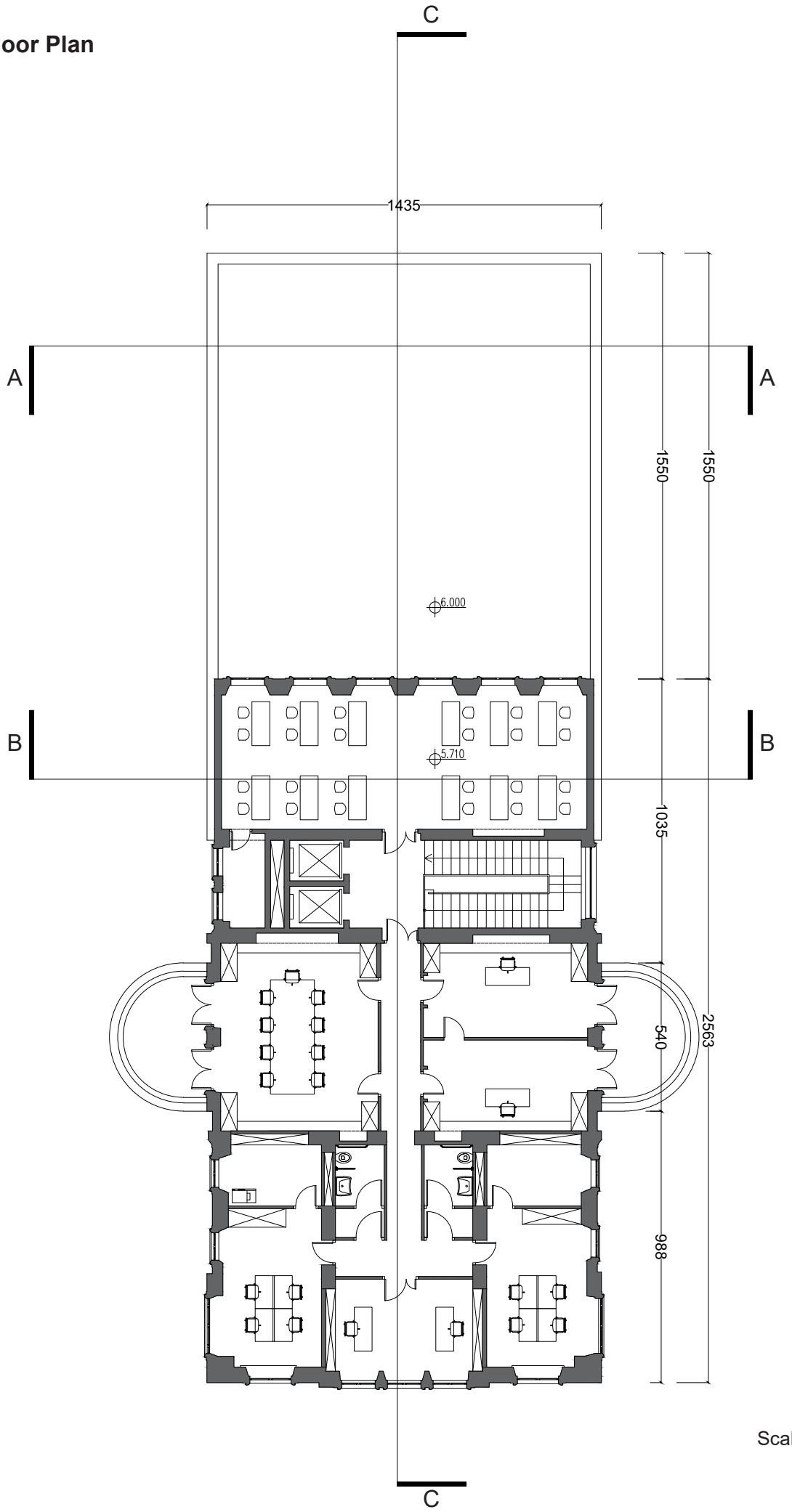
Scale 1:200

First Floor Plan



Scale 1:200

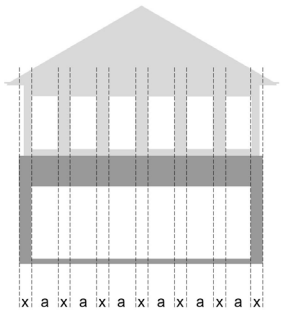
First Floor Plan



Scale 1:200

Elevations

North elevation of the new addition has the same rhythm as the original north facade of existing building. North facade of new addition designed more transparent to benefit from sunlight maximum.Old facade was made of plaster and masonry structure. We could see compatible and harmoneous feeling from the north elevation, also comparison between the old material and new material where it has created an interesting dialog over 100 years' development.



North Elevation

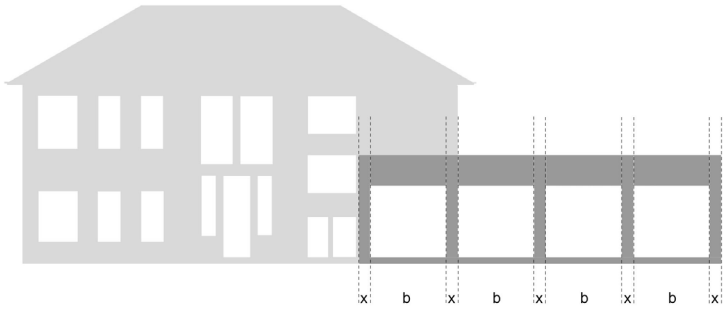
Scale 1:300

South Elevation

Scale 1:300

Elevations

From west and east elevation, we could obviously recognise the preserved part and new addition part of the building 22090. Also, similar rhythm of north elevation was preserved. By pushing the main entrance hall back from the building boundary, both a waiting area for the entrance was provided and the entrance was emphasized. The clear design of the new facade respects to the host building.



West Elevation

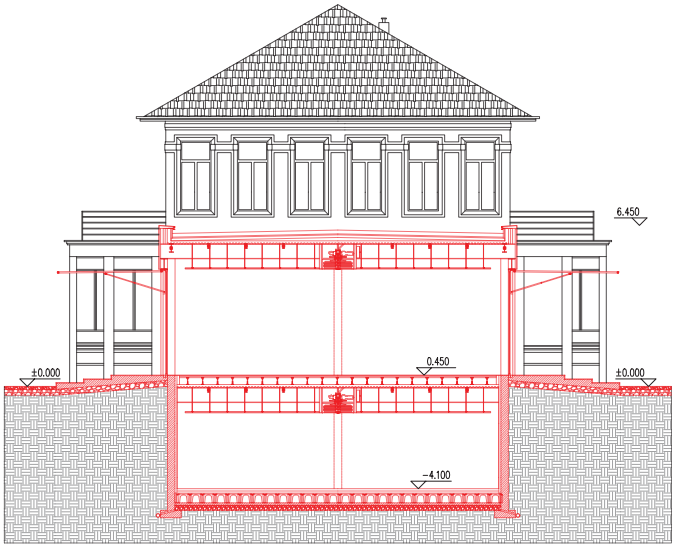
Scale 1:300

East Elevation

Scale 1:300

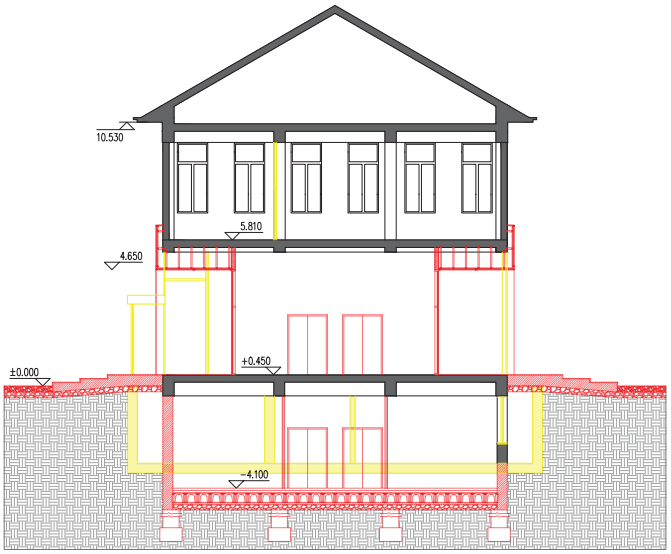
Sections

A - A Section

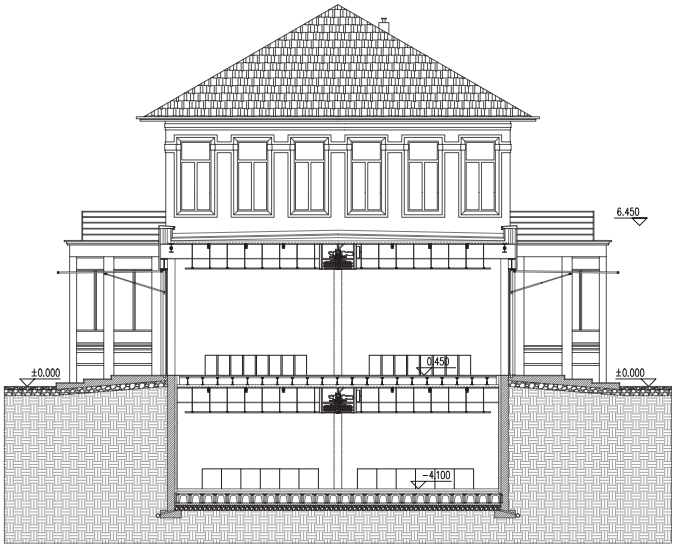


Scale 1:300

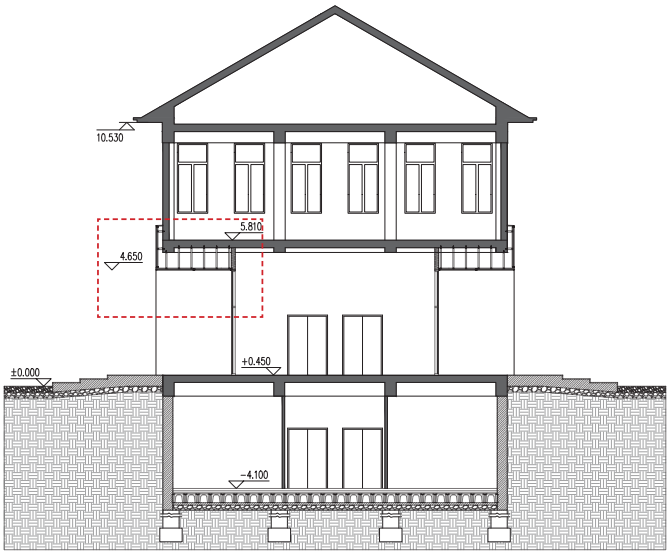
B - B Section



Scale 1:300



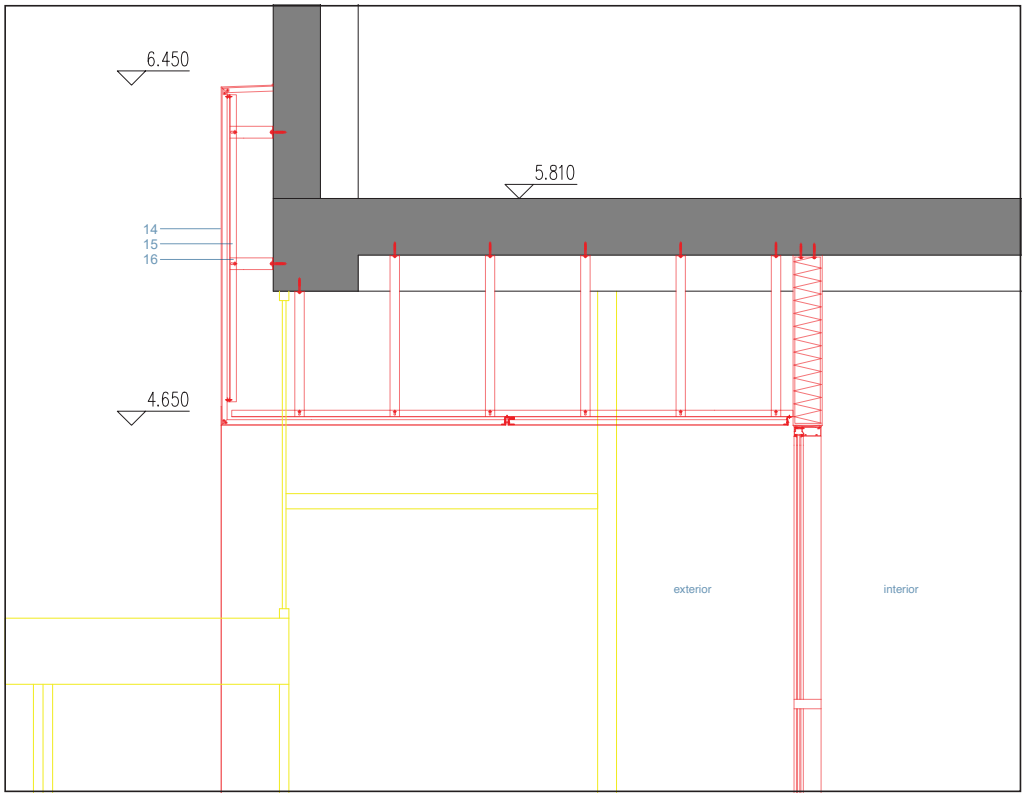
Scale 1:300



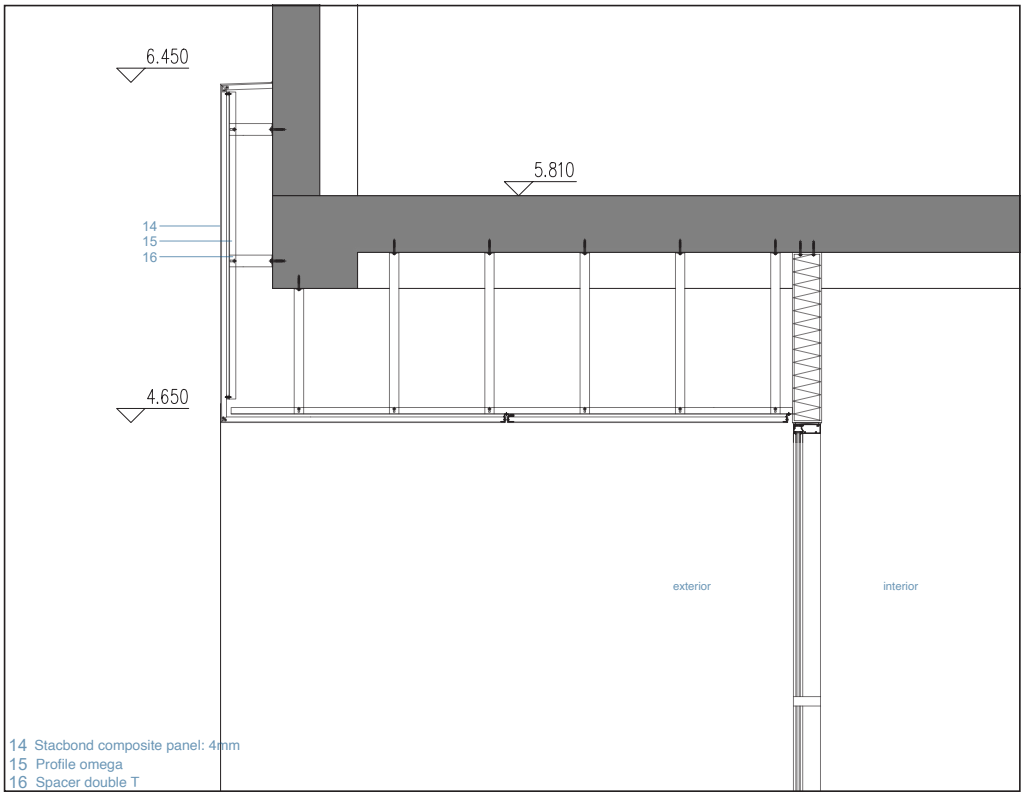
Scale 1:300

Sections

Detail



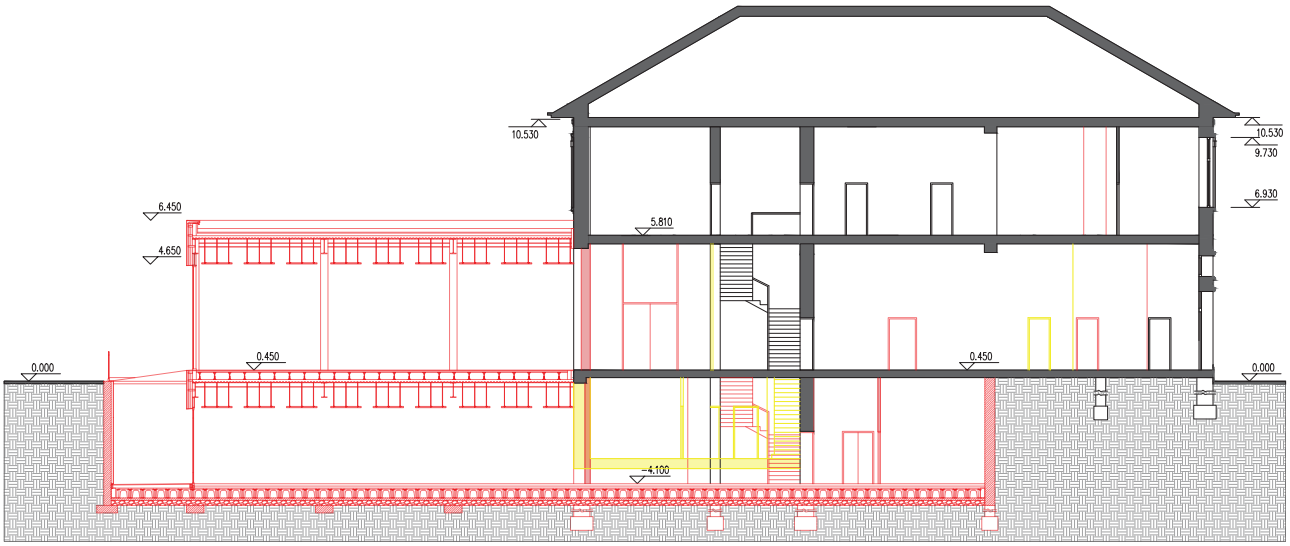
Scale 1:40



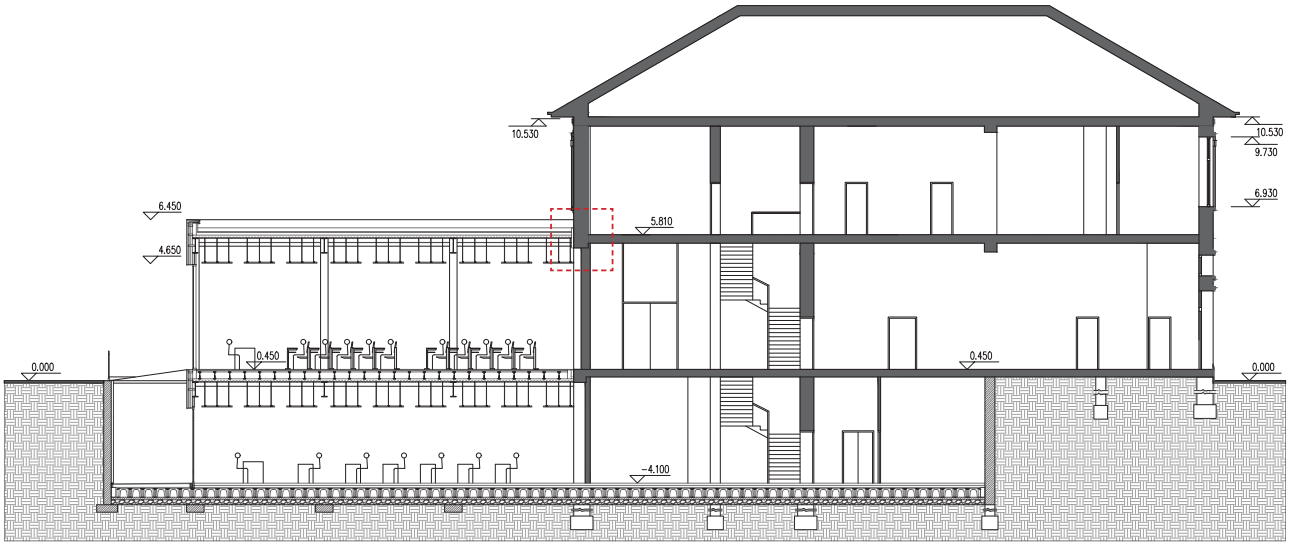
Scale 1:40

Sections

C - C Section



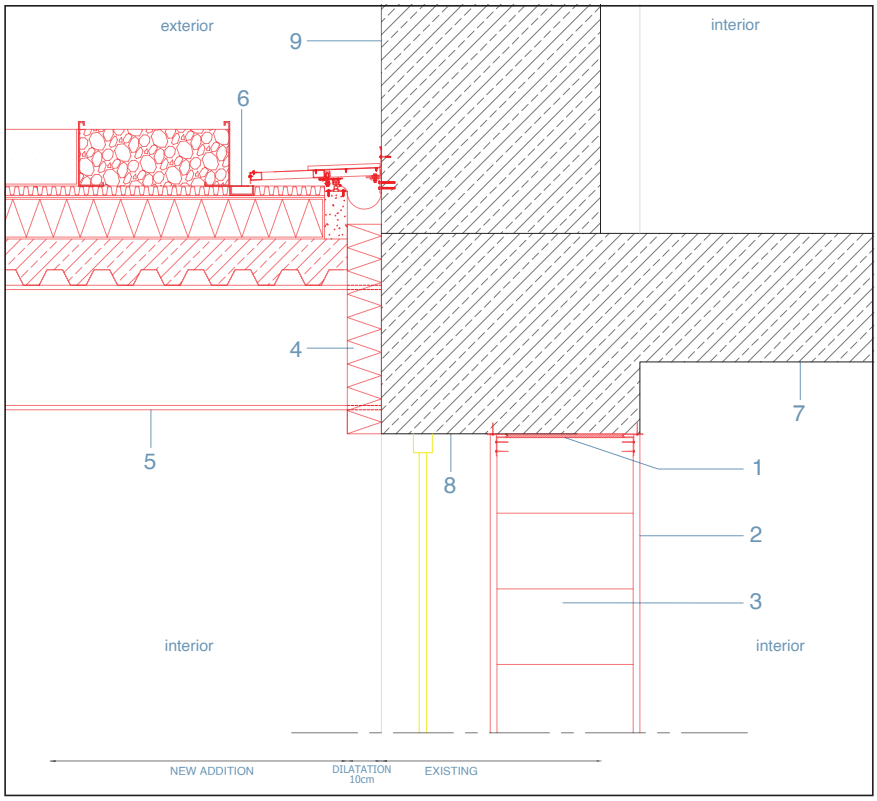
Scale 1:300



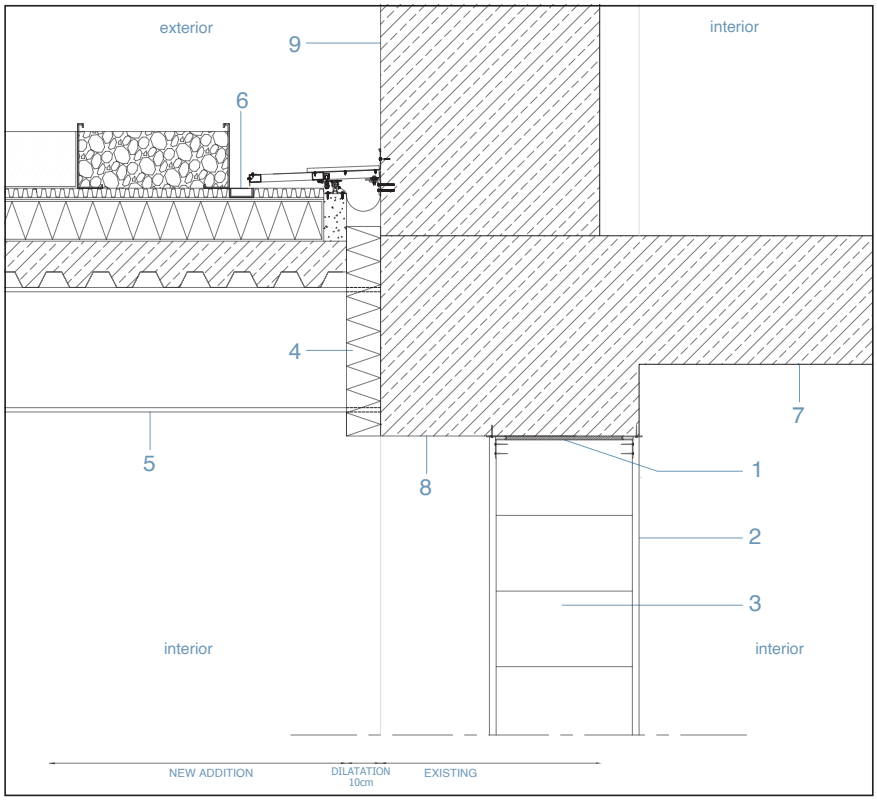
Scale 1:300

Sections

Roof Connection Detail



Scale 1:20

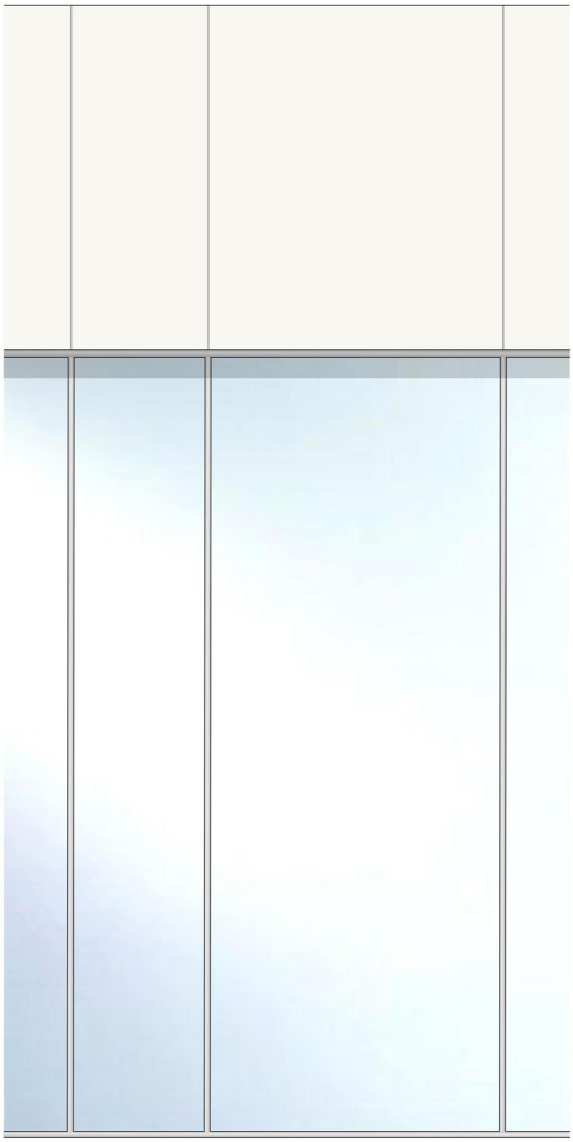


Polyurethane foam 1
Thrakon external plasterboard 2
18mm (with quartz sand)
Ytong Climagold block 3
360mm
Thermal insulation 4
Steel beam IPE330 5
Rainwater drainage 6
Existing slab 7
Existing concrete beam 8
Existing exterior wall 9

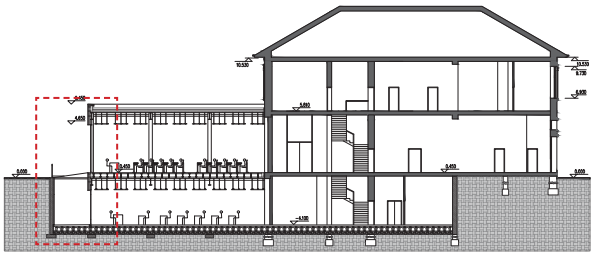
Scale 1:20

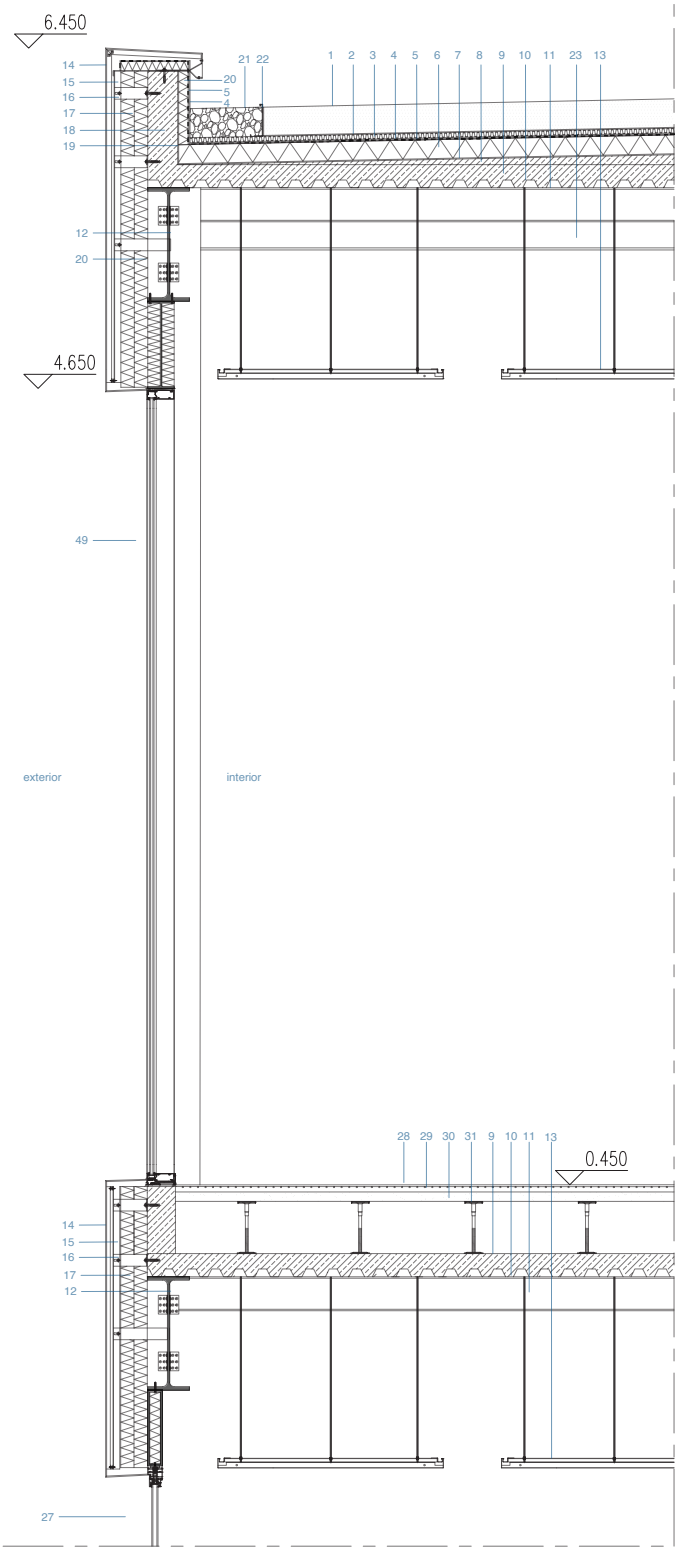
Detail

First section shows the details of north elevation of the new addition building. This detail section includes green roof, ground floor and underground floor part. Glass facade can be seen from the section entirely. Also shows the relationship between interior and exterior space.



1 Planting soil: 150mm
2 Filtering layer (geotextile): 2mm
3 Draining layer: 25mm
4 Root barrier
5 Waterproof membrane
6 Thermal insulation: 100mm
7 Vapour barrier: 4mm
8 Concrete (2% slope)
9 Concrete slab: 120mm
10 Metal deck
11 Secondary steel beam IPE180
12 Primary steel beam IPE600
13 Acoustic suspended ceiling raft
14 Stacbond composite panel: 4mm
15 Profile omega
16 Spacer double T
17 Rockwool thermal insulation: 150mm
18 Concrete parapet: 150mm
19 Vapour barrier: 4mm
20 Thermal insulation: 50mm
21 Gravel: 150mm
22 Metal support
23 Primary steel beam IPE330
24 Shading fabric
25 Hydraulic single swing system
26 Hydraulic ram
27 Aluminum folding glass door
28 Indoor pavement: 10mm
29 Radiant panel with insulating polystyrene: 40mm
30 Screed: 50mm
31 Raised floor system (with acoustic attaching): 270mm
32 Mortar: 10mm
33 Screed: 70mm
34 UFH tube: 10mm
35 Rockwool RW3 Acoustic, Thermal, and Fire Performance Insulation: 75mm
36 Flexter Testudo membrane: 4mm
37 Iglu ventilated cavities: 350mm
38 Concrete Slab: 100mm
39 Gravel: 200mm
40 Earth
41 External flooring: 20mm
42 Concrete: 170mm (2% slope)
43 Flexter Testudo membrane: 4mm
44 Gravel: 160mm
45 Protefon Tex drainage sheet: 4mm
46 Concrete wall: 300mm
47 Knauf Sheetrock wall plasterboard: 10mm
49 Double glazed aluminum storefront
50 External flooring: 20mm
51 Screed: 150mm
52 Fine gravel: 100mm
53 Glass railing




6.450
14
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16
17
18
19
21 22
1 2 3 4 5 6 7 8 9 10 11 23 13
20
5
4
12
20
4.650
49
exterior
interior
28 29 30 31 9 10 11 13
0.450
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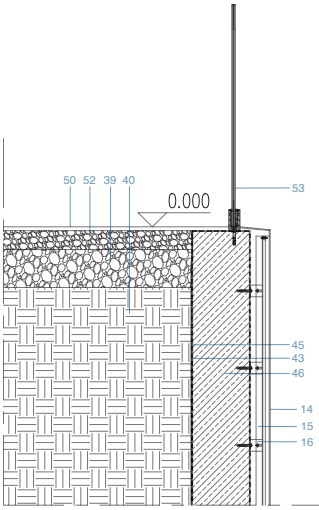
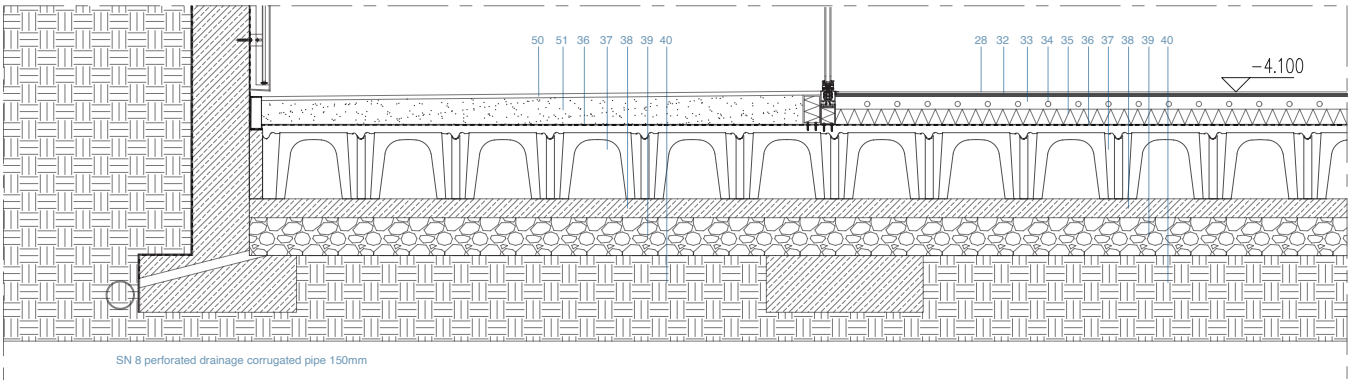
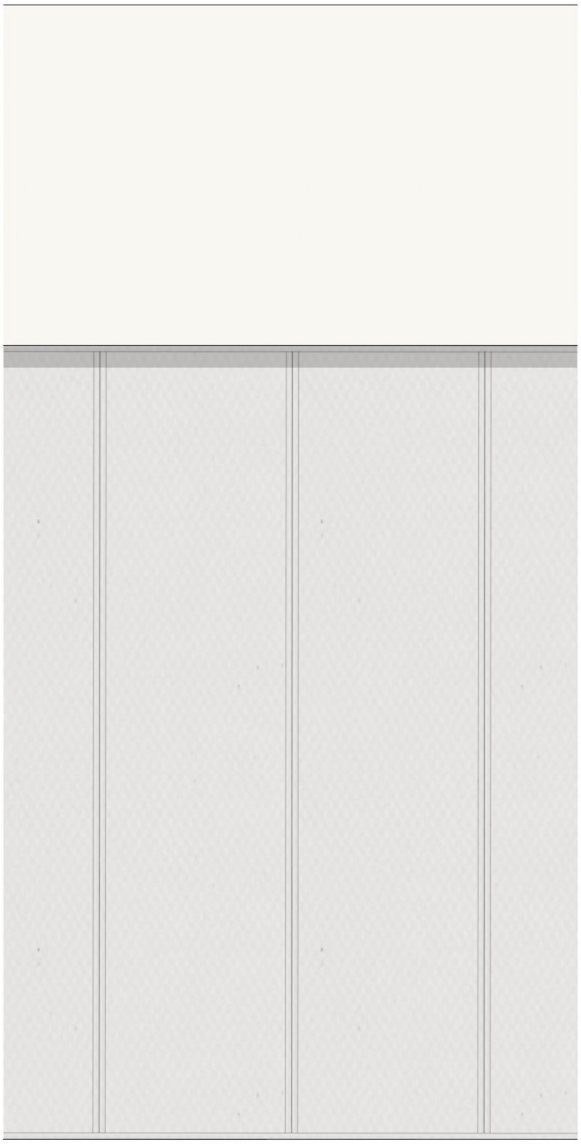
15
16
17
12
27


50 52 39 40
0.000
53
45
43
46
14
15
16


50 51 36 37 38 39 40
28 32 33 34 35 36 37 38 39 40
-4.100
SN 8 perforated drainage corrugated pipe 150mm

Detail

Second section shows the details of east and west elevation of the new addition building. This detail section includes green roof, ground floor and underground floor part. Single swing canopy can be seen from the section entirely. Also shows the relationship between interior and exterior space.



1 Planting soil: 150mm
2 Filtering layer (geotextile): 2mm
3 Draining layer: 25mm
4 Root barrier
5 Waterproof membrane
6 Thermal insulation: 100mm
7 Vapour barrier: 4mm
8 Concrete (2% slope)
9 Concrete slab: 120mm
10 Metal deck
11 Secondary steel beam IPE180
12 Primary steel beam IPE600
13 Acoustic suspended ceiling raft
14 Stacbond composite panel: 4mm
15 Profile omega
16 Spacer double T
17 Rockwool thermal insulation: 150mm
18 Concrete parapet: 150mm
19 Vapour barrier: 4mm
20 Thermal insulation: 50mm
21 Gravel: 150mm
22 Metal support
23 Primary steel beam IPE330
24 Shading fabric
25 Hydraulic single swing system
26 Hydraulic ram
27 Aluminum folding glass door
28 Indoor pavement: 10mm
29 Radiant panel with insulating polystyrene: 40mm
30 Screed: 50mm
31 Raised floor system (with acoustic attaching): 270mm
32 Mortar: 10mm
33 Screed: 70mm
34 UFH tube: 10mm
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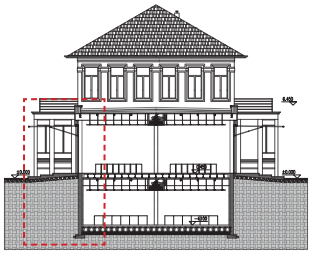
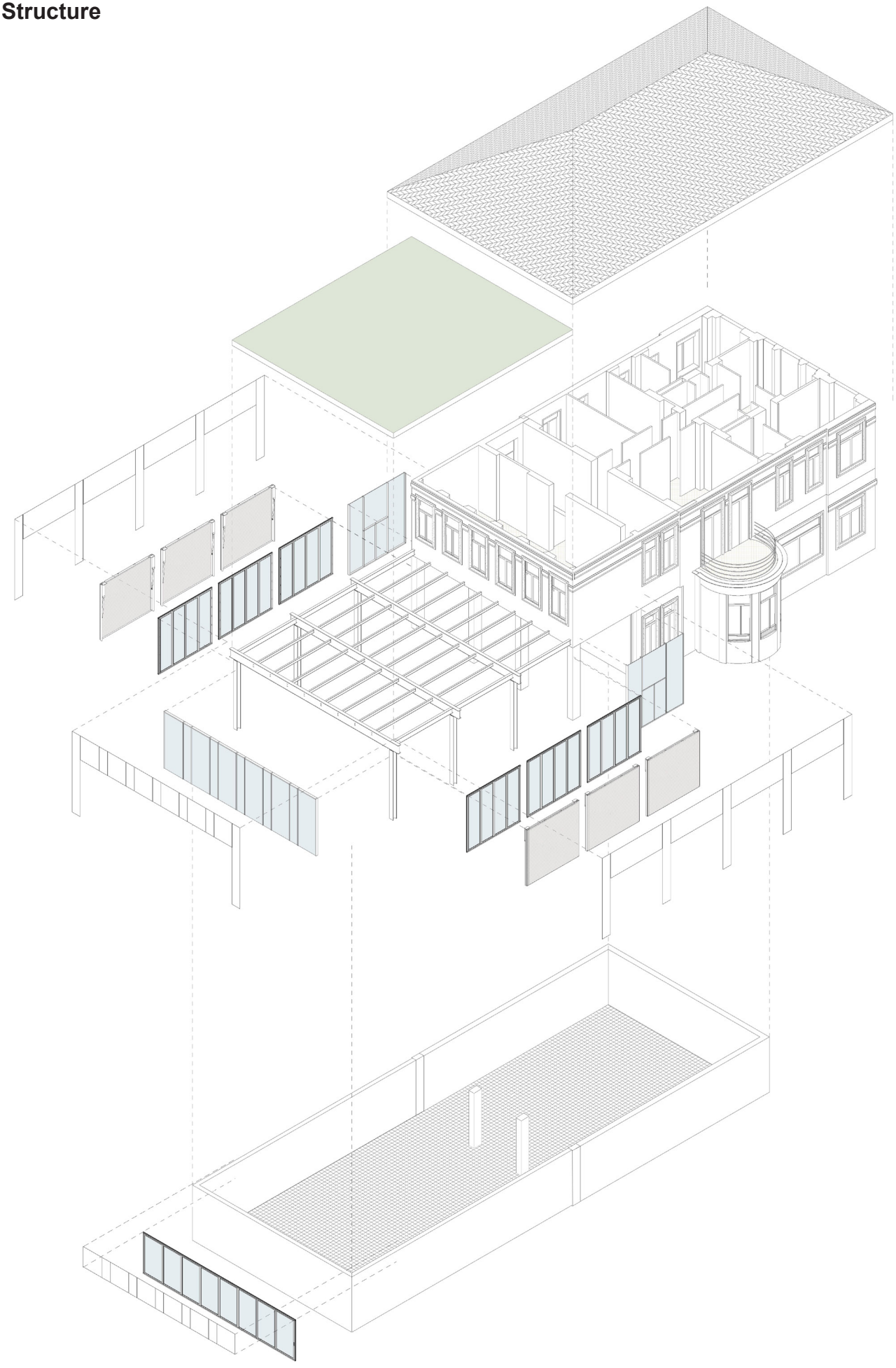
36 Flexter Testudo membrane: 4mm
37 Iglu ventilated cavities: 350mm
38 Concrete Slab: 100mm
39 Gravel: 200mm
40 Earth
41 External flooring: 20mm
42 Concrete: 170mm (2% slope)
43 Flexter Testudo membrane: 4mm
44 Gravel: 160mm
45 Protefon Tex drainage sheet: 4mm
46 Concrete wall: 300mm
47 Knauf Sheetrock wall plasterboard: 10mm
49 Double glazed aluminum storefront
50 External flooring: 20mm
51 Screed: 150mm
52 Fine gravel: 100mm
53 Glass railing



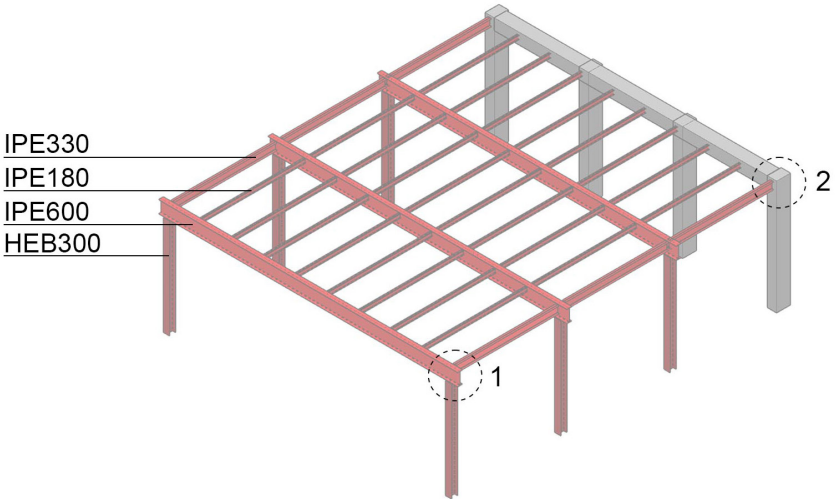
6.450
14
15
16
17
18
19
21 22
20
5
4
1 2 3 4 5 6 7 8 9 10 11 12 13
23
24 25 26
3%
4.650
27
exterior
interior
41 42 43 44 40
0.450
28 29 30 31 9 10 11 12 13
45
43
46
35
47
28 32 33 34 35 36 37 38 39 40
−4.100
SN 8 perforated drainage corrugated pipe 150mm

Structure

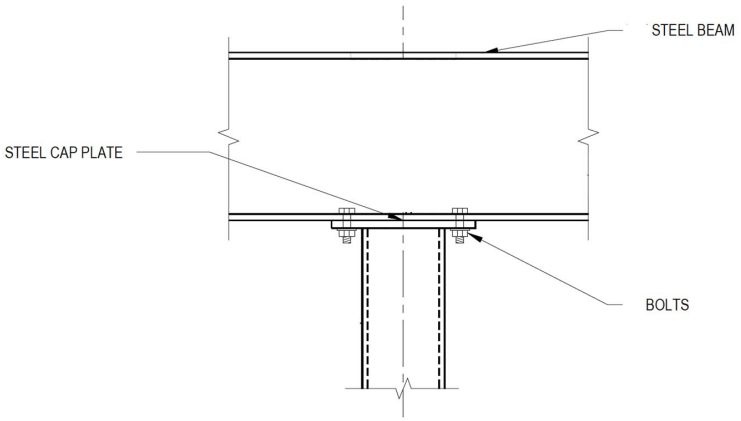


Structure

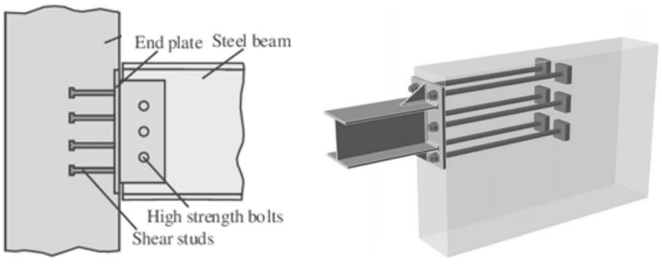
In the structure design, first assignment is the existing masonry and concrete structure preservation. When it comes to the new addtion,I chose steel frame as main structure and steel connection between the existing reinceforcement concrete structure and the new steel structure. The reasons of the choosing steel structure are lightness, long span requirements and possibility of easy operation.



1- steel column and beam bolted connection

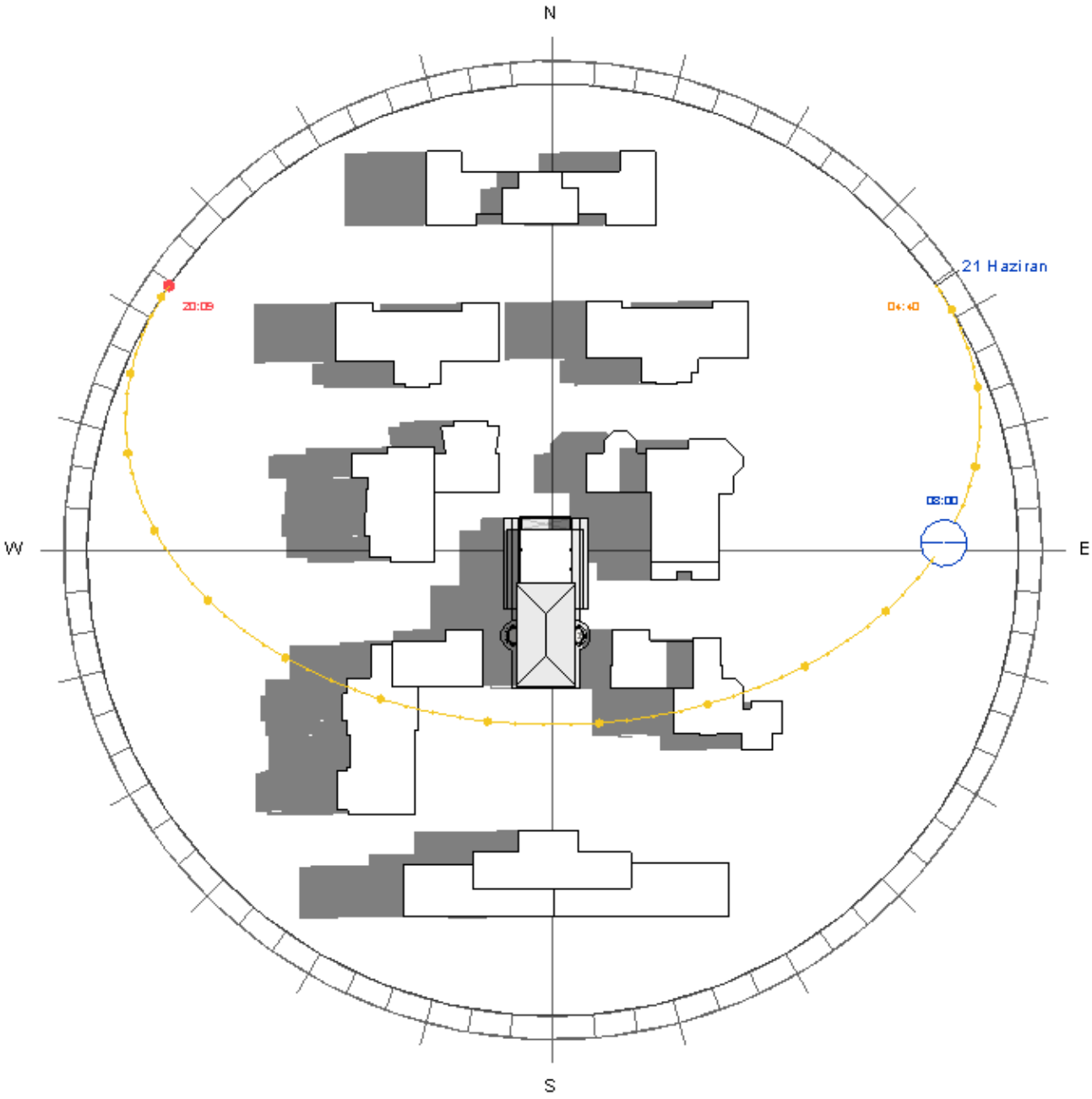


2- steel beam and existing concrete connection



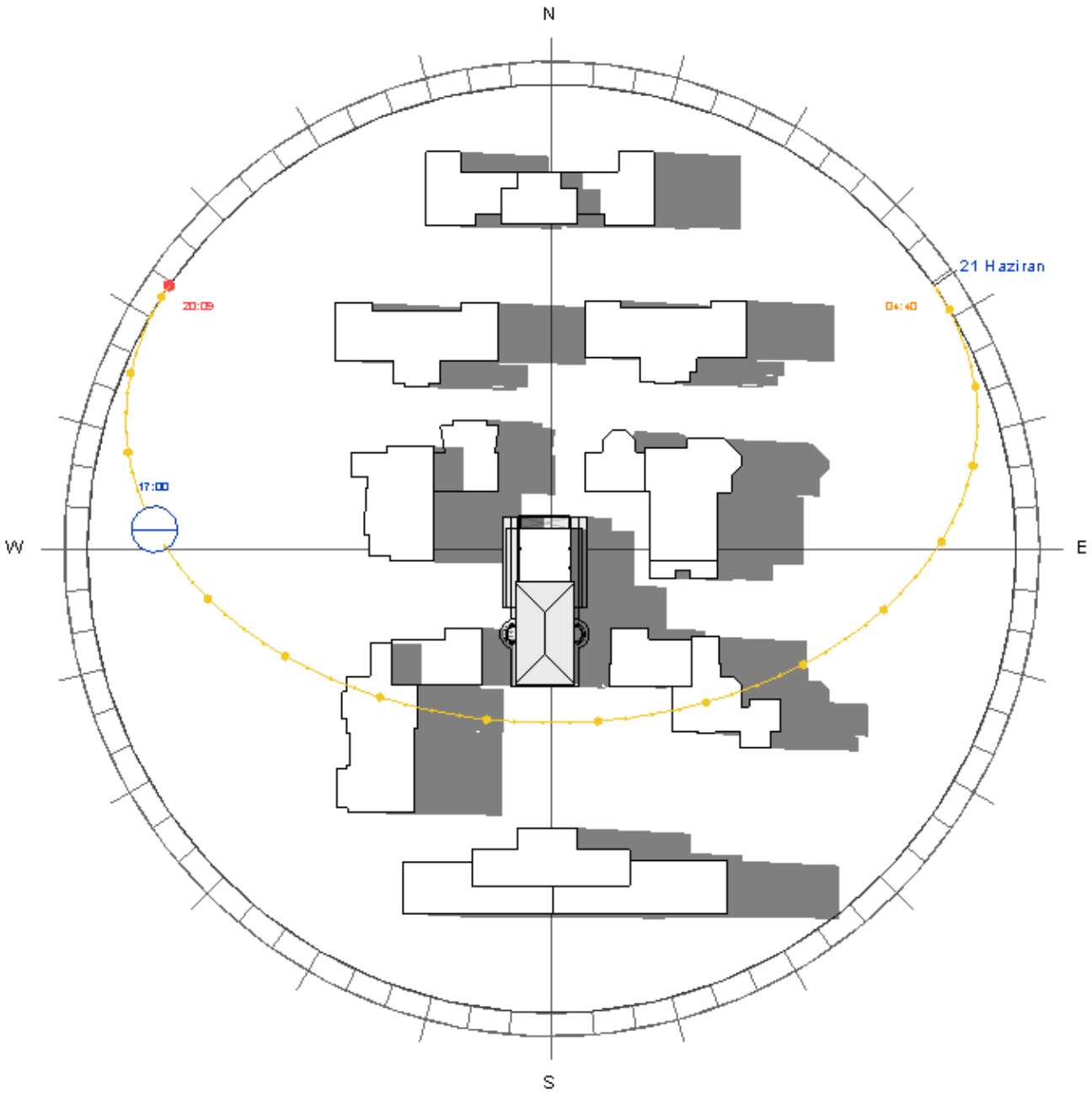
Shading Analysis

Date: 21 June
Time: 08.00



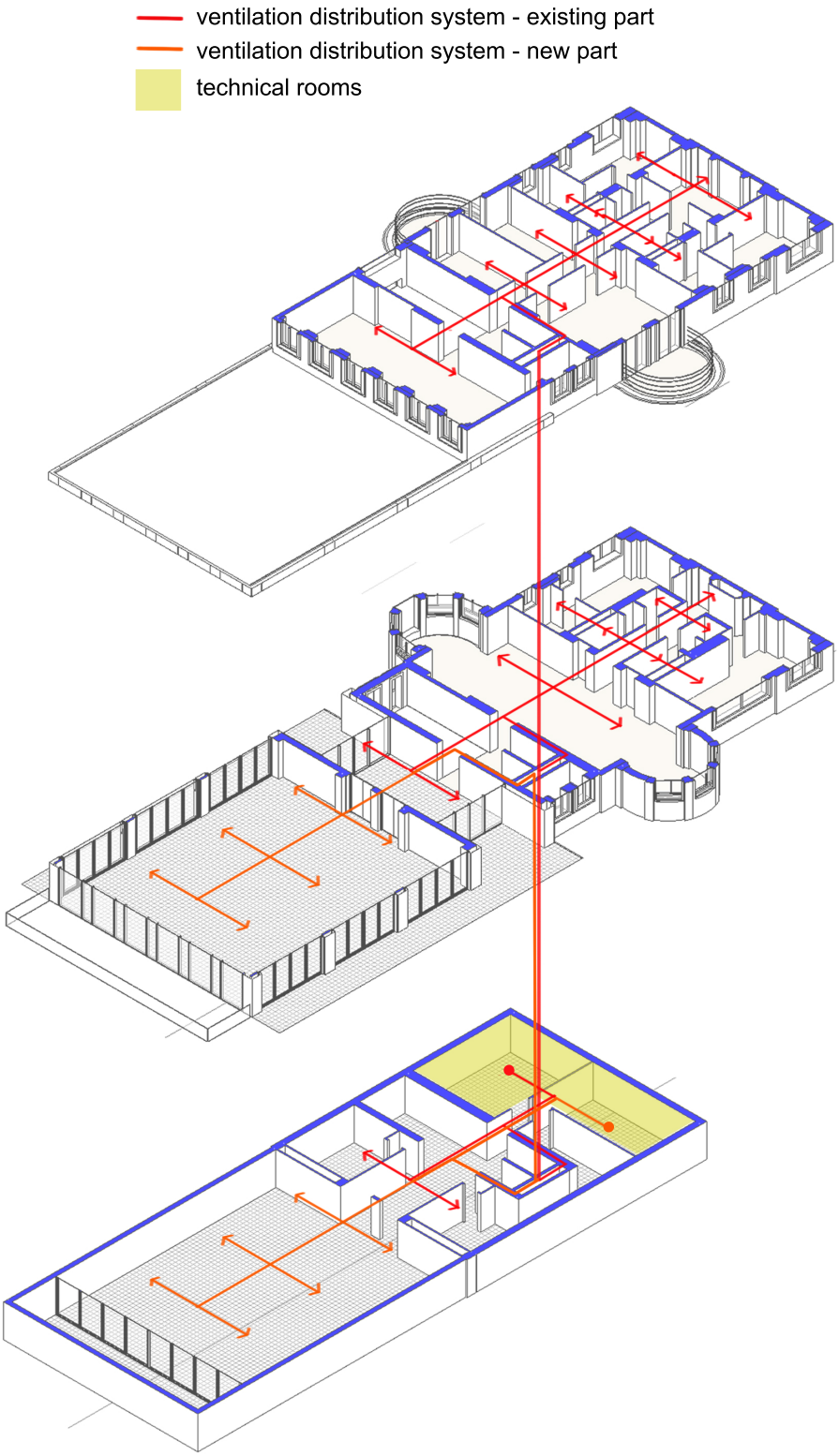
Shading Analysis

Date: 21 June
Time: 17.00



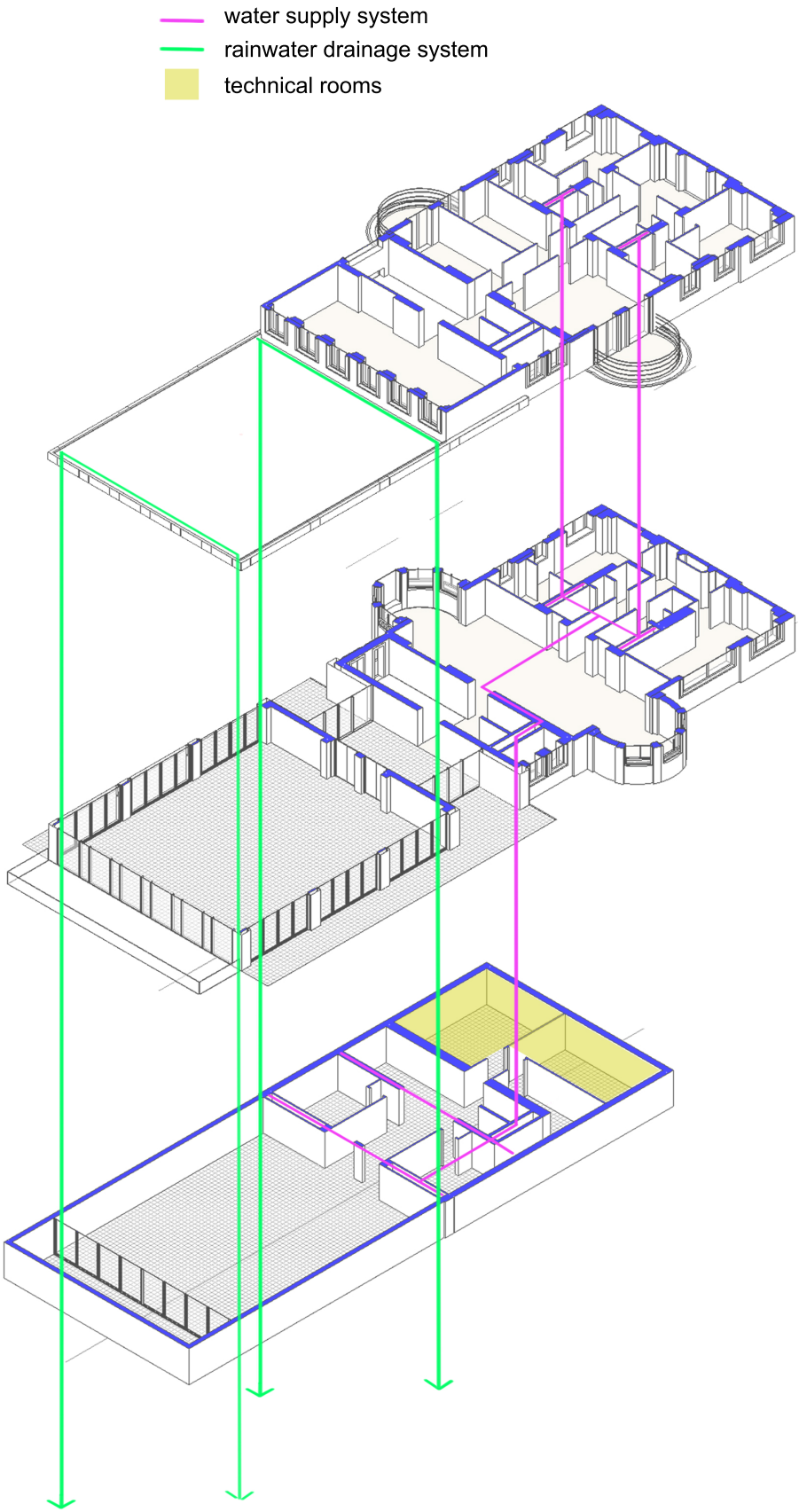
Services Design Concept

Ventilation System



Services Design Concept

Water Supply and Waste System



Services Design

Ventilation System

Ventilation system of this project divided into two parts. Unique ventilation systems are designed for the existing and new part.

Table A. 7b— Design ventilation rates for diluting emissions from buildings: low-polluting building

Building	Type of space	Airflow per floor area l/(s m2)		
		Category I	Category II	Category III
Offices	Small offices	0,50	0,40	0,30
	Landscaped offices, Conference rooms	0,70	0,60	0,40
	Call center	0,80	0,70	0,50
Hospitals[3]	Bedrooms, wards, diagnostic and examination rooms	0,50	0,40	0,30
	Treatment room	1,00	0,80	0,60
	Sitting rooms	0,75	0,60	0,45
Places of assembly	Auditoriums, cinemas, theaters, museums, exhibition's halls, churches	0,50	0,40	0,30
	Libraries, reading rooms	0,63	0,50	0,30
	games rooms, betting rooms	0,75	0,60	0,45
	dance halls, discos	1,38	1,10	0,83
Commercial	grocery stores, dry cleaning, pharmacies	1,00	0,80	0,60
	barbers and beauty salons	0,60	0,50	0,40
	All other retail stores, department stores, supermarkets	0,50	0,40	0,30
Restaurants	Cafeterias, Bars, Dining rooms	1,25	1,00	0,75
Educational	kindergartens and nursery schools	1,25	1,00	0,75
	Primary and high schools, university class rooms, labs and teachers' rooms	0,63	0,50	0,38
	libraries, reading rooms	0,63	0,50	0,38
	languages and music classrooms	0,38	0,30	0,23
Sport	Covered sport facilities: play fields	0,75	0,60	0,45
	Covered sport facilities: spectators areas	0,50	0.40	0,30
	Swimming Pools (water pool area)	0,75	0,60	0,45
	locker rooms	0,38	0,30	0,23
General	Service rooms, Corridors	1,00	0,70	0,40

Calculation of the new part

	Formula	Units	Computer lab		Lecture hall	
Area	S	m2	198		210	
Airflow per area	Qs	L/(S*m2)	0.5		0.5	
People	Np	Pers	72		160	
Airflow per person	Qp	L/(S*Pers)	6		6	
Airflow	Q=(S*Qs)+(Np*Qp)	L/S	531		1065	
		m3/h	1911,6		3834	
Air velocity	Vprimary	m/s	6		6	
	Vsecondary	m/s		**Duct size**		**Duct size**
Duct section area	Ap=Q/Vp	m2	0,0885	300*300	0,1775	500*400

Tabella F-1.5 – Caratteristiche dimensionali dei canali rettangolari.

a [mm]	**b [mm]**											
	100	**150**	**200**	**250**	**300**	**400**	**500**	**600**	**800**	**1000**	**1200**	
250	0,025	0,038	0,050	0,063								A_c
	143	188	122	250								d_{eq}
	165	206	241	273								d_{ce}
	0,70	0,80	0,90	1,00								A_i
300	0,030	0,045	0,60	0,075	0,090							A_c
	150	200	240	273	300							d_{eq}
	180	224	262	296	327							d_{ce}
	0,80	0,090	1,00	1,10	1,20							A_i
400	0,040	0,060	0,080	0,10	0,12	0,16						A_c
	160	218	267	308	343	400						d_{eq}
	205	255	299	337	373	436						d_{ce}
	1,00	1,10	1,20	1,30	1,40	1,60						A_i
500		0,075	0,10	0,13	0,55	0,20	0,25					A_c
		231	286	333	375	444	500					d_{eq}
		283	331	374	413	483	545					d_{ce}
		1,30	1,40	1,50	1,60	1,80	2,00					A_i
600		0,090	0,12	0,15	0,18	0,24	0,30	0,36				A_c
		240	300	353	400	480	545	600				d_{eq}
		307	359	406	448	524	592	654				d_{ce}
		1,50	1,60	1,70	1,80	2,00	2,20	2,40				A_i
800			0,16	0,20	0,24	0,32	0,40	0,48	0,64			A_c
			320	381	436	533	615	686	800			d_{eq}
			410	463	511	598	675	745	872			d_{ce}
			2,00	2,10	2,20	2,40	2,60	2,80	3,20			A_i
1000				0,25	0,30	0,40	0,50	0,60	0,80	1,00		A_c
				400	462	571	667	750	889	1000		d_{eq}
				512	566	662	747	825	965	1090		d_{ce}
				2,50	2,60	2,80	3,00	3,20	3,60	4,00		A_i
1200					0,36	0,48	0,60	0,72	0,96	1,20	1,44	A_c
					480	600	706	800	960	1091	1200	d_{eq}
					614	719	812	896	1049	1184	1308	d_{ce}
					3,00	3,20	3,40	3,60	4,00	4,40	4,80	A_i
1400						0,56	0,70	0,84	1,12	1,40	1,68	A_c
						622	737	840	1018	1167	1292	d_{eq}
						771	871	962	1125	1270	1403	d_{ce}
						3,60	3,80	4,00	4,40	4,80	5,20	A_i

Services Design

Heating System

Heating system design concept is similar to ventilation, existing buidling is seperated to new addition part. Under the background of Milan climate, I calculated heat loads of new addtions in winter applying designed U-Values for different materials.

U Values

Code Element	Code Material	Description	d	λ	R	U k
Element	Material		m	W/mK	m2K/W	W/m2K
18		Insulated green roof				
	62	External surface resistance			0,04	
	0	Substrate (earth)	0,15	0,25	0,6	
	0	Filtering layer	0,002	0,22	0	
	0	Draining layer	0,025	0,38	0,065	
	0	Waterproof membrane	0,001	0,16	0	
	23	Thermal insulation	0,1	0,042	2,38	
	2	Concrete	0,12	1,75	0,06	
	61	Internal surface resistance			0,13	
	Total thickness and Uk		0,398		3,275	0,305
6		Floor of ground floor				
	63	Internal surface resistance			0,1	
	11	Gypsum	0.1	0,35	0,285	
	41	Unventilated air layer	0,27	0	0	
	2	Concrete	0,12	1,75	0,068	
	63	Internal surface resistance			0,1	
	Total thickness and Uk		0,49		0,553	1,808
4		External wall				
	62	External surface resistance			0,04	
	5	Metal composite facade cladding	0,004	5,67	0	
	0	Ytong climagold block	0,36	0,072	5	
	21	Plasterboard	0,018	0,19	0,094	
	61	Internal surface resistance			0,13	
	Total thickness and Uk		0,382		5,264	0,189
1		Insulated External wall				
	62	External surface resistance			0,04	
	5	Metal composite facade cladding	0,004	5,67	0	
	41	Unventilated air layer	0,075	0	0	
	9	Metal column covering	0,007	0,12	0,058	
	23	Thermal insulation	0,075	0,042	1,785	
	9	Metal column covering	0,007	0,12	0,058	
	61	Internal surface resistance			0,13	
	Total thickness and Uk		0,168		2,071	0,482
15		Internal door				
	61	Internal surface resistance			0,13	
	53	Metal composite	0,1	0,12	0,833	
	61	Internal surface resistance			0,13	
	Total thickness and Uk		0,1		1,093	0,914
2		Bifold glazed facade				
	Total thickness and Uk					1,6
3		Glazed facade				
	Total thickness and Uk					1,5

Design Transmission Heat Loss

HEAT LOSSES DIRECTLY TO THE EXTERIOR								
Code	Building Element	L1	L2	Ak	Uk	ek	AkxUkxek	
		[m]	[m]	[m2]	[W/m2K]	[p.u]	[W/K]	
3	Glazed facade	13	4,2	54,6	1,5	1,2	98,28	NORTH
1	Insulated external wall	0,61	4,2	2,56	0,482	1,2	1,48	NORTH
2	Bifold glazed facade	13	4,2	54,6	1,6	1,15	100,46	EAST
1	Insulated external wall	1,7	4,2	7,14	0,482	1,15	3,95	EAST
2	Bifold glazed facade	13	4,2	54,6	1,6	1,1	96,09	WEST
1	Insulated external wall	1,7	4,2	7,14	0,482	1,1	3,78	WEST
18	Insulated green roof			220	0,305	1	67,1	Above
4	External wall	4,6	4,2	19,32	0,189	1	3,65	SOUTH
Total of buildings elements				ΣkxAkxUkxek		[W/K]	374,79	
Code	Thermal bridge			lk	ψk	ek	lkxψkxek	
				[m]	[W/m·K]	[p.u]	[W/K]	
62A	Window base			13	0,12	1,2	1,87	NORTH
62B	Window top			13	0,12	1,2	1,87	NORTH
62C	Window side			8,4	0,12	1,2	1,2	NORTH
63A	Window door base			13	0,13	1,15	1,94	EAST
63B	Window door top			13	0,12	1,15	1,79	EAST
63C	Window door side			25,2	0,12	1,15	3,47	EAST
63A	Window door base			13	0,13	1,1	1,86	WEST
63B	Window door top			13	0,12	1,1	1,71	WEST
63C	Window door side			25,2	0,12	1,1	3,32	WEST
Total of Thermal bridges				Σklkxψkxek		[W/K]	19,03	
Total heat loss coefficient directly to the exterior		Ht,ie= ΣkxAkxUkxek + Σkxlkxψkxek					393,82	

HEAT LOSSES THROUGH UNHEATED SPACES								
Code	Building Element	L1	L2	Ak	Uk	bu	AkxUkxbu	
		[m]	[m]	[m2]	[W/m2K]	[p.u]	[W/K]	
15	internal door	3,2	2,4	7,68	0,914	0,4	2,8	SOUTH
13	interior wall	4,7	4,9	23,03	0,189	0,4	1,74	SOUTH
Total of buildings elements				ΣkxAkxUkxbu		[W/K]	4,54	
Code	Thermal bridge			lk	ψk	ek	lkxψkxek	
				[m]	[W/m·K]	[p.u]	[W/K]	
65A	Internal door base			3,2	0,13	1	0,41	SOUTH
65B	Internal door top			3,2	0,12	1	0,38	SOUTH
65C	Internal door side			9,6	0,12	1	1,15	SOUTH
Total of Thermal bridges				Σkxlkxψkxek		[W/K]	1,94	
Total heat loss coefficient through unheated spaces		Ht,ie= ΣkxAkxUkxek + Σkxlkxψkxek					6,48	

TOTAL TRANSMISSION HEAT LOSS COEFFICIENT	HT,i= HT,ie+HT,iue+HT,ig+HT,ij	[W/K]	400,3

TEMPERATURE DATA			
Design external temperature	θe	[°C]	-5
Designa internal temperature	θint	[°C]	20
Design temperature difference	θint - θe	[°C]	25
DESIGN TRANSMISSION HEAT LOSS	ΦT,i=HT,ix(θint-θe)	[W]	10007

Design Ventilation Heat Loss

ROOM NAME				lecture hall
Room internal volume		V_i	[m3]	892,5
External Temperature		θ_e	[°C]	-5
internal Temperature		$\theta_{int,i}$	[°C]	20
Minimum hygenic needs	Minimum hygenic air exchange rate	$n_{min,i}$	[h-1]	2
	Minimum hygenic air flow rate	$V'_{min,i}$	[m3/h]	1785
Infiltration flow rate	Exposed openings	-	[p.u.]	4
	Air exchenge rate at 50 Pa	n_{50}	[h-1]	2
	Shielding Coefficient	e	[p.u.]	0,02
	Height correction factor	ε	[p.u.]	1
	Infiltration air flow rate V'inf,i=2×Vi×n50×e×ε	$V'_{inf,i}$	[m3/h]	71,4
Ventilation heat loss calculation	Selected value for calculation V'i=max(V'inf,i ; V'min,i)	V'i	[m3/h]	1785
	Design ventilation heat loss coefficient	HV,i	[W/K]	606,9
	Temperature Difference	θint,i-θe	[°C]	25
	Design ventilation heat loss	**ΦV,i**	**[W]**	**15172,5**

Heating Up Capacity

ADDITIONAL HEATING UP POWER IN INTERMITTEDNTLY HEATED SPACES			
Room Name	**Heating UP factor**	**Room area**	**Heating Up Capacity**
	fRH	**Ai**	**ΦRH,i=fRHxA,i**
	[W/m2]	[m2]	[W]
lecture hall	13	210	**2730**

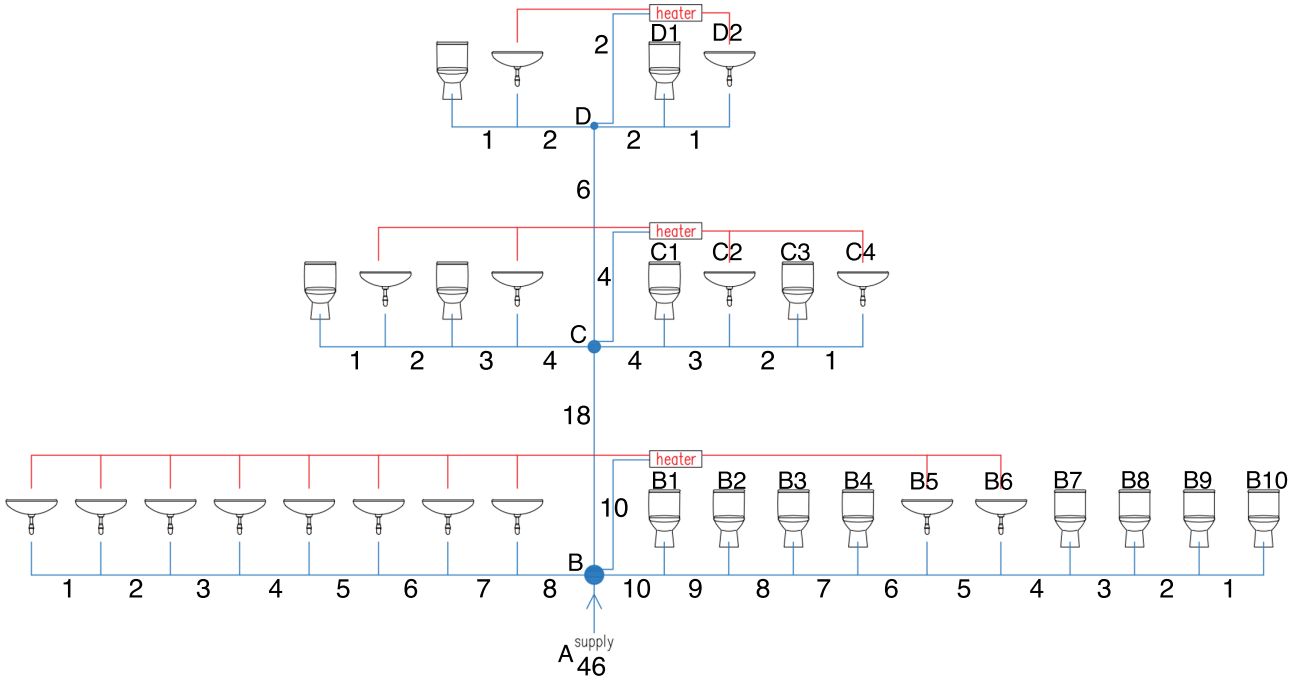
Total Heating Load

Room Name	**Design Transmission Heat Loss**	**Design Ventilation Heat Loss**	**Design Heating UP**	**Design Heating load**
	ΦT,i	**ΦV,i**	**ΦRH,i**	**ΦHL,i**
	[W]	[W]	[W]	[W]
lecture hall	**10007**	**15172,5**	**2730**	**27909,5**

Services Design

Water Supply and Waste System

Cold and Hot Water Supply



Cold Water Supply				
WC	1	LU		
Washbasin	1	LU		
	Branches	LU total	diameter (mm)	
underground floor	A - B	46	32*3	vertical shaft
	B - B1	10	20*2.5	
	B1 - B2	9	20*2.5	
	B2 - B3	8	20*2.5	
	B3 - B4	7	20*2.5	
	B4 - B5	6	20*2.5	
	B5 - B6	5	16*2.25	
	B6 - B7	4	16*2.25	
	B7 - B8	3	16*2.25	
	B8 - B9	2	16*2.25	
	B9 - B10	1	16*2.25	
ground floor	B - C	18	26*3	vertical shaft
	C - C1	4	16*2.25	
	C1 - C2	3	16*2.25	
	C2 - C3	2	16*2.25	
	C3 - C4	1	16*2.25	
first floor	C- D	6	20*2.5	vertical shaft
	D - D1	2	16*2.25	
	D1 - D2	1	16*2.25	

Table 5.1 Loading units for different points of use (EN 806-3).

Point of use	Flow rate Q_A [l/s]	Loading unit (LU)
Washbasin, bidet, WC	0.1	1
Domestic sink, dishwasher, domestic washing machine, shower	0.2	2
Urinal with outlet valve	0.3	3
Domestic bathtub	0.4	4
Garden or garage taps	0.5	5
Non-domestic sinks and bathtubs DN20	0.8	8
DN20 outlet valve	1.5	15

Table 5.12 Diameters of the multilayer pipes in relation to the LUs in compliance with EN 806-3.

∑LU	LU	3	4	5	6	10	20	55	180	540	1300	2200*	3400*
LU_{max}	LU			4	5	5	8						
d_e x s	mm	16x2.25/16x2			18x2	20x2.5	26x3	32x3	40x3.5	50x4	63x4.5	75x5	90x7
d_i	mm	11.5/12			14	15	20	26	33	42	54	65	76
max pipe length	m	9	5	4									

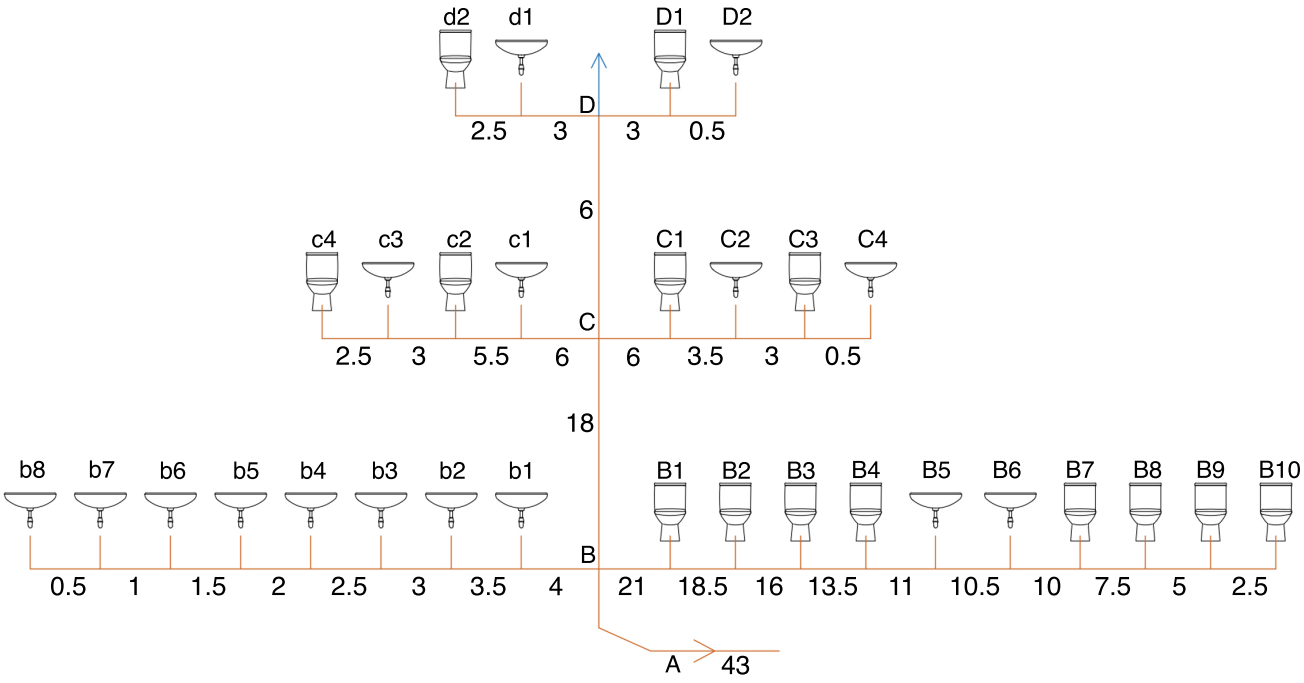
Hot Water Supply			
		LU total	diameter (mm)
underground floor	heater B	10	20*2.5
ground floor	heater C	4	16*2.25
first floor	heater D	2	16*2.25

Services Design

Water Supply and Waste System

Waste System

Considering drainage system for the new addition part, I made use of the roof garden to collect rainfall through columns and transfer to underground.



The formula for calculating the flow rate of the waste waters in relation to the type of building is the following:

$$Q_{ww} = K \cdot \sqrt{\sum DU} \qquad [4.3]$$

where:

K is the factor of contemporary use (or frequency factor) defined in the table that follows.

∑DU is the sum of the drainage units of the sanitary fixtures that flow in that section of the system.

The drainage unit DU (Drainage Unit) is the average flow rate of a sanitary fixture expressed in litres per second [l/s]. It is important to remember that the value Q_{ww} must correspond, minimum, to the flow rate of the sanitary fixtures with the biggest drainage unit.

Table 4.2 Coefficient of contemporary use as a function of use and type of building.

Use	Building type	Coefficient K
Intermittent	Homes and offices	0.5
Frequent	Hospitals, schools, restaurants, hotels	0.7
Very frequent	Public bathrooms and showers	1.0
Special	Laboratories	1.2

Waste system				
Washbasin	0.5	DU (l/s)		
WC (9 litre cistern)	2.5	DU (l/s)		
K	0.7			
	Branches	Sum DU (l/s)	DN	
first floor	d2 - d1	2.5	DN80	
	d1 - D	3	DN90	
	D - D1	3	DN90	
	D1 - D2	0.5	DN60	
	D - C	6	DN100	vertical shaft
ground floor	C - c1	6	DN100	
	c1 - c2	5.5	DN100	
	c2 - c3	3	DN90	
	c3 - c4	2.5	DN80	
	C - C1	6	DN100	
	C1 - C2	3.5	DN90	
	C2 - C3	3	DN90	
	C3 - C4	0.5	DN60	
	C - B	18	DN125	vertical shaft
underground floor	B - b1	4	DN90	
	b1 - b2	3.5	DN90	
	b2 - b3	3	DN90	
	b3 - b4	2.5	DN80	
	b4 - b5	2	DN80	
	b5 - b6	1.5	DN70	
	b6 - b7	1	DN60	
	b7 - b8	0.5	DN60	
	B - B1	21	DN125	
	B1 - B2	18.5	DN125	
	B2 - B3	16	DN125	
	B3 - B4	13.5	DN125	
	B4 - B5	11	DN100	
	B5 - B6	10.5	DN100	
	B6 - B7	10	DN100	
	B7 - B8	7.5	DN100	
	B8 - B9	5	DN100	
	B9 - B10	2.5	DN80	
	B - A	43	DN150	vertical shaft

Rainwater Drainage System

Q = r*A*c1*c2	
r	0,04 l/s*m2
A	210 m2
c1	1
c2	2
Q	16,8 l/s
Q_{pipe}	4,2 l/s
n_{pipe}	4

Conclusion

The presented thesis aimed at analysing and critical thinking the theme of new addition through the application on a XX century case study in Milan. Specifically, the constrained 22090 building of Veterinaria Campus in Citta Studi has been taken into account.
Considering the project, the 22090 building, located at the center of symmetrical and original campus, with a series of design choices, will give an identity to the campus and Citta Studi area, which is complex and rich in terms of academic institutes.
Also from the point of view of the conservation approach of the existing heritage, the intervention respects the character and value of the host building and campus. Stick by the principles of this conservation approach, transformation of building 22090 into research center of the campus was achieved. Demolitions and modifications are often seen as a negative element, in this case, however, the modifications responded to need for space. At the same time, from the architectural point of view, the suitability of interventions for users was an important aspect.
The design process was rich and difficult, in every aspect. This allowed to me to be able to deepen, study and enhance many aspects thanks to the daily and continuous work, constantly seeking dialogue and stimulating the creativity and uniqueness of each component.
As a result of the project, old and new buildings built with different construction techniques, technologies and materials occurred a new integration seamlessly. The project characterized well, enriching the whole and guaranteeing new possibilities to the Veterinaria Campus and Citta Studi.

Bibliography

ICOMOS, Approaches for the Conservation of Twentieth-Century Architectural Heritage, Madrid, 2011

Icomos-ISCS,“Illustrated glossary on stone deterioration patterns”, Ateliers 30 Impression, Champigny/ Mame, France, 2008

M. Ridolfi , “Manuale dell’Architetto”, CNR Consiglio Nazionale delle Ricerche, Roma, 1946

Raffaella Neri, Milan 1945, the Reconstruction: Modernity, Tradition, Continuity, 2019

Florencia Andreola, Marco Biraghi, Gabriella Lo Ricco, Milano. L’architettura dal 1945 a oggi, 2018

Pietro Lingeri, 1894-1968: la figura e l’opera: atti della Giornata di studio: Triennale di Milano, 8 Novembre 1994

Pietro Lingeri. Astrazione e costruzione-Abstraction and construction. Catalogo della mostra.Ediz. Bilingue

Casabella, 884, Italian+English Edition, 7 Apr 2018

Scott Joseph Budzynski, Evoking the New City, 2020

R. Koolhaas, “Preservation is overtaking us”, Columbia University Press, New York, 2014

L.Wong, Adaptive Reuse, 2016

By Glenn Hawkins, Rules of Thumb Guidelines for building services(5th Edition), 2011

Websites

https://dictionary.cambridge.org/dictionary/english/integration

https://iiif.lib.harvard.edu/manifests/view/ids:11160216

https://www.oldmapsonline.org/

https://www.domusweb.it/en/architecture/gallery/2020/06/16/luigi-mattioni-the-architect-who-gave-a-new shape-to-post-war-milan.html

https://www.domusweb.it/en/architecture/gallery/2021/02/02/rediscovering-gigi-gho-an-architect-in-post-war-milan.html

https://www.storiemilanesi.org/en/place/da-via-padova-a-citta-studi/

https://www.archdaily.com/785910/kunstmuseum-basel-christ-and-gantenbein

https://www.archdaily.com/44267/kunstmuseum-extension-christ-gantenbein

https://www.dezeen.com/2009/12/17/extension-kunstmuseum-by-christ-gantenbein/

https://www.archdaily.com/628472/fondazione-prada-oma

https://www.fondazioneprada.org/

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